

1. In the figure below, lines ℓ and m are parallel and $m\angle ABC = 70^\circ$. What is $m\angle BAD$?

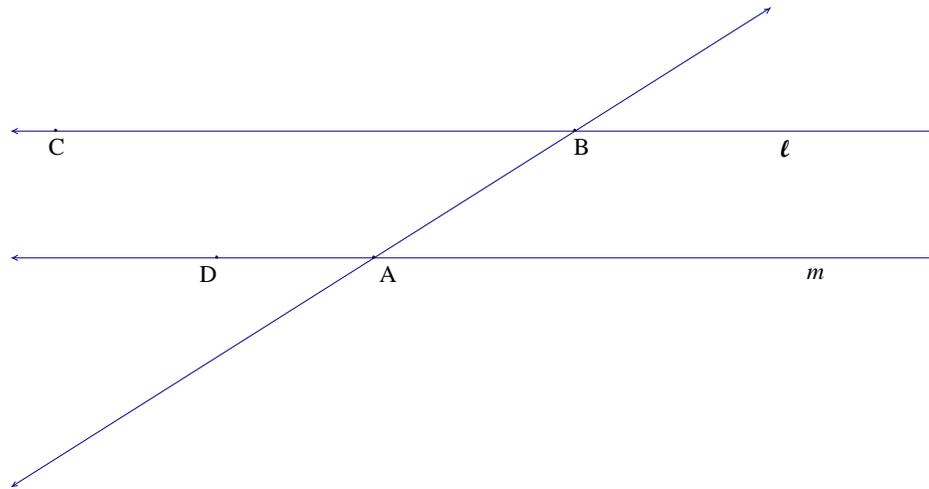
(a) 160°

(b) 140°

(c) 110°

(d) 70°

(e) 40°



2. The sum of the measures of all of the interior angles of a regular polygon is 1440° . How many sides does this polygon have?

(a) 8

(b) 9

(c) 10

(d) 12

(e) 18

3. A sphere of radius r units centered at the origin is the set of all points (x, y, z) satisfying $x^2 + y^2 + z^2 = r^2$. Which of the following points is on a sphere whose radius is an odd prime?

(a) $(3, 0, 2)$

(b) $(-1, 2, -2)$

(c) $(1, 1, 1)$

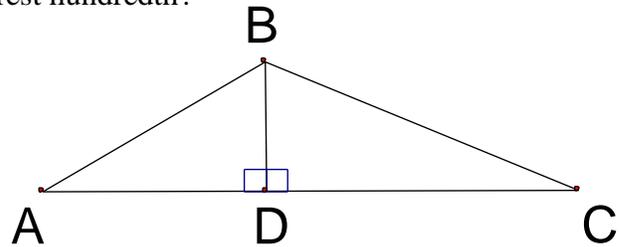
(d) $(3, 5, 1)$

(e) $(4, 1, 0)$

4. The shapes in the net for a regular dodecahedron are

- (a) 20 equilateral triangles
- (b) 10 equilateral triangles and 10 regular hexagons
- (c) 12 regular hexagons
- (d) 12 regular pentagons
- (e) 12 equilateral triangles

5. In the figure below, $m\angle BAC = 30^\circ$, the length of \overline{AB} is 8.0 cm, and the length of \overline{BC} is 12.8 cm. What is the area of $\triangle ABC$ to the nearest hundredth?



- (a) 18.25 cm²
- (b) 24.32 cm²
- (c) 37.28 cm²
- (d) 42.32 cm²
- (e) 51.20 cm²

6. How many cubes with edges of length 2 centimeters can be placed in a cubical box with edges of length 20 centimeters?

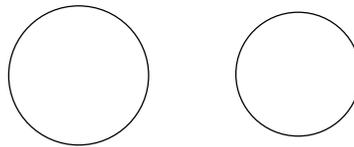
- (a) 10
- (b) 100
- (c) 1000
- (d) 10000
- (e) 100000

