1. Given: $\triangle ABD$, $BC$ is the perpendicular bisector of $AD$

Which statement can not always be proven?
1) $AC \cong DC$
2) $BC \cong CD$
3) $\angle ACB \cong \angle DCB$
4) $\triangle ABC \cong \triangle DBC$

2. In the diagram of circle $O$ below, chord $CD$ is parallel to diameter $AOB$ and $mCD = 110$.

What is $mDB$?
1) 35
2) 55
3) 70
4) 110

3. Given the statement: One is a prime number.
What is the negation and the truth value of the negation?
1) One is not a prime number; true
2) One is not a prime number; false
3) One is a composite number; true
4) One is a composite number; false

4. Triangle $ABC$ has the coordinates $A(1, 2)$, $B(5, 2)$, and $C(5, 5)$. Triangle $ABC$ is rotated 180° about the origin to form triangle $A'B'C'$. Triangle $A'B'C'$ is
1) acute
2) isosceles
3) obtuse
4) right

5. What is an equation of the circle with center $(-5, 4)$ and a radius of $7$?
1) $(x - 5)^2 + (y + 4)^2 = 14$
2) $(x - 5)^2 + (y + 4)^2 = 49$
3) $(x + 5)^2 + (y - 4)^2 = 14$
4) $(x + 5)^2 + (y - 4)^2 = 49$

6. In $\triangle ABC$, $\angle A \cong \angle B$ and $\angle C$ is an obtuse angle. Which statement is true?
1) $AC \cong AB$ and $BC$ is the longest side.
2) $AC \cong BC$ and $AB$ is the longest side.
3) $AC \cong AB$ and $BC$ is the shortest side.
4) $AC \cong BC$ and $AB$ is the shortest side.

7. In the diagram of $\triangle ABC$ below, medians $\overline{AD}$ and $\overline{BE}$ intersect at point $F$.

If $AF = 6$, what is the length of $FD$?
1) 6
2) 2
3) 3
4) 9

8. In circle $O$, diameter $AB$ intersects chord $CD$ at $E$. If $CE = ED$, then $\angle CEA$ is which type of angle?
1) straight
2) obtuse
3) acute
4) right
9. If \( \triangle ABC \cong \triangle JKL \cong \triangle RST \), then \( \overline{BC} \) must be congruent to
   1) \( JL \)
   2) \( JK \)
   3) \( ST \)
   4) \( RS \)

10. In the diagram of \( \triangle ABC \) below, \( \overline{AB} \) is extended to point \( D \).

   \[
   \begin{align*}
   \angle CAB &= x + 40, \\
   \angle ACB &= 3x + 10, \\
   \angle CBD &= 6x,
   \end{align*}
   \]

   What is \( \angle CAB \)?
   1) 13
   2) 25
   3) 53
   4) 65

11. The bases of a right triangular prism are \( \triangle ABC \) and \( \triangle DEF \). Angles \( A \) and \( D \) are right angles, \( AB = 6 \), \( AC = 8 \), and \( AD = 12 \). What is the length of edge \( \overline{BE} \)?
   1) 10
   2) 12
   3) 14
   4) 16

12. What is the equation of circle \( O \) shown in the diagram below?

   \[
   \begin{align*}
   1) \ (x + 4)^2 + (y - 1)^2 &= 3 \\
   2) \ (x - 4)^2 + (y + 1)^2 &= 3 \\
   3) \ (x + 4)^2 + (y - 1)^2 &= 9 \\
   4) \ (x - 4)^2 + (y + 1)^2 &= 9 
   \end{align*}
   \]

13. The diagram below shows the construction of line \( m \), parallel to line \( \ell \), through point \( P \).

   Which theorem was used to justify this construction?
   1) If two lines are cut by a transversal and the alternate interior angles are congruent, the lines are parallel.
   2) If two lines are cut by a transversal and the interior angles on the same side are supplementary, the lines are parallel.
   3) If two lines are perpendicular to the same line, they are parallel.
   4) If two lines are cut by a transversal and the corresponding angles are congruent, they are parallel.
14. The lateral area of a right circular cone is equal to $120\pi$ cm$^2$. If the base of the cone has a diameter of 24 cm, what is the length of the slant height, in centimeters?
   1) 2.5
   2) 5
   3) 10
   4) 15.7

15. A student wrote the following equations:
   
   \[ 3y + 6 = 2x \]
   \[ 2y - 3x = 6 \]

   The lines represented by these equations are
   1) parallel
   2) the same line
   3) perpendicular
   4) intersecting, but not perpendicular

16. In a coordinate plane, the locus of points 5 units from the x-axis is the
   1) lines $x = 5$ and $x = -5$
   2) lines $y = 5$ and $y = -5$
   3) line $x = 5$, only
   4) line $y = 5$, only

