Dear Sir

I have to acknowledge the receipt of your favor of May 14. in which you mention that you have finished the 6. first books of Euclid, plane trigonometry, surveying & algebra and ask whether I think a further pursuit of that branch of science would be useful to you. there are some propositions in the latter books of Euclid, & some of Archimedes, which are useful, & I have no doubt you have been made acquainted with them. trigonometry, so far as this, is most valuable to every man, there is scarcely a day in which he will not resort to it for some of the purposes of common life. the science of calculation also is indispensable as far as the extraction of the square & cube roots; Algebra as far as the quadratic equation & the use of logarithms are often of value in ordinary cases; but all beyond these is but a luxury; a delicious luxury indeed; but not to be indulged in by one who is to have a profession to follow for his subsistence. in this light I view the conic sections, curves of the higher orders, perhaps even spherical trigonometry, Algebraical operations beyond the 2d dimension, and fluxions.

Letter from Thomas Jefferson to William G. Munford, Monticello, June 18, 1799.
1. In the diagram below of $\triangle DAE$ and $\triangle BCE$, $\overline{AB}$ and $\overline{CD}$ intersect at $E$, such that $\overline{AE} \cong \overline{CE}$ and $\angle BCE \cong \angle DAE$.

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

2. 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

3. Which diagram represents a correct construction of equilateral $\triangle ABC$, given side $AB$?

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

5 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) \((-3, 2)\)

6 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

7 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

8 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

9 In the diagram below of right triangle \(ABC\), \(\overline{CD}\) is the altitude to hypotenuse \(\overline{AB}\), \(CB = 6\), and \(AD = 5\).

![Diagram of triangle ABC with altitude CD]

What is the length of \(\overline{BD}\)?
1) 5
2) 9
3) 3
4) 4

10 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
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 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) $(x + 7)^2 + (y - 3)^2 = 16$

13 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) $(x - 2)^2 + (y + 8)^2 = 81$

14 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

15 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
16 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

17 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

18 When a quadrilateral is reflected over the line \( y = x \), which geometric relationship is not preserved?
1) congruence
2) orientation
3) parallelism
4) perpendicularity

19 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) \( \triangle DCE \cong \triangle BCE \)

20 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) \( y = 2x - 1 \)

21 If \( \triangle JKL \cong \triangle MNO \), which statement is always true?
1) \( \angle KLI \cong \angle NMO \)
2) \( \angle KJL \cong \angle MON \)
3) \( \overline{JL} \cong \overline{MO} \)
4) \( \overline{JK} \cong \overline{ON} \)
22. 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.

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

23. 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

24. 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

25. 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) $288\pi$

26. 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) $(5, -2)$
27 What is an equation of circle $O$ shown in the graph below?

![Graph of circle with center at (-1,3) and radius 5]

1) $(x+1)^2 + (y-3)^2 = 25$
2) $(x-1)^2 + (y+3)^2 = 25$
3) $(x-5)^2 + (y+6)^2 = 25$
4) $(x+5)^2 + (y-6)^2 = 25$

28 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

29 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

30 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) $y = \frac{1}{2}x + 1$

31 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) $\angle ABC \cong \angle EDF$

32 In the diagram below of $\triangle ABC$, $D$ is the midpoint of $AB$, and $E$ is the midpoint of $BC$.

![Diagram of triangle with midpoints]

If $AC = 4x + 10$, which expression represents $DE$?

1) $x + 2.5$
2) $2x + 5$
3) $2x + 10$
4) $8x + 20$
33. 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

34. 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

35. Pentagon $PQRST$ has $PQ$ parallel to $TS$. After a translation of $T_2\,-\,\vec{s}$, which line segment is parallel to $P'Q'$?
1) $R'Q'$
2) $R'S'$
3) $T'S'$
4) $T'P'$

36. 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

37. 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) $AB + CD = AD$

38. 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
39 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

40 In the diagram below of circle $O$, chord $AB$ is parallel to chord $GH$. Chord $CD$ intersects $AB$ at $E$ and $GH$ at $F$.

Which statement must be true?
1) $\overrightarrow{AF}$ bisects side $BC$
2) $\overrightarrow{AF}$ bisects $\angle BAC$
3) $\overrightarrow{AF} \perp BC$
4) $\triangle ABG \sim \triangle ACG$

41 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.

Which statement must be true?
1) $\overrightarrow{AF}$ bisects side $BC$
2) $\overrightarrow{AF}$ bisects $\angle BAC$
3) $\overrightarrow{AF} \perp BC$
4) $\triangle ABG \sim \triangle ACG$

42 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 $90^\circ$. 
43 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

44 In the diagram below, $AB$ is perpendicular to plane $AEFG$.

Which plane must be perpendicular to plane $AEFG$?

1) $ABCE$
2) $BCDH$
3) $CDEF$
4) $HDFG$

45 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) $(x - 4)^2 + y^2 = 36$

46 In the diagram below, point $P$ is the centroid of $\triangle ABC$.

If $PM = 2x + 5$ and $BP = 7x + 4$, what is the length of $PM$?

1) 9
2) 2
3) 18
4) 27

47 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
48 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

49 When solved graphically, what is the solution to the following system of equations?
\[
y = x^2 - 4x + 6
\]
\[
y = x + 2
\]
1) (1,4)
2) (4,6)
3) (1,3) and (4,6)
4) (3,1) and (6,4)

50 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.

51 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 $c$.

52 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) $\frac{1}{10}$

53 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) $y = -\frac{3}{2}x + 2$
54 In the diagram below of circle O, chord $\overline{AB}$ is parallel to chord $\overline{CD}$.

Which statement must be true?
1) $\overline{AC} \cong \overline{BD}$
2) $\overline{AB} \cong \overline{CD}$
3) $\overline{AB} \cong \overline{CD}$
4) $\overline{ABD} \cong \overline{CDB}$

55 In $\triangle AED$ with $\overline{ABCD}$ shown in the diagram below, $\overline{EB}$ and $\overline{EC}$ are drawn.

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

56 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

57 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

58 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°

59 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) $(-15,-8)$
60. In the diagram below of rhombus $ABCD$, $m\angle C = 100$. What is $m\angle DBC$?
   1) 40
   2) 45
   3) 50
   4) 80

61. The graph below shows $JT$ and its image, $J'T'$, after a transformation. Which transformation would map $JT$ onto $J'T'$?
   1) translation
   2) glide reflection
   3) rotation centered at the origin
   4) reflection through the origin

62. Given that $ABCD$ is a parallelogram, a student wrote the proof below to show that a pair of its opposite angles are congruent.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $ABCD$ is a parallelogram.</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. $BC = AD$</td>
<td>2. Opposite sides of a parallelogram are congruent.</td>
</tr>
<tr>
<td>$\overline{AB} = \overline{DC}$</td>
<td>3. Reflexive Postulate of Congruency</td>
</tr>
<tr>
<td>3. $\overline{AC} = \overline{CA}$</td>
<td></td>
</tr>
<tr>
<td>4. $\triangle ABC \cong \triangle CDA$</td>
<td>4. Side-Side-Side</td>
</tr>
<tr>
<td>5. $\angle B \cong \angle D$</td>
<td></td>
</tr>
</tbody>
</table>

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.

63. If $\overrightarrow{AB}$ is contained in plane $P$, and $\overrightarrow{AB}$ is perpendicular to plane $R$, which statement is true?
   1) $\overrightarrow{AB}$ is parallel to plane $R$.
   2) Plane $P$ is parallel to plane $R$.
   3) $\overrightarrow{AB}$ is perpendicular to plane $P$.
   4) Plane $P$ is perpendicular to plane $R$. 
64. As shown in the diagram below, lines \( m \) and \( n \) are cut by transversal \( p \).

![Diagram showing lines \( m \) and \( n \) cut by transversal \( p \).]

If \( m \angle 1 = 4x + 14 \) and \( m \angle 2 = 8x + 10 \), lines \( m \) and \( n \) are parallel when \( x \) equals
1) 1  
2) 6  
3) 13  
4) 17

66. 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 \( D \).

67. 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) \( 3 < AC < 7 \)

68. 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

69. 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) \( y = 3 \)
70 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) $R_{90}$

71 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) $(x - 2)^2 + (y + 2)^2 = 3$

72 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

73 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)
74. 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) \( \sqrt{233} \)

75. Which graph represents a circle whose equation is \((x + 2)^2 + y^2 = 16\)?

76. 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) \( m\angle D = m\angle F \)

77. 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

78. 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) \( 2,160\pi \)

79. 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) \( y = -\frac{1}{3}x + 3 \)
80 If the vertex angles of two isosceles triangles are congruent, then the triangles must be
1) acute
2) congruent
3) right
4) similar

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

82 In scalene triangle \( ABC \), \( \angle B = 45 \) and \( \angle C = 55 \).
What is the order of the sides in length, from longest to shortest?
1) \( AB, BC, AC \)
2) \( BC, AC, AB \)
3) \( AC, BC, AB \)
4) \( BC, AB, AC \)

83 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) 60º
2) 120º
3) 180º
4) 300º

84 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
85 Point M is the midpoint of \(AB\). 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) \((-7, -2)\)

86 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

87 As shown in the diagram below, \(EF\) intersects planes \(P\), \(Q\), and \(R\).

If \(EF\) 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 \(P\).

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

89 As shown in the diagram of \(\triangle ACD\) below, B is a point on \(AC\) and \(DB\) is drawn.

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) \(\overline{BD}\)

90 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) \(y = \frac{3}{2}x + 6\)
91 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

92 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) $(-1,3)$

93 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) $2\sqrt{41}$

94 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) $y = 2x - 12$

95 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) $(-8,-12)$

96 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 not sufficient to show that planes $R$ and $S$ are perpendicular?
1) $FA \perp DE$
2) $AD \perp AF$
3) $BC \perp FJ$
4) $DE \perp BC$

97 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
98. 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

99. 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) $3x + 4y = 14$

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

What is the length of $LF$?
1) 6
2) 8
3) 3
4) 4

101. Which quadrilateral has diagonals that always bisect its angles and also bisect each other?
1) rhombus
2) rectangle
3) parallelogram
4) isosceles trapezoid

102. 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

103. 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) $\frac{5}{3}$
104 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

105 In \( \triangle FGH \), \( \angle F = 42 \) and an exterior angle at vertex \( H \) has a measure of 104. What is \( \angle G \)?
1) 34
2) 62
3) 76
4) 146

106 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) \( y = \frac{3}{2}x + 1 \)
2) \( y = \frac{2}{3}x + \frac{4}{3} \)
3) \( y = \frac{3}{2}x - 2 \)
4) \( y = -\frac{2}{3}x + \frac{8}{3} \)

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

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

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

109 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) \((-4b, 3a)\)
110 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

111 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

112 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) $\{15,36,39\}$

113 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

114 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) $y = -2x - 5$

115 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

116 The number of degrees in the sum of the interior angles of a pentagon is
1) 72  
2) 360  
3) 540  
4) 720
117 The diagram below represents a rectangular solid.

Which statement must be true?
1) \( \overline{EH} \) and \( \overline{BC} \) are coplanar
2) \( \overline{FG} \) and \( \overline{AB} \) are coplanar
3) \( \overline{EH} \) and \( \overline{AD} \) are skew
4) \( \overline{FG} \) and \( \overline{CG} \) are skew

118 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

119 Segment \( \overline{AB} \) 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) \((-5,2)\)

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

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

121 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.

122 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.
123 In the diagram below of \(\triangle BCD\), side \(DB\) is extended to point \(A\).

Which statement must be true?
1) \(m\angle C > m\angle D\)
2) \(m\angle ABC < m\angle D\)
3) \(m\angle ABC > m\angle C\)
4) \(m\angle ABC > m\angle C + m\angle D\)

124 In the diagram below, \(DE\) 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 \(\triangle CAB\)

125 What is the measure of each interior angle of a regular hexagon?
1) 60°
2) 120°
3) 135°
4) 270°

126 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) \(y = \frac{5}{3}x + 1\)

127 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
128 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.

129 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.

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

131 In the diagram below, $\overline{EF}$ 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

132 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) $\sqrt{50}$
133 Which graph represents a circle with the equation \((x - 3)^2 + (y + 1)^2 = 4\)?

1)  

2)  

3)  

4)  

134 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

135 In the diagram of \(\triangle ABC\) shown below, \(DE \parallel BC\).

If \(AB = 10\), \(AD = 8\), and \(AE = 12\), what is the length of \(EC\)?
1) 6
2) 2
3) 3
4) 15
136 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) \((x - 1)^2 + (y + 4)^2 = 25\)

137 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) \(\frac{(n - 2) \cdot 180}{n}\)

138 In \(\triangle ABC\) shown below, \(P\) is the centroid and \(BF = 18\).

What is the length of \(BP\)?
1) 6
2) 9
3) 3
4) 12

139 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

140 .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) \(m\angle ABD = m\angle DBC\)
2) \(\frac{1}{2} (m\angle ABC) = m\angle ABD\)
3) \(2(m\angle DBC) = m\angle ABC\)
4) \(2(m\angle ABC) = m\angle CBD\)
141 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) \((x - 5)^2 + (y - 4)^2 = 25\)

142 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

143 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) \(3x + y = 0\)

144 In the diagram below of \(\triangle ACE\), medians \(AD, EB,\) and \(CF\) 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

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

If \(m\angle AEC = 34\) and \(m\angle AC = 50\), what is \(m\angle DB\)?
1) 16
2) 18
3) 68
4) 118
146 Which diagram shows the construction of the perpendicular bisector of \(AB\)?

