1 Based on the diagram below, which statement is true?

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

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

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

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

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

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

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

Which statement is true based on the given information?

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

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

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

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

What is the measure of $\angle 2$?

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

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

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

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

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

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

12. Given the equations: \( y = x^2 - 6x + 10 \) and \( y + x = 4 \). What is the solution to the given system of equations?
    1) (2, 3)
    2) (3, 2)
    3) (2, 2) and (1, 3)
    4) (2, 2) and (3, 1)

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

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

   ![Diagram](image)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

What is the value of \(x\)?

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

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

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

![Diagram of circle construction](image)

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

26 A right circular cylinder has a volume of 1,000 cubic inches and a height of 8 inches. What is the radius of the cylinder to the nearest tenth of an inch?

1) 6.3
2) 11.2
3) 19.8
4) 39.8

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

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

![Tangent circles](image)

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

29 In the diagram below of isosceles trapezoid \( DEFG \), \( DE \parallel GF \), \( DE = 4x - 2 \), \( EF = 3x + 2 \), \( FG = 5x - 3 \), and \( GD = 2x + 5 \). Find the value of \( x \).

![Trapezoid DEFG](image)
30 A regular pyramid with a square base is shown in the diagram below.

A side, $s$, of the base of the pyramid is 12 meters, and the height, $h$, is 42 meters. What is the volume of the pyramid in cubic meters?

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

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

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

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

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

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

38 Given: Quadrilateral $ABCD$, diagonal $\overline{AFEC}$, $\overline{AE} \cong \overline{FC}$, $BF \perp \overline{AC}$, $DE \perp \overline{AC}$, $\angle 1 \cong \angle 2$

Prove: $ABCD$ is a parallelogram.
1 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
2 ANS: 3  PTS: 2  REF: 080902ge  STA: G.G.17  TOP: Constructions
3 ANS: 4  
\[ 180 - (40 + 40) = 100 \]

PTS: 2  REF: 080903ge  STA: G.G.31  TOP: Isosceles Triangle Theorem
4 ANS: 2  
Parallel chords intercept congruent arcs. \( \overline{AC} = \overline{BD} = 30 \). \[ 180 - 30 - 30 = 120. \]

PTS: 2  REF: 080904ge  STA: G.G.52  TOP: Chords
6 ANS: 2  
A dilation affects distance, not angle measure.

PTS: 2  REF: 080906ge  STA: G.G.60  TOP: Identifying Transformations
7 ANS: 1  
\( \angle DCB \) and \( \angle ADC \) are supplementary adjacent angles of a parallelogram. \[ 180 - 120 = 60. \] \( \angle 2 = 60 - 45 = 15. \)

PTS: 2  REF: 080907ge  STA: G.G.38  TOP: Parallelograms
8 ANS: 1  
Translations and reflections do not affect distance.

PTS: 2  REF: 080908ge  STA: G.G.59  TOP: Properties of Transformations
9 ANS: 3  
The slope of \( y = x + 2 \) is 1. The slope of \( y - x = -1 \) is \( \frac{A}{B} = \frac{-(-1)}{1} = 1. \)

PTS: 2  REF: 080909ge  STA: G.G.63  TOP: Parallel and Perpendicular Lines
10 ANS: 2  
\[ M_x = \frac{-2 + 6}{2} = 2. \] \[ M_y = \frac{-4 + 2}{2} = -1 \]

PTS: 2  REF: 080910ge  STA: G.G.66  TOP: Midpoint
12 ANS: 4

\[ y + x = 4 \quad x^2 - 6x + 10 = -x + 4 \quad y + x = 4 \quad y + 2 = 4 \]

\[ y = -x + 4 \quad x^2 - 5x + 6 = 0 \quad y + 3 = 4 \quad y = 2 \]

\[ (x - 3)(x - 2) = 0 \quad y = 1 \]

\[ x = 3 \text{ or } 2 \]

PTS: 2 REF: 080912ge STA: G.G.70 TOP: Quadratic-Linear Systems

13 ANS: 3 PTS: 2 REF: 080913ge STA: G.G.28

TOP: Triangle Congruency

14 ANS: 4 PTS: 2 REF: 080914ge STA: G.G.7

TOP: Planes

15 ANS: 4 PTS: 2 REF: 080915ge STA: G.G.56

TOP: Identifying Transformations

16 ANS: 2

\[ 6 + 17 > 22 \]

PTS: 2 REF: 080916ge STA: G.G.33 TOP: Triangle Inequality Theorem

17 ANS: 4

The slope of \( y = \frac{2}{3}x - 5 \) is \(-\frac{2}{3}\). Perpendicular lines have slope that are opposite reciprocals.