7. What is the measure of one of the interior angles in a regular octagon?

- (a) 45°
- (b) 90°
- (c) 120°
- (d) 135°
- (e) 150°

8. How many lines are simultaneously tangent to both circles shown below?

- (a) 0
- (b) 1
- (c) 2
- (d) 3
- (e) 4



9. Which of the following is not a congruence criterion for two triangles?

- (a) Side-Side-Angle
- (b) Angle-Side-Angle
- (c) Side-Side-Side
- (d) Angle-Angle-Side
- (e) Side-Angle-Angle

10. Two angles of a triangle each have a measure of 30° and the length of the included side is 4 inches. What is the area of the triangle?
- (a) $8\sqrt{3}$ square inches
 - (b) 8 square inches
 - (c) $4\sqrt{3}$ square inches
 - (d) $\frac{2}{3}\sqrt{3}$ square inches
 - (e) $\frac{4}{3}\sqrt{3}$ square inches
11. Which of the following is not equal to π ?
- (a) The ratio of the circumference of a circle to the diameter of the circle
 - (b) The ratio of the area of a circle to the square of the radius of the circle
 - (c) The ratio of the surface area of a sphere to the square of the diameter of the sphere
 - (d) The ratio of the volume of a sphere to the cube of the radius of the sphere
 - (e) The ratio of the lateral surface area of a cylinder whose height is equal to its radius and twice the square of the radius of the base of such a cylinder
12. Which of the following triangles has the largest perimeter?
- (a) An isosceles triangle whose base has a length of 10 cm and whose base angles measure 30°
 - (b) An isosceles right triangle whose hypotenuse has a length of 10 cm
 - (c) A triangle whose sides have a length of 5 cm, 8 cm, and 10 cm
 - (d) An equilateral triangle with sides of length 10 cm
 - (e) A triangle where two sides have lengths 5 cm and 8 cm and the measure of the included angle between the sides is 150°

13. A cube is inscribed in a sphere and then this sphere is inscribed in another cube. If the radius of the sphere is 6π cm, what is the ratio of the volume of the large cube to the volume of the small cube?

(a) $3\sqrt{3}$

(b) $\sqrt{3}$

(c) 3

(d) 6

(e) 9

14. Which of the triangles described below is unique?

(a) A triangle with a 45° angle and a 62° angle

(b) A triangle with sides of length 8 cm and 9 cm

(c) A triangle with a perimeter of 24 cm

(d) A triangle whose inscribed circle has a radius of 4 cm

(e) A triangle with the points (5, 4), (3, 2), and (1, 7) as the midpoints of its sides

15. In the triangle below, $CD = 9$ cm, $BE = 3$ cm, and $DE = 2$ cm. What is AB in centimeters, to the nearest hundredth?

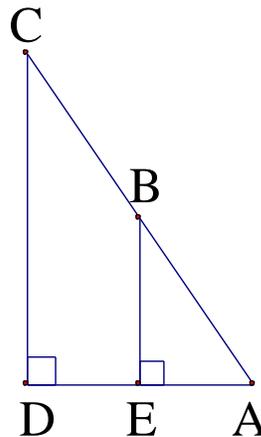
(a) 2.07 cm

(b) 3.16 cm

(c) 4.39 cm

(d) 5.71 cm

(e) 6.92 cm



16. A triangular plot of land measures 50 yards on one side, 60 yards on another, and 104 yards on the third side. What is the area of this plot of land to the nearest hundredth?
- (a) 630.04 square yards
 - (b) 771.68 square yards
 - (c) 876.09 square yards
 - (d) 927.34 square yards
 - (e) 1042.81 square yards
17. Four of the interior angles in a pentagon have measures 70° , 100° , 115° , and 125° . What is the measure of the other interior angle?
- (a) 70°
 - (b) 100°
 - (c) 108°
 - (d) 130°
 - (e) 140°
18. The radius and height of a cylinder are equal and are the same as the radius of a sphere. The volume of the cylinder is what percentage of the volume of the sphere?
- (a) 20%
 - (b) 25%
 - (c) $33\frac{1}{3}\%$
 - (d) 50%
 - (e) 75%

