1 The midpoint of $AB$ is $M(4, 2)$. If the coordinates of $A$ are $(6, -4)$, what are the coordinates of $B$?
1) $(1, -3)$
2) $(2, 8)$
3) $(5, -1)$
4) $(14, 0)$

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

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

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

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

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

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

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

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

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

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

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

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

Using only the information given in the diagrams, which pair of triangles can *not* be proven congruent?

1) A  
2) B  
3) C  
4) D

13. In ΔABC shown below, L is the midpoint of BC, M is the midpoint of AB, and N is the midpoint of AC.

If MN = 8, ML = 5, and NL = 6, the perimeter of trapezoid BMNC is

1) 35  
2) 31  
3) 28  
4) 26

14. In the diagram below, RCBT and ΔABC are shown with m∠A = 60 and m∠ABT = 125.

What is m∠ACR?

1) 125  
2) 115  
3) 65  
4) 55

15. Which equation represents circle O shown in the graph below?

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

16. For which measures of the sides of ΔABC is angle B the largest angle of the triangle?

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

18 As shown in the diagram below, a landscaper uses a cylindrical lawn roller on a lawn. The roller has a radius of 9 inches and a width of 42 inches.

To the nearest square inch, the area the roller covers in one complete rotation is
1) 2,374
2) 2,375
3) 10,682
4) 10,688

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

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

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

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

22 Lines \( p \) and \( q \) are intersected by line \( r \), as shown below.

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

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

If \( AE = 2 \) and \( FB = 17 \), then the length of \( \overline{CE} \) is
1) 7
2) 8
3) 15
4) 16

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

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

27 Trapezoid \( QRST \) is graphed on the set of axes below.

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

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

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

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

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

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

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

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. circle $O$, diameter $\overline{RS}$, chord $\overline{AS}$, tangent $\overrightarrow{TS}$, and secant $\overline{TAR}$</td>
<td>1. Given</td>
</tr>
<tr>
<td>2. $RS \perp TS$</td>
<td>2.</td>
</tr>
<tr>
<td>3. $\angle BST$ is a right angle</td>
<td>3. $\perp$ lines form right angles</td>
</tr>
<tr>
<td>4. $\angle BRS$ is a right angle</td>
<td>4.</td>
</tr>
<tr>
<td>5. $\angle BST \cong \angle BAS$</td>
<td>5.</td>
</tr>
<tr>
<td>6. $\angle R = \angle R$</td>
<td>6. Reflexive property</td>
</tr>
<tr>
<td>7. $\triangle BST \sim \triangle BAS$</td>
<td>7.</td>
</tr>
<tr>
<td>8. $\frac{RS}{RA} = \frac{RT}{RS}$</td>
<td>8.</td>
</tr>
<tr>
<td>9. $(RS)^2 = RA \cdot RT$</td>
<td>9.</td>
</tr>
</tbody>
</table>
0114ge

