

Geometry Written Test - Alpha Division
 (for students who have had more math than Algebra I, Algebra II, and Geometry)

NO CALCULATORS

- The area of a circle is 100π . Find the circumference of the circle.
 A) 100π B) 50π C) 20π D) 10π E) none of these
- The measures of the 3 angles of a triangle are in the ratio 4:9:11. Find the degree measure of the largest angle of the triangle.
 A) 70° B) 75.5° C) 77.5° D) 81° E) none of these
- A diameter of a circle has endpoints at (5, -6) and (11, 2). Find the coordinates of the center of the circle.
 A) (8, 4) B) (8, -2) C) (3, 4) D) (3, -2) E) none of these

- The area of the right triangle shown is:

- A) 136 B) 68 C) 120 D) 60
 E) none of these



- If all side lengths are integers, how many distinct isosceles, but non-equilateral, triangles exist such that 5 is the length of one of the congruent sides?
 A) 4 B) 5 C) 6 D) 8 E) none of these
- The faces of two cubes have edges of lengths x and y . Find the ratio of the volumes of the two cubes.
 A) $x:y$ B) $x^2:y^2$ C) $x^3:y^3$ D) $x^4:y^4$ E) $x^6:y^6$

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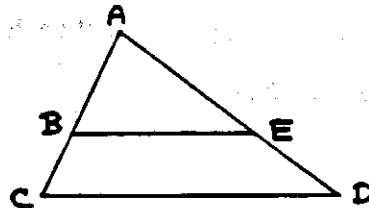
7. $\overline{BE} \parallel \overline{CD}$

$AB = 4$

$BE = 6$

$BC = 2$

Find CD .



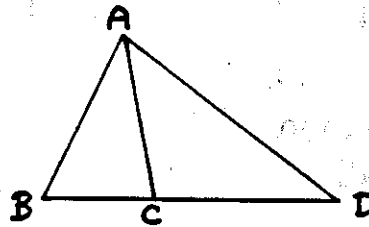
- A) 3 B) 9 C) 12 D) 18

E) none of these

8. In $\triangle ABD$, \overline{AC} is both a median and an altitude.

If $BD = 12$ and $AC = 8$,

then $AB + AD$ is:



- A) 16 B) 18 C) 20 D) 24

E) none of these

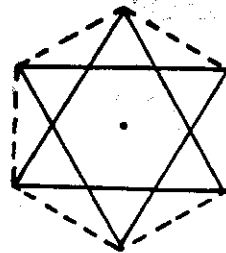
9. Two chords, \overline{AB} and \overline{BC} , are drawn in a circle. \widehat{AB} is 80° and \widehat{BC} is 50° .
 Under these conditions, if $\angle ABC$ is acute, find the degree measure of $\angle ABC$.

- A) 15 B) 30 C) 45 D) 60 E) 75

10. Two concentric equilateral triangles are placed so that corresponding sides are parallel. If the area of each original equilateral triangle is 15, find the area of the convex polygon formed by joining vertices.

A) $30\sqrt{3}$ B) $20\sqrt{3}$ C) 20

D) 30 E) $15\sqrt{3}$



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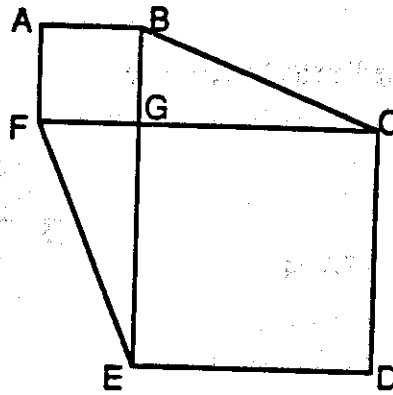
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11. How many distinct diagonals does a regular polygon have if each interior angle is 170° ?
 A) 135 B) 561 C) 594 D) 119 E) 612
12. Three vertices of a parallelogram are $(-7,5)$, $(-3,-2)$ and $(12,-2)$. None of its sides is parallel to either the X or Y axis. Find the fourth vertex.
 A) $(8,5)$ B) $(-22,5)$ C) $(8,-5)$ D) $(16,-9)$ E) $(15,-8)$

