

**Euclidean Applications**  
**FAMAT State Convention 2002**

For all questions, answer E, "NOTA" means none of the above answers is correct.

1. A right triangle is drawn in a coordinate plane with legs of length 16 along the x-axis and length 30 along the y-axis. Find the length of the median to the hypotenuse.

- a. 8                                      b. 15                                      c. 17                                      d. 24

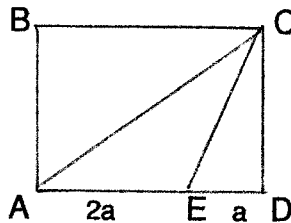
2. Find the sum of all real value solutions for  $|3x + 7| = |-7x - 1|$ .

- a. 0.4                                      b. 0.7                                      c. 1.5                                      d. 1.9

3. Find the sum of all odd numbers in between 10 and 50.

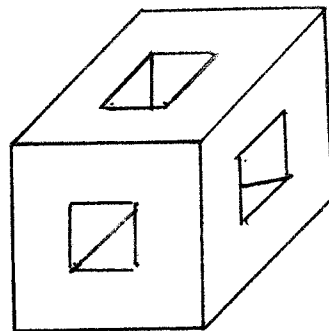
- a. 570                                      b. 600                                      c. 1140                                      d. 2280

4. What is the ratio of the area of  $\triangle ACE$  to the area of rectangle ABCD?



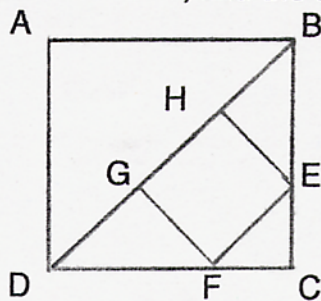
- a. 1:3                                      b. 1:4                                      c. 1:9                                      d. 4:9

5. In the adjoining figure, a wooden cube has edges 3 meters. Square holes of side one meter, centered in each face, are cut through to the opposite face. The edges of the holes are parallel to the edges of the cube. Find the total surface area, including the inside.



- a. 54                                      b. 72                                      c. 96                                      d. 108

6. If ABCD and EFGH are squares and  $AB=1$ , find the area of square EFGH.



a.  $\frac{1}{5}$

b.  $\frac{1}{4}$

c.  $\frac{2}{5}$

d.  $\frac{4}{9}$

7. Find the absolute value of the difference between the sum and the product of the solutions of the equation  $8x^2 + 3x + 10 = 4x^2 - x$ .

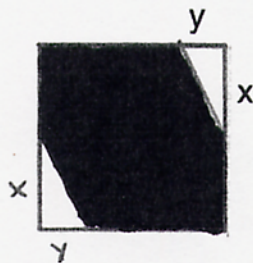
a. 5

b. 19

c. 41

d. 54

8. The square to the right has an area of  $4x^2$ . A rectangle with width  $x$  has the same area as the shaded region. Find the length of the rectangle.



a.  $3x$

b.  $3x - y$

c.  $4x - y$

d.  $4x - xy$

9. The ratio of an angle to its supplement is 3:7. Find the ratio of the angle to its complement.

a. 1:2

b. 2:1

c. 3:2

d. 2:3

10. In a very unusual drawer there is a regular triangle, a regular quadrilateral, a regular pentagon, and a regular hexagon. The drawer is opened, and an interior angle from one of the polygons is selected at random. What is the probability the measure of the angle is an integral multiple of 30°?

- a.  $\frac{1}{4}$                       b.  $\frac{1}{2}$                       c.  $\frac{13}{18}$                       d.  $\frac{5}{6}$

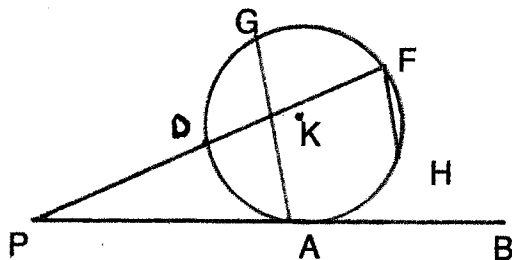
11. If the average of the degree measures of two angles of an isosceles triangle is 70°, which could be the sum of two of the angles of the triangle?

- a. 80°                      b. 100°                      c. 120°                      d. 130°

12. Find the length of the altitude to the shortest side of a triangle with sides 8, 9, and 15.

- a.  $\sqrt{14}$                       b.  $\frac{8\sqrt{14}}{9}$                       c.  $\frac{8\sqrt{14}}{15}$                       d.  $2\sqrt{14}$

13. In circle K,  $\overrightarrow{PB}$  is a tangent at A,  $\overrightarrow{PF}$  is a secant,  $\widehat{DG} \cong \widehat{GF}$ ,  $\overline{GA} \parallel \overline{FH}$ ,  $m\widehat{FH} = 110^\circ$ , and  $m\widehat{HA} = 50^\circ$ . Find  $m\angle P$ .



