1 In trapezoid $RSTV$ with bases $RS$ and $VT$, diagonals $RT$ and $SV$ intersect at $Q$.

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

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

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

Which statement can not be proven?

1) $\angle XYV \cong \angle TVS$
2) $\angle YVX \cong \angle VUT$
3) $XY \cong TS$
4) $YV \cong SV$

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

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

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

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

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

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

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

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

8 In \(\triangle ABC\), \(m\angle A = 3x + 1\), \(m\angle B = 4x - 17\), and \(m\angle C = 5x - 20\). Which type of triangle is \(\triangle ABC\)?

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

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

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

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

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

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

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

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

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

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

\[
x + y = 2 \\
\]

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

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

![Diagram of a right pyramid with base $ABCD$ and slant height $EF$.]

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

16 The volume of a sphere is approximately 44.6022 cubic centimeters. What is the radius of the sphere, to the nearest tenth of a centimeter?
1) 2.2
2) 3.3
3) 4.4
4) 4.7

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

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

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

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

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

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

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

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

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

1) 

2) 

3) 

4) 

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

What is the length of \( AB \)?

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

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

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

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

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

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

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

34 The coordinates of two vertices of square $ABCD$ are $A(2,1)$ and $B(4,4)$. Determine the slope of side $BC$. 

\[ \text{Slope of } BC = \frac{4 - 1}{4 - 2} = \frac{3}{2} \]
35 The coordinates of the vertices of parallelogram \(SWAN\) are \(S(2, -2), W(-2, -4), A(-4, 6),\) and \(N(0, 8)\). State and label the coordinates of parallelogram \(S''W''A''N''\), the image of \(SWAN\) after the transformation \(T_{4, -2} \circ D_{\frac{1}{2}}\). [The use of the set of axes below is optional.]

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

Determine the length of \(DF\). Determine the length of \(OA\).

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

38 In the diagram of \(\triangle MAH\) below, \(MH \cong AH\) and medians \(AB\) and \(MT\) are drawn. Prove: \(\angle MBA \cong \angle ATM\)
0613ge
Answer Section

1 ANS: 2
Isosceles or not, $\triangle RSV$ and $\triangle RST$ have a common base, and since $RS$ and $VT$ are bases, congruent altitudes.

PTS: 2   REF: 061301ge   STA: G.G.40   TOP: Trapezoids

2 ANS: 2
(1) is true because of vertical angles. (3) and (4) are true because CPCTC.

PTS: 2   REF: 061302ge   STA: G.G.29   TOP: Triangle Congruency

3 ANS: 4
TOP: Locus

4 ANS: 4
$(x,y) \rightarrow (-x,-y)$

PTS: 2   REF: 061304ge   STA: G.G.54   TOP: Rotations

5 ANS: 2
TOP: Constructions

6 ANS: 3
TOP: Equations of Circles

7 ANS: 1
TOP: Properties of Transformations

8 ANS: 3
$3x + 1 + 4x - 17 + 5x - 20 = 180, \ 3(18) + 1 = 55$
$12x - 36 = 180, \ 4(18) - 17 = 55$
$12x = 216, \ 5(18) - 20 = 70$
$x = 18$

PTS: 2   REF: 061308ge   STA: G.G.30   TOP: Interior and Exterior Angles of Triangles

9 ANS: 3
TOP: Equations of Circles

10 ANS: 1
TOP: Planes

11 ANS: 3
$3x - 15 = 2(6)$
$3x = 27$
$x = 9$

PTS: 2   REF: 061311ge   STA: G.G.42   TOP: Midsegments
12 ANS: 2
\[ M_x = \frac{8 + (-3)}{2} = 2.5 \quad M_y = \frac{-4 + 2}{2} = -1. \]

