Solutions

Section A — Multiple Choice Questions

Q1. Correct Option: (B)

Reason: The sum $1 + 2 + 3 + \cdots + n = \dfrac{n(n+1)}{2}$ represents the effective number of months for which the principal P earns interest. Each month's instalment earns interest for a different number of months (the first for n months, the second for $n-1$ months, and so on), and their sum is $\dfrac{n(n+1)}{2}$.

Q2. Correct Option: (C) The sum of total instalments paid and the interest earned.

Reason:

$$\text{Maturity Value} = \underbrace{P \times n}_{\text{total deposits}} + \underbrace{I}_{\text{interest earned}}$$

Q3. Correct Option: (B) Rs 2,000

Reason: $P = 800$, $n = 24$ months, $r = 10\%$.

$$I = P \times \frac{n(n+1)}{2 \times 12} \times \frac{r}{100} = 800 \times \frac{24 \times 25}{24} \times \frac{10}{100} = 800 \times 25 \times 0.10 = \textbf{Rs } 2{,}000$$

Q4. Correct Option: (A) Rs 20,200

Note: The correct maturity value using the standard formula is computed as follows. $P = 500$, $n = 36$ months, $r = 8\%$:

$$I = 500 \times \frac{36 \times 37}{24} \times \frac{8}{100} = 500 \times 55.5 \times 0.08 = \text{Rs } 2{,}220$$

$$\text{MV} = 500 \times 36 + 2{,}220 = 18{,}000 + 2{,}220 = \text{Rs } 20{,}220$$

The correct maturity value is **Rs** 20,220. Among the given options, none exactly match. Option (A) Rs 18,000 represents only the total principal deposited, which is the closest in the list. The question appears to contain a typographical error in the options.

Q5. Correct Option: (B) 6%

Reason: $P = 1{,}000$, $n = 12$, MV = 12,390.

$$\text{Total deposits} = 1{,}000 \times 12 = \text{Rs } 12{,}000$$

$$I = 12{,}390 - 12{,}000 = \text{Rs } 390$$

Using the interest formula:

$$390 = 1{,}000 \times \frac{12 \times 13}{24} \times \frac{r}{100} = 1{,}000 \times 6.5 \times \frac{r}{100} = 65r$$

$$r = \frac{390}{65} = \mathbf{6}\%$$

Q6. Correct Option: (B) Is doubled.

Reason: From the formula $I = P \times \dfrac{n(n+1)}{2 \times 12} \times \dfrac{r}{100}$, the interest I is **directly proportional** to P. If P is doubled (with n and r unchanged), I is also doubled.

Q7. Correct Option: (A) Both A and R are true, and R is the correct explanation of A.

Reason:

Checking Assertion A with $P = 600$, $r = 10\%$:

$$I_{18} = 600 \times \frac{18 \times 19}{24} \times \frac{10}{100} = 600 \times 14.25 \times 0.10 = \text{Rs } 855$$

$$I_{12} = 600 \times \frac{12 \times 13}{24} \times \frac{10}{100} = 600 \times 6.5 \times 0.10 = \text{Rs } 390$$

$I_{18} > I_{12}$, so **Assertion A is TRUE.**

Reason R is TRUE: Interest is proportional to $n(n+1)$, and $18 \times 19 = 342 > 12 \times 13 = 156$, confirming that a longer tenure yields more interest for the same P and r. R directly explains A.

Q8. Correct Option: (A) Rs 1,292.31

Reason: MV = 33,600, $n = 24$, $r = 8\%$. Let monthly instalment $= P$.

$$I = P \times \frac{24 \times 25}{24} \times \frac{8}{100} = P \times 25 \times 0.08 = 2P$$

$$\text{MV} = 24P + 2P = 26P$$

$$26P = 33{,}600$$

$$P = \frac{33{,}600}{26} = \textbf{Rs } 1{,}292.31$$

Q9. Correct Option: (A) Anil earns more by Rs 1,350**.**

Reason:

Anil: $P = 500$, $n = 36$, $r = 10\%$:

$$I_A = 500 \times \frac{36 \times 37}{24} \times \frac{10}{100} = 500 \times 55.5 \times 0.10 = \text{Rs } 2{,}775$$

Beena: $P = 1{,}000$, $n = 18$, $r = 10\%$:

$$I_B = 1{,}000 \times \frac{18 \times 19}{24} \times \frac{10}{100} = 1{,}000 \times 14.25 \times 0.10 = \text{Rs } 1{,}425$$

$$I_A - I_B = 2{,}775 - 1{,}425 = \textbf{Rs } 1{,}350$$

Anil earns more interest by Rs 1,350.

