

March Regional

Pre-Calculus Team Question 1

Find **ABC**

- A. Find $n + m$, where (n, m) is the point of intersection of $g(x) = \frac{x}{x+1}$ and its inverse
- B. Compute $f^{-1}(3)$, where $f(x) = \ln(x + 5) + 3$
- C. The sum of the roots of $f(x) = 12x^3 - 6x^2 + 6x - 3$

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Pre-Calculus Team Question 2

Find **ABCD** (as an improper fraction)

- A. The number of positive five-digit palindromes, where the first digit is non-zero
- B. The probability that a randomly selected integer is divisible by 5 on the interval $(1000, 10000]$
- C. The probability that a randomly selected number on the interval $[1000, 8100)$ is a perfect square
- D. The probability of rolling two fair six-sided standard dice and obtaining a sum of 5

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Pre-Calculus Team Question 3

Find **ABCD**

- A. Simplify $\sqrt{8192}$
- B. Find $Im\left(\left(\frac{\sqrt{3}+i}{2}\right)^{2020}\right)$ in rectangular form, where $Im(a + bi) = b$ and $i = \sqrt{-1}$
- C. A fair coin is flipped four times. After the first three flips, the coin lands on tails only once. Find the probability that the coin lands on heads after the fourth flip.
- D. The amplitude of $f(x) = 4 \cos\left(\frac{x}{3} - \frac{\pi}{4}\right)$

March RegionalPre-Calculus Team Question 4

Find **ABCD** (as an improper fraction)

A. The length of the latus rectum of the conic $5x^2 - 30x + 4y^2 - 32y + 69 = 0$

B. The sum of the series $\frac{3}{4} - \frac{1}{2} + \frac{1}{3} - \frac{2}{9} + \dots$

C. The distance between the directrix and the vertex of $y - 3 = \frac{3}{2}(x - 2)^2$

D. Evaluate $\sum_{n=0}^{12} \left(\frac{3n+2}{12}\right)$

March RegionalPre-Calculus Team Question 5

Find $\frac{BCD}{6A}$ (as one simplified and rationalized improper fraction)

A. The sum of the solutions to the equation $\cos(3x) = \frac{\sqrt{3}}{2}$ on the interval $[0, \pi]$

B. Find $\tan(15^\circ)$

C. The period of $h(t) = 23 \sin\left(\frac{1}{5}t - \frac{1}{4}\right) + 34$

D. The area of triangle CDE , where $CD = 4$, $CE = 5$, and $m\angle C = 60^\circ$

March RegionalPre-Calculus Team Question 6

Find $\frac{AC}{B}$ (as an improper fraction)

A. Let $f(x) = \frac{x^5+4}{5+x^2}$ and $g(x) = x^3 + 11$. Find $g(f(2))$

B. The area bounded above by the x-axis and below by $y = |x| - 5$

C. Golam Incorporated sends out a shipment of 20, individually boxed, pressure transducers. Each transducer, in the shipment, has a 30% probability that it is defective upon arrival. If three transducers are inspected upon arrival, what is the probability that at least one transducer is defective?

Find **AB**A. $F(x)$ is a quartic polynomial with no constant term. $F(x)$ satisfies the following equations:

$$f(-1) = 3, f(-2) = 2, f(1) = -3, \text{ and } f(2) = 4$$

Find the coefficient of the fourth degree term in $F(x)$.B. Nick and Joy both take Snow's midterm. They score 92 and 88 respectively. The midterm exam scores are normally distributed. The standard score of Joy's midterm score is $\frac{7}{3}$ and the standard score of Nick's midterm score is $\frac{8}{3}$. Find the standard deviation (σ) of Snow's midterm exam scores.Find **ABCD**A. The tangent of the acute angle formed by the lines $2y_1 + 4 = (x - 3)$ and $y_2 - 7 = \frac{1}{3}(x + 8)$

