

Mu Alpha Theta National Convention: Denver, 2001
Geometry Topic Test – Euclidean Division

1. What is the perimeter, in centimeters, of a rectangle with length 12 centimeters and width 107 centimeters?

- (A) 119 cm (B) 192 cm (C) 238 cm (D) 252 cm (E) NOTA

2. What is the distance between the points (3, 4) and (8, -1)?

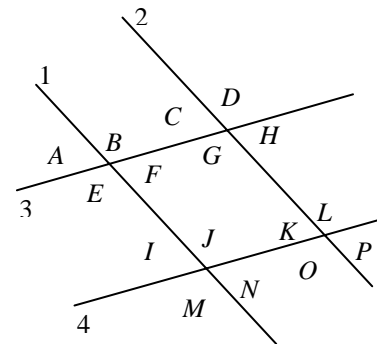
- (A) 6 (B) $4\sqrt{2}$ (C) $4\sqrt{3}$ (D) $5\sqrt{2}$ (E) NOTA

3. If the measures of an angle and its supplement are in the ratio of 2:7, what is the measure of the angle's complement, in degrees?

- (A) 20° (B) 30° (C) 40° (D) 50° (E) NOTA

4. Lines *l* and 2 are parallel and lines 3 and 4 are parallel. The letters in the figure represent the measures of the angles in which they appear. How many of the following statements are always true?

- | | |
|--------------|---------------|
| I. $A = B$ | V. $L = F$ |
| II. $C = G$ | VI. $E = N$ |
| III. $M = P$ | VII. $H = I$ |
| IV. $O = D$ | VIII. $J = K$ |



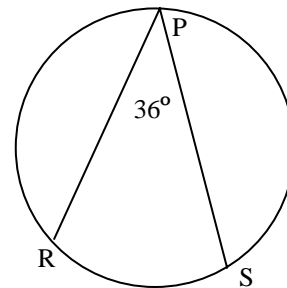
- (A) 0 (B) 1
(C) 2 (D) 3 (E) NOTA

5. A right triangle has a leg of length 10 units and another of length 24 units. What is the length of the hypotenuse?

- (A) 18 units (B) 25 units (C) 26 units (D) 30 units (E) NOTA

6. What is the length of minor arc *RS* if the radius of the circle is 15 meters?

- (A) 8π m (B) 8 m
(C) 6π m (D) 15 m (E) NOTA



7. What is the area, in square centimeters, of an equilateral triangle with perimeter 24 centimeters?

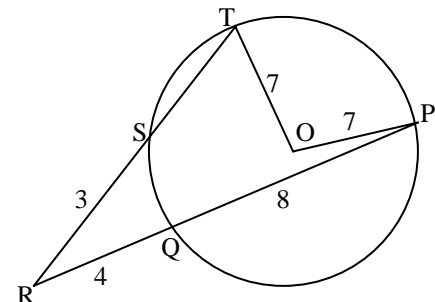
- (A) 18 cm^2 (B) $16\sqrt{3} \text{ cm}^2$ (C) $18\sqrt{2} \text{ cm}^2$ (D) $24\sqrt{3} \text{ cm}^2$ (E) NOTA

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8. A cube has a surface area of 294 square centimeters. What is the volume of the cube, in cubic centimeters?
- (A) 216 cm^3 (B) 256 cm^3 (C) 300 cm^3 (D) 343 cm^3 (E) NOTA
9. A box in the shape of a rectangular parallelepiped has its height increased by 4 centimeters. This increases the volume of the box by 12%. What is the new height of the box, in centimeters?
- (A) $\frac{112}{3} \text{ cm}$ (B) 40 cm (C) 42 cm (D) $\frac{89}{2} \text{ cm}$ (E) NOTA
10. A tank in the shape of a right rectangular prism has a length of 75 meters, a width of 25 meters, and a volume of 150,000 cubic meters. What is the depth of the tank, in meters?
- (A) 70 m (B) 75 m (C) 80 m (D) 90 m (E) NOTA
11. What is the radius, in meters, of the base of a cone with a volume of 56π cubic meters and a height of 12 meters?
- (A) $\sqrt{14}$ m (B) $2\sqrt{7}$ m (C) 7 m (D) 14 m (E) NOTA
12. A restaurant prices their pizzas proportionately to the area of the pizza. If a pizza 60 centimeters in diameter costs \$20.00, how much would a pizza 45 centimeters in diameter cost?
- (A) \$8.75 (B) \$10.00 (C) \$11.25 (D) \$15.00 (E) NOTA
13. A circle is inscribed in an equilateral triangle. If the radius of the circle is 8 centimeters, what is the area of the triangle, in square centimeters?
- (A) $192\sqrt{3} \text{ cm}^2$ (B) $156\sqrt{6} \text{ cm}^2$ (C) $156\sqrt{3} \text{ cm}^2$ (D) $180\sqrt{2} \text{ cm}^2$ (E) NOTA
14. A right triangle has legs of length 12 meters and 16 meters. What is the length, in meters, of the median to the hypotenuse?
- (A) 10 m (B) 11 m (C) $\frac{23}{2}$ m (D) 12 m (E) NOTA

