1 In $\triangle ABC$ shown below with $\overline{ADC}$, $\overline{AEB}$, $\overline{CFE}$, and $\overline{BFD}$, $\triangle ACE \cong \triangle ABD$.

Which statement must be true?
1) $\angle ACF \cong \angle BCF$
2) $\angle DAE \cong \angle DFE$
3) $\angle BCD \cong \angle ABD$
4) $\angle AEF \cong \angle ADF$

2 In a circle whose equation is $(x - 1)^2 + (y + 3)^2 = 9$, the coordinates of the center and length of its radius are
1) $(1, -3)$ and $r = 81$
2) $(-1, 3)$ and $r = 81$
3) $(1, -3)$ and $r = 3$
4) $(-1, 3)$ and $r = 3$

3 Parallel secants $FH$ and $GJ$ intersect circle $O$, as shown in the diagram below.

If $\widehat{FH} = 106$ and $\widehat{GJ} = 24$, then $\widehat{FG}$ equals
1) 106
2) 115
3) 130
4) 156

4 What are the coordinates of $P'$, the image of point $P(x,y)$ after translation $T_{4,4}$?
1) $(x - 4, y - 4)$
2) $(x + 4, y + 4)$
3) $(4x, 4y)$
4) $(4, 4)$

5 The statement "$x > 5$ or $x < 3$" is false when $x$ is equal to
1) 1
2) 2
3) 7
4) 4
6 Triangle $JTM$ is shown on the graph below.

Which transformation would result in an image that is not congruent to $\triangle JTM$?

1) $r_{y=x}$
2) $R_{90^\circ}$
3) $T_{0,-3}$
4) $D_2$

7 In the diagram below of $\triangle ABC$, with $CDEA$ and $BGFA$, $EF \parallel DG \parallel CB$.

Which statement is false?

1) $\frac{AC}{AD} = \frac{AB}{AG}$
2) $\frac{AE}{AF} = \frac{AC}{AB}$
3) $\frac{AE}{AD} = \frac{EC}{AC}$
4) $\frac{BG}{BA} = \frac{CD}{CA}$

8 Which pair of edges is not coplanar in the cube shown below?

1) $\overline{EH}$ and $\overline{CD}$
2) $\overline{AD}$ and $\overline{FG}$
3) $\overline{DH}$ and $\overline{AE}$
4) $\overline{AB}$ and $\overline{EF}$

9 What is an equation of the line that passes through the point $(-2,1)$ and is parallel to the line whose equation is $4x - 2y = 8$?

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

10 In $\triangle JKL$, $\overline{JL} \cong \overline{KL}$. If $m\angle J = 58$, then $m\angle L$ is

1) 61
2) 64
3) 116
4) 122
11 The corresponding medians of two similar triangles are 8 and 20. If the perimeter of the larger triangle is 45, what is the perimeter of the smaller triangle?

1) 14  
2) 18  
3) 33  
4) 37

12 Which construction of parallel lines is justified by the theorem "If two lines are cut by a transversal to form congruent alternate interior angles, then the lines are parallel"?

1)  
2)  
3)  
4)  

13 Given: "If a polygon is a triangle, then the sum of its interior angles is 180°." What is the contrapositive of this statement?

1) "If the sum of the interior angles of a polygon is not 180°, then it is not a triangle."  
2) "A polygon is a triangle if and only if the sum of its interior angles is 180°."  
3) "If a polygon is not a triangle, then the sum of the interior angles is not 180°."  
4) "If the sum of the interior angles of a polygon is 180°, then it is a triangle."

14 In the diagram below, point P is not on line ℓ.

![Diagram of point P not on line ℓ]

How many distinct planes that contain point P are also perpendicular to line ℓ?

1) 1  
2) 2  
3) 0  
4) an infinite amount

15 The image of ΔABC after the transformation $r_{y-axis}$ is Δ$A'B'C'$. Which property is not preserved?

1) distance  
2) orientation  
3) collinearity  
4) angle measure
16 The equations \( y = 2x + 3 \) and \( y = -x^2 - x + 1 \) are graphed on the same set of axes. The coordinates of a point in the solution of this system of equations are
1) (0,1)
2) (1,5)
3) (−1,−2)
4) (−2,−1)

17 Which quadrilateral has diagonals that are always perpendicular bisectors of each other?
1) square
2) rectangle
3) trapezoid
4) parallelogram

18 As shown in the diagram below, \( \overline{AB} \) is a diameter of circle \( O \), and chord \( \overline{AC} \) is drawn.