1) 

2) 

3) 

4) 

147 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) \(CB \cong XZ\)

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

What is the length of \(CE\)?
1) \(4\sqrt{3}\)
2) \(2\sqrt{3}\)
3) \(8\sqrt{2}\)
4) \(4\sqrt{2}\)
149 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) \( \angle BAC \cong \angle EDF \)

150 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

151 In rhombus \( ABCD \), the diagonals \( \overline{AC} \) and \( \overline{BD} \) intersect at \( E \). If \( AE = 5 \) and \( BE = 12 \), what is the length of \( AB \)?

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

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

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

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

Which expression is not always true?

1) \( \angle DAE \cong \angle BCE \)
2) \( \angle DEC \cong \angle BEA \)
3) \( AC \cong DB \)
4) \( DE \cong EB \)

154 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) \( 2\sqrt{26} \)
155 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 $N'O'$

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

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157 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 $n$.

158 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

159 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
160 In the diagram below of \( \triangle ABC \), \( AE \cong BE \), \( AF \cong CF \), and \( CD \cong BD \).

Point \( P \) must be the
1) centroid
2) circumcenter
3) Incenter
4) orthocenter

161 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

162 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

163 In the diagram below of \( \triangle ABC \), \( AB \cong AC \), \( m \angle A = 3x \), and \( m \angle B = x + 20 \).

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

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

165 In \( \triangle PQR \), \( \angle PRQ \) is a right angle and \( RT \) is drawn perpendicular to hypotenuse \( PQ \). If \( PT = x \), \( RT = 6 \), and \( TQ = 4x \), what is the length of \( PQ \)?
1) 9
2) 12
3) 3
4) 15
166 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

167 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) \( y = -\frac{1}{2}x - \frac{25}{2} \)

168 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

169 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

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

171 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) \( \sqrt{145} \)

172 A transformation of a polygon that always preserves both length and orientation is
   1) dilation
   2) translation
   3) line reflection
   4) glide reflection
173 Which graph could be used to find the solution to the following system of equations?

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

174 In \( \triangle ABC \), point \( D \) is on \( AB \), and point \( E \) is on \( BC \) 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

175 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) \( D_{1\frac{1}{2}} \circ R_{180^\circ} \)
4) \( D_{1\frac{1}{2}} \circ R_{90^\circ} \)
176 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

177 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

178 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) $(-1, \frac{1}{2})$
3) $(-1,3)$
4) $(3,4 \frac{1}{2})$

179 The diagram below shows a right pentagonal prism.

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

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

181 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) $-6$
182 The diagonal $AC$ is drawn in parallelogram $ABCD$. Which method can not be used to prove that $\triangle ABC \cong \triangle CDA$?
1) SSS
2) SAS
3) SSA
4) ASA

183 What is the measure of an interior angle of a regular octagon?
1) 45°
2) 60°
3) 120°
4) 135°

184 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

185 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

186 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) $(7, -4)$

187 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) $(x + 2)^2 + (y + 3)^2 = 4$
188 In the diagram below of right triangle $ACB$, altitude $CD$ is drawn to hypotenuse $AB$.

![Diagram of right triangle with altitude drawn to hypotenuse]

If $AB = 36$ and $AC = 12$, what is the length of $AD$?
1) 32
2) 6
3) 3
4) 4

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

190 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

191 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 $\sqrt{13}$

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

![Diagram of a cylinder]

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

193 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) $3y = -2x + 12$
194 Based on the diagram below, which statement is true?

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

195 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

196 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.

197 Based on the construction below, which statement must be true?

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

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

If \( \angle BCD = 6x + 2 \), \( \angle BAC = 3x + 15 \), and \( \angle ABC = 2x - 1 \), what is the value of \( x \)?
1) 12
2) \( \frac{10}{11} \)
3) 16
4) \( \frac{18}{9} \)
199 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 \( AB > BC \)

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

If \( CF = 24 \), what is the length of \( FG \)?
1) 8
2) 10
3) 12
4) 16

201 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

202 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

203 Which equation represents circle \( K \) shown in the graph below?
204 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

205 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°

206 In the diagram of circle $O$ below, chords $AB$ and $CD$ are parallel, and $BD$ is a diameter of the circle. If $m\angle AD = 60$, what is $m\angle CDB$?
1) 20
2) 30
3) 60
4) 120

207 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

208 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) $2\sqrt{5}$

209 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
210 The endpoints of $\overline{AB}$ are $A(3,2)$ and $B(7,1)$. If $A''B''$ is the result of the transformation of $A'B'$ under $D_2 \circ T_{-4,3}$, 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 $B''(22,-4)$

211 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) $m\angle RQT > m\angle PQR$

212 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) $12$

213 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) $\frac{4}{3}$

214 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) $288\pi$

215 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) $\overline{AB}$ and $\overline{DC}$
2) $\overline{AB}$ and $\overline{BC}$
3) $\overline{AD}$ and $\overline{BC}$
4) $\overline{AC}$ and $\overline{BD}$

216 In the diagram below of $\triangle AGE$ and $\triangle OLD$, $\angle GAE \cong \angle LOD$, and $\overline{AE} \cong \overline{OD}$.

To prove that $\triangle AGE$ and $\triangle OLD$ are congruent by SAS, what other information is needed?

1) $\overline{GE} \cong \overline{LD}$
2) $\overline{AG} \cong \overline{OL}$
3) $\angle AGE \cong \angle OLD$
4) $\angle AEG \cong \angle ODL$
217 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

218 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) $-\frac{5}{3}$

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

220 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

221 In the diagram of circle $O$ below, chord $\overline{AB}$ intersects chord $\overline{CD}$ at $E$, $DE = 2x + 8$, $EC = 3$, $AE = 4x - 3$, and $EB = 4$.

What is the value of $x$?
1) 1
2) 3.6
3) 5
4) 10.25
222. 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) $2y + 10x = 8$

223. In the diagram below of regular pentagon $ABCDE$, $EB$ is drawn.

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

224. 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) $\frac{3}{2}$

225. 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) $x + \frac{2}{3}x = 6$

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

227. 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
228 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\}

229 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 \(k_2\).

230 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.

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

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

232 Given \(\triangle ABC\) with base \(AFEDC\), median \(BF\), altitude \(BD\), and \(BE\) bisects \(\angle ABC\), which conclusion is valid?

1) \(\angle FAB \cong \angle ABF\)
2) \(\angle ABF \cong \angle CBD\)
3) \(\overline{CE} \cong \overline{EA}\)
4) \(\overline{CF} \cong \overline{FA}\)
233 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

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

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

235 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

236 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.

237 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

238 Point $A$ is not contained in plane $B$. How many lines can be drawn through point $A$ that will be perpendicular to plane $B$?

1) one  
2) two  
3) zero  
4) infinite
239 Which graph represents a circle with the equation 
\((x - 5)^2 + (y + 1)^2 = 9\)?

1)  

2)  

3)  

4)  

240 One step in a construction uses the endpoints of \(\overline{AB}\) to create arcs with the same radii. The arcs intersect above and below the segment. What is the relationship of \(\overline{AB}\) and the line connecting the points of intersection of these arcs?
1) collinear
2) congruent
3) parallel
4) perpendicular

241 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) \(y = \frac{1}{3}x - 2\)

242 Which transformation can map the letter \(S\) onto itself?
1) glide reflection
2) translation
3) line reflection
4) rotation

243 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.
244 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) $AC + CB = AB$

245 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 $R$.

246 The diagram below illustrates the construction of $\overrightarrow{PS}$ parallel to $\overrightarrow{RQ}$ 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) $\overline{PS} \cong \overline{RQ}$

247 In the diagram of circle $O$ below, chord $\overline{CD}$ is parallel to diameter $\overline{AOB}$ and $m\angle C = 30$.

What is $m\overarc{CD}$?
1) 150
2) 120
3) 100
4) 60
248 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

249 In the diagram below of circle $O$, chords $AD$ and $BC$ intersect at $E$, $mAC = 87$, and $mBD = 35$.

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

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

\[
y = (x + 3)^2 - 4 \\
y = 2x + 5
\]
1) $(0, -4)$
2) $(-4, 0)$
3) $(-4, -3)$ and $(0, 5)$
4) $(-3, -4)$ and $(5, 0)$

251 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 $\triangle ABC$

252 In the diagram of $\triangle ABC$ and $\triangle EDC$ below, $AE$ and $BD$ 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
253 Square $LMNO$ is shown in the diagram below.

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

1) $\left(\frac{4}{2}, -\frac{1}{2}\right)$
2) $\left(-\frac{3}{2}, \frac{1}{2}\right)$
3) $\left(-\frac{1}{2}, \frac{3}{2}\right)$
4) $\left(-\frac{1}{2}, \frac{4}{2}\right)$

254 A quadrilateral whose diagonals bisect each other and are perpendicular is a
1) rhombus
2) rectangle
3) trapezoid
4) parallelogram

255 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) $y - 2x = 3$

256 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

257 The figure in the diagram below is a triangular prism.

Which statement must be true?

1) $DE \cong AB$
2) $AD \cong BC$
3) $AD \parallel CE$
4) $DE \parallel BC$
258 In the diagram below, tangent $\overline{AB}$ and secant $\overline{ACD}$ are drawn to circle $O$ from an external point $A$, $AB = 8$, and $AC = 4$.

What is the length of $CD$?
1) 16  
2) 13  
3) 12  
4) 10

259 In the diagram below of $\triangle ABC$, $\overline{CD}$ 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) $\angle DBG \cong \angle EBG$

260 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.

261 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) $BC < AC < AB$
262 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) $m \angle ABC = 60$

263 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

264 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)

265 In $\triangle ABC$, $\overline{AB} \cong \overline{BC}$. 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) $\overline{AD} \cong \overline{BD}$
4) $\overline{AD} \cong \overline{DC}$

266 The rectangle $ABCD$ shown in the diagram below will be reflected across the x-axis.

267 In the diagram of $\triangle ABC$ below, $\overline{AB} \cong \overline{AC}$. The measure of $\angle B$ is $40^\circ$.

What is the measure of $\angle A$?

1) $40^\circ$
2) $50^\circ$
3) $70^\circ$
4) $100^\circ$
268 The lateral faces of a regular pyramid are composed of
1) squares
2) rectangles
3) congruent right triangles
4) congruent isosceles triangles

269 In the diagram below, $\overline{PS}$ is a tangent to circle $O$ at point $S$, $\overline{PQ}$ is a secant, $PS = x$, $PQ = 3$, and $PR = x + 18$. What is the length of $\overline{PS}$?
1) 6
2) 9
3) 3
4) 27

270 In $\triangle PQR$, $PQ = 8$, $QR = 12$, and $RP = 13$. Which statement about the angles of $\triangle PQR$ must be true?
1) $\angle Q > \angle P > \angle R$
2) $\angle Q > \angle R > \angle P$
3) $\angle R > \angle P > \angle Q$
4) $\angle P > \angle R > \angle Q$

271 In the diagram below, $\triangle ABC \cong \triangle XYZ$.

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

272 The diagram below shows $\overline{AB}$ and $\overline{DE}$.

Which transformation will move $\overline{AB}$ onto $\overline{DE}$ 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) $r_{y=x}$
273 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

274 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

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

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

276 In the diagram below of trapezoid $RSUT$, $\overline{RS} \parallel \overline{TU}$, $X$ is the midpoint of $\overline{RT}$, and $V$ is the midpoint of $\overline{SU}$.

If $RS = 30$ and $XV = 44$, what is the length of $\overline{TU}$?
1) 37
2) 58
3) 74
4) 118
277 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) $r_{y=x}$

278 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 $EF$

279 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) $y = -2x - 9$

280 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

281 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) $x^2 + y^2 = 16$

282 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) $(1,-1)$
283 Which diagram shows the construction of an equilateral triangle?

1)

2)

3)

4)

284 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.

285 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.

286 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) \( \triangle AEC \sim \triangle BED \)
3) \( \angle ACB \cong \angle CBD \)
4) \( \overline{CA} \cong \overline{DB} \)
287 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.

288 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) $\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} = \frac{3}{2}$

289 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) $\sqrt{110}$

290 In the diagram of trapezoid $ABCD$ below, diagonals $\overline{AC}$ and $\overline{BD}$ intersect at $E$ and $\triangle ABC \cong \triangle DCB$.

Which statement is true based on the given information?

1) $\overline{AC} \cong \overline{BC}$
2) $\overline{CD} \cong \overline{AD}$
3) $\angle CDE \cong \angle BAD$
4) $\angle CDB \cong \angle BAC$
291 In the diagram below, the length of the legs $\overline{AC}$ and $\overline{BC}$ of right triangle $ABC$ are 6 cm and 8 cm, respectively. Altitude $\overline{CD}$ is drawn to the hypotenuse of $\triangle ABC$.

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

292 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

293 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) $(x + 3)^2 + (y - 5)^2 = 4$

294 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

295 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 $\mathcal{P}$.

296 In plane $\mathcal{P}$, 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 $\mathcal{P}$
2) parallel to plane $\mathcal{P}$
3) perpendicular to plane $\mathcal{P}$
4) skew to plane $\mathcal{P}$
297 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

298 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) \( \angle C, \angle A, \angle B \)

299 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) \( y = -2x + 17 \)

300 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

301 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) \( m\angle DBF = m\angle EBF \)
302 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

303 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

304 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

305 The endpoints of $\overline{CD}$ are $C(−2,−4)$ and $D(6,2)$. What are the coordinates of the midpoint of $\overline{CD}$?

