Maths

Your name:

Your tutor's name:

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Welcome to Make your Mark

Welcome to Make your Mark, run by The Brilliant Club. This programme is designed to help you boost your confidence and knowledge in Maths and to help you practice using the most effective study strategies. Your teacher has selected you because you are already doing well at school but believes that with extra support from this tuition you can achieve even more ambitious grades and reach your full potential.

You'll be covering the following topics in Maths: Percentages, Fractions, Ratio and Proportion. In each tutorial, you will learn about a mix of these topics, working in a small tutorial group with a university student as your tutor. This means that the programme also offers you the opportunity to widen your understanding of university.

You'll be in a small group with other pupils and will have 12 hours of tutoring. Some tutorials will be in person at school and some will be delivered virtually.

Making the most of your tutorials

The purpose of your tutorials is for you to learn, recap or revise topics that you will cover in school, and to help you feel more confident about studying independently. Your tutor will get you involved in activities and tasks to help you with this. To make the most of the tutorials, we expect you to:

- Turn on your video and microphone in online tutorials.
- Engage with the activities your tutor sets and answer their questions via the chat functions or by using your microphone.
- Use appropriate language, listen carefully and be respectful of your tutor and others in your group.
- Be organised – log on in time for the start of your tutorial and bring this handbook and any stationary or equipment you might need. If your tutorial is in person, make sure you know where and when it is happening.
- Complete any surveys and assessments that you are asked to do by your school or tutor.

Learning Assessments

You'll complete a short assessment at the start and end of the programme, so that you, your tutor, and your school can see how far you've progressed over the course of your tutorials. The aim of this assessment is to measure your progress on the programme, and it will not be a part of your school grades. It is meant to be challenging and it doesn't matter how you do, so just do your best.

Contact Us

If you ever have any questions or need help from The Brilliant Club, contact us on: makeyourmark@thebrilliantclub.org

Study strategies

As well as learning about Maths curriculum content in Make your Mark, you will be learning about and using study strategies.

What are study strategies?

Study strategies are the skills and activities you undertake to help you successfully complete schoolwork and prepare for tests and exams, both at school and at home. For example, when revising for an exam, you might make flashcards or do a practice test that you mark yourself – these are both examples of study strategies.

Why are study strategies important?

Psychologists have been researching how we learn for many years, which includes finding out which study strategies are the most effective at helping us to understand and remember information.

However, many students at school and university don't use effective study strategies. In fact, many students do just the opposite and use study strategies that have been shown to be *in*effective, such as highlighting textbooks and rereading the same paragraph many times to remember the information in it.

Learning about and practicing effective study strategies in Make your Mark will not only benefit you in Maths, but give you tools to use in your other studies at school and beyond. Studies have shown that students who use more effective study strategies in school and at university have higher grades than students who don't[1].

What study strategies will I learn?

You will learn and use five study strategies in Make your Mark, that have been identified by academic researchers as the most effective strategies to use when studying. Throughout your tutorials you will see these badges[2], each one representing one of the five study strategies that you will learn about. It is important that you take time to understand the study strategies – your tutor will help you with this, and always ask if you are unsure about how to use them. At the end of each tutorial, you will reflect on which strategies you used by completing the tracker in the back of this handbook.

[1] Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the public interest, 14*(1), 4-58.

[2] The study strategies badges have been adapted from The Learning Scientists.

How can the study strategies help me?

1. Planning when to study

Though it might be tempting to cram lots of information just before an exam, this isn't the most effective way of remembering and understanding a topic in the long term. **Spaced practice** means spreading your studying out over time. For example, in the month leading up to an exam, you could revise for half an hour four days a week. This might seem like more effort than cramming but studying little and often will go a long way. **When doing your revision**, make sure you study older and newer information.

Interleaving means switching between ideas when you study and varying the order in which you revise your topics. For example, when revising for your Maths exam, you might study ratios and percentages one day, and ratios and geometry another day. While this might feel more difficult than studying topics in separate blocks, it will help you make connections between topics and is more effective for remembering information.

2. Developing your understanding

Developing your understanding of a new topic means adding details to it and combining it with existing knowledge that you already have. There are a few different ways you can do this:

Use **concrete examples** to understand abstract ideas. For example, you might learn about repeated percentage increases in Maths, but this is quite an abstract concept. Can you think of several different examples of how repeated percentage increases work in the real world to help you remember what it means?