If \( m\angle BAC = 70 \), then \( m\overline{AC} \) is
1) 40
2) 70
3) 110
4) 140

19 In parallelogram \( JKLM \), \( m\angle J \) exceeds \( m\angle M \) by 30 degrees. What is the measure of \( m\angle J \)?
1) 75°
2) 105°
3) 165°
4) 195°

20 Which equation represents the circle shown in the graph below?

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

21 What is the measure of each interior angle in a regular octagon?
1) 108°
2) 135°
3) 144°
4) 1080°

22 Points \( A \) and \( B \) are on line \( \ell \), and line \( \ell \) is parallel to line \( m \), as shown in the diagram below.

How many points are in the same plane as \( \ell \) and \( m \) and equidistant from \( \ell \) and \( m \), and also equidistant from \( A \) and \( B \)?
1) 1
2) 2
3) 3
4) 0
23 A carpenter made a storage container in the shape of a rectangular prism. It is 5 feet high and has a volume of 720 cubic feet. He wants to make a second container with the same height and volume as the first one, but in the shape of a triangular prism. What will be the number of square feet in the area of the base of the new container?

1) 36
2) 72
3) 144
4) 288

24 In $\triangle ABC$, $m\angle B < m\angle A < m\angle C$. Which statement is false?

1) $AC > BC$
2) $BC > AC$
3) $AC < AB$
4) $BC < AB$

25 In the diagram below of circle $O$ with radius $OA$, tangent $CA$ and secant $COB$ are drawn.

(Not drawn to scale)

If $AC = 20$ cm and $OA = 7$ cm, what is the length of $OC$, to the nearest centimeter?

1) 19
2) 20
3) 21
4) 27

26 In the diagram below of $\triangle ABC$, point $H$ is the intersection of the three medians.

If $DH$ measures 2.4 centimeters, what is the length, in centimeters, of $AD$?

1) 3.6
2) 4.8
3) 7.2
4) 9.6

27 Which set of numbers could be the lengths of the sides of an isosceles triangle?

1) $\{1, 1, 2\}$
2) $\{3, 3, 5\}$
3) $\{3, 4, 5\}$
4) $\{4, 4, 9\}$

28 In the diagram below of right triangle $ABC$, $CD$ is the altitude to hypotenuse $AB$, $AD = 3$, and $DB = 4$.

What is the length of $CB$?

1) $2\sqrt{3}$
2) $\sqrt{21}$
3) $2\sqrt{7}$
4) $4\sqrt{3}$
29 The image of \( RS \) after a reflection through the origin is \( R'S' \). If the coordinates of the endpoints of \( RS \) are \( R(2, -3) \) and \( S(5, 1) \), state and label the coordinates of \( R' \) and \( S' \). [The use of the set of axes below is optional.]

![Graph showing a reflection through the origin]

30 A paper container in the shape of a right circular cone has a radius of 3 inches and a height of 8 inches. Determine and state the number of cubic inches in the volume of the cone, in terms of \( \pi \).

31 In isosceles triangle \( RST \) shown below, \( RS \cong RT \), \( M \) and \( N \) are midpoints of \( RS \) and \( RT \), respectively, and \( MN \) is drawn. If \( MN = 3.5 \) and the perimeter of \( \triangle RST \) is 25, determine and state the length of \( NT \).

![Diagram of an isosceles triangle]

32 In the diagram below, \( \triangle ABC \) is equilateral.

![Diagram of an equilateral triangle]

Using a compass and straightedge, construct a new equilateral triangle congruent to \( \triangle ABC \) in the space below. [Leave all construction marks.]

33 Write an equation of the line that is perpendicular to the line whose equation is \( 2y = 3x + 12 \) and that passes through the origin.

