



eClassroom

GCSE MATHEMATICS • RATIO & PROPORTION

Percentage Change

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator only where shown

Full worked solutions for the free Percentage Change worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Percentage Change worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

Ratio revision engine

Free courses

More worksheets



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $32 - 25 = 7$ $\frac{7}{25} \times 100 = \boxed{28\%}$

A2 $8000 - 6000 = 2000$ $\frac{2000}{8000} \times 100 = \boxed{25\%}$

A3 Profit = $98 - 80 = 18$ $\frac{18}{80} \times 100 = \boxed{22.5\% \text{ profit}}$

HIGHER

A4 $1.2 \times 1.05 = 1.26$ $\boxed{\text{increase of } 26\%}$

A5 $240 \div 750 = 0.32\text{p per ml}$ $204 \div 600 = 0.34\text{p per ml}$ $\frac{0.02}{0.32} \times 100 = \boxed{\text{increase of } 6.25\%}$

A6 Time $\propto \frac{1}{\text{workers}}$: $1 \div 1.6 = 0.625$ $\boxed{\text{decrease of } 37.5\%}$

A7 Square $\times 1.44$, so the number $\times \sqrt{1.44} = 1.2$ $n + 6 = 1.2n$ $0.2n = 6$ $\boxed{n = 30}$
Check: $30^2 = 900$ and $36^2 = 1296$, and $1296 \div 900 = 1.44$

B**Fluency solutions**

One mark for each correct part. The notes in italics explain why each sequence was chosen.

FOUNDATION

B1 (a) $\boxed{25\%}$ (b) $\boxed{20\%}$ (c) $\frac{120}{80} \times 100 = \boxed{150\%}$ (d) $\frac{0.9}{2.5} \times 100 = \boxed{36\%}$

(a) and (b) both go up by 10, but from different originals, so the percentages differ.

B2 (a) $\boxed{20\%}$ (b) $\boxed{15\%}$ (c) $\boxed{37.5\%}$ (d) $\boxed{4\%}$

40 to 50 is 25%, but 50 to 40 is only 20%: the original has changed.

- B3** (a) $\frac{20}{45}$: **20% profit** (b) $\frac{9}{45}$: **20% loss** (c) $\frac{15}{12}$: **125% profit** (d) $\frac{8}{64}$: **12.5% loss**

In (a) and (b) the selling price is the same but the cost is not. Always divide by the cost.

- B4** (a) **increase of 35%** (b) **decrease of 8%** (c) **increase of 140%** (d) **decrease of 40%**

Compare the multiplier with 1. 0.92 is 8% less than 1, not 92%.

- B5** (a) $\frac{15}{45}$: **increase of $33\frac{1}{3}\%$** (b) $\frac{450}{750}$: **increase of 60%** (c) $\frac{115}{200}$: **decrease of 57.5%**

Change to the same units first: 60 minutes, 1200 ml, 200 cm.

- B6** (a) original £60: **increase of 25%** (b) original £60: **decrease of 20%**
 (c) original £72: $\frac{12}{72} \times 100 =$ **increase of 16.7%** (d) original 3 kg: **decrease of 10%**

You are given the new value, so work back to the original first. Dividing 15 by 75 is the common mistake.

HIGHER

- B7** (a) $1.1^2 = 1.21$ **increase of 21%** (b) $1.2 \times 0.8 = 0.96$ **decrease of 4%**
 (c) $1.1^3 = 1.331$ **increase of 33.1%** (d) $0.7^2 = 0.49$ **decrease of 51%**

Up 20% and down 20% is not "no change".

- B8** (a) $1 \div 1.5$ **decrease of $33\frac{1}{3}\%$** (b) $1 \div 0.8 = 1.25$ **increase of 25%**
 (c) $1 \div 1.2$ **decrease of 16.7%** (d) $1 \div 2 = 0.5$ **decrease of 50%**

Inverse changes are not the same size: 50% faster is not 50% less time.

- B9** (a) 40p to 50p **increase of 25%** (b) 0.4p to 0.45p per g **increase of 12.5%**
 (c) 50p to 55p **increase of 10%** (d) £5 to £4.40 per kg **decrease of 12%**

- B10** (a) **increase of 30%** (b) $\times 1.25$ **increase of 25%**
 (c) $\times 0.8$ **decrease of 20%** (d) $1.2^2 = 1.44$ **increase of 44%**



C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 (a) Kim divided by the new price, £50. She should divide by the original price, £40

(b) $\frac{10}{40} \times 100 = 25\%$

C2 The pass rate went up by 10 **percentage points**. As a percentage of the original 40%: $\frac{10}{40} \times 100 = 25\%$

C3 (a) A decrease of 100% takes the price to £0. It cannot go below £0, so it cannot fall by more than 100%

(b) $75 - 30 = 45$ $\frac{45}{30} \times 100 = 150\%$ as required

C4 Shop A: $\frac{3}{15-3} = \frac{3}{12}$, so 25% Shop B: $\frac{5}{25}$, so 20%

No. Shop B's price rose by more money, but Shop A's percentage increase is greater.