1) (2,3)
2) (2,−1)
3) (4,−2)
4) (4,3)

306 In the diagram below of parallelogram $ABCD$ with diagonals $\overline{AC}$ and $\overline{BD}$, $\angle 1 = 45$ and $\angle DCB = 120$.

What is the measure of $\angle 2$?

1) 15º
2) 30º
3) 45º
4) 60º
307 If a line segment has endpoints \( A(3x + 5, 3y) \) and \( B(x - 1, -y) \), what are the coordinates of the midpoint of \( \overline{AB} \)?

1) \((x + 3, 2y)\)
2) \((2x + 2, y)\)
3) \((2x + 3, y)\)
4) \((4x + 4, 2y)\)

308 Which transformation of the line \( x = 3 \) results in an image that is perpendicular to the given line?

1) \( r_{y\text{-axis}} \)
2) \( r_{x\text{-axis}} \)
3) \( r_{y = x} \)
4) \( r_{x = 1} \)

309 In the diagram of \( \triangle ABC \) and \( \triangle DEF \) below, \( \overline{AB} \cong \overline{DE} \), \( \angle A \cong \angle D \), 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

310 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

311 In the diagram below of circle \( O \), chords \( \overline{AE} \) and \( \overline{DC} \) 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

312 Tangents \( \overline{PA} \) and \( \overline{PB} \) are drawn to circle \( O \) from an external point, \( P \), and radii \( \overline{OA} \) and \( \overline{OB} \) are drawn. If \( m\angle APB = 40 \), what is the measure of \( \angle AOB \)?

1) 140°
2) 100°
3) 70°
4) 50°
313 In the diagram below of $\triangle ACT$, $BE \parallel AT$.

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

315 If $\triangle ABC \sim \triangle ZXY$, $m\angle A = 50$, and $m\angle C = 30$, what is $m\angle X$?
1) 30
2) 50
3) 80
4) 100

316 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.

317 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) $\frac{1}{2}$

318 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) $m\angle C < m\angle B$
319 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.

320 \( \triangle ABC \) 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) \( \frac{\text{m} \angle A}{\text{m} \angle D} \)
2) \( \frac{\text{m} \angle B}{\text{m} \angle F} \)
3) \( \frac{\text{area of } \triangle ABC}{\text{area of } \triangle DEF} \)
4) \( \frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} \)

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

322 A support beam between the floor and ceiling of a house forms a 90° 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°
2) 60°
3) 90°
4) 180°

323 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
324 Given the system of equations: \( y = x^2 - 4x \)  
\[ x = 4 \]
The number of points of intersection is
1) 1  
2) 2  
3) 3  
4) 0

325 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

326 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 \( k \).

327 The equation of a circle is \( (x - 2)^2 + (y + 4)^2 = 4 \). Which diagram is the graph of the circle?
328. 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

329. 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

330. 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) $x^2 + 6x + 8$

331. 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.

332. Which geometric principle is used in the construction shown below?

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.
333 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

334 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) $\frac{AB + BC + AC}{RS + ST + RT} = \frac{AB}{RS}$

335 In an equilateral triangle, what is the difference between the sum of the exterior angles and the sum of the interior angles?
1) 180°
2) 120°
3) 90°
4) 60°

336 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.
337 Given: Two is an even integer or three is an even integer. Determine the truth value of this disjunction. Justify your answer.

338 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.

339 The volume of a cylinder is 12,566.4 cm$^3$. The height of the cylinder is 8 cm. Find the radius of the cylinder to the nearest tenth of a centimeter.

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

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

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

343 In $\triangle RST$, $m\angle RST = 46$ and $\overline{RS} \cong \overline{ST}$. Find $m\angle STR$.

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

345 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.
346 Using a compass and straightedge, construct a line perpendicular to $AB$ through point $P$. [Leave all construction marks.]

347 Triangle $XYZ$, shown in the diagram below, is reflected over the line $x = 2$. State the coordinates of $X'Y'Z'$, the image of $\Delta XYZ$.

348 In the diagram below, point $M$ is located on $\overrightarrow{AB}$. Sketch the locus of points that are 1 unit from $\overrightarrow{AB}$ and the locus of points 2 units from point $M$. Label with an $\text{x}$ all points that satisfy both conditions.

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

350 In circle $O$, diameter $\overline{RS}$ 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.
351 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?

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

353 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?

354 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 $r_x$. [The use of the grid is optional.]

355 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 $\angle C$. 
356 Determine whether the two lines represented by the equations \( y = 2x + 3 \) and \( 2y + x = 6 \) are parallel, perpendicular, or neither. Justify your response.

357 Using a compass and straightedge, construct the bisector of \( \angle CBA \). [Leave all construction marks.]

358 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 \( EB \).

359 A sphere has a diameter of 18 meters. Find the volume of the sphere, in cubic meters, in terms of \( \pi \).

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

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

362 The degree measures of the angles of \( \triangle ABC \) are represented by \( x \), \( 3x \), and \( 5x - 54 \). Find the value of \( x \).
363 Write an equation of the circle graphed in the diagram below.

364 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.]

365 In the diagram below of circle $O$, diameter $AB$ is perpendicular to chord $CD$ at $E$. If $AO = 10$ and $BE = 4$, find the length of $CE$.

366 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.
367 In the diagram below, \( \ell \parallel m \) and \( \overline{QR} \perp \overline{ST} \) at \( R \).

If \( m \angle 1 = 63 \), find \( m \angle 2 \).

368 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.]

369 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.]

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

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

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

373 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 $(x,y) \rightarrow (x-5,y-1)$.

374 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 $m\angle QPT$. 

(Not drawn to scale)
375 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.

376 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.

377 Using a compass and straightedge, on the diagram below of $\overrightarrow{RS}$, construct an equilateral triangle with $\overline{RS}$ as one side. [Leave all construction marks.]

378 The endpoints of $\overline{PQ}$ are $P(-3,1)$ and $Q(4,25)$. Find the length of $\overline{PQ}$.

379 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 $x$.

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

381 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.
382 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.

![Diagram of parallelogram QRST]

383 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.

![Graph showing locus]

384 Two lines, $AB$ and $CRD$, are parallel and 10 inches apart. Sketch the locus of all points that are equidistant from $AB$ and $CRD$ and 7 inches from point $R$. Label with an $X$ each point that satisfies both conditions.

![Sketch of parallel lines]

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

![Construction of angle bisector]
386 In the diagram below of \( \triangle GJK \), \( H \) is a point on \( GJ \), \( HJ \equiv JK \), \( \angle G = 28 \), and \( \angle GJK = 70 \). Determine whether \( \triangle GHK \) is an isosceles triangle and justify your answer.

![Diagram of \( \triangle GJK \)](image1)

387 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.

388 In the diagram below of circle \( C \), \( QR \) 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 \( R \).

![Diagram of circle with points](image2)

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

![Diagram of angle bisector](image3)

390 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 \( AB \parallel A'B' \).
391 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.

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

393 In the diagram below of \(\triangle TEM\), medians \(TB\), \(EC\), and \(MA\) intersect at \(D\), and \(TB = 9\). Find the length of \(TD\).

394 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 \(T_{-3,1} \circ D_2\).

395 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 \(\triangle ABC\).

396 In right \(\triangle DEF\), \(m\angle D = 90\) and \(m\angle F\) is 12 degrees less than twice \(m\angle E\). Find \(m\angle E\).
397 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.

398 Find an equation of the line passing through the point $(5,4)$ and parallel to the line whose equation is $2x + y = 3$.

399 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 $m \angle BAD$.

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

401 On the line segment below, use a compass and straightedge to construct equilateral triangle $ABC$. [Leave all construction marks.]
402 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.

403 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 $288 \text{ cm}^3$.

404 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 $\pi$.

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

406 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 $\times$ all points that satisfy both conditions.

407 Using a compass and straightedge, and $AB$ below, construct an equilateral triangle with all sides congruent to $AB$. [Leave all construction marks.]
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.
409 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.]

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

411 Given: $JKLM$ is a parallelogram.

$JM \cong LN$

$\angle LMN \cong \angle LNM$

Prove: $JKLM$ is a rhombus.

412 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.

413 In the diagram below, circles $X$ and $Y$ have two tangents drawn to them from external point $T$. The points of tangency are $C$, $A$, $S$, and $E$. The ratio of $TA$ to $AC$ is $1:3$. If $TS = 24$, find the length of $SE$. (Not drawn to scale)
414 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.

415 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 $m\angle K'$. Find the length of $K'M'$. Justify your answer.

416 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 $h$.

417 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.]

418 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 $\times$ all points that satisfy both conditions.
419 A paint can is in the shape of a right circular cylinder. The volume of the paint can is 600\(\text{in}^3\) 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.

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

421 Given: \(AD\) bisects \(BC\) at \(E\).
\[
\begin{align*}
AB & \perp BC \\
DC & \perp BC
\end{align*}
\]
Prove: \(AB \cong DC\)

422 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.]

423 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.
424 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.

425 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.

426 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.]

427 In the diagram below of circle $O$, chords $DF$, $DE$, $FG$, and $EG$ are drawn such that $m\angle DF : m\angle FE : m\angle EG : m\angle GD = 5:2:1:7$. Identify one pair of inscribed angles that are congruent to each other and give their measure.
428 In the diagram below, tangent $ML$ and secant $MNK$ are drawn to circle $O$. The ratio \( mLN : mNK : mKL \) is 3:4:5. Find \( m\angle LMK \).

429 In the diagram below, $BFCE$, $AB \perp BE$, $DE \perp BE$, and $\angle BFD \cong \angle ECA$. Prove that $\triangle ABC \sim \triangle DEF$.

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

431 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 $PS$. 
432 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 $\triangle D'E'G'$. State the coordinates of the vertices $D'$, $E'$, and $G'$. Justify that this transformation preserves distance.

433 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]

434 In the diagram below of quadrilateral $ABCD$ with diagonal $\overline{BD}$, $\angle A = 93$, $\angle ADB = 43$, $\angle C = 3x + 5$, $\angle BDC = x + 19$, and $\angle DBC = 2x + 6$. Determine if $AB$ is parallel to $DC$. Explain your reasoning.

435 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 $r_{x-axis} \circ r_{y=x}$ is performed on trapezoid $ABCD$. State the coordinates of trapezoid $A'B'C'D'$. [The use of the set of axes below is optional.]
436 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 \( T_{-3,1} \circ D_2 \).

437 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 \( X \) all possible locations for the new park.
438 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.]

439 Solve the following system of equations graphically.

\[2x^2 - 4x = y + 1\]
\[x + y = 1\]
440 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 \( GH \parallel DE \).

441 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 \( C'' \).
442 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[(x + 3)^2 + (y - 2)^2 = 25\]
\[2y + 4 = -x\]

443 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.
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.]
Geometry 6 Point Regents Exam Questions

445 Given: \( \triangle ABC \) and \( \triangle EDC \), C is the midpoint of \( \overline{BD} \) and \( \overline{AE} \)
Prove: \( AB \parallel DE \)

446 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 \( m\angle AC : m\angle CB = 3:1 \).

Determine \( m\angle CEB \). Determine \( m\angle F \). Determine \( m\angle DAC \).

447 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.]

448 In the diagram below, \( \overline{PA} \) and \( \overline{PB} \) are tangent to circle \( O \), \( \overline{OA} \) and \( \overline{OB} \) are radii, and \( \overline{OP} \) intersects the circle at \( C \). Prove: \( \angle AOP \cong \angle BOP \)
449 In the diagram below, quadrilateral $ABCD$ is inscribed in circle $O$, $AB \parallel DC$, and diagonals $AC$ and $BD$ are drawn. Prove that $\Delta ACD \cong \Delta BDC$.

450 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 $m\angle TAS$.

451 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.]

452 In the diagram below of quadrilateral $ABCD$, $AD \cong BC$ and $\angle DAE \cong \angle BCE$. Line segments $AC$, $DB$, and $FG$ intersect at $E$. Prove: $\Delta AEF \cong \Delta CEG$
453 Given: Quadrilateral $ABCD$, diagonal $AFEC$, $AE \cong FC$, $BF \perp AC$, $DE \perp AC$, $\angle 1 \cong \angle 2$
Prove: $ABCD$ is a parallelogram.

455 On the set of axes below, solve the following system of equations graphically for all values of $x$ and $y$.

$$y = (x - 2)^2 + 4$$
$$4x + 2y = 14$$

456 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.]
Geometry Multiple Choice Regents Exam Questions
Answer Section

1 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

2 ANS: 2

The slope of \( x + 2y = 3 \) is \( m = \frac{-A}{B} = \frac{-1}{2} \). \( m_\perp = 2 \).


