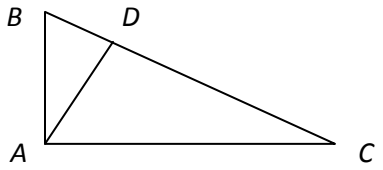
1. Given $\triangle ABC$ is a right triangle with *AD* a perpendicular from the right angle to the hypotenuse, find the length of *AD* given AB = 6, BC = 10 and AC = 8.



a) 7.5 b) 6.5 c) 4.8 d) $\sqrt{10}$ e) $4\sqrt{3}$

2. Using the figure in #1, the area of triangle *ABD* is

a) 1/3 area of triangle *ABC* b) 3.6 c) 3 d) $2\sqrt{3}$ e) 8.64

3. Using the figure in #1, the perimeter of triangle ADC is

a) 19.2 b) 12.4 + $\sqrt{10}$ c) 12.4 + $4\sqrt{3}$ d) 14 + $\sqrt{3}$ e) 21.2

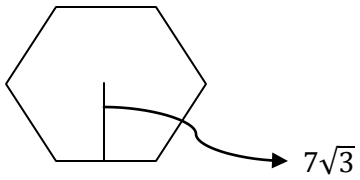
4. Euclid's fifth postulate is equivalent to: Given a line and a point not on that line

a) there are infinitely many lines through the point, parallel to the given line.
b) there are no lines through the point, perpendicular to the given line.
c) there are no lines through the given point, parallel to the given line.
d) there is only one line through the given point, parallel to the given line.
e) none of these.

5. Find the measure of an interior angle of a regular 18-gon.

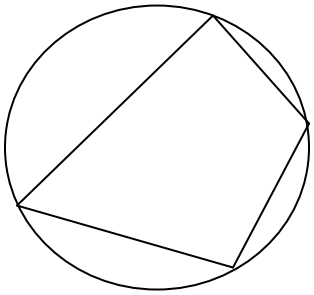
a) 180^o
b) 150^o
c) 160^o
d) 200^o
e) 135^o

6. The perimeter of the regular hexagon shown below is



a) 90 b) $42\sqrt{3}$ c) 106 d) $50\sqrt{3}$ e) 84

7. The opposite angles of the inscribed quadrilateral below



a) are complementary b) are supplementary c) are equal

d) have a sum that may differ from the sum of the remaining angles

e) vary in sum according to the inscribed quadrilateral

8. The semi-perimeter of a triangle whose vertices are given by the ordered pairs (1, 1), (4, -3), and (-1, -4) is

a) $\frac{\sqrt{96}}{2}$ b) $\frac{5+\sqrt{26}+\sqrt{29}}{2}$ c$\frac{\sqrt{96}}{3}$ d) $\frac{5+\sqrt{26}+\sqrt{29}}{3}$ e) 48

9. A circle has the equation $x^2 - 2x + y^2 - 4y - 4 = 0$. The area of the circle is

   a) 9π b) 3π c) 12π d) 4π e) 16π

10. A circle is centered at (1, 2) with a radius of 2.

    a) it lies inside the circle in #9 with a difference in area of π
    b) it contains the circle in #9 with a difference in area of π
    c) it is totally outside the circle in #9 with a difference in area of π
    d) It is tangent to the circle in #9 with a difference of area π
    e) none of the above

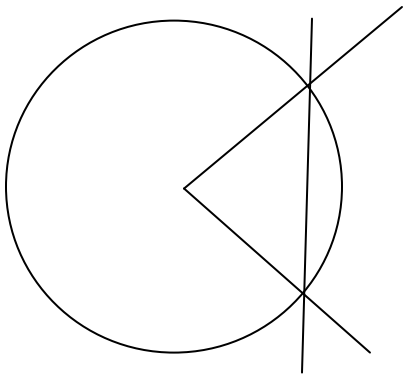
11. The equation of a circle that is tangent to the circle in #10 with four times the area is

    a) $(x + 8)^2 + (y - 2)^2 = 64$ b) $(x - 1)^2 + (y + 7)^2 = 36$ b) $(x - 1)^2 + (y + 7)^2 = 16$

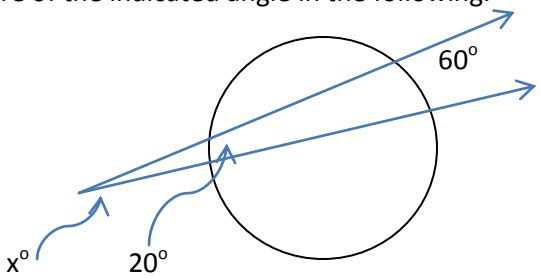
    b) $(x - 4)^2 + (y - 2)^2 = 36$ b) $(x - 4)^2 + (y - 2)^2 = 16$

