1 Juliann plans on drawing $\triangle ABC$, where the measure of $\angle A$ can range from 50° to 60° and the measure of $\angle B$ can range from 90° to 100°. Given these conditions, what is the correct range of measures possible for $\angle C$?
1) 20° to 40°
2) 30° to 50°
3) 80° to 90°
4) 120° to 130°

2 In the diagram of $\triangle ABC$ and $\triangle DEF$ below, $AB \cong DE$, $\angle A \cong \angle D$, and $\angle B \cong \angle E$.
Which method can be used to prove $\triangle ABC \cong \triangle DEF$?
1) SSS
2) SAS
3) ASA
4) HL

3 In the diagram below, under which transformation will $\triangle A'B'C'$ be the image of $\triangle ABC$?

4 The lateral faces of a regular pyramid are composed of
1) squares
2) rectangles
3) congruent right triangles
4) congruent isosceles triangles

5 Point $A$ is located at $(4, -7)$. The point is reflected in the $x$-axis. Its image is located at
1) $(-4, 7)$
2) $(-4, -7)$
3) $(4, 7)$
4) $(7, -4)$
6 In the diagram of circle $O$ below, chords $\overline{AB}$ and $\overline{CD}$ are parallel, and $\overline{BD}$ is a diameter of the circle.

If $m \overline{AD} = 60$, what is $m \angle CDB$?

1) 20  
2) 30  
3) 60  
4) 120

7 What is an equation of the line that passes through the point $(-2, 5)$ and is perpendicular to the line whose equation is $y = \frac{1}{2}x + 5$?

1) $y = 2x + 1$  
2) $y = -2x + 1$  
3) $y = 2x + 9$  
4) $y = -2x - 9$

8 After a composition of transformations, the coordinates $A(4, 2)$, $B(4, 6)$, and $C(2, 6)$ become $A''(-2, -1)$, $B''(-2, -3)$, and $C''(-1, -3)$, as shown on the set of axes below.

Which composition of transformations was used?

1) $R_{180^\circ} \circ D_2$  
2) $R_{90^\circ} \circ D_2$  
3) $D_\frac{1}{2} \circ R_{180^\circ}$  
4) $D_\frac{1}{2} \circ R_{90^\circ}$

9 In an equilateral triangle, what is the difference between the sum of the exterior angles and the sum of the interior angles?

1) $180^\circ$  
2) $120^\circ$  
3) $90^\circ$  
4) $60^\circ$

10 What is an equation of a circle with its center at $(-3, 5)$ and a radius of 4?

1) $(x - 3)^2 + (y + 5)^2 = 16$  
2) $(x + 3)^2 + (y - 5)^2 = 16$  
3) $(x - 3)^2 + (y + 5)^2 = 4$  
4) $(x + 3)^2 + (y - 5)^2 = 4$
11 In $\triangle ABC$, $m\angle A = 95$, $m\angle B = 50$, and $m\angle C = 35$. Which expression correctly relates the lengths of the sides of this triangle?
   1) $AB < BC < CA$
   2) $AB < AC < BC$
   3) $AC < BC < AB$
   4) $BC < AC < AB$

12 In a coordinate plane, how many points are both 5 units from the origin and 2 units from the $x$-axis?
   1) 1
   2) 2
   3) 3
   4) 4

13 What is the contrapositive of the statement, “If I am tall, then I will bump my head”?
   1) If I bump my head, then I am tall.
   2) If I do not bump my head, then I am tall.
   3) If I am tall, then I will not bump my head.
   4) If I do not bump my head, then I am not tall.

14 In the diagram of $\triangle ABC$ below, Jose found centroid $P$ by constructing the three medians. He measured $CF$ and found it to be 6 inches.

If $PF = x$, which equation can be used to find $x$?
   1) $x + x = 6$
   2) $2x + x = 6$
   3) $3x + 2x = 6$
   4) $x + \frac{2}{3}x = 6$

15 In the diagram below, the length of the legs $\overline{AC}$ and $\overline{BC}$ of right triangle $ABC$ are 6 cm and 8 cm, respectively. Altitude $\overline{CD}$ is drawn to the hypotenuse of $\triangle ABC$.

