Up, Down and Back Again with Multipliers

Teacher		**Class**	Year 8
Subject	Maths	**Topic**	Percentage change
Date		**Room**	
Lesson length	60 minutes	**Country**	United Kingdom

Pupils learn to use multipliers for increase, decrease, original values and simple interest. They move, calculate and practise with sale prices and savings in pounds.

Curriculum links

- solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics

Learning objectives

- Students will use multipliers to calculate new amounts after percentage increase and decrease.
- Students will divide by multipliers to find original values before percentage change.
- Students will calculate simple interest and total savings over time in pounds.

Success criteria

- I can choose multipliers like 1.15 and 0.75 to find new prices.
- I can divide the new amount by the multiplier to find the original.
- I can work out yearly interest and the final savings balance.

What students already know

2-minute retrieval: ask what 50%, 25% and 10% of £60 are, and what 45% means as a fraction and decimal.

Key words

multiplier	a decimal number used to find a new amount in one step
percentage increase	when an amount gets bigger, shown as parts out of a hundred [4]
percentage decrease	when an amount gets smaller, shown as parts out of a hundred [4]
original value	the starting amount before it goes up or down
simple interest	extra money for saving, worked out only on the starting amount

Materials

- three corner signs labelled Increase, Decrease and Find the Original
- problem cards for Move to the Multiplier (text in plan)
- mini whiteboards and pens
- Slides 1-12 and projector
- Worksheet Tasks B and C, printed
- multiplier reminder cards showing 100% + x% and 100% - x%

Before the lesson

- Print corner signs, problem cards and Worksheet Tasks B and C
- Test Video clip 2 (0:00–3:35) on slide 6 and Video clip 4 (0:17–2:49) on slide 8
- Clear walkways and space for three corners, push chairs in
- Set out mini whiteboards, pens and multiplier reminder cards

Lesson outline

0–8 min **Starter** 8 min · Whole class

Recall per cent basics and spark curiosity about percentage change up and down.

YOU DO

1. Show Slide 1 title with Increase, decrease, original values and simple interest and Slide 2: Shops put prices up and bring them down in sales. Today we calculate exactly how much they change.
2. Show Slide 3: Work out percentage increase with multipliers · Work out percentage decrease with multipliers · Find the original value by reversing · Calculate simple interest.
3. Show Slide 4: Up 10% then down 10% does not get you back! · £200 up 10% is £220, then down 10% is £198. Ask for yes/no vote on returning to £200.
4. Introduce three corners and say the hook, then try one teaser card to model moving.

STUDENTS DO

1. Vote yes or no on whether up 10% then down 10% returns to £200.
2. Listen to teaser problem and walk to Increase, Decrease or Find the Original corner.
3. Answer quick retrieval on 50%, 25% and 10% of £60.

Say: Stand up. I will read a problem. Walk to the corner that matches it. No running. Today we decide if a problem is an increase, a decrease or finding the start, then we calculate it in pounds.

Worked example: £200 up 10% is £220, because 110% of £200 is £200 x 1.1 = £220. Then down 10% is £198, because 90% of £220 is £220 x 0.9 = £198 [4]. The £22 drop is bigger than the £20 rise because the two per cent changes are measured from different starting values, £200 and £220 [4].

Ask: If £200 goes up 10% to £220, then down 10%, why is the drop £22 not £20? (Because the second 10% is taken from £220, not £200, so the chunk is bigger.) · What is 45% as a fraction and decimal? (45/100 or 0.45 [4].)

Check understanding: Hands up vote and whiteboard jottings for £200 to £198; if unsure, re-show the two different 10% chunks on a bar before moving on.

Support: Show a bar for £200 and £220 side by side and point to the different 10% parts. **Stretch:** Ask what overall per cent change £200 to £198 is and how they know.

Use: Slides 1-4

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8–20 min **Teaching** 12 min · Whole class

Teach how to choose and use multipliers for percentage increase and decrease.

YOU DO

1. Play Video clip 2 and ask pupils to spot the multiplier for increase, spot the multiplier for decrease and listen for divide by original.
2. Show Slide 7 cards: Increase · New = original x (100% + change%). ·  · Decrease · New = original x (100% - change%). ·  · Reverse · Original = new divided by multiplier.
3. Model £60 with 15% rise as £60 x 1.15 = £69 and £48 with 25% off as £48 x 0.75 = £36, noting a change of x per cent gives 100 + x per cent of the original [4].
4. Ask class to call out multipliers for 20% off and 5% rise and write them on the board.