34 Rectangle \( KLMN \) has vertices \( K(0, 4) \), \( L(4, 2) \), \( M(1, -4) \), and \( N(-3, -2) \). Determine and state the coordinates of the point of intersection of the diagonals.
35 On the set of axes below, graph the locus of points 5 units from the point (2, −3) and the locus of points 2 units from the line whose equation is \( y = -1 \). State the coordinates of all points that satisfy both conditions.

36 If \( \overline{AB} \) is defined by the endpoints \( A(4, 2) \) and \( B(8, 6) \), write an equation of the line that is the perpendicular bisector of \( \overline{AB} \).

37 On the set of axes below, graph and label circle \( A \) whose equation is \((x + 4)^2 + (y - 2)^2 = 16\) and circle \( B \) whose equation is \( x^2 + y^2 = 9 \). Determine, in simplest radical form, the length of the line segment with endpoints at the centers of circles \( A \) and \( B \).

38 Given: Parallelogram \( DEFG \), \( K \) and \( H \) are points on \( \overrightarrow{DE} \) such that \( \angle DGK \cong \angle EFH \) and \( \overline{GK} \) and \( \overline{FH} \) are drawn.

Prove: \( \overline{DK} \cong \overline{EH} \)
0815ge

Answer Section

1. ANS: 4   PTS: 2   REF: 081501ge   STA: G.G.29
   TOP: Triangle Congruency
2. ANS: 3   PTS: 2   REF: 081502ge   STA: G.G.73
   TOP: Equations of Circles
3. ANS: 2
   Parallel secants intercept congruent arcs. \( \frac{360 - (106 + 24)}{2} = \frac{230}{2} = 115 \)
   PTS: 2   REF: 081503ge   STA: G.G.52   TOP: Chords and Secants
4. ANS: 2   PTS: 2   REF: 081504ge   STA: G.G.61
   TOP: Analytical Representations of Transformations
5. ANS: 4   PTS: 2   REF: 081505ge   STA: G.G.25
   TOP: Compound Statements   KEY: disjunction
   TOP: Properties of Transformations
7. ANS: 3   PTS: 2   REF: 081507ge   STA: G.G.46
   TOP: Side Splitter Theorem
8. ANS: 1   PTS: 2   REF: 081508ge   STA: G.G.10
   TOP: Solids
9. ANS: 3
   \( m = \frac{-A}{B} = \frac{-4}{-2} = 2 \) \( y = mx + b \)
   \[ 1 = 2(-2) + b \]
   \[ 1 = -4 + b \]
   \[ 5 = b \]
   PTS: 2   REF: 081509ge   STA: G.G.65   TOP: Parallel and Perpendicular Lines
10. ANS: 2
    \( 180 - 2(58) = 64 \)
    PTS: 2   REF: 081510ge   STA: G.G.31   TOP: Isosceles Triangle Theorem
11. ANS: 2
    \( 45 \cdot \frac{8}{20} = 18 \)
    PTS: 2   REF: 081511ge   STA: G.G.45   TOP: Similarity   KEY: perimeter and area
12. ANS: 3   PTS: 2   REF: 081512ge   STA: G.G.19
    TOP: Constructions
13. ANS: 1   PTS: 2   REF: 081513ge   STA: G.G.26
    TOP: Contrapositive
    TOP: Planes
15 ANS: 2 PTS: 2 REF: 081515ge STA: G.G.55
TOP: Properties of Transformations

