JMAP
REGENTS BY DATE
The NY Geometry Regents Exam Questions from Fall, 2008 to August, 2015 Sorted by Date
www.jmap.org
1. Isosceles trapezoid $ABCD$ has diagonals $AC$ and $BD$. If $AC = 5x + 13$ and $BD = 11x - 5$, what is the value of $x$?
   1) 28
   2) $10 \frac{3}{4}$
   3) 3
   4) $\frac{1}{2}$

2. What is the negation of the statement “The Sun is shining”?
   1) It is cloudy.
   2) It is daytime.
   3) It is not raining.
   4) The Sun is not shining.

3. Triangle $ABC$ has vertices $A(1, 3), B(0, 1),$ and $C(4, 0)$. Under a translation, $A'$, the image point of $A$, is located at $(4, 4)$. Under this same translation, point $C'$ is located at
   1) $(7, 1)$
   2) $(5, 3)$
   3) $(3, 2)$
   4) $(1, -1)$

4. The diagram below shows the construction of the perpendicular bisector of $AB$.
   Which statement is not true?
   1) $AC = CB$
   2) $CB = \frac{1}{2} AB$
   3) $AC = 2AB$
   4) $AC + CB = AB$
5. Which graph could be used to find the solution to the following system of equations?

\[ y = -x + 2 \]
\[ y = x^2 \]

6. Line \( k \) is drawn so that it is perpendicular to two distinct planes, \( P \) and \( R \). What must be true about planes \( P \) and \( R \)?
   1) Planes \( P \) and \( R \) are skew.
   2) Planes \( P \) and \( R \) are parallel.
   3) Planes \( P \) and \( R \) are perpendicular.
   4) Plane \( P \) intersects plane \( R \) but is not perpendicular to plane \( R \).

7. The diagram below illustrates the construction of \( PS \parallel RQ \) through point \( P \).

Which statement justifies this construction?
   1) \( m\angle 1 = m\angle 2 \)
   2) \( m\angle 1 = m\angle 3 \)
   3) \( \overline{PR} \cong \overline{RQ} \)
   4) \( \overline{PS} \cong \overline{RQ} \)
8. The figure in the diagram below is a triangular prism.

Which statement must be true?
1) \(\overline{DE} \cong \overline{AB}\)
2) \(\overline{AD} \cong \overline{BC}\)
3) \(\overline{AD} \parallel \overline{CE}\)
4) \(\overline{DE} \parallel \overline{BC}\)

9. The vertices of \(\triangle ABC\) are \(A(-1,-2), B(-1,2)\) and \(C(6,0)\). Which conclusion can be made about the angles of \(\triangle ABC\)?
1) \(m\angle A = m\angle B\)
2) \(m\angle A = m\angle C\)
3) \(m\angle ACB = 90\)
4) \(m\angle ABC = 60\)

10. Given \(\triangle ABC\) with base \(\overline{AFEDC}\), median \(\overline{BF}\), altitude \(\overline{BD}\), and \(\overline{BE}\) bisects \(\angle ABC\), which conclusion is valid?
1) \(\angle FAB \cong \angle AFB\)
2) \(\angle AFB \cong \angle CBD\)
3) \(\overline{CE} \cong \overline{EA}\)
4) \(\overline{CF} \cong \overline{FA}\)

11. In the diagram below, circle \(O\) has a radius of 5, and \(CE = 2\). Diameter \(AC\) is perpendicular to chord \(BD\) at \(E\).

What is the length of \(BD\)?
1) 12
2) 10
3) 8
4) 4
12. What is the equation of a line that passes through the point \((-3, -11)\) and is parallel to the line whose equation is \(2x - y = 4\)?
1) \(y = 2x + 5\)  
2) \(y = 2x - 5\)  
3) \(y = \frac{1}{2} x + \frac{25}{2}\)  
4) \(y = -\frac{1}{2} x - \frac{25}{2}\)

13. Line segment \(AB\) has endpoints \(A(2, -3)\) and \(B(-4, 6)\). What are the coordinates of the midpoint of \(AB\)?
1) \((-2, 3)\)  
2) \((-1, 1 \frac{1}{2})\)  
3) \((-1, 3)\)  
4) \((3, 4 \frac{1}{2})\)

14. What are the center and radius of a circle whose equation is \((x - A)^2 + (y - B)^2 = C\)?
1) center = \((A, B)\); radius = \(C\)  
2) center = \((-A, -B)\); radius = \(C\)  
3) center = \((A, B)\); radius = \(\sqrt{C}\)  
4) center = \((-A, -B)\); radius = \(\sqrt{C}\)

15. A rectangular prism has a volume of \(3x^2 + 18x + 24\). Its base has a length of \(x + 2\) and a width of 3. Which expression represents the height of the prism?
1) \(x + 4\)  
2) \(x + 2\)  
3) 3  
4) \(x^2 + 6x + 8\)

16. Lines \(k_1\) and \(k_2\) intersect at point \(E\). Line \(m\) is perpendicular to lines \(k_1\) and \(k_2\) at point \(E\).

Which statement is always true?
1) Lines \(k_1\) and \(k_2\) are perpendicular.  
2) Line \(m\) is parallel to the plane determined by lines \(k_1\) and \(k_2\).  
3) Line \(m\) is perpendicular to the plane determined by lines \(k_1\) and \(k_2\).  
4) Line \(m\) is coplanar with lines \(k_1\) and \(k_2\).
17 In the diagram below, $PS$ is a tangent to circle $O$ at point $S$, $PQR$ is a secant, $PS = x$, $PQ = 3$, and $PR = x + 18$.

What is the length of $PS$?
1) 6
2) 9
3) 3
4) 27

18 A polygon is transformed according to the rule: $(x,y) \rightarrow (x+2,y)$. Every point of the polygon moves two units in which direction?
1) up
2) down
3) left
4) right

19 In the diagram below of $\triangle ABC$, $D$ is a point on $AB$, $AC = 7$, $AD = 6$, and $BC = 18$.

The length of $DB$ could be
1) 5
2) 12
3) 19
4) 25

20 The diameter of a circle has endpoints at $(-2,3)$ and $(6,3)$. What is an equation of the circle?
1) $(x-2)^2 + (y-3)^2 = 16$
2) $(x-2)^2 + (y-3)^2 = 4$
3) $(x+2)^2 + (y+3)^2 = 16$
4) $(x+2)^2 + (y+3)^2 = 4$
21 In the diagram below of \( \triangle PRT \), \( Q \) is a point on \( PR \), \( S \) is a point on \( TR \), \( QS \) is drawn, and \( \angle RPT \cong \angle RSQ \).

Which reason justifies the conclusion that \( \triangle PRT \sim \triangle SRQ \)?
1) AA
2) ASA
3) SAS
4) SSS

22 The lines \( 3y + 1 = 6x + 4 \) and \( 2y + 1 = x - 9 \) are
1) parallel
2) perpendicular
3) the same line
4) neither parallel nor perpendicular

23 The endpoints of \( \overline{AB} \) are \( A(3, 2) \) and \( B(7, 1) \). If \( A''B'' \) is the result of the transformation of \( \overline{AB} \) under \( D_2 \circ T_{\text{4,3}} \) what are the coordinates of \( A'' \) and \( B'' \)?
1) \( A''(-2, 10) \) and \( B''(6, 8) \)
2) \( A''(-1, 5) \) and \( B''(3, 4) \)
3) \( A''(2, 7) \) and \( B''(10, 5) \)
4) \( A''(14, -2) \) and \( B''(22, -4) \)

24 In the diagram below, circle \( A \) and circle \( B \) are shown.

What is the total number of lines of tangency that are common to circle \( A \) and circle \( B \)?
1) 1
2) 2
3) 3
4) 4

25 In which triangle do the three altitudes intersect outside the triangle?
1) a right triangle
2) an acute triangle
3) an obtuse triangle
4) an equilateral triangle

26 Two triangles are similar, and the ratio of each pair of corresponding sides is 2:1. Which statement regarding the two triangles is not true?
1) Their areas have a ratio of 4:1.
2) Their altitudes have a ratio of 2:1.
3) Their perimeters have a ratio of 2:1.
4) Their corresponding angles have a ratio of 2:1.

27 What is the measure of an interior angle of a regular octagon?
1) \( 45^\circ \)
2) \( 60^\circ \)
3) \( 120^\circ \)
4) \( 135^\circ \)
28 What is the slope of a line perpendicular to the line whose equation is $5x + 3y = 8$?

1) $\frac{5}{3}$
2) $\frac{3}{5}$
3) $-\frac{3}{5}$
4) $-\frac{5}{3}$

29 In the diagram below of right triangle $ACB$, altitude $CD$ intersects $AB$ at $D$. If $AD = 3$ and $DB = 4$, find the length of $CD$ in simplest radical form.

30 The vertices of $\triangle ABC$ are $A(3, 2)$, $B(6, 1)$, and $C(4, 6)$. Identify and graph a transformation of $\triangle ABC$ such that its image, $\triangle A'B'C'$, results in $AB \parallel A'B'$.

31 The endpoints of $PQ$ are $P(-3, 1)$ and $Q(4, 25)$. Find the length of $PQ$.

32 Using a compass and straightedge, construct the bisector of the angle shown below. [Leave all construction marks.]
33 The volume of a cylinder is $12,566.4 \text{ cm}^3$. The height of the cylinder is 8 cm. Find the radius of the cylinder to the nearest tenth of a centimeter.

34 Write a statement that is logically equivalent to the statement “If two sides of a triangle are congruent, the angles opposite those sides are congruent.” Identify the new statement as the converse, inverse, or contrapositive of the original statement.

35 On the set of axes below, graph and label $\triangle DEF$ with vertices at $D(-4, -4)$, $E(-2, 2)$, and $F(8, -2)$. If $G$ is the midpoint of $EF$ and $H$ is the midpoint of $DF$, state the coordinates of $G$ and $H$ and label each point on your graph. Explain why $GH \parallel DE$.

36 In the diagram below of circle $O$, chords $DF$, $DE$, $FG$, and $EG$ are drawn such that $mDF : mFE : mEG : mGD = 5:2:1:7$. Identify one pair of inscribed angles that are congruent to each other and give their measure.

37 A city is planning to build a new park. The park must be equidistant from school $A$ at $(3, 3)$ and school $B$ at $(3, -5)$. The park also must be exactly 5 miles from the center of town, which is located at the origin on the coordinate graph. Each unit on the graph represents 1 mile. On the set of axes below, sketch the compound loci and label with an $\times$ all possible locations for the new park.
38 In the diagram below, quadrilateral $ABCD$ is inscribed in circle $O$, $AB \parallel DC$, and diagonals $AC$ and $BD$ are drawn. Prove that $\triangle ACD \cong \triangle BDC$. 
1 Juliann plans on drawing \( \triangle ABC \), where the measure of \( \angle A \) can range from 50° to 60° and the measure of \( \angle B \) can range from 90° to 100°. Given these conditions, what is the correct range of measures possible for \( \angle C \)?

1) 20° to 40°
2) 30° to 50°
3) 80° to 90°
4) 120° to 130°

2 In the diagram of \( \triangle ABC \) and \( \triangle DEF \) below, \( AB \cong DE \), \( \angle A \cong \angle D \), and \( \angle B \cong \angle E \). Which method can be used to prove \( \triangle ABC \cong \triangle DEF \)?

1) SSS
2) SAS
3) ASA
4) HL

3 In the diagram below, under which transformation will \( \triangle A'B'C' \) be the image of \( \triangle ABC \)?

![Diagram of triangles](image)

1) rotation
2) dilation
3) translation
4) glide reflection

4 The lateral faces of a regular pyramid are composed of

1) squares
2) rectangles
3) congruent right triangles
4) congruent isosceles triangles

5 Point \( A \) is located at \((4, -7)\). The point is reflected in the \( x \)-axis. Its image is located at

1) \((-4, 7)\)
2) \((-4, -7)\)
3) \((4, 7)\)
4) \((7, -4)\)
6 In the diagram of circle $O$ below, chords $\overline{AB}$ and $\overline{CD}$ are parallel, and $\overline{BD}$ is a diameter of the circle. If $m\overline{AD} = 60$, what is $m\angle CDB$?

1) 20
2) 30
3) 60
4) 120

7 What is an equation of the line that passes through the point $(-2,5)$ and is perpendicular to the line whose equation is $y = \frac{1}{2}x + 5$?

1) $y = 2x + 1$
2) $y = -2x + 1$
3) $y = 2x + 9$
4) $y = -2x - 9$

8 After a composition of transformations, the coordinates $A(4,2)$, $B(4,6)$, and $C(2,6)$ become $A'(-2,-1)$, $B'(-2,-3)$, and $C'(-1,-3)$, as shown on the set of axes below.

Which composition of transformations was used?
1) $R_{180^\circ} \circ D_2$
2) $R_{90^\circ} \circ D_2$
3) $D_{\frac{1}{2}} \circ R_{180^\circ}$
4) $D_{\frac{1}{2}} \circ R_{90^\circ}$

9 In an equilateral triangle, what is the difference between the sum of the exterior angles and the sum of the interior angles?

1) $180^\circ$
2) $120^\circ$
3) $90^\circ$
4) $60^\circ$

10 What is an equation of a circle with its center at $(-3,5)$ and a radius of 4?

1) $(x - 3)^2 + (y + 5)^2 = 16$
2) $(x + 3)^2 + (y - 5)^2 = 16$
3) $(x - 3)^2 + (y + 5)^2 = 4$
4) $(x + 3)^2 + (y - 5)^2 = 4$
11 In \( \triangle ABC \), \( m \angle A = 95 \), \( m \angle B = 50 \), and \( m \angle C = 35 \). Which expression correctly relates the lengths of the sides of this triangle?
1) \( AB < BC < CA \)
2) \( AB < AC < BC \)
3) \( AC < BC < AB \)
4) \( BC < AC < AB \)

12 In a coordinate plane, how many points are both 5 units from the origin and 2 units from the x-axis?
1) 1
2) 2
3) 3
4) 4

13 What is the contrapositive of the statement, “If I am tall, then I will bump my head”?
1) If I bump my head, then I am tall.
2) If I do not bump my head, then I am tall.
3) If I am tall, then I will not bump my head.
4) If I do not bump my head, then I am not tall.

14 In the diagram of \( \triangle ABC \) below, Jose found centroid \( P \) by constructing the three medians. He measured \( CF \) and found it to be 6 inches.

If \( PF = x \), which equation can be used to find \( x \)?
1) \( x + x = 6 \)
2) \( 2x + x = 6 \)
3) \( 3x + 2x = 6 \)
4) \( x + \frac{2}{3} x = 6 \)

15 In the diagram below, the length of the legs \( AC \) and \( BC \) of right triangle \( ABC \) are 6 cm and 8 cm, respectively. Altitude \( CD \) is drawn to the hypotenuse of \( \triangle ABC \).

![Diagram of right triangle](image)

What is the length of \( AD \) to the nearest tenth of a centimeter?
1) 3.6
2) 6.0
3) 6.4
4) 4.0

16 In the diagram below, tangent \( AB \) and secant \( ACD \) are drawn to circle \( O \) from an external point \( A \), \( AB = 8 \), and \( AC = 4 \).

![Diagram of circle with tangent and secant](image)

What is the length of \( CD \)?
1) 16
2) 13
3) 12
4) 10
17 In the diagram of $\triangle ABC$ and $\triangle EDC$ below, $\overline{AE}$ and $\overline{BD}$ intersect at $C$, and $\angle CAB \cong \angle CED$.

Which method can be used to show that $\triangle ABC$ must be similar to $\triangle EDC$?

1) SAS
2) AA
3) SSS
4) HL

18 Point $P$ is on line $m$. What is the total number of planes that are perpendicular to line $m$ and pass through point $P$?

1) 1
2) 2
3) 0
4) infinite

19 Square $LMNO$ is shown in the diagram below.

What are the coordinates of the midpoint of diagonal $LN$?

1) $\left(4\frac{1}{2}, -2\frac{1}{2}\right)$
2) $\left(-3\frac{1}{2}, 3\frac{1}{2}\right)$
3) $\left(-2\frac{1}{2}, 3\frac{1}{2}\right)$
4) $\left(-2\frac{1}{2}, 4\frac{1}{2}\right)$
20. Which graph represents a circle with the equation \((x - 5)^2 + (y + 1)^2 = 9\)?

1) 

2) 

3) 

4) 

21. In the diagram below, a right circular cone has a diameter of 8 inches and a height of 12 inches.

What is the volume of the cone to the nearest cubic inch?

1) 201 
2) 481 
3) 603 
4) 804 

22. A circle is represented by the equation \(x^2 + (y + 3)^2 = 13\). What are the coordinates of the center of the circle and the length of the radius?

1) \((0,3)\) and 13 
2) \((0,3)\) and \(\sqrt{13}\) 
3) \((0,-3)\) and 13 
4) \((0,-3)\) and \(\sqrt{13}\) 

23. Given the system of equations: 
\[
\begin{align*}
y &= x^2 - 4x \\
x &= 4
\end{align*}
\]

The number of points of intersection is

1) 1 
2) 2 
3) 3 
4) 0
24 Side \( \overline{PQ} \) of \( \triangle PQR \) is extended through \( Q \) to point \( T \). Which statement is not always true?
1) \( m\angle RQT > m\angle R \)
2) \( m\angle RQT > m\angle P \)
3) \( m\angle RQT = m\angle P + m\angle R \)
4) \( m\angle RQT > m\overline{PQR} \)

25 Which illustration shows the correct construction of an angle bisector?

![Diagram of angle bisector](image)

26 Which equation represents a line perpendicular to the line whose equation is \( 2x + 3y = 12 \)?
1) \( 6y = -4x + 12 \)
2) \( 2y = 3x + 6 \)
3) \( 2y = -3x + 6 \)
4) \( 3y = -2x + 12 \)

27 In \( \triangle ABC \), point \( D \) is on \( \overline{AB} \), and point \( E \) is on \( \overline{BC} \) such that \( DE \parallel AC \). If \( DB = 2 \), \( DA = 7 \), and \( DE = 3 \), what is the length of \( AC \)?
1) 8
2) 9
3) 10.5
4) 13.5

28 In three-dimensional space, two planes are parallel and a third plane intersects both of the parallel planes. The intersection of the planes is a
1) plane
2) point
3) pair of parallel lines
4) pair of intersecting lines

29 In the diagram of \( \triangle ABC \) below, \( AB = 10 \), \( BC = 14 \), and \( AC = 16 \). Find the perimeter of the triangle formed by connecting the midpoints of the sides of \( \triangle ABC \).

![Diagram of triangle](image)

30 Using a compass and straightedge, construct a line that passes through point \( P \) and is perpendicular to line \( m \). [Leave all construction marks.]

31 Find an equation of the line passing through the point (5,4) and parallel to the line whose equation is \( 2x + y = 3 \).
32. The length of $AB$ is 3 inches. On the diagram below, sketch the points that are equidistant from $A$ and $B$ and sketch the points that are 2 inches from $A$. Label with an $\times$ all points that satisfy both conditions.

33. Given: Two is an even integer or three is an even integer.
Determine the truth value of this disjunction.
Justify your answer.

34. In the diagram below, $\triangle ABC \sim \triangle EFG$,
$m \angle C = 4x + 30$, and $m \angle G = 5x + 10$. Determine the value of $x$.

35. In the diagram below, circles $X$ and $Y$ have two tangents drawn to them from external point $T$. The points of tangency are $C, A, S, \text{ and } E$. The ratio of $TA$ to $AC$ is $1:3$. If $TS = 24$, find the length of $SE$. 
36 Triangle $ABC$ has coordinates $A(-6,2)$, $B(-3,6)$, and $C(5,0)$. Find the perimeter of the triangle. Express your answer in simplest radical form. [The use of the grid below is optional.]

37 The coordinates of the vertices of parallelogram $ABCD$ are $A(-2,2)$, $B(3,5)$, $C(4,2)$, and $D(-1,-1)$. State the coordinates of the vertices of parallelogram $A'B'C'D'$ that result from the transformation $r_{y-axis} \circ T_{2,-3}$. [The use of the set of axes below is optional.]

38 Given: $\triangle ABC$ and $\triangle EDC$, $C$ is the midpoint of $BD$ and $AE$.
Prove: $AB \parallel DE$
1. Based on the diagram below, which statement is true?

1) \(a \parallel b\)
2) \(a \parallel c\)
3) \(b \parallel c\)
4) \(d \parallel e\)

2. The diagram below shows the construction of the bisector of \(\angle ABC\).

Which statement is not true?
1) \(m\angle EBF = \frac{1}{2} m\angle ABC\)
2) \(m\angle DBF = \frac{1}{2} m\angle ABC\)
3) \(m\angle EBF = m\angle ABC\)
4) \(m\angle DBF = m\angle EBF\)

3. In the diagram of \(\triangle ABC\) below, \(\overline{AB} \cong \overline{AC}\). The measure of \(\angle B\) is 40°.

What is the measure of \(\angle A\)?
1) 40°
2) 50°
3) 70°
4) 100°

4. In the diagram of circle \(O\) below, chord \(\overline{CD}\) is parallel to diameter \(\overline{AOB}\) and \(m\overline{AC} = 30\).

What is \(m\overline{CD}\)?
1) 150
2) 120
3) 100
4) 60
5 In the diagram of trapezoid $ABCD$ below, diagonals $AC$ and $BD$ intersect at $E$ and $\triangle ABC \cong \triangle DCB$. 

Which statement is true based on the given information?

1) $AC \cong BC$
2) $CD \cong AD$
3) $\angle CDE \cong \angle BAD$
4) $\angle CDB \cong \angle BAC$

6 Which transformation produces a figure similar but not congruent to the original figure?

1) $T_{1,3}$
2) $D\frac{1}{2}$
3) $R_{90^\circ}$
4) $r_{y=x}$

7 In the diagram below of parallelogram $ABCD$ with diagonals $AC$ and $BD$, $m \angle 1 = 45$ and $m \angle DCB = 120$.

What is the measure of $\angle 2$?

1) $15^\circ$
2) $30^\circ$
3) $45^\circ$
4) $60^\circ$

8 On the set of axes below, Geoff drew rectangle $ABCD$. He will transform the rectangle by using the translation $(x,y) \rightarrow (x+2,y+1)$ and then will reflect the translated rectangle over the $x$-axis.

What will be the area of the rectangle after these transformations?

1) exactly 28 square units
2) less than 28 square units
3) greater than 28 square units
4) It cannot be determined from the information given.
9. What is the equation of a line that is parallel to the line whose equation is \( y = x + 2 \)?
   1) \( x + y = 5 \)
   2) \( 2x + y = -2 \)
   3) \( y - x = -1 \)
   4) \( y - 2x = 3 \)

10. The endpoints of \( CD \) are \( C(-2, -4) \) and \( D(6, 2) \). What are the coordinates of the midpoint of \( CD \)?
   1) \( (2, 3) \)
   2) \( (2, -1) \)
   3) \( (4, -2) \)
   4) \( (4, 3) \)

11. What are the center and the radius of the circle whose equation is \( (x - 3)^2 + (y + 3)^2 = 36 \)?
   1) center = \( (3, -3) \); radius = 6
   2) center = \( (-3, 3) \); radius = 6
   3) center = \( (3, -3) \); radius = 36
   4) center = \( (-3, 3) \); radius = 36

12. Given the equations: \( y = x^2 - 6x + 10 \)
    \( y + x = 4 \)

   What is the solution to the given system of equations?
   1) \( (2, 3) \)
   2) \( (3, 2) \)
   3) \( (2, 2) \) and \( (1, 3) \)
   4) \( (2, 2) \) and \( (3, 1) \)

13. The diagonal \( AC \) is drawn in parallelogram \( ABCD \). Which method can not be used to prove that \( \Delta ABC \cong \Delta CDA \)?
   1) SSS
   2) SAS
   3) SSA
   4) ASA

14. In the diagram below, line \( k \) is perpendicular to plane \( \mathcal{P} \) at point \( T \).

   Which statement is true?
   1) Any point in plane \( \mathcal{P} \) also will be on line \( k \).
   2) Only one line in plane \( \mathcal{P} \) will intersect line \( k \).
   3) All planes that intersect plane \( \mathcal{P} \) will pass through \( T \).
   4) Any plane containing line \( k \) is perpendicular to plane \( \mathcal{P} \).
15 In the diagram below, which transformation was used to map $\triangle ABC$ to $\triangle A'B'C'$?

1) dilation
2) rotation
3) reflection
4) glide reflection

16 Which set of numbers represents the lengths of the sides of a triangle?

1) $\{5, 18, 13\}$
2) $\{6, 17, 22\}$
3) $\{16, 24, 7\}$
4) $\{26, 8, 15\}$

17 What is the slope of a line perpendicular to the line whose equation is $y = -\frac{2}{3}x - 5$?

1) $-\frac{3}{2}$
2) $-\frac{2}{3}$
3) $\frac{2}{3}$
4) $\frac{3}{2}$

18 A quadrilateral whose diagonals bisect each other and are perpendicular is a

1) rhombus
2) rectangle
3) trapezoid
4) parallelogram

19 If the endpoints of $\overline{AB}$ are $A(-4, 5)$ and $B(2, -5)$, what is the length of $\overline{AB}$?

1) $2\sqrt{34}$
2) 2
3) $\sqrt{61}$
4) 8

20 In the diagram below of $\triangle ACT$, $D$ is the midpoint of $\overline{AC}$, $O$ is the midpoint of $\overline{AT}$, and $G$ is the midpoint of $\overline{CT}$.

If $AC = 10$, $AT = 18$, and $CT = 22$, what is the perimeter of parallelogram $CDOG$?

1) 21
2) 25
3) 32
4) 40
21 Which equation represents circle \( K \) shown in the graph below?

![Graph of Circle K](image_url)

1) \((x + 5)^2 + (y - 1)^2 = 3\)
2) \((x + 5)^2 + (y - 1)^2 = 9\)
3) \((x - 5)^2 + (y + 1)^2 = 3\)
4) \((x - 5)^2 + (y + 1)^2 = 9\)

22 In the diagram below of right triangle \( ACB \), altitude \( CD \) is drawn to hypotenuse \( AB \).

![Right Triangle ACB](image_url)

If \( AB = 36 \) and \( AC = 12 \), what is the length of \( AD \)?

1) 32
2) 6
3) 3
4) 4

23 In the diagram of circle \( O \) below, chord \( AB \) intersects chord \( CD \) at \( E \), \( DE = 2x + 8 \), \( EC = 3 \), \( AE = 4x - 3 \), and \( EB = 4 \).

![Circle O with chords](image_url)

What is the value of \( x \)?

1) 1
2) 3.6
3) 5
4) 10.25

24 What is the negation of the statement “Squares are parallelograms”?

1) Parallelograms are squares.
2) Parallelograms are not squares.
3) It is not the case that squares are parallelograms.
4) It is not the case that parallelograms are squares.
25 The diagram below shows the construction of the center of the circle circumscribed about \( \triangle ABC \).

This construction represents how to find the intersection of:
1) the angle bisectors of \( \triangle ABC \)
2) the medians to the sides of \( \triangle ABC \)
3) the altitudes to the sides of \( \triangle ABC \)
4) the perpendicular bisectors of the sides of \( \triangle ABC \)

26 A right circular cylinder has a volume of 1,000 cubic inches and a height of 8 inches. What is the radius of the cylinder to the nearest tenth of an inch?
1) 6.3
2) 11.2
3) 19.8
4) 39.8

27 If two different lines are perpendicular to the same plane, they are
1) collinear
2) coplanar
3) congruent
4) consecutive

28 How many common tangent lines can be drawn to the two externally tangent circles shown below?

1) 1
2) 2
3) 3
4) 4

29 In the diagram below of isosceles trapezoid \( DEFG \), \( DE \parallel GF \), \( DE = 4x - 2 \), \( EF = 3x + 2 \), \( FG = 5x - 3 \), and \( GD = 2x + 5 \). Find the value of \( x \).
30 A regular pyramid with a square base is shown in the diagram below. A side, $s$, of the base of the pyramid is 12 meters, and the height, $h$, is 42 meters. What is the volume of the pyramid in cubic meters?

31 Write an equation of the line that passes through the point $(6, -5)$ and is parallel to the line whose equation is $2x - 3y = 11$.

32 Using a compass and straightedge, construct the angle bisector of $\angle ABC$ shown below. [Leave all construction marks.]

33 The degree measures of the angles of $\triangle ABC$ are represented by $x$, $3x$, and $5x - 54$. Find the value of $x$.

34 In the diagram below of $\triangle ABC$ with side $\overline{AC}$ extended through $D$, $m\angle A = 37$ and $m\angle BCD = 117$. Which side of $\triangle ABC$ is the longest side? Justify your answer.

35 Write an equation of the perpendicular bisector of the line segment whose endpoints are $(-1, 1)$ and $(7, -5)$. [The use of the grid below is optional]
36 On the set of axes below, sketch the points that are 5 units from the origin and sketch the points that are 2 units from the line $y = 3$. Label with an $\mathbf{X}$ all points that satisfy both conditions.

37 Triangle $DEG$ has the coordinates $D(1,1)$, $E(5,1)$, and $G(5,4)$. Triangle $DEG$ is rotated $90^\circ$ about the origin to form $\triangle D'E'G'$. On the grid below, graph and label $\triangle DEG$ and $\triangle D'E'G'$. State the coordinates of the vertices $D'$, $E'$, and $G'$. Justify that this transformation preserves distance.

38 Given: Quadrilateral $ABCD$, diagonal $\overline{AFEC}$, $AE \cong FC$, $BF \perp AC$, $DE \perp AC$, $\angle 1 \cong \angle 2$
Prove: $ABCD$ is a parallelogram.
1 In the diagram below of trapezoid RSUT, RS \parallel TU, X is the midpoint of RT, and V is the midpoint of SU.

If RS = 30 and XV = 44, what is the length of TU?
1) 37
2) 58
3) 74
4) 118

2 In \(\triangle ABC\), \(\angle A = x\), \(\angle B = 2x + 2\), and \(\angle C = 3x + 4\). What is the value of \(x\)?
1) 29
2) 31
3) 59
4) 61

3 Which expression best describes the transformation shown in the diagram below?
1) same orientation; reflection
2) opposite orientation; reflection
3) same orientation; translation
4) opposite orientation; translation
4 Based on the construction below, which statement must be true?

1) \( m\angle ABD = \frac{1}{2} m\angle CBD \)
2) \( m\angle ABD = m\angle CBD \)
3) \( m\angle ABD = m\angle ABC \)
4) \( m\angle CBD = \frac{1}{2} m\angle ABD \)

5 In the diagram below, \( \triangle ABC \) is inscribed in circle \( P \). The distances from the center of circle \( P \) to each side of the triangle are shown.

Which statement about the sides of the triangle is true?
1) \( AB > AC > BC \)
2) \( AB < AC \) and \( AC > BC \)
3) \( AC > AB > BC \)
4) \( AC = AB \) and \( AB > BC \)

6 Which transformation is not always an isometry?
1) rotation
2) dilation
3) reflection
4) translation

7 In \( \triangle ABC \), \( AB \cong BC \). An altitude is drawn from \( B \) to \( AC \) and intersects \( AC \) at \( D \). Which conclusion is not always true?
1) \( \angle ABD \cong \angle CBD \)
2) \( \angle BDA \cong \angle BDC \)
3) \( AD \cong BD \)
4) \( AD \cong DC \)

8 In the diagram below, tangent \( PA \) and secant \( PBC \) are drawn to circle \( O \) from external point \( P \).

If \( PB = 4 \) and \( BC = 5 \), what is the length of \( PA \)?
1) 20
2) 9
3) 8
4) 6
9 Which geometric principle is used to justify the construction below?

1) A line perpendicular to one of two parallel lines is perpendicular to the other.
2) Two lines are perpendicular if they intersect to form congruent adjacent angles.
3) When two lines are intersected by a transversal and alternate interior angles are congruent, the lines are parallel.
4) When two lines are intersected by a transversal and the corresponding angles are congruent, the lines are parallel.

10 Which equation represents the circle whose center is \((-2, 3)\) and whose radius is 5?

1) \((x - 2)^2 + (y + 3)^2 = 5\)
2) \((x + 2)^2 + (y - 3)^2 = 5\)
3) \((x + 2)^2 + (y - 3)^2 = 25\)
4) \((x - 2)^2 + (y + 3)^2 = 25\)

11 Towns \(A\) and \(B\) are 16 miles apart. How many points are 10 miles from town \(A\) and 12 miles from town \(B\)?

1) 1
2) 2
3) 3
4) 0

12 Lines \(j\) and \(k\) intersect at point \(P\). Line \(m\) is drawn so that it is perpendicular to lines \(j\) and \(k\) at point \(P\). Which statement is correct?

1) Lines \(j\) and \(k\) are in perpendicular planes.
2) Line \(m\) is in the same plane as lines \(j\) and \(k\).
3) Line \(m\) is parallel to the plane containing lines \(j\) and \(k\).
4) Line \(m\) is perpendicular to the plane containing lines \(j\) and \(k\).

13 In the diagram below of parallelogram \(STUV\), \(SV = x + 3\), \(VU = 2x - 1\), and \(TU = 4x - 3\).

What is the length of \(SV\)?

1) 5
2) 2
3) 7
4) 4

14 Which equation represents a line parallel to the line whose equation is \(2y - 5x = 10\)?

1) \(5y - 2x = 25\)
2) \(5y + 2x = 10\)
3) \(4y - 10x = 12\)
4) \(2y + 10x = 8\)
15 In the diagram below of circle \( O \), chords \( AD \) and \( BC \) intersect at \( E \), \( \overarc{AC} = 87 \), and \( \overarc{BD} = 35 \).

What is the degree measure of \( \angle CEA \)?
1) 87
2) 61
3) 43.5
4) 26

16 In the diagram below of \( \triangle ADB \), \( m\angle BDA = 90 \), \( AD = 5\sqrt{2} \), and \( AB = 2\sqrt{15} \).

What is the length of \( \overline{BD} \)?
1) \( \sqrt{10} \)
2) \( \sqrt{20} \)
3) \( \sqrt{50} \)
4) \( \sqrt{110} \)

17 What is the distance between the points \((-3, 2)\) and \((1, 0)\)?
1) \( 2\sqrt{2} \)
2) \( 2\sqrt{3} \)
3) \( 5\sqrt{2} \)
4) \( 2\sqrt{5} \)

18 What is an equation of the line that contains the point \((3, -1)\) and is perpendicular to the line whose equation is \( y = -3x + 2 \)?
1) \( y = -3x + 8 \)
2) \( y = -3x \)
3) \( y = \frac{1}{3}x \)
4) \( y = \frac{1}{3}x - 2 \)

19 In the diagram below, \( \overline{SQ} \) and \( \overline{PR} \) intersect at \( T \), \( \overline{PQ} \) is drawn, and \( \overline{PS} \parallel \overline{QR} \).

What technique can be used to prove that \( \triangle PST \sim \triangle RQT \)?
1) SAS
2) SSS
3) ASA
4) AA
20 The equation of a circle is \((x - 2)^2 + (y + 4)^2 = 4\). Which diagram is the graph of the circle?

1)

2)

3)

4)

21 In the diagram below, \(\triangle ABC\) is shown with \(\overline{AC}\) extended through point \(D\).

If \(m\angle BCD = 6x + 2\), \(m\angle BAC = 3x + 15\), and \(m\angle ABC = 2x - 1\), what is the value of \(x\)?

1) 12

2) \(14 \frac{10}{11}\)

3) 16

4) 18 \(\frac{1}{9}\)

22 Given \(\triangle ABC \sim \triangle DEF\) such that \(\frac{AB}{DE} = \frac{3}{2}\). Which statement is not true?

1) \(\frac{BC}{EF} = \frac{3}{2}\)

2) \(\frac{m\angle A}{m\angle D} = \frac{3}{2}\)

3) \(\frac{\text{area of } \triangle ABC}{\text{area of } \triangle DEF} = \frac{9}{4}\)

4) \(\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} = \frac{3}{2}\)
23. The pentagon in the diagram below is formed by five rays.

What is the degree measure of angle $x$?
1) 72
2) 96
3) 108
4) 112

24. Through a given point, $P$, on a plane, how many lines can be drawn that are perpendicular to that plane?
1) 1
2) 2
3) more than 2
4) none

25. What is the slope of a line that is perpendicular to the line whose equation is $3x + 4y = 12$?
1) $\frac{3}{4}$
2) $-\frac{3}{4}$
3) $\frac{4}{3}$
4) $-\frac{4}{3}$

26. What is the image of point $A(4, 2)$ after the composition of transformations defined by $R_{90^\circ} \circ r_y = x$?
1) $(-4, 2)$
2) $(4, -2)$
3) $(-4, -2)$
4) $(2, -4)$

27. Which expression represents the volume, in cubic centimeters, of the cylinder represented in the diagram below?

1) $162\pi$
2) $324\pi$
3) $972\pi$
4) $3,888\pi$

28. What is the inverse of the statement “If two triangles are not similar, their corresponding angles are not congruent”?
1) If two triangles are similar, their corresponding angles are not congruent.
2) If corresponding angles of two triangles are not congruent, the triangles are not similar.
3) If two triangles are similar, their corresponding angles are congruent.
4) If corresponding angles of two triangles are congruent, the triangles are similar.
29 In $\triangle RST$, $m\angle RST = 46$ and $\overline{RS} \cong \overline{ST}$. Find $m\angle STR$.

30 Tim has a rectangular prism with a length of 10 centimeters, a width of 2 centimeters, and an unknown height. He needs to build another rectangular prism with a length of 5 centimeters and the same height as the original prism. The volume of the two prisms will be the same. Find the width, in centimeters, of the new prism.

31 In the diagram below of circle $C$, $\overline{QR}$ is a diameter, and $Q(1,8)$ and $C(3.5,2)$ are points on a coordinate plane. Find and state the coordinates of point $R$.

32 Using a compass and straightedge, and $\overline{AB}$ below, construct an equilateral triangle with all sides congruent to $\overline{AB}$. [Leave all construction marks.]

33 In the diagram below of $\triangle ACD$, $E$ is a point on $\overline{AD}$ and $B$ is a point on $\overline{AC}$, such that $\overline{EB} \parallel \overline{DC}$. If $AE = 3$, $ED = 6$, and $DC = 15$, find the length of $\overline{EB}$.

34 In the diagram below of $\triangle TEM$, medians $\overline{TB}$, $\overline{EC}$, and $\overline{MA}$ intersect at $D$, and $TB = 9$. Find the length of $\overline{TD}$.

35 In $\triangle KLM$, $m\angle K = 36$ and $KM = 5$. The transformation $D_2$ is performed on $\triangle KLM$ to form $\triangle K'L'M'$. Find $m\angle K'$. Justify your answer. Find the length of $K'M'$. Justify your answer.
36  Given: \(JKLM\) is a parallelogram.

\[
\begin{align*}
JM & \cong LN \\
\angle LMN & \cong \angle LNM
\end{align*}
\]

Prove: \(JKLM\) is a rhombus.

37  On the grid below, graph the points that are equidistant from both the \(x\) and \(y\) axes and the points that are 5 units from the origin. Label with an \(X\) all points that satisfy both conditions.

38  On the set of axes below, solve the following system of equations graphically for all values of \(x\) and \(y\).

\[
\begin{align*}
y &= (x - 2)^2 + 4 \\
4x + 2y &= 14
\end{align*}
\]
0610ge

1. In the diagram below of circle $O$, chord $\overline{AB} \parallel \overline{CD}$, and chord $\overline{CD} \parallel \overline{EF}$.

   Which statement must be true?
   1) $\overline{CE} \cong \overline{DF}$
   2) $\overline{AC} \cong \overline{DF}$
   3) $\overline{AC} \cong \overline{CE}$
   4) $\overline{EF} \cong \overline{CD}$

2. What is the negation of the statement “I am not going to eat ice cream”?
   1) I like ice cream.
   2) I am going to eat ice cream.
   3) If I eat ice cream, then I like ice cream.
   4) If I don’t like ice cream, then I don’t eat ice cream.

3. The diagram below shows a right pentagonal prism.

   Which statement is always true?
   1) $\overline{BC} \parallel \overline{ED}$
   2) $\overline{FG} \parallel \overline{CD}$
   3) $\overline{FJ} \parallel \overline{IH}$
   4) $\overline{GB} \parallel \overline{HC}$

4. In isosceles triangle $ABC$, $AB = BC$. Which statement will always be true?
   1) $m\angle B = m\angle A$
   2) $m\angle A > m\angle B$
   3) $m\angle A = m\angle C$
   4) $m\angle C < m\angle B$
5 The rectangle $ABCD$ shown in the diagram below will be reflected across the $x$-axis.

![Diagram of rectangle ABCD](image)

What will not be preserved?

1) slope of $AB$
2) parallelism of $AB$ and $CD$
3) length of $AB$
4) measure of $\angle A$

6 A right circular cylinder has an altitude of 11 feet and a radius of 5 feet. What is the lateral area, in square feet, of the cylinder, to the nearest tenth?

1) 172.7
2) 172.8
3) 345.4
4) 345.6

7 A transversal intersects two lines. Which condition would always make the two lines parallel?

1) Vertical angles are congruent.
2) Alternate interior angles are congruent.
3) Corresponding angles are supplementary.
4) Same-side interior angles are complementary.

8 If the diagonals of a quadrilateral do not bisect each other, then the quadrilateral could be a

1) rectangle
2) rhombus
3) square
4) trapezoid

9 What is the converse of the statement "If Bob does his homework, then George gets candy"?

1) If George gets candy, then Bob does his homework.
2) Bob does his homework if and only if George gets candy.
3) If George does not get candy, then Bob does not do his homework.
4) If Bob does not do his homework, then George does not get candy.

10 In $\triangle PQR$, $PQ = 8$, $QR = 12$, and $RP = 13$. Which statement about the angles of $\triangle PQR$ must be true?

1) $m\angle Q > m\angle P > m\angle R$
2) $m\angle Q > m\angle R > m\angle P$
3) $m\angle R > m\angle P > m\angle Q$
4) $m\angle P > m\angle R > m\angle Q$

11 Given: $y = \frac{1}{4}x - 3$

$y = x^2 + 8x + 12$

In which quadrant will the graphs of the given equations intersect?

1) I
2) II
3) III
4) IV
12 Which diagram shows the construction of an equilateral triangle?

1) 

2) 

3) 

4) 

13 Line segment $AB$ is tangent to circle $O$ at $A$. Which type of triangle is always formed when points $A$, $B$, and $O$ are connected?

1) right
2) obtuse
3) scalene
4) isosceles

14 What is an equation for the circle shown in the graph below?

1) $x^2 + y^2 = 2$
2) $x^2 + y^2 = 4$
3) $x^2 + y^2 = 8$
4) $x^2 + y^2 = 16$

15 Which transformation can map the letter $S$ onto itself?

1) glide reflection
2) translation
3) line reflection
4) rotation
16 In isosceles trapezoid $ABCD$, $AB \cong CD$. If $BC = 20$, $AD = 36$, and $AB = 17$, what is the length of the altitude of the trapezoid?
1) 10
2) 12
3) 15
4) 16

17 In plane $P$, lines $m$ and $n$ intersect at point $A$. If line $k$ is perpendicular to line $m$ and line $n$ at point $A$, then line $k$ is
1) contained in plane $P$
2) parallel to plane $P$
3) perpendicular to plane $P$
4) skew to plane $P$

18 The diagram below shows $AB$ and $DE$.

Which transformation will move $AB$ onto $DE$ such that point $D$ is the image of point $A$ and point $E$ is the image of point $B$?
1) $T_{3,-3}$
2) $D \frac{1}{2}$
3) $R_{90^\circ}$
4) $r_{y=x}$
19 In the diagram below of circle $O$, chords $AE$ and $DC$ intersect at point $B$, such that $m\overline{AC} = 36$ and $m\overline{DE} = 20$.

What is $m\angle ABC$?
1) 56
2) 36
3) 28
4) 8

20 The diagram below shows the construction of a line through point $P$ perpendicular to line $m$.

Which statement is demonstrated by this construction?
1) If a line is parallel to a line that is perpendicular to a third line, then the line is also perpendicular to the third line.
2) The set of points equidistant from the endpoints of a line segment is the perpendicular bisector of the segment.
3) Two lines are perpendicular if they are equidistant from a given point.
4) Two lines are perpendicular if they intersect to form a vertical line.

21 What is the length, to the nearest tenth, of the line segment joining the points $(-4, 2)$ and $(146, 52)$?
1) 141.4
2) 150.5
3) 151.9
4) 158.1

22 What is the slope of a line perpendicular to the line whose equation is $y = 3x + 4$?
1) $\frac{1}{3}$
2) $-\frac{1}{3}$
3) 3
4) $-3$
23 In the diagram below of circle $O$, secant $AB$ intersects circle $O$ at $D$, secant $AOC$ intersects circle $O$ at $E$, $AE = 4$, $AB = 12$, and $DB = 6$.