3 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

4 ANS: 2

\[ 0 = (x + 9)(x - 4) \]

\( x = 4 \)

PTS: 2 REF: 011205ge STA: G.G.47 TOP: Similarity KEY: leg
20 + 8 + 10 + 6 = 44.

\[ y = mx + b \]
\[-1 = 2(2) + b \]
\[-5 = b \]

Opposite sides of a parallelogram are congruent and the diagonals of a parallelogram bisect each other.
22 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

23 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

24 ANS: 2 PTS: 2 REF: 061101ge STA: G.G.18
TOP: Constructions

25 ANS: 2
\[ V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \cdot \left(\frac{6}{2}\right)^3 \approx 36\pi \]

PTS: 2 REF: 081215ge STA: G.G.16 TOP: Volume and Surface Area

26 ANS: 2
\[ M_x = \frac{7+(-3)}{2} = 2, \quad M_y = \frac{-1+3}{2} = 1. \]

PTS: 2 REF: 011106ge STA: G.G.66 TOP: Midpoint

27 ANS: 1 PTS: 2 REF: 061110ge STA: G.G.72
TOP: Equations of Circles

28 ANS: 4 PTS: 2 REF: 081101ge STA: G.G.25
TOP: Compound Statements KEY: conjunction

29 ANS: 3 PTS: 2 REF: 011202ge STA: G.G.21
TOP: Centroid, Orthocenter, Incenter and Circumcenter

30 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

31 ANS: 4 PTS: 2 REF: 081216ge STA: G.G.45
TOP: Similarity KEY: basic

32 ANS: 2
\[ \frac{4x + 10}{2} = 2x + 5 \]

PTS: 2 REF: 011103ge STA: G.G.42 TOP: Midsegments
33 ANS: 1
\[ x^2 = 7(16 - 7) \]
\[ x^2 = 63 \]
\[ x = \sqrt{9 \cdot 7} \]
\[ x = 3\sqrt{7} \]

PTS: 2 REF: 061128ge STA: G.G.47 TOP: Similarity
KEY: altitude

34 ANS: 2 PTS: 2 REF: 061121ge STA: G.G.22
TOP: Locus

35 ANS: 3 PTS: 2 REF: 081104ge STA: G.G.55
TOP: Properties of Transformations

36 ANS: 2
\[ V = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \cdot \left(\frac{15}{2}\right)^3 \approx 1767.1 \]

PTS: 2 REF: 061207ge STA: G.G.16 TOP: Volume and Surface Area

37 ANS: 2
\[ AC = BD \]
\[ AC - BC = BD - BC \]
\[ AB = CD \]

PTS: 2 REF: 061206ge STA: G.G.27 TOP: Line Proofs

38 ANS: 2 PTS: 2 REF: 061202ge STA: G.G.24
TOP: Negations

39 ANS: 3
\[ \frac{180 - 70}{2} = 55 \]

PTS: 2 REF: 061205ge STA: G.G.52 TOP: Chords

40 ANS: 4
Parallel lines intercept congruent arcs.

PTS: 2 REF: 081201ge STA: G.G.52 TOP: Chords

41 ANS: 2 PTS: 2 REF: 081205ge STA: G.G.17
TOP: Constructions
42 ANS: 4
\[ x + 6y = 12 \quad \quad 3(x - 2) = -y - 4 \]
\[ 6y = -x + 12 \quad \quad -3(x - 2) = y + 4 \]
\[ y = \frac{1}{6}x + 2 \quad \quad m = -3 \]
\[ m = \frac{1}{6} \]

PTS: 2  REF: 011119ge  STA: G.G.63  TOP: Parallel and Perpendicular Lines

43 ANS: 1  PTS: 2  REF: 011122ge  STA: G.G.28
TOP: Triangle Congruency

44 ANS: 1  PTS: 2  REF: 081116ge  STA: G.G.7
TOP: Planes

45 ANS: 3  PTS: 2  REF: 061210ge  STA: G.G.71
TOP: Equations of Circles

46 ANS: 1
\[ 7x + 4 = 2(2x + 5). \quad PM = 2(2) + 5 = 9 \]
\[ 7x + 4 = 4x + 10 \]
\[ 3x = 6 \]
\[ x = 2 \]

PTS: 2  REF: 011226ge  STA: G.G.43  TOP: Centroid

47 ANS: 1  PTS: 2  REF: 061113ge  STA: G.G.63
TOP: Parallel and Perpendicular Lines

48 ANS: 3

PTS: 2  REF: 011101ge  STA: G.G.53  TOP: Segments Intercepted by Circle
KEY: two tangents

49 ANS: 3

PTS: 2  REF: 081118ge  STA: G.G.70  TOP: Quadratic-Linear Systems

50 ANS: 3  PTS: 2  REF: 011104ge  STA: G.G.38
TOP: Parallelograms
51 ANS: 1  PTS: 2  REF: 061108ge  STA: G.G.9
TOP: Planes

52 ANS: 2
\[ m = \frac{-A}{B} = \frac{-20}{-2} = 10, \quad m_\perp = \frac{1}{10} \]

PTS: 2  REF: 061219ge  STA: G.G.62  TOP: Parallel and Perpendicular Lines

53 ANS: 4
\[ m = \frac{-A}{B} = \frac{-3}{2} \cdot \quad y = mx + b \]
\[ -1 = \left( \frac{-3}{2} \right)(2) + b \]
\[ -1 = -3 + b \]
\[ 2 = b \]

PTS: 2  REF: 061226ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

54 ANS: 1
Parallel lines intercept congruent arcs.

PTS: 2  REF: 061105ge  STA: G.G.52  TOP: Chords

55 ANS: 1
\[ AB = CD \]
\[ AB + BC = CD + BC \]
\[ AC = BD \]

PTS: 2  REF: 081207ge  STA: G.G.27  TOP: Line Proofs

56 ANS: 1

PTS: 2  REF: 061211ge  STA: G.G.31  TOP: Isosceles Triangle Theorem

57 ANS: 2  PTS: 2  REF: 011215ge  STA: G.G.12
TOP: Volume

58 ANS: 2  PTS: 2  REF: 081214ge  STA: G.G.50
TOP: Tangents  KEY: point of tangency

59 ANS: 3
\[ -5 + 3 = -2 \quad 2 + -4 = -2 \]

PTS: 2  REF: 011107ge  STA: G.G.54  TOP: Translations

60 ANS: 1  PTS: 2  REF: 011112ge  STA: G.G.39
TOP: Special Parallelograms
61 ANS: 2 PTS: 2 REF: 061227ge STA: G.G.56
TOP: Identifying Transformations

62 ANS: 3 PTS: 2 REF: 081208ge STA: G.G.27
TOP: Quadrilateral Proofs

63 ANS: 4 PTS: 2 REF: 061213ge STA: G.G.5
TOP: Planes

64 ANS: 3
4x + 14 + 8x + 10 = 180
12x = 156
x = 13

PTS: 2 REF: 081213ge STA: G.G.35 TOP: Parallel Lines and Transversals

65 ANS: 2

\[ \sqrt{17^2 - 15^2} = 8, \quad 17 - 8 = 9 \]

PTS: 2 REF: 061221ge STA: G.G.49 TOP: Chords

66 ANS: 2 PTS: 2 REF: 011109ge STA: G.G.9
TOP: Planes

67 ANS: 2
5 - 3 = 2, 5 + 3 = 8

PTS: 2 REF: 011228ge STA: G.G.33 TOP: Triangle Inequality Theorem

68 ANS: 2 PTS: 2 REF: 081202ge STA: G.G.55
TOP: Properties of Transformations

69 ANS: 4
\( \overline{AB} \) is a vertical line, so its perpendicular bisector is a horizontal line through the midpoint of \( \overline{AB} \), which is (0,3).

PTS: 2 REF: 011225ge STA: G.G.68 TOP: Perpendicular Bisector

70 ANS: 2 PTS: 2 REF: 061201ge STA: G.G.59
TOP: Properties of Transformations

71 ANS: 1 PTS: 2 REF: 011220ge STA: G.G.72
TOP: Equations of Circles

72 ANS: 3
7x = 5x + 30
2x = 30
x = 15

PTS: 2 REF: 081109ge STA: G.G.35 TOP: Parallel Lines and Transversals
73 ANS: 3  PTS: 2  REF: 011110ge  STA: G.G.21
KEY: Centroid, Orthocenter, Incenter and Circumcenter

74 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

75 ANS: 3  PTS: 2  REF: 061220ge  STA: G.G.74
TOP: Graphing Circles

76 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

77 ANS: 3
\[ 180(n - 2) = n \left( 180 - \frac{180(n - 2)}{n} \right) \]
\[ 180n - 360 = 180n - 180n + 360 \]
\[ 180n = 720 \]
\[ n = 4 \]

PTS: 2  REF: 081223ge  STA: G.G.36  TOP: Interior and Exterior Angles of Polygons

78 ANS: 2
\[ V = \pi r^2 h = \pi \cdot 6^2 \cdot 15 = 540\pi \]

PTS: 2  REF: 011117ge  STA: G.G.14  TOP: Volume

79 ANS: 4
\[ m_\perp = -\frac{1}{3}. \ y = mx + b \]
\[ 6 = -\frac{1}{3} (-9) + b \]
\[ 6 = 3 + b \]
\[ 3 = b \]

PTS: 2  REF: 061215ge  STA: G.G.64  TOP: Parallel and Perpendicular Lines

80 ANS: 4  PTS: 2  REF: 061124ge  STA: G.G.31
TOP: Isosceles Triangle Theorem
81 ANS: 2
7\(x = 5x + 30\)
2\(x = 30\)
x = 15

PTS: 2  REF: 061106ge  STA: G.G.35  TOP: Parallel Lines and Transversals

82 ANS: 4
m\(\angle A\) = 80

PTS: 2  REF: 011115ge  STA: G.G.34  TOP: Angle Side Relationship

83 ANS: 2  PTS: 2  REF: 061107ge  STA: G.G.32
TOP: Exterior Angle Theorem

84 ANS: 2
6\(x + 42 = 18x - 12\)

54 = 12\(x\)

\(x = \frac{54}{12} = 4.5\)

PTS: 2  REF: 011201ge  STA: G.G.35  TOP: Parallel Lines and Transversals

85 ANS: 4
\(-5 = \frac{-3 + x}{2}\),  \(2 = \frac{6 + y}{2}\)

\(-10 = -3 + x\),  \(4 = 6 + y\)

\(-7 = x\),  \(-2 = y\)

PTS: 2  REF: 081203ge  STA: G.G.66  TOP: Midpoint

86 ANS: 2  PTS: 2  REF: 081226ge  STA: G.G.69
TOP: Triangles in the Coordinate Plane

87 ANS: 4  PTS: 2  REF: 061203ge  STA: G.G.9
TOP: Planes

88 ANS: 3  PTS: 2  REF: 081209ge  STA: G.G.71
TOP: Equations of Circles

89 ANS: 1

PTS: 2  REF: 081219ge  STA: G.G.34  TOP: Angle Side Relationship
90 ANS: 4
\[ y = mx + b \]
\[ 3 = \frac{3}{2}(-2) + b \]
\[ 3 = -3 + b \]
\[ 6 = b \]

PTS: 2 REF: 011114ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

91 ANS: 1
PTS: 2 REF: 081121ge STA: G.G.39 TOP: Special Parallelograms

92 ANS: 1
The diagonals of a parallelogram intersect at their midpoints. \( M_{AB} \left( \frac{1+3}{2}, \frac{5+(-1)}{2} \right) = (2,2) \)

PTS: 2 REF: 061209ge STA: G.G.69 TOP: Quadrilaterals in the Coordinate Plane

93 ANS: 4
\[ d = \sqrt{(-5-3)^2 + (4-(-6))^2} = \sqrt{64+100} = \sqrt{164} \approx 2\sqrt{41} \]

PTS: 2 REF: 011121ge STA: G.G.67 TOP: Distance KEY: general

94 ANS: 1
\[ m = \left( \frac{8+0}{2}, \frac{2+6}{2} \right) = (4,4) \]
\[ m = \frac{6-2}{0-8} = -\frac{1}{2} \]
\[ m_\perp = 2 \]
\[ y = mx + b \]
\[ 4 = 2(4) + b \]
\[ -4 = b \]

PTS: 2 REF: 081126ge STA: G.G.68 TOP: Perpendicular Bisector

95 ANS: 3
\[ (3,-2) \rightarrow (2,3) \rightarrow (8,12) \]

PTS: 2 REF: 011126ge STA: G.G.54 TOP: Compositions of Transformations KEY: basic

96 ANS: 4
PTS: 2 REF: 081211ge STA: G.G.5 TOP: Planes

97 ANS: 1
PTS: 2 REF: 011218ge STA: G.G.3 TOP: Planes

98 ANS: 4
\[ \sqrt{25^2 - 7^2} = 24 \]

PTS: 2 REF: 081105ge STA: G.G.50 TOP: Tangents KEY: point of tangency
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:

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

$$3y - 6 = -4x - 20$$

$$4x + 3y = -14$$

\[
\begin{align*}
\frac{40 - 24}{2} &= 8. \quad \sqrt{10^2 - 8^2} = 6.
\end{align*}
\]

The slope of $3x + 5y = 4$ is $m = -\frac{A}{B} = \frac{-3}{5}$. $m_{\perp} = \frac{5}{3}$.

\[
\begin{align*}
\text{The slope of } 3x + 5y &= 4 \\
m &= \frac{3}{2} \\
y &= mx + b \\
2 &= \frac{3}{2}(1) + b \\
\frac{1}{2} &= b
\end{align*}
\]
107 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


