REPEATED PERCENTAGE CHANGE

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA

Each new change starts from the NEW amount.



+10%: £100 + £10 = £110



+10%: £110 + £11 = £121

The second 10% is bigger, because 10% of £110 is £11.

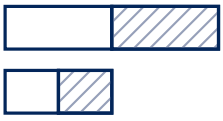
1 Increase £200 by 10%. Then increase your answer by 10%.

200 → +10% → ☐ → +10% → ☐

10% of 200 = ☐ 10% of your first answer = ☐

2 Decrease £80 by 50%. Then decrease your answer by 50%.

80 → −50% → ☐ → −50% → ☐



Half each time

3 Write each repeated multiplication as a power.

a) $2 \times 2 \times 2 = 2^{\square}$

b) $1.1 \times 1.1 = 1.1^{\square}$

c) $1.5 \times 1.5 \times 1.5 \times 1.5 = 1.5^{\square}$

d) $0.9 \times 0.9 \times 0.9 = 0.9^{\square}$

4 A plant is 3 cm tall. Its height doubles every week.

WEEK	0	1	2	3	4
Height (cm)	3	6	☐	☐	☐

Week 4: $3 \times 2 \times 2 \times 2 \times 2 = 3 \times 2^{\square}$

REPEATED PERCENTAGE CHANGE

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

Increase £200 by 10% every year for 3 years:

200 → × 1.1 → 220 → × 1.1 → 242 → × 1.1 → 266.20

200 × 1.1 × 1.1 × 1.1 = 200 × 1.1^3 = £266.20

1 Fill in each chain.

a) £500 → × 1.2 → ☐ → × 1.2 → ☐

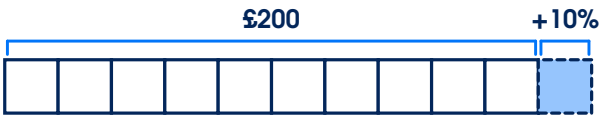
b) £800 → × 0.75 → ☐ → × 0.75 → ☐

c) Write a) using a power: £500 × $1.2^{\square}$

2 A car is worth £15 000. Its value decreases by 10% every year. Complete the table.

END OF YEAR	0	1	2	3
Value (£)	15 000			

3 Increase £200 by 10%. Then decrease the new amount by 10%.



10% of £200 = £ ☐ New: £ ☐

10% of that = £ ☐ New: £ ☐

Is the final amount back to £200? YES NO

4 Write each calculation using a power (multiplier and power). Then work it out.

a) £300 increased by 5% each year for 4 years

300 × ☐$^{\square}$ = ☐

b) 80 kg decreased by 15% each year for 3 years

80 × ☐$^{\square}$ = ☐

REPEATED PERCENTAGE CHANGE

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

Multiply by each multiplier in turn. The same change n times is × multiplier^n, e.g. +5% for 3 years is × 1.05^3. Percentages do not add: +10% then +20% is × 1.1 × 1.2 = × 1.32, a 32% increase.

FLUENCY

1 Use a calculator. Give money to the nearest penny.

a) Increase £2500 by 4% each year for 3 years.

b) Decrease 6000 by 12% each year for 2 years.

c) Increase £150 by 10%, then increase the result by 20%.

d) Increase 64 by 25%, then decrease the result by 20%.

2 Draw a line to match each change to its multiplier.

Increase by 5% for 3 years	× 1.5^3
Decrease by 5% for 3 years	× 1.15
Increase by 15% once	× 1.05^3
Increase by 50% for 3 years	× 0.95^3

REASONING

3 Compare the changes.

Is a 20% increase followed by a 30% increase the same as a 50% increase?

Use £100 to explain.

.....

4 £200 is increased by 25% each year for 2 years.

Kim says, "200 × 1.25 × 2 = £500"

a) Explain Kim's mistake.

.....

b) Work out the correct amount.

REPEATED PERCENTAGE CHANGE

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

REASONING

1 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) Increasing by x% then decreasing by x% gets back to the start. ALWAYS SOMETIMES NEVER

b) Two 10% increases are the same as one 21% increase. ALWAYS SOMETIMES NEVER

c) An increase then a decrease gives less than the start. ALWAYS SOMETIMES NEVER

d) Repeated 10% decreases will reach zero. ALWAYS SOMETIMES NEVER

PROBLEM SOLVING

2 A car is worth £18 000. In the next three years its value falls by 15%, then by 10%, then by 5%.

a) Value after 3 years = £ ____

b) Overall percentage decrease = ____ % (1 d.p.)

3 A price is increased by x%. The new price is then decreased by x%. Overall, this is a 4% decrease. Find x.

x = ____

★ CHALLENGE FOR ALL

4 A sample has 2000 bacteria. The number increases by 30% every hour. After how many whole hours will there first be more than 10 000 bacteria?

Number of whole hours = ____

REPEATED PERCENTAGE CHANGE

ANSWERS

BUILDING BLOCKS

1 220, then 242 · 10% of 200 = 20 · 10% of 220 = 22
2 40, then 20
3 a) 2^3 b) 1.1^2 c) 1.5^4 d) 0.9^3
4 Week 2: 12 · Week 3: 24 · Week 4: 48 · 3×2^4

SUPPORT

1 a) £600, £720 = 500×1.2^2 b) £600, £450
2 £13 500 · £12 150 · £10 935
3 £20, £220 · £22, £198 · NO (the second 10% is of £220, not £200)
4 a) 300×1.05^4 = £364.65 b) 80×0.85^3 = 49.13 kg

CORE

1 a) £2812.16 b) 4646.4 c) £198 d) 64
2 +5% for 3 years → $\times 1.05^3$ · −5% for 3 years → $\times 0.95^3$ · +15% once → $\times 1.15$ · +50% for 3 years → $\times 1.5^3$
3 No. £100 × 1.2 = £120, then £120 × 1.3 = £156: a 56% increase, not 50%. The 30% is of the bigger amount.
4 a) A repeated change uses a power: $\times 1.25^2$, not $\times 1.25 \times 2$ b) 200×1.25^2 = £312.50

GREATER DEPTH

1 a) Never (for $x > 0$), e.g. $100 \times 1.1 \times 0.9 = 99$ b) Always ($1.1^2 = 1.21$) c) Sometimes: +10% then −10% gives less; +50% then −10% gives more d) Never
2 a) $18\,000 \times 0.85 \times 0.9 \times 0.95$ = £13 081.50 b) 27.3%
3 $(1 + x/100)(1 - x/100) = 0.96$, so $1 - (x/100)^2 = 0.96$, $(x/100)^2 = 0.04$: $x = 20$
4 $2000 \times 1.3^6 = 9653.618$ (not yet); 2000×1.3^7 = 12 549.70..., so 7 hours