What is the length of $OC$?
1) 4.5
2) 7
3) 9
4) 14

24 The diagram below shows a pennant in the shape of an isosceles triangle. The equal sides each measure 13, the altitude is $x + 7$, and the base is $2x$.

What is the length of the base?
1) 5
2) 10
3) 12
4) 24

25 In the diagram below of $\triangle ABC$, $CD$ is the bisector of $\angle BCA$, $AE$ is the bisector of $\angle CAB$, and $BG$ is drawn.

Which statement must be true?
1) $DG = EG$
2) $AG = BG$
3) $\angle AEB \cong \angle AEC$
4) $\angle DBG \cong \angle EBG$

26 In the diagram below of circle $O$, chords $AD$ and $BC$ intersect at $E$.

Which relationship must be true?
1) $\triangle CAE \cong \triangle DBE$
2) $\triangle AEC \sim \triangle BDE$
3) $\angle ACB \cong \angle CBD$
4) $CA \cong DB$
27 Two lines are represented by the equations \(-\frac{1}{2}y = 6x + 10\) and \(y = mx\). For which value of \(m\) will the lines be parallel?
1) \(-12\)
2) \(-3\)
3) 3
4) 12

28 The coordinates of the vertices of parallelogram \(ABCD\) are \(A(-3, 2), B(-2, -1), C(4, 1),\) and \(D(3, 4)\). The slopes of which line segments could be calculated to show that \(ABCD\) is a rectangle?
1) \(AB\) and \(DC\)
2) \(AB\) and \(BC\)
3) \(AD\) and \(BC\)
4) \(AC\) and \(BD\)

29 Tim is going to paint a wooden sphere that has a diameter of 12 inches. Find the surface area of the sphere, to the nearest square inch.

30 In the diagram below of \(\triangle ABC\), \(\overline{DE}\) is a midsegment of \(\triangle ABC\), \(DE = 7\), \(AB = 10\), and \(BC = 13\). Find the perimeter of \(\triangle ABC\).

31 In right \(\triangle DEF\), \(m\angle D = 90\) and \(m\angle F\) is 12 degrees less than twice \(m\angle E\). Find \(m\angle E\).

32 Triangle \(XYZ\), shown in the diagram below, is reflected over the line \(x = 2\). State the coordinates of \(\triangle X'Y'Z'\), the image of \(\triangle XYZ\).
34 The base of a pyramid is a rectangle with a width of 6 cm and a length of 8 cm. Find, in centimeters, the height of the pyramid if the volume is 288 cm\(^3\).

35 Given: Quadrilateral \(ABCD\) with \(AB \cong CD\), \(AD \cong BC\), and diagonal \(BD\) is drawn
Prove: \(\angle BDC \cong \angle ABD\)

36 Find an equation of the line passing through the point \((6, 5)\) and perpendicular to the line whose equation is \(2y + 3x = 6\).

37 Write an equation of the circle whose diameter \(AB\) has endpoints \(A(-4, 2)\) and \(B(4, -4)\). [The use of the grid below is optional.]

38 In the diagram below, quadrilateral \(STAR\) is a rhombus with diagonals \(SA\) and \(TR\) intersecting at \(E\). \(ST = 3x + 30\), \(SR = 8x - 5\), \(SE = 3z\), \(TE = 5z + 5\), \(AE = 4z - 8\), \(m\angle RTA = 5y - 2\), and \(m\angle TAS = 9y + 8\). Find \(SR\), \(RT\), and \(m\angle TAS\).
1 In the diagram below, \( \triangle ABC \cong \triangle XYZ \).

Which two statements identify corresponding congruent parts for these triangles?
1) \( AB \cong XY \) and \( \angle C \cong \angle Y \)
2) \( AB \cong YZ \) and \( \angle C \cong \angle X \)
3) \( BC \cong XY \) and \( \angle A \cong \angle Y \)
4) \( BC \cong YZ \) and \( \angle A \cong \angle X \)

2 A support beam between the floor and ceiling of a house forms a 90\(^\circ\) angle with the floor. The builder wants to make sure that the floor and ceiling are parallel. Which angle should the support beam form with the ceiling?
1) 45\(^\circ\)
2) 60\(^\circ\)
3) 90\(^\circ\)
4) 180\(^\circ\)

3 In the diagram below, the vertices of \( \triangle DEF \) are the midpoints of the sides of equilateral triangle \( ABC \), and the perimeter of \( \triangle ABC \) is 36 cm.

What is the length, in centimeters, of \( EF \)?
1) 6
2) 12
3) 18
4) 4

4 What is the solution of the following system of equations?

\[
y = (x + 3)^2 - 4 \\
y = 2x + 5
\]

1) \((-4,-3)\) and \((0,5)\)
2) \((-3,-4)\) and \((5,0)\)

5 One step in a construction uses the endpoints of \( AB \) to create arcs with the same radii. The arcs intersect above and below the segment. What is the relationship of \( AB \) and the line connecting the points of intersection of these arcs?
1) collinear
2) congruent
3) parallel
4) perpendicular
6 If \( \triangle ABC \sim \triangle ZXY \), \( \angle A = 50 \), and \( \angle C = 30 \), what is \( \angle X \)?
1) 30
2) 50
3) 80
4) 100

7 In the diagram below of \( \triangle AGE \) and \( \triangle OLD \), \( \angle GAE \cong \angle LOD \), and \( AE \cong OD \).

To prove that \( \triangle AGE \) and \( \triangle OLD \) are congruent by SAS, what other information is needed?
1) \( GE \cong LD \)
2) \( AG \cong OL \)
3) \( \angle AGE \cong \angle OLD \)
4) \( \angle AEG \cong \angle ODL \)

8 Point \( A \) is not contained in plane \( \beta \). How many lines can be drawn through point \( A \) that will be perpendicular to plane \( \beta \)?
1) one
2) two
3) zero
4) infinite

9 The equation of a circle is \( x^2 + (y - 7)^2 = 16 \). What are the center and radius of the circle?
1) center = (0, 7); radius = 4
2) center = (0, 7); radius = 16
3) center = (0, -7); radius = 4
4) center = (0, -7); radius = 16

10 What is an equation of the line that passes through the point (7, 3) and is parallel to the line \( 4x + 2y = 10 \)?
1) \( y = \frac{1}{2}x - \frac{1}{2} \)
2) \( y = -\frac{1}{2}x + \frac{13}{2} \)
3) \( y = 2x - 11 \)
4) \( y = -2x + 17 \)

11 In \( \triangle ABC \), \( AB = 7 \), \( BC = 8 \), and \( AC = 9 \). Which list has the angles of \( \triangle ABC \) in order from smallest to largest?
1) \( \angle A, \angle B, \angle C \)
2) \( \angle B, \angle A, \angle C \)
3) \( \angle C, \angle B, \angle A \)
4) \( \angle C, \angle A, \angle B \)

12 Tangents \( PA \) and \( PB \) are drawn to circle \( O \) from an external point, \( P \), and radii \( OA \) and \( OB \) are drawn. If \( \angle APB = 40 \), what is the measure of \( \angle AOB \)?
1) 140°
2) 100°
3) 70°
4) 50°

13 What is the length of the line segment with endpoints (-6, 4) and (2, -5)?
1) \( \sqrt{13} \)
2) \( \sqrt{17} \)
3) \( \sqrt{72} \)
4) \( \sqrt{145} \)
14 The lines represented by the equations \( y + \frac{1}{2}x = 4 \) and \( 3x + 6y = 12 \) are
1) the same line
2) parallel
3) perpendicular
4) neither parallel nor perpendicular

15 A transformation of a polygon that always preserves both length and orientation is
1) dilation
2) translation
3) line reflection
4) glide reflection

16 In which polygon does the sum of the measures of the interior angles equal the sum of the measures of the exterior angles?
1) triangle
2) hexagon
3) octagon
4) quadrilateral

17 In the diagram below of circle \( O \), chords \( AB \) and \( CD \) intersect at \( E \).

If \( CE = 10 \), \( ED = 6 \), and \( AE = 4 \), what is the length of \( EB \)?
1) 15
2) 12
3) 6.7
4) 2.4

18 In the diagram below of \( \triangle ABC \), medians \( AD \), \( BE \), and \( CF \) intersect at \( G \).

If \( CF = 24 \), what is the length of \( FG \)?
1) 8
2) 10
3) 12
4) 16
19. If a line segment has endpoints $A(3x + 5, 3y)$ and $B(x - 1, -y)$, what are the coordinates of the midpoint of $AB$?
1) $(x + 3, 2y)$  
2) $(2x + 2, y)$  
3) $(2x + 3, y)$  
4) $(4x + 4, 2y)$

20. If the surface area of a sphere is represented by $144\pi$, what is the volume in terms of $\pi$?
1) $36\pi$  
2) $48\pi$  
3) $216\pi$  
4) $288\pi$

21. Which transformation of the line $x = 3$ results in an image that is perpendicular to the given line?
1) $r_{x-axis}$  
2) $r_{y-axis}$  
3) $r_{y=x}$  
4) $r_{x=1}$

22. In the diagram below of regular pentagon $ABCDE$, $\overline{EB}$ is drawn.

What is the measure of $\angle AEB$?
1) $36^\circ$  
2) $54^\circ$  
3) $72^\circ$  
4) $108^\circ$

23. $\triangle ABC$ is similar to $\triangle DEF$. The ratio of the length of $AB$ to the length of $DE$ is $3:1$. Which ratio is also equal to $3:1$?
1) $\frac{m\angle A}{m\angle D}$  
2) $\frac{m\angle B}{m\angle F}$  
3) $\frac{\text{area of } \triangle ABC}{\text{area of } \triangle DEF}$  
4) $\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF}$

24. What is the slope of a line perpendicular to the line whose equation is $2y = -6x + 8$?
1) $-3$  
2) $\frac{1}{6}$  
3) $\frac{1}{3}$  
4) $-6$

25. In the diagram below of circle $C$, $m\overline{QT} = 140$, and $m\angle P = 40$.

What is $m\overline{RS}$?
1) 50  
2) 60  
3) 90  
4) 110
26 Which statement is logically equivalent to "If it is warm, then I go swimming"
   1) If I go swimming, then it is warm.
   2) If it is warm, then I do not go swimming.
   3) If I do not go swimming, then it is not warm.
   4) If it is not warm, then I do not go swimming.

27 In the diagram below of \( \triangle ACT \), \( BE \parallel AT \).

![Diagram](image)

If \( CB = 3 \), \( CA = 10 \), and \( CE = 6 \), what is the length of \( ET \)?
   1) 5
   2) 14
   3) 20
   4) 26

28 Which geometric principle is used in the construction shown below?

![Diagram](image)

1) The intersection of the angle bisectors of a triangle is the center of the inscribed circle.
2) The intersection of the angle bisectors of a triangle is the center of the circumscribed circle.
3) The intersection of the perpendicular bisectors of the sides of a triangle is the center of the inscribed circle.
4) The intersection of the perpendicular bisectors of the sides of a triangle is the center of the circumscribed circle.

29 The diagram below shows isosceles trapezoid \( ABCD \) with \( AB \parallel DC \) and \( AD \cong BC \). If \( m\angle BAD = 2x \) and \( m\angle BCD = 3x + 5 \), find \( m\angle BAD \).

![Diagram](image)

30 A right circular cone has a base with a radius of 15 cm, a vertical height of 20 cm, and a slant height of 25 cm. Find, in terms of \( \pi \), the number of square centimeters in the lateral area of the cone.
31. In the diagram below of $\triangle HQP$, side $HP$ is extended through $P$ to $T$, $m\angle QPT = 6x + 20$, $m\angle HQP = x + 40$, and $m\angle PHQ = 4x - 5$. Find $m\angle QPT$.

![Diagram of triangle HQP with angles labeled](image)

32. On the line segment below, use a compass and straightedge to construct equilateral triangle $ABC$. [Leave all construction marks.]

![Line segment with points A and B](image)

33. In the diagram below, car $A$ is parked 7 miles from car $B$. Sketch the points that are 4 miles from car $A$ and sketch the points that are 4 miles from car $B$. Label with an $X$ all points that satisfy both conditions.

![Diagram with points A and B and labeled X](image)

34. Write an equation for circle $O$ shown on the graph below.

![Graph with circle and labeled points](image)
35 In the diagram below of quadrilateral $ABCD$ with diagonal $BD$, $m\angle A = 93$, $m\angle ADB = 43$, $m\angle C = 3x + 5$, $m\angle BDC = x + 19$, and $m\angle DBC = 2x + 6$. Determine if $AB$ is parallel to $DC$. Explain your reasoning.

36 The coordinates of the vertices of $\triangle ABC$ $A(1, 3)$, $B(-2, 2)$ and $C(0, -2)$. On the grid below, graph and label $\triangle A''B''C''$, the result of the composite transformation $D_2 \circ T_{3,-2}$. State the coordinates of $A''$, $B''$, and $C''$.

37 In the diagram below, $\triangle RST$ is a $3 - 4 - 5$ right triangle. The altitude, $h$, to the hypotenuse has been drawn. Determine the length of $h$.

38 Given: Quadrilateral $ABCD$ has vertices $A(-5, 6)$, $B(6, 6)$, $C(8, -3)$, and $D(-3, -3)$.
Prove: Quadrilateral $ABCD$ is a parallelogram but is neither a rhombus nor a rectangle. [The use of the grid below is optional.]
1 In the diagram below, $AB$, $BC$, and $AC$ are tangents to circle $O$ at points $F$, $E$, and $D$, respectively, $AF = 6$, $CD = 5$, and $BE = 4$. What is the perimeter of $\triangle ABC$?

1) 15
2) 25
3) 30
4) 60

2 Quadrilateral $MNOP$ is a trapezoid with $MN \parallel OP$. If $M'N'O'P'$ is the image of $MNOP$ after a reflection over the x-axis, which two sides of quadrilateral $M'N'O'P'$ are parallel?

1) $M'N'$ and $O'P'$
2) $M'N'$ and $N'O'$
3) $P'M'$ and $O'P'$
4) $P'M'$ and $N'O'$

3 In the diagram below of $\triangle ABC$, $D$ is the midpoint of $AB$, and $E$ is the midpoint of $BC$. If $AC = 4x + 10$, which expression represents $DE$?

1) $x + 2.5$
2) $2x + 5$
3) $2x + 10$
4) $8x + 20$

4 Which statement is true about every parallelogram?

1) All four sides are congruent.
2) The interior angles are all congruent.
3) Two pairs of opposite sides are congruent.
4) The diagonals are perpendicular to each other.
5 The diagram below shows a rectangular prism.

Which pair of edges are segments of lines that are coplanar?
1) $AB$ and $DH$
2) $AE$ and $DC$
3) $BC$ and $EH$
4) $CG$ and $EF$

6 A line segment has endpoints $A(7, -1)$ and $B(-3, 3)$.
What are the coordinates of the midpoint of $AB$?
1) $(1, 2)$
2) $(2, 1)$
3) $(-5, 2)$
4) $(5, -2)$

7 What is the image of the point $(-5, 2)$ under the translation $T_{3, -4}$?
1) $(-9, 5)$
2) $(-8, 6)$
3) $(-2, -2)$
4) $(-15, -8)$

8 When writing a geometric proof, which angle relationship could be used alone to justify that two angles are congruent?
1) supplementary angles
2) linear pair of angles
3) adjacent angles
4) vertical angles

9 Plane $R$ is perpendicular to line $k$ and plane $D$ is perpendicular to line $k$. Which statement is correct?
1) Plane $R$ is perpendicular to plane $D$.
2) Plane $R$ is parallel to plane $D$.
3) Plane $R$ intersects plane $D$.
4) Plane $R$ bisects plane $D$.

10 The vertices of the triangle in the diagram below are $A(7, 9), B(3, 3),$ and $C(11, 3)$.

What are the coordinates of the centroid of $\triangle ABC$?
1) $(5, 6)$
2) $(7, 3)$
3) $(7, 5)$
4) $(9, 6)$

11 Which set of numbers does not represent the sides of a right triangle?
1) $\{6, 8, 10\}$
2) $\{8, 15, 17\}$
3) $\{8, 24, 25\}$
4) $\{15, 36, 39\}$
12 In the diagram below of rhombus $ABCD$, $m \angle C = 100$. What is $m \angle DBC$?

1) 40  
2) 45  
3) 50  
4) 80

13 In the diagram below of circle $O$, radius $OC$ is 5 cm. Chord $AB$ is 8 cm and is perpendicular to $OC$ at point $P$. What is the length of $OP$, in centimeters?

1) 8  
2) 2  
3) 3  
4) 4

14 What is an equation of the line that passes through the point $(-2, 3)$ and is parallel to the line whose equation is $y = \frac{3}{2} x - 4$?

1) $y = -\frac{2}{3} x$  
2) $y = -\frac{2}{3} x + \frac{5}{3}$  
3) $y = \frac{3}{2} x$  
4) $y = \frac{3}{2} x + 6$

15 In scalene triangle $ABC$, $m \angle B = 45$ and $m \angle C = 55$. What is the order of the sides in length, from longest to shortest?

1) $\overline{AB}$, $\overline{BC}$, $\overline{AC}$  
2) $\overline{BC}$, $\overline{AC}$, $\overline{AB}$  
3) $\overline{AC}$, $\overline{BC}$, $\overline{AB}$  
4) $\overline{BC}$, $\overline{AB}$, $\overline{AC}$

16 What is an equation of a circle with center $(7, -3)$ and radius 4?

1) $(x - 7)^2 + (y + 3)^2 = 4$  
2) $(x + 7)^2 + (y - 3)^2 = 4$  
3) $(x - 7)^2 + (y + 3)^2 = 16$  
4) $(x + 7)^2 + (y - 3)^2 = 16$

17 What is the volume, in cubic centimeters, of a cylinder that has a height of 15 cm and a diameter of 12 cm?

1) $180\pi$  
2) $540\pi$  
3) $675\pi$  
4) $2,160\pi$
18 Which compound statement is true?
1) A triangle has three sides and a quadrilateral has five sides.
2) A triangle has three sides if and only if a quadrilateral has five sides.
3) If a triangle has three sides, then a quadrilateral has five sides.
4) A triangle has three sides or a quadrilateral has five sides.

19 The two lines represented by the equations below are graphed on a coordinate plane.
\[ x + 6y = 12 \]
\[ 3(x - 2) = -y - 4 \]
Which statement best describes the two lines?
1) The lines are parallel.
2) The lines are the same line.
3) The lines are perpendicular.
4) The lines intersect at an angle other than 90°.

20 Which diagram shows the construction of the perpendicular bisector of \( AB \)?

21 In circle \( O \), a diameter has endpoints \((-5, 4)\) and \((3, -6)\). What is the length of the diameter?
1) \( \sqrt{2} \)
2) \( 2\sqrt{2} \)
3) \( \sqrt{10} \)
4) \( 2\sqrt{41} \)
22 In the diagram of quadrilateral $ABCD$, $AB \parallel CD$, $\angle ABC \cong \angle CDA$, and diagonal $AC$ is drawn.

Which method can be used to prove $\triangle ABC$ is congruent to $\triangle CDA$?
1) AAS
2) SSA
3) SAS
4) SSS

23 In the diagram below of right triangle $ABC$, $CD$ is the altitude to hypotenuse $AB$, $CB = 6$, and $AD = 5$.

What is the length of $BD$?
1) 5
2) 9
3) 3
4) 4

24 In the diagram below, quadrilateral $JUMP$ is inscribed in a circle.

Opposite angles $J$ and $M$ must be
1) right
2) complementary
3) congruent
4) supplementary
25 Which graph represents a circle with the equation 
\((x - 3)^2 + (y + 1)^2 = 4\)?

1)  

2)  

3)  

4)  

26 The point \((3, -2)\) is rotated 90° about the origin and then dilated by a scale factor of 4. What are the coordinates of the resulting image? 
1) \((-12, 8)\) 
2) \((12, -8)\) 
3) \((8, 12)\) 
4) \((-8, -12)\) 

27 In the diagram below of \(\triangle ABC\), side \(\overline{BC}\) is extended to point \(D\), \(m\angle A = x\), \(m\angle B = 2x + 15\), and \(m\angle ACD = 5x + 5\).

What is \(m\angle B\)? 
1) 5 
2) 20 
3) 25 
4) 55 

28 Point \(P\) lies on line \(m\). Point \(P\) is also included in distinct planes \(Q, R, S,\) and \(T\). At most, how many of these planes could be perpendicular to line \(m\)? 
1) 1 
2) 2 
3) 3 
4) 4
29 In the diagram below of $\triangle ACD$, $B$ is a point on $AC$ such that $\triangle ADB$ is an equilateral triangle, and $\triangle DBC$ is an isosceles triangle with $DB \cong BC$. Find $m\angle C$.

![Diagram of triangle ACD with B on AC, ADB equilateral, and DBC isosceles]

30 Triangle $ABC$ has vertices $A(-2, 2)$, $B(-1, -3)$, and $C(4, 0)$. Find the coordinates of the vertices of $\triangle A'B'C'$, the image of $\triangle ABC$ after the transformation $r_{x-axis}$. [The use of the grid is optional.]

![Diagram of triangle ABC and its image A'B'C']

31 Find, in degrees, the measures of both an interior angle and an exterior angle of a regular pentagon.

32 In the diagram below of circle $O$, chord $AB$ bisects chord $CD$ at $E$. If $AE = 8$ and $BE = 9$, find the length of $CE$ in simplest radical form.

![Diagram of circle O with chord AB bisecting chord CD at E]

33 On the diagram below, use a compass and straightedge to construct the bisector of $\angle ABC$. [Leave all construction marks.]

![Diagram showing construction of angle bisector]

34 Find the slope of a line perpendicular to the line whose equation is $2y - 6x = 4$. 

![Diagram showing line and its perpendicular]
35 On the set of axes below, graph the locus of points that are four units from the point (2, 1). On the same set of axes, graph the locus of points that are two units from the line \(x = 4\). State the coordinates of all points that satisfy both conditions.

36 In the diagram below, \(\overline{BFCE}, \overline{AB} \perp \overline{BE}, \overline{DE} \perp \overline{BE}\), and \(\angle BFD \cong \angle ECA\). Prove that \(\triangle ABC \sim \triangle DEF\).

37 In the diagram below of \(\triangle ADE\), \(B\) is a point on \(\overline{AE}\) and \(C\) is a point on \(\overline{AD}\) such that \(\overline{BC} \parallel \overline{ED}\), \(AC = x - 3, BE = 20, AB = 16, \) and \(AD = 2x + 2\). Find the length of \(\overline{AC}\).

38 Quadrilateral \(MATH\) has coordinates \(M(1, 1), A(-2, 5), T(3, 5), \) and \(H(6, 1)\). Prove that quadrilateral \(MATH\) is a rhombus and prove that it is not a square. [The use of the grid is optional.]
1 Line segment $AB$ is shown in the diagram below.

Which two sets of construction marks, labeled I, II, III, and IV, are part of the construction of the perpendicular bisector of line segment $AB$?
1) I and II
2) I and III
3) II and III
4) II and IV

2 If $\triangle JKL \cong \triangle MNO$, which statement is always true?
1) $\angle K \cong \angle N$
2) $\angle K \cong \angle M$
3) $\overline{JL} \cong \overline{MO}$
4) $\overline{JK} \cong \overline{ON}$

3 In the diagram below, $\triangle A'B'C'$ is a transformation of $\triangle ABC$, and $\triangle A''B''C''$ is a transformation of $\triangle A'B'C'$.

The composite transformation of $\triangle ABC$ to $\triangle A''B''C''$ is an example of a
1) reflection followed by a rotation
2) reflection followed by a translation
3) translation followed by a rotation
4) translation followed by a reflection
4 In the diagram below of \( \triangle ACE \), medians \( \overline{AD}, \overline{EB}, \) and \( \overline{CF} \) intersect at \( G \). The length of \( FG \) is 12 cm. What is the length, in centimeters, of \( GC \)?

1) 24
2) 12
3) 6
4) 4

5 In the diagram below of circle \( O \), chord \( AB \) is parallel to chord \( CD \).

Which statement must be true?

1) \( \overline{AC} \cong \overline{BD} \)
2) \( \overline{AB} \cong \overline{CD} \)
3) \( \overline{AB} \cong \overline{CD} \)
4) \( \overline{ABD} \cong \overline{CDB} \)

6 In the diagram below, line \( p \) intersects line \( m \) and line \( n \).

If \( \angle 1 = 7x \) and \( \angle 2 = 5x + 30 \), lines \( m \) and \( n \) are parallel when \( x \) equals

1) 12.5
2) 15
3) 87.5
4) 105

7 In the diagram of \( \triangle KLM \) below, \( \angle L = 70 \), \( \angle M = 50 \), and \( MK \) is extended through \( N \).

What is the measure of \( \angle LKN \)?

1) 60°
2) 120°
3) 180°
4) 300°
8 If two distinct planes, \( A \) and \( B \), are perpendicular to line \( c \), then which statement is true?
1) Planes \( A \) and \( B \) are parallel to each other.
2) Planes \( A \) and \( B \) are perpendicular to each other.
3) The intersection of planes \( A \) and \( B \) is a line parallel to line \( c \).
4) The intersection of planes \( A \) and \( B \) is a line perpendicular to line \( c \).

9 What is the length of the line segment whose endpoints are \( A(-1, 9) \) and \( B(7, 4) \)?
1) \( \sqrt{61} \)
2) \( \sqrt{89} \)
3) \( \sqrt{205} \)
4) \( \sqrt{233} \)

10 What is an equation of circle \( O \) shown in the graph below?

11 In the diagram below, parallelogram \( ABCD \) has diagonals \( AC \) and \( BD \) that intersect at point \( E \).

Which expression is not always true?
1) \( \angle DAE \cong \angle BCE \)
2) \( \angle DEC \cong \angle BEA \)
3) \( \overline{AC} \cong \overline{DB} \)
4) \( \overline{DE} \cong \overline{EB} \)

12 The volume, in cubic centimeters, of a sphere whose diameter is 6 centimeters is
1) \( 12\pi \)
2) \( 36\pi \)
3) \( 48\pi \)
4) \( 288\pi \)

13 The equation of line \( k \) is \( y = \frac{1}{3}x - 2 \). The equation of line \( m \) is \(-2x + 6y = 18\). Lines \( k \) and \( m \) are
1) parallel
2) perpendicular
3) the same line
4) neither parallel nor perpendicular

14 What are the center and the radius of the circle whose equation is \((x - 5)^2 + (y + 3)^2 = 16\)?
1) \((-5, 3)\) and \(16\)
2) \((5, -3)\) and \(16\)
3) \((-5, 3)\) and \(4\)
4) \((5, -3)\) and \(4\)

15 Triangle \( ABC \) has vertices \( A(0, 0) \), \( B(3, 2) \), and \( C(0, 4) \). The triangle may be classified as
1) equilateral
2) isosceles
3) right
4) scalene
16 In rhombus $ABCD$, the diagonals $AC$ and $BD$ intersect at $E$. If $AE = 5$ and $BE = 12$, what is the length of $AB$?

1) 7  
2) 10  
3) 13  
4) 17

17 In the diagram below of circle $O$, $PA$ is tangent to circle $O$ at $A$, and $PBC$ is a secant with points $B$ and $C$ on the circle.

If $PA = 8$ and $PB = 4$, what is the length of $BC$?

1) 20  
2) 16  
3) 15  
4) 12

18 Lines $m$ and $n$ intersect at point $A$. Line $k$ is perpendicular to both lines $m$ and $n$ at point $A$. Which statement must be true?

1) Lines $m$, $n$, and $k$ are in the same plane.  
2) Lines $m$ and $n$ are in two different planes.  
3) Lines $m$ and $n$ are perpendicular to each other.  
4) Line $k$ is perpendicular to the plane containing lines $m$ and $n$.

19 In $\triangle DEF$, $m\angle D = 3x + 5$, $m\angle E = 4x - 15$, and $m\angle F = 2x + 10$. Which statement is true?

1) $DF = FE$  
2) $DE = FE$  
3) $m\angle E = m\angle F$  
4) $m\angle D = m\angle F$

20 As shown in the diagram below, $\triangle ABC \sim \triangle DEF$, $AB = 7x$, $BC = 4$, $DE = 7$, and $EF = x$.

What is the length of $AB$?

1) 28  
2) 2  
3) 14  
4) 4

21 A man wants to place a new bird bath in his yard so that it is 30 feet from a fence, $f$, and also 10 feet from a light pole, $P$. As shown in the diagram below, the light pole is 35 feet away from the fence.

How many locations are possible for the bird bath?

1) 1  
2) 2  
3) 3  
4) 0
22. As shown on the graph below, \( \triangle R'S'T' \) is the image of \( \triangle RST \) under a single transformation. Which transformation does this graph represent?

1) glide reflection
2) line reflection
3) rotation
4) translation

23. Which line is parallel to the line whose equation is
\[ 4x + 3y = 7 \] and also passes through the point \((-5, 2)\)?

1) \( 4x + 3y = -26 \)
2) \( 4x + 3y = -14 \)
3) \( 3x + 4y = -7 \)
4) \( 3x + 4y = 14 \)

24. If the vertex angles of two isosceles triangles are congruent, then the triangles must be

1) acute
2) congruent
3) right
4) similar

25. Which quadrilateral has diagonals that always bisect its angles and also bisect each other?

1) rhombus
2) rectangle
3) parallelogram
4) isosceles trapezoid

26. When \( \triangle ABC \) is dilated by a scale factor of 2, its image is \( \triangle A'B'C' \). Which statement is true?

1) \( \overline{AC} \cong A'C' \)
2) \( \angle A \cong \angle A' \)
3) perimeter of \( \triangle ABC \) = perimeter of \( \triangle A'B'C' \)
4) 2(area of \( \triangle ABC \)) = area of \( \triangle A'B'C' \)

27. What is the slope of a line that is perpendicular to the line whose equation is \( 3x + 5y = 4 \)?

1) \( -\frac{3}{5} \)
2) \( \frac{3}{5} \)
3) \( -\frac{5}{3} \)
4) \( \frac{5}{3} \)

28. In the diagram below of right triangle \( ABC \), altitude \( BD \) is drawn to hypotenuse \( AC \), \( AC = 16 \), and \( CD = 7 \).

What is the length of \( BD \)?

1) \( 3\sqrt{7} \)
2) \( 4\sqrt{7} \)
3) \( 7\sqrt{3} \)
4) 12

29. Given the true statement, "The medians of a triangle are concurrent," write the negation of the statement and give the truth value for the negation.
30. Using a compass and straightedge, on the diagram below of $RS$, construct an equilateral triangle with $RS$ as one side. [Leave all construction marks.]

31. The Parkside Packing Company needs a rectangular shipping box. The box must have a length of 11 inches and a width of 8 inches. Find, to the nearest tenth of an inch, the minimum height of the box such that the volume is at least 800 cubic inches.

32. A pentagon is drawn on the set of axes below. If the pentagon is reflected over the $y$-axis, determine if this transformation is an isometry. Justify your answer. [The use of the set of axes is optional.]

33. In the diagram below of $\triangle ABC$, $D$ is a point on $AB$, $E$ is a point on $BC$, $AC \parallel DE$, $CE = 25$ inches, $AD = 18$ inches, and $DB = 12$ inches. Find, to the nearest tenth of an inch, the length of $EB$.

34. In circle $O$, diameter $RS$ has endpoints $R(3a, 2b - 1)$ and $S(a - 6, 4b + 5)$. Find the coordinates of point $O$, in terms of $a$ and $b$. Express your answer in simplest form.
35 On the set of coordinate axes below, graph the locus of points that are equidistant from the lines \( y = 6 \) and \( y = 2 \) and also graph the locus of points that are 3 units from the \( y \)-axis. State the coordinates of all points that satisfy both conditions.

36 In the diagram below, tangent \( ML \) and secant \( MNK \) are drawn to circle \( O \). The ratio \( mLN : mNK : mKL \) is \( 3:4:5 \). Find \( m\angle LMK \).

37 Solve the following system of equations graphically.

\[
\begin{align*}
2x^2 - 4x &= y + 1 \\
x + y &= 1
\end{align*}
\]

38 In the diagram below, \( PA \) and \( PB \) are tangent to circle \( O \), \( OA \) and \( OB \) are radii, and \( OP \) intersects the circle at \( C \). Prove: \( \angle AOP \approx \angle BOP \).
1 The statement "x is a multiple of 3, and x is an even integer" is true when x is equal to
1) 9
2) 8
3) 3
4) 6

2 In the diagram below, \( \triangle ABC \cong \triangle XYZ \).

Which statement must be true?
1) \( \angle C \cong \angle Y \)
2) \( \angle A \cong \angle X \)
3) \( AC \cong YZ \)
4) \( CB \cong XZ \)

3 In the diagram below of \( \triangle ABC \), \( TV \parallel BC \), \( AT = 5 \), \( TB = 7 \), and \( AV = 10 \).

What is the length of \( VC \)?
1) \( 3 \frac{1}{2} \)
2) \( 7 \frac{1}{7} \)
3) 14
4) 24

4 Pentagon \( PQRST \) has \( PQ \) parallel to \( TS \). After a translation of \( T_{2,-5} \), which line segment is parallel to \( P'Q' \)?
1) \( R'S' \)
2) \( R'Q' \)
3) \( T'S' \)
4) \( T'P' \)

5 In the diagram below of \( \triangle PAO \), \( AP \) is tangent to circle \( O \) at point \( A \), \( OB = 7 \), and \( BP = 18 \).

What is the length of \( AP \)?
1) 10
2) 12
3) 17
4) 24
6 A straightedge and compass were used to create the construction below. Arc $EF$ was drawn from point $B$, and arcs with equal radii were drawn from $E$ and $F$.

Which statement is false?
1) $\angle ABD = \angle DBC$
2) $\frac{1}{2}(\angle ABC) = \angle ABD$
3) $2(\angle DBC) = \angle ABC$
4) $2(\angle ABC) = \angle CBD$

7 What is the length of the line segment whose endpoints are $(1, -4)$ and $(9, 2)$?
1) 5
2) $2\sqrt{17}$
3) 10
4) $2\sqrt{26}$

8 What is the image of the point $(2, -3)$ after the transformation $r_y$-axis?
1) $(2, 3)$
2) $(-2, -3)$
3) $(-2, 3)$
4) $(-3, 2)$

9 In the diagram below, lines $n$ and $m$ are cut by transversals $p$ and $q$.

What value of $x$ would make lines $n$ and $m$ parallel?
1) 110
2) 80
3) 70
4) 50

10 What is an equation of the circle with a radius of 5 and center at $(1, -4)$?
1) $(x + 1)^2 + (y - 4)^2 = 5$
2) $(x - 1)^2 + (y + 4)^2 = 5$
3) $(x + 1)^2 + (y - 4)^2 = 25$
4) $(x - 1)^2 + (y + 4)^2 = 25$

11 In the diagram below of $\triangle BCD$, side $DB$ is extended to point $A$.

Which statement must be true?
1) $\angle C > \angle D$
2) $\angle ABC < \angle D$
3) $\angle ABC > \angle C$
4) $\angle ABC > \angle C + \angle D$
12 Which equation represents the line parallel to the line whose equation is \(4x + 2y = 14\) and passing through the point \((2, 2)\)?
1) \(y = -2x\)
2) \(y = -2x + 6\)
3) \(y = \frac{1}{2}x\)
4) \(y = \frac{1}{2}x + 1\)

13 The coordinates of point \(A\) are \((-3a, 4b)\). If point \(A'\) is the image of point \(A\) reflected over the line \(y = x\), the coordinates of \(A'\) are
1) \((4b, -3a)\)
2) \((3a, 4b)\)
3) \((-3a, -4b)\)
4) \((-4b, -3a)\)

14 As shown in the diagram below, \(AC\) bisects \(\angle BAD\) and \(\angle B \cong \angle D\).

Which method could be used to prove \(\triangle ABC \cong \triangle ADC\)?
1) SSS
2) AAA
3) SAS
4) AAS

15 Segment \(AB\) is the diameter of circle \(M\). The coordinates of \(A\) are \((-4, 3)\). The coordinates of \(M\) are \((1, 5)\). What are the coordinates of \(B\)?
1) \((6, 7)\)
2) \((5, 8)\)
3) \((-3, 8)\)
4) \((-5, 2)\)

16 In the diagram below, \(AB\) is perpendicular to plane \(AEFG\).

Which plane must be perpendicular to plane \(AEFG\)?
1) \(ABCE\)
2) \(BCDH\)
3) \(CDFE\)
4) \(HDFG\)

17 How many points are both 4 units from the origin and also 2 units from the line \(y = 4\)?
1) 1
2) 2
3) 3
4) 4

18 When solved graphically, what is the solution to the following system of equations?
\[\begin{align*}
y &= x^2 - 4x + 6 \\
y &= x + 2
\end{align*}\]
1) \((1, 4)\)
2) \((4, 6)\)
3) \((1, 3)\) and \((4, 6)\)
4) \((3, 1)\) and \((6, 4)\)

19 Triangle \(PQR\) has angles in the ratio of 2:3:5. Which type of triangle is \(\triangle PQR\)?
1) acute
2) isosceles
3) obtuse
4) right
20 Plane \( A \) is parallel to plane \( B \). Plane \( C \) intersects plane \( A \) in line \( m \) and intersects plane \( B \) in line \( n \). Lines \( m \) and \( n \) are
1) intersecting
2) parallel
3) perpendicular
4) skew

21 The diagonals of a quadrilateral are congruent but do not bisect each other. This quadrilateral is
1) an isosceles trapezoid
2) a parallelogram
3) a rectangle
4) a rhombus

22 What is the slope of a line that is perpendicular to the line represented by the equation \( x + 2y = 3 \)?
1) \(-2\)
2) \(2\)
3) \(-\frac{1}{2}\)
4) \(\frac{1}{2}\)

23 A packing carton in the shape of a triangular prism is shown in the diagram below.

What is the volume, in cubic inches, of this carton?
1) 20
2) 60
3) 120
4) 240

24 In the diagram below of circle \( O \), diameter \( \overline{AOB} \) is perpendicular to chord \( \overline{CD} \) at point \( E \), \( OA = 6 \), and \( OE = 2 \).

What is the length of \( \overline{CE} \)?
1) \(4\sqrt{3}\)
2) \(2\sqrt{3}\)
3) \(8\sqrt{2}\)
4) \(4\sqrt{2}\)

25 What is the measure of each interior angle of a regular hexagon?
1) \(60^\circ\)
2) \(120^\circ\)
3) \(135^\circ\)
4) \(270^\circ\)

26 Which equation represents the perpendicular bisector of \( AB \) whose endpoints are \( A(8, 2) \) and \( B(0, 6) \)?
1) \(y = 2x - 4\)
2) \(y = -\frac{1}{2}x + 2\)
3) \(y = -\frac{1}{2}x + 6\)
4) \(y = 2x - 12\)
27 As shown in the diagram below, a kite needs a vertical and a horizontal support bar attached at opposite corners. The upper edges of the kite are 7 inches, the side edges are \( x \) inches, and the vertical support bar is \((x + 1)\) inches.

![Diagram of a kite](image)

What is the measure, in inches, of the vertical support bar?
1) 23
2) 24
3) 25
4) 26

28 Given three distinct quadrilaterals, a square, a rectangle, and a rhombus, which quadrilaterals must have perpendicular diagonals?
1) the rhombus, only
2) the rectangle and the square
3) the rhombus and the square
4) the rectangle, the rhombus, and the square

29 In the diagram below, trapezoid \( ABCD \), with bases \( AB \) and \( DC \), is inscribed in circle \( O \), with diameter \( DC \). If \( m\overline{AB} = 80 \), find \( m\overline{BC} \).

![Diagram of a circle and a trapezoid](image)

30 On the diagram of \( \triangle ABC \) shown below, use a compass and straightedge to construct the perpendicular bisector of \( \overline{AC} \). [Leave all construction marks.]

![Diagram of a triangle](image)

31 A sphere has a diameter of 18 meters. Find the volume of the sphere, in cubic meters, in terms of \( \pi \).
32 Write an equation of the circle graphed in the diagram below.

33 The diagram below shows $\triangle ABC$, with $AEB$, $ADC$, and $\angle ACB \cong \angle AED$. Prove that $\triangle ABC$ is similar to $\triangle ADE$.

34 Triangle $ABC$ has vertices $A(3, 3)$, $B(7, 9)$, and $C(11, 3)$. Determine the point of intersection of the medians, and state its coordinates. [The use of the set of axes below is optional.]

35 In the diagram below of $\triangle GJK$, $H$ is a point on $GJ$, $HJ \cong JK$, $m \angle G = 28$, and $m \angle GJK = 70$. Determine whether $\triangle GHK$ is an isosceles triangle and justify your answer.
36 As shown on the set of axes below, \( \triangle GHS \) has vertices \( G(3, 1), H(5, 3), \) and \( S(1, 4) \). Graph and state the coordinates of \( \triangle G''H''S'' \), the image of \( \triangle GHS \) after the transformation \( T_{-3, 1} \circ D_2 \).

37 In the diagram below, \( \triangle ABC \sim \triangle DEF \), \( DE = 4 \), \( AB = x \), \( AC = x + 2 \), and \( DF = x + 6 \). Determine the length of \( AB \). [Only an algebraic solution can receive full credit.]

38 Given: \( \triangle ABC \) with vertices \( A(-6, -2), B(2, 8), \) and \( C(6, -2) \). \( AB \) has midpoint \( D \), \( BC \) has midpoint \( E \), and \( AC \) has midpoint \( F \).
Prove: \( ADEF \) is a parallelogram
\( ADEF \) is not a rhombus
[The use of the grid is optional.]
1. Line \( n \) intersects lines \( l \) and \( m \), forming the angles shown in the diagram below.

Which value of \( x \) would prove \( l \parallel m \)?
1) 2.5  
2) 4.5  
3) 6.25  
4) 8.75

2. In a given triangle, the point of intersection of the three medians is the same as the point of intersection of the three altitudes. Which classification of the triangle is correct?
1) scalene triangle  
2) isosceles triangle  
3) equilateral triangle  
4) right isosceles triangle

3. A circle has the equation \((x - 2)^2 + (y + 3)^2 = 36\). What are the coordinates of its center and the length of its radius?
1) \((-2, 3)\) and 6  
2) \((2, -3)\) and 6  
3) \((-2, 3)\) and 36  
4) \((2, -3)\) and 36

4. In the diagram below, \( MATH \) is a rhombus with diagonals \( AH \) and \( MT \).

If \( m \angle HAM = 12 \), what is \( m \angle AMT \)?
1) 12  
2) 78  
3) 84  
4) 156

5. A line segment has endpoints \((4, 7)\) and \((1, 11)\). What is the length of the segment?
1) 5  
2) 7  
3) 16  
4) 25

6. In \( \triangle FGH \), \( m \angle F = 42 \) and an exterior angle at vertex \( H \) has a measure of 104. What is \( m \angle G \)?
1) 34  
2) 62  
3) 76  
4) 146
7  Which diagram represents a correct construction of equilateral \(\triangle ABC\), given side \(AB\)?

8  In the diagram below, \(\triangle ABC\) is circumscribed about circle \(O\) and the sides of \(\triangle ABC\) are tangent to the circle at points \(D, E,\) and \(F\).

If \(AB = 20, AE = 12,\) and \(CF = 15\), what is the length of \(AC\)?
1) 8  
2) 15  
3) 23  
4) 27

9  In \(\triangle ABC\) and \(\triangle DEF\), \(\frac{AC}{DF} = \frac{CB}{FE}\). Which additional information would prove \(\triangle ABC \sim \triangle DEF\)?
1) \(AC = DF\)  
2) \(CB = FE\)  
3) \(\angle ACB \cong \angle DFE\)  
4) \(\angle BAC \cong \angle EDF\)

10 The angles of triangle \(ABC\) are in the ratio of 8:3:4. What is the measure of the smallest angle?
1) 12°  
2) 24°  
3) 36°  
4) 72°

11 When a quadrilateral is reflected over the line \(y = x\), which geometric relationship is not preserved?
1) congruence  
2) orientation  
3) parallelism  
4) perpendicularity
12. Which equation represents circle O with center (2, -8) and radius 9?
   1) \((x + 2)^2 + (y - 8)^2 = 9\)
   2) \((x - 2)^2 + (y + 8)^2 = 9\)
   3) \((x + 2)^2 + (y - 8)^2 = 81\)
   4) \((x - 2)^2 + (y + 8)^2 = 81\)

13. Which statement is the negation of “Two is a prime number” and what is the truth value of the negation?
   1) Two is not a prime number; false
   2) Two is not a prime number; true
   3) A prime number is two; false
   4) A prime number is two; true

14. In the diagram below of circle O, chords \(AB\) and \(CD\) intersect at E.

If \(m\angle AEC = 34^\circ\) and \(m\overset{⏜}{AC} = 50^\circ\), what is \(m\overset{⏜}{DB}\)?
   1) 16
   2) 18
   3) 68
   4) 118

15. The volume of a rectangular prism is 144 cubic inches. The height of the prism is 8 inches. Which measurements, in inches, could be the dimensions of the base?
   1) 3.3 by 5.5
   2) 2.5 by 7.2
   3) 12 by 8
   4) 9 by 9

16. The diagram below shows a pair of congruent triangles, with \(\angle ADB \cong \angle CBD\) and \(\angle ABD \cong \angle CBD\).

