Case Study 3

A major e-commerce company is calculating its daily operational expenses for a new delivery hub in North City. The total cost of fuel for the delivery vans is represented by the expression $15x^2 + 10x - 250$ rupees, where x represents the price of crude oil per barrel. The maintenance cost for the fleet is expressed as $12x + 100$ rupees. To improve efficiency, the company uses a software that estimates savings based on route optimization, which is given by the expression $4x - 50$ rupees.

During a board meeting, the logistics manager explained that identifying the nature of these expressions is vital for financial forecasting. He pointed out that the fuel cost expression consists of three terms, whereas the maintenance cost consists of two. The team needs to calculate the total expenditure by adding the fuel and maintenance costs and then subtracting the software-calculated savings. Furthermore, they need to identify like terms across different departments to consolidate their accounts. Understanding the coefficients of these variables allows the company to predict how a slight change in the variable x will impact their million-dollar operations.

Questions

1. Which of the following correctly identifies the terms in the maintenance cost expression $12x + 100$?

   (a) 12 and x
   (b) $12x$ and 100
   (c) $12, x$, and 100
   (d) $112x$

   Answer: (b) $12x$ and 100
   Solution: Terms are the parts of an expression separated by addition or subtraction signs. In $12x + 100$, the two distinct terms are $12x$ and 100.

2. What is the sum of the fuel cost $(15x^2 + 10x - 250)$ and the maintenance cost $(12x + 100)$?

   (a) $15x^2 + 22x - 150$
   (b) $27x^2 + 10x - 150$
   (c) $15x^2 + 22x - 350$
   (d) $37x - 150$

   Answer: (a) $15x^2 + 22x - 150$
   Solution: Sum $= (15x^2 + 10x - 250) + (12x + 100)$
   Grouping like terms: $15x^2 + (10x + 12x) + (-250 + 100) = 15x^2 + 22x - 150$.

3. If the company wants to find the total effective expenditure (Fuel + Maintenance - Savings), what is the final simplified expression? (Savings $= 4x - 50$)

   (a) $15x^2 + 18x - 200$
   (b) $15x^2 + 26x - 100$
   (c) $15x^2 + 18x - 100$
   (d) $15x^2 + 22x - 200$

   Answer: (c) $15x^2 + 18x - 100$
   Solution: Expenditure $= (15x^2 + 22x - 150) - (4x - 50)$
   $= 15x^2 + 22x - 150 - 4x + 50$
   $= 15x^2 + (22x - 4x) + (-150 + 50) = 15x^2 + 18x - 100$.

4. In the fuel cost expression $15x^2 + 10x - 250$, what is the coefficient of x^2 and the constant term?

   (a) 10 and 250

   (b) 15 and -250

   (c) 15 and 250

   (d) 10 and -250

   Answer: (b) 15 and -250
   Solution: The coefficient of x^2 is the number multiplied by it, which is 15. The constant term is the numerical value without a variable, which is -250.

5. Which of the following pairs are "unlike terms"?

   (a) $10x$ and $12x$

   (b) -250 and 100

   (c) $15x^2$ and $10x$

   (d) $4x$ and $-3x$

   Answer: (c) $15x^2$ and $10x$
   Solution: Unlike terms have different variables or the same variable raised to different powers. x^2 and x have different powers, so they are unlike terms. All other pairs consist of either similar variables with the same power or pure constants.