

Note: NOTA stands for “None of the Above”. Figures not drawn to scale.

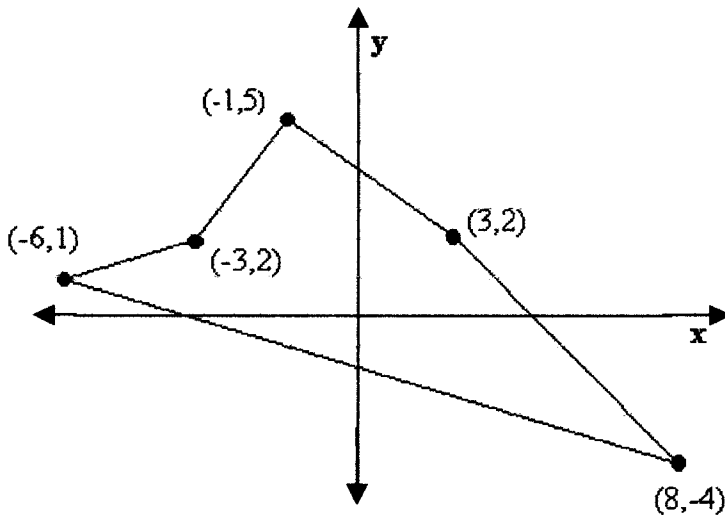
1. If the equation of the line perpendicular to $3x - 7y + 2 = 0$ is expressed in $Ax + BY + C = 0$ (where A and B are relatively prime) form and passes through the $(-3, 2)$, find $A + B + C$.

A. -5 B. 5 C. 25 D. 31 E. NOTA

2. If α and β are acute angles (both between 0 and $\frac{\pi}{2}$), and $\sin(\alpha + \beta) = \frac{\sqrt{2} + \sqrt{6}}{4}$ and $\sin(\alpha - \beta) = \frac{\sqrt{2} - \sqrt{6}}{4}$, and $\beta = \frac{\pi}{3}$, find α .

A. $-\frac{\pi}{4}$ B. $-\frac{\pi}{4}, \frac{\pi}{4}$ C. $\frac{\pi}{4}$ D. $\{ \}$ E. NOTA

3. Find the area of the polygon to the nearest tenth.



A. 9.2 B. 27.5 C. 55.0 D. 110.0 E. NOTA

4. Which of the following is (are) true of the graph with the following equation:

$$r = 2 \cos(2\theta)$$

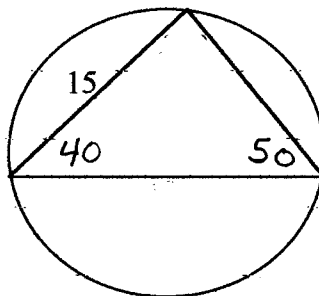
- I. When graphed on polar coordinate system the graph exhibits 2 leaves
 II. The length of each leaf is 4 units.
 III. When graphed on a polar coordinate system, the graph exhibits 4 leaves.

A. I, II only B. II, III only C. I only D. III only E. NOTA

5. Find the distance to the nearest tenth from $4x - 5y + 3 = 0$ to the point of intersection between $2x + y = 2$ and $x - 5y = 4$.

- A. 0.8 B. 1.5 C. 1.7 D. 3.0 E. NOTA

6. Find the diameter, to the nearest tenth, of the circumscribed circle of the triangle:



- A. 10.0 B. 12.1 C. 13.5 D. 19.6 E. NOTA

7. Find the acute angle, to the nearest tenth of a degree, between the lines $4x - 3y + 2 = 0$ and $7x + 8y + 18 = 0$.

- A. 9.2° B. 50.3° C. 85.7° D. 279.2° E. NOTA

8. Which of the following is (are) **NOT** true?

- I. Points P_1, P_2, P_3 are collinear if and only if $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = 0$.
- II. The eccentricity of a parabola is always equal to 1.
- III. The eccentricity of an ellipse is always greater than 1.

- A. I, II only B. II, III only C. III only D. I, II, III only E. NOTA

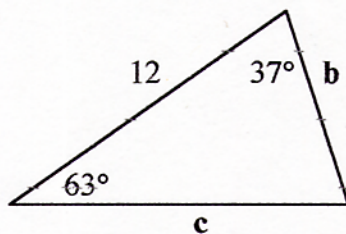
9. Solve, α for $\left(\frac{\pi}{2} > \alpha > 0\right)$:

$$4 \sin \alpha \cos \alpha - 8 \sin^3 \alpha \cos \alpha = \frac{\sqrt{3}}{2} \text{ and}$$

$$8 \cos^4 \alpha - 8 \cos^2 \alpha + 1 = -\frac{1}{2}.$$

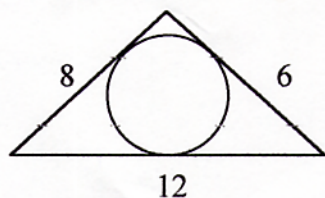
- A. $\frac{\pi}{6}$ B. $\frac{\pi}{3}$ C. $\frac{2\pi}{3}$ D. $\frac{\pi}{4}$ E. NOTA