12. If the circle has radius 1 and the central angle subtended is 90^o, then the area to the right of the triangle and inside the circle is

    a) $\pi/4 - 1$ b) $(\pi-1)/4$ c) $\pi/4 - 1/2$ d) $\pi/2 - 1$ e) $2 - \pi/2$

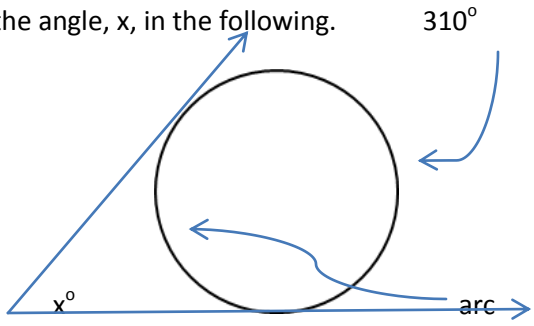


13. Find the measure of the indicated angle in the following.



a) 10° b) 12° c) 15° d) 20° e) 12.5°

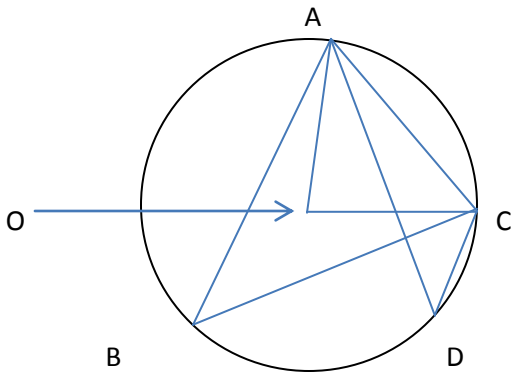
14. Find the measure of the angle, x, in the following.



a) 50° b) 115° c) 55° d) 130° e) 120°

15. In the figure shown, the center of the circle is O and m $\angle D = 40^{\circ}$. Find m $\angle ABC$.

a) 40° b) 45° c) 50° d) 30° e) none of the choices



16. A Golden Rectangle could have sides of length

a) 1, $1 + \sqrt{5}$ b) 1, $\sqrt{5}$ c) 1, $\frac{\sqrt{5}}{2}$ d) 1, ½ e) 1, $\frac{1+\sqrt{5}}{2}$

17. An axiomatic system consists of the following four axiom: A1 – There are exactly three students, A2 – For every pair of students, there is exactly one class in which they are enrolled, A3 – Not all of the students belong to the same class, and A4 – Two separate classes share at least one student. Which of the following can be deduced from these axioms?

a) Two separate classes share one and only one student in common.
b) There are exactly three classes in the system.
c) Each class has exactly two students.
d) b and c only
e) a, b, and c

18. An axiomatic system is said to be consistent if

a) the axioms are independent
b) no two statements contradict each other
c) one axiom cannot be proved from one of the others
d) it is complete
e) it is both complete and independent

19. A chord of length 8 units is perpendicular to a diameter of a circle at a point 3 units from the center. Find the length of the diameter.

a) 5
b) 10
c) 15
d) 24
e) 25

20. The incenter of a triangle is the point where

a) the medians meet
b) the perpendicular bisectors meet
c) the angle bisectors meet
d) the altitudes meet
e) the symmedians meet

21. Three points that lie on the Euler line are

a) incenter, centroid, circumcenter
b) incenter, centroid, orthocenter
c) incenter, circumcenter, orthocenter
d) circumcenter, centroid, orthocenter
e) circumcenter, orthocenter, incenter

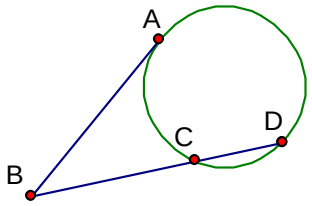
22. If the radii of two tangent circles are a and b, then find the length of an external tangent.

a) $\frac{a+b}{2}$
b) a + b
c) $\sqrt{\frac{a^2+b^2}{2}}$
d) $\sqrt{a^2+b^2}$
e) $2\sqrt{ab}$