HIGHER

C5 Change 1: area $\times 1.3$ Change 2: area $\times 1.15^2 = 1.3225$

Change 2 gives the greater increase: 32.25% compared with 30%

C6 Speed = distance $\div$ time. Time $\times 0.75$, so speed $\times \frac{1}{0.75} = \frac{4}{3}$

$\frac{4}{3} = 1 + \frac{1}{3}$, an increase of $\frac{1}{3} \times 100 = 33\frac{1}{3}\%$ as required

C7 Increase from a to $b = \frac{b-a}{a} \times 100$ Decrease from b to $a = \frac{b-a}{b} \times 100$

Both have the same positive numerator $b-a$. Since $a < b$, dividing by a gives the larger result.

proved



C8 (a) Money taken = price $\times$ number sold. New total = $\left(1 - \frac{p}{100}\right) \left(1 + \frac{2p}{100}\right) \times \text{old total} = 1.08 \times \text{old total}$

Multiply by 5000: $(100 - p)(50 + p) = 5400$ $5000 + 50p - p^2 = 5400$ so $p^2 - 50p + 400 = 0$

as required

(b) $(p - 10)(p - 40) = 0$ $p = 10$ or $p = 40$

Check $p = 40$: $0.6 \times 1.8 = 1.08$ Check $p = 10$: $0.9 \times 1.2 = 1.08$

D

Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 February = $40 + 12 = £52$ March = $52 \times 0.75 = £39$

Change = $39 - 40 = -1$ $\frac{1}{40} \times 100 = \text{decrease of } 2.5\%$

D2 Old contract: $25 \times 24 = £600$ New contract: $18 \times 24 + 120 = 432 + 120 = £552$

Saving = $£48$ $\frac{48}{600} \times 100 = 8\%$

D3 2 h 40 min = 160 minutes, 2 h 12 min = 132 minutes. Decrease = 28 minutes.

$\frac{28}{160} \times 100 = 17.5\%$

D4 Area before = $12 \times 8 = 96 \text{ m}^2$ Area after = $12 \times 7 = 84 \text{ m}^2$

$\frac{12}{96} \times 100 = 12.5\%$

HIGHER

D5 Total of 8 numbers = $8 \times 50 = 400$ New mean = $50 \times 1.1 = 55$, total = $10 \times 55 = 550$

The two numbers add up to $550 - 400 = 150$ Mean = $150 \div 2 = 75$

D6 Before: $4.5 \times 8 = 36$ litres, $36 \times 1.40 = £50.40$ After: $4.5 \times 6.5 = 29.25$ litres, $29.25 \times 1.50 = £43.875$

$\frac{43.875 - 50.40}{50.40} \times 100 = -12.94\ldots$ decrease of 12.9%



D7 Let the cost price be £ c . The selling price is $c + 8$

$$\text{New profit} = (c + 8) - 1.1c = 8 - 0.1c = 5 \quad 0.1c = 3 \quad \boxed{\text{£30}}$$

D8 Area: $\left(1 + \frac{x}{100}\right)\left(1 - \frac{x}{100}\right) = 0.96$, so $1 - \frac{x^2}{10000} = 0.96$ and $x^2 = 400$ $x = 20$

$$\text{Perimeter: } 2(1.2b + 0.8h) = 0.95 \times 2(b + h) \quad 1.2b + 0.8h = 0.95b + 0.95h \quad 0.25b = 0.15h$$

$$\text{base : height} = 0.15 : 0.25 = \boxed{3 : 5}$$

E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

E1 (a) $\frac{0.40}{3.20} \times 100$ M1

$$\boxed{12.5} \% \quad \text{A1}$$

(b) $\frac{12500 - 9750}{12500} \times 100 = \frac{2750}{12500} \times 100$ M1

$$\boxed{22} \% \quad \text{A1}$$

E2 March = 400, April = 340 B1

$$\frac{60}{400} \times 100 \quad \text{M1}$$

$$\boxed{15} \% \quad \text{A1}$$

E3 (a) $\frac{40}{160} \times 100$ M1

$$\boxed{25} \% \quad \text{A1}$$

(b) 200×1.25 M1

$$\boxed{250} \quad \text{A1}$$

E4 Fall: $\frac{10}{50} \times 100 = \boxed{20\%}$ M1

$$\text{Rise: } \frac{10}{40} \times 100 = \boxed{25\%} \quad \text{M1}$$

No. The rise is 25%, because it is worked out from £40, not £50 C1



E5 Loss = $240 - 204 = 36$ M1

$$\frac{36}{240} \times 100$$

15 % A1

E6 Jo before = $2240 \div 1.12$ P1

 = £2000 A1

Lee: $\frac{250}{2000} \times 100 = \text{span style="border: 1px solid green; padding: 2px;">12.5\%$

Lee got the greater percentage rise, because $12.5\% > 12\%$ P1

C1

HIGHER

E7 1.2×0.85 M1

 = 1.02 M1

increase of 2% A1

E8 Before: $160 \div 200 = 0.8\text{p per g}$ After: $162 \div 180 = 0.9\text{p per g}$ M1

$$\frac{0.1}{0.8} \times 100$$

12.5 % M1

A1

E9 The number of tickets $\times 1.2$, so the price $\times \frac{1}{1.2}$ M1

$$\frac{1}{1.2} = 0.8333\ldots$$

16.7 % M1

A1

E10 Width w , length $2w$. New area = $(2w + 2)(w + 2)$ P1

$$(2w + 2)(w + 2) = 1.68 \times 2w^2$$

P1

$$2w^2 + 6w + 4 = 3.36w^2, \text{ so } 1.36w^2 - 6w - 4 = 0, \text{ and } \times 12.5: 17w^2 - 75w - 50 = 0$$

P1

$$(w - 5)(17w + 10) = 0$$

P1

5 cm (the other root is negative) A1

Check: $10 \times 5 = 50$ and $12 \times 7 = 84$, and $84 \div 50 = 1.68$