   Which statement must be true?
   1) \(\angle ADB \cong \angle CBD\)
   2) \(\angle ABC \cong \angle ADC\)
   3) \(\frac{AB}{CD} \cong \frac{AD}{CD}\)
   4) \(\frac{AD}{CD} \cong \frac{AD}{CD}\)

17. What is an equation of the line that is perpendicular to the line whose equation is \(y = \frac{3}{5}x - 2\) and that passes through the point \((3, -6)\)?
   1) \(y = \frac{5}{3}x - 11\)
   2) \(y = -\frac{5}{3}x + 11\)
   3) \(y = -\frac{5}{3}x - 1\)
   4) \(y = \frac{5}{3}x + 1\)

18. Point A lies in plane \(B\). How many lines can be drawn perpendicular to plane \(B\) through point \(A\)?
   1) one
   2) two
   3) zero
   4) infinite
19 In the diagram below of isosceles trapezoid $ABCD$, $AB = CD = 25$, $AD = 26$, and $BC = 12$.

What is the length of an altitude of the trapezoid?
1) 7
2) 14
3) 19
4) 24

20 What is an equation of circle $O$ shown in the graph below?

1) $(x + 2)^2 + (y - 2)^2 = 9$
2) $(x + 2)^2 + (y - 2)^2 = 3$
3) $(x - 2)^2 + (y + 2)^2 = 9$
4) $(x - 2)^2 + (y + 2)^2 = 3$

21 The diagram below represents a rectangular solid.

Which statement must be true?
1) $EH$ and $BC$ are coplanar
2) $FG$ and $AB$ are coplanar
3) $EH$ and $AD$ are skew
4) $FG$ and $CG$ are skew

22 In $\triangle RST$, $m\angle R = 58$ and $m\angle S = 73$. Which inequality is true?
1) $RT < TS < RS$
2) $RS < RT < TS$
3) $RT < RS < TS$
4) $RS < TS < RT$

23 The number of degrees in the sum of the interior angles of a pentagon is
1) 72
2) 360
3) 540
4) 720

24 What is the equation of a line passing through $(2, -1)$ and parallel to the line represented by the equation $y = 2x + 1$?
1) $y = -\frac{1}{2}x$
2) $y = -\frac{1}{2}x + 1$
3) $y = 2x - 5$
4) $y = 2x - 1$
25 The coordinates of the endpoints of \( \overline{AB} \) are \( A(0,0) \) and \( B(0,6) \). The equation of the perpendicular bisector of \( AB \) is
1) \( x = 0 \)
2) \( x = 3 \)
3) \( y = 0 \)
4) \( y = 3 \)

26 In the diagram below, point \( P \) is the centroid of \( \triangle ABC \).

![Diagram of \( \triangle ABC \) with centroid \( P \)]

If \( PM = 2x + 5 \) and \( BP = 7x + 4 \), what is the length of \( PM \)?
1) 9
2) 2
3) 18
4) 27

27 In \( \triangle PQR \), \( \angle PRQ \) is a right angle and \( \overline{RT} \) is drawn perpendicular to hypotenuse \( \overline{PQ} \). If \( PT = x \), \( RT = 6 \), and \( TQ = 4x \), what is the length of \( \overline{PQ} \)?
1) 9
2) 12
3) 3
4) 15

28 In \( \triangle ABC \), \( AB = 5 \) feet and \( BC = 3 \) feet. Which inequality represents all possible values for the length of \( AC \), in feet?
1) \( 2 \leq AC \leq 8 \)
2) \( 2 < AC < 8 \)
3) \( 3 \leq AC \leq 7 \)
4) \( 3 < AC < 7 \)

29 In the diagram below, two parallel lines intersect circle \( O \) at points \( A, B, C, \) and \( D \), with \( m\overline{AB} = x + 20 \) and \( m\overline{DC} = 2x - 20 \). Find \( m\overline{AB} \).

![Diagram of parallel lines intersecting circle]

30 In the diagram below, point \( M \) is located on \( \overline{AB} \).

Sketch the locus of points that are 1 unit from \( \overline{AB} \) and the locus of points 2 units from point \( M \). Label with an \( \times \) all points that satisfy both conditions.

![Diagram with \( M \) on \( \overline{AB} \), and loci indicated]

31 Determine whether the two lines represented by the equations \( y = 2x + 3 \) and \( 2y + x = 6 \) are parallel, perpendicular, or neither. Justify your response.
32 The coordinates of the vertices of \( \triangle RST \) are \( R(-2,3), S(4,4), \) and \( T(2,-2) \). Triangle \( R'S'T' \) is the image of \( \triangle RST \) after a rotation of 90° about the origin. State the coordinates of the vertices of \( \triangle R'S'T' \). [The use of the set of axes below is optional.]

33 On the diagram below, use a compass and straightedge to construct the bisector of \( \angle XYZ \). [Leave all construction marks.]

34 In the diagram below of circle \( O \), diameter \( \overline{AB} \) is perpendicular to chord \( \overline{CD} \) at \( E \). If \( AO = 10 \) and \( BE = 4 \), find the length of \( CE \).

35 Triangle \( ABC \) has coordinates \( A(2,-2), B(2,1), \) and \( C(4,-2) \). Triangle \( A'B'C' \) is the image of \( \triangle ABC \) under \( T_{5,-2} \). On the set of axes below, graph and label \( \triangle ABC \) and its image, \( \triangle A'B'C' \). Determine the relationship between the area of \( \triangle ABC \) and the area of \( \triangle A'B'C' \). Justify your response.
36 A paint can is in the shape of a right circular cylinder. The volume of the paint can is $600\pi$ cubic inches and its altitude is 12 inches. Find the radius, in inches, of the base of the paint can. Express the answer in simplest radical form. Find, to the nearest tenth of a square inch, the lateral area of the paint can.

37 Triangle $HKL$ has vertices $H(-7, 2)$, $K(3, -4)$, and $L(5, 4)$. The midpoint of $HL$ is $M$ and the midpoint of $LK$ is $N$. Determine and state the coordinates of points $M$ and $N$. Justify the statement: $MN$ is parallel to $HK$. [The use of the set of axes below is optional.]

38 In the diagram below of quadrilateral $ABCD$, $\overline{AD} \cong \overline{BC}$ and $\angle DAE \cong \angle BCE$. Line segments $AC$, $DB$, and $FG$ intersect at $E$. Prove: $\triangle AEF \cong \triangle CEG$
1 Triangle $ABC$ is graphed on the set of axes below.

Which transformation produces an image that is similar to, but not congruent to, $\triangle ABC$?
1) $T_{2,3}$
2) $D_2$
3) $r_{y=x}$
4) $R_{90}$

2 A student wrote the sentence “4 is an odd integer.”
What is the negation of this sentence and the truth value of the negation?
1) 3 is an odd integer; true
2) 4 is not an odd integer; true
3) 4 is not an even integer; false
4) 4 is an even integer; false

3 As shown in the diagram below, $\overrightarrow{EF}$ intersects planes $P$, $Q$, and $R$.

If $\overrightarrow{EF}$ is perpendicular to planes $P$ and $R$, which statement must be true?
1) Plane $P$ is perpendicular to plane $Q$.
2) Plane $R$ is perpendicular to plane $P$.
3) Plane $P$ is parallel to plane $Q$.
4) Plane $R$ is parallel to plane $P$.

4 In the diagram below, $LATE$ is an isosceles trapezoid with $\overline{LE} \cong \overline{AT}$, $LA = 24$, $ET = 40$, and $AT = 10$. Altitudes $LF$ and $AG$ are drawn.

What is the length of $\overline{LF}$?
1) 6
2) 8
3) 3
4) 4
25 In the diagram below of circle $O$, diameter $AB$ is parallel to chord $CD$.

If $m\overline{CD} = 70$, what is $m\overline{AC}$?
1) 110  
2) 70  
3) 55  
4) 35

6 In the diagram below of $ABCD$, $AC \cong BD$.

Using this information, it could be proven that
1) $BC = AB$  
2) $AB = CD$  
3) $AD - BC = CD$  
4) $AB + CD = AD$

7 The diameter of a sphere is 15 inches. What is the volume of the sphere, to the nearest tenth of a cubic inch?
1) 706.9  
2) 1767.1  
3) 2827.4  
4) 14,137.2

8 The diagram below shows the construction of $\overrightarrow{AB}$ through point $P$ parallel to $\overrightarrow{CD}$.

Which theorem justifies this method of construction?
1) If two lines in a plane are perpendicular to a transversal at different points, then the lines are parallel.  
2) If two lines in a plane are cut by a transversal to form congruent corresponding angles, then the lines are parallel.  
3) If two lines in a plane are cut by a transversal to form congruent alternate interior angles, then the lines are parallel.  
4) If two lines in a plane are cut by a transversal to form congruent alternate exterior angles, then the lines are parallel.

9 Parallelogram $ABCD$ has coordinates $A(1, 5)$, $B(6, 3)$, $C(3, -1)$, and $D(-2, 1)$. What are the coordinates of $E$, the intersection of diagonals $AC$ and $BD$?
1) $(2, 2)$  
2) $(4.5, 1)$  
3) $(3.5, 2)$  
4) $(-1, 3)$

10 What is the equation of a circle whose center is 4 units above the origin in the coordinate plane and whose radius is 6?
1) $x^2 + (y - 6)^2 = 16$  
2) $(x - 6)^2 + y^2 = 16$  
3) $x^2 + (y - 4)^2 = 36$  
4) $(x - 4)^2 + y^2 = 36$
11 In the diagram of $\triangle ABC$ shown below, $D$ is the midpoint of $AB$, $E$ is the midpoint of $BC$, and $F$ is the midpoint of $AC$.

If $AB = 20$, $BC = 12$, and $AC = 16$, what is the perimeter of trapezoid $ABEF$?
1) 24
2) 36
3) 40
4) 44

12 In the diagram below, $\triangle LMO$ is isosceles with $LO = MO$.

If $\angle L = 55$ and $\angle NOM = 28$, what is $\angle N$?
1) 27
2) 28
3) 42
4) 70

13 If $AB$ is contained in plane $\mathcal{P}$ and $\overrightarrow{AB}$ is perpendicular to plane $\mathcal{R}$, which statement is true?
1) $\overrightarrow{AB}$ is parallel to plane $\mathcal{R}$.
2) Plane $\mathcal{P}$ is parallel to plane $\mathcal{R}$.
3) $\overrightarrow{AB}$ is perpendicular to plane $\mathcal{P}$.
4) Plane $\mathcal{P}$ is perpendicular to plane $\mathcal{R}$.

14 In the diagram below of $\triangle ABC$, $\overline{AE} \cong \overline{BE}$, $\overline{AF} \cong \overline{CF}$, and $\overline{CD} \cong \overline{BD}$.

Point $P$ must be the
1) centroid
2) circumcenter
3) incenter
4) orthocenter

15 What is the equation of the line that passes through the point $(-9, 6)$ and is perpendicular to the line $y = 3x - 5$?
1) $y = 3x + 21$
2) $y = -\frac{1}{3}x - 3$
3) $y = 3x + 33$
4) $y = -\frac{1}{3}x + 3$

16 In the diagram of $\triangle ABC$ shown below, $\overrightarrow{DE} \parallel \overrightarrow{BC}$.

If $AB = 10$, $AD = 8$, and $AE = 12$, what is the length of $EC$?
1) 6
2) 2
3) 3
4) 15
17 What is the length of $\overline{AB}$ with endpoints $A(-1, 0)$ and $B(4, -3)$?  
1) $\sqrt{6}$  
2) $\sqrt{18}$  
3) $\sqrt{34}$  
4) $\sqrt{50}$

18 The sum of the interior angles of a polygon of $n$ sides is  
1) 360  
2) $\frac{360}{n}$  
3) $(n - 2) \cdot 180$  
4) $\frac{(n - 2) \cdot 180}{n}$

19 What is the slope of a line perpendicular to the line whose equation is $20x - 2y = 6$?  
1) $-10$  
2) $\frac{-1}{10}$  
3) 10  
4) $\frac{1}{10}$

20 Which graph represents a circle whose equation is $(x + 2)^2 + y^2 = 16$?  
1)  
2)  
3)  
4)
21 In circle $O$ shown below, diameter $DB$ is perpendicular to chord $AC$ at $E$.

If $DB = 34$, $AC = 30$, and $DE > BE$, what is the length of $BE$?
1) 8
2) 9
3) 16
4) 25

22 In parallelogram $ABCD$ shown below, diagonals $AC$ and $BD$ intersect at $E$.

Which statement must be true?
1) $AC \cong DB$
2) $\angle ABD \cong \angle CBD$
3) $\triangle AED \cong \triangle CEB$
4) $\triangle DCE \cong \triangle BCE$

23 Which equation of a circle will have a graph that lies entirely in the first quadrant?
1) $(x - 4)^2 + (y - 5)^2 = 9$
2) $(x + 4)^2 + (y + 5)^2 = 9$
3) $(x + 4)^2 + (y + 5)^2 = 25$
4) $(x - 5)^2 + (y - 4)^2 = 25$

24 In the diagram below, $\triangle ABC \sim \triangle RST$.

Which statement is not true?
1) $\angle A \cong \angle R$
2) $\frac{AB}{RS} = \frac{BC}{ST}$
3) $\frac{AB}{BC} = \frac{ST}{RS}$
4) $\frac{AB + BC + AC}{RS + ST + RT} = \frac{AB}{RS}$

25 In the diagram below of $\triangle ABC$, $BC$ is extended to $D$.

If $m\angle A = x^2 - 6x$, $m\angle B = 2x - 3$, and $m\angle ACD = 9x + 27$, what is the value of $x$?
1) 10
2) 2
3) 3
4) 15

26 An equation of the line that passes through $(2, -1)$ and is parallel to the line $2y + 3x = 8$ is
1) $y = \frac{3}{2}x - 4$
2) $y = \frac{3}{2}x + 4$
3) $y = -\frac{3}{2}x - 2$
4) $y = -\frac{3}{2}x + 2$
27. The graph below shows $\overline{JT}$ and its image, $\overline{J'T'}$, after a transformation.

Which transformation would map $\overline{JT}$ onto $\overline{J'T'}$?

1) translation  
2) glide reflection  
3) rotation centered at the origin  
4) reflection through the origin

28. Which reason could be used to prove that a parallelogram is a rhombus?

1) Diagonals are congruent.  
2) Opposite sides are parallel.  
3) Diagonals are perpendicular.  
4) Opposite angles are congruent.

29. Triangle $TAP$ has coordinates $T(-1, 4)$, $A(2, 4)$, and $P(2, 0)$. On the set of axes below, graph and label $\triangle T'A'P'$, the image of $\triangle TAP$ after the translation $(x, y) \rightarrow (x - 5, y - 1)$.

30. In the diagram below, $\ell \parallel m$ and $QR \perp ST$ at $R$.

If $\angle 1 = 63$, find $\angle 2$.

31. Two lines are represented by the equations $x + 2y = 4$ and $4y - 2x = 12$. Determine whether these lines are parallel, perpendicular, or neither. Justify your answer.
32 Using a compass and straightedge, construct the bisector of $\angle CBA$. [Leave all construction marks.]

33 The cylindrical tank shown in the diagram below is to be painted. The tank is open at the top, and the bottom does not need to be painted. Only the outside needs to be painted. Each can of paint covers 600 square feet. How many cans of paint must be purchased to complete the job?

34 On the set of axes below, graph the locus of points that are 4 units from the line $x = 3$ and the locus of points that are 5 units from the point (0, 2). Label with an $X$ all points that satisfy both conditions.

35 Given: $AD$ bisects $BC$ at $E$. $AB \perp BC$ $DC \perp BC$

Prove: $AB \cong DC$
36 The coordinates of trapezoid $ABCD$ are $A(-4,5)$, $B(1,5)$, $C(1,2)$, and $D(-6,2)$. Trapezoid $A''B''C''D''$ is the image after the composition $r_x - \text{axis} \circ r_y = \text{x}$ is performed on trapezoid $ABCD$. State the coordinates of trapezoid $A''B''C''D''$. [The use of the set of axes below is optional.]

37 In the diagram below of circle $O$, chords $RT$ and $QS$ intersect at $M$. Secant $PTR$ and tangent $PS$ are drawn to circle $O$. The length of $RM$ is two more than the length of $TM$, $QM = 2$, $SM = 12$, and $PT = 8$.

Find the length of $RT$. Find the length of $PS$.

38 On the set of axes below, solve the system of equations graphically and state the coordinates of all points in the solution.

$$y = (x - 2)^2 - 3$$
$$2y + 16 = 4x$$
1. In the diagram below of circle O, chord \( \overline{AB} \) is parallel to chord \( \overline{GH} \). Chord \( \overline{CD} \) intersects \( \overline{AB} \) at \( E \) and \( \overline{GH} \) at \( F \).

[Diagram of circle with chords and intersecting lines]

Which statement must always be true?
1) \( \overline{AC} \cong \overline{CB} \)
2) \( \overline{DH} \cong \overline{BH} \)
3) \( \overline{AB} \cong \overline{GH} \)
4) \( \overline{AG} \cong \overline{BH} \)

2. The vertices of parallelogram \( ABCD \) are \( A(2, 0), B(0, -3), C(3, -3), \) and \( D(5, 0) \). If \( ABCD \) is reflected over the x-axis, how many vertices remain invariant?
1) 1
2) 2
3) 3
4) 0

3. Point M is the midpoint of \( \overline{AB} \). If the coordinates of \( A \) are \((-3, 6)\) and the coordinates of \( M \) are \((-5, 2)\), what are the coordinates of \( B \)?
1) \((1, 2)\)
2) \((7, 10)\)
3) \((-4, 4)\)
4) \((-7, -2)\)

4. When a dilation is performed on a hexagon, which property of the hexagon will not be preserved in its image?
1) parallelism
2) orientation
3) length of sides
4) measure of angles

5. As shown in the diagram below of \( \triangle ABC \), a compass is used to find points \( D \) and \( E \), equidistant from point \( A \). Next, the compass is used to find point \( F \), equidistant from points \( D \) and \( E \). Finally, a straightedge is used to draw \( \overrightarrow{AF} \). Then, point \( G \), the intersection of \( \overrightarrow{AF} \) and side \( BC \) of \( \triangle ABC \), is labeled.

[Diagram of \( \triangle ABC \) with points labeled and \( \overrightarrow{AF} \)]

Which statement must be true?
1) \( \overrightarrow{AF} \) bisects side \( BC \)
2) \( \overrightarrow{AF} \) bisects \( \angle BAC \)
3) \( \overrightarrow{AF} \perp BC \)
4) \( \triangle ABG \sim \triangle ACG \)
6 In the diagram of \( \triangle JEA \) below, \( m\angle JEA = 90 \) and \( m\angle EAJ = 48 \). Line segment \( MS \) connects points \( M \) and \( S \) on the triangle, such that \( m\angle EMS = 59 \).

What is \( m\angle JSM \)?
1) 163
2) 121
3) 42
4) 17

7 In \( \triangle AED \) with \( ABCD \) shown in the diagram below, \( EB \) and \( EC \) are drawn.

If \( AB \cong CD \), which statement could always be proven?
1) \( AC \cong DB \)
2) \( AE \cong ED \)
3) \( AB \cong BC \)
4) \( EC \cong EA \)

8 Given that \( ABCD \) is a parallelogram, a student wrote the proof below to show that a pair of its opposite angles are congruent.

What is the reason justifying that \( \angle B \cong \angle D \)?
1) Opposite angles in a quadrilateral are congruent.
2) Parallel lines have congruent corresponding angles.
3) Corresponding parts of congruent triangles are congruent.
4) Alternate interior angles in congruent triangles are congruent.

9 The equation of a circle with its center at \((-3, 5)\) and a radius of 4 is
1) \((x + 3)^2 + (y - 5)^2 = 4\)
2) \((x - 3)^2 + (y + 5)^2 = 4\)
3) \((x + 3)^2 + (y - 5)^2 = 16\)
4) \((x - 3)^2 + (y + 5)^2 = 16\)
10. In the diagram below of $\triangle DAE$ and $\triangle BCE$, $AB$ and $CD$ intersect at $E$, such that $AE \cong CE$ and $\angle BCE \cong \angle DAE$.

Triangle $DAE$ can be proved congruent to triangle $BCE$ by
1) ASA
2) SAS
3) SSS
4) HL

11. As shown in the diagram below, $FJ$ is contained in plane $R$, $BC$ and $DE$ are contained in plane $S$, and $FJ$, $BC$, and $DE$ intersect at $A$.

Which fact is sufficient to show that planes $R$ and $S$ are perpendicular?
1) $FA \perp DE$
2) $AD \perp AF$
3) $BC \perp FJ$
4) $DE \perp BC$

12. What is an equation of the circle shown in the graph below?

1) $(x - 3)^2 + (y - 4)^2 = 25$
2) $(x + 3)^2 + (y + 4)^2 = 25$
3) $(x - 3)^2 + (y - 4)^2 = 10$
4) $(x + 3)^2 + (y + 4)^2 = 10$

13. As shown in the diagram below, lines $m$ and $n$ are cut by transversal $p$.

If $\angle 1 = 4x + 14$ and $\angle 2 = 8x + 10$, lines $m$ and $n$ are parallel when $x$ equals
1) 1
2) 6
3) 13
4) 17
14. The angle formed by the radius of a circle and a tangent to that circle has a measure of:
   1) 45°
   2) 90°
   3) 135°
   4) 180°

15. A sphere is inscribed inside a cube with edges of 6 cm. In cubic centimeters, what is the volume of the sphere, in terms of $\pi$?
   1) $12\pi$
   2) $36\pi$
   3) $48\pi$
   4) $288\pi$

16. Scalene triangle $ABC$ is similar to triangle $DEF$. Which statement is false?
   1) $AB:BC=DE:EF$
   2) $AC:DF=BC:EF$
   3) $\angle ACB \cong \angle DFE$
   4) $\angle ABC \cong \angle EDF$

17. Which equation represents a line that is parallel to the line whose equation is $y = \frac{3}{2}x - 3$ and passes through the point (1, 2)?
   1) $y = \frac{3}{2}x + \frac{1}{2}$
   2) $y = \frac{2}{3}x + \frac{4}{3}$
   3) $y = \frac{3}{2}x - 2$
   4) $y = -\frac{2}{3}x + \frac{8}{3}$

18. Lines $a$ and $b$ intersect at point $P$. Line $c$ passes through $P$ and is perpendicular to the plane containing lines $a$ and $b$. Which statement must be true?
   1) Lines $a$, $b$, and $c$ are coplanar.
   2) Line $a$ is perpendicular to line $b$.
   3) Line $c$ is perpendicular to both line $a$ and line $b$.
   4) Line $c$ is perpendicular to line $a$ or line $b$, but not both.

19. As shown in the diagram of $\triangle ACD$ below, $B$ is a point on $\overline{AC}$ and $\overline{DB}$ is drawn.

![Diagram]

If $m\angle A = 66$, $m\angle CDB = 18$, and $m\angle C = 24$, what is the longest side of $\triangle ABD$?
   1) $\overline{AB}$
   2) $\overline{DC}$
   3) $\overline{AD}$
   4) $\overline{BD}$

20. In $\triangle ABC$ shown below, $P$ is the centroid and $BF = 18$.

![Diagram]

What is the length of $\overline{BP}$?
   1) 6
   2) 9
   3) 3
   4) 12
21 In the diagram below, $EF$ is the median of trapezoid $ABCD$.

If $AB = 5x - 9$, $DC = x + 3$, and $EF = 2x + 2$, what is the value of $x$?
1) 5  
2) 2  
3) 7  
4) 8

22 In the diagram below of $\triangle ABC$, $\overline{AB} \cong \overline{AC}$, $m\angle A = 3x$, and $m\angle B = x + 20$.

What is the value of $x$?
1) 10  
2) 28  
3) 32  
4) 40

23 For which polygon does the sum of the measures of the interior angles equal the sum of the measures of the exterior angles?
1) hexagon  
2) pentagon  
3) quadrilateral  
4) triangle

24 For a triangle, which two points of concurrence could be located outside the triangle?
1) incenter and centroid  
2) centroid and orthocenter  
3) incenter and circumcenter  
4) circumcenter and orthocenter

25 The slope of line $\ell$ is $-\frac{1}{3}$. What is an equation of a line that is perpendicular to line $\ell$?
1) $y + 2 = \frac{1}{3}x$  
2) $-2x + 6 = 6y$  
3) $9x - 3y = 27$  
4) $3x + y = 0$

26 Which type of triangle can be drawn using the points $(-2, 3)$, $(-2, -7)$, and $(4, -5)$?
1) scalene  
2) isosceles  
3) equilateral  
4) no triangle can be drawn

27 In the diagram below, $\overline{DE}$ joins the midpoints of two sides of $\triangle ABC$.

Which statement is not true?
1) $CE = \frac{1}{2} CB$  
2) $DE = \frac{1}{2} AB$  
3) area of $\triangle CDE = \frac{1}{2}$ area of $\triangle CAB$  
4) perimeter of $\triangle CDE = \frac{1}{2}$ perimeter of $\triangle CAB$

28 Which equation represents the line that is perpendicular to $2y = x + 2$ and passes through the point $(4, 3)$?
1) $y = \frac{1}{2} x - 5$  
2) $y = \frac{1}{2} x + 1$  
3) $y = -2x + 11$  
4) $y = -2x - 5$
29 Write the negation of the statement “2 is a prime number,” and determine the truth value of the negation.

30 The coordinates of the vertices of $\Delta ABC$ are $A(1, 2)$, $B(-4, 3)$, and $C(-3, -5)$. State the coordinates of $\Delta A'B'C'$, the image of $\Delta ABC$ after a rotation of 90º about the origin. [The use of the set of axes below is optional.]

31 A cylinder has a height of 7 cm and a base with a diameter of 10 cm. Determine the volume, in cubic centimeters, of the cylinder in terms of $\pi$.

32 The coordinates of the endpoints of $FG$ are $(-4, 3)$ and $(2, 5)$. Find the length of $FG$ in simplest radical form.

33 Using a compass and straightedge, construct a line perpendicular to $AB$ through point $P$. [Leave all construction marks.]

34 The graph below shows the locus of points equidistant from the $x$-axis and $y$-axis. On the same set of axes, graph the locus of points 3 units from the line $x = 0$. Label with an X all points that satisfy both conditions.
35. As shown in the diagram below, the diagonals of parallelogram $QRST$ intersect at $E$. If $QE = x^2 + 6x$, $SE = x + 14$, and $TE = 6x - 1$, determine $TE$ algebraically.

36. The vertices of $\triangle RST$ are $R(-6, 5)$, $S(-7, -2)$, and $T(1, 4)$. The image of $\triangle RST$ after the composition $T_{-2,3} \circ r_{y=x}$ is $\triangle R''S''T''$. State the coordinates of $\triangle R''S''T''$. [The use of the set of axes below is optional.]

37. On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

$$(x + 3)^2 + (y - 2)^2 = 25$$
$$2y + 4 = -x$$

38. Chords $\overline{AB}$ and $\overline{CD}$ intersect at $E$ in circle $O$, as shown in the diagram below. Secant $\overline{FDA}$ and tangent $\overline{FB}$ are drawn to circle $O$ from external point $F$ and chord $\overline{AC}$ is drawn. The $m\angle DA = 56$, $m\angle DB = 112$, and the ratio of $m\overline{AC} : m\overline{CB} = 3:1$.

Determine $m\angle CEB$. Determine $m\angle F$. Determine $m\angle DAC$. 

1 If $\triangle MNP \cong \triangle VWX$ and $PM$ is the shortest side of $\triangle MNP$, what is the shortest side of $\triangle VWX$?

1) $XY$
2) $WX$
3) $VW$
4) $NP$

2 In circle $O$ shown in the diagram below, chords $AB$ and $CD$ are parallel.

If $m\overline{AB} = 104$ and $m\overline{CD} = 168$, what is $m\overline{BD}$?

1) $38$
2) $44$
3) $88$
4) $96$

3 As shown in the diagram below, $CD$ is a median of $\triangle ABC$.

Which statement is always true?

1) $AD \cong DB$
2) $AC \cong AD$
3) $\angle ACD \cong \angle CDB$
4) $\angle BCD \cong \angle ACD$

4 In the diagram below, under which transformation is $\triangle A'B'C'$ the image of $\triangle ABC$?

1) $D_2$
2) $r_x$-axis
3) $r_y$-axis
4) $(x,y) \rightarrow (x - 2, y)$

5 Line segment $AB$ is a diameter of circle $O$ whose center has coordinates $(6, 8)$. What are the coordinates of point $B$ if the coordinates of point $A$ are $(4, 2)$?

1) $(1, 3)$
2) $(5, 5)$
3) $(8, 14)$
4) $(10, 10)$

6 Plane $\mathcal{A}$ and plane $\mathcal{B}$ are two distinct planes that are both perpendicular to line $\ell$. Which statement about planes $\mathcal{A}$ and $\mathcal{B}$ is true?

1) Planes $\mathcal{A}$ and $\mathcal{B}$ have a common edge, which forms a line.
2) Planes $\mathcal{A}$ and $\mathcal{B}$ are perpendicular to each other.
3) Planes $\mathcal{A}$ and $\mathcal{B}$ intersect each other at exactly one point.
4) Planes $\mathcal{A}$ and $\mathcal{B}$ are parallel to each other.
7 Triangle $ABC$ is similar to triangle $DEF$. The lengths of the sides of $\triangle ABC$ are 5, 8, and 11. What is the length of the shortest side of $\triangle DEF$ if its perimeter is 60?
1) 10
2) 12.5
3) 20
4) 27.5

8 In the diagram below of right triangle $ABC$, altitude $CD$ is drawn to hypotenuse $AB$.

If $AD = 3$ and $DB = 12$, what is the length of altitude $CD$?
1) 6
2) $6\sqrt{5}$
3) 3
4) $3\sqrt{5}$

9 The diagram below shows the construction of an equilateral triangle.

Which statement justifies this construction?
1) $\angle A + \angle B + \angle C = 180$
2) $m\angle A = m\angle B = m\angle C$
3) $AB = AC = BC$
4) $AB + BC > AC$

10 What is the slope of the line perpendicular to the line represented by the equation $2x + 4y = 12$?
1) $-2$
2) $2$
3) $-\frac{1}{2}$
4) $\frac{1}{2}$

11 Triangle $ABC$ is shown in the diagram below.

If $DE$ joins the midpoints of $\overline{ADC}$ and $\overline{AEB}$, which statement is not true?
1) $DE = \frac{1}{2} CB$
2) $DE \parallel CB$
3) $\frac{AD}{DC} = \frac{DE}{CB}$
4) $\triangle ABC \sim \triangle AED$

12 The equations $x^2 + y^2 = 25$ and $y = 5$ are graphed on a set of axes. What is the solution of this system?
1) $(0, 0)$
2) $(5, 0)$
3) $(0, 5)$
4) $(5, 5)$

13 Square $ABCD$ has vertices $A(-2, -3)$, $B(4, -1)$, $C(2, 5)$, and $D(-4, 3)$. What is the length of a side of the square?
1) $2\sqrt{5}$
2) $2\sqrt{10}$
3) $4\sqrt{5}$
4) $10\sqrt{2}$
14 The diagram below shows $\triangle ABD$, with $\overrightarrow{ABC}$, $BE \perp AD$, and $\angle EBD \cong \angle CBD$.

If $m\angle ABE = 52$, what is $m\angle D$?
1) 26
2) 38
3) 52
4) 64

15 As shown in the diagram below, $\overline{FD}$ and $\overline{CB}$ intersect at point $A$ and $\overline{ET}$ is perpendicular to both $\overline{FD}$ and $\overline{CB}$ at $A$.

16 Which set of numbers could not represent the lengths of the sides of a right triangle?
1) $\{1, 3, \sqrt{10}\}$
2) $\{2, 3, 4\}$
3) $\{3, 4, 5\}$
4) $\{8, 15, 17\}$

17 How many points are 5 units from a line and also equidistant from two points on the line?
1) 1
2) 2
3) 3
4) 0

18 The equation of a circle is $(x - 2)^2 + (y + 5)^2 = 32$. What are the coordinates of the center of this circle and the length of its radius?
1) $(-2, 5)$ and 16
2) $(2, -5)$ and 16
3) $(-2, 5)$ and $4\sqrt{2}$
4) $(2, -5)$ and $4\sqrt{2}$

19 The equation of a line is $y = \frac{2}{3}x + 5$. What is an equation of the line that is perpendicular to the given line and that passes through the point $(4, 2)$?
1) $y = \frac{2}{3}x - \frac{2}{3}$
2) $y = \frac{3}{2}x - 4$
3) $y = -\frac{3}{2}x + 7$
4) $y = -\frac{3}{2}x + 8$
20 Consider the relationship between the two statements below.

If \( \sqrt{16 + 9} \neq 4 + 3 \), then 5 \( \neq 4 + 3 \)

If \( \sqrt{16 + 9} = 4 + 3 \), then 5 \( = 4 + 3 \)

These statements are
1) inverses
2) converses
3) contrapositives
4) biconditionals

21 In the diagram of trapezoid \( \text{ABCD} \) below, \( \overline{AB} \parallel \overline{DC} \), \( \overline{AD} \cong \overline{BC} \), \( m\angle A = 4x + 20 \), and \( m\angle C = 3x - 15 \).

What is \( m\angle D \)?
1) 25
2) 35
3) 60
4) 90

22 In circle \( R \) shown below, diameter \( \overline{DE} \) is perpendicular to chord \( \overline{ST} \) at point \( L \).

Which statement is not always true?
1) \( \overline{SL} \cong \overline{TL} \)
2) \( RS = DR \)
3) \( RL \cong LE \)
4) \( (DL)(LE) = (SL)(LT) \)

23 Which equation represents circle \( A \) shown in the diagram below?

1) \((x - 4)^2 + (y - 1)^2 = 3 \)
2) \((x + 4)^2 + (y + 1)^2 = 3 \)
3) \((x - 4)^2 + (y - 1)^2 = 9 \)
4) \((x + 4)^2 + (y + 1)^2 = 9 \)
24 Which equation represents a line that is parallel to the line whose equation is \(3x - 2y = 7\)?

1) \(y = -\frac{3}{2}x + 5\)  
2) \(y = -\frac{2}{3}x + 4\) 
3) \(y = \frac{3}{2}x - 5\)  
4) \(y = \frac{2}{3}x - 4\)

25 In the diagram below of circle \(O\), \(PAC\) and \(PBD\) are secants.

If \(mCD = 70\) and \(mAB = 20\), what is the degree measure of \(\angle P\)?

1) 25  
2) 35  
3) 45  
4) 50

26 The measure of an interior angle of a regular polygon is 120°. How many sides does the polygon have?

1) 5  
2) 6  
3) 3  
4) 4

27 As shown in the diagram of rectangle \(ABCD\) below, diagonals \(AC\) and \(BD\) intersect at \(E\).

If \(AE = x + 2\) and \(BD = 4x - 16\), then the length of \(AC\) is

1) 6  
2) 10  
3) 12  
4) 24

28 If the vertices of \(\triangle ABC\) are \(A(-2,4), B(-2,8),\) and \(C(-5,6),\) then \(\triangle ABC\) is classified as

1) right  
2) scalene  
3) isosceles  
4) equilateral

29 After the transformation \(r_{y=x}\), the image of \(\triangle ABC\) is \(\triangle A'B'C'.\) If \(AB = 2x + 13\) and \(A'B' = 9x - 8,\) find the value of \(x\).

30 In the diagram below, circles \(A\) and \(B\) are tangent at point \(C\) and \(AB\) is drawn. Sketch all common tangent lines.
31 On the set of axes below, graph the locus of points 4 units from (0, 1) and the locus of points 3 units from the origin. Label with an \textbf{X} any points that satisfy both conditions.

32 Write an equation of a circle whose center is \((-3, 2)\) and whose diameter is 10.

33 Using a compass and straightedge, construct a line perpendicular to line \(\ell\) through point \(P\). [Leave all construction marks.]

34 Write an equation of the line that is the perpendicular bisector of the line segment having endpoints \((3, -1)\) and \((3, 5)\). [The use of the grid below is optional]
35 A right circular cylinder with a height of 5 cm has a base with a diameter of 6 cm. Find the lateral area of the cylinder to the nearest hundredth of a square centimeter. Find the volume of the cylinder to the nearest hundredth of a cubic centimeter.

36 Triangle $ABC$ has vertices $A(5,1)$, $B(1,4)$ and $C(1,1)$. State and label the coordinates of the vertices of $\Delta A''B''C''$, the image of $\Delta ABC$, following the composite transformation $T_{1,-1} \circ D_2$. [The use of the set of axes below is optional.]

37 In $\Delta ABC$, $m\angle A = x^2 + 12$, $m\angle B = 11x + 5$, and $m\angle C = 13x - 17$. Determine the longest side of $\Delta ABC$.

38 The diagram below shows rectangle $ABCD$ with points $E$ and $F$ on side $AB$. Segments $CE$ and $DF$ intersect at $G$, and $\angle ADG \cong \angle BCG$. Prove: $AE \cong BF$. 
1. In trapezoid $RSTV$ with bases $RS$ and $VT$, diagonals $RT$ and $SV$ intersect at $Q$.

If trapezoid $RSTV$ is not isosceles, which triangle is equal in area to $RSV$?

1) $\triangle RQV$
2) $\triangle RST$
3) $\triangle RVV$
4) $\triangle SVT$

2. In the diagram below, $\triangle XYZ \cong \triangle TSV$.

Which statement can not be proven?
1) $\angle XZY \cong \angle TVS$
2) $\angle YXZ \cong \angle VUT$
3) $XY \cong TS$
4) $YY \cong SV$

3. In a park, two straight paths intersect. The city wants to install lamppots that are both equidistant from each path and also 15 feet from the intersection of the paths. How many lampposts are needed?

1) 1
2) 2
3) 3
4) 4

4. What are the coordinates of $A'$, the image of $A(-3,4)$, after a rotation of $180^\circ$ about the origin?

1) $(4,-3)$
2) $(-4,3)$
3) $(3,4)$
4) $(3,-4)$

5. Based on the construction below, which conclusion is not always true?

1) $AB \perp CD$
2) $AB = CD$
3) $AE = EB$
4) $CE = DE$
6. Which equation represents the circle whose center is \((-5,3)\) and that passes through the point \((-1,3)\)?

1) \((x + 1)^2 + (y - 3)^2 = 16\)
2) \((x - 1)^2 + (y + 3)^2 = 16\)
3) \((x + 5)^2 + (y - 3)^2 = 16\)
4) \((x - 5)^2 + (y + 3)^2 = 16\)

7. As shown in the diagram below, when right triangle \(DAB\) is reflected over the \(x\)-axis, its image is triangle \(DCB\).

Which statement justifies why \(AB \cong CB\)?

1) Distance is preserved under reflection.
2) Orientation is preserved under reflection.
3) Points on the line of reflection remain invariant.
4) Right angles remain congruent under reflection.

8. In \(\triangle ABC\), \(m \angle A = 3x + 1\), \(m \angle B = 4x - 17\), and \(m \angle C = 5x - 20\). What is the equation for circle \(O\) shown in the graph below?

1) \((x - 3)^2 + (y + 1)^2 = 6\)
2) \((x + 3)^2 + (y - 1)^2 = 6\)
3) \((x - 3)^2 + (y + 1)^2 = 9\)
4) \((x + 3)^2 + (y - 1)^2 = 9\)

9. What is the equation for circle \(O\) shown in the graph below?

10. Point \(A\) is on line \(m\). How many distinct planes will be perpendicular to line \(m\) and pass through point \(A\)?

1) one
2) two
3) zero
4) infinite
11 In \( \triangle ABC \), \( D \) is the midpoint of \( AB \) and \( E \) is the midpoint of \( BC \). If \( AC = 3x - 15 \) and \( DE = 6 \), what is the value of \( x \)?

1) 6  
2) 7  
3) 9  
4) 12

12 What are the coordinates of the center of a circle if the endpoints of its diameter are \( A(8, -4) \) and \( B(-3, 2) \)?

1) (2.5, 1)  
2) (2.5, -1)  
3) (5.5, -3)  
4) (5.5, 3)

13 Which graph could be used to find the solution to the following system of equations?

\[
y = (x + 3)^2 - 1 \\
x + y = 2
\]

1)  
2)  
3)  
4)
14 What is the converse of “If an angle measures 90 degrees, then it is a right angle”?
   1) If an angle is a right angle, then it measures 90 degrees.
   2) An angle is a right angle if it measures 90 degrees.
   3) If an angle is not a right angle, then it does not measure 90 degrees.
   4) If an angle does not measure 90 degrees, then it is not a right angle.

15 As shown in the diagram below, a right pyramid has a square base, $ABCD$, and $EF$ is the slant height.

Which statement is not true?
   1) $EA \cong EC$
   2) $EB \cong EF$
   3) $\triangle AEB \cong \triangle BEC$
   4) $\triangle CED$ is isosceles

16 The volume of a sphere is approximately 44,6022 cubic centimeters. What is the radius of the sphere, to the nearest tenth of a centimeter?
   1) 2.2
   2) 3.3
   3) 4.4
   4) 4.7

17 What is the equation of a line passing through the point (6, 1) and parallel to the line whose equation is $3x = 2y + 4$?
   1) $y = \frac{2}{3}x + 5$
   2) $y = \frac{2}{3}x - 3$
   3) $y = \frac{3}{2}x - 8$
   4) $y = \frac{3}{2}x - 5$

18 Points $A(5,3)$ and $B(7,6)$ lie on $\overrightarrow{AB}$. Points $C(6,4)$ and $D(9,0)$ lie on $\overrightarrow{CD}$. Which statement is true?
   1) $\overrightarrow{AB} \parallel \overrightarrow{CD}$
   2) $\overrightarrow{AB} \perp \overrightarrow{CD}$
   3) $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are the same line.
   4) $\overrightarrow{AB}$ and $\overrightarrow{CD}$ intersect, but are not perpendicular.

19 Which set of equations represents two circles that have the same center?
   1) $x^2 + (y + 4)^2 = 16$ and $(x + 4)^2 + y^2 = 16$
   2) $(x + 3)^2 + (y - 3)^2 = 16$ and $(x - 3)^2 + (y + 3)^2 = 25$
   3) $(x - 7)^2 + (y - 2)^2 = 16$ and $(x + 7)^2 + (y + 2)^2 = 25$
   4) $(x - 2)^2 + (y - 5)^2 = 16$ and $(x - 2)^2 + (y - 5)^2 = 25$
20 Transversal $EF$ intersects $AB$ and $CD$, as shown in the diagram below.

Which statement could always be used to prove $AB \parallel CD$?
1) $\angle 2 \cong \angle 4$
2) $\angle 7 \cong \angle 8$
3) $\angle 3$ and $\angle 6$ are supplementary
4) $\angle 1$ and $\angle 5$ are supplementary

21 In $\triangle ABC$, $m\angle A = 60$, $m\angle B = 80$, and $m\angle C = 40$. Which inequality is true?
1) $AB > BC$
2) $AC > BC$
3) $AC < BA$
4) $BC < BA$

22 Circle $O$ with $\angle AOC$ and $\angle ABC$ is shown in the diagram below.

What is the ratio of $m\angle AOC$ to $m\angle ABC$?
1) $1 : 1$
2) $2 : 1$
3) $3 : 1$
4) $1 : 2$

23 A rectangular prism has a base with a length of 25, a width of 9, and a height of 12. A second prism has a square base with a side of 15. If the volumes of the two prisms are equal, what is the height of the second prism?
1) 6
2) 8
3) 12
4) 15

24 In triangles $ABC$ and $DEF$, $AB = 4$, $AC = 5$, $DE = 8$, $DF = 10$, and $\angle A \cong \angle D$. Which method could be used to prove $\triangle ABC \sim \triangle DEF$?
1) AA
2) SAS
3) SSS
4) ASA
25 Which graph represents a circle whose equation is \(x^2 + (y - 1)^2 = 9\)?

