Unit 2 · Compound Interest

HARDER WORKSHEET · ANSWER KEY

Full marks 24

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Find the unknown

ANSWER A · 3

SI for 2 years $= 2 \times \frac{PR}{100} = 2400$, so one year's interest is $\frac{PR}{100} = 1200$.

CI − SI for 2 years is the second year's interest on the first year's interest: $2520 - 2400 = 120$, which is R% of 1,200, so $R = \frac{120}{1200} \times 100 = 10$.

$P = \frac{1200 \times 100}{10} = 12000$. **10% a year and Rs 12,000.**

MARKING SCHEME

- ✓ One year's interest is Rs 1,200.
- ✓ 120 is the interest on 1,200, so $R = 10\%$.
- ✓ $P =$ Rs 12,000.

2 Which is better?

ANSWER HA · 3

P: $200000 \times 1.12^2 =$ Rs 2,50,880.

Q: $200000\left(1 + \frac{11.7}{400}\right)^8 = 200000 \times 1.02925^8 \approx$ Rs 2,51,881.92.

Bank Q gives about Rs 1,001.92 more, although its rate is lower: adding interest four times a year more than makes up for a rate 0.3 points lower.

MARKING SCHEME

- ✓ P's amount Rs 2,50,880.
- ✓ Q's amount about Rs 2,51,881.92 (2.925% for 8 quarters).
- ✓ Q gives more, by about Rs 1,001.92.

3 Is the claim true?

ANSWER HA · 3

7 years have 14 half-years at 5%: $100000 \times 1.05^{14} \approx 197993$. So after 7 years there is about **Rs 1,97,993, not Rs 2,00,000**: the poster is not quite right.

One more half-year: $197993 \times 1.05 \approx 207893$, more than Rs 2,00,000. So it doubles in the next half-year: **at most half a year more** (7½ years).

MARKING SCHEME

- ✓ 14 periods at 5%: amount about Rs 1,97,993.
- ✓ So the poster is wrong (just under double).
- ✓ After one more half-year it is about Rs 2,07,893: doubled within 7½ years.

4 Spot the error

MARKING SCHEME U · 3

- ✓ The mistake: tax is on the interest only (each year), not on the whole amount.
- ✓ Year 1 after tax 3,800 (principal 43,800); year 2 after tax 4,161.
- ✓ Rs 47,961.

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5 Show it

ANSWER HA · 3

$A_3 = A_2\left(1 + \frac{R}{100}\right)$, since the third year adds R% to the amount after 2 years. So $A_3 - A_2 = A_2 \times \frac{R}{100}$, and $R = \frac{A_3 - A_2}{A_2} \times 100$.

$R = \frac{6655 - 6050}{6050} \times 100 = \frac{605}{6050} \times 100 = \mathbf{10\%}$.

MARKING SCHEME

- ✓ $A_3 = A_2\left(1 + \frac{R}{100}\right)$ (the third year multiplies the amount after 2 years).
- ✓ Rearranged to $R = \frac{A_3 - A_2}{A_2} \times 100$.
- ✓ 10%.

6 Work backwards

ANSWER A · 3

After tax the deposit grows by $10\% \times 0.95 = 9.5\%$ a year, a factor of 1.095.

$P \times 1.095^2 = 59951.25$, so $P = \frac{59951.25}{1.199025} = \mathbf{Rs\ 50{,}000}$.

MARKING SCHEME

- ✓ The yearly factor after tax is 1.095.
- ✓ $P \times 1.199025 = 59951.25$.
- ✓ Rs 50,000.

7 In a real setting

ANSWER A · 4

End of year 1 he owes $21000 \times 1.1 = 23100$; after paying x he owes $23100 - x$.
End of year 2 he owes $1.1(23100 - x) = 25410 - 1.1x$, and the second payment clears it:
$25410 - 1.1x = x$, so $2.1x = 25410$ and $x = \mathbf{Rs\ 12{,}100}$.
Check: $23100 - 12100 = 11000$, and $11000 \times 1.1 = 12100$ ✓. He pays Rs 24,200 in all, Rs 3,200 of it interest.

MARKING SCHEME

- ✓ Owed after year 1 and the first payment: $23100 - x$.
- ✓ Owed at the end of year 2: $1.1(23100 - x)$.
- ✓ $1.1(23100 - x) = x$ set up.
- ✓ Each payment Rs 12,100.

8 Make your own

ANSWER HA · 2

For 2 years, CI − SI = $P\left(\frac{R}{100}\right)^2$. For example, $R = 10$: $P \times 0.01 = 50$, so $P = 5000$. Check: SI = 1000, CI $= 5000 \times 0.21 = 1050$, difference 50 ✓. (Others work too: Rs 20,000 at 5%, Rs 1,250 at 20%.)

MARKING SCHEME

- ✓ A sum and rate with $P\left(\frac{R}{100}\right)^2 = 50$.
- ✓ A check that CI − SI is Rs 50.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	10	11	**24**

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