17. The sides of a triangle are 8, 12, and 15. The longest side of a similar triangle is 18. What is the ratio of the perimeter of the smaller triangle to the perimeter of the larger triangle?
   1) 2:3
   2) 4:9
   3) 5:6
   4) 25:36

18. Lines $m$ and $n$ are in plane $\mathcal{A}$. What is the converse of the statement "If lines $m$ and $n$ are parallel, then lines $m$ and $n$ do not intersect"?
   1) If lines $m$ and $n$ are not parallel, then lines $m$ and $n$ intersect.
   2) If lines $m$ and $n$ are not parallel, then lines $m$ and $n$ do not intersect.
   3) If lines $m$ and $n$ intersect, then lines $m$ and $n$ are not parallel.
   4) If lines $m$ and $n$ do not intersect, then lines $m$ and $n$ are parallel.

19. When the system of equations $y + 2 = (x - 4)^2$ and $2x + y - 6 = 0$ is solved graphically, the solution is
   1) $(-4, -2)$ and $(-2, 2)$
   2) $(4, -2)$ and $(2, 2)$
   3) $(-4, 2)$ and $(-6, 6)$
   4) $(4, 2)$ and $(6, 6)$

20. In the diagram of $\Delta UVW$ below, $A$ is the midpoint of $\overline{UV}$, $B$ is the midpoint of $\overline{UW}$, $C$ is the midpoint of $\overline{VW}$, and $\overline{AB}$ and $\overline{AC}$ are drawn.

   If $VW = 7x - 3$ and $AB = 3x + 1$, what is the length of $VC$?
   1) 5
   2) 13
   3) 16
   4) 32

21. Two prisms have equal heights and equal volumes. The base of one is a pentagon and the base of the other is a square. If the area of the pentagonal base is 36 square inches, how many inches are in the length of each side of the square base?
   1) 6
   2) 9
   3) 24
   4) 36

22. What is the difference between the sum of the measures of the interior angles of a regular pentagon and the sum of the measures of the exterior angles of a regular pentagon?
   1) 36
   2) 72
   3) 108
   4) 180
23 If line \(\ell\) is perpendicular to distinct planes \(P\) and \(Q\), then planes \(P\) and \(Q\):
1) are parallel
2) contain line \(\ell\)
3) are perpendicular
4) intersect, but are not perpendicular

24 Which graph represents a circle whose equation is \(x^2 + (y - 2)^2 = 4\)?

25 In the diagram below, \(\overline{AC}\) and \(\overline{AD}\) are tangent to circle \(B\) at points \(C\) and \(D\), respectively, and \(\overline{BC}\), \(\overline{BD}\), and \(\overline{BA}\) are drawn.

If \(AC = 12\) and \(AB = 15\), what is the length of \(BD\)?
1) 5.5
2) 9
3) 12
4) 18

26 Triangle \(ABC\) shown below is a right triangle with altitude \(AD\) drawn to the hypotenuse \(BC\).

If \(BD = 2\) and \(DC = 10\), what is the length of \(AB\)?
1) \(2\sqrt{2}\)
2) \(2\sqrt{5}\)
3) \(2\sqrt{6}\)
4) \(2\sqrt{30}\)

27 Triangle \(ABC\) has vertices \(A(0, 0)\), \(B(6, 8)\), and \(C(8, 4)\). Which equation represents the perpendicular bisector of \(BC\)?
1) \(y = 2x - 6\)
2) \(y = -2x + 4\)
3) \(y = \frac{1}{2}x + \frac{5}{2}\)
4) \(y = -\frac{1}{2}x + \frac{19}{2}\)
28 Chords $\overline{AB}$ and $\overline{CD}$ intersect at point $E$ in a circle with center at $O$. If $AE = 8$, $AB = 20$, and $DE = 16$, what is the length of $CE$?
1) 6
2) 9
3) 10
4) 12

29 Triangle $ABC$ has vertices $A(6, 6)$, $B(9, 0)$, and $C(3, -3)$. State and label the coordinates of $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation of $D \frac{1}{3}$.

30 Using a compass and straightedge, construct the bisector of $\angle MJH$. [Leave all construction marks.]

31 Find, in simplest radical form, the length of the line segment with endpoints whose coordinates are $(-1, 4)$ and $(3, -2)$.

32 In $\triangle ABC$, the measure of angle $A$ is fifteen less than twice the measure of angle $B$. The measure of angle $C$ equals the sum of the measures of angle $A$ and angle $B$. Determine the measure of angle $B$.

33 A circle has the equation $(x - 3)^2 + (y + 4)^2 = 10$. Find the coordinates of the center of the circle and the length of the circle's radius.