Dual coding means combining words and visuals to aid your learning. Doing this gives you two different ways of remembering information, as we process words and visuals through separate channels in our brains. This doesn't mean drawing the perfect picture – it's more important to ensure the information is being connected across the words and the visuals, for example a mind map or a diagram. You could also take an existing visual and add words too it.

Elaboration means asking yourself questions about how and why things work, and then producing the answers to those questions yourself. This works best when you already have some knowledge about a topic. For example, if you are learning about a method to combine ratios in Maths, ask yourself why this method works and how you might apply it in different kinds of questions.

3. Reinforcing knowledge

Once you have remembered some information about a topic, you should practice bringing it to mind through **retrieval practice**. Any activity that involves remembering information is a retrieval-based activity – retrieval means to bring something back. There are lots of different ways to do this – you could do a brain dump and write down everything you can remember about a topic, you could make flashcards and test yourself with those, or you could do a practice test provided by your teacher or with questions you write

yourself. Don't look at your notes while you are bringing information to mind – check what you've written down afterwards for accuracy, and then go back and review the topics you struggled to understand.

Top tips for preparing for exams at school and at university

- Plan in advance how you are going to spread out your studying (spaced practice). Set aside a bit of time every day for studying and it will become an automatic habit.
- Review information from each class, but not immediately after class (retrieval practice). It's better to spread out the content you are revising so that you don't forget about older topics (interleaving).
- Make connections between ideas: ask yourself how they are similar and how they are different (elaboration). This means not just rereading and highlight information. Research shows that this won't help you to remember the information in the long run and won't help you make connections between ideas.
- When revising a new topic, it's fine to refer to your class materials more often. Work your way to drawing what you know from memory.
- There is a lot of overlap between the study strategies, and they are designed to be used together.
- Get plenty of sleep, adequate nutrition, and don't consume loads of caffeine to stay awake.

Topics: Percentages, Fractions, Ratio and Proportion

In your tutorials, you will be shown how percentages and fractions are connected and how one mathematical method can be used to solve many different types of questions involving fractions and percentages of amounts, percentage increase and decrease, percentage change and algebraic fractions. You will also learn about ratios and proportions and how to solve applied ratio problems.

Learning about these topics in Maths is important for your classroom studies and for your everyday life. For example, understanding percentages and fractions helps us to compare prices when shopping and to understand interest on bank accounts. Understanding ratios and proportions is relevant for solving problems in physics related to speed and mass.

Learning objectives: Percentages and Fractions

- Finding one percentage of an amount, if you are given another
- Finding fractions of amounts
- Finding the amount if we know the fraction value
- Calculating percentage increases and decreases
- Investigating repeated percentage change questions
- Adding and subtracting fractions
- Finding percentage profit/change
- Applying the ratio method to solving a range of different problems involving fractions

Learning objectives: Ratio and Proportions

- Representing ratios in different ways
- Writing equivalent ratios, simplifying ratios and writing ratios as fractions and percentages
- Sharing ratios and using this to solve a variety of ratio problems
- Comparing ratios of differing values and solving ratio problems
- Writing ratios in the form of 1:n or n:1
- Direct proportion and how it connects to straight line graphs
- Using the ratio table method to solve compound measure problems

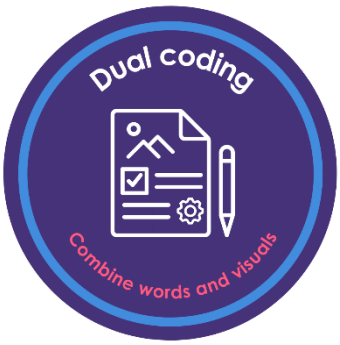
Key Words

Word	Definition
Annual	Yearly
Appreciates	Increases in value
Denominator	Value on the bottom of a fraction, for example 8 for $\frac{3}{8}$
Depreciates	Decreases in value
Difference	In Maths, finding the difference means subtracting the smallest number from the largest.
Improper fraction	A fraction where the numerator is larger than the denominator
Interest	Money that is paid regularly at a particular percentage, usually when money has been lent or borrowed. For example, a bank will give its customers interest to reward them for saving money with them, but it will also charge interest to anyone who has borrowed money from them.
Mixed number	A number that is made up of a whole number along with a fraction, for example $5\frac{3}{8}$
Numerator	Value of the top of a fraction, for example 3 for $\frac{3}{8}$
Per cent	Out of 100
Proportional	Two values are connected or related by a single mathematical value, for instance one number maybe double the other number
Ratio	A ratio shows how much of one thing there is compared to another, usually written in the form a:b ("a to b").
Simple interest	A quick way of calculating interest. Simple interest is worked out by calculating the percentage amount and multiplying it by the number of periods that the money will be invested for.