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15. A non-degenerate triangle has a side of length 12 centimeters, and a side of length 9 centimeters. How many integral values are possible for the length, measured in centimeters, of the third side?
- (A) 16 (B) 17 (C) 18 (D) 19 (E) NOTA
16. A triangle with base 15 millimeters and height 20 millimeters is truncated by a line parallel to the base, 4 millimeters from the base. What is the area, in square millimeters, of the trapezoid remaining after truncation?
- (A) 54 mm^2 (B) 100 mm^2 (C) 108 mm^2 (D) 120 mm^2 (E) NOTA
17. A regular hexagon is inscribed in a circle of radius 9 millimeters, and another is circumscribed about the same circle. What is the ratio of the area of the outer hexagon to that of the inner hexagon?
- (A) $\frac{6}{5}$ (B) $\frac{5}{6}$ (C) $\frac{5}{4}$ (D) $\frac{4}{3}$ (E) NOTA
18. The height of a cylinder is quadrupled. By what number must the radius of the base of the cylinder be multiplied if the new cylinder is to have three times the volume of the original?
- (A) $\frac{\sqrt{3}}{4}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\frac{3}{4}$ (D) $\frac{3}{2}$ (E) NOTA
19. A rectangular picture of width 30 centimeters and height 20 centimeters is framed in a rectangular frame 3 centimeters wide. What is the area of the frame in square centimeters?
- (A) 288 cm^2 (B) 300 cm^2 (C) 336 cm^2 (D) 352 cm^2 (E) NOTA
20. The measures of the angles of a triangle are in the ratio of 2:9:1. Which of the following is the measure of one of the angles, in degrees?
- (A) 10° (B) 20° (C) 30° (D) 40° (E) NOTA
21. Given the two intersecting secants, PR and RT, to circle O of radius 7, what is the length of ST?



- (A) 2 (B) 10
(C) 13 (D) 16 (E) NOTA

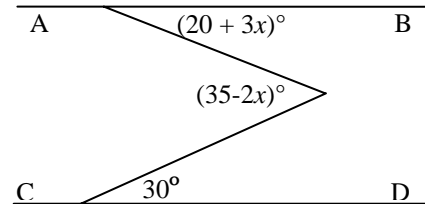
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22. What is the smaller angle, in degrees, between the hands of a standard 12-hour analog clock at 8:10 PM?

- (A) 165° (B) 170° (C) 175° (D) 180° (E) NOTA

23. Lines AB and CD are parallel. What is the value of x , if the measures of the angles are given in degrees?

- (A) -8 (B) -3
(C) 4 (D) 17 (E) NOTA



24. A triangle has vertices at the points $(4, -3)$, $(3, 0)$, and $(-2, 1)$. What is the area of the triangle?

- (A) $\frac{11}{2}$ (B) $\frac{13}{2}$ (C) 7 (D) $\frac{15}{2}$ (E) NOTA

25. A sphere is circumscribed about a cube with edge length 30 meters. What is the volume of the sphere?

- (A) $2700\pi\sqrt{3} \text{ m}^3$ (B) $4500\pi\sqrt{3} \text{ m}^3$
(C) $13500\pi\sqrt{3} \text{ m}^3$ (D) $40500\pi\sqrt{3} \text{ m}^3$ (E) NOTA

26. What is the perimeter of a regular polygon whose interior angles each measure 168° , and a side of which is 4 units long?

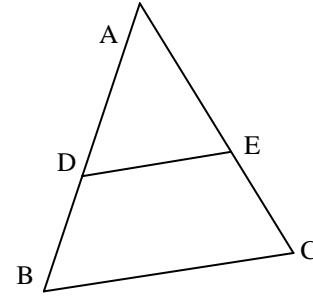
- (A) 60 units (B) 72 units (C) 116 units (D) 120 units (E) NOTA

27. What is the surface area of a rectangular box with length 3 meters, width 6 meters, and height 9 meters?

- (A) 149 m^2 (B) 152 m^2 (C) 198 m^2 (D) 209 m^2 (E) NOTA

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28. Given isosceles triangle ABC with \overline{DE} parallel to \overline{BC} , if $AD = AE = 35$ units, $DE = 21$ units, and $BC = 48$ units, what is the sum of the lengths of \overline{EC} and \overline{AB} ?