What is the length of $\overline{AD}$ to the nearest tenth of a centimeter?
   1) 3.6
   2) 6.0
   3) 6.4
   4) 4.0

16 In the diagram below, tangent $\overline{AB}$ and secant $\overline{ACD}$ are drawn to circle $O$ from an external point $A$, $AB = 8$, and $AC = 4$.

What is the length of $\overline{CD}$?
   1) 16
   2) 13
   3) 12
   4) 10
17 In the diagram of \( \triangle ABC \) and \( \triangle EDC \) below, \( \overline{AE} \) and \( \overline{BD} \) intersect at \( C \), and \( \angle CAB \cong \angle CED \).

Which method can be used to show that \( \triangle ABC \) must be similar to \( \triangle EDC \)?
1) SAS
2) AA
3) SSS
4) HL

18 Point \( P \) is on line \( m \). What is the total number of planes that are perpendicular to line \( m \) and pass through point \( P \)?
1) 1
2) 2
3) 0
4) infinite

19 Square \( LMNO \) is shown in the diagram below.

What are the coordinates of the midpoint of diagonal \( LN \)?
1) \( \left( \frac{4}{2}, \frac{-2}{2} \right) \)
2) \( \left( \frac{-3}{2}, \frac{3}{2} \right) \)
3) \( \left( \frac{-2}{2}, \frac{3}{2} \right) \)
4) \( \left( \frac{-2}{2}, \frac{4}{2} \right) \)
20 Which graph represents a circle with the equation 
\[(x - 5)^2 + (y + 1)^2 = 9\]?

1)  
2)  
3)  
4)  

21 In the diagram below, a right circular cone has a diameter of 8 inches and a height of 12 inches. What is the volume of the cone to the nearest cubic inch?

1) 201  
2) 481  
3) 603  
4) 804  

22 A circle is represented by the equation 
\[x^2 + (y + 3)^2 = 13\]. What are the coordinates of the center of the circle and the length of the radius?

1) (0,3) and 13  
2) (0,3) and \(\sqrt{13}\)  
3) (0,-3) and 13  
4) (0,-3) and \(\sqrt{13}\)  

23 Given the system of equations: 
\[y = x^2 - 4x\]  
\[x = 4\]  
The number of points of intersection is

1) 1  
2) 2  
3) 3  
4) 0
24 Side $\overline{PQ}$ of $\triangle PQR$ is extended through $Q$ to point $T$. Which statement is not always true?
1) $m\angle RQT > m\angle R$
2) $m\angle RQT > m\angle P$
3) $m\angle RQT = m\angle P + m\angle R$
4) $m\angle RQT > m\angle PQR$

25 Which illustration shows the correct construction of an angle bisector?

1)

2)

3)

4)

26 Which equation represents a line perpendicular to the line whose equation is $2x + 3y = 12$?
1) $6y = -4x + 12$
2) $2y = 3x + 6$
3) $2y = -3x + 6$
4) $3y = -2x + 12$

27 In $\triangle ABC$, point $D$ is on $\overline{AB}$, and point $E$ is on $\overline{BC}$ such that $\overline{DE} \parallel \overline{AC}$. If $DB = 2$, $DA = 7$, and $DE = 3$, what is the length of $AC$?
1) 8
2) 9
3) 10.5
4) 13.5

28 In three-dimensional space, two planes are parallel and a third plane intersects both of the parallel planes. The intersection of the planes is a
1) plane
2) point
3) pair of parallel lines
4) pair of intersecting lines

29 In the diagram of $\triangle ABC$ below, $AB = 10$, $BC = 14$, and $AC = 16$. Find the perimeter of the triangle formed by connecting the midpoints of the sides of $\triangle ABC$.

30 Using a compass and straightedge, construct a line that passes through point $P$ and is perpendicular to line $m$. [Leave all construction marks.]

31 Find an equation of the line passing through the point (5,4) and parallel to the line whose equation is $2x + y = 3$. 
32. The length of $AB$ is 3 inches. On the diagram below, sketch the points that are equidistant from $A$ and $B$ and sketch the points that are 2 inches from $A$. Label with an $X$ all points that satisfy both conditions.