STUDENTS DO

1. Watch the video and note one multiplier for increase and one for decrease.
2. Write multipliers for 20% off and 5% rise on mini whiteboards and hold up.
3. Repeat back the two rules for multipliers over and under 1.

Say: A rise uses more than 100%, so the multiplier is over 1. A cut uses less than 100%, so the multiplier is under 1. Once you have it, new amount equals starting amount times the multiplier.

Worked example: Increase: 15% rise means 100% + 15% = 115% = 1.15, so £60 x 1.15 = £69. Decrease: 25% off leaves 100% - 25% = 75% = 0.75, so £48 x 0.75 = £36. A decrease of 60% would leave 40% of the original [4].

Ask: What multiplier turns £60 into a new price after a 15% rise? (1.15, because 100% + 15% = 115%.) · What multiplier gives the sale price after 25% off? (0.75, because 100% - 25% = 75%.) · Why is 20% off the same as x0.8? (Because 100% - 20% = 80% = 0.8.)

Check understanding: All hold up boards for x1.15 and x0.75; reteach 100% ± change if more than a few are wrong.

Support: Let pupils find 10% by dividing by 10 first, then build to 15% or 25% before using the single multiplier. **Stretch:** Ask pupils to order multipliers 0.8, 1.2 and 2.0 by size of final amount without calculating.

Use: Video clip 2 (0:00–3:35), Slides 6–7

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20–35 min **Main activity** 15 min · Whole class

Practise choosing the correct multiplier for increase, decrease and original value problems.

YOU DO

1. Label corners Increase, Decrease and Find the Original and hand out multiplier reminder cards.
2. Read the six problem cards in turn: 1) Find new price after 15% rise on £60. 2) Find sale price after 25% off £48. 3) You pay £36 after 20% off. What did it cost before the sale? 4) Find original when £63 is price after 5% rise. 5) £200 savings with 5% simple interest for 1 year. How much interest? 6) A £40 game rises to £46. How would you find the percentage increase?
3. On a signal, pupils walk to the matching corner, then write the multiplier and answer on whiteboards. Remind them the multiplier is 1 plus or minus the percentage as a decimal [4]: a 20% increase means x1.2 and 20% off means x0.8.
4. Check each corner together, using Slide 10: Increase · Multiplier over 1, e.g. 1.15 · New amount bigger than start · Example: 25% up means x 1.25 and Slide 11: You pay £36 after 20% off. What did it cost before the sale? · £45, because £36 is 80%, so 10% is £4.50.

STUDENTS DO

1. Move to the corner that matches each problem card.
2. Write the multiplier and answer on mini whiteboards and hold them up together.
3. Explain to another corner why the multiplier is over or under 1.

Say: Listen, decide and walk to Increase, Decrease or Find the Original. Then write your multiplier and your answer. You must be able to explain why you chose that corner.

Worked example: Card 3: £36 after 20% off is Find the Original. Multiplier was 0.8, so original = £36 divided by 0.8 = £45. Check: £45 x 0.8 = £36. Card 6: £46 - £40 = £6, then (£6 divided by £40) x 100 = 15% [4].

Ask: Card 4 says £63 is after a 5% rise. Which corner and which multiplier? (Find the Original, x1.05, so £63 divided by 1.05 = £60.) · Card 2 is 25% off £48. What multiplier and new price? (x0.75, £36.)

Check understanding: Hold-up of multipliers and answers each round; if a corner is split, model that card again with a bar before next card.

Support: Give each pupil a card showing increase uses 100% + x% and decrease uses 100% - x% [4].
Stretch: Ask them to write a new problem for the class that could trick people into the wrong corner.

Use: Slides 5, 10-11

35–50 min **Practice** 15 min · Pairs

Apply reversing to find original values and calculate simple interest in pairs.

YOU DO

1. Show Slide 8 and play Video clip 4, asking pupils to watch the bar showing the final percent and see division to find 1% or 100%.
2. Model reversing with £96 after 20% off: £96 is 80% or 0.8, so £96 divided by 0.8 = £120, then check £120 x 0.8 = £96. Note a 25% rise from £100 to £125 needs a 20% fall to return [4].
3. Model simple interest: 5% of £200 is £10 each year, so 3 years gives £30 interest and £230 balance, since per cent means per hundred [4].
4. Set Slide 9 task: Find new price after 15% rise on £60 · Find sale price after 25% off £48 · Find original when £63 is price after 5% rise, then Worksheet Tasks B and C in pairs.