1) 

2) 

3) 

4) 

26 What is the perimeter of a rhombus whose diagonals are 16 and 30?

1) 92
2) 68
3) 60
4) 17

27 In right triangle \(ABC\) shown in the diagram below, altitude \(BD\) is drawn to hypotenuse \(AC\), \(CD = 12\), and \(AD = 3\).

What is the length of \(AB\)?

1) \(5\sqrt{3}\)
2) 6
3) \(3\sqrt{5}\)
4) 9

28 Secants \(JKL\) and \(JMN\) are drawn to circle \(O\) from an external point, \(J\). If \(JK = 8\), \(LK = 4\), and \(JM = 6\), what is the length of \(JN\)?

1) 16
2) 12
3) 10
4) 8

29 A right circular cylinder has a height of 7 inches and the base has a diameter of 6 inches. Determine the lateral area, in square inches, of the cylinder in terms of \(\pi\).

30 Determine, in degrees, the measure of each interior angle of a regular octagon.
31 Triangle $ABC$ has vertices at $A(3,0)$, $B(9,-5)$, and $C(7,-8)$. Find the length of $AC$ in simplest radical form.

32 On the ray drawn below, using a compass and straightedge, construct an equilateral triangle with a vertex at $R$. The length of a side of the triangle must be equal to a length of the diagonal of rectangle $ABCD$.

33 On the set of axes below, graph the locus of points 4 units from the $x$-axis and equidistant from the points whose coordinates are $(-2,0)$ and $(8,0)$. Mark with an $X$ all points that satisfy both conditions.

34 The coordinates of two vertices of square $ABCD$ are $A(2,1)$ and $B(4,4)$. Determine the slope of side $BC$. 
35. The coordinates of the vertices of parallelogram $SWAN$ are $S(2, -2)$, $W(-2, -4)$, $A(-4, 6)$, and $N(0, 8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of $SWAN$ after the transformation $T_{4, -2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]

36. In circle $O$ shown below, chords $AB$ and $CD$ and radius $OA$ are drawn, such that $AB \cong CD$, $OE \perp AB$, $OF \perp CD$, $OF = 16$, $CF = y + 10$, and $CD = 4y - 20$.

Determine the length of $DF$. Determine the length of $OA$.

37. If $\triangle RST \sim \triangle ABC$, $m\angle A = x^2 - 8x$, $m\angle C = 4x - 5$, and $m\angle R = 5x + 30$, find $m\angle C$. [Only an algebraic solution can receive full credit.]

38. In the diagram of $\triangle MAH$ below, $MH \cong AH$ and medians $AB$ and $MT$ are drawn.

Prove: $\angle MBA \cong \angle ATM$
1. Given: \( \triangle ABD, \overline{BC} \) is the perpendicular bisector of \( AD \)

Which statement can not always be proven?
1) \( \overline{AC} \cong \overline{DC} \)
2) \( \overline{BC} \cong \overline{CD} \)
3) \( \angle ACB \cong \angle DCB \)
4) \( \triangle ABC \cong \triangle DBC \)

2. In the diagram of circle \( O \) below, chord \( \overline{CD} \) is parallel to diameter \( \overline{AOB} \) and \( m\overline{CD} = 110 \).

What is \( m\overline{DB} \)?
1) 35
2) 55
3) 70
4) 110

3. Given the statement: One is a prime number.
What is the negation and the truth value of the negation?
1) One is not a prime number; true
2) One is not a prime number; false
3) One is a composite number; true
4) One is a composite number; false

4. Triangle \( ABC \) has the coordinates \( A(1, 2), B(5, 2), \) and \( C(5, 5) \). Triangle \( ABC \) is rotated 180° about the origin to form triangle \( A'B'C' \). Triangle \( A'B'C' \) is
1) acute
2) isosceles
3) obtuse
4) right

5. What is an equation of the circle with center \((-5, 4)\) and a radius of 7?
1) \((x - 5)^2 + (y + 4)^2 = 14\)
2) \((x - 5)^2 + (y + 4)^2 = 49\)
3) \((x + 5)^2 + (y - 4)^2 = 14\)
4) \((x + 5)^2 + (y - 4)^2 = 49\)

6. In \( \triangle ABC, \angle A \cong \angle B \) and \( \angle C \) is an obtuse angle. Which statement is true?
1) \( \overline{AC} \cong \overline{AB} \) and \( \overline{BC} \) is the longest side.
2) \( \overline{AC} \cong \overline{BC} \) and \( \overline{AB} \) is the longest side.
3) \( \overline{AC} \cong \overline{AB} \) and \( \overline{BC} \) is the shortest side.
4) \( \overline{AC} \cong \overline{BC} \) and \( \overline{AB} \) is the shortest side.

7. In the diagram of \( \triangle ABC \) below, medians \( \overline{AD} \) and \( \overline{BE} \) intersect at point \( F \).

If \( AF = 6 \), what is the length of \( \overline{FD} \)?
1) 6
2) 3
3) 9
4) 2

8. In circle \( O \), diameter \( \overline{AB} \) intersects chord \( \overline{CD} \) at \( E \). If \( CE = ED \), then \( \angle CEA \) is which type of angle?
1) straight
2) obtuse
3) acute
4) right
9. If $\triangle ABC \cong \triangle JKL \cong \triangle RST$, then $\overline{BC}$ must be congruent to
   1) $\overline{JL}$
   2) $\overline{JK}$
   3) $\overline{ST}$
   4) $\overline{RS}$

10. In the diagram of $\triangle ABC$ below, $\overline{AB}$ is extended to point $D$.

   ![Diagram of triangle ABC]

   If $\angle CAB = x + 40$, $\angle ACB = 3x + 10$, $\angle CBD = 6x$, what is $\angle CAB$?
   1) 13
   2) 25
   3) 53
   4) 65

11. The bases of a right triangular prism are $\triangle ABC$ and $\triangle DEF$. Angles $A$ and $D$ are right angles, $AB = 6$, $AC = 8$, and $AD = 12$. What is the length of edge $BE$?
   1) 10
   2) 12
   3) 14
   4) 16

12. What is the equation of circle $O$ shown in the diagram below?

   ![Diagram of circle O]

   1) $(x + 4)^2 + (y - 1)^2 = 3$
   2) $(x - 4)^2 + (y + 1)^2 = 3$
   3) $(x + 4)^2 + (y - 1)^2 = 9$
   4) $(x - 4)^2 + (y + 1)^2 = 9$

13. The diagram below shows the construction of line $m$, parallel to line $\ell$, through point $P$.

   ![Diagram of construction]

   Which theorem was used to justify this construction?
   1) If two lines are cut by a transversal and the alternate interior angles are congruent, the lines are parallel.
   2) If two lines are cut by a transversal and the interior angles on the same side are supplementary, the lines are parallel.
   3) If two lines are perpendicular to the same line, they are parallel.
   4) If two lines are cut by a transversal and the corresponding angles are congruent, they are parallel.
14 The lateral area of a right circular cone is equal to \(120\pi\ \text{cm}^2\). If the base of the cone has a diameter of 24 cm, what is the length of the slant height, in centimeters?
1) 2.5
2) 5
3) 10
4) 15.7

15 A student wrote the following equations:

\[
3y + 6 = 2x \\
2y - 3x = 6
\]

The lines represented by these equations are
1) parallel
2) the same line
3) perpendicular
4) intersecting, but not perpendicular

16 In a coordinate plane, the locus of points 5 units from the x-axis is the
1) lines \(x = 5\) and \(x = -5\)
2) lines \(y = 5\) and \(y = -5\)
3) line \(x = 5\), only
4) line \(y = 5\), only

17 The sides of a triangle are 8, 12, and 15. The longest side of a similar triangle is 18. What is the ratio of the perimeter of the smaller triangle to the perimeter of the larger triangle?
1) 2:3
2) 4:9
3) 5:6
4) 25:36

18 Lines \(m\) and \(n\) are in plane \(\mathcal{A}\). What is the converse of the statement “If lines \(m\) and \(n\) are parallel, then lines \(m\) and \(n\) do not intersect”?  
1) If lines \(m\) and \(n\) are not parallel, then lines \(m\) and \(n\) intersect.
2) If lines \(m\) and \(n\) are not parallel, then lines \(m\) and \(n\) do not intersect
3) If lines \(m\) and \(n\) intersect, then lines \(m\) and \(n\) are not parallel.
4) If lines \(m\) and \(n\) do not intersect, then lines \(m\) and \(n\) are parallel.

19 When the system of equations \(y + 2 = (x - 4)^2\) and \(2x + y - 6 = 0\) is solved graphically, the solution is
1) \((-4, -2)\) and \((-2, 2)\)
2) \((4, -2)\) and \((2, 2)\)
3) \((-4, 2)\) and \((-6, 6)\)
4) \((4, 2)\) and \((6, 6)\)

20 In the diagram of \(\triangle UVW\) below, \(A\) is the midpoint of \(UV\), \(B\) is the midpoint of \(UW\), \(C\) is the midpoint of \(VW\), and \(AB\) and \(AC\) are drawn.

If \(VW = 7x - 3\) and \(AB = 3x + 1\), what is the length of \(VC\)?
1) 5
2) 13
3) 16
4) 32

21 Two prisms have equal heights and equal volumes. The base of one is a pentagon and the base of the other is a square. If the area of the pentagonal base is 36 square inches, how many inches are in the length of each side of the square base?
1) 6
2) 9
3) 24
4) 36

22 What is the difference between the sum of the measures of the interior angles of a regular pentagon and the sum of the measures of the exterior angles of a regular pentagon?
1) 36
2) 72
3) 108
4) 180
23 If line $\ell$ is perpendicular to distinct planes $P$ and $Q$, then planes $P$ and $Q$ are parallel.
   1) are parallel
   2) contain line $\ell$
   3) are perpendicular
   4) intersect, but are not perpendicular

24 Which graph represents a circle whose equation is $x^2 + (y - 2)^2 = 4$?

25 In the diagram below, $AC$ and $AD$ are tangent to circle $B$ at points $C$ and $D$, respectively, and $BC$, $BD$, and $BA$ are drawn.

If $AC = 12$ and $AB = 15$, what is the length of $BD$?
   1) 5.5
   2) 9
   3) 12
   4) 18

26 Triangle $ABC$ shown below is a right triangle with altitude $AD$ drawn to the hypotenuse $BC$.

If $BD = 2$ and $DC = 10$, what is the length of $AB$?
   1) $2\sqrt{2}$
   2) $2\sqrt{5}$
   3) $2\sqrt{6}$
   4) $2\sqrt{30}$

27 Triangle $ABC$ has vertices $A(0, 0)$, $B(6, 8)$, and $C(8, 4)$. Which equation represents the perpendicular bisector of $BC$?
   1) $y = 2x - 6$
   2) $y = -2x + 4$
   3) $y = \frac{1}{2}x + \frac{5}{2}$
   4) $y = -\frac{1}{2}x + \frac{19}{2}$
28. Chords $\overline{AB}$ and $\overline{CD}$ intersect at point $E$ in a circle with center at $O$. If $AE = 8$, $AB = 20$, and $DE = 16$, what is the length of $CE$?

1) 6
2) 9
3) 10
4) 12

29. Triangle $ABC$ has vertices $A(6, 6)$, $B(9, 0)$, and $C(3, -3)$. State and label the coordinates of $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation of $D \frac{1}{3}$.

30. Using a compass and straightedge, construct the bisector of $\angle MJH$. [Leave all construction marks.]

31. Find, in simplest radical form, the length of the line segment with endpoints whose coordinates are $(-1, 4)$ and $(3, -2)$.

32. In $\triangle ABC$, the measure of angle $A$ is fifteen less than twice the measure of angle $B$. The measure of angle $C$ equals the sum of the measures of angle $A$ and angle $B$. Determine the measure of angle $B$.

33. A circle has the equation $(x - 3)^2 + (y + 4)^2 = 10$. Find the coordinates of the center of the circle and the length of the circle's radius.

34. Two intersecting lines are shown in the diagram below. Sketch the locus of points that are equidistant from the two lines. Sketch the locus of points that are a given distance, $d$, from the point of intersection of the given lines. State the number of points that satisfy both conditions.

35. Given: $\triangle ABC$, $BD$ bisects $\angle ABC$, $BD \perp AC$

Prove: $AB \cong CB$
36 Quadrilateral $MATH$ has coordinates $M(-6,-3)$, $A(-1,-3)$, $T(-2,-1)$, and $H(-4,-1)$. The image of quadrilateral $MATH$ after the composition $r_{x-axis} \circ T_{7,5}$ is quadrilateral $M''A''T''H''$. State and label the coordinates of $M''A''T''H''$. [The use of the set of axes below is optional.]

37 Trapezoid $TRAP$, with median $MQ$, is shown in the diagram below. Solve algebraically for $x$ and $y$.

38 Quadrilateral $ABCD$ with vertices $A(-7,4)$, $B(-3,6), C(3,0)$, and $D(1,-8)$ is graphed on the set of axes below. Quadrilateral $MNPQ$ is formed by joining $M, N, P$, and $Q$, the midpoints of $AB, BC, CD$, and $AD$, respectively. Prove that quadrilateral $MNPQ$ is a parallelogram. Prove that quadrilateral $MNPQ$ is not a rhombus.
1 The midpoint of $AB$ is $M(4, 2)$. If the coordinates of $A$ are $(6, -4)$, what are the coordinates of $B$?
1) $(1, -3)$
2) $(2, 8)$
3) $(5, -1)$
4) $(14, 0)$

2 Which diagram shows the construction of a $45^\circ$ angle?
1)

3 What are the coordinates of the center and the length of the radius of the circle whose equation is $(x + 1)^2 + (y - 5)^2 = 16$?
1) $(1, -5)$ and $16$
2) $(-1, 5)$ and $16$
3) $(1, -5)$ and $4$
4) $(-1, 5)$ and $4$

4 If distinct planes $R$ and $S$ are both perpendicular to line $\ell$, which statement must always be true?
1) Plane $R$ is parallel to plane $S$.
2) Plane $R$ is perpendicular to plane $S$.
3) Planes $R$ and $S$ and line $\ell$ are all parallel.
4) The intersection of planes $R$ and $S$ is perpendicular to line $\ell$.

5 If $\triangle ABC$ and its image, $\triangle A'B'C'$, are graphed on a set of axes, $\triangle ABC \cong \triangle A'B'C'$ under each transformation except
1) $D_2$
2) $R_{90^\circ}$
3) $r_y = x$
4) $T_{(-2, 3)}$
6. A rectangular right prism is shown in the diagram below.

Which pair of edges are not coplanar?
1) $BF$ and $CG$
2) $BF$ and $DH$
3) $EF$ and $CD$
4) $EF$ and $BC$

7. How many points in the coordinate plane are 3 units from the origin and also equidistant from both the x-axis and the y-axis?
1) 1
2) 2
3) 8
4) 4

8. As shown below, the medians of $\triangle ABC$ intersect at $D$.

If the length of $BE$ is 12, what is the length of $BD$?
1) 8
2) 9
3) 3
4) 4

9. The solution of the system of equations $y = x^2 - 2$ and $y = x$ is
1) $(1, 1)$ and $(-2, -2)$
2) $(2, 2)$ and $(-1, -1)$
3) $(1, 1)$ and $(2, 2)$
4) $(-2, -2)$ and $(-1, -1)$

10. Line $\ell$ passes through the point $(5, 3)$ and is parallel to line $k$ whose equation is $5x + y = 6$. An equation of line $\ell$ is
1) $y = \frac{1}{5}x + 2$
2) $y = -5x + 28$
3) $y = \frac{1}{5}x - 2$
4) $y = -5x - 28$

11. In the diagram below of quadrilateral $ABCD$, $E$ and $F$ are points on $AB$ and $CD$, respectively, $BE \cong DF$, and $AE \cong CF$.

Which conclusion can be proven?
1) $ED \cong FB$
2) $AB \cong CD$
3) $\angle A \cong \angle C$
4) $\angle AED \cong \angle CFB$
12 In the diagram below, four pairs of triangles are shown. Congruent corresponding parts are labeled in each pair.

Using only the information given in the diagrams, which pair of triangles can not be proven congruent?
1) A  
2) B  
3) C  
4) D

13 In \(\triangle ABC\) shown below, \(L\) is the midpoint of \(BC\), \(M\) is the midpoint of \(AB\), and \(N\) is the midpoint of \(AC\).

If \(MN = 8\), \(ML = 5\), and \(NL = 6\), the perimeter of trapezoid \(BMNC\) is
1) 35  
2) 31  
3) 28  
4) 26

14 In the diagram below, \(BCRT\) and \(\triangle ABC\) are shown with \(m\angle A = 60\) and \(m\angle ABT = 125\).

What is \(m\angle ACR\)?
1) 125  
2) 115  
3) 65  
4) 55

15 Which equation represents circle \(O\) shown in the graph below?
1) \(x^2 + (y - 2)^2 = 10\)  
2) \(x^2 + (y + 2)^2 = 10\)  
3) \(x^2 + (y - 2)^2 = 25\)  
4) \(x^2 + (y + 2)^2 = 25\)

16 For which measures of the sides of \(\triangle ABC\) is angle \(B\) the largest angle of the triangle?
1) \(AB = 2\), \(BC = 6\), \(AC = 7\)  
2) \(AB = 6\), \(BC = 12\), \(AC = 8\)  
3) \(AB = 16\), \(BC = 9\), \(AC = 10\)  
4) \(AB = 18\), \(BC = 14\), \(AC = 5\)
17. What is the measure of the largest exterior angle that any regular polygon can have?
   1) 60º  
   2) 90º  
   3) 120º  
   4) 360º  

18. As shown in the diagram below, a landscaper uses a cylindrical lawn roller on a lawn. The roller has a radius of 9 inches and a width of 42 inches. To the nearest square inch, the area the roller covers in one complete rotation is
   1) 2,374  
   2) 2,375  
   3) 10,682  
   4) 10,688  

19. In the diagram below, $AC$ and $BC$ are tangent to circle $O$ at $A$ and $B$, respectively, from external point $C$.

   If $m \angle ACB = 38$, what is $m \angle AOB$?
   1) 71  
   2) 104  
   3) 142  
   4) 161  

20. What is the perimeter of a square whose diagonal is $3\sqrt{2}$?
   1) 18  
   2) 12  
   3) 9  
   4) 6  

21. The coordinates of point $P$ are (7, 1). What are the coordinates of the image of $P$ after $R_{90^\circ}$ about the origin?
   1) (1, 7)  
   2) (−7, −1)  
   3) (1, −7)  
   4) (−1, 7)  

22. Lines $p$ and $q$ are intersected by line $r$, as shown below.

   If $m \angle 1 = 7x - 36$ and $m \angle 2 = 5x + 12$, for which value of $x$ would $p \parallel q$?
   1) 17  
   2) 24  
   3) 83  
   4) 97  

23. What is the equation of the circle with its center at $(-1, 2)$ and that passes through the point $(1, 2)$?
   1) $(x + 1)^2 + (y - 2)^2 = 4$  
   2) $(x - 1)^2 + (y + 2)^2 = 4$  
   3) $(x + 1)^2 + (y - 2)^2 = 2$  
   4) $(x - 1)^2 + (y + 2)^2 = 2$
24 In the diagram below, diameter $AB$ bisects chord $CD$ at point $E$ in circle $F$.

![Diagram of circle with diameter AB bisecting chord CD at point E](image)

If $AE = 2$ and $FB = 17$, then the length of $CE$ is
1) 7
2) 8
3) 15
4) 16

25 Which quadrilateral does not always have congruent diagonals?
1) isosceles trapezoid
2) rectangle
3) rhombus
4) square

26 A circle with the equation $(x + 6)^2 + (y - 7)^2 = 64$ does not include points in Quadrant
1) I
2) II
3) III
4) IV

27 Trapezoid $QRST$ is graphed on the set of axes below.

![Graph of trapezoid QRST on axes](image)

Under which transformation will there be no invariant points?
1) $r_y = 0$
2) $r_x = 0$
3) $r_{(0,0)}$
4) $r_y = x$

28 How many common tangent lines can be drawn to the circles shown below?

![Two circles with common tangent lines](image)

1) 1
2) 2
3) 3
4) 4

29 The diameter of a sphere is 5 inches. Determine and state the surface area of the sphere, to the nearest hundredth of a square inch.
30 Using a compass and straightedge, construct the perpendicular bisector of $AB$. [Leave all construction marks.]

31 The endpoints of $AB$ are $A(3, -4)$ and $B(7, 2)$. Determine and state the length of $AB$ in simplest radical form.

32 A right prism has a square base with an area of 12 square meters. The volume of the prism is 84 cubic meters. Determine and state the height of the prism, in meters.

33 State whether the lines represented by the equations $y = \frac{1}{2}x - 1$ and $y + 4 = \frac{1}{2}(x - 2)$ are parallel, perpendicular, or neither. Explain your answer.

34 A tree, $T$, is 6 meters from a row of corn, $c$, as represented in the diagram below. A farmer wants to place a scarecrow 2 meters from the row of corn and also 5 meters from the tree. Sketch both loci. Indicate, with an $X$, all possible locations for the scarecrow.

35 In the diagram of $\triangle BCD$ shown below, $BA$ is drawn from vertex $B$ to point $A$ on $DC$, such that $BC \cong BA$.

In $\triangle DAB$, $m\angle D = x$, $m\angle DAB = 5x - 30$, and $m\angle DBA = 3x - 60$. In $\triangle ABC$, $AB = 6y - 8$ and $BC = 4y - 2$. [Only algebraic solutions can receive full credit.] Find $m\angle D$. Find $m\angle BAC$. Find the length of $BC$. Find the length of $DC$. 
36  The coordinates of the vertices of $\triangle ABC$ are $A(-6, 5)$, $B(-4, 8)$, and $C(1, 6)$. State and label the coordinates of the vertices of $\triangle A'B'C''$, the image of $\triangle ABC$ after the composition of transformations $T_{(4, -5)} \circ r_{y\text{-axis}}$. [The use of the set of axes below is optional.]

37  In right triangle $ABC$ below, $\overline{CD}$ is the altitude to hypotenuse $\overline{AB}$. If $CD = 6$ and the ratio of $AD$ to $AB$ is $1:5$, determine and state the length of $\overline{BD}$. [Only an algebraic solution can receive full credit.]

38  In the diagram of circle $O$ below, diameter $\overline{RS}$, chord $\overline{AS}$, tangent $\overline{TS}$, and secant $\overline{TAR}$ are drawn.

Complete the following proof to show $(RS)^2 = RA \cdot RT$

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. circle $O$, diameter $\overline{RS}$, chord $\overline{AS}$, tangent $\overline{TS}$, and secant $\overline{TAR}$</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. $\overline{RS} \perp \overline{TS}$</td>
<td>2. ______________________</td>
</tr>
<tr>
<td>3. $\angle BST$ is a right angle</td>
<td>3. ______________________</td>
</tr>
<tr>
<td>4. $\angle BAS$ is a right angle</td>
<td>4. ______________________</td>
</tr>
<tr>
<td>5. $\angle BST = \angle BAS$</td>
<td>5. ______________________</td>
</tr>
<tr>
<td>6. $\angle R = \angle R$</td>
<td>6. ______________________</td>
</tr>
<tr>
<td>7. $\triangle BST \sim \triangle BAS$</td>
<td>7. ______________________</td>
</tr>
<tr>
<td>8. $\frac{RS}{RA} = \frac{RT}{RS}$</td>
<td>8. ______________________</td>
</tr>
<tr>
<td>9. $(RS)^2 = RA \cdot RT$</td>
<td>9. ______________________</td>
</tr>
</tbody>
</table>
1. Plane $\mathcal{P}$ is parallel to plane $\mathcal{Q}$. If plane $\mathcal{P}$ is perpendicular to line $\ell$, then plane $\mathcal{Q}$
   1) contains line $\ell$
   2) is parallel to line $\ell$
   3) is perpendicular to line $\ell$
   4) intersects, but is not perpendicular to line $\ell$

2. In the diagram below, quadrilateral $ABCD$ has vertices $A(-5, 1), B(6, -1), C(3, 5),$ and $D(-2, 7)$.

What are the coordinates of the midpoint of diagonal $AC$?
   1) $(-1, 3)$
   2) $(1, 3)$
   3) $(1, 4)$
   4) $(2, 3)$

3. In the diagram below, transversal $TU$ intersects $PQ$ and $RS$ at $V$ and $W$, respectively.

If $m\angle TVQ = 5x - 22$ and $m\angle VWS = 3x + 10$, for which value of $x$ is $PQ \parallel RS$?
   1) 6
   2) 16
   3) 24
   4) 28

4. The measures of the angles of a triangle are in the ratio 2:3:4. In degrees, the measure of the largest angle of the triangle is
   1) 20
   2) 40
   3) 80
   4) 100

5. The diameter of the base of a right circular cylinder is 6 cm and its height is 15 cm. In square centimeters, the lateral area of the cylinder is
   1) $180\pi$
   2) $135\pi$
   3) $90\pi$
   4) $45\pi$

6. When the system of equations $y + 2x = x^2$ and $y = x$ is graphed on a set of axes, what is the total number of points of intersection?
   1) 1
   2) 2
   3) 3
   4) 0
7. The vertex angle of an isosceles triangle measures 15 degrees more than one of its base angles. How many degrees are there in a base angle of the triangle?

1) 50
2) 55
3) 65
4) 70

8. Circle $O$ is graphed on the set of axes below. Which equation represents circle $O$?

1) $(x + 1)^2 + (y - 3)^2 = 9$
2) $(x - 1)^2 + (y + 3)^2 = 9$
3) $(x + 1)^2 + (y - 3)^2 = 6$
4) $(x - 1)^2 + (y + 3)^2 = 6$

9. In the diagram of the circle shown below, chords $AC$ and $BD$ intersect at $Q$, and chords $AE$ and $BD$ are parallel.

Which statement must always be true?

1) $\overline{AB} \cong \overline{CD}$
2) $\overline{DE} \cong \overline{CD}$
3) $\overline{AB} \cong \overline{DE}$
4) $\overline{BD} \cong \overline{AE}$

10. In the diagram below, $\triangle AEC \cong \triangle BED$.

Which statement is not always true?

1) $\overline{AC} \cong \overline{BD}$
2) $\overline{CE} \cong \overline{DE}$
3) $\angle EAC \cong \angle EBD$
4) $\angle ACE \cong \angle DBE$

11. What is the length of $\overline{RS}$ with $R(-2, 3)$ and $S(4, 5)$?

1) $2\sqrt{2}$
2) 40
3) $2\sqrt{10}$
4) $2\sqrt{17}$

12. What are the truth values of the statement “Two is prime” and its negation?

1) The statement is false and its negation is true.
2) The statement is false and its negation is false.
3) The statement is true and its negation is true.
4) The statement is true and its negation is false.
13 A regular polygon has an exterior angle that measures 45°. How many sides does the polygon have?
1) 10
2) 8
3) 6
4) 4

14 In rhombus $ABCD$, with diagonals $AC$ and $DB$, $AD = 10$.

If the length of diagonal $AC$ is 12, what is the length of $DB$?
1) 8
2) 16
3) $\sqrt{44}$
4) $\sqrt{136}$

15 If the surface area of a sphere is $144\pi$ square centimeters, what is the length of the diameter of the sphere, in centimeters?
1) 36
2) 18
3) 12
4) 6

16 Which numbers could represent the lengths of the sides of a triangle?
1) 5, 9, 14
2) 7, 7, 15
3) 1, 2, 4
4) 3, 6, 8

17 The equation of a line is $3y + 2x = 12$. What is the slope of the line perpendicular to the given line?
1) $\frac{2}{3}$
2) $\frac{3}{2}$
3) $-\frac{2}{3}$
4) $-\frac{3}{2}$

18 In the diagram below, point $K$ is in plane $P$.

How many lines can be drawn through $K$, perpendicular to plane $P$?
1) 1
2) 2
3) 0
4) an infinite number

19 In the diagram below, $AB$ and $CD$ are bases of trapezoid $ABCD$.

If $m\angle B = 123$ and $m\angle D = 75$, what is $m\angle C$?
1) 57
2) 75
3) 105
4) 123
20. What is the equation of a line passing through the point (4, -1) and parallel to the line whose equation is $2y - x = 8$?
   1) $y = \frac{1}{2}x - 3$
   2) $y = \frac{1}{2}x - 1$
   3) $y = -2x + 7$
   4) $y = -2x + 2$

21. The image of rhombus $VWXYZ$ preserves which properties under the transformation $T_{2,-3}$?
   1) parallelism, only
   2) orientation, only
   3) both parallelism and orientation
   4) neither parallelism nor orientation

22. The equation of a circle is $(x - 3)^2 + y^2 = 8$. The coordinates of its center and the length of its radius are
   1) $(-3, 0)$ and 4
   2) $(3, 0)$ and 4
   3) $(-3, 0)$ and $2\sqrt{2}$
   4) $(3, 0)$ and $2\sqrt{2}$

23. Which statement has the same truth value as the statement “If a quadrilateral is a square, then it is a rectangle”?
   1) If a quadrilateral is a rectangle, then it is a square.
   2) If a quadrilateral is a rectangle, then it is not a square.
   3) If a quadrilateral is not a square, then it is not a rectangle.
   4) If a quadrilateral is not a rectangle, then it is not a square.

24. The three medians of a triangle intersect at a point. Which measurements could represent the segments of one of the medians?
   1) 2 and 3
   2) 3 and 4.5
   3) 3 and 6
   4) 3 and 9

25. In the diagram of $\triangle PQR$ shown below, $\overline{PR}$ is extended to $S$, $\angle P = 110^\circ$, $\angle Q = 4x$, and $\angle QRS = x^2 + 5x$.

   ![Diagram](image1)

   What is $\angle Q$?
   1) 44
   2) 40
   3) 11
   4) 10

26. Triangle $PQT$ with $RS \parallel QT$ is shown below.

   ![Diagram](image2)

   If $PR = 12$, $RQ = 8$, and $PS = 21$, what is the length of $PT$?
   1) 14
   2) 17
   3) 35
   4) 38

27. In the diagram of $WXYZ$ below, $\overline{WY} \cong \overline{XZ}$.

   ![Diagram](image3)

   Which reasons can be used to prove $\overline{WX} \cong \overline{YZ}$?
   1) reflexive property and addition postulate
   2) reflexive property and subtraction postulate
   3) transitive property and addition postulate
   4) transitive property and subtraction postulate
28 The coordinates of the endpoints of the diameter of a circle are (2, 0) and (2, −8). What is the equation of the circle?
1) \((x - 2)^2 + (y + 4)^2 = 16\)
2) \((x + 2)^2 + (y - 4)^2 = 16\)
3) \((x - 2)^2 + (y + 4)^2 = 8\)
4) \((x + 2)^2 + (y - 4)^2 = 8\)

29 The coordinates of the endpoints of \(BC\) are \(B(5, 1)\) and \(C(-3, -2)\). Under the transformation \(R_{90}\), the image of \(BC\) is \(B'C'\). State the coordinates of points \(B'\) and \(C'\).

30 As shown in the diagram below, \(AS\) is a diagonal of trapezoid \(STAR\), \(RA \parallel ST\), \(m\angle ATS = 48\), \(m\angle RSA = 47\), and \(m\angle ARS = 68\).

Determine and state the longest side of \(\triangle SAT\).

31 In right triangle \(ABC\) shown below, altitude \(BD\) is drawn to hypotenuse \(AC\).

If \(AD = 8\) and \(DC = 10\), determine and state the length of \(AB\).

32 Two prisms with equal altitudes have equal volumes. The base of one prism is a square with a side length of 5 inches. The base of the second prism is a rectangle with a side length of 10 inches. Determine and state, in inches, the measure of the width of the rectangle.

33 As shown in the diagram below, \(BO\) and tangents \(BA\) and \(BC\) are drawn from external point \(B\) to circle \(O\). Radii \(OA\) and \(OC\) are drawn.

If \(OA = 7\) and \(DB = 18\), determine and state the length of \(AB\).

34 Triangle \(RST\) is similar to \(\triangle XYZ\) with \(RS = 3\) inches and \(XY = 2\) inches. If the area of \(\triangle RST\) is 27 square inches, determine and state the area of \(\triangle XYZ\), in square inches.
35 The graph below shows $\triangle A'B'C'$, the image of $\triangle ABC$ after it was reflected over the $y$-axis. Graph and label $\triangle ABC$, the pre-image of $\triangle A'B'C'$. Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected through the origin. State a single transformation that will map $\triangle ABC$ onto $\triangle A''B''C''$.

36 On the set of axes below, sketch the locus of points 2 units from the $x$-axis and sketch the locus of points 6 units from the point $(0, 4)$. Label with an $\times$ all points that satisfy both conditions.

37 Using a compass and straightedge, construct an equilateral triangle with $AB$ as a side. Using this triangle, construct a $30^\circ$ angle with its vertex at $A$. [Leave all construction marks.]

38 The vertices of quadrilateral $JKLM$ have coordinates $J(-3, 1)$, $K(1, -5)$, $L(7, -2)$, and $M(3, 4)$. Prove that $JKLM$ is a parallelogram. Prove that $JKLM$ is not a rhombus. [The use of the set of axes below is optional.]
1. A rectangular prism is shown in the diagram below.

Which pair of line segments would always be both congruent and parallel?
1) \( \overline{AC} \) and \( \overline{FB} \)
2) \( \overline{FB} \) and \( \overline{DB} \)
3) \( \overline{HF} \) and \( \overline{AC} \)
4) \( \overline{DB} \) and \( \overline{HF} \)

2. In parallelogram \( QRST \), diagonal \( QS \) is drawn.
   Which statement must always be true?
1) \( \triangle QRS \) is an isosceles triangle.
2) \( \triangle STQ \) is an acute triangle.
3) \( \triangle STQ \cong \triangle QRS \)
4) \( QS \cong QT \)

3. In the diagram below of circle \( O \), diameter \( AB \) and chord \( CD \) intersect at \( E \).

   If \( AB \perp CD \), which statement is always true?
1) \( \overline{AC} \cong \overline{BD} \)
2) \( \overline{BD} \cong \overline{DA} \)
3) \( \overline{AD} \cong \overline{BC} \)
4) \( \overline{CB} \cong \overline{BD} \)

4. What is an equation of the line that passes through \((-9, 12)\) and is perpendicular to the line whose equation is \( y = \frac{1}{3}x + 6 \)?

1) \( y = \frac{1}{3}x + 15 \)
2) \( y = -3x - 15 \)
3) \( y = \frac{1}{3}x - 13 \)
4) \( y = -3x + 27 \)
5 In the diagram below, under which transformation is \( \triangle X'Y'Z' \) the image of \( \triangle XYZ \)?

1) dilation
2) reflection
3) rotation
4) translation

6 What is the solution of the system of equations
\[
y - x = 5 \quad \text{and} \quad y = x^2 + 5\]
1) (0, 5) and (1, 6)
2) (0, 5) and (−1, 6)
3) (2, 9) and (−1, 4)
4) (−2, 9) and (−1, 4)

7 In the diagram below, parallelogram \( ABCD \) has vertices \( A(1, 3), B(5, 7), C(10, 7), \) and \( D(6, 3) \).
Diagonals \( AC \) and \( BD \) intersect at \( E \).

What are the coordinates of point \( E \)?
1) (0.5, 2)
2) (4.5, 2)
3) (5.5, 5)
4) (7.5, 7)

8 Right triangle \( ABC \) is shown in the graph below.

After a reflection over the \( y \)-axis, the image of \( \triangle ABC \) is \( \triangle A'B'C' \). Which statement is not true?
1) \( BC \cong B'C' \)
2) \( A'B' \perp B'C' \)
3) \( AB = A'B' \)
4) \( AC \parallel A'C' \)
9 What is an equation of circle $O$ shown in the graph below?

1) $(x - 2)^2 + (y + 4)^2 = 4$
2) $(x - 2)^2 + (y + 4)^2 = 16$
3) $(x + 2)^2 + (y - 4)^2 = 4$
4) $(x + 2)^2 + (y - 4)^2 = 16$

10 In the diagram below of right triangle $ABC$, an altitude is drawn to the hypotenuse $AB$.

Which proportion would always represent a correct relationship of the segments?

1) $\frac{c}{z} = \frac{z}{y}$
2) $\frac{c}{a} = \frac{a}{y}$
3) $\frac{x}{z} = \frac{z}{y}$
4) $\frac{y}{b} = \frac{b}{x}$

11 Quadrilateral $ABCD$ is graphed on the set of axes below.

Which quadrilateral best classifies $ABCD$?

1) trapezoid
2) rectangle
3) rhombus
4) square

12 Circle $O$ is represented by the equation $(x + 3)^2 + (y - 5)^2 = 48$. The coordinates of the center and the length of the radius of circle $O$ are

1) $(-3, 5)$ and $4\sqrt{3}$
2) $(-3, 5)$ and 24
3) $(3, -5)$ and $4\sqrt{3}$
4) $(3, -5)$ and 24
13 In the diagram below of circle $O$, chord $AB$ is parallel to chord $CD$.

A correct justification for $m\overarc{AC} = m\overarc{BD}$ in circle $O$ is
1) parallel chords intercept congruent arcs
2) congruent chords intercept congruent arcs
3) if two chords are parallel, then they are congruent
4) if two chords are equidistant from the center, then the arcs they intercept are congruent

14 What is the slope of a line perpendicular to the line whose equation is $3x - 7y + 14 = 0$?
1) $\frac{3}{7}$
2) $-\frac{7}{3}$
3) $3$
4) $-\frac{1}{3}$

15 Line segment $AB$ has endpoint $A$ located at the origin. Line segment $AB$ is longest when the coordinates of $B$ are
1) $(3, 7)$
2) $(2, -8)$
3) $(-6, 4)$
4) $(-5, -5)$

16 In $\triangle FGH$, $m\angle F = m\angle H$, $GF = x + 40$, $HF = 3x - 20$, and $GH = 2x + 20$. The length of $GH$ is
1) 20
2) 40
3) 60
4) 80

17 In the diagram below of quadrilateral $ABCD$, diagonals $AEC$ and $BED$ are perpendicular at $E$.

Which statement is always true based on the given information?
1) $DE \cong EB$
2) $AD \cong AB$
3) $\angle DAC \cong \angle BAC$
4) $\angle AED \cong \angle CED$

18 Which set of numbers could represent the lengths of the sides of a right triangle?
1) $\{2, 3, 4\}$
2) $\{5, 9, 13\}$
3) $\{7, 7, 12\}$
4) $\{8, 15, 17\}$

19 In quadrilateral $ABCD$, the diagonals bisect its angles. If the diagonals are not congruent, quadrilateral $ABCD$ must be a
1) square
2) rectangle
3) rhombus
4) trapezoid
20 Line \( m \) and point \( P \) are shown in the graph below.

Which equation represents the line passing through \( P \) and parallel to line \( m \)?

1) \( y - 3 = 2(x + 2) \)
2) \( y + 2 = 2(x - 3) \)
3) \( y - 3 = -\frac{1}{2}(x + 2) \)
4) \( y + 2 = -\frac{1}{2}(x - 3) \)

21 Which compound statement is true?

1) A square has four sides or a hexagon has eight sides.
2) A square has four sides and a hexagon has eight sides.
3) If a square has four sides, then a hexagon has eight sides.
4) A square has four sides if and only if a hexagon has eight sides.

22 In \( \triangle CAT \), \( \angle C = 65^\circ \), \( \angle A = 40^\circ \), and \( B \) is a point on side \( CA \), such that \( \overline{TB} \perp \overline{CA} \). Which line segment is shortest?

1) \( \overline{CT} \)
2) \( \overline{BC} \)
3) \( \overline{TB} \)
4) \( \overline{AT} \)

23 In the diagram of \( \triangle ABC \) below, \( \overline{DE} \parallel \overline{BC} \), \( AD = 3 \), \( DB = 2 \), and \( DE = 6 \).

What is the length of \( \overline{BC} \)?

1) 12
2) 10
3) 8
4) 4

24 In \( \triangle ABC \), an exterior angle at \( C \) measures 50°. If \( \angle A > 30^\circ \), which inequality must be true?

1) \( \angle B < 20^\circ \)
2) \( \angle B > 20^\circ \)
3) \( \angle BCA < 130^\circ \)
4) \( \angle BCA > 130^\circ \)
25 Which graph represents the graph of the equation 
\((x - 1)^2 + y^2 = 4\)?

1)

2)

3)

4)

26 The equations of lines \(k\), \(p\), and \(m\) are given below:

- \(k: x + 2y = 6\)
- \(p: 6x + 3y = 12\)
- \(m: -x + 2y = 10\)

Which statement is true?

1) \(p \perp m\)
2) \(m \perp k\)
3) \(k \parallel p\)
4) \(m \parallel k\)

27 Peach Street and Cherry Street are parallel. Apple Street intersects them, as shown in the diagram below.

If \(m\angle 1 = 2x + 36\) and \(m\angle 2 = 7x - 9\), what is \(m\angle 1\)?

1) 9
2) 17
3) 54
4) 70

28 A regular pyramid has a height of 12 centimeters and a square base. If the volume of the pyramid is 256 cubic centimeters, how many centimeters are in the length of one side of its base?

1) 8
2) 16
3) 32
4) 64
29 Triangle $ABC$ has coordinates $A(-2, 1)$, $B(3, 1)$, and $C(0, -3)$. On the set of axes below, graph and label $\Delta A'B'C'$, the image of $\Delta ABC$ after a dilation of 2.

30 In the diagram below of $\Delta ABC$, $DE$ and $DF$ are midsegments. If $DE = 9$, and $BC = 17$, determine and state the perimeter of quadrilateral $FDEC$.

31 The image of $\Delta ABC$ under a translation is $\Delta A'B'C'$. Under this translation, $B(3, -2)$ maps onto $B'(1, -1)$. Using this translation, the coordinates of image $A'$ are $(-2, 2)$. Determine and state the coordinates of point $A$.

32 As shown in the diagram below, quadrilateral $DEFG$ is inscribed in a circle and $m\angle D = 86$.

Determine and state $m\angle GFE$. Determine and state $m\angle F$.

33 In the diagram below, $QM$ is a median of triangle $PQR$ and point $C$ is the centroid of triangle $PQR$.

If $QC = 5x$ and $CM = x + 12$, determine and state the length of $QM$. 

(Not drawn to scale)
34 The sum of the interior angles of a regular polygon is 540°. Determine and state the number of degrees in one interior angle of the polygon.

35 Given: $MT$ and $HA$ intersect at $B$, $MA \parallel HT$, and $MT$ bisects $HA$.

Prove: $MA \cong HT$

36 A right circular cone has an altitude of 10 ft and the diameter of the base is 6 ft as shown in the diagram below. Determine and state the lateral area of the cone, to the nearest tenth of a square foot.

37 Use a compass and straightedge to divide line segment $AB$ below into four congruent parts. [Leave all construction marks.]

38 On the set of axes below, graph the locus of points 5 units from the point $(3, -2)$. On the same set of axes, graph the locus of points equidistant from the points $(0, -6)$ and $(2, -4)$. State the coordinates of all points that satisfy both conditions.
1. What is the solution of the system of equations graphed below?

\[ y = 2x + 1 \]
\[ y = x^2 + 2x - 3 \]

1) (0, -3)
2) (-1, -4)
3) (-3, 0) and (1, 0)
4) (-2, -3) and (2, 5)

2. What are the coordinates of the midpoint of the line segment with endpoints (2, -5) and (8, 3)?

1) (3, -4)
2) (3, -1)
3) (5, -4)
4) (5, -1)

3. As shown in the diagram below, when hexagon ABCDEF is reflected over line \( m \), the image is hexagon \( A'B'C'D'E'F' \).

Under this transformation, which property is not preserved?
1) area
2) distance
3) orientation
4) angle measure

4. In the diagram of \( \triangle ABC \) below, \( BD \) is drawn to side \( AC \).

If \( m \angle A = 35 \), \( m \angle ABD = 25 \), and \( m \angle C = 60 \), which type of triangle is \( \triangle BCD \)?

1) equilateral
2) scalene
3) obtuse
4) right
5 In the diagram below of rhombus $ABCD$, the diagonals $AC$ and $BD$ intersect at $E$.

If $AC = 18$ and $BD = 24$, what is the length of one side of rhombus $ABCD$?

1) 15
2) 18
3) 24
4) 30

6 What are the truth values of the statement "Opposite angles of a trapezoid are always congruent" and its negation?

1) The statement is true and its negation is true.
2) The statement is true and its negation is false.
3) The statement is false and its negation is true.
4) The statement is false and its negation is false.