109 ANS: 1  PTS: 2  REF: 081113ge  STA: G.G.54  TOP: Reflections  KEY: basic

110 ANS: 1  PTS: 2  REF: 011128ge  STA: G.G.2  TOP: Planes

111 ANS: 2  PTS: 2  REF: 061115ge  STA: G.G.69  TOP: Triangles in the Coordinate Plane

112 ANS: 3
\[8^2 + 24^2 \neq 25^2\]

PTS: 2  REF: 011111ge  STA: G.G.48  TOP: Pythagorean Theorem

113 ANS: 4  PTS: 2  REF: 061114ge  STA: G.G.73  TOP: Equations of Circles

114 ANS: 3
The slope of \(2y = x + 2\) is \(\frac{1}{2}\), which is the opposite reciprocal of \(-2\). \[3 = -2(4) + b\]
\[11 = b\]

PTS: 2  REF: 081228ge  STA: G.G.64  TOP: Parallel and Perpendicular Lines

115 ANS: 4
\[\sqrt{25^2 - \left(\frac{26 - 12}{2}\right)^2} = 24\]

PTS: 2  REF: 011219ge  STA: G.G.40  TOP: Trapezoids

116 ANS: 3
\[(n - 2)180 = (5 - 2)180 = 540\]

PTS: 2  REF: 011223ge  STA: G.G.36  TOP: Interior and Exterior Angles of Polygons


118 ANS: 3  PTS: 2  REF: 081128ge  STA: G.G.39  TOP: Special Parallelograms
119 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

120 ANS: 4 PTS: 2 REF: 011216ge STA: G.G.29 TOP: Triangle Congruency


122 ANS: 3 PTS: 2 REF: 081218ge STA: G.G.1 TOP: Planes

123 ANS: 3 PTS: 2 REF: 081111ge STA: G.G.32 TOP: Exterior Angle Theorem

124 ANS: 3 PTS: 2 REF: 081227ge STA: G.G.42 TOP: Midsegments

125 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

126 ANS: 3 PTS: 2 REF: 011217ge STA: G.G.64 TOP: Parallel and Perpendicular Lines


128 ANS: 2 PTS: 2 REF: 061208ge STA: G.G.19 TOP: Constructions

129 ANS: 3 PTS: 2 REF: 061228ge STA: G.G.39 TOP: Special Parallelograms

130 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

131 ANS: 1

The length of the midsegment of a trapezoid is the average of the lengths of its bases.

\[ \frac{x + 3 + 5x - 9}{2} = 2x + 2. \]

\[ 6x - 6 = 4x + 4 \]

\[ 2x = 10 \]

\[ x = 5 \]

PTS: 2 REF: 081221ge STA: G.G.40 TOP: Trapezoids
\[ d = \sqrt{(-1 - 4)^2 + (0 - (-3))^2} = \sqrt{25 + 9} = \sqrt{34} \]

PTS: 2  
REF: 061217ge  
STA: G.G.67  
TOP: Distance

KEY: general

133 ANS: 2  
PTS: 2  
REF: 011125ge  
STA: G.G.74

TOP: Graphing Circles

134 ANS: 3  
PTS: 2  
REF: 061122ge  
STA: G.G.56

TOP: Identifying Transformations

\[ \frac{8}{2} = \frac{12}{x}. \]

\[ 8x = 24 \]

\[ x = 3 \]

PTS: 2  
REF: 061216ge  
STA: G.G.46  
TOP: Side Splitter Theorem

136 ANS: 4  
PTS: 2  
REF: 081110ge  
STA: G.G.71

TOP: Equations of Circles

137 ANS: 3  
PTS: 2  
REF: 061218ge  
STA: G.G.36

TOP: Interior and Exterior Angles of Polygons

138 ANS: 4

The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

PTS: 2  
REF: 081220ge  
STA: G.G.43  
TOP: Centroid

139 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

140 ANS: 4  
PTS: 2  
REF: 081106ge  
STA: G.G.17

TOP: Constructions

141 ANS: 1  
PTS: 2  
REF: 061223ge  
STA: G.G.73

TOP: Equations of Circles
The slope of $9x - 3y = 27$ is $m = \frac{-A}{-3} = 3$, which is the opposite reciprocal of $-\frac{1}{3}$.

\[ \frac{50 + x}{2} = 34 \]
\[ 50 + x = 68 \]
\[ x = 18 \]
150 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 \hspace{1cm} REF: 061225ge \hspace{1cm} STA: G.G.32 \hspace{1cm} TOP: Exterior Angle Theorem

151 ANS: 3
\[ \sqrt{5^2 + 12^2} = 13 \]

PTS: 2 \hspace{1cm} REF: 061116ge \hspace{1cm} STA: G.G.39 \hspace{1cm} TOP: Special Parallelograms

152 ANS: 2 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 061126ge \hspace{1cm} STA: G.G.59 \hspace{1cm} TOP: Properties of Transformations

153 ANS: 3 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 061111ge \hspace{1cm} STA: G.G.38 \hspace{1cm} TOP: Parallelograms

154 ANS: 3
\[ d = \sqrt{(1 - 9)^2 + (-4 - 2)^2} = \sqrt{64 + 36} = \sqrt{100} = 10 \]

PTS: 2 \hspace{1cm} REF: 081107ge \hspace{1cm} STA: G.G.67 \hspace{1cm} TOP: Distance

KEY: general

155 ANS: 1 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 011102ge \hspace{1cm} STA: G.G.55 \hspace{1cm} TOP: Properties of Transformations

156 ANS: 2 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 081212ge \hspace{1cm} STA: G.G.72 \hspace{1cm} TOP: Equations of Circles

157 ANS: 4 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 061118ge \hspace{1cm} STA: G.G.1 \hspace{1cm} TOP: Planes

158 ANS: 4 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 011108ge \hspace{1cm} STA: G.G.27 \hspace{1cm} TOP: Angle Proofs

159 ANS: 3
\[ \frac{5}{7} = \frac{10}{x} \]
\[ 5x = 70 \]
\[ x = 14 \]

PTS: 2 \hspace{1cm} REF: 081103ge \hspace{1cm} STA: G.G.46 \hspace{1cm} TOP: Side Splitter Theorem

160 ANS: 1 \hspace{1cm} PTS: 2 \hspace{1cm} REF: 061214ge \hspace{1cm} STA: G.G.21 \hspace{1cm} TOP: Centroid, Orthocenter, Incenter and Circumcenter
161 ANS: 3
\[
\frac{7x}{4} = \frac{7}{x}. \quad 7(2) = 14
\]
\[
7x^2 = 28
\]
\[
x = 2
\]

PTS: 2    REF: 061120ge    STA: G.G.45    TOP: Similarity
KEY: basic

162 ANS: 4    PTS: 2    REF: 081224ge    STA: G.G.21
TOP: Centroid, Orthocenter, Incenter and Circumcenter

163 ANS: 2
\[
3x + x + 20 + x + 20 = 180
\]
\[
5x = 40
\]
\[
x = 28
\]

PTS: 2    REF: 081222ge    STA: G.G.31    TOP: Isosceles Triangle Theorem

164 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

165 ANS: 4
\[
x \cdot 4x = 6^2. \quad PQ = 4x + x = 5x = 5(3) = 15
\]
\[
4x^2 = 36
\]
\[
x = 3
\]

PTS: 2    REF: 011227ge    STA: G.G.47    TOP: Similarity
KEY: leg
Geometry Multiple Choice Regents Exam Questions
Answer Section

166 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

167 ANS: 2
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  REF: fall0812ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

168 ANS: 3
\[\frac{36 - 20}{2} = 8, \ \sqrt{17^2 - 8^2} = 15\]
PTS: 2  REF: 061016ge  STA: G.G.40  TOP: Trapezoids

169 ANS: 2
PTS: 2  REF: 011011ge  STA: G.G.22  TOP: Locus

170 ANS: 3
PTS: 2  REF: 060925ge  STA: G.G.17  TOP: Constructions

171 ANS: 4
\[d = \sqrt{(-6 - 2)^2 + (4 - (-5))^2} = \sqrt{64 + 81} = \sqrt{145}\]
PTS: 2  REF: 081013ge  STA: G.G.67  TOP: Distance
KEY: general

172 ANS: 2
\[ \triangle ABC \sim \triangle DBE, \quad \frac{AB}{DB} = \frac{AC}{DE} \]

\[ \frac{9}{2} = \frac{x}{3} \]

\[ x = 13.5 \]

\[ M_x = \frac{2 + (-4)}{2} = -1, \quad M_y = \frac{-3 + 6}{2} = \frac{3}{2} \]
2y = -6x + 8 \ Perpendicular \ lines \ have \ slope \ the \ opposite \ and \ reciprocal \ of \ each \ other.

y = -3x + 4

m = -3

m_\perp = \frac{1}{3}

\text{PTS: 2} \ \text{REF: 081024ge} \ \text{STA: G.G.62} \ \text{TOP: Parallel and Perpendicular Lines}

Opposite sides of a parallelogram are congruent. \ 4x - 3 = x + 3. \ SV = (2) + 3 = 5.

3x = 6

x = 2

\text{PTS: 2} \ \text{REF: fall0827ge} \ \text{STA: G.G.37} \ \text{TOP: Interior and Exterior Angles of Polygons}

\text{ANS: 1}

\text{ANS: 2}

(d + 4)4 = 12(6)

4d + 16 = 72

d = 14

r = 7

\text{PTS: 2} \ \text{REF: 061023ge} \ \text{STA: G.G.53} \ \text{TOP: Segments Intercepted by Circle}

\text{ANS: 3}

\text{PTS: 2} \ \text{REF: 060905ge} \ \text{STA: G.G.54} \ \text{TOP: Reflections}

\text{KEY: two secants}

\text{KEY: basic}

\text{ANS: 1}

M_x = \frac{-2 + 6}{2} = 2. \ M_y = \frac{3 + 3}{2} = 3. \ \text{The \ center \ is} \ (2,3). \ d = \sqrt{(-2 - 6)^2 + (3 - 3)^2} = \sqrt{64 + 0} = 8. \ \text{If \ the \ diameter \ is} 8, \ \text{the \ radius \ is} 4 \ \text{and} \ r^2 = 16.

\text{PTS: 2} \ \text{REF: fall0820ge} \ \text{STA: G.G.71} \ \text{TOP: Equations of Circles}

\text{ANS: 4}

\text{Let} \ AD = x. \ 36x = 12^2

x = 4

\text{PTS: 2} \ \text{REF: 080922ge} \ \text{STA: G.G.47} \ \text{TOP: Similarity}

\text{KEY: leg}
189 ANS: 2   PTS: 2   REF: 080927ge   STA: G.G.4
TOP: Planes

190 ANS: 1   PTS: 2   REF: 060918ge   STA: G.G.2
TOP: Planes

191 ANS: 4   PTS: 2   REF: 060922ge   STA: G.G.73
TOP: Equations of Circles

192 ANS: 3
\[ V = \pi r^2 h = \pi \cdot 6^2 \cdot 27 = 972\pi \]

PTS: 2   REF: 011027ge   STA: G.G.14   TOP: Volume

193 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

194 ANS: 4
The marked 60º angle and the angle above it are on the same straight line and supplementary. This unmarked supplementary angle is 120º. Because the unmarked 120º angle and the marked 120º angle are alternate exterior angles and congruent, \(d \parallel e\).

PTS: 2   REF: 080901ge   STA: G.G.35   TOP: Parallel Lines and Transversals

195 ANS: 4   PTS: 2   REF: 061008ge   STA: G.G.40
TOP: Trapezoids

196 ANS: 3   PTS: 2   REF: 011028ge   STA: G.G.26
TOP: Conditional Statements

197 ANS: 2   PTS: 2   REF: 011004ge   STA: G.G.17
TOP: Constructions

198 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

199 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
200 ANS: 1
The centroid divides each median into segments whose lengths are in the ratio 2 : 1.
\[ GC = 2FG \]
\[ GC + FG = 24 \]
\[ 2FG + FG = 24 \]
\[ 3FG = 24 \]
\[ FG = 8 \]

PTS: 2
REF: 081018ge
STA: G.G.43
TOP: Centroid

201 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

202 ANS: 1
\[ L = 2\pi rh = 2\pi \cdot 5 \cdot 11 \approx 345.6 \]

PTS: 2
REF: 061006ge
STA: G.G.14
TOP: Volume

203 ANS: 2
\[ m\angle A = m\angle B = 60^\circ \]
\[ m\angle C = m\angle D = 30^\circ \]

PTS: 2
REF: 060901ge
STA: G.G.30
TOP: Interior and Exterior Angles of Triangles

204 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

KEY: general
209 ANS: 2
\[
\frac{140 - RS}{2} = 40
\]
\[
140 - RS = 80
\]
\[
RS = 60
\]

PTS: 2 REF: 081025ge STA: G.G.51 TOP: Arcs Determined by Angles
KEY: outside circle
210 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
211 ANS: 4
(4) is not true if \(\angle PQR\) is obtuse.

PTS: 2 REF: 060924ge STA: G.G.32 TOP: Exterior Angle Theorem
212 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
213 ANS: 3
\[
m = -\frac{A}{B} = -\frac{3}{4}
\]

PTS: 2 REF: 011025ge STA: G.G.62 TOP: Parallel and Perpendicular Lines
214 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: Surface Area
215 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
Because \( OC \) is a radius, its length is 5. Since \( CE = 2 \ OE = 3 \). \( \triangle EDO \) is a 3-4-5 triangle. If \( ED = 4 \), \( BD = 8 \).