10. Given the following figure, find $b + c$, to the nearest tenth.



- A. 11.0 B. 12.0 C. 18.2 D. 21.4 E. NOTA

11. Find the radius, to the nearest tenth, of the inscribed circle of the plane triangle:

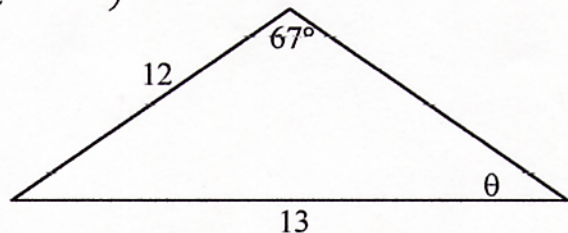


- A. 1.6 B. 2.4 C. 5.9 D. 13.9 E. NOTA

12. If $\cosh(u) = 9$, find $\tanh^2(u)$ to the nearest hundredth.

- A. 0.11 B. 0.49 C. 0.99 D. 1.01 E. NOTA

13. Find the angle θ for $\left(\frac{\pi}{2} > \theta > 0\right)$, to the nearest tenth:



- A. 4.4° B. 23° C. 58.2° D. 60.3° E. NOTA

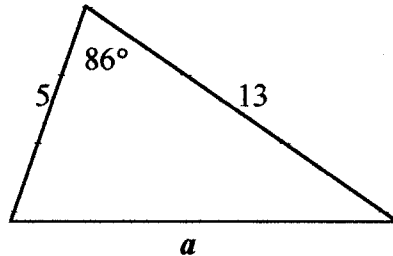
14. Simplify: $\left(\frac{\pi}{4} > \beta > 0\right)$, $\left(0 < \alpha < \frac{\pi}{2}\right)$

$$\frac{(1 + \cos(\alpha))(1 - \cos(\alpha))}{\left(\csc(\alpha) \tan(\alpha)\right) \left(\cot\left(\frac{\beta}{2}\right) - \cot(\beta)\right)}$$

- A. $\sin^2(\alpha)\cos(\alpha)\cos(\beta)$ B. $\sin^2(\alpha)\cos(\alpha)\csc(\beta)$
 C. $\sin^2(\alpha)\cos(\alpha)\sin(\beta)$ D. $\sin^2(\alpha)\cos(\alpha)\cot(\beta)$ E. NOTA

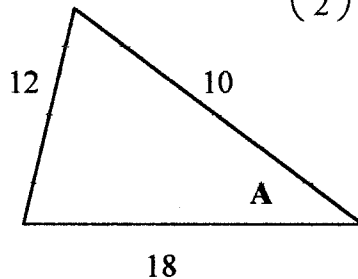
15. Let $n = \sqrt{2 + \sqrt{1 + \sqrt{2 + \sqrt{1 + \sqrt{\dots}}}}}$. Find the value of $n^4 - 4n^2 - n + 6$
- A. 0 B. 2 C. 3 D. ∞ E. NOTA

16. Find the length, to the nearest tenth, of side a :



- A. 3.0 B. 8.0 C. 13.6 D. 14.3 E. NOTA

17. Given the following acute triangle find $\tan\left(\frac{A}{2}\right)$:



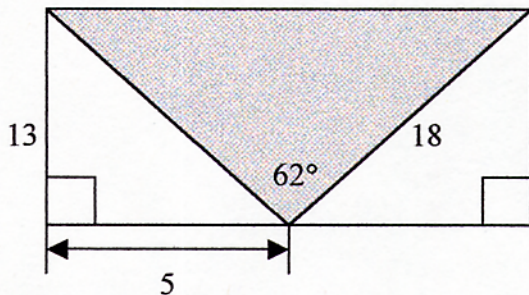
- A. $\frac{\sqrt{2}}{5}$ B. $\frac{\sqrt{2}}{4}$ C. $\frac{1}{2}$ D. $\sqrt{2}$ E. NOTA

18. Simplify:

$$\frac{2 \cosh^2(u) \tanh(u) \cosh(u) \coth(u) \sinh(u) \csc(u) - 2 \sinh^2(u) \tanh(u) \cosh(u) \coth(u) \sinh(u) \csc(u)}{\csc(u) \tanh(u) \coth(u)}$$