7 What is the length of a line segment whose endpoints have coordinates (5, 3) and (1, 6)?

1) 5
2) 25
3) $\sqrt{17}$
4) $\sqrt{29}$

8 In the diagram below of isosceles $\triangle ABC$, the measure of vertex angle $B$ is 80°. If $AC$ extends to point $D$, what is $m\angle BCD$?

1) 50
2) 80
3) 100
4) 130

9 A student used a compass and a straightedge to construct $\overline{CE}$ in $\triangle ABC$ as shown below.

Which statement must always be true for this construction?

1) $\angle CEA \cong \angle CEB$
2) $\angle ACE \cong \angle BCE$
3) $AE \cong BE$
4) $EC \cong AC$

10 In $\triangle ABC$, $AB = 4$, $BC = 7$, and $AC = 10$. Which statement is true?

1) $m\angle B > m\angle C > m\angle A$
2) $m\angle B > m\angle A > m\angle C$
3) $m\angle C > m\angle B > m\angle A$
4) $m\angle C > m\angle A > m\angle B$
11 A circle whose center has coordinates \((-3, 4)\) passes through the origin. What is the equation of the circle?

1) \((x + 3)^2 + (y - 4)^2 = 5\)
2) \((x + 3)^2 + (y - 4)^2 = 25\)
3) \((x - 3)^2 + (y + 4)^2 = 5\)
4) \((x - 3)^2 + (y + 4)^2 = 25\)

12 Point \(W\) is located in plane \(R\). How many distinct lines passing through point \(W\) are perpendicular to plane \(R\)?

1) one
2) two
3) zero
4) infinite

13 In the diagram below, line \(\ell\) is parallel to line \(m\), and line \(w\) is a transversal.

If \(\angle 2 = 3x + 17\) and \(\angle 3 = 5x - 21\), what is \(\angle 1\)?

1) 19
2) 23
3) 74
4) 86

14 The diagram below is a graph of circle \(O\).

Which equation represents circle \(O\)?

1) \((x - 5)^2 + (y + 3)^2 = 4\)
2) \((x + 5)^2 + (y - 3)^2 = 4\)
3) \((x - 5)^2 + (y + 3)^2 = 16\)
4) \((x + 5)^2 + (y - 3)^2 = 16\)

15 In isosceles trapezoid \(QRST\) shown below, \(QR\) and \(TS\) are bases.

If \(\angle Q = 5x + 3\) and \(\angle R = 7x - 15\), what is \(\angle Q\)?

1) 83
2) 48
3) 16
4) 9
16 Triangle $ABC$ is graphed on the set of axes below.

What are the coordinates of the point of intersection of the medians of $\triangle ABC$?
1) $(-1, 2)$
2) $(-3, 2)$
3) $(0, 2)$
4) $(1, 2)$

17 Given the statement, "If a number has exactly two factors, it is a prime number," what is the contrapositive of this statement?
1) If a number does not have exactly two factors, then it is not a prime number.
2) If a number is not a prime number, then it does not have exactly two factors.
3) If a number is a prime number, then it has exactly two factors.
4) A number is a prime number if it has exactly two factors.

18 Which graph represents a circle whose equation is $(x - 2)^2 + (y + 4)^2 = 4$?

1) 
2) 
3) 
4) 

19 If two sides of a triangle have lengths of 4 and 10, the third side could be
1) 8
2) 2
3) 16
4) 4
20. The lines represented by the equations \(4x + 6y = 6\) and \(y = \frac{2}{3}x - 1\) are
1) parallel
2) the same line
3) perpendicular
4) intersecting, but not perpendicular

21. In the diagram of \(\triangle ABC\) below, \(DE \parallel AB\).

If \(CD = 4\), \(CA = 10\), \(CE = x + 2\), and \(EB = 4x - 7\), what is the length of \(CE\)?
1) 10
2) 8
3) 6
4) 4

22. Parallelogram \(ABCD\) with diagonals \(\overline{AC}\) and \(\overline{BD}\) intersecting at \(E\) is shown below.

Which statement must be true?
1) \(BE \cong CE\)
2) \(\angle BAE \cong \angle DCE\)
3) \(AB \cong BC\)
4) \(\angle DAE \cong \angle CBE\)

23. In the diagram below of circle \(O\), \(m\angle ABC = 24\).

What is the \(m\angle AOC\)?
1) 12
2) 24
3) 48
4) 60

24. Triangle \(A'B'C'\) is the image of \(\triangle ABC\) after a dilation of 2. Which statement is true?
1) \(AB = A'B'\)
2) \(BC = 2(B'C')\)
3) \(m\angle B = m\angle B'\)
4) \(m\angle A = \frac{1}{2}(m\angle A')\)

25. In the diagram of the circle below, \(\overline{AD} \parallel \overline{BC}\), \(\overline{AB} = (5x + 30)^\circ\), and \(\overline{CD} = (9x - 10)^\circ\).

What is \(m\overline{AB}\)?
1) 5
2) 10
3) 55
4) 80
26 The bases of a prism are right trapezoids, as shown in the diagram below.

![Diagram of a prism with right trapezoid bases]

Which two edges do not lie in the same plane?
1) $BC$ and $WZ$
2) $AW$ and $CY$
3) $DC$ and $WX$
4) $BX$ and $AB$

27 In the diagram below, $A'B'$ is the image of $AB$ under which single transformation?

![Graph with points A, B, A', B']

1) dilation
2) rotation
3) translation
4) glide reflection

28 For which diagram is the statement $\triangle ABC \sim \triangle ADE$ not always true?

![Diagrams of triangles ABC and ADE]

29 Given: $BE$ and $AD$ intersect at point $C$
$BC \cong EC$
$AC \cong DC$
$AB$ and $DE$ are drawn
Prove: $\triangle ABC \cong \triangle DEC$
30 Using a compass and straightedge, construct the perpendicular bisector of side $AR$ in $\triangle ART$ shown below. [Leave all construction marks.]

![Diagram of triangle ART with construction marks]

31 Determine and state the measure, in degrees, of an interior angle of a regular decagon.

32 Write an equation of a line that is parallel to the line whose equation is $3y = x + 6$ and that passes through the point $(-3, 4)$.

33 In the diagram below, secants $PQR$ and $PST$ are drawn to a circle from point $P$.

![Diagram of circle with secants PQR and PST]

If $PR = 24$, $PQ = 6$, and $PS = 8$, determine and state the length of $PT$.

34 The slope of $QR$ is $\frac{x - 1}{4}$ and the slope of $ST$ is $\frac{8}{3}$. If $QR \perp ST$, determine and state the value of $x$.

35 Quadrilateral $HYPE$ has vertices $H(2,3)$, $Y(1,7)$, $P(-2,7)$, and $E(-2,4)$. State and label the coordinates of the vertices of $H^\prime Y^\prime P^\prime E^\prime$ after the composition of transformations $r_{x-axis} \circ T_{5,-3}$.

[The use of the set of axes below is optional.]
36 On the set of axes below, graph two horizontal lines whose \( y \)-intercepts are \((0, -2)\) and \((0, 6)\), respectively. Graph the locus of points equidistant from these horizontal lines. Graph the locus of points 3 units from the \( y \)-axis. State the coordinates of the points that satisfy both loci.

37 In the diagram below, a right circular cone with a radius of 3 inches has a slant height of 5 inches, and a right cylinder with a radius of 4 inches has a height of 6 inches. Determine and state the number of full cones of water needed to completely fill the cylinder with water.

38 In the diagram below, right triangle \( RSU \) is inscribed in circle \( O \), and \( UT \) is the altitude drawn to hypotenuse \( RS \). The length of \( RT \) is 16 more than the length of \( TS \) and \( TU = 15 \). Find the length of \( TS \). Find, in simplest radical form, the length of \( RU \).
1 Quadrilateral $ABCD$ undergoes a transformation, producing quadrilateral $A'B'C'D'$. For which transformation would the area of $A'B'C'D'$ not be equal to the area of $ABCD$?
1) a rotation of $90^\circ$ about the origin
2) a reflection over the $y$-axis
3) a dilation by a scale factor of 2
4) a translation defined by $(x,y) \rightarrow (x + 4, y - 1)$

2 The diameter of a sphere is 12 inches. What is the volume of the sphere to the nearest cubic inch?
1) 288
2) 452
3) 905
4) 7,238

3 A right rectangular prism is shown in the diagram below.

![Diagram of a right rectangular prism]

Which line segments are coplanar?
1) $EF$ and $BC$
2) $HD$ and $FG$
3) $GH$ and $FB$
4) $EA$ and $GC$

4 What are the coordinates of the image of point $A(2,-7)$ under the translation $(x,y) \rightarrow (x - 3, y + 5)$?
1) $(-1, -2)$
2) $(-1, 2)$
3) $(5, -12)$
4) $(5, 12)$

5 Point $M$ is the midpoint of $AB$. If the coordinates of $M$ are $(2,8)$ and the coordinates of $A$ are $(10,12)$, what are the coordinates of $B$?
1) $(6,10)$
2) $(-6,4)$
3) $(-8,-4)$
4) $(18,16)$

6 In the diagram below, $QM$ is an altitude of right triangle $PQR$, $PM = 8$, and $RM = 18$.

![Diagram of a right triangle]

What is the length of $QM$?
1) 20
2) 16
3) 12
4) 10

7 What is an equation of the line that passes through the point $(2,4)$ and is perpendicular to the line whose equation is $3y = 6x + 3$?
1) $y = -\frac{1}{2}x + 5$
2) $y = -\frac{1}{2}x + 4$
3) $y = 2x - 6$
4) $y = 2x$
8. In all isosceles triangles, the exterior angle of a base angle must always be
   1) a right angle
   2) an acute angle
   3) an obtuse angle
   4) equal to the vertex angle

9. If ΔW'X'Y' is the image of ΔWXYZ after the transformation R$_{90^\circ}$, which statement is false?
   1) XY = X'Y'
   2) WX || W'X'
   3) ΔWXYZ ≅ ΔW'X'Y'
   4) m∠WXY = m∠W'X'Y'

10. Which equation represents the circle shown in the graph below?

   1) $(x - 2)^2 + y^2 = 9$
   2) $(x + 2)^2 + y^2 = 9$
   3) $(x - 2)^2 + y^2 = 3$
   4) $(x + 2)^2 + y^2 = 3$

11. In quadrilateral $ABCD$, each diagonal bisects opposite angles. If $m\angle DAB = 70$, then $ABCD$ must be a
   1) rectangle
   2) trapezoid
   3) rhombus
   4) square

12. Which diagram illustrates a correct construction of an altitude of ΔABC?

13. From external point $A$, two tangents to circle $O$ are drawn. The points of tangency are $B$ and $C$. Chord $BC$ is drawn to form ΔABC. If $m\angle ABC = 66$, what is $m\angle A$?
   1) 33
   2) 48
   3) 57
   4) 66
14 Point $A$ lies on plane $P$. How many distinct lines passing through point $A$ are perpendicular to plane $P$?
1) 1
2) 2
3) 0
4) infinite

15 Students made four statements about a circle.
A: The coordinates of its center are $(4, -3)$.
B: The coordinates of its center are $(-4, 3)$.
C: The length of its radius is $5\sqrt{2}$.
D: The length of its radius is 25.
If the equation of the circle is $(x + 4)^2 + (y - 3)^2 = 50$, which statements are correct?
1) A and C
2) A and D
3) B and C
4) B and D

16 Points $A$, $B$, $C$, and $D$ are located on circle $O$, forming trapezoid $ABCD$ with $AB \parallel DC$. Which statement must be true?
1) $AB \cong DC$
2) $AD \cong BC$
3) $\angle A \cong \angle D$
4) $AB \cong DC$

17 If $\triangle ABC \sim \triangle LMN$, which statement is not always true?
1) $m \angle A \cong m \angle N$
2) $m \angle B \cong m \angle M$
3) $\frac{\text{area of } \triangle ABC}{\text{area of } \triangle LMN} = \frac{(AC)^2}{(LN)^2}$
4) $\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle LMN} = \frac{AB}{LM}$

18 The equations of lines $k$, $m$, and $n$ are given below.
$k: 3y + 6 = 2x$
$m: 3y + 2x + 6 = 0$
$n: 2y = 3x + 6$
Which statement is true?
1) $k \parallel m$
2) $n \parallel m$
3) $m \perp k$
4) $m \perp n$

19 A regular polygon with an exterior angle of $40^\circ$ is a
1) pentagon
2) hexagon
3) nonagon
4) decagon

20 In $\triangle ABC$ shown below, $L$ is the midpoint of $BC$, $M$ is the midpoint of $AB$, and $N$ is the midpoint of $AC$.

\[\text{If } MN = 8, ML = 5, \text{ and } NL = 6, \text{ the perimeter of trapezoid } BMNC \text{ is}\]
1) 26
2) 28
3) 30
4) 35

21 The sum of the interior angles of a regular polygon is $720^\circ$. How many sides does the polygon have?
1) 8
2) 6
3) 5
4) 4
22 In the prism shown below, \( AD \perp AE \) and \( AD \perp AB \).

Which plane is perpendicular to \( AD \)?
1) HEA
2) BAD
3) EAB
4) EHG

23 In \( \triangle ABC \), \( m\angle A = 65 \) and \( m\angle B \) is greater than \( m\angle A \). The lengths of the sides of \( \triangle ABC \) in order from smallest to largest are
1) \( AB, BC, AC \)
2) \( BC, AB, AC \)
3) \( AC, BC, AB \)
4) \( AB, AC, BC \)

24 Which equation represents a circle whose center is the origin and that passes through the point \((-4, 0)\)?
1) \( x^2 + y^2 = 8 \)
2) \( x^2 + y^2 = 16 \)
3) \((x + 4)^2 + y^2 = 8\)
4) \((x + 4)^2 + y^2 = 16\)

25 The lengths of two sides of a triangle are 7 and 11. Which inequality represents all possible values for \( x \), the length of the third side of the triangle?
1) \( 4 \leq x \leq 18 \)
2) \( 4 < x \leq 18 \)
3) \( 4 \leq x < 18 \)
4) \( 4 < x < 18 \)

26 Which statement is the inverse of “If \( x + 3 = 7 \), then \( x = 4 \)?
1) If \( x = 4 \), then \( x + 3 = 7 \).
2) If \( x \neq 4 \), then \( x + 3 \neq 7 \).
3) If \( x + 3 \neq 7 \), then \( x \neq 4 \).
4) If \( x + 3 = 7 \), then \( x \neq 4 \).

27 In the diagram below of \( \triangle MAR \), medians \( MN, AT, \) and \( RH \) intersect at \( O \).

If \( TO = 10 \), what is the length of \( TA \)?
1) 30
2) 25
3) 20
4) 15

28 What is an equation of the line that passes through the point \((4, 5)\) and is parallel to the line whose equation is \( y = \frac{2}{3}x - 4 \)?
1) \( 2y + 3x = 11 \)
2) \( 2y + 3x = 22 \)
3) \( 3y - 2x = 2 \)
4) \( 3y - 2x = 7 \)

29 The measures of the angles of a triangle are in the ratio 5:6:7. Determine the measure, in degrees, of the smallest angle of the triangle.
30 Triangle $ABC$ has vertices $A(-1, 1)$, $B(1, 3)$, and $C(4, 1)$. The image of $\triangle ABC$ after the transformation $r_{y=x}$ is $\triangle A'B'C'$. State and label the coordinates of $\triangle A'B'C'$. [The use of the set of axes below is optional.]

31 As shown in the diagram below, a right circular cone has a height of 12 and a radius of 5.

Determine, in terms of $\pi$, the lateral area of the right circular cone.

32 Using a compass and straightedge, locate the midpoint of $AB$ by construction. [Leave all construction marks.]

33 The coordinates of the endpoints of $CD$ are $C(3, 8)$ and $D(6, -1)$. Find the length of $\overline{CD}$ in simplest radical form.

34 In the diagram below, point $B$ is the incenter of $\triangle FEC$, and $EBR$, $CBD$, and $FB$ are drawn.

If $m\angle FEC = 84$ and $m\angle ECF = 28$, determine and state $m\angle BRC$. 
35 Solve the following system of equations graphically. State the coordinates of all points in the solution.

\[ \begin{align*}
  y + 4x &= x^2 + 5 \\
  x + y &= 5
\end{align*} \]

36 In parallelogram \(ABCD\), with diagonal \(AC\) drawn, \(m \angle BCA = 4x + 2\), \(m \angle DAC = 6x - 6\), \(m \angle BAC = 5y - 1\), and \(m \angle DCA = 7y - 15\). Determine \(m \angle B\).

37 Point \(P\) is 5 units from line \(j\). Sketch the locus of points that are 3 units from line \(j\) and also sketch the locus of points that are 8 units from \(P\). Label with an \(X\) all points that satisfy both conditions.

38 The diagram below shows square \(ABCD\) where \(E\) and \(F\) are points on \(BC\) such that \(\overline{BE} \cong \overline{FC}\), and segments \(AF\) and \(DE\) are drawn. Prove that \(AF \cong DE\).
1 In $\triangle ABC$ shown below with $\overline{ADC}$, $\overline{AEB}$, $\overline{CFE}$, and $\overline{BFD}$, $\triangle ACE \cong \triangle ABD$.

Which statement must be true?
1) $\angle ACF \cong \angle BCF$
2) $\angle DAE \cong \angle DFE$
3) $\angle BCD \cong \angle ABD$
4) $\angle AEF \cong \angle ADF$

2 In a circle whose equation is $(x - 1)^2 + (y + 3)^2 = 9$, the coordinates of the center and length of its radius are
1) $(1, -3)$ and $r = 81$
2) $(-1, 3)$ and $r = 81$
3) $(1, -3)$ and $r = 3$
4) $(-1, 3)$ and $r = 3$

3 Parallel secants $FH$ and $GJ$ intersect circle $O$, as shown in the diagram below.

If $m\overline{FH} = 106$ and $m\overline{GJ} = 24$, then $m\overline{FG}$ equals
1) 106
2) 115
3) 130
4) 156

4 What are the coordinates of $P'$, the image of point $P(x, y)$ after translation $T_{4,4}$?
1) $(x - 4, y - 4)$
2) $(x + 4, y + 4)$
3) $(4x, 4y)$
4) $(4, 4)$

5 The statement "$x > 5$ or $x < 3$" is false when $x$ is equal to
1) 1
2) 2
3) 7
4) 4
6 Triangle $JTM$ is shown on the graph below.

Which transformation would result in an image that is not congruent to $\triangle JTM$?
1) $r_{y=x}$
2) $R_{90^\circ}$
3) $T_{0,-3}$
4) $D_2$

8 Which pair of edges is *not* coplanar in the cube shown below?

1) $\overline{EH}$ and $\overline{CD}$
2) $\overline{AD}$ and $\overline{FG}$
3) $\overline{DH}$ and $\overline{AE}$
4) $\overline{AB}$ and $\overline{EF}$

7 In the diagram below of $\triangle ABC$, with $\overline{CDEA}$ and $\overline{BGFA}$, $\overline{EF} \parallel \overline{DG} \parallel \overline{CB}$.

Which statement is *false*?
1) $\frac{AC}{AD} = \frac{AB}{AG}$
2) $\frac{AE}{AF} = \frac{AC}{AB}$
3) $\frac{AE}{AD} = \frac{EC}{AC}$
4) $\frac{BG}{BA} = \frac{CD}{CA}$

9 What is an equation of the line that passes through the point $(-2,1)$ and is parallel to the line whose equation is $4x - 2y = 8$?
1) $y = \frac{1}{2} x + 2$
2) $y = \frac{1}{2} x - 2$
3) $y = 2x + 5$
4) $y = 2x - 5$

10 In $\triangle JKL$, $\overline{JL} \cong \overline{KL}$. If $m\angle J = 58$, then $m\angle L$ is
1) 61
2) 64
3) 116
4) 122
11 The corresponding medians of two similar triangles are 8 and 20. If the perimeter of the larger triangle is 45, what is the perimeter of the smaller triangle?
1) 14
2) 18
3) 33
4) 37

12 Which construction of parallel lines is justified by the theorem "If two lines are cut by a transversal to form congruent alternate interior angles, then the lines are parallel"?
1)
2)
3)
4)

13 Given: "If a polygon is a triangle, then the sum of its interior angles is 180°." What is the contrapositive of this statement?
1) "If the sum of the interior angles of a polygon is not 180°, then it is not a triangle."
2) "A polygon is a triangle if and only if the sum of its interior angles is 180°."
3) "If a polygon is not a triangle, then the sum of the interior angles is not 180°."
4) "If the sum of the interior angles of a polygon is 180°, then it is a triangle."

14 In the diagram below, point P is not on line ℓ.

How many distinct planes that contain point P are also perpendicular to line ℓ?
1) 1
2) 2
3) 0
4) an infinite amount

15 The image of ΔABC after the transformation \( r_{y-axis} \) is ΔA'B'C'. Which property is not preserved?
1) distance
2) orientation
3) collinearity
4) angle measure
16 The equations \( y = 2x + 3 \) and \( y = -x^2 - x + 1 \) are graphed on the same set of axes. The coordinates of a point in the solution of this system of equations are
1) \((0,1)\)
2) \((1,5)\)
3) \((-1,-2)\)
4) \((-2,-1)\)

17 Which quadrilateral has diagonals that are always perpendicular bisectors of each other?
1) square
2) rectangle
3) trapezoid
4) parallelogram

18 As shown in the diagram below, \(AB\) is a diameter of circle \(O\), and chord \(AC\) is drawn.

If \(m\angle BAC = 70\), then \(m\overarc{AC}\) is
1) 40
2) 70
3) 110
4) 140

19 In parallelogram \(JKLM\), \(m\angle L\) exceeds \(m\angle M\) by 30 degrees. What is the measure of \(m\angle J\)?
1) 75°
2) 105°
3) 165°
4) 195°

20 Which equation represents the circle shown in the graph below?

```
1) \((x - 5)^2 + (y + 3)^2 = 1\)
2) \((x + 5)^2 + (y - 3)^2 = 1\)
3) \((x - 5)^2 + (y + 3)^2 = 2\)
4) \((x + 5)^2 + (y - 3)^2 = 2\)
```

21 What is the measure of each interior angle in a regular octagon?
1) 108°
2) 135°
3) 144°
4) 1080°

22 Points \(A\) and \(B\) are on line \(\ell\), and line \(\ell\) is parallel to line \(m\), as shown in the diagram below.

How many points are in the same plane as \(\ell\) and \(m\) and equidistant from \(\ell\) and \(m\), and also equidistant from \(A\) and \(B\)?
1) 1
2) 2
3) 3
4) 0
23 A carpenter made a storage container in the shape of a rectangular prism. It is 5 feet high and has a volume of 720 cubic feet. He wants to make a second container with the same height and volume as the first one, but in the shape of a triangular prism. What will be the number of square feet in the area of the base of the new container?
   1) 36
   2) 72
   3) 144
   4) 288

24 In $\triangle ABC$, $m\angle B < m\angle A < m\angle C$. Which statement is false?
   1) $AC > BC$
   2) $BC > AC$
   3) $AC < AB$
   4) $BC < AB$

25 In the diagram below of circle $O$ with radius $OA$, tangent $CA$ and secant $COB$ are drawn.

[Diagram]

If $AC = 20$ cm and $OA = 7$ cm, what is the length of $OC$, to the nearest centimeter?
   1) 19
   2) 20
   3) 21
   4) 27

26 In the diagram below of $\triangle ABC$, point $H$ is the intersection of the three medians.

[Diagram]

If $DH$ measures 2.4 centimeters, what is the length, in centimeters, of $AD$?
   1) 3.6
   2) 4.8
   3) 7.2
   4) 9.6

27 Which set of numbers could be the lengths of the sides of an isosceles triangle?
   1) $\{1, 1, 2\}$
   2) $\{3, 3, 5\}$
   3) $\{3, 4, 5\}$
   4) $\{4, 4, 9\}$

28 In the diagram below of right triangle $ABC$, $CD$ is the altitude to hypotenuse $AB$, $AD = 3$, and $DB = 4$.

[Diagram]

What is the length of $CB$?
   1) $2\sqrt{3}$
   2) $\sqrt{21}$
   3) $2\sqrt{7}$
   4) $4\sqrt{3}$
29 The image of $RS$ after a reflection through the origin is $R'S'$. If the coordinates of the endpoints of $RS$ are $R(2, -3)$ and $S(5, 1)$, state and label the coordinates of $R'$ and $S'$. [The use of the set of axes below is optional.]

30 A paper container in the shape of a right circular cone has a radius of 3 inches and a height of 8 inches. Determine and state the number of cubic inches in the volume of the cone, in terms of $\pi$.

31 In isosceles triangle $RST$ shown below, $RS \cong RT$, $M$ and $N$ are midpoints of $RS$ and $RT$, respectively, and $MN$ is drawn. If $MN = 3.5$ and the perimeter of $\triangle RST$ is 25, determine and state the length of $NT$.

32 In the diagram below, $\triangle ABC$ is equilateral.

Using a compass and straightedge, construct a new equilateral triangle congruent to $\triangle ABC$ in the space below. [Leave all construction marks.]

33 Write an equation of the line that is perpendicular to the line whose equation is $2y = 3x + 12$ and that passes through the origin.

34 Rectangle $KLMN$ has vertices $K(0, 4)$, $L(4, 2)$, $M(1, -4)$, and $N(-3, -2)$. Determine and state the coordinates of the point of intersection of the diagonals.
35 On the set of axes below, graph the locus of points 5 units from the point (2, −3) and the locus of points 2 units from the line whose equation is \( y = −1 \). State the coordinates of all points that satisfy both conditions.

36 If \( \overline{AB} \) is defined by the endpoints \( A(4, 2) \) and \( B(8, 6) \), write an equation of the line that is the perpendicular bisector of \( \overline{AB} \).

37 On the set of axes below, graph and label circle \( A \) whose equation is \((x + 4)^2 + (y - 2)^2 = 16\) and circle \( B \) whose equation is \( x^2 + y^2 = 9 \). Determine, in simplest radical form, the length of the line segment with endpoints at the centers of circles \( A \) and \( B \).

38 Given: Parallelogram \( DEFG \), \( K \) and \( H \) are points on \( \overrightarrow{DE} \) such that \( \angle DGK \cong \angle EFH \) and \( \overline{GK} \) and \( \overline{FH} \) are drawn.

Prove: \( DK \cong EH \)
1 ANS: 3
The diagonals of an isosceles trapezoid are congruent. $5x + 3 = 11x - 5$.

\[ 6x = 18 \]

\[ x = 3 \]

PTS: 2 REF: fall0801ge STA: G.G.40 TOP: Trapezoids

2 ANS: 4 PTS: 2
TOP: Negations

2 ANS: 4 PTS: 2
TOP: Negations

3 ANS: 1
\[(x, y) \rightarrow (x + 3, y + 1)\]

PTS: 2 REF: fall0803ge STA: G.G.54 TOP: Translations

4 ANS: 3 PTS: 2
TOP: Constructions

5 ANS: 3

PTS: 2 REF: fall0805ge STA: G.G.70 TOP: Quadratic-Linear Systems

6 ANS: 2 PTS: 2
TOP: Planes

7 ANS: 1 PTS: 2
TOP: Constructions

8 ANS: 3
The lateral edges of a prism are parallel.

PTS: 2 REF: fall0808ge STA: G.G.10 TOP: Solids

9 ANS: 1
Since $\overline{AC} \cong \overline{BC}$, $m \angle A = m \angle B$ under the Isosceles Triangle Theorem.

PTS: 2 REF: fall0809ge STA: G.G.69 TOP: Triangles in the Coordinate Plane

10 ANS: 4
Median $\overline{BF}$ bisects $\overline{AC}$ so that $\overline{CF} \cong \overline{FA}$.

PTS: 2 REF: fall0810ge STA: G.G.24 TOP: Statements

11 ANS: 3
Because $\overline{OC}$ is a radius, its length is 5. Since $CE = 2 \overline{OE} = 3$. $\triangle EDO$ is a 3-4-5 triangle. If $ED = 4$, $BD = 8$.

PTS: 2 REF: fall0811ge STA: G.G.49 TOP: Chords
The slope of a line in standard form is \( \frac{-A}{B} \), so the slope of this line is \( \frac{-2}{-1} = 2 \). A parallel line would also have a slope of 2. Since the answers are in slope intercept form, find the \( y \)-intercept:

\[
y = mx + b
\]

\[-11 = 2(-3) + b\]

\[-5 = b\]

\[PTS: 2 \quad REF: \ fall0812ge \quad STA: \ G.G.65 \quad TOP: \ Parallel \ and \ Perpendicular \ Lines\]

\[M_x = \frac{2 + (-4)}{2} = -1, \quad M_y = \frac{-3 + 6}{2} = \frac{3}{2}\]

\[PTS: 2 \quad REF: \ fall0813ge \quad STA: \ G.G.66 \quad TOP: \ Midpoint\]

\[TOP: \ Equations \ of \ Circles\]

\[3x^2 + 18x + 24 = 0\]

\[3(x^2 + 6x + 8) = 3(x + 2)\]

\[3(x + 4)(x + 2) = 3(x + 2)\]

\[x + 4\]

\[PTS: 2 \quad REF: \ fall0815ge \quad STA: \ G.G.12 \quad TOP: \ Volume\]

\[TOP: \ Planes\]

\[x^2 = 3(x + 18)\]

\[x^2 - 3x - 54 = 0\]

\[(x - 9)(x + 6) = 0\]

\[x = 9\]

\[PTS: 2 \quad REF: \ fall0817ge \quad STA: \ G.G.53 \quad TOP: \ Segments \ Intercepted \ by \ Circle\]

\[KEY: \ tangent \ and \ secant\]

\[TOP: \ Analytical \ Representations \ of \ Transformations\]

\[TOP: \ Plane\]

\[7 + 18 > 6 + 12\]

\[PTS: 2 \quad REF: \ fall0819ge \quad STA: \ G.G.33 \quad TOP: \ Triangle \ Inequality \ Theorem\]
20 ANS: 1

\[ M_x = \frac{-2 + 6}{2} = 2. \quad M_y = \frac{3 + 3}{2} = 3. \]

The center is (2, 3). \( d = \sqrt{(-2-6)^2 + (3-3)^2} = \sqrt{64 + 0} = 8. \) If the diameter is 8, the radius is 4 and \( r^2 = 16. \)

PTS: 2

REF: fall0820ge

STA: G.G.71

TOP: Equations of Circles

21 ANS: 1

\( \triangle PRT \) and \( \triangle SRQ \) share \( \angle R \) and it is given that \( \angle RPT \cong \angle RSQ. \)

PTS: 2

REF: fall0821ge

STA: G.G.44

TOP: Similarity Proofs

22 ANS: 4

\[ 3y + 1 = 6x + 4. \quad 2y + 1 = x - 9 \]
\[ 3y = 6x + 3 \quad 2y = x - 10 \]
\[ y = 2x + 1 \quad y = \frac{1}{2} x - 5 \]

PTS: 2

REF: fall0822ge

STA: G.G.63

TOP: Parallel and Perpendicular Lines

23 ANS: 1

After the translation, the coordinates are \( A'(-1, 5) \) and \( B'(3, 4). \) After the dilation, the coordinates are \( A''(-2, 10) \) and \( B''(6, 8). \)

PTS: 2

REF: fall0823ge

STA: G.G.58

TOP: Compositions of Transformations

24 ANS: 4

PTS: 2

REF: fall0824ge

STA: G.G.50

TOP: Tangents

KEY: common tangency

25 ANS: 3

PTS: 2

REF: fall0825ge

STA: G.G.21

TOP: Centroid, Orthocenter, Incenter and Circumcenter

26 ANS: 4

Corresponding angles of similar triangles are congruent.

PTS: 2

REF: fall0826ge

STA: G.G.45

TOP: Similarity

KEY: perimeter and area

27 ANS: 4

\[ (n - 2)180 = (8 - 2)180 = 1080. \quad \frac{1080}{8} = 135. \]

PTS: 2

REF: fall0827ge

STA: G.G.37

TOP: Interior and Exterior Angles of Polygons

28 ANS: 2

The slope of a line in standard form is \( -\frac{A}{B} \) so the slope of this line is \( -\frac{5}{3}. \) Perpendicular lines have slope that are the opposite and reciprocal of each other.

PTS: 2

REF: fall0828ge

STA: G.G.62

TOP: Parallel and Perpendicular Lines
29. ANS:
\[ 2\sqrt{3}. \quad x^2 = 3 \cdot 4 \]
\[ x = \sqrt{12} = 2\sqrt{3} \]

PTS: 2 REF: fall0829ge STA: G.G.47 TOP: Similarity
KEY: altitude

30. ANS:

PTS: 2 REF: fall0830ge STA: G.G.55 TOP: Properties of Transformations

31. ANS:
\[ 25. \quad d = \sqrt{(-3 - 4)^2 + (1 - 25)^2} = \sqrt{49 + 576} = \sqrt{625} = 25. \]

PTS: 2 REF: fall0831ge STA: G.G.67 TOP: Distance

32. ANS:

PTS: 2 REF: fall0832ge STA: G.G.17 TOP: Constructions
33 ANS:

\[ V = \pi r^2 h \]

\[ 12566.4 = \pi r^2 \cdot 8 \]

\[ r^2 = \frac{12566.4}{8\pi} \]

\[ r \approx 22.4 \]

PTS: 2 REF: fall0833ge STA: G.G.14 TOP: Volume and Lateral Area

34 ANS:

Contrapositive-If two angles of a triangle are not congruent, the sides opposite those angles are not congruent.

PTS: 2 REF: fall0834ge STA: G.G.26 TOP: Conditional Statements

35 ANS:

\[ \angle D, \angle G \text{ and } 24^\circ \text{ or } \angle E, \angle F \text{ and } 84^\circ. \]

\[ \text{m}\overline{FE} = \frac{2}{15} \times 360 = 48. \] Since the chords forming \( \angle D \) and \( \angle G \) are intercepted by \( \overline{FE} \), their measure is \( 24^\circ \).

\[ \text{m}\overline{GD} = \frac{7}{15} \times 360 = 168. \] Since the chords forming \( \angle E \) and \( \angle F \) are intercepted by \( \overline{GD} \), their measure is \( 84^\circ \).

PTS: 4 REF: fall0835ge STA: G.G.42 TOP: Midsegments

36 ANS:

\[ \angle D, \angle G \text{ and } 24^\circ \text{ or } \angle E, \angle F \text{ and } 84^\circ. \]

\[ \text{m}\overline{FE} = \frac{2}{15} \times 360 = 48. \] Since the chords forming \( \angle D \) and \( \angle G \) are intercepted by \( \overline{FE} \), their measure is \( 24^\circ \).

\[ \text{m}\overline{GD} = \frac{7}{15} \times 360 = 168. \] Since the chords forming \( \angle E \) and \( \angle F \) are intercepted by \( \overline{GD} \), their measure is \( 84^\circ \).

PTS: 4 REF: fall0836ge STA: G.G.51 TOP: Ares Determined by Angles

KEY: inscribed
37 ANS:

Because \( AB \parallel DC \), \( AD \cong BC \) since parallel chords intersect congruent arcs. \( \angle BDC \cong \angle ACD \) because inscribed angles that intercept congruent arcs are congruent. \( AD \cong BC \) since congruent chords intersect congruent arcs. \( \angle DAC \cong \angle DBC \) because inscribed angles that intercept the same arc are congruent. Therefore, \( \triangle ACD \cong \triangle BDC \) because of AAS.

38 ANS:

Because \( AB \parallel DC \), \( AD \cong BC \) since parallel chords intersect congruent arcs. \( \angle BDC \cong \angle ACD \) because inscribed angles that intercept congruent arcs are congruent. \( AD \cong BC \) since congruent chords intersect congruent arcs. \( \angle DAC \cong \angle DBC \) because inscribed angles that intercept the same arc are congruent. Therefore, \( \triangle ACD \cong \triangle BDC \) because of AAS.
1 ANS: 1
If \( \angle A \) is at minimum (50°) and \( \angle B \) is at minimum (90°), \( \angle C \) is at maximum of 40° (180° - (50° + 90°)). If \( \angle A \) is at maximum (60°) and \( \angle B \) is at maximum (100°), \( \angle C \) is at minimum of 20° (180° - (60° + 100°)).

PTS: 2 REF: 060901ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

2 ANS: 3

2 ANS: 3

3 ANS: 1

PTS: 2 REF: 060902ge STA: G.G.28 TOP: Triangle Congruency

TOP: Identifying Transformations

4 ANS: 4

PTS: 2 REF: 060903ge STA: G.G.13 TOP: Solids

5 ANS: 3

PTS: 2 REF: 060904ge STA: G.G.56 TOP: Reflections KEY: basic

6 ANS: 2

Parallel chords intercept congruent arcs. \( \widehat{AD} = \widehat{BC} = 60° \). \( \widehat{CDB} = \frac{1}{2} \widehat{BC} = 30° \).

PTS: 2 REF: 060905ge STA: G.G.54 TOP: Chords

7 ANS: 2

The slope of \( y = \frac{1}{2} x + 5 \) is \( \frac{1}{2} \). The slope of a perpendicular line is \( -2 \). \( y = mx + b \) 
\[ 5 = (-2)(-2) + b \]
\[ b = 1 \]

PTS: 2 REF: 060906ge STA: G.G.52 TOP: Chords

8 ANS: 3

PTS: 2 REF: 060907ge STA: G.G.64 TOP: Parallel and Perpendicular Lines

TOP: Identifying Transformations

9 ANS: 1

In an equilateral triangle, each interior angle is 60° and each exterior angle is 120° (180° - 120°). The sum of the three interior angles is 180° and the sum of the three exterior angles is 360°.

PTS: 2 REF: 060908ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

10 ANS: 2

PTS: 2 REF: 060909ge STA: G.G.71 TOP: Equations of Circles

11 ANS: 2

Longest side of a triangle is opposite the largest angle. Shortest side is opposite the smallest angle.

PTS: 2 REF: 060910ge STA: G.G.34 TOP: Angle Side Relationship
12 ANS: 4 PTS: 2 REF: 060912ge STA: G.G.23
TOP: Locus
13 ANS: 4 PTS: 2 REF: 060913ge STA: G.G.26
TOP: Conditional Statements
14 ANS: 2
The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

PTS: 2 REF: 060914ge STA: G.G.43 TOP: Centroid
15 ANS: 1
\[ AB = 10 \text{ since } \triangle ABC \text{ is a 6-8-10 triangle. } \ 6^2 = 10x \]
\[ 3.6 = x \]

PTS: 2 REF: 060915ge STA: G.G.47 TOP: Similarity
KEY: leg
16 ANS: 3
\[ 4(x + 4) = 8^2 \]
\[ 4x + 16 = 64 \]
\[ x = 12 \]

PTS: 2 REF: 060916ge STA: G.G.53 TOP: Segments Intercepted by Circle
KEY: tangent and secant
17 ANS: 2
\[ \angle ACB \] and \[ \angle ECD \] are congruent vertical angles and \[ \angle CAB \cong \angle CED \].

PTS: 2 REF: 060917ge STA: G.G.44 TOP: Similarity Proofs
18 ANS: 1 PTS: 2 REF: 060918ge STA: G.G.2
TOP: Planes
19 ANS: 4
\[ M_x = \frac{-6 + 1}{2} = \frac{-5}{2}, \]
\[ M_y = \frac{1 + 8}{2} = \frac{9}{2} \]

PTS: 2 REF: 060919ge STA: G.G.66 TOP: Midpoint
20 ANS: 1 PTS: 2 REF: 060920ge STA: G.G.74
TOP: Graphing Circles
21 ANS: 1
\[ V = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \cdot 4^2 \cdot 12 \approx 201 \]

PTS: 2 REF: 060921ge STA: G.G.15 TOP: Volume and Lateral Area
22 ANS: 4 PTS: 2 REF: 060922ge STA: G.G.73
TOP: Equations of Circles
23 ANS: 1

\[ y = x^2 - 4x = (4)^2 - 4(4) = 0. \] (4,0) is the only intersection.

PTS: 2 REF: 060923ge STA: G.G.70 TOP: Quadratic-Linear Systems

24 ANS: 4

(4) is not true if \( \angle PQR \) is obtuse.

PTS: 2 REF: 060924ge STA: G.G.32 TOP: Exterior Angle Theorem

25 ANS: 3 PTS: 2 REF: 060925ge STA: G.G.17 TOP: Constructions

26 ANS: 2

The slope of \( 2x + 3y = 12 \) is \( \frac{A}{B} = \frac{2}{3} \). The slope of a perpendicular line is \( \frac{3}{2} \). Rewritten in slope intercept form, (2) becomes \( y = \frac{3}{2}x + 3 \).

PTS: 2 REF: 060926ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

27 ANS: 4

\[ \triangle ABC \sim \triangle DBE. \] \[ \frac{AB}{DB} = \frac{AC}{DE} \]

\[ \frac{9}{2} = \frac{x}{3} \]

\[ x = 13.5 \]

PTS: 2 REF: 060927ge STA: G.G.46 TOP: Side Splitter Theorem

28 ANS: 3 PTS: 2 REF: 060928ge STA: G.G.8 TOP: Planes

29 ANS:

20. The sides of the triangle formed by connecting the midpoints are half the sides of the original triangle.

\[ 5 + 7 + 8 = 20. \]

PTS: 2 REF: 060929ge STA: G.G.42 TOP: Midsegments
30 ANS:

![Diagram 1]

PTS: 2  REF: 060930ge  STA: G.G.19  TOP: Constructions

31 ANS:

\[ y = -2x + 14. \] The slope of \( 2x + y = 3 \) is \( \frac{-A}{B} = \frac{-2}{1} = -2. \) \( y = mx + b \).

\[
4 = (-2)(5) + b
\]

\[ b = 14 \]

PTS: 2  REF: 060931ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

32 ANS:

![Diagram 2]

PTS: 2  REF: 060932ge  STA: G.G.22  TOP: Locus

33 ANS:

True. The first statement is true and the second statement is false. In a disjunction, if either statement is true, the disjunction is true.

PTS: 2  REF: 060933ge  STA: G.G.25  TOP: Compound Statements

KEY: disjunction
34 ANS:
20. \(5x + 10 = 4x + 30\)

\[x = 20\]

PTS: 2  REF: 060934ge  STA: G.G.45  TOP: Similarity
KEY: basic

35 ANS:
18. If the ratio of \(TA\) to \(AC\) is 1:3, the ratio of \(TE\) to \(ES\) is also 1:3. \(x + 3x = 24\). \(3(6) = 18\).

\[x = 6\]

PTS: 4  REF: 060935ge  STA: G.G.50  TOP: Tangents
KEY: common tangency

36 ANS:
\[15 + 5\sqrt{5}\]

PTS: 4  REF: 060936ge  STA: G.G.69  TOP: Triangles in the Coordinate Plane
KEY: grids

37 ANS:

PTS: 4  REF: 060937ge  STA: G.G.54  TOP: Compositions of Transformations
KEY: grids
ANS: 
$\overline{AC} \cong \overline{EC}$ and $\overline{DC} \cong \overline{BC}$ because of the definition of midpoint. $\angle ACB \cong \angle ECD$ because of vertical angles.

$\triangle ABC \cong \triangle EDC$ because of SAS. $\angle CDE \cong \angle CBA$ because of CPCTC. $BD$ is a transversal intersecting $AB$ and $ED$. Therefore $\overline{AB} \parallel \overline{DE}$ because $\angle CDE$ and $\angle CBA$ are congruent alternate interior angles.

1. **ANS: 4**
   The marked 60° angle and the angle above it are on the same straight line and supplementary. This unmarked supplementary angle is 120°. Because the unmarked 120° angle and the marked 120° angle are alternate exterior angles and congruent, \( d \parallel e \).

   **PTS: 2**  
   **REF: 080901ge**  
   **STA: G.G.35**  
   **TOP: Parallel Lines and Transversals**

2. **ANS: 3**  
   **PTS: 2**  
   **REF: 080902ge**  
   **STA: G.G.17**  
   **TOP: Constructions**

3. **ANS: 4**  
   \( 180 - (40 + 40) = 100 \)

   **PTS: 2**  
   **REF: 080903ge**  
   **STA: G.G.31**  
   **TOP: Isosceles Triangle Theorem**

4. **ANS: 2**  
   Parallel chords intercept congruent arcs. \( \overline{AC} = \overline{BD} = 30 \). \( 180 - 30 - 30 = 120 \).

   **PTS: 2**  
   **REF: 080904ge**  
   **STA: G.G.52**  
   **TOP: Chords**

5. **ANS: 4**  
   **PTS: 2**  
   **REF: 080905ge**  
   **STA: G.G.29**  
   **TOP: Triangle Congruency**

6. **ANS: 2**  
   A dilation affects distance, not angle measure.