PTS: 2  REF: 061312ge  STA: G.G.66  TOP: Midpoint


14 ANS: 1  PTS: 2  REF: 061314ge  STA: G.G.26  TOP: Converse and Biconditional


16 ANS: 1
\[ V = \frac{4}{3} \pi r^3 \]
\[ 44.6022 = \frac{4}{3} \pi r^3 \]
\[ 10.648 \approx r^3 \]
\[ 2.2 \approx r \]

PTS: 2  REF: 061317ge  STA: G.G.16  TOP: Volume and Surface Area

17 ANS: 3
\[ 2y = 3x - 4 \quad 1 = \frac{3}{2} (6) + b \]
\[ y = \frac{3}{2} x - 2 \quad 1 = 9 + b \]
\[ -8 = b \]

PTS: 2  REF: 061316ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

18 ANS: 4
\[ m_{AB} = \frac{6 - 3}{7 - 5} = \frac{3}{2} \quad m_{CD} = \frac{4 - 0}{6 - 9} = \frac{4}{-3} \]

PTS: 2  REF: 061318ge  STA: G.G.63  TOP: Parallel and Perpendicular Lines


20 ANS: 3  PTS: 2  REF: 061320ge  STA: G.G.35  TOP: Parallel Lines and Transversals

21 ANS: 2  PTS: 2  REF: 061321ge  STA: G.G.34  TOP: Angle Side Relationship

23 ANS: 3
\[25 \times 9 \times 12 = 15^2 h\]
\[2700 = 15^2 h\]
\[12 = h\]

PTS: 2 REF: 061323ge STA: G.G.11 TOP: Volume

24 ANS: 2 PTS: 2 REF: 061324ge STA: G.G.44
TOP: Similarity Proofs

25 ANS: 1 PTS: 2 REF: 061325ge STA: G.G.74
TOP: Graphing Circles

26 ANS: 2
\[\sqrt{8^2 + 15^2} = 17\]

PTS: 2 REF: 061326ge STA: G.G.39 TOP: Special Parallelograms

27 ANS: 3
\[x^2 = 3 \times 12. \sqrt{6^2 + 3^2} = \sqrt{45} = \sqrt{9 \cdot 5} = 3\sqrt{5}\]
\[x = 6\]

PTS: 2 REF: 061327ge STA: G.G.47 TOP: Similarity
KEY: altitude

28 ANS: 1
\[12(8) = x(6)\]
\[96 = 6x\]
\[16 = x\]

PTS: 2 REF: 061328ge STA: G.G.53 TOP: Segments Intercepted by Circle
KEY: two secants

29 ANS:
\[L = 2\pi rh = 2\pi \cdot 3 \cdot 7 = 42\pi\]

PTS: 2 REF: 061329ge STA: G.G.14 TOP: Volume and Lateral Area

30 ANS:
\[(n - 2)180 = (8 - 2)180 = 1080. \quad \frac{1080}{8} = 135.\]

PTS: 2 REF: 061330ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

31 ANS:
\[\sqrt{(7 - 3)^2 + (-8 - 0)^2} = \sqrt{16 + 64} = \sqrt{80} = 4\sqrt{5}\]

PTS: 2 REF: 061331ge STA: G.G.69 TOP: Triangles in the Coordinate Plane
32 ANS:

![Diagram of a triangle with a ruler and a compass]

PTS: 2 REF: 061332ge STA: G.G.20 TOP: Constructions

33 ANS:

![Diagram of a construction with a ruler and a compass]

PTS: 2 REF: 061333ge STA: G.G.23 TOP: Locus

34 ANS:

\[ m_{AB} = \frac{4 - 1}{4 - 2} = \frac{3}{2}, \quad m_{BC} = -\frac{2}{3} \]

PTS: 4 REF: 061334ge STA: G.G.69 TOP: Quadrilaterals in the Coordinate Plane

35 ANS:

![Diagram of a quadrilateral with labeled points]

S″(5, −3), W″(3, −4), A″(2, 1), and N″(4, 2)

PTS: 4 REF: 061335ge STA: G.G.58 TOP: Compositions of Transformations

KEY: grids
36 ANS:
\[ 2(y + 10) = 4y - 20. \quad \overline{DF} = y + 10 = 20 + 10 = 30. \quad \overline{OA} = \overline{OD} = \sqrt{16^2 + 30^2} = 34 \]
\[ 2y + 20 = 4y - 20 \]
\[ 40 = 2y \]
\[ 20 = y \]

PTS: 4  REF: 061336ge  STA: G.G.49  TOP: Chords

37 ANS:
\[ x^2 - 8x = 5x + 30. \quad \text{m}\angle C = 4(15) - 5 = 55 \]
\[ x^2 - 13x - 30 = 0 \]
\[ (x - 15)(x + 2) = 0 \]
\[ x = 15 \]

PTS: 4  REF: 061337ge  STA: G.G.45  TOP: Similarity

38 ANS:
\[ \triangle MAH, \overline{MH} \cong \overline{AH} \text{ and medians } \overline{AB} \text{ and } \overline{MT} \text{ are given. } \overline{MA} \cong \overline{AM} \text{ (reflexive property). } \triangle MAH \text{ is an isosceles triangle (definition of isosceles triangle). } \angle AMB \cong \angle MAT \text{ (isosceles triangle theorem). } B \text{ is the midpoint of } \overline{MH} \]
\[ T \text{ is the midpoint of } \overline{AH} \text{ (definition of median). } \overline{MB} = \frac{1}{2} \overline{MH} \text{ and } \overline{AT} = \frac{1}{2} \overline{AH} \text{ (definition of midpoint). } \overline{MB} \cong \overline{AT} \text{ (multiplication postulate). } \triangle MBA \cong \triangle ATM \text{ (SAS). } \angle MBA \cong \angle ATM \text{ (CPCTC).} \]