33. Given: Two is an even integer or three is an even integer. Determine the truth value of this disjunction. Justify your answer.

34. In the diagram below, $\triangle ABC \sim \triangle EFG$, $m\angle C = 4x + 30$, and $m\angle G = 5x + 10$. Determine the value of $x$.

35. In the diagram below, circles $X$ and $Y$ have two tangents drawn to them from external point $T$. The points of tangency are $C, A, S,$ and $E$. The ratio of $TA$ to $AC$ is 1:3. If $TS = 24$, find the length of $SE$. 
36 Triangle \(ABC\) has coordinates \(A(-6,2), B(-3,6), \) and \(C(5,0)\). Find the perimeter of the triangle. Express your answer in simplest radical form. [The use of the grid below is optional.]

37 The coordinates of the vertices of parallelogram \(ABCD\) are \(A(-2,2), B(3,5), C(4,2), \) and \(D(-1,-1)\). State the coordinates of the vertices of parallelogram \(A''B''C''D''\) that result from the transformation \(r_{y-axis} \circ T_{2,-3}\). [The use of the set of axes below is optional.]

38 Given: \(\triangle ABC\) and \(\triangle EDC\), \(C\) is the midpoint of \(BD\) and \(AE\).
Prove: \(AB \parallel DE\)
1 ANS: 1
If \( \angle A \) is at minimum (50°) and \( \angle B \) is at minimum (90°), \( \angle C \) is at maximum of 40° (180° - (50° + 90°)). If \( \angle A \) is at maximum (60°) and \( \angle B \) is at maximum (100°), \( \angle C \) is at minimum of 20° (180° - (60° + 100°)).

PTS: 2 REF: 060901ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

2 ANS: 3

3 ANS: 1
4 ANS: 4
5 ANS: 3
6 ANS: 2

Parallel chords intercept congruent arcs. \( \overparen{AD} = \overparen{BC} = 60 \). \( \overparen{CDB} = \frac{1}{2} \overparen{BC} = 30 \).

7 ANS: 2
8 ANS: 3
9 ANS: 1

In an equilateral triangle, each interior angle is 60° and each exterior angle is 120° (180° - 120°). The sum of the three interior angles is 180° and the sum of the three exterior angles is 360°.

PTS: 2 REF: 060909ge STA: G.G.30 TOP: Interior and Exterior Angles of Triangles

10 ANS: 2
11 ANS: 2

Longest side of a triangle is opposite the largest angle. Shortest side is opposite the smallest angle.

PTS: 2 REF: 060911ge STA: G.G.34 TOP: Angle Side Relationship
12. ANS: 4  PTS: 2  REF: 060912ge  STA: G.G.23  TOP: Locus
14. ANS: 2
   The centroid divides each median into segments whose lengths are in the ratio 2 : 1.
   PTS: 2  REF: 060914ge  STA: G.G.43  TOP: Centroid
15. ANS: 1
   \( AB = 10 \) since \( \triangle ABC \) is a 6-8-10 triangle. \( 6^2 = 10x \)
   \[ 3.6 = x \]
   PTS: 2  REF: 060915ge  STA: G.G.47  TOP: Similarity
   KEY: leg
16. ANS: 3
   \( 4(x + 4) = 8^2 \)
   \[ 4x + 16 = 64 \]
   \[ x = 12 \]
   PTS: 2  REF: 060916ge  STA: G.G.53  TOP: Segments Intercepted by Circle
   KEY: tangent and secant
17. ANS: 2
   \( \angle ACB \) and \( \angle ECD \) are congruent vertical angles and \( \angle CAB \cong \angle CED \).
   PTS: 2  REF: 060917ge  STA: G.G.44  TOP: Similarity Proofs
18. ANS: 1  PTS: 2  REF: 060918ge  STA: G.G.2  TOP: Planes
19. ANS: 4
   \[ M_x = \frac{-6+1}{2} = \frac{5}{2}, \quad M_y = \frac{1+8}{2} = \frac{9}{2} \]
   PTS: 2  REF: 060919ge  STA: G.G.66  TOP: Midpoint
20. ANS: 1  PTS: 2  REF: 060920ge  STA: G.G.74  TOP: Graphing Circles
21. ANS: 1
   \[ V = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \cdot 4^2 \cdot 12 \approx 201 \]
   PTS: 2  REF: 060921ge  STA: G.G.15  TOP: Volume and Lateral Area
23 ANS: 1

\[ y = x^2 - 4x = (4)^2 - 4(4) = 0. \] (4,0) is the only intersection.

