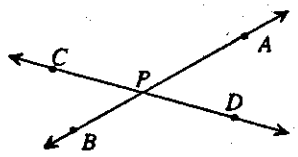
Theta Team Question 1

Solve over {Complex Numbers}:

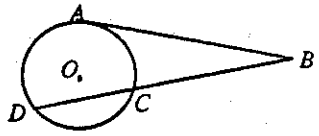
$x^4 - 6x^3 + 10x^2 + 2x - 15 = 0$

Theta Team Question 2

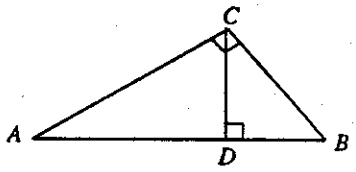
Given: $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at P
$m\angle APC = 11x + 3$
$m\angle APD = 4x - 3$
$m\angle CPB = 2w + 9$



Circle O with tangent $\overline{AB}$ and secant $\overline{BD}$
$AB = 24$
$CD = 20$
$BC = y$



Right triangle ACB
$\overline{CD}$ is the altitude to the hypotenuse
$CD = 4$
$AD = 3$
$DB = z$



Find the numerical value of $\frac{x}{w} + y + z$.

Theta Team Question 3

Find the value of k so that the graph of $4x^2 + 9y^2 - 8x + 36y - 8 + 2k = 0$ is a point.

Theta Team Question 4

A = the sum of all real solutions of the equation $\log(x + 3) + \log 2 = 0$

B = the real solution to the equation $\sqrt[3]{\log x} = 3\log\sqrt[3]{2}$, rounded to the nearest tenth

$C = \log_{,}15$, rounded to the nearest tenth

$D = \log_{;}35$, rounded to the nearest tenth

Find the numerical value of $A + B + C + D$.

Theta Team Question 5

The graphs of $16x^2 - 3y^2 = -11$ and $8x - y = -11$ intersect in the points A and B.

Find the slope of line AB.

Theta Team Question 6

A = the number of committees consisting of 3 representatives and 5 senators that can be selected from a group of 5 representatives and 8 senators

B = the number of distinguishable permutations of the letters in the word PARABOLA

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

D = the number of 4-digit numbers greater than 3000 that can be formed using the digits 1, 2, 3, 4, 5, 6, if repetition of digits is not allowed

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

Theta Team Question 7

A = the number of terms in the arithmetic series whose first term is 2.8, third term is 3.6, and sum is 19273.6

B = the number of terms in the geometric series whose first term is 400, third term is 324, and sum, when rounded to the nearest hundredth, is 3971.72

Find the sum $A + B$.

Theta Team Question 8

Given: $z = 2 + 3i$

J = the conjugate of z
K = the reciprocal of z
L = the opposite of z
M = the absolute value of z

Find $JKLM^2$ expressed in the form $a + bi$.
$\left(a, b \in \Re, i = \sqrt{-1}\right)$

Theta Team Question 9

A point moves in a plane such that its distance from the point (4, 0) is twice its distance from the line $x = -4$. An equation describing this set of coplanar points can be written in the form $Ax^2 + Cy^2 + Dx + Ey + F = 0$. If A, C, D, E, and F are relatively prime integers, and $A > 0$, find the sum $A + C + D + E + F$.

Theta Team Question 10

A = the third of five arithmetic means between 27 and 57

B = the average of the two positive geometric means between 40 and 320

$$C = \sum_{k=1}^{10} 6k$$

$$D = \sum_{k=1}^{8} 3\left(2^{k-1}\right)$$

Find the numerical value of $(A + D) - (B + C)$.

Theta Team Question 11

Find the product of all real solutions of the given equation:

$$\log_3 x^2 + (\log_3 x)(\log_3 x) = \log_3 6561$$

Theta Team Question 12

Given: $455x^{12}y^3$ is a term in the expansion of $(x + y)^n$, where n is a positive integer

A = the value of n
B = the term number of the given term
C = the simplified coefficient of the term in the expansion immediately following the given term
D = the total number of terms in the expansion

Find the numerical value of $\frac{C}{A} + BD$.

Theta Team Question 13

The rational expression $\frac{8x-9}{2x^2+x-15}$ can be written in the form $\frac{A}{x+3}+\frac{B}{2x-5}$.

Find the numerical value of $A+B$.

Theta Team Question 14

Two points are selected at random from the following list:

$$A(-1,3),\ B(2,-1),\ C(3,-5),\ D(6,4)$$

What is the probability that the line containing them will be perpendicular to a line with slope $\frac{3}{4}$?

Theta Team Question 15

Evaluate: $2+\sqrt{\frac{16}{2+\sqrt{\frac{16}{2+\ldots}}}}$