- (A) 120 units (B) 125 units
(C) 130 units (D) 135 units (E) NOTA

29. \overline{AB} is a diameter of circle O . P is a point on the circumference such that $AP = 7$ meters and $BP = 6$ meters. What is the area of circle O , in square meters?

- (A) $42\pi \text{ m}^2$ (B) $85\pi \text{ m}^2$ (C) $\frac{21\pi}{2} \text{ m}^2$ (D) $\frac{85\pi}{4} \text{ m}^2$ (E) NOTA

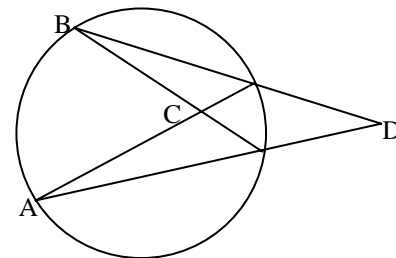
30. A circle is inscribed in a triangle with sides of lengths six, ten, and eight centimeters. What is the radius of the circle, in centimeters?

- (A) 2 cm (B) $\sqrt{5}$ cm (C) $\sqrt{7}$ cm (D) 3 cm (E) NOTA

31. Determine the volume of a right triangular prism whose base has sides of lengths 5, 6, and 7 units, and whose height is 8 units.

- (A) $24\sqrt{6} \text{ units}^3$ (B) $48\sqrt{3} \text{ units}^3$ (C) $48\sqrt{6} \text{ units}^3$ (D) $96\sqrt{3} \text{ units}^3$ (E) NOTA

32. What is the measure of minor arc AB in the figure (in degrees) if the measure of angle BCA is 66° and the measure of angle ADB is 12° ?



- (A) 64° (B) 66°
(C) 74° (D) 78° (E) NOTA

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33. In Euclidean geometry, which of the following statements are true?
- I. Given two distinct points, there is exactly one line which contains both points.
 - II. Given three distinct points, there is exactly one plane that contains all three points.
 - III. Given a line A , and a point B not on line A , there is exactly one line through point B parallel to line A .

(A) I only (B) I & II only (C) I & III only (D) I, II, & III (E) NOTA

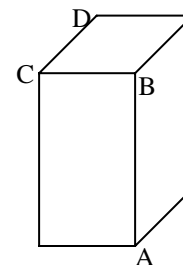
34. How many values of k exist such that $(-1,2)$, $(-10,5)$, and $(-4,k)$ are the vertices of a right triangle?

(A) 1 (B) 2 (C) 3 (D) 4 (E) NOTA

35. A cylinder of height h meters is inscribed in a sphere of radius q meters. What is the volume of the cylinder, in cubic meters?

(A) $(hq^2 - h^3)\pi \text{ m}^3$ (B) $\left(\frac{4qh - h^2}{4}\right)\pi \text{ m}^3$
 (C) $\left(\frac{4q^2 - h^3}{4}\right)\pi \text{ m}^3$ (D) $\left(\frac{4q^2h - h^3}{4}\right)\pi \text{ m}^3$ (E) NOTA

36. In the right rectangular prism shown, the measure of angle BAD is 30° , and the measure of angle CBD is 45° . If the length of the longest diagonal is 8 units, what is the volume of the box?



(A) $16\sqrt{2} \text{ units}^3$ (B) $16\sqrt{6} \text{ units}^3$
 (C) $32\sqrt{3} \text{ units}^3$ (D) $32\sqrt{6} \text{ units}^3$ (E) NOTA

37. In a rhombus, the product of the lengths of the diagonals measured in centimeters is 65, and the sum of the lengths of the diagonals measured in centimeters is 20. What is the area of the rhombus in square centimeters?

(A) 10 cm^2 (B) $\frac{45}{2} \text{ cm}^2$ (C) 30 cm^2 (D) $\frac{65}{2} \text{ cm}^2$ (E) NOTA

38. Determine the area, in square centimeters, of a quadrilateral whose sides are 80, 80, 80, and 120 centimeters long.

(A) $200\sqrt{30} \text{ cm}^2$ (B) 1100 cm^2 (C) $600\sqrt{6} \text{ cm}^2$ (D) 1000 cm^2 (E) NOTA

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39. What is the maximum value of $f(x) = -x^2 + 4x + 16$?

- (A) 16 (B) 18 (C) 19 (D) 20 (E) NOTA

40. A triangle has its vertices at the points $A(3, -2)$, $B(4, 1)$, and $C(-1, 6)$. What is the equation in slope-intercept form of the line that contains the median to side \overline{BC} ?

- (A) $y = -4x + 10$ (B) $y = -\frac{11}{3}x + 9$ (C) $y = -\frac{7}{2}x + \frac{17}{2}$ (D) $y = -\frac{3}{2}x + \frac{5}{2}$ (E) NOTA