QUESTION 1

Let

$$\begin{aligned} A &= \text{the sum of the prime factors of 2013.} \\ B &= \text{the difference between the largest and smallest positive integer factors of 2013.} \\ C &= \text{the sum of all integer factors of 2013.} \\ D &= \text{the fourth root of the product of all positive factors of 2013.} \end{aligned}$$

Compute $A + B + C + D$.

QUESTION 2

In a certain gumball machine, there are 75 green gumballs, 60 blue gumballs, 50 red gumballs, and 15 purple gumballs. After a month, exactly 10 of each colored gumball has been withdrawn from the machine. If selection is random, let A be the difference between the probability of getting a red gumball at the beginning and at the end of the month.

At a certain bank, there is an account with a balance of $\$10,000$. Let B be the final balance after 4 years if the bank gives 10% interest per year (compounded annually) and then a deposit of $\$1,000$ is made at the end of every year.

Compute $A + B$.

QUESTION 3

Consider the solutions to the following systems of equations:

A. $\begin{aligned} 4x - 3y &= -1 \\ 2x + 5y &= 19 \end{aligned}$

B. $\begin{aligned} 4x + y &= 9 \\ -3x + 2y &= 7 \end{aligned}$

C. $\begin{aligned} 9x + 5y &= 24 \\ x + y &= 12 \end{aligned}$

D. $\begin{aligned} 8x + 2y &= 16 \\ -6x + y &= 18 \end{aligned}$

Compute the average of the abscissas of the solutions to each system.

QUESTION 4

Let

$$\begin{aligned} A &= \text{the sum of the positive solutions of the equation } x^2 + 5x + 6 = 2x^2 + 5x - 6 \\ B &= \text{the sum of the solutions of the equation } x^2 + 8x = 8x + 7 \\ C &= \text{the sum of the positive solutions of the equation } 3x^2 + 6x + 9 = 2x^2 + 4x + 12 \\ D &= \text{the sum of the distinct positive solutions of the equation } 3x^2 - 3x - 7 = x^3 - 8 \end{aligned}$$

Compute $AB + CD$.

QUESTION 5

Let

$$\begin{aligned} A &= \text{the value of } 13.7 \text{ rounded to the nearest integer} \\ B &= \text{the value of } \sqrt{325} \text{ rounded to the nearest integer} \\ C &= \text{the value of } \sqrt{7^5 + 14 \cdot 7^3} \text{ rounded to the nearest integer} \\ D &= \text{the value of } \sqrt{101 \cdot 103 + 1} \text{ rounded to the nearest integer} \end{aligned}$$

Find $A + B + C + D$.

QUESTION 6

Let

$$\begin{aligned} A &= \sqrt{6x^2yz} \\ B &= \frac{\sqrt{25xz}}{y^{-2}} \\ C &= xy\sqrt{3z} \\ D &= \frac{xyz}{x^{-1}y^{-1}z^{-1}} \end{aligned}$$

Find $\dfrac{BCD}{A}$ in simplest form.

QUESTION 7

At the school's store, pencils are sold for 10 cents each and pens are sold for 20 cents each. If I buy a total of 50 items with a total price of \$8.50, let A be the number of pencils I buy.

At a certan grocery store, orange juice is only sold in two different ways: either with 20% concentrated pulp or 80% concentrated pulp. If I want to combine the two different concentrations to make one of 44% and I bought 300 cups of the juice with 20% concentrated pulp, let B be the number of cups of the juice with 80% concentrated pulp that I should buy.

Find AB.

QUESTION 8

Tommy created the Tommy Function, which he takes a lot of pride in, even though it doesn't really do anything. In the Tommy Function, take any number, square it, multiply the result by 7, and subtract that number from 100 to get the end result. To make Tommy happy and get this question right, perform the Tommy Function on the first 4 prime numbers, and find the sum of the results.

QUESTION 9

Let $f(x) = 2x^2 + 3x - 1$ and $g(x) = 30 - 2x + x^3$. Let

$$\begin{aligned} A &= f(3) \\ B &= g(3) \\ C &= f(g(0)) \\ D &= g(f(0)) \end{aligned}$$

Find $A + B + C + D$.

QUESTION 10

Christian is an adventurous guy who likes to fly, and has seen many places and acquired many different currencies, but now he wishes to convert his foreign currencies to dollars. Consider the following conversion table:

2 Nim	30 Won
100 Won	4 Lau
1 Lau	20 Baht
40 Baht	3 Dollars

Let

$$\begin{aligned} A &= \text{the number of dollars he gets if he exchanges 200 Nim} \\ B &= \text{the number of dollars he gets if he exchanges 3000 Won} \\ C &= \text{the number of dollars he gets if he exchanges 40 Lau} \\ D &= \text{the number of dollars he gets if he exchanges 120 Baht} \end{aligned}$$

Find $4A + 3B + 2C + D$.

QUESTION 11

If I travel up a hill at a speed of 3 miles per hour and come back down at 7 miles per hour, let A be my average speed in mph.

Steven and Kevin are brothers. Last year, Steven was three times as old as his brother, and four years ago Steven was five times as old as his brother. Let B be the age of Kevin in three years.

Find $A + B$.

QUESTION 12

Let

$$\begin{aligned} A &= \frac{1}{2}+\frac{1}{3}-\frac{1}{4}\cdot\frac{1}{5}\div\frac{1}{6} \\ B &= \left(7^3-4^2\right)-\left(4^3-7^2\right)^2 \\ C &= \text{the slope of the line connecting the points } (-2,7) \text{ and } (32,2) \\ D &= \text{the slope of the line perpendicular to the line in part C} \end{aligned}$$

Find $ABCD$.

QUESTION 13

Let

$$\begin{aligned} A &= \frac{8+\sqrt{5}}{8-\sqrt{5}}, \text{ with a rationalized denominator} \\ B &= \text{The the sum of the roots and the degree of } x^3 - 3x^2 + 3x - 1 \\ C &= \text{The value of } x, \text{ where } 4^x = 16^3 \\ D &= \text{The number of real solutions to the equation } 3x^2 - 4x + 2 = x^2 - 4 \end{aligned}$$

Find $A + B + C + D$

QUESTION 14

Find the sum of the missing values in each of the following patterned sequences.

$$\begin{aligned} A &= \_\_\_, -5, 9, 23 \\ B &= 97, \_\_\_, 331, 448 \\ C &= 6, \frac{9}{2}, \_\_\_, \frac{81}{32} \\ D &= 18, 306, 5202, \_\_\_ \end{aligned}$$