Question 1

If $f(x) = 3x^2 - 1$ and $g(x) = 4x$, let

$$\begin{aligned} A &= \text{the sum of the roots of } f(g(x)). \\ B &= \text{the value of } g(g(x)) \text{ at } x = 2. \\ C &= \text{the value of } g(f(x)) \text{ at } x = 3. \\ D &= \text{the } y\text{-intercept of the function } g(f(x)) \end{aligned}$$

Find $A + B + C - D$.

Question 2

Let

$$\begin{aligned} A &= (\log_2 3)(\log_3 4)(\log_4 5)(\log_5 6)\cdots(\log_{127} 128) \\ B &= \text{the sum of the real solutions of } 3^{2x} - 3^x - 2 = 0 \\ C &= 5^{\log_{25} 16} \times \frac{\log 25}{\log 5} \\ D &= \log_3 6 \times \log_3 \frac{3}{2} + (\log_3 2)^2 \end{aligned}$$

Find $A + D - C + B$

Question 3

Let $a = 1 + 2i$, and $b = 3 + i$.

$A = |ab|$

$B = \left|\frac{a}{b}\right|$

$C = |a + b|$

$D =$ Evaluate $P(1) + Q(1)$, if $P(x)$ is the quadratic with leading coefficient 1 and real coefficients having a as a root and $Q(x)$ is the quadratic with leading coefficient 1 and real coefficients having b as a root.

Find $ABC + D$

Question 4

Where defined, let:

$$\begin{aligned} A &= \text{the area enclosed by the figure, } |x| + |y| = 16 \\ B &= \text{the area of the conic, } x^2 - 4x + 4 + y^2 - 30x + 225 = 0 \\ C &= \text{the area enclosed by the line } y = 3x + 9\text{, the } x\text{-axis, and the } y\text{-axis} \end{aligned}$$

Evaluate $A + B + C$

Question 5

Let

A = the sum of the real values of x, where the function, $f(x) = \dfrac{x^2+3x+4}{x^2-6x+4}$ is undefined.

B = the number of vertical asymptotes of $f(x) = \dfrac{x^2-5x+6}{x^3-6x^2+11x-6}$

C = $p(7)$, where $p(x)$ is the equation of the slant asymptote of $f(x) = \dfrac{x^3+3x^2+2x+1}{x^2+3x+1}$

D = the y-coordinate of the removable discontinuity of the rational function, $f(x) = \dfrac{(x-7)(x+2)(x-10)}{(x-1)(x-7)}$

Find $\dfrac{2ACD}{B}$

Question 6

For the function, $y = 2x^2 + 8x - 13$, let

$$\begin{aligned} (A, B) &= \text{the vertex} \\ (C, D) &= \text{the focus} \\ E &= \text{the equation of the directrix} \\ F &= \text{the length of the latus rectum} \end{aligned}$$

Find $A + B + C + D - E + F$

Question 7

Expand the following:

$$\begin{aligned} A &= (2x+1)^6 \\ B &= (4x-3)^5 \\ C &= (7x-1)^4 \\ D &= (8x+1)^3 \end{aligned}$$

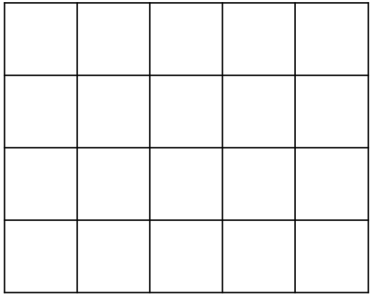
Find the coefficient of the x^3 term in $A+B+C+D$.

Question 8

Let

A = the maximum number of slices you can make on a pizza with 7 cuts

B = the number of rectangles with integer side lengths and corners on the points of the grid in the 4×5 rectangle below:



C = the sum of the product of the roots taken three at a time of the polynomial $5x^4 + 3x^3 - 4x^2 - 2x - 4 = 0$

D = the number of distinct arrangements of the term "ALGEBRA"

Evaluate $\dfrac{A + B \times C}{D}$

Question 9

If $i = \sqrt{-1}$, let

$$\begin{aligned} A &= (i+1)^8 \\ B &= (i-2)^3 \\ C &= (i-15)^3 \\ D &= (i-7)^2 \end{aligned}$$

Find $A + B + C + D$

Question 10

Let

$$A = \sum_{n=1}^{2012} i^n$$

$$B = \sum_{n=1}^{\infty} \left(\frac{2}{3}\right)^n$$

$$C = \sum_{n=1}^{\infty} \frac{n}{7^n}$$

D = the total distance travelled by a ball that is dropped at an initial height of 60 units and bounces back to $\frac{5}{6}$ of the previous height after every bounce. (ignore the units in your answer)

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

Question 11

For the conic whose equation is $x^2 - 4x + 3y^2 + 18y + 10 = 0$, find

$$\begin{aligned} A &= \text{the area of the conic} \\ B &= \text{the eccentricity of the conic} \\ C &= \text{the length of the latera recta} \\ D &= \text{the distance between the foci} \end{aligned}$$

Find $ABCD$

Question 12

Define $M = \begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$. Let

$$\begin{aligned} A &= \text{the determinant of } M \\ B &= \text{the determinant of } M^{-1} \\ C &= \text{the trace of } M \\ D &= \text{the sum of the eigenvalues of } M \end{aligned}$$

Find $AB - CD$

Question 13

Let

$$\begin{aligned} A &= \sqrt{5 \times 6 \times 7 \times 8 + 1} \\ B &= \sqrt{20 \times 21 \times 22 \times 23 + 1} \end{aligned}$$

Find $A + B$

Question 14

Find the number of digits in each of the following numbers, given that $\log 4 \approx .602, \log 7 \approx .845, \log 9 \approx .9542, \log 13 \approx 1.1139,$.

$$\begin{aligned} A &= 4^{16} \\ B &= 7^{29} \\ C &= 9^{8} \\ D &= 13^{21} \end{aligned}$$

What is the sum of the digits of $A + B + C + D$?