PTS: 2 REF: 080917ge STA: G.G.62 TOP: Parallel and Perpendicular Lines

18 ANS: 1 PTS: 2 REF: 080918ge STA: G.G.41

TOP: Special Quadrilaterals

19 ANS: 1

\[ d = \sqrt{(-4 - 2)^2 + (5 - (-5))^2} = \sqrt{36 + 100} = \sqrt{136} = \sqrt{4 \cdot 34} = 2\sqrt{34}. \]

PTS: 2 REF: 080919ge STA: G.G.67 TOP: Distance

20 ANS: 3

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

21 ANS: 2 PTS: 2 REF: 080921ge STA: G.G.72

TOP: Equations of Circles
22. **ANS: 4**  
Let \( AD = x \). \( 36x = 12^2 \)  
\[ x = 4 \]  

**PTS: 2**  
**REF: 080922ge**  
**STA: G.G.47**  
**TOP: Similarity**  

**KEY: leg**

23. **ANS: 2**  
\[ 4(4x - 3) = 3(2x + 8) \]  
\[ 16x - 12 = 6x + 24 \]  
\[ 10x = 36 \]  
\[ x = 3.6 \]  

**PTS: 2**  
**REF: 080923ge**  
**STA: G.G.53**  
**TOP: Segments Intercepted by Circle**  

**KEY: two chords**

24. **ANS: 3**  
**TOP: Negations**

25. **ANS: 4**  
**TOP: Centroid, Orthocenter, Incenter and Circumcenter**

26. **ANS: 1**  
\[ V = \pi r^2 h \]  
\[ 1000 = \pi r^2 \cdot 8 \]  
\[ r^2 = \frac{1000}{8\pi} \]  
\[ r \approx 6.3 \]  

**PTS: 2**  
**REF: 080926ge**  
**STA: G.G.14**  
**TOP: Volume and Lateral Area**

27. **ANS: 2**  
**TOP: Planes**

28. **ANS: 3**  
**TOP: Tangents**  
**KEY: common tangency**

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

**PTS: 2**  
**REF: 080929ge**  
**STA: G.G.40**  
**TOP: Trapezoids**

30. **ANS:**  
\[ 2016. \ V = \frac{1}{3} Bh = \frac{1}{3} s^2 h = \frac{1}{3} \cdot 12^2 \cdot 42 = 2016 \]  

**PTS: 2**  
**REF: 080930ge**  
**STA: G.G.13**  
**TOP: Volume**
31 ANS: 
\[ y = \frac{2}{3}x - 9. \] The slope of \(2x - 3y = 11\) is \(\frac{A}{B} = \frac{-2}{-3} = \frac{2}{3} \). 
\[ -5 = \frac{2}{3}(6) + b \]
\[ -5 = 4 + b \]
\[ b = -9 \]

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

32 ANS:

![Diagram of geometric construction](image)

PTS: 2 REF: 080932ge STA: G.G.17 TOP: Constructions

33 ANS:
26. \( x + 3x + 5x - 54 = 180 \)
\[ 9x = 234 \]
\[ x = 26 \]

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

34 ANS:
\( \overline{AC} \) \( \angle BCA = 63 \) and \( \angle ABC = 80 \). \( \overline{AC} \) is the longest side as it is opposite the largest angle.

PTS: 2 REF: 080934ge STA: G.G.34 TOP: Angle Side Relationship
35 ANS:
\[ y = \frac{4}{3}x - 6 \]
\[ M_x = \frac{-1 + 7}{2} = 3 \]
\[ M_y = \frac{1 + (-5)}{2} = -2 \]
\[ m = \frac{1 - (-5)}{-1 - 7} = \frac{3}{4} \]

The perpendicular bisector goes through (3, -2) and has a slope of \( \frac{4}{3} \).

\[ y - y_M = m(x - x_M) \]
\[ y + 2 = \frac{4}{3}(x - 3) \]

36 ANS:

37 ANS:

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

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

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

ANS:

\[ FE \cong FE \text{ (Reflexive Property); } AE - FE \cong FC - EF \text{ (Line Segment Subtraction Theorem)}; \]

\[ AF \cong CE \text{ (Substitution); } \angle BFA \cong \angle DEC \text{ (All right angles are congruent); } \triangle BFA \cong \triangle DEC \text{ (AAS)}; \]

\[ AB \cong CD \text{ and } BF \cong DE \text{ (CPCTC); } \angle BFC \cong \angle DEA \text{ (All right angles are congruent); } \triangle BFC \cong \triangle DEA \text{ (SAS)}; \]

\[ AD \cong CB \text{ (CPCTC); } ABCD \text{ is a parallelogram (opposite sides of quadrilateral } ABCD \text{ are congruent)} \]