



Repeated Percentage Change Exam Practice

Q1. Ben invests some money for 3 years in a savings account. He gets 4% compound interest each year. If Ben has £11,171.00 at the end of the 3 years, work how much he invested.

$$N \times 1.04^3 = 11,171$$

$$N = 11,171 \div 1.04^3$$

$$N = 9930.98$$

Answer: £ 9930.98
(3 marks)

Q2. Ron gets a pay-rise of 2% last month, and a further pay-rise of 3% this month. He says, "In total, I've had a pay increase of 5%". Do you agree? You must justify your answer.

Let $N =$ Ron's monthly pay (before his first rise)

He now gets $N \times 1.02 \times 1.03$

$$= N \times 1.0506 \quad (\text{rise of } 5.06\% \text{ overall})$$

So Ron is incorrect

Answer: Incorrect
(2 marks)



Q3. Sam invests £5000 for 4 years in a savings account. She gets 2% per compound interest in the first year, then $p\%$ for the next 3 years. If Sam has £5508.23 at the end of 4 years, work out the value of p .

$$\begin{aligned} & \cdot 5000 \times 1.02 = 5100 \text{ after year 1} \\ & \cdot 5100 \times M^3 = 5508.23 \text{ where } M \text{ is the \% multiplier.} \\ & \Rightarrow M^3 = 1.0800 \\ & \Rightarrow M = 1.026 \\ & \Rightarrow p = 2.6\% \end{aligned}$$

Answer: $p = 2.6\%$
(4 marks)

Q4. The share price in an energy company rose by 4% last year, and decreased by 7% this year. Work out the percentage change over this period.

$$\begin{aligned} & \text{let } N = \text{price before first change} \\ & \Rightarrow N \times 1.04 \times 0.93 = 0.9672 \text{ overall multiplier} \\ & \Rightarrow \text{overall decrease of } 3.28\% \end{aligned}$$

Answer: Decrease 3.28%
(2 marks)



Q5. Jerry started a new fitness regime in January, and on it he is losing 1.5% of his body weight each month. He plans to have lost 11% of his weight by the end of June. He works out that he won't, and will increase his training in June. What % bodyweight will he have to lose in June to reach this goal?
Give your answer correct to 1 decimal place.

- let $N =$ Jerry's starting weight
- His weight at end of May: $N \times (0.985)^5$
 $= N \times 0.9272$
- Target is $N \times 0.89$
- $\Rightarrow 0.9272 \times M = 0.89$
 $\Rightarrow M = 0.9598$
 \Rightarrow lose 4.0%.

Answer: lose 4.0%
(4 marks)



Q6. A tree is 2.8 metres tall. It grows at the rate of 1.9% each year for the next 10 years, and then at half that rate for the next 10 years. Work out how tall it will be after this period, giving your answer to the nearest cm.

$$\begin{aligned} & 280\text{cm} \times 1.019^{10} \times 1.0095^{10} \\ &= 371.503 \\ &= 372\text{cm} \end{aligned}$$

Answer: 372 cm
(4 marks)

Q7. A car is decreasing in value by $x\%$ each year. If the car will half in value in 6 years, work out the value of x . Give your answer to 1 decimal place.

- let N = starting value of the car
 - $N \times M^6 = N \times 0.5$ where M is the % multiplier
 - $M^6 = 0.5$
 - $M = 0.8909$
- $\Rightarrow x$ is 10.9%.

Answer: 10.9%
(3 marks)



Q8. The volume of water in a garden pond fell by 3.4% last week, and then increased by 0.75% this week. Work out the overall percentage change in the volume of water over this period.

$$\begin{aligned} & V \times 0.966 \times 1.0075 \\ &= V \times 0.973 \\ &\Rightarrow \text{overall decrease of } 2.7\% \end{aligned}$$

Answer: decrease of 2.7%
(3 marks)

Q9. The number of insects in a colony is increasing by $x\%$ each day. If the population is expected to increase by a factor of three in 12 days, work out the value of x . Give your answer to 1 decimal place.

• let N = starting population

work $N \times M^{12} = N \times 3$ where M is the % multiplier

$$\begin{aligned} \Rightarrow M^{12} &= 3 \\ \Rightarrow M &= 3^{\frac{1}{12}} \\ M &= 1.0959 \\ \Rightarrow x &= 9.6\% \end{aligned}$$

Answer: 9.6%
(2 marks)



Q10. An oil-slick, in the shape of a circle, is increasing in area by 3% each day. Work out the % increase in the radius r of the oil-slick after 5 days.

• let r_1 = radius of circle before increase
 \Rightarrow let A = Area of circle before increase $\Rightarrow A = \pi r_1^2$
let r_2 = of circle after 5 days.