19. What is the length of the radius of the circle that circumscribes a triangle whose sides have lengths of 9, 40, and 41 feet?
- (a) 4.0 feet
 - (b) 6.0 feet
 - (c) 12.5 feet
 - (d) 20.5 feet
 - (e) 24.5 feet
20. Each side of a regular hexagon has a length of 1 unit. What is the area of the hexagon?
- (a) 1 square unit
 - (b) $\frac{\sqrt{3}}{4}$ square units
 - (c) $\frac{3\sqrt{5}}{2}$ square units
 - (d) $\frac{3\sqrt{3}}{2}$ square units
 - (e) 3 square units
21. Which of the following is the locus in a plane of the centers of all circles of a given radius passing through a fixed point?
- (a) a square
 - (b) a line
 - (c) two lines
 - (d) a circle
 - (e) two circles

22. The three sides of a triangle have measures 2 cm, 5 cm, and 6 cm. The cosine of the largest angle in this triangle:

(a) is $\frac{-7}{20}$.

(b) is $\frac{-\sqrt{65}}{10}$.

(c) is $\frac{-6}{10}$.

(d) is $\frac{7}{20}$.

(e) cannot be determined with the given information.

23. The four circles in the figure below have the same radius r units and are mutually tangent. What is the area of region A outlined in bold?

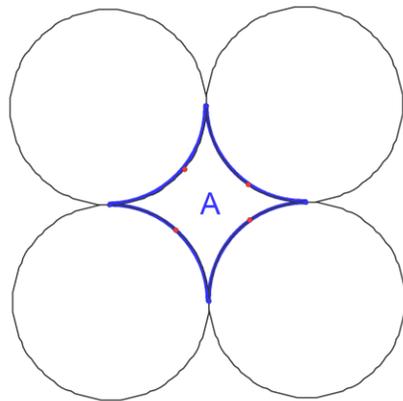
(a) $\frac{1}{4}\pi r^2$ square units

(b) $(4 - \pi)r^2$ square units

(c) $\frac{1}{2}\pi r^2$ square units

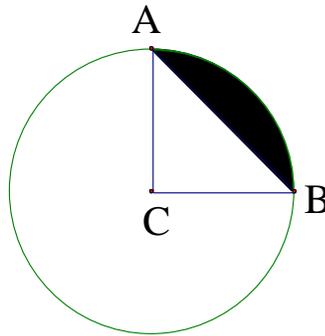
(d) $(\pi - 2)r^2$ square units

(e) $\frac{2}{3}\pi r^2$ square units

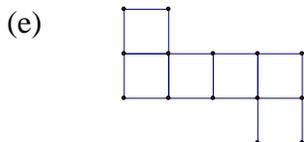
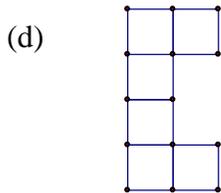
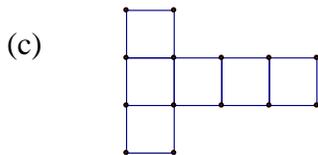
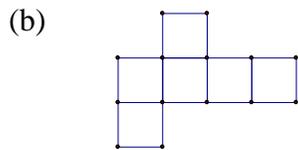
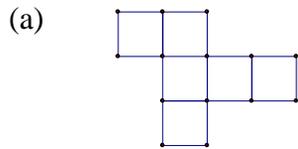


24. In the figure below, the circle with center C has a radius of 2 units and $\angle ACB$ is a right angle. What is the area of the shaded region?

- (a) $\pi + 1$ square units
- (b) $\pi - 1$ square units
- (c) π square units
- (d) 2π square units
- (e) $\pi - 2$ square units



25. Which of the following is not the net of a cube?

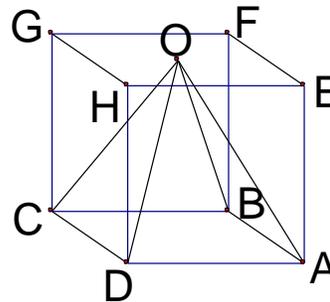


26. An isosceles triangle has a base of length 10 inches and 40° base angles. What is the area of this triangle to the nearest hundredth?