- a. 5                      b. 20                      c. 30                      d. 40

14. A triangle with sides 6, 8, and 10 is inscribed within a circle and circumscribed about another. Find the area that is contained between the circumscribed circle and the inscribed circle.

- a.  $6\pi$                       b.  $15\pi$                       c.  $19\pi$                       d.  $21\pi$



20. Find the area of pentagon ABCDE, with vertices A(-4,2), B(2,5), C(4,3), D(3,-4), and E(-4,-2).

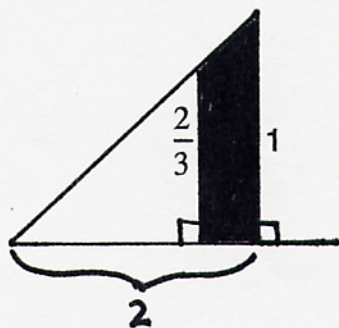
a. 51.5

b. 50.5

c. 49.5

d. 47.5

21. Find the area of the shaded region



a.  $\frac{4}{9}$

b.  $\frac{5}{9}$

c.  $\frac{8}{9}$

d.  $\frac{3}{4}$

22. An aquarium shaped like a rectangular prism has a square base with an edge of 2 feet. It is filled to a depth of 3.25 feet with water. A rock with a volume of  $1.5 \text{ ft}^3$  is dropped in and is covered completely by water. How many inches will the water rise?

a. 18

b. 4.5

c. 1.5

d. 0.375

23. A helicopter left its launching pad went up to an elevation of 0.125 miles, flew 2 miles north, one mile east, and up an additional 0.125 miles in elevation. Ignoring the curvature of the earth how many miles was the helicopter from the launch pad?

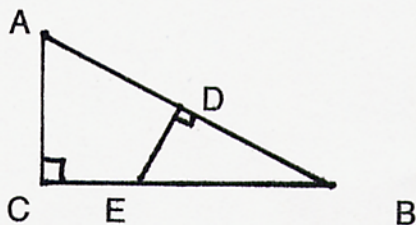
a. 3.25

b. 2.5

c. 2.25

d. 5.0625

24. Given triangle ABC with  $AD = \frac{13}{3}$ ,  $DB = 4$ ,  $BE = 5$ , and  $AC = 5$ . Find CE.



a.  $\frac{5}{3}$

b.  $\frac{13}{3}$

c.  $\frac{65}{3}$

d. 5

25. The length of a side of an equilateral triangle is a root of  $x^3 + 3x^2 - 4x - 12 = 0$ . Find the area of the triangle.

a.  $\frac{1}{4}\sqrt{3}$

b.  $\sqrt{3}$

c.  $\frac{9}{4}\sqrt{3}$

d.  $9\sqrt{3}$

26. Find an equation of the line if the line  $y = \frac{3}{4}x - 1$  is reflected over  $y = x$ .

a.  $y = -\frac{3}{4}x + 1$

b.  $y = -\frac{3}{4}x - 1$

c.  $y = \frac{4}{3}x + \frac{4}{3}$

d.  $y = -\frac{4}{3}x + \frac{4}{3}$

27. A hexagon has all sides tripled in size. Find the percent of increase in the area of the hexagon.

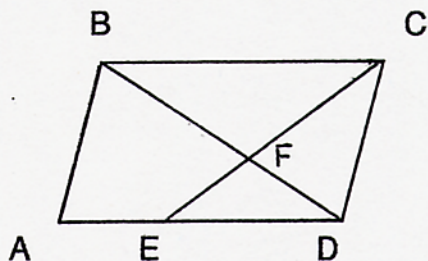
a. 200%

b. 300%

c. 800%

d. 900%

28. Given parallelogram ABCD with area 56, diagonal BD, and  $AE:ED = 1:3$ . Find the area of triangle EFD.



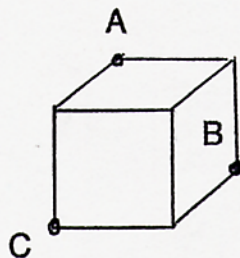
a. 9

b. 10

c. 12

d. 12.5

29. Given cube as shown, find the measure of angle ABC.



a.  $45^\circ$

b.  $60^\circ$

c.  $75^\circ$

d.  $90^\circ$

30. Find the area of the square inscribed in the circle  $x^2 + y^2 + 8x - 10y + 5 = 0$ .

a. 12

b. 36

c. 72

d. 144