34 Two intersecting lines are shown in the diagram below. Sketch the locus of points that are equidistant from the two lines. Sketch the locus of points that are a given distance, $d$, from the point of intersection of the given lines. State the number of points that satisfy both conditions.

35 Given: $\triangle ABC$, $\overline{BD}$ bisects $\angle ABC$, $\overline{BD} \perp \overline{AC}$
Prove: $AB \cong CB$
36 Quadrilateral $MATH$ has coordinates $M(-6,-3)$, $A(-1,-3)$, $T(-2,-1)$, and $H(-4,-1)$. The image of quadrilateral $MATH$ after the composition $r_{x\text{-axis}} \circ T_{7,5}$ is quadrilateral $M''A''T''H''$. State and label the coordinates of $M''A''T''H''$. [The use of the set of axes below is optional.]

37 Trapezoid $TRAP$, with median $\overline{MQ}$, is shown in the diagram below. Solve algebraically for $x$ and $y$.

38 Quadrilateral $ABCD$ with vertices $A(-7,4)$, $B(-3,6), C(3,0)$, and $D(1,-8)$ is graphed on the set of axes below. Quadrilateral $MNPQ$ is formed by joining $M, N, P,$ and $Q$, the midpoints of $\overline{AB}, \overline{BC}, \overline{CD},$ and $\overline{AD}$, respectively. Prove that quadrilateral $MNPQ$ is a parallelogram. Prove that quadrilateral $MNPQ$ is not a rhombus.
1. Parallel chords intercept congruent arcs. $\overparen{AC} = \overparen{BD}$. $\frac{180 - 110}{2} = 35$.

2. Distance is preserved after a rotation.

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

4. $6x = x + 40 + 3x + 10$. $m\angle CAB = 25 + 40 = 65$

5. $6x = 4x + 50$

6. $2x = 50$

7. $x = 25$

8. $120\pi = \pi(12)(l)$

9. $10 = l$
15 | ANS: 4
   | \[3y + 6 = 2x \quad 2y - 3x = 6\]
   | \[3y = 2x - 6 \quad 2y = 3x + 6\]
   | \[y = \frac{2}{3}x - 2 \quad y = \frac{3}{2}x + 3\]
   | \[m = \frac{2}{3} \quad m = \frac{3}{2}\]

PTS: 2   REF: 081315ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

16 | ANS: 2
   | PTS: 2   REF: 081316ge STA: G.G.23
   | TOP: Locus

17 | ANS: 3
   | \[\frac{15}{18} = \frac{5}{6}\]

PTS: 2   REF: 081317ge STA: G.G.45 TOP: Similarity
KEY: perimeter and area

18 | ANS: 4
   | PTS: 2   REF: 081318ge STA: G.G.26
   | TOP: Converse and Biconditional

19 | ANS: 2
   | \[(x - 4)^2 - 2 = -2x + 6 \quad y = -2(4) + 6 = -2\]
   | \[x^2 - 8x + 16 - 2 = -2x + 6 \quad y = -2(2) + 6 = 2\]
   | \[x^2 - 6x + 8 = 0\]
   | \[(x - 4)(x - 2) = 0\]
   | \[x = 4,2\]

PTS: 2   REF: 081319ge STA: G.G.70 TOP: Quadratic-Linear Systems

20 | ANS: 3
   | PTS: 2   REF: 081320ge STA: G.G.42
   | TOP: Midsegments

21 | ANS: 1
   | If two prisms have equal heights and volume, the area of their bases is equal.

PTS: 2   REF: 081321ge STA: G.G.11 TOP: Volume

22 | ANS: 4
   | \[(n - 2)180 - n \left( \frac{(n - 2)180}{n} \right) = 180n - 360 - 180n + 180n - 360 = 180n - 720.\]
   | \[180(5) - 720 = 180\]

PTS: 2   REF: 081322ge STA: G.G.37 TOP: Interior and Exterior Angles of Polygons

23 | ANS: 1
   | PTS: 2   REF: 081323ge STA: G.G.9
   | TOP: Planes

24 | ANS: 1
   | PTS: 2   REF: 081324ge STA: G.G.74
   | TOP: Graphing Circles
25 \[ \sqrt{15^2 - 12^2} = 9 \]

PTS: 2 REF: 081325ge STA: G.G.50 TOP: Tangents KEY: point of tangency

26 \[ x^2 = 2(2 + 10) \]
\[ x^2 = 24 \]
\[ x = \sqrt{24} = \sqrt{4 \cdot 6} = 2 \sqrt{6} \]