   **PTS: 2**  
   **REF: 080906ge**  
   **STA: G.G.60**  
   **TOP: Identifying Transformations**

7. **ANS: 1**  
   \( \angle DCB \) and \( \angle ADC \) are supplementary adjacent angles of a parallelogram. \( 180 - 120 = 60 \). \( \angle 2 = 60 - 45 = 15 \).

   **PTS: 2**  
   **REF: 080907ge**  
   **STA: G.G.38**  
   **TOP: Parallelograms**

8. **ANS: 1**  
   Translations and reflections do not affect distance.

   **PTS: 2**  
   **REF: 080908ge**  
   **STA: G.G.59**  
   **TOP: Properties of Transformations**

9. **ANS: 3**  
   The slope of \( y = x + 2 \) is 1. The slope of \( y - x = -1 \) is \( \frac{-A}{B} = \frac{(-1)}{1} = 1 \).

   **PTS: 2**  
   **REF: 080909ge**  
   **STA: G.G.63**  
   **TOP: Parallel and Perpendicular Lines**

10. **ANS: 2**  
    \( M_x = \frac{-2 + 6}{2} = 2 \). \( M_y = \frac{-4 + 2}{2} = -1 \)

    **PTS: 2**  
    **REF: 080910ge**  
    **STA: G.G.66**  
    **TOP: Midpoint**

11. **ANS: 1**  
    **PTS: 2**  
    **REF: 080911ge**  
    **STA: G.G.73**  
    **TOP: Equations of Circles**
12 ANS: 4

\[
y + x = 4 \quad x^2 - 6x + 10 = -x + 4 \quad y + x = 4 \quad y + 2 = 4
\]
\[
y = -x + 4 \quad x^2 - 5x + 6 = 0 \quad y + 3 = 4 \quad y = 2
\]
\[
(x - 3)(x - 2) = 0 \quad y = 1
\]
\[
x = 3 \text{ or } 2
\]

PTS: 2 REF: 080912ge STA: G.G.70 TOP: Quadratic-Linear Systems

13 ANS: 3 PTS: 2 REF: 080913ge STA: G.G.28

TOP: Triangle Congruency

14 ANS: 4 PTS: 2 REF: 080914ge STA: G.G.7

TOP: Planes

15 ANS: 4 PTS: 2 REF: 080915ge STA: G.G.56

TOP: Identifying Transformations

16 ANS: 2

6 + 17 > 22

PTS: 2 REF: 080916ge STA: G.G.33 TOP: Triangle Inequality Theorem

17 ANS: 4

The slope of \( y = -\frac{2}{3}x - 5 \) is \(-\frac{2}{3}\). Perpendicular lines have slope that are opposite reciprocals.

PTS: 2 REF: 080917ge STA: G.G.62 TOP: Parallel and Perpendicular Lines

18 ANS: 1 PTS: 2 REF: 080918ge STA: G.G.41

TOP: Special Quadrilaterals

19 ANS: 1

\[
d = \sqrt{(-4 - 2)^2 + (5 - (-5))^2} = \sqrt{36 + 100} = \sqrt{136} = \sqrt{4 \cdot 34} = 2\sqrt{34}.
\]

PTS: 2 REF: 080919ge STA: G.G.67 TOP: Distance

20 ANS: 3

PTS: 2 REF: 080920ge STA: G.G.42 TOP: Midsegments

21 ANS: 2 PTS: 2 REF: 080921ge STA: G.G.72

TOP: Equations of Circles
22 ANS: 4
Let \( AD = x \). 
\[
36x = 12^2
\]
\[
x = 4
\]
PTS: 2 REF: 080922ge STA: G.G.47 TOP: Similarity KEY: leg

23 ANS: 2
\[
4(4x - 3) = 3(2x + 8)
\]
\[
16x - 12 = 6x + 24
\]
\[
10x = 36
\]
\[
x = 3.6
\]
PTS: 2 REF: 080923ge STA: G.G.53 TOP: Segments Intercepted by Circle KEY: two chords

24 ANS: 3 PTS: 2 REF: 080924ge STA: G.G.24 TOP: Negations


26 ANS: 1
\[
V = \pi r^2 h
\]
\[
1000 = \pi r^2 \cdot 8
\]
\[
r^2 = \frac{1000}{8 \pi}
\]
\[
r \approx 6.3
\]
PTS: 2 REF: 080926ge STA: G.G.14 TOP: Volume and Lateral Area

27 ANS: 2 PTS: 2 REF: 080927ge STA: G.G.4 TOP: Planes

28 ANS: 3 PTS: 2 REF: 080928ge STA: G.G.50 TOP: Tangents KEY: common tangency

29 ANS:
3. The non-parallel sides of an isosceles trapezoid are congruent. 
\[
2x + 5 = 3x + 2
\]
\[
x = 3
\]
PTS: 2 REF: 080929ge STA: G.G.40 TOP: Trapezoids

30 ANS:
\[
2016. \quad V = \frac{1}{3} Bh = \frac{1}{3} s^2 h = \frac{1}{3} 12^2 \cdot 42 = 2016
\]
PTS: 2 REF: 080930ge STA: G.G.13 TOP: Volume
31 ANS:

\[ y = \frac{2}{3}x - 9. \] The slope of \(2x - 3y = 11\) is \(\frac{-A}{B} = \frac{-2}{-3} = \frac{2}{3}\). \(-5 = \left(\frac{2}{3}\right)(6) + b\)

\[-5 = 4 + b\]

\[b = -9\]

PTS: 2 REF: 080931ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

32 ANS:

PTS: 2 REF: 080932ge STA: G.G.17 TOP: Constructions

33 ANS:

26. \(x + 3x + 5x - 54 = 180\)

\(9x = 234\)

\(x = 26\)

PTS: 2 REF: 080933ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

34 ANS:

\(AC\): \(m\angle BCA = 63\) and \(m\angle ABC = 80\). \(AC\) is the longest side as it is opposite the largest angle.

PTS: 2 REF: 080934ge STA: G.G.34 TOP: Angle Side Relationship
35 ANS:
\[ y = \frac{4}{3}x - 6. \quad M_x = \frac{-1 + 7}{2} = 3 \]
The perpendicular bisector goes through \((3, -2)\) and has a slope of \(\frac{4}{3}\).
\[ M_y = \frac{1 + (-5)}{2} = -2 \]
\[ m = \frac{1 - (-5)}{-1 - 7} = -\frac{3}{4} \]
\[ y - y_M = m(x - x_M). \]
\[ y - 1 = \frac{4}{3}(x - 2) \]

PTS: 4  
REF: 080935ge  
STA: G.G.68  
TOP: Perpendicular Bisector

36 ANS:

PTS: 4  
REF: 080936ge  
STA: G.G.23  
TOP: Locus

37 ANS:

\[ D'(-1, 1), E'(-1, 5), G'(-4, 5) \]

PTS: 4  
REF: 080937ge  
STA: G.G.55  
TOP: Properties of Transformations
ANS:

\[ \overline{FE} \cong \overline{FE} \text{ (Reflexive Property); } \overline{AE} - \overline{FE} \cong \overline{FC} - \overline{EF} \text{ (Line Segment Subtraction Theorem); } \overline{AF} \cong \overline{CE} \text{ (Substitution); } \angle BFA \cong \angle DEC \text{ (All right angles are congruent); } \triangle BFA \cong \triangle DEC \text{ (AAS); }
\]
\[ \overline{AB} \cong \overline{CD} \text{ and } \overline{BF} \cong \overline{DE} \text{ (CPCTC); } \angle BFC \cong \angle DEA \text{ (All right angles are congruent); } \triangle BFC \cong \triangle DEA \text{ (SAS); } \overline{AD} \cong \overline{CB} \text{ (CPCTC); } \triangle ABCD \text{ is a parallelogram (opposite sides of quadrilateral } \triangle ABCD \text{ are congruent)} \]

1. ANS: 2
   The length of the midsegment of a trapezoid is the average of the lengths of its bases. \( \frac{x + 30}{2} = 44 \).
   
   \[ x + 30 = 88 \]
   \[ x = 58 \]

   PTS: 2   REF: 011001ge   STA: G.G.40   TOP: Trapezoids

2. ANS: 1
   \[ x + 2x + 2 + 3x + 4 = 180 \]
   \[ 6x + 6 = 180 \]
   \[ x = 29 \]

   PTS: 2   REF: 011002ge   STA: G.G.30   TOP: Interior and Exterior Angles of Triangles


4. ANS: 2   PTS: 2   REF: 011004ge   STA: G.G.17   TOP: Constructions

5. ANS: 1
   The closer a chord is to the center of a circle, the longer the chord.

   PTS: 2   REF: 011005ge   STA: G.G.49   TOP: Chords


7. ANS: 3   PTS: 2   REF: 011007ge   STA: G.G.31   TOP: Isosceles Triangle Theorem

8. ANS: 4
   \[ x^2 = (4 + 5) \times 4 \]
   \[ x^2 = 36 \]
   \[ x = 6 \]

   PTS: 2   REF: 011008ge   STA: G.G.53   TOP: Segments Intercepted by Circle
   KEY: tangent and secant


11. ANS: 2   PTS: 2   REF: 011011ge   STA: G.G.22   TOP: Locus

13 ANS: 1
Opposite sides of a parallelogram are congruent. \(4x - 3 = x + 3\). \(SV = (2) + 3 = 5\).

\[
3x = 6 \\
x = 2
\]

PTS: 2 REF: 011013ge STA: G.G.38 TOP: Parallelograms

14 ANS: 3
\[
m = \frac{-A}{B} = \frac{5}{2}, \quad m = \frac{-A}{B} = \frac{10}{4} = \frac{5}{2}
\]

PTS: 2 REF: 011014ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

15 ANS: 2
\[
\frac{87 + 35}{2} = \frac{122}{2} = 61
\]

PTS: 2 REF: 011015ge STA: G.G.51 TOP: Arcs Determined by Angles

KEY: inside circle

16 ANS: 1
\[
a^2 + (5\sqrt{2})^2 = (2\sqrt{15})^2 \\
a^2 + (25 \times 2) = 4 \times 15 \\
a^2 + 50 = 60 \\
a^2 = 10 \\
a = \sqrt{10}
\]

PTS: 2 REF: 011016ge STA: G.G.48 TOP: Pythagorean Theorem

17 ANS: 4
\[
d = \sqrt{(-3 - 1)^2 + (2 - 0)^2} = \sqrt{16 + 4} = \sqrt{20} = \sqrt{4 \cdot 5} = 2\sqrt{5}
\]

PTS: 2 REF: 011017ge STA: G.G.67 TOP: Distance

18 ANS: 4
The slope of \(y = -3x + 2\) is \(-3\). The perpendicular slope is \(-\frac{1}{3}\). \(-1 = \frac{1}{3} (3) + b\)

\[
-1 = 1 + b \\
b = -2
\]

PTS: 2 REF: 011018ge STA: G.G.64 TOP: Parallel and Perpendicular Lines

TOP: Similarity Proofs

19 ANS: 4 PTS: 2 REF: 011019ge STA: G.G.44 TOP: Graphing Circles

20 ANS: 2 PTS: 2 REF: 011020ge STA: G.G.74
21 ANS: 1

\[3x + 15 + 2x - 1 = 6x + 2\]
\[5x + 14 = 6x + 2\]
\[x = 12\]

PTS: 2 REF: 011021ge STA: G.G.32 TOP: Exterior Angle Theorem

22 ANS: 2

Because the triangles are similar, \(\frac{m\angle A}{m\angle D} = 1\)

PTS: 2 REF: 011022ge STA: G.G.45 TOP: Similarity
KEY: perimeter and area

23 ANS: 3

The sum of the interior angles of a pentagon is \((5 - 2)180 = 540\).

PTS: 2 REF: 011023ge STA: G.G.36 TOP: Interior and Exterior Angles of Polygons

24 ANS: 1

PTS: 2 REF: 011024ge STA: G.G.3 TOP: Planes

25 ANS: 3

\[m = \frac{-A}{B} = \frac{-3}{4}\]

PTS: 2 REF: 011025ge STA: G.G.62 TOP: Parallel and Perpendicular Lines

26 ANS: 1

\[A'(2,4)\]

PTS: 2 REF: 011023ge STA: G.G.54 TOP: Compositions of Transformations
KEY: basic

27 ANS: 3

\[V = \pi r^2h = \pi \cdot 6^2 \cdot 27 = 972\pi\]

PTS: 2 REF: 011027ge STA: G.G.14 TOP: Volume and Lateral Area

28 ANS: 3

PTS: 2 REF: 011028ge STA: G.G.26 TOP: Conditional Statements
29 ANS:
\[
67. \frac{180 - 46}{2} = 67
\]
PTS: 2 REF: 011029ge STA: G.G.31 TOP: Isosceles Triangle Theorem

30 ANS:
4. \[l_1w_1h_1 = l_2w_2h_2\]
   \[10 \times 2 \times h = 5 \times w_2 \times h\]
   \[20 = 5w_2\]
   \[w_2 = 4\]

PTS: 2 REF: 011030ge STA: G.G.11 TOP: Volume

31 ANS:
\[(6, -4). \quad C_x = \frac{Q_x + R_x}{2}, \quad C_y = \frac{Q_y + R_y}{2}.\]
\[3.5 = \frac{1 + R_x}{2}, \quad 2 = \frac{8 + R_y}{2}\]
\[7 = 1 + R_x, \quad 4 = 8 + R_y\]
\[6 = R_x, \quad -4 = R_y\]

PTS: 2 REF: 011031ge STA: G.G.66 TOP: Midpoint

32 ANS:

PTS: 2 REF: 011032ge STA: G.G.20 TOP: Constructions

33 ANS:
5. \[\frac{3}{x} = \frac{6 + 3}{15}\]
   \[9x = 45\]
   \[x = 5\]

PTS: 2 REF: 011033ge STA: G.G.46 TOP: Side Splitter Theorem

34 ANS:
6. The centroid divides each median into segments whose lengths are in the ratio 2 : 1. \[\overline{TD} = 6 \text{ and } \overline{DB} = 3\]

PTS: 2 REF: 011034ge STA: G.G.43 TOP: Centroid
35 ANS:
36, because a dilation does not affect angle measure. 10, because a dilation does affect distance.

PTS: 4  
REF: 011035ge  
STA: G.G.59  
TOP: Properties of Transformations

36 ANS:

\[ JK \cong LM \] because opposite sides of a parallelogram are congruent. \[ LM \cong LN \] because of the Isosceles Triangle Theorem. \[ LM \cong JM \] because of the transitive property. \( JKLM \) is a rhombus because all sides are congruent.

PTS: 4  
REF: 011036ge  
STA: G.G.27  
TOP: Quadrilateral Proofs

37 ANS:

PTS: 4  
REF: 011037ge  
STA: G.G.23  
TOP: Locus

38 ANS:

PTS: 6  
REF: 011038ge  
STA: G.G.70  
TOP: Quadratic-Linear Systems
1 ANS: 1
Parallel lines intercept congruent arcs.

PTS: 2 REF: 061001ge STA: G.G.52 TOP: Chords

2 ANS: 2
TOP: Negations

3 ANS: 4
TOP: Solids

4 ANS: 3
TOP: Isosceles Triangle Theorem

5 ANS: 1
TOP: Properties of Transformations

6 ANS: 4
$L = 2\pi rh = 2\pi \cdot 5 \cdot 11 \approx 345.6$

PTS: 2 REF: 061006ge STA: G.G.14 TOP: Volume and Lateral Area

7 ANS: 2
TOP: Parallel Lines and Transversals

8 ANS: 4
TOP: Trapezoids

9 ANS: 1
TOP: Converse

10 ANS: 1
TOP: Angle Side Relationship

11 ANS: 3

PTS: 2 REF: 061011ge STA: G.G.70 TOP: Quadratic-Linear Systems

12 ANS: 1
TOP: Constructions

13 ANS: 1
TOP: Tangents KEY: point of tangency

14 ANS: 4
The radius is 4. $r^2 = 16.$

PTS: 2 REF: 061014ge STA: G.G.72 TOP: Equations of Circles

15 ANS: 4
TOP: Identifying Transformations
16 ANS: 3

\[
\frac{36 - 20}{2} = 8, \quad \sqrt{17^2 - 8^2} = 15
\]

PTS: 2 REF: 061016ge STA: G.G.40 TOP: Trapezoids

17 ANS: 3 PTS: 2 REF: 061017ge STA: G.G.1 TOP: Planes

18 ANS: 4 PTS: 2 REF: 061018ge STA: G.G.56 TOP: Identifying Transformations

19 ANS: 3

\[
\frac{36 + 20}{2} = 28
\]

PTS: 2 REF: 061019ge STA: G.G.51 TOP: Arcs Determined by Angles
KEY: inside circle

20 ANS: 2 PTS: 2 REF: 061020ge STA: G.G.19 TOP: Constructions

21 ANS: 4

\[
d = \sqrt{(146 - (-4))^2 + (52 - 2)^2} = \sqrt{25,000} \approx 158.1
\]

PTS: 2 REF: 061021ge STA: G.G.67 TOP: Distance


23 ANS: 2

\[
(d + 4)4 = 12(6)
\]
\[
4d + 16 = 72
\]
\[
d = 14
\]
\[
r = 7
\]

PTS: 2 REF: 061023ge STA: G.G.53 TOP: Segments Intercepted by Circle
KEY: two secants
24 ANS: 2
\[x^2 + (x + 7)^2 = 13^2\]
\[x^2 + x^2 + 7x + 7x + 49 = 169\]
\[2x^2 + 14x - 120 = 0\]
\[x^2 + 7x - 60 = 0\]
\[(x + 12)(x - 5) = 0\]
\[x = 5\]
\[2x = 10\]

PTS: 2 REF: 061024ge STA: G.G.48 TOP: Pythagorean Theorem

25 ANS: 4
\[\overline{BG}\] is also an angle bisector since it intersects the concurrence of \(\overline{CD}\) and \(\overline{AE}\)

PTS: 2 REF: 061025ge STA: G.G.21 KEY: Centroid, Orthocenter, Incenter and Circumcenter

26 ANS: 2

PTS: 2 REF: 061026ge STA: G.G.51 TOP: Arcs Determined by Angles KEY: inscribed

27 ANS: 1
\[-2 \left( -\frac{1}{2} y = 6x + 10 \right) \]
\[y = -12x - 20\]

PTS: 2 REF: 061027ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

28 ANS: 2
Adjacent sides of a rectangle are perpendicular and have opposite and reciprocal slopes.

PTS: 2 REF: 061028ge STA: G.G.69 TOP: Quadrilaterals in the Coordinate Plane

29 ANS:
\[452. \ SA = 4\pi r^2 = 4\pi \cdot 6^2 = 144\pi \approx 452\]

PTS: 2 REF: 061029ge STA: G.G.16 TOP: Volume and Surface Area
30 ANS:

37. Since $DE$ is a midsegment, $AC = 14$. $10 + 13 + 14 = 37$

PTS: 2  REF: 061030ge  STA: G.G.42  TOP: Midsegments

31 ANS:

34. $2x - 12 + x + 90 = 180$

$3x + 78 = 90$

$3x = 102$

$x = 34$

PTS: 2  REF: 061031ge  STA: G.G.30  TOP: Interior and Exterior Angles of Triangles

32 ANS:

![Diagram](image)

PTS: 2  REF: 061032ge  STA: G.G.54  TOP: Reflections

KEY: grids

33 ANS:

![Diagram](image)

PTS: 2  REF: 061033ge  STA: G.G.22  TOP: Locus
34 ANS:
18. \( V = \frac{1}{3} Bh = \frac{1}{3} lwh \)

\[ 288 = \frac{1}{3} \cdot 8 \cdot 6 \cdot h \]

\[ 288 = 16h \]

\[ 18 = h \]

PTS: 2 REF: 061034ge STA: G.G.13 TOP: Volume

35 ANS:
\[ BD \cong DB \text{ (Reflexive Property); } \Delta ABD \cong \Delta CDB \text{ (SSS); } \angle BDC \cong \angle ABD \text{ (CPCTC).} \]

PTS: 4 REF: 061035ge STA: G.G.27 TOP: Quadrilateral Proofs

36 ANS:
\[ y = \frac{2}{3} x + 1 \]

\[ 2y + 3x = 6 \]

\[ y = mx + b \]

\[ 2y = -3x + 6 \]

\[ 5 = \frac{2}{3} (6) + b \]

\[ y = -\frac{3}{2} x + 3 \]

\[ 5 = 4 + b \]

\[ m = -\frac{3}{2} \]

\[ 1 = b \]

\[ m_{\perp} = \frac{2}{3} \]

\[ y = \frac{2}{3} x + 1 \]

PTS: 4 REF: 061036ge STA: G.G.64 TOP: Parallel and Perpendicular Lines

37 ANS:
Midpoint: \( \left( \frac{-4 + 4}{2}, \frac{2 + (-4)}{2} \right) = (0, -1) \).

Distance: \( d = \sqrt{(-4 - 4)^2 + (2 - (-4))^2} = \sqrt{100} = 10 \)

\[ r = 5 \]

\[ r^2 = 25 \]

\[ x^2 + (y + 1)^2 = 25 \]

38 ANS:

\[8x - 5 = 3x + 30, \ 4z - 8 = 3z, \ 9y + 8 + 5y - 2 = 90.\]

\[5x = 35, \quad z = 8, \quad 14y + 6 = 90\]

\[x = 7, \quad 14y = 84, \quad y = 6\]

1 ANS: 4

![Diagram of two overlapping triangles]

PTS: 2  REF: 081001ge  STA: G.G.29  TOP: Triangle Congruency

2 ANS: 3  PTS: 2  REF: 081002ge  STA: G.G.9  TOP: Planes

3 ANS: 1

![Diagram of a triangle with midsegments]

PTS: 2  REF: 081003ge  STA: G.G.42  TOP: Midsegments

4 ANS: 3

\[(x + 3)^2 - 4 = 2x + 5\]
\[x^2 + 6x + 9 - 4 = 2x + 5\]
\[x^2 + 4x = 0\]
\[x(x + 4) = 0\]
\[x = 0, -4\]

PTS: 2  REF: 081004ge  STA: G.G.70  TOP: Quadratic-Linear Systems

5 ANS: 4  PTS: 2  REF: 081005ge  STA: G.G.18  TOP: Constructions

6 ANS: 4

\[180 - (50 + 30) = 100\]

PTS: 2  REF: 081006ge  STA: G.G.45  TOP: Similarity

KEY: basic
7 ANS: 2
8 ANS: 1
9 ANS: 1
10 ANS: 4
11 ANS: 4
12 ANS: 1
13 ANS: 4
14 ANS: 2
15 ANS: 2
ID: A

16 ANS: 4

\[
\text{sum of interior } \angle s = \text{sum of exterior } \angle s \\
(n - 2)180 = n \left(180 - \frac{(n - 2)180}{n}\right) \\
180n - 360 = 180n - 180n + 360 \\
180n = 720 \\
n = 4
\]

PTS: 2 REF: 081016ge STA: G.G.36 TOP: Interior and Exterior Angles of Polygons

17 ANS: 1

\[4x = 6 \cdot 10 \]
\[x = 15\]

PTS: 2 REF: 081017ge STA: G.G.53 TOP: Segments Intercepted by Circle

KEY: two chords

18 ANS: 1

The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

\[
\overline{GC} = 2\overline{FG} \\
\overline{GC} + \overline{FG} = 24 \\
2\overline{FG} + \overline{FG} = 24 \\
3\overline{FG} = 24 \\
\overline{FG} = 8
\]

PTS: 2 REF: 081018ge STA: G.G.43 TOP: Centroid

19 ANS: 2

\[
M_x = \frac{3x + 5 + x - 1}{2} = \frac{4x + 4}{2} = 2x + 2, \quad M_y = \frac{3y + (-y)}{2} = \frac{2y}{2} = y.
\]

PTS: 2 REF: 081019ge STA: G.G.66 TOP: Midpoint
20 ANS: 4

\[ SA = 4\pi r^2 \quad V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \cdot 6^3 = 288\pi \]

144\pi = 4\pi r^2

36 = r^2

6 = r

PTS: 2  REF: 081020ge  STA: G.G.16  TOP: Volume and Surface Area

21 ANS: 3  PTS: 2  REF: 081021ge  STA: G.G.57

TOP: Properties of Transformations

22 ANS: 1

\[ \angle A = \frac{(n - 2)180}{n} = \frac{(5 - 2)180}{5} = 108 \quad \angle AEB = \frac{180 - 108}{2} = 36 \]

PTS: 2  REF: 081022ge  STA: G.G.37  TOP: Interior and Exterior Angles of Polygons

23 ANS: 4  PTS: 2  REF: 081023ge  STA: G.G.45

TOP: Similarity  KEY: perimeter and area

24 ANS: 3

\[ 2y = -6x + 8 \quad \text{Perpendicular lines have slope the opposite and reciprocal of each other.} \]

\[ y = -3x + 4 \]

\[ m = -3 \]

\[ m_{\perp} = \frac{1}{3} \]


25 ANS: 2

\[ \begin{align*}
\frac{140 - RS}{2} &= 40 \\
140 - RS &= 80 \\
RS &= 60
\end{align*} \]

PTS: 2  REF: 081025ge  STA: G.G.51  TOP: Arcs Determined by Angles  KEY: outside circle

26 ANS: 3  PTS: 2  REF: 081026ge  STA: G.G.26

TOP: Contrapositive

27 ANS: 2

\[ \frac{3}{7} = \frac{6}{x} \]

3x = 42

\[ x = 14 \]

PTS: 2  REF: 081027ge  STA: G.G.46  TOP: Side Splitter Theorem

28 ANS: 1  PTS: 2  REF: 081028ge  STA: G.G.21

TOP: Centroid, Orthocenter, Incenter and Circumcenter
29 \hspace{10pt} \text{ANS:} \\
70. \hspace{10pt} 3x + 5 + 3x + 5 + 2x + 2x = 180 \\
\hspace{10pt} 10x + 10 = 360 \\
\hspace{10pt} 10x = 350 \\
\hspace{10pt} x = 35 \\
\hspace{10pt} 2x = 70 \\
\hspace{10pt} \text{PTS: 2} \hspace{10pt} \text{REF: 081029ge} \hspace{10pt} \text{STA: G.G.40} \hspace{10pt} \text{TOP: Trapezoids} \\
30 \hspace{10pt} \text{ANS:} \\
375\pi \hspace{10pt} L = \pi rl = \pi(15)(25) = 375\pi \\
\hspace{10pt} \text{PTS: 2} \hspace{10pt} \text{REF: 081030ge} \hspace{10pt} \text{STA: G.G.15} \hspace{10pt} \text{TOP: Volume and Lateral Area} \\
31 \hspace{10pt} \text{ANS:} \\
110. \hspace{10pt} 6x + 20 = x + 40 + 4x - 5 \\
\hspace{10pt} 6x + 20 = 5x + 35 \\
\hspace{10pt} x = 15 \\
\hspace{10pt} 6((15) + 20 = 110 \\
\hspace{10pt} \text{PTS: 2} \hspace{10pt} \text{REF: 081031ge} \hspace{10pt} \text{STA: G.G.31} \hspace{10pt} \text{TOP: Isosceles Triangle Theorem} \\
32 \hspace{10pt} \text{ANS:} \\
\hspace{10pt} \text{PTS: 2} \hspace{10pt} \text{REF: 081032ge} \hspace{10pt} \text{STA: G.G.20} \hspace{10pt} \text{TOP: Constructions} \\
33 \hspace{10pt} \text{ANS:} \\
\hspace{10pt} \text{PTS: 2} \hspace{10pt} \text{REF: 081033ge} \hspace{10pt} \text{STA: G.G.22} \hspace{10pt} \text{TOP: Locus}
34 ANS:
\[(x + 1)^2 + (y - 2)^2 = 36\]

PTS: 2  REF: 081034ge  STA: G.G.72  TOP: Equations of Circles

35 ANS:
Yes, \(m\angle ABD = m\angle BDC = 44\) \(180 - (93 + 43) = 44\) \(x + 19 + 2x + 6 + 3x + 5 = 180\). Because alternate interior angles \(\angle ABD\) and \(\angle CDB\) are congruent, \(\overline{AB}\) is parallel to \(\overline{DC}\).

PTS: 4  REF: 081035ge  STA: G.G.35  TOP: Parallel Lines and Transversals

36 ANS:
\(A''(8,2), B''(2,0), C''(6,-8)\)

PTS: 4  REF: 081036ge  STA: G.G.58  TOP: Compositions of Transformations

37 ANS:
2.4. \(5a = 4^2\) \(5b = 3^2\) \(h^2 = ab\)
\[a = 3.2\] \(b = 1.8\) \(h^2 = 3.2 \cdot 1.8\)
\[h = \sqrt{5.76} = 2.4\]

PTS: 4  REF: 081037ge  STA: G.G.47  TOP: Similarity

38 ANS:
\(\overline{AB} \parallel \overline{CD}\) and \(\overline{AD} \parallel \overline{CB}\) because their slopes are equal. \(ABCD\) is a parallelogram because opposite side are parallel. \(\overline{AB} \neq \overline{BC}\). \(ABCD\) is not a rhombus because all sides are not equal. \(\overline{AB} \perp \overline{BC}\) because their slopes are not opposite reciprocals. \(ABCD\) is not a rectangle because \(\angle ABC\) is not a right angle.

PTS: 4  REF: 081038ge  STA: G.G.69  TOP: Quadrilaterals in the Coordinate Plane
0111ge
Answer Section

1 ANS: 3

2 ANS: 1

3 ANS: 2
\[
\frac{4x + 10}{2} = 2x + 5
\]

4 ANS: 3

5 ANS: 3

6 ANS: 2

\[
M_x = \frac{7 + (-3)}{2} = 2, \quad M_y = \frac{-1 + 3}{2} = 1.
\]

7 ANS: 3

8 ANS: 4

9 ANS: 2

10 ANS: 3

11 ANS: 3
\[
8^2 + 24^2 \neq 25^2
\]

12 ANS: 1
13 ANS: 3

14 ANS: 4
\[ y = mx + b \]
\[ 3 = \frac{3}{2}(-2) + b \]
\[ 3 = -3 + b \]
\[ 6 = b \]

15 ANS: 4
\[ m \angle A = 80 \]

16 ANS: 3
PTS: 2
TOP: Equations of Circles

17 ANS: 2
\[ V = \pi r^2 h = \pi \cdot 6^2 \cdot 15 = 540\pi \]

18 ANS: 4
PTS: 2
TOP: Compound Statements
KEY: general

19 ANS: 4
\[ x + 6y = 12 \]
\[ 3(x - 2) = -y - 4 \]
\[ 6y = -x + 12 \]
\[ -3(x - 2) = y + 4 \]
\[ y = -\frac{1}{6}x + 2 \]
\[ m = -3 \]
\[ m = -\frac{1}{6} \]

20 ANS: 1
PTS: 2
TOP: Constructions
21 ANS: 4
\[ d = \sqrt{(-5 - 3)^2 + (4 - (-6))^2} = \sqrt{64 + 100} = \sqrt{164} = \sqrt{4 \cdot 41} = 2\sqrt{41} \]

PTS: 2  REF: 011121ge  STA: G.G.67  TOP: Distance
KEY: general

22 ANS: 1  PTS: 2  REF: 011122ge  STA: G.G.28
TOP: Triangle Congruency

23 ANS: 4
\[ 6^2 = x(x + 5) \]
\[ 36 = x^2 + 5x \]
\[ 0 = x^2 + 5x - 36 \]
\[ 0 = (x + 9)(x - 4) \]
\[ x = 4 \]

PTS: 2  REF: 011123ge  STA: G.G.47  TOP: Similarity
KEY: leg

24 ANS: 4  PTS: 2  REF: 011124ge  STA: G.G.51
TOP: Arcs Determined by Angles
KEY: inscribed

25 ANS: 2  PTS: 2  REF: 011125ge  STA: G.G.74
TOP: Graphing Circles

26 ANS: 3
\[ (3, -2) \to (2, 3) \to (8, 12) \]

PTS: 2  REF: 011126ge  STA: G.G.54  TOP: Compositions of Transformations
KEY: basic

27 ANS: 3
\[ x + 2x + 15 = 5x + 15 \quad 2(5) + 15 = 25 \]
\[ 3x + 15 = 5x + 5 \]
\[ 10 = 2x \]
\[ 5 = x \]

PTS: 2  REF: 011127ge  STA: G.G.32  TOP: Exterior Angle Theorem

28 ANS: 1  PTS: 2  REF: 011128ge  STA: G.G.2
TOP: Planes

29 ANS: 

PTS: 2  REF: 011129ge  STA: G.G.31  TOP: Isosceles Triangle Theorem
30 ANS:

![Diagram](image)

PTS: 2  REF: 011130ge  STA: G.G.54  TOP: Reflections
KEY: grids

31 ANS:

\((5 - 2)180 = 540\). \(\frac{540}{5} = 108\) interior. \(180 - 108 = 72\) exterior

PTS: 2  REF: 011131ge  STA: G.G.37  TOP: Interior and Exterior Angles of Polygons

32 ANS:

\[x^2 = 9 \cdot 8\]
\[x = \sqrt{72}\]
\[x = \sqrt{36} \cdot \sqrt{2}\]
\[x = 6\sqrt{2}\]

PTS: 2  REF: 011132ge  STA: G.G.53  TOP: Segments Intercepted by Circle
KEY: two chords

33 ANS:

![Diagram](image)

PTS: 2  REF: 011133ge  STA: G.G.17  TOP: Constructions

34 ANS:

\[m = \frac{-A}{B} = \frac{6}{2} = 3.\] \[m_\perp = -\frac{1}{3}\]

35 ANS:

\[ \text{\image} \]

PTS: 4 REF: 011135ge STA: G.G.23 TOP: Locus

36 ANS:
\[ \angle B \text{ and } \angle E \text{ are right angles because of the definition of perpendicular lines. } \angle B \cong \angle E \text{ because all right angles are congruent. } \angle BFD \text{ and } \angle DFE \text{ are supplementary and } \angle ECA \text{ and } \angle ACB \text{ are supplementary because of the definition of supplementary angles. } \angle DFE \cong \angle ACB \text{ because angles supplementary to congruent angles are congruent. } \triangle ABC \sim \triangle DEF \text{ because of AA.} \]

PTS: 4 REF: 011136ge STA: G.G.44 TOP: Similarity Proofs

37 ANS:

\[ 32. \quad \frac{16}{20} = \frac{x - 3}{x + 5} \quad AC = x - 3 = 35 - 3 = 32 \]

\[ 16x + 80 = 20x - 60 \]
\[ 140 = 4x \]
\[ 35 = x \]

PTS: 4 REF: 011137ge STA: G.G.46 TOP: Side Splitter Theorem

38 ANS:

\[ \text{\image} \]

The length of each side of quadrilateral is 5. Since each side is congruent, quadrilateral \( MATH \) is a rhombus. The slope of \( MH \) is 0 and the slope of \( HT \) is \(-\frac{4}{3}\). Since the slopes are not negative reciprocals, the sides are not perpendicular and do not form right angles. Since adjacent sides are not perpendicular, quadrilateral \( MATH \) is not a square.

PTS: 6 REF: 011138ge STA: G.G.69 TOP: Quadrilaterals in the Coordinate Plane
Answer Section

1 ANS: 2 PTS: 2 REF: 061101ge STA: G.G.18
TOP: Constructions

2 ANS: 3 PTS: 2 REF: 061102ge STA: G.G.29
TOP: Triangle Congruency

3 ANS: 4 PTS: 2 REF: 061103ge STA: G.G.60
TOP: Identifying Transformations

4 ANS: 1 PTS: 2 REF: 061104ge STA: G.G.43
TOP: Centroid

5 ANS: 1
Parallel lines intercept congruent arcs.

PTS: 2 REF: 061105ge STA: G.G.52 TOP: Chords

6 ANS: 2
7x = 5x + 30
2x = 30
x = 15

PTS: 2 REF: 061106ge STA: G.G.35 TOP: Parallel Lines and Transversals

7 ANS: 2 PTS: 2 REF: 061107ge STA: G.G.32
TOP: Exterior Angle Theorem

8 ANS: 1 PTS: 2 REF: 061108ge STA: G.G.9
TOP: Planes

9 ANS: 2
\[ d = \sqrt{(-1 - 7)^2 + (9 - 4)^2} = \sqrt{64 + 25} = \sqrt{89} \]

PTS: 2 REF: 061109ge STA: G.G.67 TOP: Distance
KEY: general

10 ANS: 1 PTS: 2 REF: 061110ge STA: G.G.72
TOP: Equations of Circles

11 ANS: 3 PTS: 2 REF: 061111ge STA: G.G.38
TOP: Parallelograms

12 ANS: 2
\[ V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \cdot 3^3 = 36\pi \]

PTS: 2 REF: 061112ge STA: G.G.16 TOP: Volume and Surface Area

13 ANS: 1 PTS: 2 REF: 061113ge STA: G.G.63
TOP: Parallel and Perpendicular Lines

14 ANS: 4 PTS: 2 REF: 061114ge STA: G.G.73
TOP: Equations of Circles

15 ANS: 2 PTS: 2 REF: 061115ge STA: G.G.69
TOP: Triangles in the Coordinate Plane
16 ANS: 3
\[ \sqrt{5^2 + 12^2} = 13 \]

PTS: 2 REF: 061116ge STA: G.G.39 TOP: Special Parallelograms

17 ANS: 4
\[ 4(x + 4) = 8^2 \]
\[ 4x + 16 = 64 \]
\[ 4x = 48 \]
\[ x = 12 \]

PTS: 2 REF: 061117ge STA: G.G.53 TOP: Segments Intercepted by Circle
KEY: tangent and secant

18 ANS: 4

PTS: 2 REF: 061118ge STA: G.G.1 TOP: Planes

19 ANS: 1
\[ 3x + 5 + 4x - 15 + 2x + 10 = 180. \ m \angle D = 3(20) + 5 = 65. \ m \angle E = 4(20) - 15 = 65. \]
\[ 9x = 180 \]
\[ x = 20 \]

PTS: 2 REF: 061119ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

20 ANS: 3
\[ \frac{7x}{4} = \frac{7}{x}. \ 7(2) = 14 \]
\[ 7x^2 = 28 \]
\[ x = 2 \]

PTS: 2 REF: 061120ge STA: G.G.45 TOP: Similarity
KEY: basic

21 ANS: 2

PTS: 2 REF: 061121ge STA: G.G.22 TOP: Locus

22 ANS: 3

PTS: 2 REF: 061122ge STA: G.G.56 TOP: Identifying Transformations

23 ANS: 2

The slope of a line in standard form is \( \frac{-A}{B} \), so the slope of this line is \( \frac{-4}{3} \). A parallel line would also have a slope of \( \frac{-4}{3} \). Since the answers are in standard form, use the point-slope formula.
\[ y - 2 = \frac{-4}{3} (x + 5) \]
\[ 3y - 6 = -4x - 20 \]
\[ 4x + 3y = -14 \]

PTS: 2 REF: 061123ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

24 ANS: 4

PTS: 2 REF: 061124ge STA: G.G.31 TOP: Isosceles Triangle Theorem
25 ANS: 1  PTS: 2  REF: 061125ge  STA: G.G.39
TOP: Special Parallelograms

26 ANS: 2  PTS: 2  REF: 061126ge  STA: G.G.59
TOP: Properties of Transformations

27 ANS: 4
The slope of $3x + 5y = 4$ is $m = \frac{-A}{B} = \frac{-3}{5}$. $m_\perp = \frac{5}{3}$.


28 ANS: 1
$x^2 = 7(16 - 7)$
$x^2 = 63$
$x = \sqrt{9} \sqrt{7}$
$x = 3\sqrt{7}$

PTS: 2  REF: 061128ge  STA: G.G.47  TOP: Similarity
KEY: altitude

29 ANS:
The medians of a triangle are not concurrent. False.

PTS: 2  REF: 061129ge  STA: G.G.24  TOP: Negations

30 ANS:

31 ANS:
9.1. $(11)(8)h = 800$
$h \approx 9.1$

PTS: 2  REF: 061130ge  STA: G.G.20  TOP: Constructions

31 ANS:

9.1. $(11)(8)h = 800$
$h \approx 9.1$

PTS: 2  REF: 061131ge  STA: G.G.12  TOP: Volume
32 ANS:
Yes. A reflection is an isometry.


33 ANS:
\[ \frac{x}{25} = \frac{12}{18} \]
\[ 18x = 300 \]
\[ x \approx 16.7 \]

PTS: 2 REF: 061133ge STA: G.G.46 TOP: Side Splitter Theorem

34 ANS:
\[ (2a - 3, 3b + 2). \left( \frac{3a + a - 6}{2}, \frac{2b - 1 + 4b + 5}{2} \right) = \left( \frac{4a - 6}{2}, \frac{6b + 4}{2} \right) = (2a - 3, 3b + 2) \]

PTS: 2 REF: 061134ge STA: G.G.66 TOP: Midpoint

35 ANS:

PTS: 4 REF: 061135ge STA: G.G.23 TOP: Locus

36 ANS:
30. \[ 3x + 4x + 5x = 360. \quad m\overparen{LN} : m\overparen{NK} : m\overparen{KL} = 90 : 120 : 150. \quad \frac{150 - 90}{2} = 30 \]
\[ x = 20 \]

PTS: 4 REF: 061136ge STA: G.G.51 TOP: Arcs Determined by Angles
KEY: outside circle
37 ANS:

OA \cong OB \text{ because all radii are equal. } OP \cong OP \text{ because of the reflexive property. } OA \perp PA \text{ and } OB \perp PB \text{ because tangents to a circle are perpendicular to a radius at a point on a circle. } \angle PAO \cong \angle PBO \text{ because all right angles are congruent. } \triangle AOP \cong \triangle BOP \text{ because of HL. } \angle AOP \cong \angle BOP \text{ because of CPCTC. }

38 ANS:

PTS: 4 REF: 061137ge STA: G.G.70 TOP: Quadratic-Linear Systems

PTS: 6 REF: 061138ge STA: G.G.27 TOP: Circle Proofs
1. ANS: 4  
   PTS: 2  
   TOP: Compound Statements  
   REF: 081101ge  
   STA: G.G.25  
   KEY: conjunction

2. ANS: 2  
   PTS: 2  
   TOP: Triangle Congruency  
   REF: 081102ge  
   STA: G.G.29

3. ANS: 3  
   \[ \frac{5}{7} = \frac{10}{x} \]
   \[ 5x = 70 \]
   \[ x = 14 \]
   PTS: 2  
   REF: 081103ge  
   STA: G.G.46  
   TOP: Side Splitter Theorem

4. ANS: 3  
   PTS: 2  
   TOP: Properties of Transformations  
   REF: 081104ge  
   STA: G.G.55

5. ANS: 4  
   \[ \sqrt{25^2 - 7^2} = 24 \]
   PTS: 2  
   REF: 081105ge  
   STA: G.G.50  
   TOP: Tangents  
   KEY: point of tangency

6. ANS: 4  
   PTS: 2  
   TOP: Constructions  
   REF: 081106ge  
   STA: G.G.17

7. ANS: 3  
   \[ d = \sqrt{(1 - 9)^2 + (-4 - 2)^2} = \sqrt{64 + 36} = \sqrt{100} = 10 \]
   PTS: 2  
   REF: 081107ge  
   STA: G.G.67  
   TOP: Distance  
   KEY: general

8. ANS: 2  
   PTS: 2  
   TOP: Reflections  
   KEY: basic  
   REF: 081108ge  
   STA: G.G.54

9. ANS: 3  
   \[ 7x = 5x + 30 \]
   \[ 2x = 30 \]
   \[ x = 15 \]
   PTS: 2  
   REF: 081109ge  
   STA: G.G.35  
   TOP: Parallel Lines and Transversals

10. ANS: 4  
    PTS: 2  
    TOP: Equations of Circles  
    REF: 081110ge  
    STA: G.G.71

11. ANS: 3  
    PTS: 2  
    TOP: Exterior Angle Theorem  
    REF: 081111ge  
    STA: G.G.32
12 ANS: 2

\[ m = \frac{-A}{B} = \frac{-4}{2} = -2 \quad y = mx + b \]
\[ 2 = -2(2) + b \]
\[ 6 = b \]

PTS: 2  
REF: 081112ge  
STA: G.G.65  
TOP: Parallel and Perpendicular Lines

13 ANS: 1  
TOP: Reflections  
KEY: basic

14 ANS: 4  

PTS: 2  
REF: 081114ge  
STA: G.G.28  
TOP: Triangle Congruency

15 ANS: 1  

\[ 1 = \frac{-4 + x}{2} \quad 5 = \frac{3 + y}{2} \]
\[ -4 + x = 2 \quad 3 + y = 10 \]
\[ x = 6 \quad y = 7 \]

PTS: 2  
REF: 081115ge  
STA: G.G.66  
TOP: Midpoint

16 ANS: 1  
TOP: Planes

17 ANS: 2  
TOP: Locus

18 ANS: 3  

PTS: 2  
REF: 081118ge  
STA: G.G.70  
TOP: Quadratic-Linear Systems

19 ANS: 4  

\[ \frac{5}{2 + 3 + 5} \times 180 = 90 \]

PTS: 2  
REF: 081119ge  
STA: G.G.30  
TOP: Interior and Exterior Angles of Triangles

20 ANS: 2  
TOP: Planes
21 ANS: 1 PTS: 2 REF: 081121ge STA: G.G.39
TOP: Special Parallelograms

22 ANS: 2
The slope of \( x + 2y = 3 \) is \( m = \frac{-A}{B} = \frac{-1}{2} \). \( m_\perp = 2 \).


23 ANS: 3 PTS: 2 REF: 081123ge STA: G.G.12
TOP: Volume

24 ANS: 4
\[
\sqrt{6^2 - 2^2} = \sqrt{32} = \sqrt{16 \cdot 2} = 4\sqrt{2}
\]

PTS: 2 REF: 081124ge STA: G.G.49 TOP: Chords

25 ANS: 2
\[
(n - 2)180 = (6 - 2)180 = 720. \quad \frac{720}{6} = 120.
\]

PTS: 2 REF: 081125ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

26 ANS: 1
\[
m = \left(\frac{8 + 0}{2}, \frac{2 + 6}{2}\right) = (4, 4) \quad m = \frac{6 - 2}{0 - 8} = \frac{4}{-8} = -\frac{1}{2} \quad m_\perp = 2 \quad y = mx + b
\]
\[
4 = 2(4) + b
\]
\[
-4 = b
\]

PTS: 2 REF: 081126ge STA: G.G.68 TOP: Perpendicular Bisector

27 ANS: 3
\[
x^2 + 7^2 = (x + 1)^2 \quad x + 1 = 25
\]
\[
x^2 + 49 = x^2 + 2x + 1
\]
\[
48 = 2x
\]
\[
24 = x
\]

PTS: 2 REF: 081127ge STA: G.G.48 TOP: Pythagorean Theorem

28 ANS: 3 PTS: 2 REF: 081128ge STA: G.G.39
TOP: Special Parallelograms

29 ANS:
\[
\frac{180 - 80}{2} = 50
\]

PTS: 2 REF: 081129ge STA: G.G.52 TOP: Chords
30 ANS:

31 ANS:

\[ V = \frac{4}{3} \pi \cdot 9^3 = 972\pi \]

32 ANS:

\[(x - 5)^2 + (y + 4)^2 = 36\]

33 ANS:

\(\angle ACB \cong \angle AED\) is given. \(\angle A \cong \angle A\) because of the reflexive property. Therefore \(\triangle ABC \sim \triangle ADE\) because of AA.