23. According to the Triangle Inequality,

a) no triangle may be constructed if one side is longer than the sum of the other two sides
b) similar triangles may or may not be congruent
c) the area of a right triangle is greater than or equal to that of a non- right triangle with equal sides
d) the sum of any two sides of a triangle is greater than or equal to that of the remaining side
e) both a) and d)

24. A tangent AB and a secant BD intersect a circle as shown below. If AB = 6 units and CD = 5 units, find the length of BD



a) 4
b) 9
c) 15
d) 8
e) 10

25. A trapezoid has parallel sides of length 2 and 4 units. The median forms two smaller trapezoids. Find the ratio of the area of the smallest trapezoid to the area of the original trapezoid.

a) $\frac{5}{8}$ b) $\frac{5}{6}$ c) $\frac{1}{2}$ d) $\frac{5}{12}$ e) $\frac{25}{36}$

26. The apothem is the perpendicular from the center of a regular polygon to any of its sides. If L is the length of the apothem and Q is the perimeter of the polygon, then the area of a regular n-gon is given by

a) nQL b) nQL/2 c) QL/2 d) QL/(2n) e) QL/n

27. Which of the following in not considered a Platonic Solid?

a) Pentahedron b) Cube c) Icosahedron d) Octahedron e) Dodecahedron

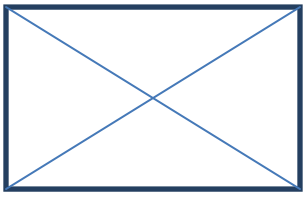
28. Plane angles are angles made at a vertex of a solid. The sum of plane angles at a vertex is

a) exactly 360 degrees
b) at most 360 degrees
c) at least 360 degrees
d) less than 360 degrees
e) more than 360 degrees

29. The light from the top of a lamppost 25 feet tall casts a shadow 4 feet long from a girl standing 15 feet from its base. How tall is the girl, to the nearest inch?

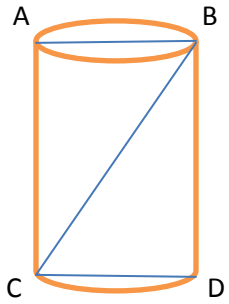
a) 60 inches b) 61 inches c) 62 inches d) 63 inches e) 64 inches

30. In the rectangular figure shown find the measure of the base if the height is 12 m and one half a diagonal is 10 m.



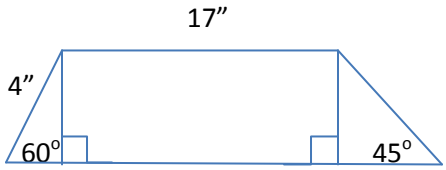
a) 16 b) 20 c) 8 d) $2\sqrt{3}$ e) 13

31. In the cylinder shown, segments AB and CD are parallel diameters and angle ABC is equal 30^{o}. If segment BC has length 10 then the radius of the base is



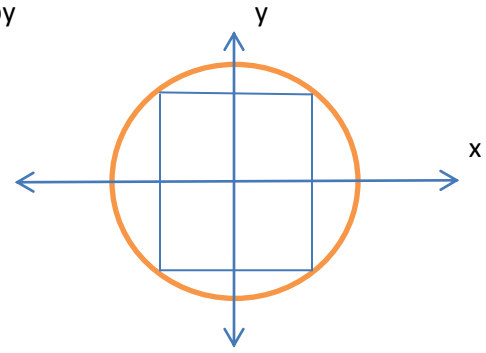
a) $2\sqrt{3}$ b) $5\sqrt{3}$ c) $\frac{2\sqrt{3}}{3}$ d) $\frac{5\sqrt{3}}{2}$ e) $\sqrt{14}$

32. Find the perimeter of the following trapezoid.



a) $34 + 2\sqrt{6} + 2\sqrt{3}$ inches
b) $40 + 2\sqrt{6} + 2\sqrt{3}$ inches
c) $37 + 2\sqrt{6} + 2\sqrt{3}$ inches
d) $40 + \sqrt{6} + \sqrt{3}$ inches
e) $34 + \sqrt{6} + \sqrt{3}$ inches

33. A circle of radius r is centered at the origin and a rectangle is inscribed. The area of the rectangle as a function of x is given by



a) $4x(r^2-x^2)^{1/2}$
b) $2x(r^2-x^2)^{1/2}$
c) $x^2(r^2-x^2)$
d) $x(r^2-x^2)^{1/2}$
e) $4x^2(r^2-x^2)$