13. $ABGF$ and $GCDE$ are squares.
 $FC = 30$, $BC = 24$

Find AD

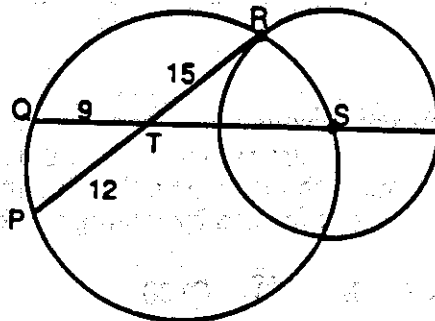
- A) 45 B) 42 C) 30
 D) $24\sqrt{2}$ E) $30\sqrt{2}$



14. \overline{PR} tangent to $\odot S$ at R .
 $PT = 12$, $QT = 9$, $RT = 15$

Find the radius of $\odot S$.

- A) 10 B) $5\sqrt{7}$ C) $6\frac{2}{3}$ D) $6\sqrt{3}$ E) 12



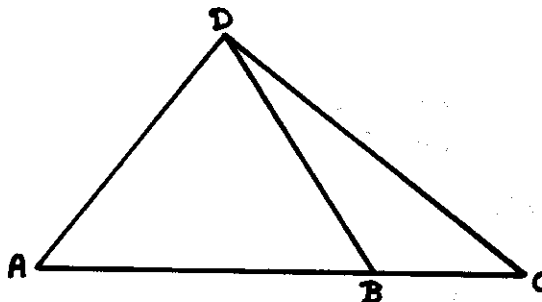
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15. Five of the six sides of a pair of similar triangles are 12, 16, 18, 20 and 24. Which of the following could be the length of the remaining side?
 A) 15 B) 17 C) 10 D) 22 E) 25
16. Using the convention in a triangle; side a is opposite $\angle A$, b is opposite $\angle B$, c is opposite $\angle C$, what is the maximum number of distinct triangles (no two congruent) that can exist having $a = 20$, $b = 16$, $\angle B = 45^\circ$?
 A) no triangle exists B) exactly one exists C) exactly two exist
 D) between 3 and 7 exist E) infinitely many exist
17. A circle is inscribed in a triangle with sides of lengths 3, 4, and 5. A second circle, interior to the triangle, is tangent to the first circle and to both sides of the larger acute angle of the triangle. Find the radius of the second circle.
 A) $\frac{\sqrt{2}}{4}$ B) $\frac{\sqrt{3}}{6}$ C) $\sqrt{3} - \sqrt{2}$ D) $\frac{\sqrt{5} - \sqrt{3}}{2}$ E) none of these

18. In the diagram, $\angle DBC = 135^\circ$, $AD = 10$, $DC = 14$, and $AC = 16$. Find BC .

- A) $16 - 10\sqrt{2}$ B) $\sqrt{3} + \sqrt{2}$ C) $\frac{1 + \sqrt{7}}{2}$
 D) $\frac{1 + \sqrt{5}}{2}$ E) none of these



19. A convex octagon is inscribed in a circle and has four consecutive sides each of length 3, and four other sides each of length 2. Find the area.
 A) $10\sqrt{5}$ B) $10\sqrt{7}$ C) $13 + 12\sqrt{2}$ D) $10\sqrt{3} + 6\sqrt{2}$ E) none of these

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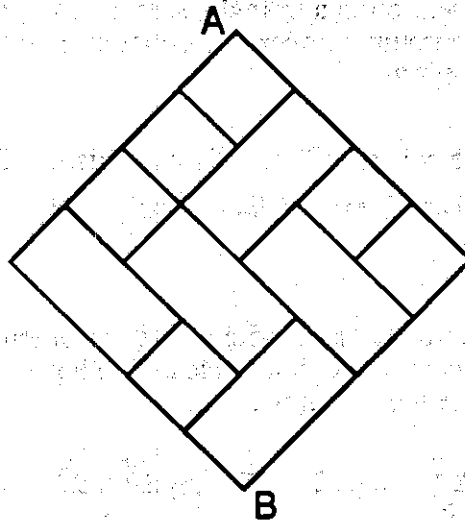
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20. The face diagonals of a rectangular box are 8, 11, and 13. Find the length of the main (solid) diagonal.