34 ANS:

\[(7, 5) \quad m_{AB} = \left(\frac{3 + 7}{2}, \frac{3 + 9}{2}\right) = (5, 6) \quad m_{BC} = \left(\frac{7 + 11}{2}, \frac{9 + 3}{2}\right) = (9, 6)\]
35 ANS:

No, \( \angle KGH \) is not congruent to \( \angle GKH \).

PTS: 2  REF: 081135ge  STA: G.G.31  TOP: Isosceles Triangle Theorem

36 ANS:

\[
G''(3, 3), H''(7, 7), S''(-1, 9)
\]

PTS: 4  REF: 081136ge  STA: G.G.58  TOP: Compositions of Transformations

37 ANS:

\[
\frac{x + 2}{x} = \frac{x + 6}{4}
\]

\[
x^2 + 6x = 4x + 8
\]

\[
x^2 + 2x - 8 = 0
\]

\[
(x + 4)(x - 2) = 0
\]

\[
x = 2
\]

PTS: 4  REF: 081137ge  STA: G.G.45  TOP: Similarity

KEY: basic

38 ANS:

\[
m_{AB} = \left( \frac{-6 + 2}{2}, \frac{-2 + 8}{2} \right) = D(2, 3) \quad m_{BC} = \left( \frac{2 + 6}{2}, \frac{8 - 2}{2} \right) = E(4, 3) \quad F(0, -2)
\]

To prove that \( ADEF \) is a parallelogram, show that both pairs of opposite sides of the parallelogram are parallel by showing the opposite sides have the same slope: \( m_{AD} = \frac{3 - (-2)}{2 - (-6)} = \frac{5}{4} \) \( \overline{AF} \parallel \overline{DE} \) because all horizontal lines have the same slope. \( ADEF \) is not a rhombus because not all sides are congruent. \( AD = \sqrt{5^2 + 4^2} = \sqrt{41} \quad AF = 6 \)

PTS: 6  REF: 081138ge  STA: G.G.69  TOP: Quadrilaterals in the Coordinate Plane
0112ge
Answer Section

1 ANS: 2
6x + 42 = 18x - 12
54 = 12x
x = \frac{54}{12} = 4.5
PTS: 2 REF: 011201ge STA: G.G.35 TOP: Parallel Lines and Transversals

2 ANS: 3
PTS: 2 REF: 011202ge STA: G.G.21
TOP: Centroid, Orthocenter, Incenter and Circumcenter

3 ANS: 2
PTS: 2 REF: 011203ge STA: G.G.73
TOP: Equations of Circles

4 ANS: 2
The diagonals of a rhombus are perpendicular. 180 - (90 + 12) = 78
PTS: 2 REF: 011204ge STA: G.G.39 TOP: Special Parallelograms

5 ANS: 1
d = \sqrt{(4 - 1)^2 + (7 - 11)^2} = \sqrt{9 + 16} = \sqrt{25} = 5
PTS: 2 REF: 011205ge STA: G.G.67 TOP: Distance
KEY: general

6 ANS: 2
PTS: 2 REF: 011206ge STA: G.G.32
TOP: Exterior Angle Theorem

7 ANS: 1
PTS: 2 REF: 011207ge STA: G.G.20
TOP: Constructions

8 ANS: 4
PTS: 2 REF: 011208ge STA: G.G.53
TOP: Segments Intercepted by Circle KEY: two tangents

9 ANS: 3
PTS: 2 REF: 011209ge STA: G.G.44
TOP: Similarity Proofs

10 ANS: 3
\frac{3}{8 + 3 + 4} \times 180 = 36
PTS: 2 REF: 011210ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

11 ANS: 2
PTS: 2 REF: 011211ge STA: G.G.55
TOP: Properties of Transformations

12 ANS: 4
PTS: 2 REF: 011212ge STA: G.G.71
TOP: Equations of Circles

13 ANS: 1
PTS: 2 REF: 011213ge STA: G.G.24
TOP: Negations
14  ANS: 2
\[
\frac{50+x}{2} = 34
\]
\[
50 + x = 68
\]
\[
x = 18
\]

PTS: 2  REF: 011214ge  STA: G.G.51  TOP: Arcs Determined by Angles

KEY: inside circle

15  ANS: 2  PTS: 2  REF: 011215ge  STA: G.G.12
TOP: Volume

16  ANS: 4  PTS: 2  REF: 011216ge  STA: G.G.29
TOP: Triangle Congruency

17  ANS: 3  PTS: 2  REF: 011217ge  STA: G.G.64
TOP: Parallel and Perpendicular Lines

18  ANS: 1  PTS: 2  REF: 011218ge  STA: G.G.3
TOP: Planes

19  ANS: 4
\[
\sqrt{25^2 - \left(\frac{26 - 12}{2}\right)^2} = 24
\]

PTS: 2  REF: 011219ge  STA: G.G.40  TOP: Trapezoids

20  ANS: 1  PTS: 2  REF: 011220ge  STA: G.G.72
TOP: Equations of Circles

21  ANS: 1  PTS: 2  REF: 011221ge  STA: G.G.10
TOP: Solids

22  ANS: 4  PTS: 2  REF: 011222ge  STA: G.G.34
TOP: Angle Side Relationship

23  ANS: 3
\[
(n - 2)180 = (5 - 2)180 = 540
\]

PTS: 2  REF: 011223ge  STA: G.G.36  TOP: Interior and Exterior Angles of Polygons

24  ANS: 3
\[
y = mx + b
\]
\[
-1 = 2(2) + b
\]
\[
-5 = b
\]

PTS: 2  REF: 011224ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

25  ANS: 4
\[
AB \text{ is a vertical line, so its perpendicular bisector is a horizontal line through the midpoint of } AB, \text{ which is } (0,3).
\]

PTS: 2  REF: 011225ge  STA: G.G.68  TOP: Perpendicular Bisector
26 ANS: 1
7x + 4 = 2(2x + 5). PM = 2(2) + 5 = 9
7x + 4 = 4x + 10
3x = 6
x = 2

PTS: 2 REF: 011226ge STA: G.G.43 TOP: Centroid

27 ANS: 4
x \cdot 4x = 6^2. PQ = 4x + x = 5x = 5(3) = 15
4x^2 = 36
x = 3

PTS: 2 REF: 011227ge STA: G.G.47 TOP: Similarity

28 ANS: 2
5 - 3 = 2, 5 + 3 = 8

PTS: 2 REF: 011228ge STA: G.G.33 TOP: Triangle Inequality Theorem

29 ANS:
2x - 20 = x + 20. \overline{mAB} = x + 20 = 40 + 20 = 60
x = 40

PTS: 2 REF: 011229ge STA: G.G.52 TOP: Chords

30 ANS:

PTS: 2 REF: 011230ge STA: G.G.22 TOP: Locus

31 ANS:
The slope of y = 2x + 3 is 2. The slope of 2y + x = 6 is \(-\frac{A}{B} = -\frac{1}{2}\). Since the slopes are opposite reciprocals, the lines are perpendicular.

PTS: 2 REF: 011231ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

32 ANS:
R'(-3, -2), S'(-4, 4), and T'(2, 2).

PTS: 2 REF: 011232ge STA: G.G.54 TOP: Rotations
33 ANS:

PTS: 2  REF: 011233ge  STA: G.G.17  TOP: Constructions

34 ANS:

EO = 6. CE = \sqrt{10^2 - 6^2} = 8

PTS: 2  REF: 011234ge  STA: G.G.49  TOP: Chords

35 ANS:

A'(7, -4), B'(7, -1). C'(9, -4). The areas are equal because translations preserve distance.


36 ANS:

\[ V = \pi r^2 h \]  \[ L = 2\pi rh = 2\pi \cdot 5\sqrt{2} \cdot 12 \approx 533.1 \]

600\pi = \pi r^2 \cdot 12

50 = r^2

\[ \sqrt{25} \sqrt{2} = r \]

5\sqrt{2} = r

PTS: 4  REF: 011236ge  STA: G.G.14  TOP: Volume and Lateral Area

37 ANS:

\[ M\left(\frac{-7 + 5}{2}, \frac{2 + 4}{2}\right) = M(-1,3). \quad N\left(\frac{3 + 5}{2}, \frac{-4 + 4}{2}\right) = N(4,0). \quad MN \text{ is a midsegment.} \]

PTS: 4  REF: 011237ge  STA: G.G.42  TOP: Midsegments
Quadrilateral $ABCD$, $AD \cong BC$ and $\angle DAE \cong \angle BCE$ are given. $AD \parallel BC$ because if two lines are cut by a transversal so that a pair of alternate interior angles are congruent, the lines are parallel. $ABCD$ is a parallelogram because if one pair of opposite sides of a quadrilateral are both congruent and parallel, the quadrilateral is a parallelogram. $AE \cong CE$ because the diagonals of a parallelogram bisect each other. $\angle FEA \cong \angle GEC$ as vertical angles. $\triangle AEF \cong \triangle CEG$ by ASA.
1. \(40 - 24 = 8. \sqrt{10^2 - 8^2} = 6.\)

2. \(\frac{180 - 70}{2} = 55\)

3. \(AC = BD\)
   \(AC - BC = BD - BC\)
   \(AB = CD\)

4. \(V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \cdot \left(\frac{\frac{15}{2}}{2}\right)^3 \approx 1767.1\)

5. \(M_{AC}\left(\frac{1 + 3}{2}, \frac{5 + (-1)}{2}\right) = (2, 2)\)

6. The diagonals of a parallelogram intersect at their midpoints.
20 + 8 + 10 + 6 = 44.

PTS: 2  REF: 061211ge  STA: G.G.42  TOP: Midsegments

12 ANS: 1

PTS: 2  REF: 061211ge  STA: G.G.31  TOP: Isosceles Triangle Theorem

13 ANS: 4  PTS: 2  REF: 061213ge  STA: G.G.5

TOP: Planes

14 ANS: 1  PTS: 2  REF: 061214ge  STA: G.G.21

TOP: Centroid, Orthocenter, Incenter and Circumcenter

15 ANS: 4

\[ m_\perp = -\frac{1}{3}. \quad y = mx + b \]

\[ 6 = -\frac{1}{3}(-9) + b \]

\[ 6 = 3 + b \]

\[ 3 = b \]

PTS: 2  REF: 061215ge  STA: G.G.64  TOP: Parallel and Perpendicular Lines

16 ANS: 3

\[ \frac{8}{2} = \frac{12}{x}. \]

\[ 8x = 24 \]

\[ x = 3 \]

PTS: 2  REF: 061216ge  STA: G.G.46  TOP: Side Splitter Theorem
17 ANS: 3
\[ d = \sqrt{(-1 - 4)^2 + (0 - (-3))^2} = \sqrt{25 + 9} = \sqrt{34} \]

PTS: 2  REF: 061217ge  STA: G.G.67  TOP: Distance
KEY: general

18 ANS: 3  PTS: 2  REF: 061218ge  STA: G.G.36  TOP: Interior and Exterior Angles of Polygons

19 ANS: 2
\[ m = -\frac{\Delta A}{B} = -\frac{-20}{-2} = 10. \quad m_{\perp} = -\frac{1}{10} \]

PTS: 2  REF: 061219ge  STA: G.G.62  TOP: Parallel and Perpendicular Lines

20 ANS: 3  PTS: 2  REF: 061220ge  STA: G.G.74  TOP: Graphing Circles

21 ANS: 2
\[ \sqrt{17^2 - 15^2} = 8. \quad 17 - 8 = 9 \]

PTS: 2  REF: 061221ge  STA: G.G.49  TOP: Chords

22 ANS: 3

. Opposite sides of a parallelogram are congruent and the diagonals of a parallelogram bisect each other.

PTS: 2  REF: 061222ge  STA: G.G.28  TOP: Triangle Congruency


24 ANS: 3  PTS: 2  REF: 061224ge  STA: G.G.45  TOP: Similarity  KEY: basic

25 ANS: 4
\[ x^2 - 6x + 2x - 3 = 9x + 27 \]
\[ x^2 - 4x - 3 = 9x + 27 \]
\[ x^2 - 13x - 30 = 0 \]
\[ (x - 15)(x + 2) = 0 \]
\[ x = 15, -2 \]

PTS: 2  REF: 061225ge  STA: G.G.32  TOP: Exterior Angle Theorem
26 ANS: $4$

\[ m = \frac{-A}{B} = \frac{-3}{2}. \]

\[ y = mx + b \]

\[-1 = \left( \frac{-3}{2} \right)(2) + b \]

\[-1 = -3 + b \]

\[ 2 = b \]

PTS: 2 REF: 061226ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

27 ANS: 2

PTS: 2

TOP: Identifying Transformations

28 ANS: 3

PTS: 2

TOP: Special Parallelograms

29 ANS:

\[ T'(−6,3), \ A'(−3,3), \ P'(−3,−1) \]


30 ANS:

\[ 180 - (90 + 63) = 27 \]

PTS: 2 REF: 061230ge STA: G.G.35 TOP: Parallel Lines and Transversals

31 ANS:

The slope of \( x + 2y = 4 \) is \( m = \frac{-A}{B} = \frac{-1}{2} \). The slope of \( 4y - 2x = 12 \) is \( \frac{-A}{B} = \frac{2}{4} = \frac{1}{2} \). Since the slopes are neither equal nor opposite reciprocals, the lines are neither parallel nor perpendicular.

PTS: 2 REF: 061231ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

32 ANS:

PTS: 2 REF: 061232ge STA: G.G.17 TOP: Constructions
33 ANS:

\[ L = 2\pi rh = 2\pi \cdot 12 \cdot 22 \approx 1659. \quad \frac{1659}{600} \approx 2.8. \] 3 cans are needed.

PTS: 2   REF: 061233ge   STA: G.G.14   TOP: Volume and Lateral Area

34 ANS:

PTS: 2   REF: 061234ge   STA: G.G.23   TOP: Locus

35 ANS:

\[ \angle B \text{ and } \angle C \text{ are right angles because perpendicular lines form right angles. } \angle B \cong \angle C \text{ because all right angles are congruent. } \angle AEB \cong \angle DEC \text{ because vertical angles are congruent. } \triangle ABE \cong \triangle DCE \text{ because of ASA. } AB \cong DC \text{ because CPCTC.} \]


36 ANS:

PTS: 4   REF: 061236ge   STA: G.G.58   TOP: Compositions of Transformations

KEY: grids
37 ANS:

\[ x(x + 2) = 12 \cdot 2. \quad RT = 6 + 4 = 10. \quad y \cdot y = 18 \cdot 8 \]

\[ x^2 + 2x - 24 = 0 \quad \quad \quad y^2 = 144 \]

\[ (x + 6)(x - 4) = 0 \quad \quad \quad y = 12 \]

\[ x = 4 \]

PTS: 4 REF: 061237ge STA: G.G.53 TOP: Segments Intercepted by Circle

KEY: tangent and secant

38 ANS:

PTS: 6 REF: 061238ge STA: G.G.70 TOP: Quadratic-Linear Systems
0812ge

Answer Section

1  ANS: 4
Parallel lines intercept congruent arcs.

PTS: 2  REF: 081201ge  STA: G.G.52  TOP: Chords

2  ANS: 2  PTS: 2  REF: 081202ge  STA: G.G.55
TOP: Properties of Transformations

3  ANS: 4
\[-5 = \frac{-3 + x}{2}, \quad 2 = \frac{6 + y}{2}\]
\[-10 = -3 + x, \quad 4 = 6 + y\]
\[-7 = x, \quad -2 = y\]

PTS: 2  REF: 081203ge  STA: G.G.66  TOP: Midpoint

4  ANS: 3  PTS: 2  REF: 081204ge  STA: G.G.59
TOP: Properties of Transformations

5  ANS: 2  PTS: 2  REF: 081205ge  STA: G.G.17
TOP: Constructions

6  ANS: 4  PTS: 2  REF: 081206ge  STA: G.G.30
TOP: Interior and Exterior Angles of Triangles

7  ANS: 1
\[AB = CD\]
\[AB + BC = CD + BC\]
\[AC = BD\]

PTS: 2  REF: 081207ge  STA: G.G.27  TOP: Triangle Proofs

8  ANS: 3  PTS: 2  REF: 081208ge  STA: G.G.27
TOP: Quadrilateral Proofs

9  ANS: 3  PTS: 2  REF: 081209ge  STA: G.G.71
TOP: Equations of Circles

10 ANS: 1

\[\begin{align*}
A & \quad C \\
B & \quad D
\end{align*}\]

PTS: 2  REF: 081210ge  STA: G.G.28  TOP: Triangle Congruency
11 ANS: 3
As originally administered, this question read, “Which fact is not sufficient to show that planes \( R \) and \( S \) are perpendicular?” The State Education Department stated that since a correct solution was not provided for Question 11, all students shall be awarded credit for this question.

PTS: 2  REF: 081211ge  STA: G.G.5  TOP: Planes

12 ANS: 2  PTS: 2  REF: 081212ge  STA: G.G.72
TOP: Equations of Circles

13 ANS: 3
\[ 4x + 14 + 8x + 10 = 180 \]
\[ 12x = 156 \]
\[ x = 13 \]

PTS: 2  REF: 081213ge  STA: G.G.35  TOP: Parallel Lines and Transversals

14 ANS: 2  PTS: 2  REF: 081214ge  STA: G.G.50
TOP: Tangents  KEY: point of tangency

15 ANS: 2
\[ V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \left( \frac{6}{2} \right)^3 \approx 36 \pi \]

PTS: 2  REF: 081215ge  STA: G.G.16  TOP: Volume and Surface Area

16 ANS: 4  PTS: 2  REF: 081216ge  STA: G.G.45
TOP: Similarity  KEY: basic

17 ANS: 1
\[ m = \frac{3}{2} \]
\[ y = mx + b \]
\[ 2 = \frac{3}{2} (1) + b \]
\[ \frac{1}{2} = b \]

PTS: 2  REF: 081217ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

18 ANS: 3  PTS: 2  REF: 081218ge  STA: G.G.1
TOP: Planes

19 ANS: 1

PTS: 2  REF: 081219ge  STA: G.G.34  TOP: Angle Side Relationship
The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

\[ \frac{x + 3 + 5x - 9}{2} = 2x + 2. \]

\[ 6x - 6 = 4x + 4 \]

\[ 2x = 10 \]

\[ x = 5 \]

The length of the midsegment of a trapezoid is the average of the lengths of its bases.

\[ x + 3 + x + 20 + x + 20 = 180 \]

\[ 5x = 40 \]

\[ x = 28 \]

The slope of \(9x - 3y = 27\) is \(m = \frac{-A}{B} = \frac{-9}{-3} = 3\), which is the opposite reciprocal of \(-\frac{1}{3}\).

\[ 3 = -2(4) + b \]

\[ 11 = b \]
29 ANS:
2 is not a prime number, false.

PTS: 2 REF: 081229ge STA: G.G.24 TOP: Negations

30 ANS:

\[ A'(-2, 1), B'(-3, -4), \text{ and } C'(5, -3) \]

PTS: 2 REF: 081230ge STA: G.G.54 TOP: Rotations

31 ANS:

\[ V = \pi r^2 h = \pi (5)^2 \cdot 7 = 175\pi \]

PTS: 2 REF: 081231ge STA: G.G.14 TOP: Volume and Lateral Area

32 ANS:

\[ \sqrt{(-4 - 2)^2 + (3 - 5)^2} = \sqrt{36 + 4} = \sqrt{40} = 2\sqrt{10}. \]

PTS: 2 REF: 081232ge STA: G.G.67 TOP: Distance

33 ANS:

PTS: 2 REF: 081233ge STA: G.G.19 TOP: Constructions

34 ANS:

PTS: 2 REF: 081234ge STA: G.G.23 TOP: Locus
35 ANS:
11. \[x^2 + 6x = x + 14. \quad 6(2) - 1 = 11\]
\[x^2 + 5x - 14 = 0\]
\[(x + 7)(x - 2) = 0\]
\[x = 2\]

PTS: 2    REF: 081235ge    STA: G.G.38    TOP: Parallelograms

36 ANS:

PTS: 4    REF: 081236ge    STA: G.G.58    TOP: Compositions of Transformations
KEY: grids

37 ANS:

PTS: 4    REF: 081237ge    STA: G.G.70    TOP: Quadratic-Linear Systems

38 ANS:
52, 40, 80. \[360 - (56 + 112) = 192. \quad \frac{192 - 112}{2} = 40. \quad \frac{112 + 48}{2} = 80\]
\[\frac{1}{4} \times 192 = 48\]
\[\frac{56 + 48}{2} = 52\]

PTS: 6    REF: 081238ge    STA: G.G.51    TOP: Arcs Determined by Angles
KEY: mixed
0113ge
Answer Section

1  ANS: 1  PTS: 2  REF: 011301ge  STA: G.G.29
TOP: Triangle Congruency

2  ANS: 2
Parallel chords intercept congruent arcs. \( \frac{360 - (104 + 168)}{2} = 44 \)

3  ANS: 1  PTS: 2  REF: 011302ge  STA: G.G.52  TOP: Chords
TOP: Statements

4  ANS: 3  PTS: 2  REF: 011303ge  STA: G.G.24
TOP: Identifying Transformations

5  ANS: 3
\[ 6 = \frac{4 + x}{2}, \quad 8 = \frac{2 + y}{2}. \]
\[ 4 + x = 12, \quad 2 + y = 16 \]
\[ x = 8, \quad y = 14 \]

6  ANS: 4  PTS: 2  REF: 011305ge  STA: G.G.66  TOP: Midpoint
TOP: Planes

7  ANS: 2
Perimeter of \( \Delta DEF \) is \( 5 + 8 + 11 = 24 \). \( \frac{5}{24} = \frac{x}{60} \)
\[ 24x = 300 \]
\[ x = 12.5 \]

8  ANS: 1
\[ x^2 = 3 \times 12 \]
\[ x = 6 \]

9  ANS: 3  PTS: 2  REF: 011309ge  STA: G.G.20
TOP: Constructions

10 ANS: 2
The slope of \( 2x + 4y = 12 \) is \( m = \frac{-A}{B} = \frac{-2}{4} = -\frac{1}{2} \). \( m_\perp = 2 \).

11 ANS: 3 PTS: 2 REF: 011311ge STA: G.G.42
TOP: Midsegments

12 ANS: 3
\[ x^2 + 5^2 = 25 \]
\[ x = 0 \]

PTS: 2 REF: 011312ge STA: G.G.70 TOP: Quadratic-Linear Systems

13 ANS: 2
\[ \sqrt{(-2 - 4)^2 + (-3 - (-1))^2} = \sqrt{40} = \sqrt{4 \cdot 10} = 2\sqrt{10} \]

PTS: 2 REF: 011313ge STA: G.G.69 TOP: Quadrilaterals in the Coordinate Plane

14 ANS: 1
\[ \frac{180 - 52}{2} = 64. \quad 180 - (90 + 64) = 26 \]

PTS: 2 REF: 011314ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

15 ANS: 4 PTS: 2 REF: 011315ge STA: G.G.1
TOP: Planes

16 ANS: 2
\[ 2^2 + 3^2 \neq 4^2 \]

PTS: 2 REF: 011316ge STA: G.G.48 TOP: Pythagorean Theorem

17 ANS: 2 PTS: 2 REF: 011317ge STA: G.G.22
TOP: Locus

18 ANS: 4 PTS: 2 REF: 011318ge STA: G.G.73
TOP: Equations of Circles

19 ANS: 4
\[ m = \frac{2}{3} \quad 2 = -\frac{3}{2} (4) + b \]
\[ m_{\perp} = -\frac{3}{2} \quad 2 = -6 + b \]
\[ 8 = b \]

PTS: 2 REF: 011319ge STA: G.G.64 TOP: Parallel and Perpendicular Lines

20 ANS: 1 PTS: 2 REF: 011320ge STA: G.G.26
TOP: Conditional Statements

21 ANS: 3
\[ 2(4x + 20) + 2(3x - 15) = 360. \quad \angle D = 3(25) - 15 = 60 \]
\[ 8x + 40 + 6x - 30 = 360 \]
\[ 14x + 10 = 360 \]
\[ 14x = 350 \]
\[ x = 25 \]

PTS: 2 REF: 011321ge STA: G.G.40 TOP: Trapezoids
22 ANS: 3 PTS: 2 REF: 011322ge STA: G.G.49
TOP: Chords

23 ANS: 4 PTS: 2 REF: 011323ge STA: G.G.72
TOP: Equations of Circles

24 ANS: 3
\[ m = \frac{-A}{B} = \frac{-3}{-2} = \frac{3}{2} \]
PTS: 2 REF: 011324ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

25 ANS: 1
\[ \frac{70 - 20}{2} = 25 \]
PTS: 2 REF: 011325ge STA: G.G.51 TOP: Ares Determined by Angles
KEY: outside circle

26 ANS: 2
\[ \frac{(n - 2)180}{n} = 120 \]
\[ 180n - 360 = 120n \]
\[ 60n = 360 \]
\[ n = 6 \]
PTS: 2 REF: 011326ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

27 ANS: 4
\[ 2x - 8 = x + 2 \]
\[ AE = 10 + 2 = 12 \]
\[ AC = 2(AE) = 2(12) = 24 \]
\[ x = 10 \]
PTS: 2 REF: 011327ge STA: G.G.39 TOP: Special Parallelograms

28 ANS: 3
\[ AB = 8 - 4 = 4 \]
\[ BC = \sqrt{(-2 - (-5))^2 + (8 - 6)^2} = \sqrt{13} \]
\[ AC = \sqrt{(-2 - (-5))^2 + (4 - 6)^2} = \sqrt{13} \]
PTS: 2 REF: 011328ge STA: G.G.69 TOP: Triangles in the Coordinate Plane

29 ANS:
Distance is preserved after the reflection.
\[ 2x + 13 = 9x - 8 \]
\[ 21 = 7x \]
\[ 3 = x \]
30 ANS:

\[ r^2 = 25. \]

\[ (x + 3)^2 + (y - 2)^2 = 25 \]

PTS: 2 REF: 011331ge STA: G.G.23 TOP: Locus

31 ANS:

\[ M = \left( \frac{3 + 3}{2}, \frac{-1 + 5}{2} \right) = (3, 2). \]

\[ y = 2. \]

PTS: 2 REF: 011332ge STA: G.G.71 TOP: Equations of Circles

32 ANS:

If \( r = 5 \), then \( r^2 = 25 \). \( (x + 3)^2 + (y - 2)^2 = 25 \)

PTS: 2 REF: 011333ge STA: G.G.19 TOP: Constructions

33 ANS:

\[ L = 2\pi rh = 2\pi \cdot 3 \cdot 5 \approx 94.25. \]

\[ V = \pi r^2 h = \pi (3)^2 (5) \approx 141.37 \]

PTS: 4 REF: 011334ge STA: G.G.68 TOP: Perpendicular Bisector

34 ANS:

\[ V = \pi r^2 h = \pi (3)^2 (5) \approx 141.37 \]

PTS: 4 REF: 011335ge STA: G.G.14 TOP: Volume and Lateral Area
PTS: 4   REF: 011336ge   STA: G.G.58   TOP: Compositions of Transformations

36 ANS:

\[ A''(11, 1), B''(3, 7), C''(3, 1) \]

PTS: 4   REF: 011337ge   STA: G.G.34   TOP: Angle Side Relationship

37 ANS:

\[ x^2 + 12 + 11x + 5 + 13x - 17 = 180 \]
\[ m\angle A = 6^2 + 12 = 48 \]
\[ m\angle B = 11(6) + 5 = 71 \]
\[ m\angle C = 13(6) - 7 = 61 \]
\[ x = 6 \]

PTS: 4   REF: 011338ge   STA: G.G.27   TOP: Quadrilateral Proofs

38 ANS:

Rectangle \(ABCD\) with points \(E\) and \(F\) on side \(AB\), segments \(CE\) and \(DF\) intersect at \(G\), and \(\angle ADG \cong \angle BCE\) are given. \(AD \cong BC\) because opposite sides of a rectangle are congruent. \(\angle A\) and \(\angle B\) are right angles and congruent because all angles of a rectangle are right and congruent. \(\triangle ADF \cong \triangle BCE\) by ASA. \(AF \cong BE\) per CPCTC. \(EF \cong FE\) under the Reflexive Property. \(AF - EF \cong BE - FE\) using the Subtraction Property of Segments. \(AE \cong BF\) because of the Definition of Segments.

0613ge

Answer Section

1 ANS: 2
Isosceles or not, $\triangle RSV$ and $\triangle RST$ have a common base, and since $\overline{RS}$ and $\overline{VT}$ are bases, congruent altitudes.

PTS: 2 REF: 061301ge STA: G.G.40 TOP: Trapezoids

2 ANS: 2
(1) is true because of vertical angles. (3) and (4) are true because CPCTC.

PTS: 2 REF: 061302ge STA: G.G.29 TOP: Triangle Congruency

3 ANS: 4
TOP: Locus

4 ANS: 4
$(x,y) \rightarrow (-x,-y)$

PTS: 2 REF: 061304ge STA: G.G.54 TOP: Rotations

5 ANS: 2
TOP: Constructions

6 ANS: 3
TOP: Equations of Circles

7 ANS: 1
TOP: Properties of Transformations

8 ANS: 3
$3x + 1 + 4x - 17 + 5x - 20 = 180, 3(18) + 1 = 55$
$12x - 36 = 180, 4(18) - 17 = 55$
$12x = 216, 5(18) - 20 = 70$
$x = 18$

PTS: 2 REF: 061308ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

9 ANS: 3
TOP: Equations of Circles

10 ANS: 1
TOP: Planes

11 ANS: 3
$3x - 15 = 2(6)$
$3x = 27$
$x = 9$

PTS: 2 REF: 061311ge STA: G.G.42 TOP: Midsegments
12 ANS: 2
\[ M_x = \frac{8 + (-3)}{2} = 2.5, \quad M_y = \frac{-4 + 2}{2} = -1. \]

PTS: 2 REF: 061312ge STA: G.G.66 TOP: Midpoint

13 ANS: 2
TOP: Quadratic-Linear Systems

14 ANS: 1
TOP: Converse and Biconditional

15 ANS: 2
TOP: Solids

16 ANS: 1
\[ V = \frac{4}{3} \pi r^3 \]
\[ 44.6022 = \frac{4}{3} \pi r^3 \]
\[ 10.648 \approx r^3 \]
\[ 2.2 \approx r \]

PTS: 2 REF: 061317ge STA: G.G.16 TOP: Volume and Surface Area

17 ANS: 3
\[ 2y = 3x - 4, \quad 1 = \frac{3}{2} (6) + b \]
\[ y = \frac{3}{2} x - 2, \quad 1 = 9 + b \]
\[ -8 = b \]

PTS: 2 REF: 061316ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

18 ANS: 4
\[ m_{AB} = \frac{6 - 3}{7 - 5} = \frac{3}{2}, \quad m_{CD} = \frac{4 - 0}{6 - 9} = \frac{4}{-3} \]

PTS: 2 REF: 061318ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

19 ANS: 4
TOP: Equations of Circles

20 ANS: 3
TOP: Parallel Lines and Transversals

21 ANS: 2
TOP: Angle Side Relationship

22 ANS: 2
TOP: Arcs Determined by Angles KEY: inscribed
23 ANS: 3
25 \times 9 \times 12 = 15^2 h
2700 = 15^2 h
12 = h

PTS: 2 REF: 061323ge STA: G.G.11 TOP: Volume

24 ANS: 2 PTS: 2 REF: 061324ge STA: G.G.44
TOP: Similarity Proofs

25 ANS: 1 PTS: 2 REF: 061325ge STA: G.G.74
TOP: Graphing Circles

26 ANS: 2
\sqrt{8^2 + 15^2} = 17

PTS: 2 REF: 061326ge STA: G.G.39 TOP: Special Parallelograms

27 ANS: 3
x^2 = 3 \times 12. \quad \sqrt{6^2 + 3^2} = \sqrt{45} = \sqrt{9 \cdot 5} = 3 \sqrt{5}
x = 6

PTS: 2 REF: 061327ge STA: G.G.47 TOP: Similarity
KEY: altitude

28 ANS: 1
12(8) = x(6)
96 = 6x
16 = x

PTS: 2 REF: 061328ge STA: G.G.53 TOP: Segments Intercepted by Circle
KEY: two secants

29 ANS:
L = 2\pi rh = 2\pi \cdot 3 \cdot 7 = 42\pi

PTS: 2 REF: 061329ge STA: G.G.14 TOP: Volume and Lateral Area

30 ANS:
(n - 2)180 = (8 - 2)180 = 1080. \quad \frac{1080}{8} = 135.

PTS: 2 REF: 061330ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

31 ANS:
\sqrt{(7 - 3)^2 + (-8 - 0)^2} = \sqrt{16 + 64} = \sqrt{80} = 4\sqrt{5}

PTS: 2 REF: 061331ge STA: G.G.69 TOP: Triangles in the Coordinate Plane
32 ANS:

\[ \text{PTS: 2} \quad \text{REF: 061332ge} \quad \text{STA: G.G.20} \quad \text{TOP: Constructions} \]

33 ANS:

\[ \text{PTS: 2} \quad \text{REF: 061333ge} \quad \text{STA: G.G.23} \quad \text{TOP: Locus} \]

34 ANS:

\[ \frac{4 - 1}{4 - 2} = \frac{3}{2}, \quad \frac{4 - 2}{4 - 2} = \frac{2}{3} \]

\[ \text{PTS: 4} \quad \text{REF: 061334ge} \quad \text{STA: G.G.69} \quad \text{TOP: Quadrilaterals in the Coordinate Plane} \]

35 ANS:

\[ \text{PTS: 4} \quad \text{REF: 061335ge} \quad \text{STA: G.G.58} \quad \text{TOP: Compositions of Transformations} \]

KEY: grids
36 ANS:
\[2(y + 10) = 4y - 20.\]
\[DF = y + 10 = 20 + 10 = 30.\]
\[OA = OD = \sqrt{16^2 + 30^2} = 34\]
\[2y + 20 = 4y - 20\]
\[40 = 2y\]
\[20 = y\]

PTS: 4  REF: 061336ge  STA: G.G.49  TOP: Chords

37 ANS:
\[x^2 - 8x = 5x + 30.\]
\[m\angle C = 4(15) - 5 = 55\]
\[x^2 - 13x - 30 = 0\]
\[(x - 15)(x + 2) = 0\]
\[x = 15\]

PTS: 4  REF: 061337ge  STA: G.G.45  TOP: Similarity

38 ANS:
\[\triangle MAH, \overline{MH} \cong \overline{AH}\] and medians \(\overline{AB}\) and \(\overline{MT}\) are given. \(\overline{MA} \cong \overline{AM}\) (reflexive property). \(\triangle MAH\) is an isosceles triangle (definition of isosceles triangle). \(\angle AMB \cong \angle MAT\) (isosceles triangle theorem). \(B\) is the midpoint of \(\overline{MH}\) and \(T\) is the midpoint of \(\overline{AH}\) (definition of median). \(\frac{1}{2} m\overline{MH}\) and \(\frac{1}{2} m\overline{AH}\) (definition of midpoint). \(\overline{MB} \cong \overline{AT}\) (multiplication postulate). \(\triangle MBA \cong \triangle ATM\) (SAS). \(\angle MBA \cong \angle ATM\) (CPCTC).

**Answer Section**

1. ANS: 2  
   PTS: 2  
   REF: 081301ge  
   STA: G.G.24  
   TOP: Statements

2. ANS: 1  
   Parallel chords intercept congruent arcs. \( \overline{AC} = \overline{BD} \).  
   \( \frac{180 - 110}{2} = 35 \).

3. ANS: 1  
   PTS: 2  
   REF: 081302ge  
   STA: G.G.52  
   TOP: Chords

4. ANS: 4  
   Distance is preserved after a rotation.

5. ANS: 4  
   PTS: 2  
   REF: 081304ge  
   STA: G.G.55  
   TOP: Properties of Transformations

6. ANS: 2  
   PTS: 2  
   REF: 081306ge  
   STA: G.G.34  
   TOP: Angle Side Relationship

7. ANS: 3  
   The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

8. ANS: 4  
   PTS: 2  
   REF: 081307ge  
   STA: G.G.43  
   TOP: Centroid

9. ANS: 3  
   PTS: 2  
   REF: 081309ge  
   STA: G.G.29  
   TOP: Triangle Congruency

10. ANS: 4  
    \[ 6x = x + 40 + 3x + 10. \ m\angle CAB = 25 + 40 = 65 \]  
    \[ 6x = 4x + 50 \]  
    \[ 2x = 50 \]  
    \[ x = 25 \]  

11. ANS: 2  
    PTS: 2  
    REF: 081311ge  
    STA: G.G.32  
    TOP: Exterior Angle Theorem

12. ANS: 3  
    PTS: 2  
    REF: 081312ge  
    STA: G.G.72  
    TOP: Equations of Circles

13. ANS: 4  
    PTS: 2  
    REF: 081313ge  
    STA: G.G.19  
    TOP: Constructions

14. ANS: 3  
    \[ 120\pi = \pi(12)/(l) \]  
    \[ 10 = l \]  

PTS: 2  
REF: 081314ge  
STA: G.G.15  
TOP: Volume and Lateral Area
15  ANS: 4
   \[3y + 6 = 2x \quad 2y - 3x = 6\]
   \[3y = 2x - 6 \quad 2y = 3x + 6\]
   \[y = \frac{2}{3}x - 2 \quad y = \frac{3}{2}x + 3\]
   \[m = \frac{2}{3} \quad m = \frac{3}{2}\]

   PTS: 2  REF: 081315ge  STA: G.G.63  TOP: Parallel and Perpendicular Lines

16  ANS: 2  PTS: 2  REF: 081316ge  STA: G.G.23
   TOP: Locus

17  ANS: 3
   \[\frac{15}{18} = \frac{5}{6}\]

   PTS: 2  REF: 081317ge  STA: G.G.45  TOP: Similarity
   KEY: perimeter and area

18  ANS: 4  PTS: 2  REF: 081318ge  STA: G.G.26
   TOP: Converse and Biconditional

19  ANS: 2
   \[(x - 4)^2 - 2 = -2x + 6 \quad y = -2(4) + 6 = -2\]
   \[x^2 - 8x + 16 - 2 = -2x + 6 \quad y = -2(2) + 6 = 2\]
   \[x^2 - 6x + 8 = 0\]
   \[(x - 4)(x - 2) = 0\]
   \[x = 4, 2\]

   PTS: 2  REF: 081319ge  STA: G.G.70  TOP: Quadratic-Linear Systems

20  ANS: 3  PTS: 2  REF: 081320ge  STA: G.G.42
   TOP: Midsegments

21  ANS: 1
   If two prisms have equal heights and volume, the area of their bases is equal.

   PTS: 2  REF: 081321ge  STA: G.G.11  TOP: Volume

22  ANS: 4
   \[(n - 2)180 - n \left( \frac{(n - 2)180}{n} \right) = 180n - 360 - 180n + 180n - 360 = 180n - 720.\]
   \[180(5) - 720 = 180\]

   PTS: 2  REF: 081322ge  STA: G.G.37  TOP: Interior and Exterior Angles of Polygons

23  ANS: 1  PTS: 2  REF: 081323ge  STA: G.G.9
   TOP: Planes

24  ANS: 1  PTS: 2  REF: 081324ge  STA: G.G.74
   TOP: Graphing Circles
25 ANS: $\sqrt{15^2 - 12^2} = 9$

KEY: point of tangency

PTS: 2 REF: 081325ge STA: G.G.50 TOP: Tangents

26 ANS: 3

$x^2 = 2(2 + 10)$

$x^2 = 24$

$x = \sqrt{24} = \sqrt{4 \cdot \sqrt{6}} = 2 \sqrt{6}$

PTS: 2 REF: 081326ge STA: G.G.47 TOP: Similarity

KEY: leg

27 ANS: 3

midpoint: $\left( \frac{6 + 8}{2}, \frac{8 + 4}{2} \right) = (7, 6)$. slope: $\frac{8 - 4}{6 - 8} = \frac{4}{-2} = -2$; $m_\perp = \frac{1}{2}$. 6 = $\frac{1}{2} (7) + b$

\[ \frac{12}{2} = \frac{7}{2} + b \]

\[ \frac{5}{12} = b \]

PTS: 2 REF: 081327ge STA: G.G.68 TOP: Perpendicular Bisector

28 ANS: 1

$8 \times 12 = 16x$

$6 = x$

PTS: 2 REF: 081328ge STA: G.G.53 TOP: Segments Intercepted by Circle

KEY: two chords

29 ANS:

$A'(2, 2), B'(3, 0), C(1, -1)$

PTS: 2 REF: 081329ge STA: G.G.58 TOP: Dilations

30 ANS:

31 ANS:

$\sqrt{(-1 - 3)^2 + (4 - (-2))^2} = \sqrt{16 + 36} = \sqrt{52} = \sqrt{4 \cdot \sqrt{13}} = 2 \sqrt{13}$

PTS: 2 REF: 081331ge STA: G.G.67 TOP: Distance
32 ANS:
\[ A = 2B - 15 \]
\[ 2B - 15 + B + 2B - 15 + B = 180 \]
\[ C = A + B \]
\[ 6B - 30 = 180 \]
\[ C = 2B - 15 + B \]
\[ 6B = 210 \]
\[ B = 35 \]

PTS: 2 \hspace{1cm} REF: 081332ge \hspace{1cm} STA: G.G.30 \hspace{1cm} TOP: Interior and Exterior Angles of Triangles

33 ANS:
center: (3, -4); radius: \( \sqrt{10} \)

PTS: 2 \hspace{1cm} REF: 081333ge \hspace{1cm} STA: G.G.73 \hspace{1cm} TOP: Equations of Circles

34 ANS:

\[ \Delta ABC, BD \text{ bisects } \angle ABC, BD \perp AC \text{ (Given).} \]
\[ \angle CBD \cong \angle ABD \text{ (Definition of angle bisector).} \]
\[ BD \cong BD \text{ (Reflexive property).} \]
\[ \angle CDB \text{ and } \angle ADB \text{ are right angles (Definition of perpendicular).} \]
\[ \angle CDB \cong \angle ADB \text{ (All right angles are congruent).} \]
\[ \Delta CDB \cong \Delta ADB \text{ (SAS).} \]
\[ AB \cong CB \text{ (CPCTC).} \]

PTS: 4 \hspace{1cm} REF: 081335ge \hspace{1cm} STA: G.G.22 \hspace{1cm} TOP: Locus

35 ANS:

\[ M''(1, -2), A''(6, -2), T''(5, -4), H''(3, -4) \]

PTS: 4 \hspace{1cm} REF: 081336ge \hspace{1cm} STA: G.G.58 \hspace{1cm} TOP: Compositions of Transformations

KEY: grids
37 ANS:

\[12x - 4 + 7x + 13 = 180, \quad 16y + 1 = \frac{12y + 1 + 18y + 6}{2}\]

\[19x + 9 = 180, \quad 32y + 2 = 30y + 7\]

\[19x = 171, \quad 2y = 5\]

\[x = 9, \quad y = \frac{5}{2}\]

PTS: 4 REF: 081337ge STA: G.G.40 TOP: Trapezoids

38 ANS:

\[M\left(\frac{-7+3}{2}, \frac{4+6}{2}\right) = M(-5, 5). \quad m_{MN} = \frac{5-3}{5-0} = \frac{2}{5}\]

\[N\left(\frac{-3+3}{2}, \frac{6+0}{2}\right) = N(0, 3) \quad m_{PQ} = \frac{4-2}{2-3} = -\frac{2}{5}\]

\[P\left(\frac{3+1}{2}, \frac{0-8}{2}\right) = P(2, -4) \quad m_{NA} = \frac{3-4}{0-2} = \frac{-1}{2}\]

\[Q\left(\frac{-7+1}{2}, \frac{4-8}{2}\right) = Q(-3, -2) \quad m_{QM} = \frac{-2-5}{-3-5} = \frac{-7}{2}\]

Since both opposite sides have equal slopes and are parallel, \(MNPQ\) is a parallelogram. \(\overrightarrow{MN} = \sqrt{(-5-0)^2 + (5-3)^2} = \sqrt{29}\). \(\overrightarrow{MN}\) is not congruent to \(\overrightarrow{NP}\), so \(MNPQ\) is not a rhombus since not all sides are congruent.