- (a) 10.12 square inches
- (b) 14.75 square inches
- (c) 18.03 square inches
- (d) 20.98 square inches
- (e) 22.34 square inches

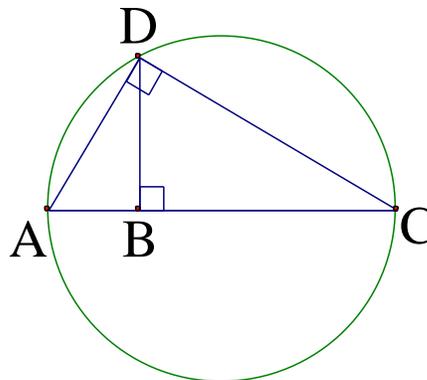
27. Shown below is a cube with a square pyramid inside it. The point O is in the center of the top of the cube. What is the angle, to the nearest degree, between the triangular face of the pyramid with vertices A, B, O and the square face of the cube with vertices A, B, F, E?

- (a) 27°
- (b) 30°
- (c) 35°
- (d) 45°
- (e) 63°



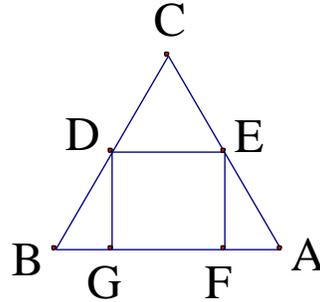
28. In the figure below, $AB = 1$ unit and $BC = x$ units. Determine DB .

- (a) 2 units
- (b) $\frac{x}{1+x}$ units
- (c) $\frac{1+x}{x}$ units
- (d) \sqrt{x} units
- (e) $\sqrt{1+x}$ units



29. In the figure below, $\triangle ABC$ is an equilateral triangle and figure DEFG is a square. If the square has an area of 4 square units, what is the area of $\triangle DCE$?

- (a) 2 square units
- (b) $2\sqrt{3}$ square units
- (c) $\sqrt{3}$ square units
- (d) $\sqrt{6}$ square units
- (e) $\frac{\sqrt{3}}{2}$ square units



30. Two perpendicular chords intersect inside a circle. The intersection point separates one of the chords into segments of lengths 3 inches and 4 inches and separates the other chord into segments of lengths 2 inches and 6 inches. What is the diameter of the circle?

- (a) $\sqrt{56}$ inches
- (b) $\sqrt{61}$ inches
- (c) $\sqrt{65}$ inches
- (d) $\sqrt{75}$ inches
- (e) $\sqrt{89}$ inches

31. The three circles in the figure below have the same radius r units and are mutually tangent at points A, B, and C. What is the area of $\triangle ABC$?

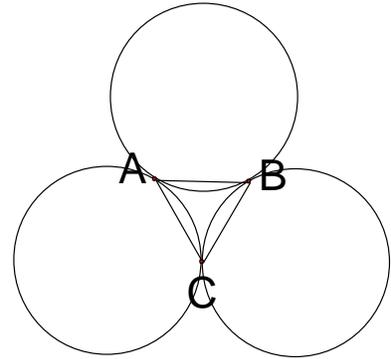
(a) $\frac{\pi}{6}r^2$ square units

(b) $\frac{1}{2}r^2$ square units

(c) $\frac{\sqrt{3}}{4}r^2$ square units

(d) $\frac{\sqrt{3}}{2}r^2$ square units

(e) $\left(1 - \frac{\sqrt{3}}{4}\right)r^2$ square units



32. A right circular cone has vertex A and center of base O. If a plane parallel to line \overline{AO} intersects the cone in more than one point, then the set of all points of intersection lie along which of the following curves?