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.

\[
4(4x - 3) = 3(2x + 8)
\]

\[
16x - 12 = 6x + 24
\]

\[
10x = 36
\]

\[
x = 3.6
\]

\[\angle A = \frac{(n - 2)180}{n} = \frac{(5 - 2)180}{5} = 108\]

\[\angle AEB = \frac{180 - 108}{2} = 36\]
The slope of \( y = -\frac{2}{3}x - 5 \) is \(-\frac{2}{3}\). Perpendicular lines have slope that are opposite reciprocals.

\[\text{PTS: 2} \quad \text{REF: 080917ge} \quad \text{STA: G.G.62} \quad \text{TOP: Parallel and Perpendicular Lines}\]

The centroid divides each median into segments whose lengths are in the ratio 2 : 1.

\[\text{PTS: 2} \quad \text{REF: 060914ge} \quad \text{STA: G.G.43} \quad \text{TOP: Centroid}\]

\[A'(2,4)\]

\[\text{PTS: 2} \quad \text{REF: 011023ge} \quad \text{STA: G.G.54} \quad \text{TOP: Compositions of Transformations}\]

\[V = \pi r^2 h\]

\[1000 = \pi r^2 \cdot 8\]

\[r^2 = \frac{1000}{8\pi}\]

\[r \approx 6.3\]

\[\text{PTS: 2} \quad \text{REF: 080926ge} \quad \text{STA: G.G.14} \quad \text{TOP: Volume}\]

\[6 + 17 > 22\]

\[\text{PTS: 2} \quad \text{REF: 080916ge} \quad \text{STA: G.G.33} \quad \text{TOP: Triangle Inequality Theorem}\]

\[\text{PTS: 2} \quad \text{REF: fall0816ge} \quad \text{STA: G.G.1}\]

\[\text{TOP: Planes}\]

\[\text{PTS: 2} \quad \text{REF: fall0802ge} \quad \text{STA: G.G.24}\]

\[\text{TOP: Negations}\]

\[\text{PTS: 2} \quad \text{REF: 060903ge} \quad \text{STA: G.G.56}\]

\[\text{TOP: Identifying Transformations}\]

\[\text{PTS: 2} \quad \text{REF: fall0810ge} \quad \text{STA: G.G.24}\]

\[\text{TOP: Statements}\]

\[\text{PTS: 2} \quad \text{REF: fall0824ge} \quad \text{STA: G.G.50}\]

\[\text{TOP: Tangents}\]

\[\text{PTS: 2} \quad \text{REF: fall0825ge} \quad \text{STA: G.G.21}\]

\[\text{TOP: Centroid, Orthocenter, Incenter and Circumcenter}\]

\[\text{PTS: 2} \quad \text{REF: 061007ge} \quad \text{STA: G.G.35}\]

\[\text{TOP: Parallel Lines and Transversals}\]
\[ y + \frac{1}{2}x = 4 \quad 3x + 6y = 12 \]
\[ y = -\frac{1}{2}x + 4 \quad 6y = -3x + 12 \]
\[ m = -\frac{1}{2} \quad y = \frac{3}{6}x + 2 \]
\[ y = -\frac{1}{2}x + 2 \]

The slope of \( y = -3x + 2 \) is \(-3\). The perpendicular slope is \( \frac{1}{3} \).

\[-1 = \frac{1}{3}(3) + b \]
\[-1 = 1 + b \]
\[b = -2\]

Parallel chords intercept congruent arcs. \( \widehat{AC} = \widehat{BD} = 30 \). \( 180 - 30 - 30 = 120 \).
250 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

251 ANS: 4 PTS: 2 REF: 080925ge STA: G.G.21 TOP: Centroid, Orthocenter, Incenter and Circumcenter

252 ANS: 2

\[\angle ACB \text{ and } \angle ECD \text{ are congruent vertical angles and } \angle CAB \cong \angle CED.\]

PTS: 2 REF: 060917ge STA: G.G.44 TOP: Similarity Proofs

253 ANS: 4
\[M_x = \frac{-6 + 1}{2} = \frac{-5}{2}, \quad M_y = \frac{1 + 8}{2} = \frac{9}{2}.\]

PTS: 2 REF: 060919ge STA: G.G.66 TOP: Midpoint KEY: graph

254 ANS: 1 PTS: 2 REF: 080918ge STA: G.G.41 TOP: Special Quadrilaterals

255 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

256 ANS: 1
\[4x = 6 \cdot 10\]
\[x = 15\]

PTS: 2 REF: 081017ge STA: G.G.53 TOP: Segments Intercepted by Circle KEY: two chords
257 ANS: 3
The lateral edges of a prism are parallel.

PTS: 2 REF: fall0808ge STA: G.G.10 TOP: Solids

258 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

259 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

260 ANS: 2
PTS: 2 REF: 061020ge STA: G.G.19 TOP: Constructions

261 ANS: 2
Longest side of a triangle is opposite the largest angle. Shortest side is opposite the smallest angle.

PTS: 2 REF: 060911ge STA: G.G.34 TOP: Angle Side Relationship

262 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

263 ANS: 3

PTS: 2 REF: 061011ge STA: G.G.70 TOP: Quadratic-Linear Systems
264 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

265 ANS: 3  PTS: 2  REF: 011007ge  STA: G.G.31  TOP: Isosceles Triangle Theorem

266 ANS: 1  PTS: 2  REF: 061005ge  STA: G.G.55  TOP: Properties of Transformations

267 ANS: 4

\[ 180 - (40 + 40) = 100 \]

PTS: 2  REF: 080903ge  STA: G.G.31  TOP: Isosceles Triangle Theorem


269 ANS: 2

\[ x^2 = 3(x + 18) \]
\[ x^2 - 3x - 54 = 0 \]
\[ (x - 9)(x + 6) = 0 \]
\[ x = 9 \]

PTS: 2  REF: fall0817ge  STA: G.G.53  TOP: Segments Intercepted by Circle
KEY: tangent and secant

270 ANS: 1  PTS: 2  REF: 061010ge  STA: G.G.34  TOP: Angle Side Relationship

271 ANS: 4

PTS: 2  REF: 081001ge  STA: G.G.29  TOP: Triangle Congruency

272 ANS: 4  PTS: 2  REF: 061018ge  STA: G.G.56  TOP: Identifying Transformations
273 ANS: 2
The diagonals of a rhombus are perpendicular. \(180 - (90 + 12) = 78\)

PTS: 2 REF: 011204ge STA: G.G.39 TOP: Special Parallelograms

274 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

275 ANS: 1
Parallel lines intercept congruent arcs.

PTS: 2 REF: 061001ge STA: G.G.52 TOP: Chords

276 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

277 ANS: 2
A dilation affects distance, not angle measure.

PTS: 2 REF: 080906ge STA: G.G.60 TOP: Identifying Transformations

278 ANS: 3 PTS: 2 REF: 011105ge STA: G.G.10 TOP: Solids

279 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: 060907ge STA: G.G.64 TOP: Parallel and Perpendicular Lines

280 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

281 ANS: 4
The radius is 4. \(r^2 = 16\).

PTS: 2 REF: 061014ge STA: G.G.72 TOP: Equations of Circles
282 ANS: 1
\((x, y) \rightarrow (x + 3, y + 1)\)

PTS: 2  REF: fall0803ge  STA: G.G.54  TOP: Translations

283 ANS: 1  PTS: 2  REF: 061012ge  STA: G.G.20  TOP: Constructions

284 ANS: 3  PTS: 2  REF: 081026ge  STA: G.G.26  TOP: Contrapositive


286 ANS: 2

\[
\frac{a}{2} + (5 \sqrt{2})^2 = (2 \sqrt{15})^2
\]
\[
a^2 + (25 \times 2) = 4 \times 15
\]
\[
a^2 + 50 = 60
\]
\[
a^2 = 10
\]
\[
a = \sqrt{10}
\]

PTS: 2  REF: 011016ge  STA: G.G.48  TOP: Pythagorean Theorem

289 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: Triangle Congruency
ANS: 1

\[
AB = 10 \text{ since } \triangle ABC \text{ is a 6-8-10 triangle. } \quad 6^2 = 10x
\]

\[
3.6 = x
\]

PTS: 2        REF: 060915ge    STA: G.G.47    TOP: Similarity

KEY: leg

ANS: 4

sum of interior \( \angle s \) = 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

TOP: Equations of Circles

ANS: 2

PTS: 2        REF: 060910ge    STA: G.G.71

TOP: Planes

ANS: 1

PTS: 2        REF: 011024ge    STA: G.G.3

TOP: Planes

ANS: 4

PTS: 2        REF: 080914ge    STA: G.G.7

TOP: Planes

ANS: 3

PTS: 2        REF: 061017ge    STA: G.G.1

TOP: Planes

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

ANS: 4

Longest side of a triangle is opposite the largest angle. Shortest side is opposite the smallest angle.

PTS: 2        REF: 081011ge    STA: G.G.34    TOP: Angle Side Relationship

ANS: 4

The slope of a line in standard form is \( -\frac{A}{B} \), so the slope of this line is \( \frac{-4}{2} = -2 \). A parallel line would also have a slope of \( -2 \). Since the answers are in slope intercept form, find the \( y \)-intercept:

\[
y = mx + b
\]

\[
3 = -2(7) + b
\]

\[
17 = b
\]

PTS: 2        REF: 081010ge    STA: G.G.65    TOP: Parallel and Perpendicular Lines
300 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

301 ANS: 3 PTS: 2 REF: 080902ge STA: G.G.17
TOP: Constructions

302 ANS: 4 PTS: 2 REF: 011019ge STA: G.G.44
TOP: Similarity Proofs

303 ANS: 1 PTS: 2 REF: 080911ge STA: G.G.73
TOP: Equations of Circles

304 ANS: 4 PTS: 2 REF: 060912ge STA: G.G.23
TOP: Locus

305 ANS: 2
\[ M_x = \frac{-2 + 6}{2} = 2. \quad M_y = \frac{-4 + 2}{2} = -1 \]

PTS: 2 REF: 080910ge STA: G.G.66 TOP: Midpoint
KEY: general

306 ANS: 1
\[ \angle DCB \text{ and } \angle ADC \] are supplementary adjacent angles of a parallelogram. \[ 180 - 120 = 60. \quad \angle 2 = 60 - 45 = 15. \]

PTS: 2 REF: 080907ge STA: G.G.38 TOP: Parallelograms

307 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
KEY: general

308 ANS: 3 PTS: 2 REF: 081021ge STA: G.G.57
TOP: Properties of Transformations

309 ANS: 3

PTS: 2 REF: 060902ge STA: G.G.28 TOP: Triangle Congruency
310 ANS: 4 
PTS: 2 
REF: fall0818ge 
STA: G.G.61
TOP: Analytical Representations of Transformations

311 ANS: 3
\[
\frac{36 + 20}{2} = 28
\]

PTS: 2 
REF: 061019ge 
STA: G.G.51 
TOP: Arcs Determined by Angles 
KEY: inside circle

312 ANS: 1
PTS: 2 
REF: 081012ge 
STA: G.G.50
TOP: Tangents 
KEY: two tangents

\[
\frac{3}{7} = \frac{6}{x}
\]

\[3x = 42\]
\[x = 14\]

PTS: 2 
REF: 081027ge 
STA: G.G.46 
TOP: Side Splitter Theorem

314 ANS: 3

\[
\begin{align*}
10 & \quad 5 \\
\hline
5 & \quad 5 \\
\hline
2 & \quad 18 \\
\end{align*}
\]

PTS: 2 
REF: 080920ge 
STA: G.G.42 
TOP: Midsegments

315 ANS: 4
\[180 - (50 + 30) = 100\]

PTS: 2 
REF: 081006ge 
STA: G.G.45 
TOP: Similarity 
KEY: basic

316 ANS: 3
PTS: 2 
REF: 080924ge 
STA: G.G.24 
TOP: Negations

317 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

318 ANS: 3
PTS: 2 
REF: 061004ge 
STA: G.G.31 
TOP: Isosceles Triangle Theorem
319 ANS: 1
Translations and reflections do not affect distance.