B. $\lim_{x \rightarrow 4} \left(\frac{x^2 - 3x - 10}{x^2 + 6x + 8} \right)$

C. Let $P = \begin{bmatrix} 3 & 5 \\ 4 & 6 \end{bmatrix} \begin{bmatrix} 8 & 9 \\ 5 & 7 \end{bmatrix}$. Find $|P|$ D. Find $\langle 5, 9, -3 \rangle \cdot \langle -5, 7, -6 \rangle$ Find **A + B - C** (as an improper fraction)A. Find $x + y$, the sum of the solutions to the system $\begin{bmatrix} 3 & 5 \\ -4 & 6 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 14 \\ -44 \end{bmatrix}$

B. Find $\begin{vmatrix} 2 & -3 & 2 \\ 5 & 1 & 7 \\ 3 & -2 & 9 \end{vmatrix}$

C. The area of a triangle with vertices $(3,4)$, $(-2,-5)$, and $(6,2)$

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Pre-Calculus Team Question 10

Find $\frac{ABC}{D}$ (as one fraction in standard form)

- A. The product of the roots of $f(x) = x^3 + x^2 - 8x - 12$
- B. Compute $\sum_{n=1}^{\infty} \left(\frac{i}{i-1}\right)^{n-1}$, where $i = \sqrt{-1}$
- C. $|9 + 12i|$, where $i = \sqrt{-1}$
- D. Number of distinct arrangements in the letters of *COLLAZO*

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Pre-Calculus Team Question 11

Find $A(B - 2)$

- A. Let $f(x) = \cos(x)$. Find the probability $|f(x)| < \frac{1}{2}$ on the interval $\left(-\frac{5\pi}{6}, \frac{2\pi}{3}\right)$
- B. Deerfield Beach is planning a trip to the State Convention located at (20,20). Deerfield Beach can only travel in one unit increments up or to the right, and will begin at (8,16). (*Disregard of the method of transportation*) How many different ways can Deerfield Beach travel to the State Convention?

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Pre-Calculus Team Question 12

Find $\frac{ABC}{\pi}$

- A. Evaluate $\cos\left(\text{Arccot}\left(\frac{5}{12}\right)\right)$
- B. The distance between the polar points $\left(4, \frac{\pi}{3}\right)$ and $\left(6\sqrt{3}, \frac{\pi}{2}\right)$
- C. Area enclosed by the graph $r = 8$

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Pre-Calculus Team Question 13

Find $AB + C + D$

- A. The sum of the series $\frac{1}{3} - \frac{2}{15} + \frac{4}{75} - \frac{8}{375} + \dots$
- B. The 11th in the sequence $a_{n+1} = a_n + 4$, where $n \geq 1$ and $a_1 = 2$
- C. Find the number of positive integral divisors for 72^{11}
- D. Find the constant term in the expansion of $\left(x^2 + \frac{2}{x^3}\right)^{10}$

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Pre-Calculus Team Question 14

Find $\frac{BD}{C} \ln\left(\frac{A}{4}\right)$

- A. $\lim_{x \rightarrow 2} \left(\sqrt{e^{(10+4\ln(x))}}\right)$
- B. $\lim_{x \rightarrow \pi/3} \left(\frac{\tan^2 x}{\sec x}\right)$
- C. $\lim_{x \rightarrow \infty} \left(\frac{3x^4 - 2x^3 + 6}{10x^4 - 7x^3 - 3x}\right)$
- D. $\lim_{x \rightarrow \pi/6} \left(\frac{\sin x + \cos x}{\cot^2 x}\right)$

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Pre-Calculus Team Question 15

Find AB (as an improper fraction)

- A. A box contains 6 red marbles, 8 white marbles, 4 green marbles and 2 blue marbles. Sixteen marbles are selected at random without replacement. What is the probability that there is exactly 4 red marbles, 4 green marbles, and 6 white marbles in the sixteen marbles that are selected?
- B. In a Math class of 175 students: 100 students take Chemistry and 94 students take History. There are 43 students that take neither Chemistry nor History. How many students take Chemistry only?