

Theta Team Question 1

A = the sum of all real solutions of the equation $|3x+10| = 5x+6$

B = the sum of all real solutions of the equation $1 + \frac{-30}{a^2-9} = \frac{5}{a-3}$

C = the sum of all real solutions of the equation $\sqrt{x+2} + x = 4$

D = the sum of all real solutions of the equation $\log_2(x+2) + \log_2 x = \log_3 27$

Find $(ABC)^D$.

Theta Team Question 2

Find A if $A^{A^{A^{\dots}}} = 3$

Find D if $D = 3 \cdot \sqrt{3} \cdot \sqrt[4]{3} \cdot \sqrt[8]{3} \dots$

Find B if $B = \sqrt{3 + \sqrt{3 + \sqrt{3 + \dots}}}$

Then find $C - B + \frac{D}{A^3}$.

Find C if $C = 3 + \frac{1}{3 + \frac{1}{3 + \dots}}$

Theta Team Question 3

Given: $i = \sqrt{-1}$; $x, y, a, b \in \{\text{Real Numbers}\}$

$A = |3 + 4i| + |7 - 24i|$

$B = (1 + i)^{12}$

C = the sum of x and y if $2x - 6 + 3iy = 9i$

Find $AD + BC$.

D = the value of a when the reciprocal of $1 + 3i$ is written in $a + bi$ form

Theta Team Question 4

A = the length of a leg of an isosceles right triangle with hypotenuse of length 4

B = the length of the altitude to the hypotenuse of a right triangle which divides the hypotenuse into segments of lengths 4 and 6

C = the length of the hypotenuse of a $30^\circ - 60^\circ - 90^\circ$ triangle with the longest leg of length 12

D = the area of a triangle with sides of lengths 4, 7 and 9

Find $A^2 + B^2 + C^2 + D^2$.

Theta Team Question 5

$A = \log_3 p + \log_3 q$ given that p and q are the roots of $3x^2 - 7x + 1 = 0$

$B =$ the sum of all solutions of the equation $\log_4(x-3) = \log_4\left[\frac{1}{x}\right] + 1$

$C =$ the value of the integer x , given that $N > 1$ and $\frac{1}{\log_3 N} + \frac{1}{\log_5 N} + \frac{1}{\log_7 N} = \frac{1}{\log_x N}$

$D = \log \frac{1}{2} + \log \frac{2}{3} + \log \frac{3}{4} + \dots + \log \frac{999}{1000}$

Find $\frac{CD}{A+B}$.

Theta Team Question 6

$A =$ the number of ways 3 boys and 3 girls can be seated alternately in a circle

$B =$ the number of ways 7 people can be arranged in a line for a photograph if 2 of the people refuse to stand next to each other

$C =$ the number of ways of selecting a committee of 7 from a group of nine people

$D =$ the number of permutations of the letters in the word GATORS that end in a vowel

Find $\frac{B}{C} + \frac{D}{A}$.

Theta Team Question 7

$A =$ the sum of all solutions of the equation $y - \sqrt{y+2} = 4$

$B = \sqrt{72 - \sqrt{72 - 72 - \dots}}$

$C = \frac{\sqrt{32} + \sqrt{48}}{\sqrt{8} + \sqrt{12}}$

$D =$ the sum of x and y when $\sqrt{14 - 4\sqrt{10}}$ is written in the form $\sqrt{x} - y$

Find $\frac{ACD}{B}$.

Theta Team Question 8

A = the probability of rolling a sum of at least 10 when throwing 2 fair six-sided dice

B = the probability that a card drawn at random from a standard 52-card deck is red or a face card

C = the probability of exactly 2 coins showing heads when flipping 5 fair coins

D = the probability of drawing 2 white marbles in succession (without replacement) from an urn containing 8 white, 4 blue, and 3 red marbles

Find $B(A + CD)$.

Theta Team Question 9

Consider the matrices $X = \begin{bmatrix} 3 & 0 & 2 \\ 1 & -4 & 0 \end{bmatrix}$ and $Y = \begin{bmatrix} 1 & 0 & 2 \\ 0 & -1 & 1 \\ -2 & 1 & 3 \end{bmatrix}$

A = the total number of rows and columns in the product matrix XY

B = the sum of all entries in the product matrix XY

C = the a_{32} (third row, second column) entry in Y^{-1}

Find $C(A + B + D)$.

D = the sum of the entries in I if $IY = YI = Y$

Theta Team Question 10

A = the sixth term of an arithmetic sequence if its first term is 1 and the sum of its first six terms is 63

B = the second of 3 real geometric means between $-\frac{2}{9}$ and -18

$$C = \sum_{i=1}^{\infty} 5 \left(\frac{2}{3} \right)^{i-1}$$

$$D = 1^3 + 2^3 + 3^3 + \dots + 9^3$$

Find $\frac{A}{B} + \frac{D}{C}$.

Theta Team Question 11

A = the number of terms in the expansion of $(x + y + z)^3$

B = the sum of the elements in the 10th row of Pascal's Triangle

C = the numerical coefficient of the 3rd term in the expansion of $(x + 2y)^{\frac{1}{2}}$

D = the numerical coefficient of the term containing x^2yz^3 in the expansion of $(x + 2y + z)^6$

Find $BC + \frac{D}{A}$.

Theta Team Question 12

A = the units digit of 546_7 when changed to base 5

B = the number of digits in $4^{12} \cdot 5^{20}$ when written in its usual base 10 form

C = the units digit of 1538^{94}

D = the number of zeroes at the end of $45!$

Find $\frac{A+B+C}{D}$.

Theta Team Question 13

P , Q , and R are the roots of the equation $2x^3 + 3x^2 + 4x + 5 = 0$

$$A = P + Q + R$$

$$B = P^2 + Q^2 + R^2$$

$$C = \frac{1}{P} + \frac{1}{Q} + \frac{1}{R}$$

$$D = PQR$$

Find $ABCD$.

Theta Team Question 14

$A = x^2 + y^2$ given that $x - y = 7$ and $xy = 3$

$B =$ the total number of subsets of $\{1, 2, 3, 4\}$

$C =$ the numerical value of $x + y + z$, given that $x + y = 8$, $x + z = 12$, and $y + z = 28$

$D =$ the distance from the point $(2, 4)$ to the line defined by the equation $4x + 3y = -5$

Find $\frac{A+B+C}{D}$.

Theta Team Question 15

Find the value of r given that the number of permutations of n objects taken r at a time is 120 times the number of combinations of n objects taken r at a time.