Case Study 3

The Green Valley High School has decided to install solar panels on its roof to reduce its carbon footprint. The school's energy consultant, Mr. Das, explains that the energy generated by solar panels is in direct proportion to the surface area of the panels installed. Currently, a small pilot setup with a surface area of 15 square meters generates 30 units of electricity per day. To meet the school's total requirement, they need to scale this up significantly.

The project budget is shared between the school management and the Parent-Teacher Association (PTA) in a ratio of 7 : 3. Furthermore, the time required to install the panels is inversely proportional to the number of technicians working on the roof. Mr. Das notes that 4 technicians can complete the installation in 15 days. However, the school wants the system to be operational before the annual sports meet, which is in just 6 days. The students in the Mathematics club have been asked to analyze these proportions to help the school manage the costs and the installation timeline effectively.

Multiple Choice Questions

1. If the school requires 120 units of electricity per day, what total surface area of solar panels must be installed?

    (a) 45 square meters

    (b) 60 square meters

    (c) 75 square meters

    (d) 90 square meters

    Answer: (b) 60 square meters
    Solution: Energy is in direct proportion to area. $\frac{\text{Area}_1}{\text{Energy}_1} = \frac{\text{Area}_2}{\text{Energy}_2}$. So, $\frac{15}{30} = \frac{x}{120}$. This simplifies to $\frac{1}{2} = \frac{x}{120}$. $x = 120/2 = 60$ square meters.

2. The total cost of the project is calculated to be Rs 2,50,000. How much money will the PTA contribute based on the 7 : 3 ratio?

    (a) Rs 1,75,000

    (b) Rs 50,000

    (c) Rs 75,000

    (d) Rs 1,00,000

    Answer: (c) Rs 75,000
    Solution: Total ratio parts $= 7 + 3 = 10$. PTA's share corresponds to 3 parts. PTA contribution $= \frac{3}{10} \times 2,50,000 = 3 \times 25,000 = 75,000$.

3. How many technicians are needed in total to complete the installation in 6 days instead of 15 days?

    (a) 8 technicians

    (b) 10 technicians

    (c) 12 technicians

    (d) 15 technicians

    Answer: (b) 10 technicians
    Solution: This is inverse proportion. $T_1 \times D_1 = T_2 \times D_2$. Here, $4 \times 15 = T_2 \times 6$. $60 = 6 \times T_2$. $T_2 = 60/6 = 10$ technicians.

4. If the ratio of energy generated to the number of panels is 2 : 1 and each panel has an area of 1.5 square meters, how many units does 1 panel generate?

   (a) 2 units
   (b) 3 units
   (c) 1.5 units
   (d) 4 units

   Answer: (b) 3 units
   Solution: From the passage, 15 sq m generates 30 units. This means 1 sq m generates $30/15 = 2$ units. If 1 panel is 1.5 sq m, it generates $1.5 \times 2 = 3$ units.

5. If the school management decides to increase their contribution such that the new ratio of Management to PTA becomes 4 : 1, what would be the Management's share for the same Rs 2,50,000 project?

   (a) Rs 2,00,000
   (b) Rs 1,50,000
   (c) Rs 1,80,000
   (d) Rs 2,10,000

   Answer: (a) Rs 2,00,000
   Solution: New ratio is 4 : 1. Total parts $= 4 + 1 = 5$. Management's share $= \frac{4}{5} \times 2,50,000 = 4 \times 50,000 = 2,00,000$.