• Area new circle is: $A \times 1.03^5 = A \times 1.1593$

$$\frac{\pi r_2^2}{\pi r_1^2} = 1.1593$$

$$\frac{r_2}{r_1} = \sqrt{1.1593}$$

$$= 1.077$$

\Rightarrow increase of 7.7%

Answer: 7.7%

(4 marks)

Q11. Walter wishes to model the population of bats which is increasing by the same amount each year. To find how many bats there will be 4 years from now, He multiplies the current number of bats by 1.00375.

Work out, correct to 1 decimal place, the percentage increase each year in the population.

In 4 years time, population is $N \times 1.00375$

$$\Rightarrow \text{In 1 year, population is } N \times (1.00375)^{\frac{1}{4}}$$
$$= N \times 1.000936$$

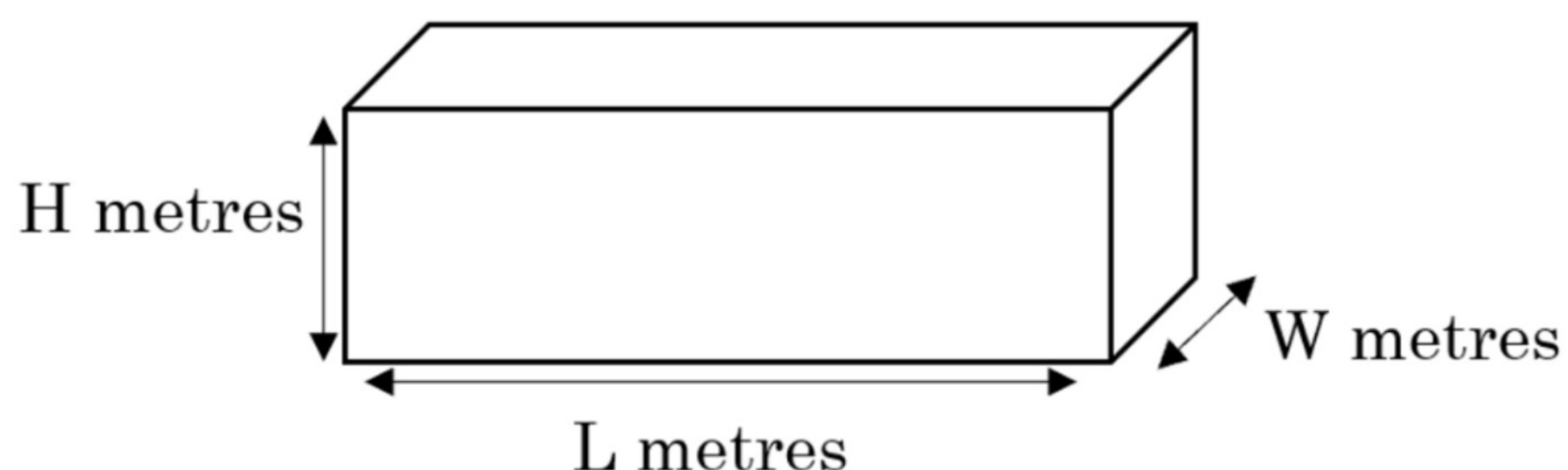
\Rightarrow increase of 0.09%

Answer: 0.09%

(2 marks)



Q12. A wall is being constructed in the shape of a cuboid. For every 1% increase in volume, the overall cost will increase by £100.



It is decided that L is to be decreased by 0.8% and W is to be increased by 2.6%. Work out the overall increase in cost of the wall.

- let $V = \text{volume of wall}$
- New volume = $V \times 0.992 \times 1.026$
- $= V \times 1.017792$
- Increase in volume is 1.7792%
So extra cost is $1.7792 \times 100 = \underline{\underline{£177.92}}$

Answer: £177.92
(4 marks)



Q13. An engineer is experimenting with cylinders of different size for his project. This week it is decided that the area of the cross-section should be increased by 5%.

Next week, it is decided that the cross-section should be increased again but by 2% this time. Work out the overall percentage increase in the radius of the cylinder over the entire period, to 1 decimal place.

• Vol changes this week to $V \times 1.05$

• Next week, Volume is $V \times 1.05 \times 1.02$
 $\Rightarrow V \times 1.071$

• old vol. = $\pi r^2 h$, new vol = $\pi r^2 h \times 1.071$
as h hasn't changed, r^2 has increased by 1.071
 $\Rightarrow r$ has increased by $\sqrt{1.071}$
 $\Rightarrow r = 1.035$, which is
an increase of 3.5%.

Answer: 3.5%

(5 marks)