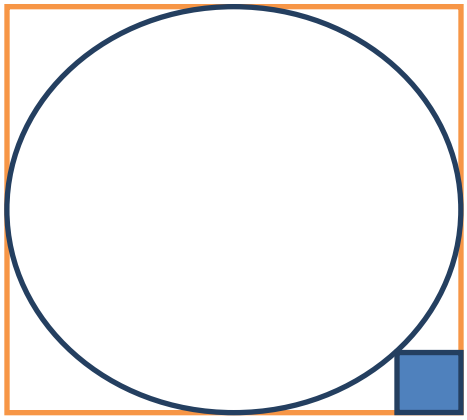
34. Successive terms of a Fibonacci Sequence, (1, 1, 2, 3, 5, …), when placed in the ratio of the (n + 1)st term to the nth term, approaches which of the following?

a) π/2 b) $\sqrt{3}$ c) $\sqrt{2}$ d) the golden ratio e) $\frac{\sqrt{10}}{2}$

35. The squaring of a circle,(that is, finding a square of equal area to a given circle), using only a straight edge and compass was first accomplished by

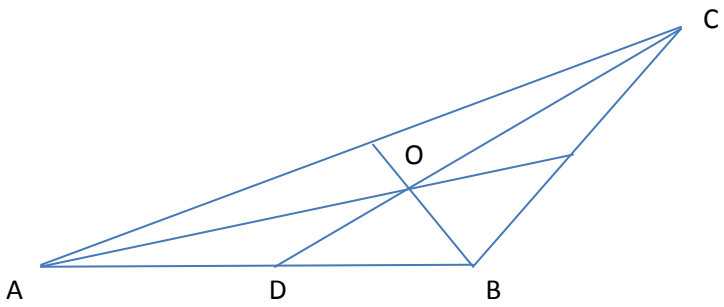
a) Euclid b) Pythagoras c) Archimedes d) Isaac Newton e) It cannot be done

36. A circle of radius 1 is inscribed in a square of side 2. What is the radius of a circle inscribed in the shaded rectangle in the figure below?



a) $1-\frac{\sqrt{2}}{2}$
b) $2\sqrt{2}-2$
c) $\sqrt{2}-½$
d) $\sqrt{2}-1$
e) $\frac{2-\sqrt{2}}{4}$

37. Three medians in the triangle below intersect at O. If the area of ΔAOD is equal to 1 then the area of ΔBDC

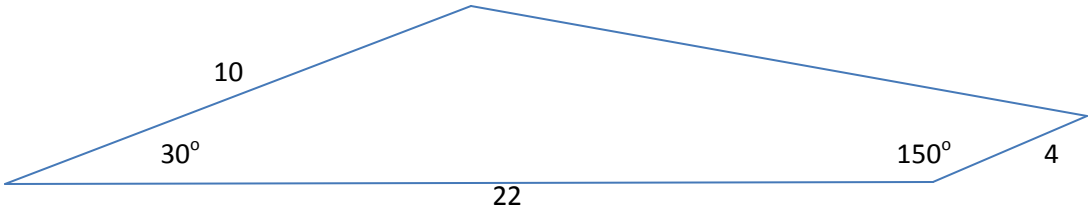


a) 4 b) 3 c) $2\sqrt{3}$ d) $3\sqrt{2}$ e) cannot be determined from the information

38. Given a triangle with one side equal to 5 inches, the angle opposite it equal to 45^{o}, and one other side equal to 10 inches, find the angle opposite that side.

a) 30^{o}
b) 60^{o}
c) 45^{o}
d) 90^{o}
e) Such a triangle does not exist.

39. Find the area of the following figure.



a) 77 b) 110 c) 120 d) 55 e) 66

40. A sphere of radius 3 is inscribed in a cube. Beside it is placed a sphere one-half its volume inscribed in a cube. This is done until there are 20 spheres. What is the sum of the volume of all 20 spheres?

a) $72\pi(1 - .5^{19})$
b) $72\pi(1 - .5^{20})$
c) $72\pi(1 + .5^{19})$
d) $72\pi(1 + .5^{20})$
e) 74π

Answers

1. C
2. E
3. A
4. D
5. E
6. E
7. B
8. B
9. A
10. E
11. B
12. C
13. D
14. E
15. A
16. E
17. E
18. B
19. A
20. C
21. D
22. D
23. E
24. B
25. A
26. C
27. A
28. D
29. D
30. A
31. D
32. B
33. A
34. D
35. E
36. E
37. B
38. E

39. A
40. B