- A. $-\sinh(2u)$ B. $\sinh(2u)$
 C. $2 \cosh(u)$ D. $2 \coth(u)$ E. NOTA

19. Find the area of the shaded region to the nearest tenth.



A. 21.2

B. 63.2

C. 65

D. 110.7

E. NOTA

20. Find the cross product of the vectors $(1, -2, 0)$ and $(3, 4, 1)$.

A. $-3i + 9k$

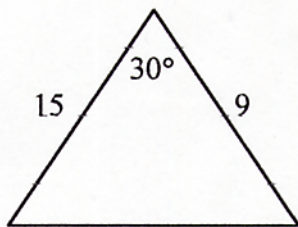
B. $4i + 2j + k$

C. $-2i - 6j - k$

D. $3i - 8j$

E. NOTA

21. Find the area, to the nearest tenth, of the following triangle:



A. 15.8

B. 16.9

C. 26.3

D. 33.8

E. NOTA

22. Express $(\sqrt{3} + i)^{10}$ in $a + bi$ form.

A. $100 - i\sqrt{3}$

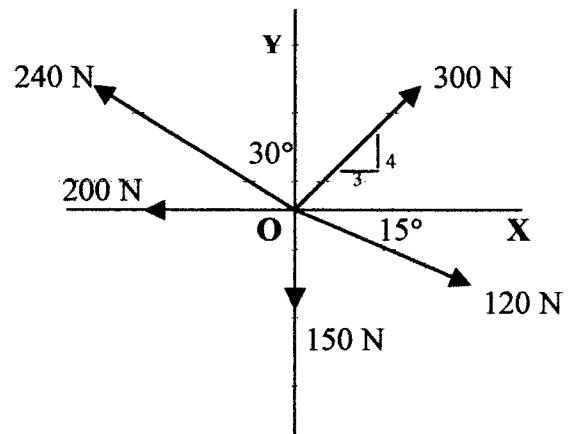
B. $512\sqrt{3} + 512i$

C. $512 - 512i\sqrt{3}$

D. $1024 - i\sqrt{3}$ E. NOTA

23. Express the polar equation $r(1 - 4\cos\theta) = 2$ to an equation in Cartesian coordinate form $Ax^2 + By^2 + Cx + Dy + E = 0$. Find $\frac{AB + (C - D)}{E}$.
- A. 0 B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. $\frac{15}{2}$ E. NOTA
24. Through what acute angle must the coordinate axes of the equation $x^2 + 8xy + y^2 + 6x + 8y + 10 = 0$ be rotated about the origin to remove the xy -term from the equation?
- A. 30° B. 45° C. 60° D. 90° E. NOTA
25. Find the distance, to the nearest tenth, between the two polar coordinates $P_1(3, 390^\circ)$ and $P_2(9, 36^\circ)$.
- A. 6.0 B. 8.2 C. 9.5 D. 12.0 E. NOTA
26. Given the following vectors, find the sum of the coordinate direction angles of the resultant force to the nearest tenth of a degree:
 $\vec{F}_1 = 60\hat{j} + 80\hat{k}$ and $\vec{F}_2 = 50\hat{i} - 100\hat{j} + 100\hat{k}$.
- A. 73.5° B. 172.4° C. 175.7° D. 196.5° E. NOTA
27. Find the angle, to the nearest tenth of a degree, formed when the diagonal of a cube intersects with two edges. Give the angle between the diagonal and one of those two edges.
- A. 54.7° B. 60.0° C. 90° D. Not enough information E. NOTA
28. Find $\vec{u} \times (\vec{v} \times \vec{w})$ if $(\vec{u} \cdot \vec{w}) = 6$, $(\vec{u} \cdot \vec{v}) = 9$, $\vec{v} = \hat{i} + 3\hat{j} + 4\hat{k}$, and $\vec{w} = \frac{1}{9}\hat{i} - \hat{j} + 2\hat{k}$.
- A. 54 B. $\frac{45}{2}\hat{i} - \frac{7}{2}\hat{j} - 3\hat{k}$
 C. $-\frac{4}{3}\hat{i} - 6\hat{j} - 18\hat{k}$ D. $5\hat{i} + 27\hat{j} + 6\hat{k}$ E. NOTA

29. Given the force system below find the resultant force, to the nearest hundredth, of the five forces and its direction angle θ measured from the positive x-axis, to the nearest hundredth of a degree.



- A. 211.06, 147.97° B. 267.87, 95.16°
 C. 880.26, 95.16° D. 211.06, 57.98° E. NOTA

30. Find the volume of the parallelepiped with sides

$$\mathbf{u} = (2, -6, 2), \mathbf{v} = (0, 4, -2), \text{ and } \mathbf{w} = (2, 2, -4).$$

- A. 16 B. 32 C. 56 D. 80 E. NOTA