PTS: 2 REF: 080908ge STA: G.G.61
TOP: Analytical Representations of Transformations

320 ANS: 4 PTS: 2 REF: 081023ge STA: G.G.45
TOP: Similarity KEY: perimeter and area

321 ANS: 3 PTS: 2 REF: fall0814ge STA: G.G.73
TOP: Equations of Circles

322 ANS: 3 PTS: 2 REF: 081002ge STA: G.G.9
TOP: Planes

323 ANS: 2
7 + 18 > 6 + 12

PTS: 2 REF: fall0819ge STA: G.G.33 TOP: Triangle Inequality Theorem

324 ANS: 1

\[ y = x^2 - 4x = (4)^2 - 4(4) = 0. \ (4,0) \text{ is the only intersection.} \]

PTS: 2 REF: 060923ge STA: G.G.70 TOP: Quadratic-Linear Systems

325 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

326 ANS: 4 PTS: 2 REF: 011012ge STA: G.G.1
TOP: Planes

327 ANS: 2 PTS: 2 REF: 011020ge STA: G.G.74
TOP: Graphing Circles

328 ANS: 3

\[ \text{The sum of the interior angles of a pentagon is } (5 - 2)180 = 540. \]

PTS: 2 REF: 011023ge STA: G.G.36 TOP: Interior and Exterior Angles of Polygons
329 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

330 ANS: 1
\[3x^2 + 18x + 24\]
\[3(x^2 + 6x + 8)\]
\[3(x + 4)(x + 2)\]

PTS: 2 REF: fall0815ge STA: G.G.12 TOP: Volume

331 ANS: 4
Corresponding angles of similar triangles are congruent.

PTS: 2 REF: fall0826ge STA: G.G.45 TOP: Similarity KEY: perimeter and area

332 ANS: 1
PTS: 2 REF: 081028ge STA: G.G.21 TOP: Centroid, Orthocenter, Incenter and Circumcenter

333 ANS: 2

334 ANS: 3
PTS: 2 REF: 061224ge STA: G.G.45 TOP: Similarity KEY: basic

335 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: 060909ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

336 ANS: 4
PTS: 2 REF: 060913ge STA: G.G.26 TOP: Conditional Statements
Answer Section

337 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

338 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

339 ANS:
22.4. \( V = \pi r^2 h \)
   \[ 12566.4 = \pi r^2 \cdot 8 \]
   \[ r^2 = \frac{12566.4}{8\pi} \]
   \[ r \approx 22.4 \]

PTS: 2 REF: fall0833ge STA: G.G.14 TOP: Volume
20. \( 5x + 10 = 4x + 30 \)

\[ x = 20 \]

PTS: 2       REF: 060934ge  STA: G.G.45  TOP: Similarity  
KEY: basic

341 ANS:

\[ m = \frac{-A}{B} = \frac{6}{2} = 3, \quad m_{\perp} = \frac{1}{3}. \]


342 ANS:

\[ (5 - 2)180 = 540, \quad \frac{540}{5} = 108 \text{ interior.} \quad 180 - 108 = 72 \text{ exterior} \]

PTS: 2       REF: 011131ge  STA: G.G.37  TOP: Interior and Exterior Angles of Polygons

343 ANS:

\[ \frac{180 - 46}{2} = 67 \]

PTS: 2       REF: 011029ge  STA: G.G.31  TOP: Isosceles Triangle Theorem

344 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.

PTS: 2       REF: 081133ge  STA: G.G.44  TOP: Similarity Proofs

345 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

346 ANS:

PTS: 2       REF: 081233ge  STA: G.G.19  TOP: Constructions
347 ANS:

\[ x^2 = (5,0) \]

PTS: 2  REF: 061032ge  STA: G.G.54  TOP: Reflections

KEY: grids

348 ANS:

\[ (2, 3) \]

PTS: 2  REF: 011230ge  STA: G.G.22  TOP: Locus

349 ANS:

\[ 2x - 20 = x + 20. \quad m\overline{AB} = x + 20 = 40 + 20 = 60 \]

\[ x = 40 \]

PTS: 2  REF: 011229ge  STA: G.G.52  TOP: Chords

350 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

351 ANS:

\[ L = 2\pi rh = 2\pi \cdot 12 \cdot 22 \approx 1659. \quad \frac{1659}{600} \approx 2.8. \quad 3 \text{ cans are needed.} \]

PTS: 2  REF: 061233ge  STA: G.G.14  TOP: Lateral Area

352 ANS:

\[ \sqrt{(-4 - 2)^2 + (3 - 5)^2} = \sqrt{36 + 4} = \sqrt{40} = \sqrt{4} \sqrt{10} = 2\sqrt{10}. \]

PTS: 2  REF: 081232ge  STA: G.G.67  TOP: Distance
353 ANS:

\[ V = \frac{1}{3} Bh = \frac{1}{3} s^2 h = \frac{1}{3} \cdot 12^2 \cdot 42 = 2016 \]

PTS: 2 REF: 080930ge STA: G.G.13 TOP: Volume

354 ANS:

\[ \text{KEY: grids} \]

PTS: 2 REF: 011130ge STA: G.G.54 TOP: Reflections

355 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: 011129ge STA: G.G.31 TOP: Isosceles Triangle Theorem

356 ANS:

PTS: 2 REF: 011231ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

357 ANS:
358 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

359 ANS: 
\[ V = \frac{4}{3} \pi \cdot 9^3 = 972\pi \]

PTS: 2  REF: 081131ge  STA: G.G.16  TOP: Surface Area

360 ANS: 

PTS: 2  REF: 011233ge  STA: G.G.17  TOP: Constructions

361 ANS: 

PTS: 2  REF: 011233ge  STA: G.G.17  TOP: Constructions

362 ANS: 
\[ x + 3x + 5x - 54 = 180 \]
\[ 9x = 234 \]
\[ x = 26 \]

PTS: 2  REF: 080933ge  STA: G.G.30  TOP: Interior and Exterior Angles of Triangles

363 ANS: 
\[ (x - 5)^2 + (y + 4)^2 = 36 \]

PTS: 2  REF: 081132ge  STA: G.G.72  TOP: Equations of Circles

364 ANS: 
Yes. A reflection is an isometry.

PTS: 2  REF: 061132ge  STA: G.G.56  TOP: Identifying Transformations
365 ANS:
\[ EO = 6. \quad CE = \sqrt{10^2 - 6^2} = 8 \]

PTS: 2   REF: 011234ge   STA: G.G.49   TOP: Chords

366 ANS:

\[ \begin{array}{c}
\text{Diagram of a circle with points marked.}
\end{array} \]

PTS: 2   REF: 061234ge   STA: G.G.23   TOP: Locus

367 ANS:
\[ 180 - (90 + 63) = 27 \]

PTS: 2   REF: 061230ge   STA: G.G.35   TOP: Parallel Lines and Transversals

368 ANS:
\[ R'(−3,−2), \quad S'(−4,4), \quad \text{and} \quad T'(2,2). \]

PTS: 2   REF: 061232ge   STA: G.G.54   TOP: Rotations

369 ANS:

\[ (7,5) \quad m_{AB} = \left( \frac{3 + 7}{2}, \frac{3 + 9}{2} \right) = (5,6) \quad m_{BC} = \left( \frac{7 + 11}{2}, \frac{9 + 3}{2} \right) = (9,6) \]

PTS: 2   REF: 081134ge   STA: G.G.21   TOP: Centroid, Orthocenter, Incenter and Circumcenter

370 ANS: 3   PTS: 2   REF: 080928ge   STA: G.G.50   TOP: Tangents   KEY: common tangency
371 ANS:

\[ A'(-2,1), B'(-3,-4), \text{ and } C'(5,-3) \]

PTS: 2  REF: 081230ge  STA: G.G.54  TOP: Rotations

372 ANS:

\[
5. \quad \frac{3}{x} = \frac{6 + 3}{15} \\
9x = 45 \\
x = 5
\]

PTS: 2  REF: 011033ge  STA: G.G.46  TOP: Side Splitter Theorem

373 ANS:

\[ T'(-6,3), A'(-3,3), P'(-3,-1) \]

PTS: 2  REF: 061229ge  STA: G.G.54  TOP: Translations

374 ANS:

\[
110. \quad 6x + 20 = x + 40 + 4x - 5 \\
6x + 20 = 5x + 35 \\
x = 15 \\
6(15) + 20 = 110
\]

PTS: 2  REF: 081031ge  STA: G.G.32  TOP: Exterior Angle Theorem

375 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
The medians of a triangle are not concurrent. False.

25. \( d = \sqrt{(-3-4)^2 + (1-25)^2} = \sqrt{49 + 576} = \sqrt{625} = 25. \)

3. The non-parallel sides of an isosceles trapezoid are congruent. \( 2x + 5 = 3x + 2 \)
\[ x = 3 \]

8
381 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: Surface Area

382 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

383 ANS:

\[
\begin{array}{c}
\quad x\\
\quad x\\
\quad x\\
\quad x\\
\quad x\\
\quad x\\
\end{array}
\]

PTS: 2  
REF: 081234ge  
STA: G.G.23  
TOP: Locus

384 ANS:

\[
\begin{array}{c}
A\\
B\\
\quad R\\
\quad C\\
\quad D
\end{array}
\]

PTS: 2  
REF: 061033ge  
STA: G.G.22  
TOP: Locus

385 ANS:

\[
\begin{array}{c}
\quad a\\
\quad b\\
\quad c\\
\quad d
\end{array}
\]

PTS: 2  
REF: 080932ge  
STA: G.G.17  
TOP: Constructions
No, $\angle KGH$ is not congruent to $\angle GKH$.

387 ANS:

$$L = \pi rl = \pi(15)(25) = 375\pi$$

388 ANS:

$$(6, -4). \quad C_x = \frac{Q_x + R_x}{2}, \quad C_y = \frac{Q_y + R_y}{2}$$.  

$$3.5 = \frac{1 + R_x}{2}, \quad 2 = \frac{8 + R_y}{2}$$

$$7 = 1 + R_x, \quad 4 = 8 + R_y$$

$$6 = R_x, \quad -4 = R_y$$

389 ANS:

$$\text{PTS: 2} \quad \text{REF: fall0832ge} \quad \text{STA: G.G.17} \quad \text{TOP: Constructions}$$
390 ANS:

PTS: 2     REF:  fall0830ge     STA:  G.G.55     TOP:  Properties of Transformations

391 ANS:
9.1.  \((11)(8)h = 800\)

\[ h \approx 9.1 \]

PTS: 2     REF:  061131ge     STA:  G.G.12     TOP:  Volume

392 ANS:
37.  Since \(DE\) is a midsegment, \(AC = 14\).  \(10 + 13 + 14 = 37\)

PTS: 2     REF:  061030ge     STA:  G.G.42     TOP:  Midsegments

393 ANS:
6.  The centroid divides each median into segments whose lengths are in the ratio 2 : 1.  \(\overline{TD} = 6\) and \(\overline{DB} = 3\)

PTS: 2     REF:  011034ge     STA:  G.G.43     TOP:  Centroid

394 ANS:

\[ G''(3,3), H''(7,7), S''(-1,9) \]

PTS: 4     REF:  081136ge     STA:  G.G.58     TOP:  Compositions of Transformations
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

ANS: 34. \(2x - 12 + x + 90 = 180\)

\[
\begin{align*}
3x + 78 & = 90 \\
3x & = 102 \\
x & = 34
\end{align*}
\]

PTS: 2 REF: 061031ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

ANS: \(x^2 = 9 \cdot 8\)

\[
\begin{align*}
x & = \sqrt{72} \\
x & = \sqrt{36} \sqrt{2} \\
x & = 6 \sqrt{2}
\end{align*}
\]

PTS: 2 REF: 011132ge STA: G.G.53 TOP: Segments Intercepted by Circle

KEY: two chords

ANS: \(y = -2x + 14\). The slope of \(2x + y = 3\) is \(\frac{-A}{B} = \frac{-2}{1} = -2\).

\[
\begin{align*}
y = mx + b \\
4 & = (-2)(5) + b \\
b & = 14
\end{align*}
\]

PTS: 2 REF: 060931ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

ANS: 70. \(3x + 5 + 3x + 5 + 2x + 2x = 180\)

\[
\begin{align*}
10x + 10 & = 360 \\
10x & = 350 \\
x & = 35 \\
2x & = 70
\end{align*}
\]

PTS: 2 REF: 081029ge STA: G.G.40 TOP: Trapezoids
400 ANS: 
\[(x + 1)^2 + (y - 2)^2 = 36\]

PTS: 2 REF: 081034ge STA: G.G.72 TOP: Equations of Circles

401 ANS:

\[
\begin{align*}
\text{PTS: } 2 & \quad \text{REF: } 081032ge \quad \text{STA: } G.G.20 \quad \text{TOP: Constructions} \\
\text{KEY: altitude}
\end{align*}
\]

402 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

403 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

404 ANS: 
\[V = \pi r^2 h = \pi (5)^2 \cdot 7 = 175\pi\]

PTS: 2 REF: 081231ge STA: G.G.14 TOP: Volume

405 ANS: 
\[y = \frac{2}{3} x - 9. \quad \text{The slope of } 2x - 3y = 11 \text{ is } \frac{A}{B} = \frac{-2}{-3} = \frac{2}{3}, \quad -5 = \left(\frac{2}{3}\right)(6) + b\]
\[-5 = 4 + b\]
\[b = -9\]

PTS: 2 REF: 080931ge STA: G.G.65 TOP: Parallel and Perpendicular Lines
406 ANS:

PTS: 2   REF: 081033ge   STA: G.G.22   TOP: Locus

407 ANS:

PTS: 2   REF: 011032ge   STA: G.G.20   TOP: Constructions

408 ANS:

PTS: 2   REF: 060932ge   STA: G.G.22   TOP: Locus
Geometry 4 Point Regents Exam Questions
Answer Section

409 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

410 ANS:

\[
y = \frac{2}{3}x + 1 \quad 2y + 3x = 6 \quad y = mx + b
\]

\[
2y = -3x + 6 \quad 5 = \frac{2}{3}(6) + b
\]

\[
y = -\frac{3}{2}x + 3 \quad 5 = 4 + b
\]

\[
m = \frac{3}{2} \quad 1 = b
\]

\[
m_\perp = \frac{2}{3}
\]

PTS: 4  REF: 061036ge  STA: G.G.64  TOP: Parallel and Perpendicular Lines

411 ANS:

\[
JK \cong LM \text{ because opposite sides of a parallelogram are congruent. } \overline{LM} \cong \overline{LN} \text{ because of the Isosceles Triangle Theorem. } \overline{LM} \cong \overline{JM} \text{ because of the transitive property. } JKLM \text{ is a rhombus because all sides are congruent.}
\]

PTS: 4  REF: 011036ge  STA: G.G.41  TOP: Special Quadrilaterals

412 ANS:

PTS: 4  REF: 011037ge  STA: G.G.23  TOP: Locus
18. If the ratio of \( TA \) to \( AC \) is 1:3, the ratio of \( TE \) to \( ES \) is also 1:3. \( x + 3x = 24 \). \( 3(6) = 18 \).
\[ x = 6 \]

**ANS:**

\( A'(7,-4), B'(7,-1), C'(9,-4) \). The areas are equal because translations preserve distance.