A) $\sqrt{177}$ B) $\sqrt{1144}$ C) $\sqrt{354}$ D) $\sqrt{254}$ E) $10\sqrt{2}$

21. How many different paths exist going from A to B, if all moves must be downward?

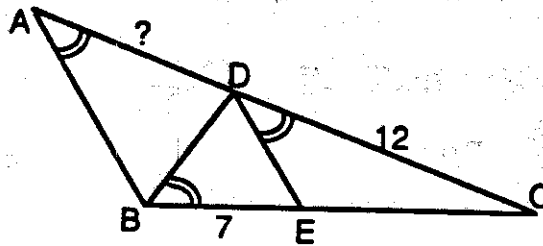
A) 16 B) 24 C) 18
 D) 30 E) 20



22. $\angle A \cong \angle DBE \cong \angle CDE$
 $DC = 12$, $BE = 7$

Find AD.

A) $5\frac{1}{4}$ B) 8 C) $8\frac{1}{2}$
 D) 9 E) $9\frac{1}{3}$



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23. \overline{PA} and \overline{PE} trisect one angle of parallelogram $\square POEM$. A is on \overline{OE} so that $OA = 4$ and $OP = 6$.

Find the perimeter of $\triangle APE$.

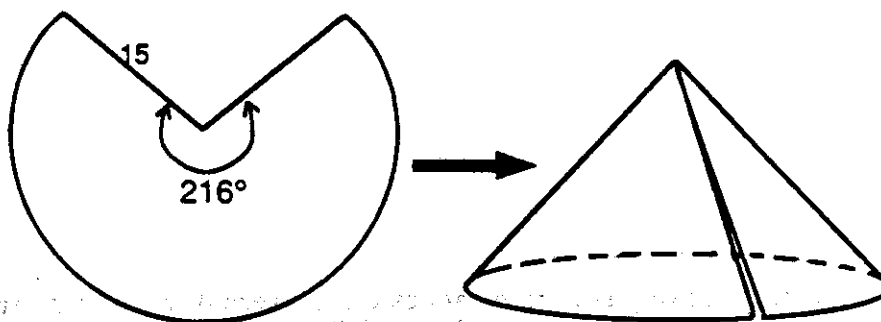
- A) 14 B) 17.5 C) 19 D) 22 E) 24.5

24. The sides of a triangle have lengths $(18-3x)$, $(x+10)$ and 24 . (x is a real number) What is the range of possible values for the perimeter, P ?

- A) $36 < P < 52$ B) $36 < P < 60$ C) $48 < P < 52$
 D) $48 < P < 60$ E) $52 < P < 60$

25. Find the volume of a cone formed by curling a 216° sector of radius 15.

- A) 72π B) 144π
 C) 156π D) 180π
 E) 324π



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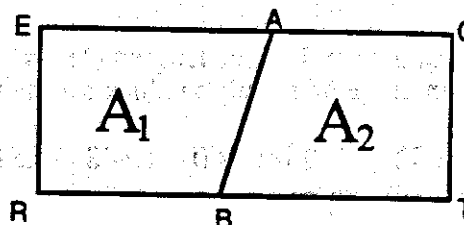
26. A "billiard ball", located at $(10,1)$, is to be bounced off of the line, $y = x$, in order to hit a ball at $(16,5)$. Find the point to aim at on the $y = x$ line.

A) $(12,12)$ B) $(5,5)$ C) $(6\frac{1}{4}, 6\frac{1}{4})$ D) $(7\frac{3}{4}, 7\frac{3}{4})$ E) $(10,10)$

27. A fence joins points A and B on sides

\overline{EC} and \overline{RT} of rectangle RECT.
 $EA:AC = 5:4$, $RB:BT = 7:8$

Find the ratio of the areas of
 REAB and ACTB.



A) 23:22 B) 35:32 C) 32:35
 D) 10:7 E) 1:1

28. Two real numbers are chosen at random between 0 and 10, inclusive. What is the probability that they are within one unit of each other? (if needed, round the answer to the nearest hundredth)

A) .01 B) .10 C) .19 D) .08 E) .17

29. Twelve distinct points lie on a circle. How many distinct inscribed convex quadrilaterals are determined with vertices at these points?

A) 240 B) 48 C) 11,880 D) 2,970 E) 495

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30. An ellipse is inscribed in a 16 by 24 rectangle.

A quadrilateral, F_1PF_2Q , is formed by joining the foci, F_1 and F_2 , and two points, P and Q , on the ellipse.

Find the perimeter of quadrilateral F_1PF_2Q .

- A) 48 B) 40 C) 36
 D) 32 E) 30