(a) a parabola

(b) an ellipse

(c) a circle

(d) a catenary

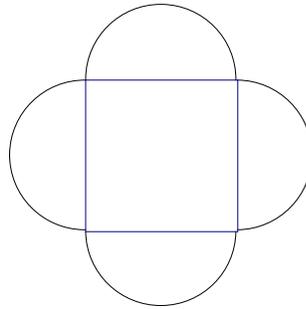
(e) a hyperbola

33. In which of the following geometries is the sum of the measures of the interior angles of a triangle at least 180° ?

- (a) Euclidean geometry
- (b) Elliptical geometry
- (c) Hyperbolic geometry
- (d) Both (a) and (b)
- (e) Both (a) and (c)

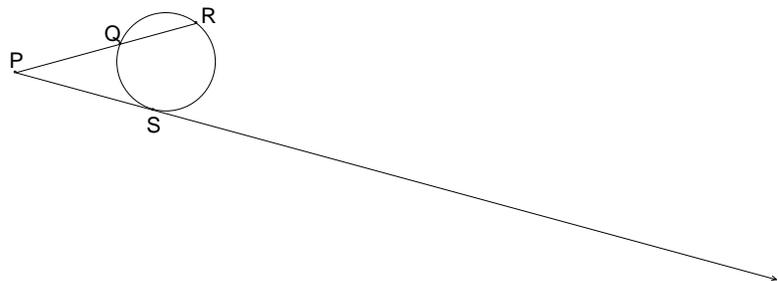
34. A company has hired a contractor to paint their logo on the side of the company headquarters. The logo is a square capped on each side by a semicircle, as shown below. The square has a side length of 10 feet and the paint must be 0.05 inches thick. If the paint costs \$103.50 per cubic foot, how much will it cost the company to have the logo painted?

- (a) \$110.87
- (b) \$314.09
- (c) \$852.90
- (d) \$1330.39
- (e) \$3769.04



35. In the figure below, \overline{PS} is tangent to the circle at point S, $PQ = 3$ units, and \overline{PR} is 6 units longer than \overline{PS} . What is the measure of \overline{PS} ?

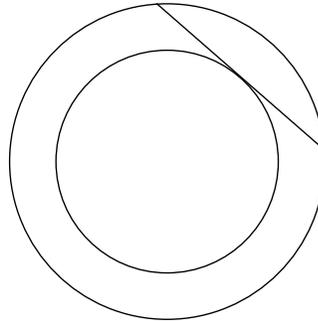
- (a) 3 units
- (b) 6 units
- (c) 9 units
- (d) 18 units
- (e) 27 units



36. Which of the following numbers is closest to the number π ?
- (a) 3.14
 - (b) $\frac{22}{7}$
 - (c) $\frac{25}{8}$
 - (d) $\frac{339}{108}$
 - (e) $\frac{3927}{1250}$
37. In triangle ABC , \overline{AB} is divided into eight congruent segments and seven line segments parallel to \overline{BC} are drawn from the points of division on \overline{AB} to \overline{AC} . If \overline{BC} has a length of 10 cm, what is the sum of the length of the seven segments that were drawn parallel to \overline{BC} ?
- (a) 33 cm
 - (b) 34 cm
 - (c) 35 cm
 - (d) 40 cm
 - (e) 45 cm
38. Which of the following is closest to the amount of space occupied by a stack of ten United States quarters?
- (a) 808.9 mm^3
 - (b) 0.8089 cm^3
 - (c) 0.008089 dm^3
 - (d) 0.008089 m^3
 - (e) 8.089 mm^3

39. The two circles shown below are concentric and the chord drawn inside the outer circle is tangent to the inner circle. If this chord has length 60 cm, which of the following is the area of the region between the circles?

- (a) $30\pi \text{ cm}^2$
- (b) $60\pi \text{ cm}^2$
- (c) $360\pi \text{ cm}^2$
- (d) $600\pi \text{ cm}^2$
- (e) $900\pi \text{ cm}^2$



40. A regular pentagon is inscribed in a rectangle as shown below. The length of \overline{AB} is 1 unit. What is the perimeter of the pentagon to the nearest hundredth?

- (a) 3.09 units
- (b) 3.15 units
- (c) 3.21 units
- (d) 3.29 units
- (e) 3.33 units