PTS: 6 REF: 081338ge STA: G.G.69 TOP: Quadrilaterals in the Coordinate Plane
0114ge

Answer Section

1. ANS: 2
   \[ \frac{6 + x}{2} = 4, \quad \frac{-4 + y}{2} = 2 \]
   \[ x = 2, \quad y = 8 \]
   PTS: 2  REF: 011401ge  STA: G.G.66  TOP: Midpoint

2. ANS: 3
   PTS: 2  REF: 011402ge  STA: G.G.17  TOP: Constructions

3. ANS: 4
   PTS: 2  REF: 011403ge  STA: G.G.73  TOP: Equations of Circles

4. ANS: 1
   PTS: 2  REF: 011404ge  STA: G.G.9  TOP: Planes

5. ANS: 1
   PTS: 2  REF: 011405ge  STA: G.G.59  TOP: Properties of Transformations

6. ANS: 4
   PTS: 2  REF: 011406ge  STA: G.G.10  TOP: Solids

7. ANS: 4
   PTS: 2  REF: 011407ge  STA: G.G.23  TOP: Locus

8. ANS: 1
   \[ 2x + x = 12, \quad BD = 2(4) = 8 \]
   \[ 3x = 12 \]
   \[ x = 4 \]
   PTS: 2  REF: 011408ge  STA: G.G.43  TOP: Centroid

9. ANS: 2
   \[ x^2 - 2 = x \]
   \[ x^2 - x - 2 = 0 \]
   \[ (x - 2)(x + 1) = 0 \]
   \[ x = 2, -1 \]
   PTS: 2  REF: 011409ge  STA: G.G.70  TOP: Quadratic-Linear Systems

10. ANS: 2
    \[ m = \frac{-A}{B} = -\frac{5}{1} = -5 \]
    \[ y = mx + b \]
    \[ 3 = -5(5) + b \]
    \[ 28 = b \]
    PTS: 2  REF: 011410ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

11. ANS: 2
    PTS: 2  REF: 011411ge  STA: G.G.27  TOP: Quadrilateral Proofs
12 ANS: 1 PTS: 2 REF: 011412ge STA: G.G.28
TOP: Triangle Congruency

13 ANS: 1

PTS: 2 REF: 011413ge STA: G.G.42 TOP: Midsegments

14 ANS: 2
\[ \angle ABC = 55, \text{ so } \angle ACR = 60 + 55 = 115 \]

PTS: 2 REF: 011414ge STA: G.G.32 TOP: Exterior Angle Theorem

15 ANS: 4 PTS: 2 REF: 011415ge STA: G.G.72
TOP: Equations of Circles

16 ANS: 1 PTS: 2 REF: 011416ge STA: G.G.34
TOP: Angle Side Relationship

17 ANS: 3
The regular polygon with the smallest interior angle is an equilateral triangle, with 60º. \( 180^\circ - 60^\circ = 120^\circ \)

PTS: 2 REF: 011417ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

18 ANS: 2
\[ 18\pi \cdot 42 \approx 2375 \]

PTS: 2 REF: 011418ge STA: G.G.14 TOP: Volume and Lateral Area

19 ANS: 3
\[ 180 - 38 = 142 \]

PTS: 2 REF: 011419ge STA: G.G.50 TOP: Tangents
KEY: two tangents

20 ANS: 2
\[ s^2 + s^2 = (3\sqrt{2})^2 \]
\[ 2s^2 = 18 \]
\[ s^2 = 9 \]
\[ s = 3 \]

PTS: 2 REF: 011420ge STA: G.G.39 TOP: Special Parallelograms

21 ANS: 4 PTS: 2 REF: 011421ge STA: G.G.54
TOP: Rotations
ID: A

22 ANS: 1
7x – 36 + 5x + 12 = 180
12x – 24 = 180
12x = 204
x = 17

PTS: 2 REF: 011422ge STA: G.G.35 TOP: Parallel Lines and Transversals

23 ANS: 1 PTS: 2 REF: 011423ge STA: G.G.71
TOP: Equations of Circles

24 ANS: 2
\[ \sqrt{17^2 - 15^2} = \sqrt{289 - 225} = \sqrt{64} = 8 \]

PTS: 2 REF: 011424ge STA: G.G.49 TOP: Chords

25 ANS: 3 PTS: 2 REF: 011425ge STA: G.G.39
TOP: Special Parallelograms

26 ANS: 4 PTS: 2 REF: 011426ge STA: G.G.73
TOP: Equations of Circles

27 ANS: 3 PTS: 2 REF: 011427ge STA: G.G.56
TOP: Identifying Transformations

28 ANS: 4 PTS: 2 REF: 011428ge STA: G.G.50
TOP: Tangents KEY: common tangency

29 ANS:
\[ SA = 4\pi r^2 = 4\pi \cdot 2.5^2 = 25\pi \approx 78.54 \]

PTS: 2 REF: 011429ge STA: G.G.16 TOP: Volume and Surface Area

30 ANS:

PTS: 2 REF: 011430ge STA: G.G.18 TOP: Constructions

31 ANS:
\[ \sqrt{(3 - 7)^2 + (-4 - 2)^2} = \sqrt{16 + 36} = \sqrt{52} = \sqrt{4 \cdot 13} = 2\sqrt{13}. \]

PTS: 2 REF: 011431ge STA: G.G.67 TOP: Distance
32 ANS:

\[ Bh = V \]

12h = 84

\[ h = 7 \]

PTS: 2 REF: 011432ge STA: G.G.12 TOP: Volume

33 ANS:

Neither. The slope of \( y = \frac{1}{2} x - 1 \) is \( \frac{1}{2} \). The slope of \( y + 4 = -\frac{1}{2}(x - 2) \) is \( -\frac{1}{2} \). The slopes are neither the same nor opposite reciprocals.

PTS: 2 REF: 011433ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

34 ANS:

PTS: 2 REF: 011434ge STA: G.G.22 TOP: Locus

35 ANS:

\[ x + 3x - 60 + 5x - 30 = 180 \quad 5(30) - 30 = 120 \quad 6y - 8 = 4y - 2 \quad \overline{DC} = 10 + 10 = 20 \]

\[ 9x - 90 = 180 \quad m\angle BAC = 180 - 120 = 60 \quad 2y = 6 \]

\[ 9x = 270 \quad y = 3 \]

\[ x = 30 = m\angle D \quad 4(3) - 2 = 10 = \overline{BC} \]

PTS: 3 REF: 011435ge STA: G.G.31 TOP: Isosceles Triangle Theorem
36 ANS:

![Diagram of transformations](image)

PTS: 3  REF: 011436ge  STA: G.G.58  TOP: Compositions of Transformations
KEY: grids

37 ANS:

\[4x \cdot x = 6^2\]
\[4x^2 = 36\]
\[x^2 = 9\]
\[x = 3\]
\[BD = 4(3) = 12\]

PTS: 4  REF: 011437ge  STA: G.G.47  TOP: Similarity
KEY: leg

38 ANS:

2. The diameter of a circle is \(\perp\) to a tangent at the point of tangency. 4. An angle inscribed in a semicircle is a right angle. 5. All right angles are congruent. 7. AA. 8. Corresponding sides of congruent triangles are in proportion. 9. The product of the means equals the product of the extremes.

PTS: 6  REF: 011438ge  STA: G.G.27  TOP: Circle Proofs
1 ANS: 3 PTS: 2 REF: 061401ge STA: G.G.9
TOP: Planes

2 ANS: 1
\[ M_x = \frac{-5 + 3}{2} = -1. \quad M_y = \frac{1 + 5}{2} = \frac{6}{2} = 3. \]

3 ANS: 2
\[ 5x - 22 = 3x + 10 \]
\[ 2x = 32 \]
\[ x = 16 \]

4 ANS: 3
\[ \frac{4}{2 + 3 + 4} \times 180 = 80 \]

5 ANS: 3
\[ L = 2\pi rh = 2\pi \cdot \frac{6}{2} \cdot 15 = 90\pi \]

6 ANS: 2
\[ x + 2x = x^2 \quad (0, 0), (3, 3) \]
\[ 0 = x^2 - 3x \]
\[ 0 = x(x - 3) \]
\[ x = 0, 3 \]

7 ANS: 2
\[ x + x + x + 15 = 180 \]
\[ 3x + 15 = 180 \]
\[ 3x = 165 \]
\[ x = 15 \]

8 ANS: 1 PTS: 2 REF: 061408ge STA: G.G.72
TOP: Equations of Circles
9 ANS: 3
Parallel lines intercept congruent arcs.

PTS: 2  REF: 061409ge  STA: G.G.52  TOP: Chords

10 ANS: 4  PTS: 2  REF: 061410ge  STA: G.G.29
TOP: Triangle Congruency

11 ANS: 3
\[ d = \sqrt{(-2 - 4)^2 + (3 - 5)^2} = \sqrt{36 + 4} = \sqrt{40} = 2\sqrt{10} \]

PTS: 2  REF: 061411ge  STA: G.G.67  TOP: Distance
KEY: general

12 ANS: 4  PTS: 2  REF: 061412ge  STA: G.G.24
TOP: Negations

13 ANS: 2
\[
180 - \frac{(n - 2)180}{n} = 45\ .
\]
\[ 180n - 180n + 360 = 45n \]
\[ 360 = 45n \]
\[ n = 8 \]

PTS: 2  REF: 061413ge  STA: G.G.37  TOP: Interior and Exterior Angles of Polygons

14 ANS: 2

PTS: 2  REF: 061414ge  STA: G.G.39  TOP: Special Parallelograms

15 ANS: 3
\[ 144\pi = 4\pi r^2 \]
\[ 36 = r^2 \]
\[ 6 = r \]

PTS: 2  REF: 061415ge  STA: G.G.16  TOP: Volume and Surface Area

16 ANS: 4
\[ 3 + 6 > 8 \]

PTS: 2  REF: 061416ge  STA: G.G.33  TOP: Triangle Inequality Theorem

17 ANS: 2
\[ m = \frac{-A}{B} = \frac{-2}{3} \]
\[ m_\perp = \frac{3}{2} \]

18 ANS: 1     PTS: 2     REF: 061418ge     STA: G.G.3
TOP: Planes

19 ANS: 1     
180 − 123 = 57

PTS: 2     REF: 061419ge     STA: G.G.40     TOP: Trapezoids

20 ANS: 1

\[ m = \frac{\overrightarrow{A} \cdot \overrightarrow{B}}{\overrightarrow{B}} = \frac{1}{2} - 1 = \frac{1}{2} (4 + b) \]

\[-1 = 2 + b \]

\[-3 = b \]

PTS: 2     REF: 061420ge     STA: G.G.65     TOP: Parallel and Perpendicular Lines

21 ANS: 3     PTS: 2     REF: 061421ge     STA: G.G.55
TOP: Properties of Transformations

22 ANS: 4     PTS: 2     REF: 061422ge     STA: G.G.73
TOP: Equations of Circles

23 ANS: 4     PTS: 2     REF: 061423ge     STA: G.G.25
TOP: Compound Statements     KEY: conditional

24 ANS: 3     PTS: 2     REF: 061424ge     STA: G.G.43
TOP: Centroid

25 ANS: 2

\[ x^2 + 5x = 4x + 110 \quad m \angle Q = 4(10) = 40 \]

\[ x^2 + x - 110 = 0 \]

\[ (x + 11)(x - 10) = 0 \]

\[ 10 = x \]

PTS: 2     REF: 061425ge     STA: G.G.32     TOP: Exterior Angle Theorem

26 ANS: 3

\[ \frac{12}{8} = \frac{21}{x} \quad 21 + 14 = 35 \]

\[ 12x = 168 \]

\[ x = 14 \]

PTS: 2     REF: 061426ge     STA: G.G.46     TOP: Side Splitter Theorem

27 ANS: 2     PTS: 2     REF: 061427ge     STA: G.G.27
TOP: Line Proofs

28 ANS: 1

\[ \left( \frac{2 + 2}{2}, \frac{0 + (-8)}{2} \right) = (2, -4) \quad \sqrt{(2 - 2)^2 + (-8 - 0)^2} = 8 = d \]

\[ 4 = r \]

\[ 16 = r^2 \]

PTS: 2     REF: 061428ge     STA: G.G.71     TOP: Equations of Circles
29 ANS:
\[(x, y) \rightarrow (-y, x)\]
\[B(5, 1) \rightarrow B'(1, -5)\]
\[C(-3, -2) \rightarrow C'(2, -3)\]

PTS: 2 REF: 061429ge STA: G.G.54 TOP: Rotations

30 ANS:

\[\text{PTS: 2 REF: 061430ge STA: G.G.34 TOP: Angle Side Relationship}\]

31 ANS:
\[x^2 = 8(10 + 8)\]
\[x^2 = 144\]
\[x = 12\]

PTS: 2 REF: 061431ge STA: G.G.47 TOP: Similarity

KEY: leg

32 ANS:
\[5 \cdot 5 = 10w\]
\[25 = 10w\]
\[2.5 = w\]

PTS: 2 REF: 061432ge STA: G.G.11 TOP: Volume

33 ANS:
\[x^2 + 7^2 = 25^2\]
\[x^2 + 49 = 625\]
\[x^2 = 576\]
\[x = 24\]

PTS: 2 REF: 061433ge STA: G.G.50 TOP: Tangents

KEY: point of tangency
34 ANS:
\[
\left( \frac{3}{2} \right)^2 = \frac{27}{A}
\]
\[
\frac{9}{4} = \frac{27}{A}
\]
\[
9A = 108
\]
\[
A = 12
\]

PTS: 2 REF: 061434ge STA: G.G.45 TOP: Similarity
KEY: perimeter and area

35 ANS:

![Diagram](image1)

PTS: 4 REF: 061435ge STA: G.G.58 TOP: Compositions of Transformations
KEY: grids

36 ANS:

![Diagram](image2)

PTS: 4 REF: 061436ge STA: G.G.23 TOP: Locus
37 \text{ ANS:}

\begin{align*}
\text{PTS: } 4 & \quad \text{REF: } 061437\text{ge} \quad \text{STA: G.G.17} \quad \text{TOP: Constructions} \\
\text{ANS:} \\
\end{align*}

\begin{align*}
m_{JM} & = \frac{1 - 4}{3 - 3} = \frac{-3}{0} = \frac{1}{2} \quad \text{Since both opposite sides have equal slopes and are parallel, } JKL \text{ is a } \text{parallelogram.} \\
m_{ML} & = \frac{4 - 2}{-7 - 3} = \frac{6}{4} = \frac{3}{2} \\
m_{LK} & = \frac{2 - 2}{-7 - 3} = \frac{0}{1} = \frac{1}{2} \\
m_{KL} & = \frac{-5 - 1}{1 - 3} = \frac{-6}{-4} = \frac{3}{2}
\end{align*}

\begin{align*}
\overline{JM} & = \sqrt{(-3 - 3)^2 + (1 - 4)^2} = \sqrt{45} \quad \text{is not congruent to } \overline{ML}, \text{ so } JKL \text{ is not a rhombus since} \\
\overline{ML} & = \sqrt{(7 - 3)^2 + (-2 - 4)^2} = \sqrt{52}
\end{align*}

not all sides are congruent.

38 \text{ ANS:}

\begin{align*}
\text{PTS: } 6 & \quad \text{REF: } 061438\text{ge} \quad \text{STA: G.G.69} \quad \text{TOP: Quadrilaterals in the Coordinate Plane} \\
\end{align*}
0814ge
Answer Section

1 ANS: 4 PTS: 2 REF: 081401ge STA: G.G.10
TOP: Solids

2 ANS: 3

PTS: 2 REF: 081402ge STA: G.G.38 TOP: Parallelograms

3 ANS: 4 PTS: 2 REF: 081403ge STA: G.G.49
TOP: Chords

4 ANS: 2
\[ m = \frac{1}{3} \quad 12 = -3(-9) + b \]
\[ m_\perp = -3 \quad 12 = 27 + b \]
\[ -15 = b \]

PTS: 2 REF: 081404ge STA: G.G.64 TOP: Parallel and Perpendicular Lines

5 ANS: 3 PTS: 2 REF: 081405ge STA: G.G.56
TOP: Identifying Transformations

6 ANS: 1
\[ x^2 + 5 = x + 5 \quad y = (0) + 5 = 5 \]
\[ x^2 - x = 0 \quad y = (1) + 5 = 6 \]
\[ x(x - 1) = 0 \]
\[ x = 0, 1 \]

PTS: 2 REF: 081406ge STA: G.G.70 TOP: Quadratic-Linear Systems

7 ANS: 3
\[ M_x = \frac{1 + 10}{2} = \frac{11}{2} = 5.5 \quad M_y = \frac{3 + 7}{2} = \frac{10}{2} = 5. \]

PTS: 2 REF: 081407ge STA: G.G.66 TOP: Midpoint
KEY: graph

8 ANS: 4 PTS: 2 REF: 081408ge STA: G.G.55
TOP: Properties of Transformations

9 ANS: 4 PTS: 2 REF: 081409ge STA: G.G.72
TOP: Equations of Circles

10 ANS: 3 PTS: 2 REF: 081410ge STA: G.G.47
TOP: Similarity KEY: altitude
11 ANS: 3
Both pairs of opposite sides are parallel, so not a trapezoid. None of the angles are right angles, so not a rectangle or square. All sides are congruent, so a rhombus.

PTS: 2 REF: 081411ge STA: G.G.69 TOP: Quadrilaterals in the Coordinate Plane

12 ANS: 1
\[ r^2 = 48 \]
\[ r = \sqrt[48]{16 \cdot \sqrt{3}} = 4\sqrt{3} \]

PTS: 2 REF: 081412ge STA: G.G.73 TOP: Equations of Circles

13 ANS: 1
Parallel lines intercept congruent arcs.

PTS: 2 REF: 081413ge STA: G.G.52 TOP: Chords

14 ANS: 2
\[ m = \frac{-A}{B} = \frac{-3}{7} = \frac{3}{7} \quad m_\perp = \frac{-7}{3} \]


15 ANS: 2
Top: Distance KEY: general

16 ANS: 3
\[ x + 40 = 2x + 20 \quad GH = 2(20) + 20 = 60 \]
\[ 20 = x \]

PTS: 2 REF: 081416ge STA: G.G.31 TOP: Isosceles Triangle Theorem

17 ANS: 4
Top: Statements

18 ANS: 4
\[ 8^2 + 15^2 = 17^2 \]

PTS: 2 REF: 081418ge STA: G.G.48 TOP: Pythagorean Theorem

19 ANS: 3
Top: Special Parallelograms

20 ANS: 2
Top: Parallel and Perpendicular Lines

21 ANS: 1
Top: Compound Statements KEY: general

22 ANS: 2

PTS: 2 REF: 081422ge STA: G.G.34 TOP: Angle Side Relationship
23 ANS: 2
\[
\frac{3}{6} = \frac{5}{x}
\]
\[3x = 30\]
\[x = 10\]
PTS: 2 REF: 081423ge STA: G.G.46 TOP: Side Splitter Theorem

24 ANS: 1
\[m\angle A + m\angle B = 50\]
\[30.1 + m\angle B = 50\]
\[m\angle B = 19.9\]
PTS: 2 REF: 081424ge STA: G.G.32 TOP: Exterior Angle Theorem

25 ANS: 2
PTS: 2 REF: 081425ge STA: G.G.74 TOP: Graphing Circles

26 ANS: 1
\[k: \frac{-A}{B} = \frac{-1}{2} \quad p: \frac{-A}{B} = \frac{-6}{3} = -2 \quad m: \frac{-A}{B} = \frac{-(-1)}{2} = \frac{1}{2}\]
PTS: 2 REF: 081426ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

27 ANS: 4
\[2x + 36 + 7x - 9 = 180\]
\[9x + 27 = 180\]
\[9x = 153\]
\[x = 17\]
PTS: 2 REF: 081427ge STA: G.G.35 TOP: Parallel Lines and Transversals

28 ANS: 1
\[256 = \frac{1}{3} B \cdot 12\]
\[64 = B\]
\[8 = s\]
PTS: 2 REF: 081428ge STA: G.G.35 TOP: Volume
29 ANS:

\[ \triangle ABC \]

PTS: 2 REF: 081429ge STA: G.G.58 TOP: Dilations

30 ANS:

\[ 8.5 + 9 + 8.5 + 9 = 35 \]

PTS: 2 REF: 081430ge STA: G.G.42 TOP: Midsegments

31 ANS:

\[ T_{-2,1} \quad A(0,1) \]

PTS: 2 REF: 081431ge STA: G.G.54 TOP: Translations

32 ANS:

\[ 86^\circ \cdot 2 = 172^\circ \quad 180^\circ - 86^\circ = 94^\circ \]

PTS: 2 REF: 081432ge STA: G.G.51 TOP: Arcs Determined by Angles

KEY: inscribed

33 ANS:

\[ 5x = 2(x + 12) \quad QM = 5(8) + (8) + 12 = 60 \]

\[ 5x = 2x + 24 \]

\[ 3x = 24 \]

\[ x = 8 \]

PTS: 2 REF: 081433ge STA: G.G.43 TOP: Centroid

34 ANS:

\[ (n - 2)180 = 540. \quad \frac{540}{5} = 108 \]

\[ n - 2 = 3 \]

\[ n = 5 \]

PTS: 2 REF: 081434ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons
35 ANS: 
\( \overline{MT} \) and \( \overline{HA} \) intersect at \( B \), \( \overline{MA} \parallel \overline{HT} \), and \( \overline{MT} \) bisects \( \overline{HA} \) (Given). \( \angle MBA \cong \angle TBH \) (Vertical Angles). \( \angle A \cong \angle H \) (Alternate Interior Angles). \( \overline{BH} \cong \overline{BA} \) (The bisection of a line segment creates two congruent segments). \( \triangle MAB \cong \triangle THB \) (ASA). \( \overline{MA} \cong \overline{HT} \) (CPCTC).

PTS: 4 REF: 081435ge STA: G.G.27 TOP: Triangle Proofs

36 ANS:
\[ l = \sqrt{10^2 + 3^2} = \sqrt{109} \quad L = \pi rl = \pi(3)(\sqrt{109}) \approx 98.4 \]


37 ANS:

PTS: 4 REF: 081437ge STA: G.G.18 TOP: Constructions

38 ANS:
\[ (x - 3)^2 + (y + 2)^2 = 25 \]
\[ m = \frac{6 - 4}{0 - 2} = \frac{-2}{-2} = 1 \]
\[ m_\perp = -1 \]
\[ M\left(\frac{0 + 2}{2}, \frac{-6 + 4}{2}\right) = M(1, -5) \quad -5 = (-1)(1) + b \]
\[ -4 = b \]
\[ y = -x - 4 \]

PTS: 6 REF: 081438ge STA: G.G.23 TOP: Locus

2. ANS: 4
   \[ M_x = \frac{2 + 8}{2} = 5, \quad M_y = \frac{-5 + 3}{2} = -1. \]
   PTS: 2  REF: 011502ge  STA: G.G.66  TOP: Midpoint
   KEY: general


4. ANS: 1

5. ANS: 1
   \[ d = \sqrt{(5 - 1)^2 + (3 - 6)^2} = \sqrt{16 + 9} = \sqrt{25} = 5 \]
   PTS: 2  REF: 011507ge  STA: G.G.67  TOP: Distance
   KEY: general

6. ANS: 4
   \[ 180 - \frac{180 - 80}{2} = 130 \]
   PTS: 2  REF: 011508ge  STA: G.G.31  TOP: Isosceles Triangle Theorem

7. ANS: 2  PTS: 2  REF: 011509ge  STA: G.G.17  TOP: Constructions


12 ANS: 1 PTS: 2 REF: 011512ge STA: G.G.3
TOP: Planes

13 ANS: 4
3x + 17 + 5x − 21 = 180 \( m\angle 1 = 3(23) + 17 = 86 \)
8x − 4 = 180
8x = 184
\( x = 23 \)

PTS: 2 REF: 011513ge STA: G.G.35 TOP: Parallel Lines and Transversals

14 ANS: 3 PTS: 2 REF: 011514ge STA: G.G.72
TOP: Equations of Circles

15 ANS: 2
5x + 3 = 7x − 15 \( 5(9) + 3 = 48 \)
18 = 2x
\( 9 = x \)

PTS: 2 REF: 011515ge STA: G.G.40 TOP: Trapezoids

16 ANS: 1

PTS: 2 REF: 011516ge STA: G.G.21 TOP: Centroid, Orthocenter, Incenter and Circumcenter

17 ANS: 2 PTS: 2 REF: 011517ge STA: G.G.26
TOP: Contrapositive

18 ANS: 3 PTS: 2 REF: 011518ge STA: G.G.74
TOP: Graphing Circles

19 ANS: 1
10 − 4 < s < 10 + 4
6 < s < 14

PTS: 2 REF: 011519ge STA: G.G.33 TOP: Triangle Inequality Theorem

20 ANS: 4
\( m = \frac{-A}{B} = \frac{-4}{6} = -\frac{2}{3} \)

PTS: 2 REF: 011520ge STA: G.G.63 TOP: Parallel and Perpendicular Lines
21 ANS: 3
\[
\frac{4}{6} = \frac{x + 2}{4x - 7}
\]
\[16x - 28 = 6x + 12\]
\[10x = 40\]
\[x = 4\]

PTS: 2  REF: 011521ge  STA: G.G.46  TOP: Side Splitter Theorem

22 ANS: 2

PTS: 2  REF: 011522ge  STA: G.G.38  TOP: Parallelograms

23 ANS: 3

PTS: 2  REF: 011523ge  STA: G.G.51  TOP: Arcs Determined by Angles  KEY: inscribed

24 ANS: 3

PTS: 2  REF: 011524ge  STA: G.G.58  TOP: Dilations

25 ANS: 4

\[9x - 10 = 5x + 30\]
\[5(10) + 30 = 80\]
\[4x = 40\]
\[x = 10\]

PTS: 2  REF: 011525ge  STA: G.G.52  TOP: Chords

26 ANS: 1

PTS: 2  REF: 011526ge  STA: G.G.10  TOP: Solids

27 ANS: 4

(2) rotation is also a correct response

PTS: 2  REF: 011527ge  STA: G.G.56  TOP: Identifying Transformations

28 ANS: 4

PTS: 2  REF: 011528ge  STA: G.G.44  TOP: Similarity Proofs

29 ANS:
\[BE \text{ and } AD \text{ intersect at point } C, BC \cong EC, AC \cong DC, AB \text{ and } DE \text{ are drawn (Given). } \angle BCA \cong \angle ECD \text{ (Vertical Angles). } \triangle ABC \cong \triangle DEC \text{ (SAS).}\]

PTS: 2  REF: 011529ge  STA: G.G.27  TOP: Triangle Proofs
30 ANS:

\[ \frac{(n - 2)180}{n} = \frac{(10 - 2)180}{10} = 144 \]

31 ANS:

\[ m = \frac{1}{3} \]
\[ 4 = \frac{1}{3}(-3) + b \]
\[ y = \frac{1}{3}x + 5 \]
\[ 4 = -1 + b \]
\[ 5 = b \]

32 ANS:

\[ 24 \cdot 6 = w \cdot 8 \]
\[ 144 = 8w \]
\[ 18 = w \]

33 ANS:

\[ x - \frac{1}{4} = \frac{-3}{8} \]
\[ 8x - 8 = -12 \]
\[ 8x = -4 \]
\[ x = -\frac{1}{2} \]

34 ANS:

\[ x - \frac{1}{4} = \frac{-3}{8} \]
\[ 8x - 8 = -12 \]
\[ 8x = -4 \]
\[ x = -\frac{1}{2} \]
35 ANS:

\[ H'(7,0), Y'(6,4), P'(3,4), E'(3,1) \]

\[ H''(7,0), Y''(6,-4), P''(3,-4), E''(3,-1) \]

PTS: 4 REF: 011535ge STA: G.G.58 TOP: Compositions of Transformations

KEY: grids

36 ANS:

37 ANS:

\[ h = \sqrt{5^2 - 3^2} = 4 \quad V = \frac{1}{3} \pi \cdot 3^2 \cdot 4 = 12\pi \quad V = \pi \cdot 4^2 \cdot 6 = 96\pi \quad \frac{96\pi}{12\pi} = 8 \]

38 ANS:

\[ x(x + 16) = 15^2 \quad 25 \cdot 34 = y^2 \]
\[ x^2 + 16x - 225 = 0 \quad 5\sqrt{34} = y \]
\[ (x + 25)(x - 9) = 0 \]

\[ x = 9 \]

PTS: 6       REF: 011538ge       STA: G.G.47       TOP: Similarity
KEY: leg
0615ge
Answer Section

1 ANS: 3 PTS: 2 REF: 061501ge STA: G.G.61
TOP: Analytical Representations of Transformations

2 ANS: 3
\[ V = \frac{2}{3} \pi \left( \frac{12}{2} \right)^3 \approx 905 \]

PTS: 2 REF: 061502ge STA: G.G.16 TOP: Volume and Surface Area

3 ANS: 4 PTS: 2 REF: 061503ge STA: G.G.10
TOP: Solids

4 ANS: 1
(2, −7) \rightarrow (2 − 3, −7 + 5) = (−1, −2)


5 ANS: 2
\[ 2 = \frac{10 + x}{2}, \quad 8 = \frac{12 + y}{2} \]
\[ 4 = 10 + x, \quad 16 = 12 + y \]
\[ x = 4, \quad y = 4 \]

PTS: 2 REF: 061505ge STA: G.G.66 TOP: Midpoint

6 ANS: 3
\[ x^2 = 8 \times 18 \]
\[ x^2 = 144 \]
\[ x = 12 \]

PTS: 2 REF: 061506ge STA: G.G.47 TOP: Similarity
KEY: altitude

7 ANS: 1
\[ m = \frac{6}{3} = 2, \quad m_{\perp} = -\frac{1}{2}, \quad 4 = -\frac{1}{2} (2) + b \]
\[ 4 = -1 + b \]
\[ 5 = b \]

PTS: 2 REF: 061507ge STA: G.G.64 TOP: Parallel and Perpendicular Lines

8 ANS: 3 PTS: 2 REF: 061508ge STA: G.G.32
TOP: Exterior Angle Theorem

9 ANS: 2 PTS: 2 REF: 061509ge STA: G.G.55
TOP: Properties of Transformations

10 ANS: 1 PTS: 2 REF: 061510ge STA: G.G.72
TOP: Equations of Circles
Diagonals of rectangles and trapezoids do not bisect opposite angles. \( \angle DAB = 90 \) if \( ABCD \) is a square.

12. ANS: 2
PTS: 2
REF: 061512ge
STA: G.G.19
TOP: Constructions

13. ANS: 2
\[ 180 - 2(66) = 48 \]

14. ANS: 1
PTS: 2
REF: 061514ge
STA: G.G.3
TOP: Planes

15. ANS: 3
\[ r^2 = 50 \]
\[ r = \sqrt{50} = \sqrt{25 \cdot 2} = 5\sqrt{2} \]

16. ANS: 2
PTS: 2
REF: 061516ge
STA: G.G.52
TOP: Chords

17. ANS: 1
PTS: 2
REF: 061517ge
STA: G.G.45
TOP: Similarity
KEY: perimeter and area

18. ANS: 4
\[ k: m = \frac{2}{3} \]
\[ m: n = \frac{-A}{B} = \frac{-2}{3} \]
\[ n: m = \frac{3}{2} \]

19. ANS: 3
\[ 180 - \frac{(n - 2)180}{n} = 40 \]
\[ 180n - 180n + 360 = 40n \]
\[ 360 = 40n \]
\[ n = 9 \]

20. ANS: 4

PTS: 2
REF: 061520ge
STA: G.G.42
TOP: Midsegments
21 ANS: 2
\[180(n - 2) = 720\]
\[n - 2 = 4\]
\[n = 6\]

PTS: 2 REF: 061521ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

22 ANS: 3
TOP: Planes

23 ANS: 1
TOP: Angle Side Relationship

24 ANS: 2
TOP: Equations of Circles

25 ANS: 4
\[11 - 7 = 4, 11 + 7 = 18\]

PTS: 2 REF: 061525ge STA: G.G.33 TOP: Triangle Inequality Theorem

26 ANS: 3
TOP: Inverse

27 ANS: 1
TOP: Centroid

28 ANS: 4
\[\frac{2}{3}(x - 4) = y - 5\]
\[2x - 8 = 3y - 15\]
\[7 = 3y - 2x\]

PTS: 2 REF: 061528ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

29 ANS:
\[\frac{5}{5 + 6 + 7} \cdot 180 = 50\]

PTS: 2 REF: 061529ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

30 ANS:

PTS: 2 REF: 061530ge STA: G.G.54 TOP: Reflections

KEY: grids
31 ANS:
\[ l = \sqrt{12^2 + 5^2} = \sqrt{169} = 13 \quad L = \pi rl = \pi (5)(13) = 65\pi \]

PTS: 2    REF: 061531ge    STA: G.G.15    TOP: Volume and Lateral Area

32 ANS:

PTS: 2    REF: 061532ge    STA: G.G.18    TOP: Constructions

33 ANS:
\[ \sqrt{(6 - 3)^2 + (-1 - 8)^2} = \sqrt{9 + 81} = \sqrt{90} = \sqrt{9 \cdot 10} = 3\sqrt{10}. \]

PTS: 2    REF: 061533ge    STA: G.G.67    TOP: Distance

34 ANS:
\[ 180 - \left( \frac{84}{2} + 28 \right) = 180 - 70 = 110 \]

PTS: 2    REF: 061534ge    STA: G.G.21    TOP: Centroid, Orthocenter, Incenter and Circumcenter

35 ANS:

PTS: 4    REF: 061535ge    STA: G.G.70    TOP: Quadratic-Linear Systems
36 ANS:
\[ 6x - 6 = 4x + 2 \quad \text{m} \angle BCA = 4(4) + 2 = 18 \quad 7y - 15 = 5y - 1 \quad \text{m} \angle BAC = 5(7) - 1 = 34 \quad \text{m} \angle B = 180 - (18 + 34) = 128 \]
\[ 2x = 8 \quad 2y = 14 \]
\[ x = 4 \quad y = 7 \]

PTS: 4 REF: 061536ge STA: G.G.38 TOP: Parallelograms

37 ANS:

PTS: 4 REF: 061537ge STA: G.G.22 TOP: Locus

38 ANS:
Square \(ABCD\); \(E\) and \(F\) are points on \(BC\) such that \(BE \cong FC\); \(AF\) and \(DE\) drawn (Given). \(AB \cong CD\) (All sides of a square are congruent). \(\angle ABF \cong \angle DCE\) (All angles of a square are equiangular). \(EF \cong FE\) (Reflexive property). \(BE + EF \cong FC + FE\) (Additive property of line segments). \(BF \cong CE\) (Angle addition). \(\triangle ABF \cong \triangle DCE\) (SAS). \(AF \cong DE\) (CPCTC).

### Answer Section

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Points</th>
<th>Reference</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>2</td>
<td>081501ge</td>
<td>G.G.29</td>
</tr>
<tr>
<td>TOP</td>
<td>Triangle Congruency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
<td>081502ge</td>
<td>G.G.73</td>
</tr>
<tr>
<td>TOP</td>
<td>Equations of Circles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parallel secants intercept congruent arcs. $\frac{360 - (106 + 24)}{2} = \frac{230}{2} = 115$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>2</td>
<td>081504ge</td>
<td>G.G.61</td>
</tr>
<tr>
<td>TOP</td>
<td>Analytical Representations of Transformations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>2</td>
<td>081505ge</td>
<td>G.G.25</td>
</tr>
<tr>
<td>TOP</td>
<td>Compound Statements</td>
<td>KEY: disjunction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>2</td>
<td>081506ge</td>
<td>G.G.59</td>
</tr>
<tr>
<td>TOP</td>
<td>Properties of Transformations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>2</td>
<td>081507ge</td>
<td>G.G.46</td>
</tr>
<tr>
<td>TOP</td>
<td>Side Splitter Theorem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>2</td>
<td>081508ge</td>
<td>G.G.10</td>
</tr>
<tr>
<td>TOP</td>
<td>Solids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$m = \frac{-A}{B} = \frac{-4}{-2} = 2$ \quad y = mx + b \quad 1 = 2(-2) + b \quad 1 = -4 + b \quad 5 = b$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td></td>
<td>081509ge</td>
<td>G.G.65</td>
</tr>
<tr>
<td></td>
<td>$180 - 2(58) = 64$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td></td>
<td>081510ge</td>
<td>G.G.31</td>
</tr>
<tr>
<td></td>
<td>$45 \cdot \frac{8}{20} = 18$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>3</td>
<td>2</td>
<td>081511ge</td>
<td>G.G.45</td>
</tr>
<tr>
<td>TOP</td>
<td>Parallel and Perpendicular Lines</td>
<td>KEY: perimeter and area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>2</td>
<td>081512ge</td>
<td>G.G.19</td>
</tr>
<tr>
<td>TOP</td>
<td>Constructions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>2</td>
<td>081513ge</td>
<td>G.G.26</td>
</tr>
<tr>
<td>TOP</td>
<td>Contrapositive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>2</td>
<td>081514ge</td>
<td>G.G.2</td>
</tr>
<tr>
<td>TOP</td>
<td>Planes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15 ANS: 2  PTS: 2  REF: 081515ge  STA: G.G.55
TOP: Properties of Transformations

16 ANS: 4
2x + 3 = −x^2 − x + 1  y = 2(−2) + 3 = −1
\[ x^2 + 3x + 2 = 0 \]
\[(x + 2)(x + 1) = 0 \]
\[ x = −2, −1 \]

PTS: 2  REF: 081516ge  STA: G.G.70  TOP: Quadratic-Linear Systems

17 ANS: 1  PTS: 2  REF: 081517ge  STA: G.G.41
TOP: Special Quadrilaterals

18 ANS: 1  PTS: 2  REF: 081518ge  STA: G.G.51
TOP: Arcs Determined by Angles  KEY: inscribed

19 ANS: 2
\[ L + L − 30 = 180 \]
\[ 2L = 210 \]
\[ L = 105 \]

PTS: 2  REF: 081519ge  STA: G.G.38  TOP: Parallelograms

20 ANS: 2  PTS: 2  REF: 081520ge  STA: G.G.72
TOP: Equations of Circles

21 ANS: 2
\[ (n − 2)180 = (8 − 2)180 = 1080. \]
\[ \frac{1080}{8} = 135. \]

PTS: 2  REF: 081521ge  STA: G.G.37  TOP: Interior and Exterior Angles of Polygons

22 ANS: 1  PTS: 2  REF: 081522ge  STA: G.G.22
TOP: Locus

23 ANS: 3
\[ 720 = 5B \]
\[ 144 = B \]

PTS: 2  REF: 081523ge  STA: G.G.11  TOP: Volume

24 ANS: 1  PTS: 2  REF: 081524ge  STA: G.G.34
TOP: Angle Side Relationship

25 ANS: 3
\[ \sqrt{20^2 + 7^2} \approx 21 \]

PTS: 2  REF: 081525ge  STA: G.G.50  TOP: Tangents  KEY: point of tangency

26 ANS: 3
\[ 2.4 + 2(2.4) = 7.2 \]

PTS: 2  REF: 081526ge  STA: G.G.43  TOP: Centroid
27 ANS: 2  PTS: 2  REF: 081527ge  STA: G.G.33
TOP: Triangle Inequality Theorem

28 ANS: 3

\[ x^2 = 4 \cdot 7 \]

\[ x = \sqrt{4 \cdot 7} \]

\[ x = 2\sqrt{7} \]

PTS: 2  REF: 081528ge  STA: G.G.47  TOP: Similarity
KEY: leg

29 ANS:

\[ x = \sqrt{4 \cdot 7} \]

PTS: 2  REF: 081529ge  STA: G.G.54  TOP: Reflections
KEY: grids

30 ANS:

\[ V = \frac{1}{3} \pi (3^2)(8) = 24\pi \]

PTS: 2  REF: 081530ge  STA: G.G.15  TOP: Volume and Lateral Area

31 ANS:

\[ 2x + 7 = 25 \]

\[ NT = \frac{25 - 7}{2} = 9 \]

PTS: 2  REF: 081531ge  STA: G.G.42  TOP: Midsegments

32 ANS:

PTS: 2  REF: 081532ge  STA: G.G.20  TOP: Constructions
33 ANS:
\[ m = \frac{3}{2}, m_\perp = -\frac{2}{3} \quad y = -\frac{2}{3}x \]

PTS: 2  
REF: 081533ge  
STA: G.G.64  
TOP: Parallel and Perpendicular Lines

34 ANS:
\[ \left( \frac{0 + 1}{2}, \frac{4 + (-4)}{2} \right) = \left( \frac{1}{2}, 0 \right) \]

PTS: 2  
REF: 081534ge  
STA: G.G.69  
TOP: Quadrilaterals in the Coordinate Plane

35 ANS:

PTS: 4  
REF: 081535ge  
STA: G.G.23  
TOP: Locus

36 ANS:
\[ M = \left( \frac{4 + 8}{2}, \frac{2 + 6}{2} \right) = (6,4) \]
\[ m = \frac{6 - 2}{8 - 4} = \frac{4}{4} = 1 \]
\[ m_\perp = -1 \]
\[ y - 4 = -(x - 6) \]

PTS: 4  
REF: 081536ge  
STA: G.G.68  
TOP: Perpendicular Bisector

37 ANS:

PTS: 4  
REF: 081537ge  
STA: G.G.74  
TOP: Graphing Circles
Parallelogram $DEFG$, $K$ and $H$ are points on $DE$ such that $\angle DGK \cong \angle EFH$ and $\overline{GK}$ and $\overline{FH}$ are drawn (given). $\overline{DG} \cong \overline{EF}$ (opposite sides of a parallelogram are congruent). $\overline{DG} \parallel \overline{EF}$ (opposite sides of a parallelogram are parallel). $\angle D \cong \angle FEH$ (corresponding angles formed by parallel lines and a transversal are congruent).

$\triangle DGK \cong \triangle EFH$ (ASA). $\overline{DK} \cong \overline{EH}$ (CPCTC). 

PTS: 6

REF: 081538ge
STA: G.G.27
TOP: Quadrilateral Proofs