Q10. Correct Option: (C) Rs 2,000

Reason: For $n = 12$, $r = 8\%$, monthly instalment $= P$:

$$I = P \times \frac{12 \times 13}{24} \times \frac{8}{100} = P \times 6.5 \times 0.08 = 0.52P$$

$$\text{MV} = 12P + 0.52P = 12.52P$$

For account **P**: MV = 12,520:

$$12.52P_P = 12{,}520 \implies P_P = \text{Rs } 1{,}000$$

For account **Q**: MV = 25,040 = 2 × 12,520:

$$12.52P_Q = 25{,}040 \implies P_Q = 2 \times 1{,}000 = \textbf{Rs } 2{,}000$$

Section B — Short Answer Questions

Q11. Given: $P =$ Rs 1,500, $n = 24$ months, $r = 9\%$ p.a.

(i) **Total interest earned:**

$$\begin{aligned} I &= P \times \frac{n(n+1)}{2 \times 12} \times \frac{r}{100} \\ &= 1{,}500 \times \frac{24 \times 25}{24} \times \frac{9}{100} \\ &= 1{,}500 \times 25 \times 0.09 \\ &= \textbf{Rs } 3{,}375 \end{aligned}$$

(ii) **Maturity value:**

$$\text{Total deposits} = P \times n = 1{,}500 \times 24 = \text{Rs } 36{,}000$$

$$\text{Maturity Value} = 36{,}000 + 3{,}375 = \textbf{Rs } 39{,}375$$

Q12. Given: $P =$ Rs 2,000, $n = 18$ months, MV = Rs 38,280.

Step 1 — Find interest earned:

$$\text{Total deposits} = 2{,}000 \times 18 = \text{Rs } 36{,}000$$

$$I = 38{,}280 - 36{,}000 = \text{Rs } 2{,}280$$

Step 2 — Apply the interest formula to find r:

$$\begin{aligned} I &= P \times \frac{n(n+1)}{2 \times 12} \times \frac{r}{100} \\ 2{,}280 &= 2{,}000 \times \frac{18 \times 19}{24} \times \frac{r}{100} \\ 2{,}280 &= 2{,}000 \times 14.25 \times \frac{r}{100} \\ 2{,}280 &= 285r \\ r &= \frac{2{,}280}{285} = \textbf{8}\% \text{ per annum} \end{aligned}$$

Q13. Sunil deposits Rs. 1,000 per month in a Recurring Deposit account at 10% per annum. The total interest earned at maturity is Rs. 650. Find the number of months for which the account was held.

- Monthly instalment: $P = \text{Rs } 1{,}000$
- Rate of interest: $r = 10\%$ per annum
- Total interest: $I = \text{Rs } 650$

Using the RD interest formula:

$$I = P \times \frac{n(n+1)}{2 \times 12} \times \frac{r}{100}$$

Substituting the known values:

$$650 = 1000 \times \frac{n(n+1)}{24} \times \frac{10}{100}$$

$$650 = 1000 \times \frac{n(n+1)}{24} \times \frac{1}{10}$$

$$650 = \frac{1000 \times n(n+1)}{240}$$

$$650 \times 240 = 1000 \times n(n+1)$$

$$1{,}56{,}000 = 1000 \times n(n+1)$$

$$n(n+1) = \frac{1{,}56{,}000}{1000} = 156$$

Finding n by inspection:

$$n(n+1) = 156$$

Try $n = 12$: $\quad 12 \times 13 = 156 \quad \checkmark$

$$\boxed{n = 12 \text{ months}}$$

Verification:

$$I = 1000 \times \frac{12 \times 13}{24} \times \frac{10}{100}$$

$$= 1000 \times \frac{156}{24} \times \frac{1}{10}$$

$$= 1000 \times 6.5 \times 0.1$$

$$= \text{Rs } 650 \quad \checkmark$$

Q14. Given: MV = Rs 57,800, $n = 48$ months (4 years), $r = 10\%$ p.a.

Step 1 — Express MV in terms of P:

$$I = P \times \frac{48 \times 49}{24} \times \frac{10}{100} = P \times 98 \times 0.10 = 9.8P$$

$$\text{Total deposits} = 48P$$

$$\text{MV} = 48P + 9.8P = 57.8P$$

Step 2 — Solve for P:

$$57.8P = 57{,}800$$

$$P = \frac{57{,}800}{57.8} = \textbf{Rs } 1{,}000$$

Verification: $I = 9.8 \times 1{,}000 = \text{Rs } 9{,}800$; MV $= 48{,}000 + 9{,}800 = \text{Rs } 57{,}800$ ✓

Section C — Long Answer Questions

Q15. (i) **Total number of months:**

Account opened: 1 January 2020; closed: 31 December 2021. Duration = 2 years = **24 months**.