PTS: 2 REF: 081326ge STA: G.G.47 TOP: Similarity KEY: leg

27 \[ \text{midpoint: } \left( \frac{6 + 8}{2}, \frac{8 + 4}{2} \right) = (7, 6). \text{ slope: } \frac{\frac{8 - 4}{6 - 8}}{\frac{4}{-2}} = -2; \ m_{\perp} = \frac{1}{2}. \text{ } 6 = \frac{1}{2} (7) + b \]
\[ \frac{12}{2} = \frac{7}{2} + b \]
\[ \frac{5}{12} = b \]

PTS: 2 REF: 081327ge STA: G.G.68 TOP: Perpendicular Bisector

28 \[ 8 \times 12 = 16x \]
\[ 6 = x \]

PTS: 2 REF: 081328ge STA: G.G.53 TOP: Segments Intercepted by Circle KEY: two chords

29 \[ A'(2, 2), B'(3, 0), C(1, -1) \]

PTS: 2 REF: 081329ge STA: G.G.58 TOP: Dilations

30 \[ \begin{array}{c}
\text{Diagram of constructions}
\end{array} \]

PTS: 2 REF: 081330ge STA: G.G.17 TOP: Constructions

31 \[ \sqrt{(-1 - 3)^2 + (4 - (-2))^2} = \sqrt{16 + 36} = \sqrt{52} = \sqrt{4 \cdot 13} = 2 \sqrt{13} \]

PTS: 2 REF: 081331ge STA: G.G.67 TOP: Distance
32 ANS: 
\[ A = 2B - 15 \quad \Rightarrow \quad 2B - 15 + B + 2B - 15 + B = 180 \]
\[ C = A + B \quad \Rightarrow \quad 6B - 30 = 180 \]
\[ C = 2B - 15 + B \quad \Rightarrow \quad 6B = 210 \]
\[ B = 35 \]

PTS: 2  REF: 081332ge  STA: G.G.30  TOP: Interior and Exterior Angles of Triangles

33 ANS: 
center: (3, -4); radius: \( \sqrt{10} \)

PTS: 2  REF: 081333ge  STA: G.G.73  TOP: Equations of Circles

34 ANS: 

PTS: 2  REF: 081334ge  STA: G.G.22  TOP: Locus

35 ANS: 
\( \triangle ABC, BD \) bisects \( \angle ABC, \overline{BD} \perp AC \) (Given). \( \angle CBD \cong \angle ABD \) (Definition of angle bisector). \( \overline{BD} \cong \overline{BD} \) (Reflexive property). \( \angle CDB \) and \( \angle ADB \) are right angles (Definition of perpendicular). \( \angle CDB \cong \angle ADB \) (All right angles are congruent). \( \triangle CDB \cong \triangle ADB \) (SAS). \( \overline{AB} \cong \overline{CB} \) (CPCTC).

PTS: 4  REF: 081335ge  STA: G.G.27  TOP: Triangle Proofs

36 ANS: 
\[ M''(1, -2), A''(6, -2), T''(5, -4), H''(3, -4) \]

PTS: 4  REF: 081336ge  STA: G.G.58  TOP: Compositions of Transformations

KEY: grids
37 ANS:

\[12x - 4 + 7x + 13 = 180\]

\[16y + 1 = \frac{12y + 1 + 18y + 6}{2}\]

\[19x + 9 = 180\]

\[32y + 2 = 30y + 7\]

\[19x = 171\]

\[x = 9\]

\[2y = 5\]

\[y = \frac{5}{2}\]

PTS: 4

REF: 081337ge

STA: G.G.40

TOP: Trapezoids

38 ANS:

\[M\left(\frac{-7 + 3}{2}, \frac{4 + 6}{2}\right) = M(-5, 5)\]

\[m_{MN} = \frac{\frac{5 - 3}{5 - 0}}{2} = \frac{2}{5}\]

Since both opposite sides have equal slopes and are parallel, \(MNPQ\) is a parallelogram.

\[N\left(\frac{-3 + 3}{2}, \frac{6 + 0}{2}\right) = N(0, 3)\]

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

\[P\left(\frac{3 + 1}{2}, \frac{0 + 8}{2}\right) = P(2, 4)\]

\[m_{PA} = \frac{\frac{3 - 4}{0 - 2}}{2} = \frac{7}{2}\]

\[Q\left(\frac{-7 + 1}{2}, \frac{4 + 8}{2}\right) = Q(-3, -2)\]

\[m_{QH} = \frac{\frac{-2 - 5}{3 - 5}}{2} = \frac{7}{2}\]

\[\overrightarrow{MN} = \sqrt{(-5 - 0)^2 + (5 - 3)^2} = \sqrt{29}\]

\[\overrightarrow{MN} \text{ is not congruent to } \overrightarrow{NP}, \text{ so } MNPQ \text{ is not a rhombus since not all sides are congruent.}\]