Answer Section

1 ANS: 2
\[
\frac{6 + x}{2} = 4, \quad \frac{-4 + y}{2} = 2
\]
\[
x = 2, \quad y = 8
\]

PTS: 2 REF: 011401ge STA: G.G.66 TOP: Midpoint

2 ANS: 3 PTS: 2 REF: 011402ge STA: G.G.17 TOP: Constructions


4 ANS: 1 PTS: 2 REF: 011404ge STA: G.G.9 TOP: Planes


7 ANS: 4 PTS: 2 REF: 011407ge STA: G.G.23 TOP: Locus

8 ANS: 1
\[
2x + x = 12, \quad BD = 2(4) = 8
\]
\[
3x = 12
\]
\[
x = 4
\]

PTS: 2 REF: 011408ge STA: G.G.43 TOP: Centroid

9 ANS: 2
\[
x^2 - 2 = x
\]
\[
x^2 - x - 2 = 0
\]
\[
(x - 2)(x + 1) = 0
\]
\[
x = 2, -1
\]

PTS: 2 REF: 011409ge STA: G.G.70 TOP: Quadratic-Linear Systems

10 ANS: 2
\[
m = \frac{-A}{B} = \frac{-5}{1} = -5 \quad y = mx + b
\]
\[
3 = -5(5) + b
\]
\[
28 = b
\]

PTS: 2 REF: 011410ge STA: G.G.65 TOP: Parallel and Perpendicular Lines

12 ANS: 1
PT: Triangle Congruency
REF: 011412ge STA: G.G.28

13 ANS: 1

14 ANS: 2
\[ \text{m} \angle ABC = 55, \text{ so } \text{m} \angle ACR = 60 + 55 = 115 \]

15 ANS: 4
PT: Midsegments
REF: 011414ge STA: G.G.42

16 ANS: 1
PT: Exterior Angle Theorem
REF: 011415ge STA: G.G.32

17 ANS: 3
The regular polygon with the smallest interior angle is an equilateral triangle, with 60°. 180° − 60° = 120°

18 ANS: 2
\[ 18 \pi \cdot 42 \approx 2375 \]

19 ANS: 3
\[ 180 - 38 = 142 \]

20 ANS: 2
\[ s^2 + s^2 = (3 \sqrt{2})^2 \]
\[ 2s^2 = 18 \]
\[ s^2 = 9 \]
\[ s = 3 \]

21 ANS: 4
PT: Special Parallelograms
REF: 011420ge STA: G.G.39

TOP: Rotations
REF: 011421ge STA: G.G.54
22 ANS: 1
7x − 36 + 5x + 12 = 180
12x − 24 = 180
12x = 204
x = 17

PTS: 2  REF: 011422ge  STA: G.G.35  TOP: Parallel Lines and Transversals

23 ANS: 1  PTS: 2  REF: 011423ge  STA: G.G.71
TOP: Equations of Circles

24 ANS: 2
\[ \sqrt{17^2 - 15^2} = \sqrt{289 - 225} = \sqrt{64} = 8 \]

PTS: 2  REF: 011424ge  STA: G.G.49  TOP: Chords

25 ANS: 3  PTS: 2  REF: 011425ge  STA: G.G.39
TOP: Special Parallelograms

26 ANS: 4  PTS: 2  REF: 011426ge  STA: G.G.73
TOP: Equations of Circles

27 ANS: 3  PTS: 2  REF: 011427ge  STA: G.G.56
TOP: Identifying Transformations

28 ANS: 4  PTS: 2  REF: 011428ge  STA: G.G.50
TOP: Tangents  KEY: common tangency

29 ANS:
\[ SA = 4\pi r^2 = 4\pi \cdot 2.5^2 = 25\pi \approx 78.54 \]

PTS: 2  REF: 011429ge  STA: G.G.16  TOP: Volume and Surface Area

30 ANS: 

PTS: 2  REF: 011430ge  STA: G.G.18  TOP: Constructions

31 ANS:
\[ \sqrt{(3 - 7)^2 + (-4 - 2)^2} = \sqrt{16 + 36} = \sqrt{52} = \sqrt{4\cdot13} = 2\sqrt{13}. \]

PTS: 2  REF: 011431ge  STA: G.G.67  TOP: Distance
32 ANS:

\[ Bh = V \]
\[ 12h = 84 \]
\[ h = 7 \]

PTS: 2 REF: 011432ge STA: G.G.12 TOP: Volume

33 ANS:

Neither. The slope of \( y = \frac{1}{2}x - 1 \) is \( \frac{1}{2} \). The slope of \( y + 4 = -\frac{1}{2}(x - 2) \) is \( -\frac{1}{2} \). The slopes are neither the same nor opposite reciprocals.

PTS: 2 REF: 011433ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

34 ANS:

PTS: 2 REF: 011434ge STA: G.G.22 TOP: Locus

35 ANS:

\[ x + 3x - 60 + 5x - 30 = 180 \quad 5(30) - 30 = 120 \quad 6y - 8 = 4y - 2 \quad \overline{DC} = 10 + 10 = 20 \]
\[ 9x - 90 = 180 \quad m\angle BAC = 180 - 120 = 60 \quad 2y = 6 \]
\[ 9x = 270 \quad y = 3 \]
\[ x = 30 = m\angle D \quad 4(3) - 2 = 10 = \overline{BC} \]

PTS: 3 REF: 011435ge STA: G.G.31 TOP: Isosceles Triangle Theorem
36 ANS:

\[
\begin{align*}
5 & \quad 36 \text{ ANS:} \\
\text{PTS: 3} & \quad \text{REF: 011436ge} \quad \text{STA: G.G.58} \quad \text{TOP: Compositions of Transformations} \quad \text{KEY: grids}
\end{align*}
\]

37 ANS:

\[
\begin{align*}
4x \cdot x &= 6^2 \\
4x^2 &= 36 \\
x^2 &= 9 \\
x &= 3 \\
BD &= 4(3) = 12 \\
\end{align*}
\]

\[
\begin{align*}
\text{PTS: 4} & \quad \text{REF: 011437ge} \quad \text{STA: G.G.47} \quad \text{TOP: Similarity} \quad \text{KEY: leg}
\end{align*}
\]

38 ANS:

2. The diameter of a circle is \( \perp \) to a tangent at the point of tangency. 4. An angle inscribed in a semicircle is a right angle. 5. All right angles are congruent. 7. AA. 8. Corresponding sides of congruent triangles are in proportion. 9. The product of the means equals the product of the extremes.

\[
\begin{align*}
\text{PTS: 6} & \quad \text{REF: 011438ge} \quad \text{STA: G.G.27} \quad \text{TOP: Circle Proofs}
\end{align*}
\]