

Mu Alpha Theta Pre-Calculus Team Test

TEAM QUESTION # 1

A square is circumscribed about a circle. Another square is inscribed in the same circle. If the diagonal of the larger square measures 10", then what is the area of the smaller square?

TEAM QUESTION # 2

Brian is hiding out in the woods at point (8,13). He needs to get to point (1,7) for supplies, but he must first get water at the river (the x-axis). What is the shortest distance he will have to run to accomplish these tasks? Round to the nearest hundredth if necessary.

TEAM QUESTION # 3

Given:

$$f(x) = \begin{cases} x^2 - 5 & \text{if } \frac{x}{3} \text{ is an integer} \\ x^{x+1} - 5 & \text{if } \frac{x}{3} \text{ is not an integer} \end{cases}$$

$$g(x) = \begin{cases} 2x - 3 & \text{if } x - 2 \text{ is a perfect square} \\ -4x + 10\sqrt{x + 4} & \text{if } x - 2 \text{ is not a perfect square} \end{cases}$$

$$h(x) = \begin{cases} x^2 + |x| & \text{if } x \geq 2 \\ x^4 - x^2 & \text{if } x < 2 \end{cases}$$

$$A = f(g(h(\sqrt{3})))$$

$$B = g(h(f(2)))$$

$$C = h(f(g(3)))$$

Find: $\frac{A - B}{C}$. Give an exact answer.

TEAM QUESTION # 4

Points (-5,7), (10, -2), and (3, y) lie in a plane, and cannot be connected by any circle. What does y equal? Round to the nearest tenth if necessary.

TEAM QUESTION # 5

The ellipse $\frac{x^2}{100} + \frac{y^2}{25} = 1$ has a rectangle inscribed in it which is longer horizontally than vertically. If one side of the rectangle is twice as long as another side, what is the exact value of combined area of the portions of the ellipse not included in the rectangle?

TEAM QUESTION # 6

$$A = \begin{bmatrix} 2 & -1 & 4 \\ 1 & 0 & -3 \end{bmatrix} \begin{bmatrix} 2 & -1 \\ 4 & 1 \\ 0 & 3 \end{bmatrix}$$

Find $\det(A)$

TEAM QUESTION # 7

Given: $\sin 2x = \sin x$

A = the sum of the solutions for the equation within the domain $[0, 2\pi)$

B = the number of solutions for the equation within the domain $[0, 2\pi)$

Find $\frac{A}{B}$. Give an exact answer.

TEAM QUESTION # 8

In $\triangle VIN$, which lies in the first quadrant, V lies on the origin, I lies on the x-axis, and N lies on the graph of $y = x^3$. If $m\angle V = 77^\circ$, and $m\angle I = 90^\circ$, what is the area of $\triangle VIN$? Round your answer to the nearest hundredth.

TEAM QUESTION # 9

$$\Theta = 30^\circ$$

$$\beta = 45^\circ$$

$$\sin \Phi = \frac{3}{4}$$

Determine the exact value of $\cot(\beta + \Theta) \cdot \cos 2\Phi$

TEAM QUESTION # 10

A circular pond has a diameter of 22 feet. A sidewalk is built around it with a constant width of 3 feet. If the sidewalk is always 4 inches thick, what is the volume of concrete needed to build the sidewalk? Give an exact answer.

TEAM QUESTION # 11

The ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$ is rotated 30 degrees counterclockwise. When written in standard form, what is the coefficient of the xy term? Give an exact answer.

TEAM QUESTION # 12

Given: $A = \log_9 12 + \ln 3e$

$$B = \log_4 8 - \ln 2$$

$$C = \ln 3 + \log_9 4 - \ln 2e$$

Find $A+B-C$.

TEAM QUESTION # 13

Suppose a segment connects the points obtained by transform the polar coordinates $(-6\sqrt{3}, 60^\circ)$ and $(4, 120^\circ)$ into rectangular coordinates. What is the acute angle that this segment forms with the x -axis? Round to the nearest degree.

TEAM QUESTION # 14

A sphere has a volume of $\frac{4000}{3\pi^2}$ cubic meters and is surrounded by a circular band such that the center of the band is the center of the sphere. If the band is extended by 4 m, what is the absolute value of the difference between the diameter of the band and the diameter of the sphere? Give an exact answer.

TEAM QUESTION #15

A triangle has sides of length b , c , and d . d is 240% of b . c is 75% of d . $b = 5$. Calculate the exact area of the triangle.