**PTS:** 4  **REF:** 011235ge  **STA:** G.G.55  **TOP:** Properties of Transformations

**KEY:** common tangency

36, because a dilation does not affect angle measure. 10, because a dilation does affect distance.

**ANS:**

\( 5a = 4^2 \quad 5b = 3^2 \quad h^2 = ab \)
\[ a = 3.2 \quad b = 1.8 \quad h^2 = 3.2 \cdot 1.8 \]
\[ h = \sqrt{5.76} = 2.4 \]

**PTS:** 4  **REF:** 081037ge  **STA:** G.G.47  **TOP:** Similarity

**KEY:** altitude

\( 15 + 5\sqrt{5} \).

**PTS:** 4  **REF:** 060936ge  **STA:** G.G.69  **TOP:** Triangles in the Coordinate Plane
418 ANS: 

\[ V = \pi r^2 h \quad \text{or} \quad L = 2 \pi rh = 2 \pi \cdot 5\sqrt{2} \cdot 12 \approx 533.1 \]

\[ 600\pi = \pi r^2 \cdot 12 \]

\[ 50 = r^2 \]

\[ \sqrt{25\sqrt{2}} = r \]

\[ 5\sqrt{2} = r \]

PTS: 4  REF: 080936ge  STA: G.G.23  TOP: Locus

419 ANS:

\[ V = \pi r^2 h \quad \text{or} \quad L = 2 \pi rh = 2 \pi \cdot 5\sqrt{2} \cdot 12 \approx 533.1 \]

\[ 600\pi = \pi r^2 \cdot 12 \]

\[ 50 = r^2 \]

\[ \sqrt{25\sqrt{2}} = r \]

\[ 5\sqrt{2} = r \]

PTS: 4  REF: 011236ge  STA: G.G.14  TOP: Volume

420 ANS:

32. \[ \frac{16}{20} = \frac{x - 3}{x + 5} \quad \Rightarrow \quad \frac{4}{5} = \frac{x - 3}{x + 5} \]

\[ 16x + 80 = 20x - 60 \]

\[ 140 = 4x \]

\[ 35 = x \]

PTS: 4  REF: 011137ge  STA: G.G.46  TOP: Side Splitter Theorem

421 ANS:

\( \angle B \) and \( \angle C \) are right angles because perpendicular lines form right angles. \( \angle B \cong \angle C \) because all right angles are congruent. \( \angle AEB \cong \angle DEC \) because vertical angles are congruent. \( \triangle ABE \cong \triangle DCE \) because of ASA. \( AB \cong DC \) because CPCTC.


422 ANS:

Midpoint: \( \left( \frac{-4 + 4}{2}, \frac{2 + (-4)}{2} \right) = (0, -1) \). Distance: \( d = \sqrt{(-4 - 4)^2 + (2 - (-4))^2} = \sqrt{100} = 10 \)

\[ r = 5 \]

\[ r^2 = 25 \]

\[ x^2 + (y + 1)^2 = 25 \]

No, $\angle KGH$ is not congruent to $\angle GKH$.

\[ x^2 + 6x = x + 14 \]
\[ 6(2) - 1 = 11 \]
\[ x^2 + 5x - 14 = 0 \]
\[ (x + 7)(x - 2) = 0 \]
\[ x = 2 \]

\[ x^2 + 6x = x + 14 \]
\[ 6(2) - 1 = 11 \]
\[ x^2 + 5x - 14 = 0 \]
\[ (x + 7)(x - 2) = 0 \]
\[ x = 2 \]
\[ \angle D, \angle G \text{ and } 24^\circ \text{ or } \angle E, \angle F \text{ and } 84^\circ. \ m\overline{FE} = \frac{2}{15} \times 360 = 48. \ \text{Since the chords forming } \angle D \text{ and } \angle G \text{ are intercepted by } \overline{FE}, \text{ their measure is } 24^\circ. \ m\overline{GD} = \frac{7}{15} \times 360 = 168. \ \text{Since the chords forming } \angle E \text{ and } \angle F \text{ are intercepted by } \overline{GD}, \text{ their measure is } 84^\circ. \]

**PTS:** 4   **REF:** fall0836ge   **STA:** G.G.51   **TOP:** Arcs Determined by Angles

**KEY:** inscribed

\[ 30. \ 3x + 4x + 5x = 360. \ \frac{150 - 90}{2} = 30 \]

**x = 20**

\[ m\angle BFD \text{ and } m\angle DFE \text{ are supplementary and } m\angle ECA \text{ and } m\angle ACB \text{ are supplementary because of the definition of supplementary angles. } m\angle DFE \cong m\angle ACB \text{ because angles supplementary to congruent angles are congruent. } \triangle ABC \sim \triangle DEF \text{ because of AA.} \]

**PTS:** 4   **REF:** 011136ge   **STA:** G.G.44   **TOP:** Similarity Proofs

**KEY:** outside circle

\[ \overline{BD} \cong \overline{DB} \text{ (Reflexive Property); } \triangle ABD \cong \triangle CDB \text{ (SSS); } \angle BDC \cong \angle ABD \text{ (CPCTC).} \]

**PTS:** 4   **REF:** 061035ge   **STA:** G.G.27   **TOP:** Quadrilateral Proofs
\[ x(x + 2) = 12 \cdot 2. \quad \overline{RT} = 6 + 4 = 10. \quad y \cdot y = 18 \cdot 8 \]
\[ x^2 + 2x - 24 = 0 \quad y^2 = 144 \]
\[ (x + 6)(x - 4) = 0 \quad y = 12 \]
\[ x = 4 \]

PTS: 4
REF: 061237ge
STA: G.G.53
TOP: Segments Intercepted by Circle
KEY: tangent and secant

\[ D'(-1, 1), E'(-1, 5), G'(-4, 5) \]

PTS: 4
REF: 080937ge
STA: G.G.55
TOP: Properties of Transformations
433 ANS:
\[ y = \frac{4}{3}x - 6. \quad M_x = \frac{-1 + 7}{2} = 3 \quad \text{The perpendicular bisector goes through } (3, -2) \text{ and has a slope of } \frac{4}{3}. \]
\[ M_y = \frac{1 + (-5)}{2} = -2 \]
\[ m = \frac{1 - (-5)}{-1 - 7} = \frac{3}{4} \]
\[ y - y_M = m(x - x_M). \]
\[ y - 1 = \frac{4}{3}(x - 2) \]

PTS: 4 REF: 080935ge STA: G.G.68 TOP: Perpendicular Bisector

434 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 \( \overline{DC}. \)
\[ 6x + 30 = 180 \]
\[ 6x = 150 \]
\[ x = 25 \]
\[ x + 19 = 44 \]

PTS: 4 REF: 081035ge STA: G.G.35 TOP: Parallel Lines and Transversals

435 ANS:
\[ A'(5, -4), B'(5, 1), C'(2, 1), D'(2, -6); A''(5, 4), B''(5, -1), C''(2, -1), D''(2, 6) \]

PTS: 4 REF: 061236ge STA: G.G.58 TOP: Compositions of Transformations
KEY: grids
436 ANS:

\[ G''(3,3), H''(7,7), S''(-1,9) \]

PTS: 4 REF: 081136ge STA: G.G.58 TOP: Compositions of Transformations

437 ANS:

PTS: 4 REF: fall0837ge STA: G.G.23 TOP: Locus

438 ANS:

PTS: 4 REF: 081236ge STA: G.G.58 TOP: Compositions of Transformations

KEY: grids
439 ANS:

![Graph showing quadratic-linear systems](image)

PTS: 4  REF: 061137ge  STA: G.G.70  TOP: Quadratic-Linear Systems

440 ANS:

Because G and H are midpoints of two sides of a triangle, GH is a midsegment, and parallel to the third side.

PTS: 4  REF: fall0835ge  STA: G.G.42  TOP: Midsegments

441 ANS:

A"(8,2), B"(2,0), C"(6,-8)

PTS: 4  REF: 081036ge  STA: G.G.58  TOP: Compositions of Transformations
ANS:

\[
\begin{align*}
M\left(\frac{-7+5}{2}, \frac{2+4}{2}\right) &= M(-1,3). \\
N\left(\frac{3+5}{2}, \frac{-4+4}{2}\right) &= N(4,0). \quad MN \text{ is a midsegment.}
\end{align*}
\]
445 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. \( \overline{BD} \) is a transversal intersecting \( \overline{AB} \) and \( \overline{ED} \). Therefore \( \overline{AB} \parallel \overline{DE} \) because \( \angle CDE \) and \( \angle CBA \) are congruent alternate interior angles.


446 ANS:
52, 40, 80.  
\[ 360 - (56 + 112) = 192. \]  
\[ \frac{192 - 112}{2} = 40, \quad \frac{112 + 48}{2} = 80 \]  
\[ \frac{1}{4} \times 192 = 48 \]  
\[ \frac{56 + 48}{2} = 52 \]

PTS: 6  REF: 081238ge  STA: G.G.51  TOP: Arcs Determined by Angles
KEY: inscribed

447 ANS:

The length of each side of quadrilateral is 5. Since each side is congruent, quadrilateral \( MATH \) is a rhombus. The slope of \( \overline{MH} \) is 0 and the slope of \( \overline{HT} \) 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

448 ANS:
\( \overline{OA} \cong \overline{OB} \) because all radii are equal. \( \overline{OP} \cong \overline{OP} \) because of the reflexive property. \( \overline{OA} \perp \overline{PA} \) and \( \overline{OB} \perp \overline{PB} \) because tangents to a circle are perpendicular to a radius at a point on a circle. \( \angle PAO \) and \( \angle PBO \) are right angles because of the definition of perpendicular. \( \angle PAO \cong \angle PBO \) because all right angles are congruent. \( \triangle AOP \cong \triangle BOP \) because of HL. \( \angle AOP \cong \angle BOP \) because of CPCTC.

PTS: 6  REF: 061138ge  STA: G.G.27  TOP: Circle Proofs
449 ANS:

Because $\overline{AB} \parallel \overline{DC}$, $\overline{AD} \cong \overline{BC}$ since parallel chords intersect congruent arcs. $\angle BDC \cong \angle ACD$ because inscribed angles that intercept congruent arcs are congruent. $\overline{AD} \cong \overline{BC}$ since congruent chords intersect congruent arcs. $\overline{DC} \cong \overline{CD}$ because of the reflexive property. Therefore, $\triangle ACD \cong \triangle BDC$ because of SAS.

PTS: 6  REF: fall0838ge  STA: G.G.27  TOP: Circle Proofs

450 ANS:

8x - 5 = 3x + 30. 4z - 8 = 3z. 9y + 8 + 5y - 2 = 90.

$5x = 35$  $z = 8$  $14y + 6 = 90$

$x = 7$  $14y = 84$

$y = 6$


451 ANS:

$\overline{AB} \parallel \overline{CD}$ and $\overline{AD} \parallel \overline{CB}$ because their slopes are equal. $ABCD$ is a parallelogram because opposite sides are parallel. $AB \neq BC$. $ABCD$ is not a rhombus because all sides are not equal. $AB \sim \perp BC$ 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

452 ANS:

Quadrilateral $ABCD$, $\overline{AD} \cong \overline{BC}$ and $\angle DAE \cong \angle BCE$ are given. $\overline{AD} \parallel \overline{BC}$ 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. $\overline{AE} \cong \overline{CE}$ because the diagonals of a parallelogram bisect each other. $\angle FEA \cong \angle GEC$ as vertical angles. $\triangle AEF \cong \triangle CEG$ by ASA.

\(FE \cong FE\) (Reflexive Property); \(AE - FE \cong FC - EF\) (Line Segment Subtraction Theorem); \(AF \cong CE\) (Substitution); \(\angle BFA \cong \angle DEC\) (All right angles are congruent); \(\triangle BFA \cong \triangle DEC\) (AAS); \(AB \cong CD\) and \(BF \cong DE\) (CPCTC); \(\angle BFC \cong \angle DEA\) (All right angles are congruent); \(\triangle BFC \cong \triangle DEA\) (SAS); \(AD \cong CB\) (CPCTC); \(ABCD\) is a parallelogram (opposite sides of quadrilateral \(ABCD\) are congruent).

- **453 ANS:**
- **454 ANS:**
- **455 ANS:**
ANS:

\[ m_{AB} = \left( \frac{-6 + 2}{2}, \frac{-2 + 8}{2} \right) = D(2,3) \quad m_{BC} = \left( \frac{2 + 6}{2}, \frac{8 + -2}{2} \right) = E(4,3) \]

\[ F(0,-2) \]

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:

\[ m_{AD} = \frac{3 - -2}{-2 - -6} = \frac{5}{4} \]

\[ AF \parallel DE \] because all horizontal lines have the same slope. \( ADEF \) is not a rhombus because not all sides are congruent.

\[ AD = \sqrt{5^2 + 4^2} = \sqrt{41} \quad AF = 6 \]