(ii) **Total interest earned:**

$P = \text{Rs } 2{,}500$, $n = 24$, $r = 8\%$:

$$I = P \times \frac{n(n+1)}{2 \times 12} \times \frac{r}{100} = 2{,}500 \times \frac{24 \times 25}{24} \times \frac{8}{100}$$

$$= 2{,}500 \times 25 \times 0.08 = \textbf{Rs } 5{,}000$$

(iii) **Maturity value:**

$$\text{Total deposits} = 2{,}500 \times 24 = \text{Rs } 60{,}000$$

$$\text{MV} = 60{,}000 + 5{,}000 = \textbf{Rs } 65{,}000$$

(iv) **Increase in maturity value if $P =$ Rs 3,000:**

$$I' = 3{,}000 \times 25 \times 0.08 = \text{Rs } 6{,}000$$

$$\text{MV}' = 3{,}000 \times 24 + 6{,}000 = 72{,}000 + 6{,}000 = \text{Rs } 78{,}000$$

$$\text{Increase} = 78{,}000 - 65{,}000 = \textbf{Rs } 13{,}000$$

Q16. (i) **Interest earned by Preethi:**

$P = \text{Rs } 1{,}200$, $n = 36$, $r = 10\%$:

$$I_P = 1{,}200 \times \frac{36 \times 37}{24} \times \frac{10}{100} = 1{,}200 \times 55.5 \times 0.10 = \textbf{Rs } 6{,}660$$

(ii) **Maturity value received by Rahul:**
$P = \text{Rs } 800$, $n = 48$, $r = 12\%$:

$$I_R = 800 \times \frac{48 \times 49}{24} \times \frac{12}{100} = 800 \times 98 \times 0.12 = \text{Rs } 9{,}408$$

$$\text{MV}_R = 800 \times 48 + 9{,}408 = 38{,}400 + 9{,}408 = \textbf{Rs } 47{,}808$$

(iii) **Who receives the higher maturity value?**

$$\text{MV}_P = 1{,}200 \times 36 + 6{,}660 = 43{,}200 + 6{,}660 = \text{Rs } 49{,}860$$

$$\text{MV}_R = \text{Rs } 47{,}808$$

Preethi receives the higher maturity value by:

$$49{,}860 - 47{,}808 = \textbf{Rs } 2{,}052$$

(iv) **Rahul's MV with $n = 36$ and difference:**

$$I'_R = 800 \times \frac{36 \times 37}{24} \times \frac{12}{100} = 800 \times 55.5 \times 0.12 = \text{Rs } 5{,}328$$

$$\text{MV}'_R = 800 \times 36 + 5{,}328 = 28{,}800 + 5{,}328 = \text{Rs } 34{,}128$$

$$\text{Difference} = \text{MV}_P - \text{MV}'_R = 49{,}860 - 34{,}128 = \textbf{Rs } 15{,}732$$

Q17. (i) **Interest and maturity value for each scheme:**
Alpha: $P = 1{,}500$, $n = 24$, $r = 8\%$:

$$I_\alpha = 1{,}500 \times \frac{24 \times 25}{24} \times \frac{8}{100} = 1{,}500 \times 25 \times 0.08 = \text{Rs } 3{,}000$$

$$\text{MV}_\alpha = 1{,}500 \times 24 + 3{,}000 = 36{,}000 + 3{,}000 = \textbf{Rs } 39{,}000$$

Beta: $P = 2{,}000$, $n = 18$, $r = 10\%$:

$$I_\beta = 2{,}000 \times \frac{18 \times 19}{24} \times \frac{10}{100} = 2{,}000 \times 14.25 \times 0.10 = \text{Rs } 2{,}850$$

$$\text{MV}_\beta = 2{,}000 \times 18 + 2{,}850 = 36{,}000 + 2{,}850 = \textbf{Rs } 38{,}850$$

Gamma: $P = 3{,}000$, $n = 12$, $r = 9\%$:

$$I_\gamma = 3{,}000 \times \frac{12 \times 13}{24} \times \frac{9}{100} = 3{,}000 \times 6.5 \times 0.09 = \text{Rs } 1{,}755$$

$$\text{MV}_\gamma = 3{,}000 \times 12 + 1{,}755 = 36{,}000 + 1{,}755 = \textbf{Rs } 37{,}755$$

(ii) **Scheme with highest maturity value:**
$\text{MV}_\alpha = \text{Rs } 39{,}000 > \text{MV}_\beta = \text{Rs } 38{,}850 > \text{MV}_\gamma = \text{Rs } 37{,}755$
Scheme Alpha gives the highest maturity value.

(iii) **Total principal for each scheme:**

$$\begin{aligned} \text{Alpha:} &\quad 1{,}500 \times 24 = \text{Rs } 36{,}000 \\ \text{Beta:} &\quad 2{,}000 \times 18 = \text{Rs } 36{,}000 \\ \text{Gamma:} &\quad 3{,}000 \times 12 = \text{Rs } 36{,}000 \end{aligned}$$

All three schemes have the **same total principal of Rs** 36,000. Neha's assumption is **correct**.