16 ANS: 4
2x + 3 = −x^2 − x + 1 \ y = 2(−2) + 3 = −1
x^2 + 3x + 2 = 0
(x + 2)(x + 1) = 0
x = −2, −1

PTS: 2 REF: 081516ge STA: G.G.70 TOP: Quadratic-Linear Systems

17 ANS: 1 PTS: 2 REF: 081517ge STA: G.G.41
TOP: Special Quadrilaterals

18 ANS: 1 PTS: 2 REF: 081518ge STA: G.G.51
TOP: Arcs Determined by Angles KEY: inscribed

19 ANS: 2
L + L − 30 = 180
2L = 210
L = 105

PTS: 2 REF: 081519ge STA: G.G.38 TOP: Parallelograms

20 ANS: 2 PTS: 2 REF: 081520ge STA: G.G.72
TOP: Equations of Circles

21 ANS: 2
(n − 2)180 = (8 − 2)180 = 1080. \frac{1080}{8} = 135.

PTS: 2 REF: 081521ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

22 ANS: 1 PTS: 2 REF: 081522ge STA: G.G.22
TOP: Locus

23 ANS: 3
720 = 5B
144 = B

PTS: 2 REF: 081523ge STA: G.G.11 TOP: Volume

24 ANS: 1 PTS: 2 REF: 081524ge STA: G.G.34
TOP: Angle Side Relationship

25 ANS: 3
\sqrt{20^2 + 7^2} \approx 21

PTS: 2 REF: 081525ge STA: G.G.50 TOP: Tangents KEY: point of tangency

26 ANS: 3
2.4 + 2(2.4) = 7.2

PTS: 2 REF: 081526ge STA: G.G.43 TOP: Centroid
27 ANS: 2  PTS: 2  REF: 081527ge  STA: G.G.33  
TOP: Triangle Inequality Theorem

28 ANS: 3  
\[ x^2 = 4 \cdot 7 \]  
\[ x = \sqrt{4} \cdot \sqrt{7} \]  
\[ x = 2\sqrt{7} \]  
PTS: 2  REF: 081528ge  STA: G.G.47  TOP: Similarity
KEY: leg

29 ANS:  
\[ \text{Diagram} \]  
PTS: 2  REF: 081529ge  STA: G.G.54  TOP: Reflections
KEY: grids

30 ANS:  
\[ V = \frac{1}{3} \pi (3^2)(8) = 24\pi \]  
PTS: 2  REF: 081530ge  STA: G.G.15  TOP: Volume and Lateral Area

31 ANS:  
\[ 2x + 7 = 25 \quad NT = 4.5 \]  
\[ 2x = 18 \]  
\[ x = 9 \]  
PTS: 2  REF: 081531ge  STA: G.G.42  TOP: Midsegments

32 ANS:  
\[ \text{Diagram} \]  
PTS: 2  REF: 081532ge  STA: G.G.20  TOP: Constructions
33 ANS:
\[ m = \frac{3}{2}, \quad m_\perp = -\frac{2}{3}, \quad y = -\frac{2}{3}x \]

PTS: 2          REF: 081533ge    STA: G.G.64    TOP: Parallel and Perpendicular Lines

34 ANS:
\[
\begin{pmatrix}
\frac{0+1}{2}, \quad \frac{4-4}{2}
\end{pmatrix}
\]
\[
\begin{pmatrix}
\frac{1}{2}, \quad 0
\end{pmatrix}
\]

PTS: 2          REF: 081534ge    STA: G.G.69    TOP: Quadrilaterals in the Coordinate Plane

35 ANS:

\[
\begin{pmatrix}
0, \quad 0
\end{pmatrix}
\]

PTS: 4          REF: 081535ge    STA: G.G.23    TOP: Locus

36 ANS:
\[
M = \left( \frac{4+8}{2}, \frac{2+6}{2} \right) = (6,4) \quad m = \frac{6-2}{8-4} = \frac{4}{4} = 1 \quad m_\perp = -1 \quad y - 4 = -(x - 6)
\]

PTS: 4          REF: 081536ge    STA: G.G.68    TOP: Perpendicular Bisector

37 ANS:

PTS: 4          REF: 081537ge    STA: G.G.74    TOP: Graphing Circles
ANS:

Parallelogram $DEFG$, $K$ and $H$ are points on $\overrightarrow{DE}$ such that $\angle DGK \cong \angle EFH$ and $\overline{GK}$ and $\overline{FH}$ are drawn (given). $\overline{DG} \cong \overline{EF}$ (opposite sides of a parallelogram are congruent). $\overline{DG} \parallel \overline{EF}$ (opposite sides of a parallelogram are parallel). $\angle D \cong \angle FEH$ (corresponding angles formed by parallel lines and a transversal are congruent).

$\triangle DGK \cong \triangle EFH$ (ASA). $\overline{DK} \cong \overline{EH}$ (CPCTC).