PTS: 2 REF: 060923ge STA: G.G.70 TOP: Quadratic-Linear Systems

24 ANS: 4

(4) is not true if \( \angle PQR \) is obtuse.

PTS: 2 REF: 060924ge STA: G.G.32 TOP: Exterior Angle Theorem

25 ANS: 3 PTS: 2 REF: 060925ge STA: G.G.17 TOP: Constructions

26 ANS: 2

The slope of \( 2x + 3y = 12 \) is \( \frac{A}{B} = -\frac{2}{3} \). The slope of a perpendicular line is \( \frac{3}{2} \). Rewritten in slope intercept form, (2) becomes \( y = \frac{3}{2}x + 3 \).

PTS: 2 REF: 060926ge STA: G.G.63 TOP: Parallel and Perpendicular Lines

27 ANS: 4

\[ \triangle ABC \sim \triangle DBE. \quad \frac{AB}{DB} = \frac{AC}{DE} \]

\[ \frac{9}{2} = \frac{x}{3} \]

\[ x = 13.5 \]

PTS: 2 REF: 060927ge STA: G.G.46 TOP: Side Splitter Theorem

28 ANS: 3 PTS: 2 REF: 060928ge STA: G.G.8 TOP: Planes

29 ANS:

20. The sides of the triangle formed by connecting the midpoints are half the sides of the original triangle.

\[ 5 + 7 + 8 = 20. \]

PTS: 2 REF: 060929ge STA: G.G.42 TOP: Midsegments
30 ANS:

PTS: 2  REF: 060930ge  STA: G.G.19  TOP: Constructions

31 ANS:

\[ y = -2x + 14. \] The slope of \( 2x + y = 3 \) is \( \frac{-A}{B} = \frac{-2}{1} = -2. \)  
\[ y = mx + b \quad . \]
\[ 4 = (-2)(5) + b \]
\[ b = 14 \]

32 ANS:

PTS: 2  REF: 060931ge  STA: G.G.65  TOP: Parallel and Perpendicular Lines

33 ANS:

True. The first statement is true and the second statement is false. In a disjunction, if either statement is true, the disjunction is true.

PTS: 2  REF: 060933ge  STA: G.G.25  TOP: Compound Statements

KEY: disjunction
20. $5x + 10 = 4x + 30$
\[ x = 20 \]

PTS: 2  REF: 060934ge  STA: G.G.45  TOP: Similarity
KEY: basic

18. If the ratio of $TA$ to $AC$ is 1:3, the ratio of $TE$ to $ES$ is also 1:3. $x + 3x = 24$. $3(6) = 18$.  
\[ x = 6 \]

PTS: 4  REF: 060935ge  STA: G.G.50  TOP: Tangents
KEY: common tangency

15 + 5\sqrt{5}.

PTS: 4  REF: 060936ge  STA: G.G.69  TOP: Triangles in the Coordinate Plane
KEY: grids

37 ANS:
ANS:
\[ \overline{AC} \cong \overline{EC} \] and \[ \overline{DC} \cong \overline{BC} \] because of the definition of midpoint. \[ \angle ACB \cong \angle ECD \] because of vertical angles.
\[ \triangle ABC \cong \triangle EDC \] because of SAS. \[ \angle CDE \cong \angle CBA \] because of CPCTC. \( BD \) is a transversal intersecting \( AB \) and \( ED \). Therefore \( AB \parallel DE \) because \( \angle CDE \) and \( \angle CBA \) are congruent alternate interior angles.