STUDENTS DO

1. Watch the video and copy the two reversing steps: divide, then check forwards.
2. In pairs, solve the three Slide 9 mini-problems, showing multiplier or division.
3. Complete Worksheet Task B to practise increases and decreases using multipliers, then Task C to work backwards to find original values and interest.

Say: To rewind, divide the new amount by its multiplier. To do simple interest, find one year first, then multiply by the years and add it on. Always check by working forwards again.

Worked example: Original: £63 after 5% rise means 105% or 1.05, so £63 divided by 1.05 = £60. Check: £60 x 1.05 = £63. Interest: 10% of £200 = £20, so 5% = £10. For 3 years: £10 x 3 = £30 interest, balance £200 + £30 = £230.

Ask: If £63 is 105%, how do you find 100%? (Divide £63 by 1.05 to get £60.) · How do you get 3-year interest at 5% on £200? (£200 x 0.05 = £10 for one year, £10 x 3 = £30, balance £230.)

Check understanding: Circulate and mark the three Slide 9 answers (£69, £36, £60); pull back if dividing for original is confused with multiplying.

Support: Start with 50% off and 25% off using easy numbers, and use a years number line to keep yearly interest separate from balance. **Stretch:** Add a second discount off the sale price to work out in two steps, and compare two interest offers with different rates and years.

Use: Video clip 4 (0:17–2:49), Slides 8–9, Worksheet Tasks B–C

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50–60 min **Plenary** 10 min · Whole class

Review multipliers, reversing and interest and check what pupils can do now.

YOU DO

1. Revisit Slide 3 objectives and ask pupils to point to Increase, Decrease or Find the Original for two quick problems.
2. Re-show Slide 4 fact and take one-sentence explanations of the £2 difference from pairs.
3. Show Slide 12 exit: One thing I learnt today... · One question I still have... · What is 10% interest on £200 for 2 years? and collect answers.

STUDENTS DO

1. Share one sentence on why up then down does not return to the start.
2. Complete the exit ticket on their own, including the interest calculation.
3. Self-assess thumbs up against the three success criteria.

Say: Tell your partner one tool you will use tomorrow. Then answer the three exit questions on your own. Be exact with multipliers and pounds.

Ask: What multiplier undoes a 20% discount? (Divide by 0.8.) · What is 10% interest on £200 for 2 years? (£20 per year, £40 interest, £240 balance.)

Check understanding: Read exit tickets; if reversing is weak, start next lesson with £36 after 20% off to £45.

Support: Provide sentence starters: The multiplier was... I divided because... **Stretch:** Ask pupils to predict up 20% then down 20% and test with £100.

Use: Slides 3–4, 12

Common mistakes

Mistake	How to spot it	How to fix it
Using the new amount as the base for percentage change	Divides difference by new price, e.g. £6 divided by £46 not £40	Stress difference divided by original times 100 [4]; label old and new before dividing.
Multiplying instead of dividing to find the original	Does £96 x 0.8 to rewind a 20% discount	Show £96 is 80%, so divide by 0.8 and check forwards; recall up then down needs different percentages to return [4].
Adding sequential percentages or mixing interest with balance	Says up 10% then down 10% cancels, or gives £30 as balance not interest	Work in two steps from the new start each time, since changes are measured from different values [4]; record yearly interest, total interest and balance separately.

Support

- Multiplier reminder cards and bars split into 10% steps for finding 10% first
- Writing frames for difference divided by original and for divide-then-check-forwards

Stretch

- Model two increases over 100% and order final amounts, and test 20% up then 20% down
- Compare two savings offers and solve original-value problems with 12% and 18% changes

For the LSE or teaching assistant

Support corner decisions in the main activity, prompt use of reminder cards, and check Task C work backwards to find original values and interest with targeted pairs.

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Safety

- Clear bags and chairs, keep walkways wide, walk to corners and do not run or push

Check for understanding

Question	Answer
Find the sale price after 25% off £48.	x0.75, £36.
Find the original when £63 is the price after a 5% rise.	£63 divided by 1.05 = £60.
What is 10% interest on £200 for 2 years?	£40 interest, £240 balance.

Homework

Find two sale prices and one original price from receipts at home, showing multipliers.

Sources

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