Study Strategies in our tutorials

Retrieval practice is where we recover information from our memories on topics we have learnt before without being re-taught them. By doing this regularly on all topics covered, we are able to retrieve the information quickly when needed

Elaboration is where we expand on an idea or concept to explain why we chose to do what we did, why what we chose worked (or didn't). Elaboration can involve explanations, highlighting decisions made, suggesting where we go next. This is helpful for us to remember both what and why for how we use an idea or concept.



Dual coding refers to using a range of ways to understand an idea or concept – numbers, words, images. By using different methods of representing an idea or concept, we are more likely to understand and remember the key points

Concrete examples of an idea or concept, help us see the idea or concept in a real-world setting. This helps us remember not just the idea or concept but how to apply it. This is useful when trying to remember something in any subject.

Interleaving means moving regularly between topics – mixing it up. This is useful for keeping multiple ideas and concepts fresh in our minds and means that no topic is left for too long without working on it

Tutorial 1 – Getting Started

In this tutorial you will look at:

- Preparing for Make your Mark
- Learning Assessment 1

Think about your Maths studies. What is:

1. The thing you're most confident about?

2. The thing you're least confident about?

3. Your favourite part of the subject?

Tutorial 2 – Fractions and Percentages of amounts

In this tutorial we will use:

The subject content we will look at:

- Finding percentages of amounts using number lines and tables
- Writing one number as a percentage of another
- Finding one percentage of an amount if given another

Task 1: Reflection Activity

Question 1: David notices that in the US, the service charge in restaurants is usually 20% of the price of the bill. In the UK it is usually 10%. A pizza in a chain restaurant in the US costs $13 and in the UK it costs the equivalent of $8. When service charge is taken into account, where is it cheaper to eat one pizza?

Question 2: A bag contains only red and blue sweets. They are shared in the ratio 3:7. There are 70 sweets in total. A different bag also contains only red and blue sweets. These sweets are shared in the ratio of 4:5. There are 45 sweets. Which bag contains more red sweets?

Question 3: Packs of toilet roll are on sale at the local supermarket. Packs of 9 rolls cost £4.23. Packs of 4 rolls cost £1.96. Which offers better value for money?

Question 4: The exchange rate from GBP to USD is £1:$1.30. I have $585 to convert back into pounds. How many pounds can I expect to get?

Task 2: Finding percentages of amounts – Your turn

Complete the table:

	200	570	44
10%			
1%			
5%			
6%			
111%			

Tip: Can you spot efficient ways of finding the values? What strategies did you use to find the answers?

Task 3: Practice makes permanent

1. Express each of the following as percentages.

(a) 6 out of 40 (b) 12 out of 80 (c) 9 out of 30 (d) 260 out of 400 (e) 51 out of 60

2. In a class of 25 children there are 10 girls. What percentage of the class are girls and what percentage are boys?
3. The price of a bar of chocolate is 25p and includes 5p profit. Express the profit as a percentage of the price.
4. The value of a house is £40 000 and the value of the contents is £3 200. Express the contents value as a percentage of the house value.
5. In the crowd at a football match there were 28 000 Manchester United supporters and 22 000 Tottenham supporters. What percentage of the crowd supported each team?

Task 4: Practice makes permanent

By using a double number line or other method, find:

100% = £44 ___% = £11	4% = £24 7% = £___	25% = £75 33% = £___
40% = £80 ___% = £18	2% = £2.50 3% = £___	100% = £24 250% = £___
1% = £6 0.5% = £___	___%= £8 2.5% = £2	13% = £52 ___% = £26
10% = £60 15% = £___	7% = £42 8% = £___	88% = £22 12% = £___

Tutorial 3 – Repeated percentage increases

In this tutorial we will use:

The subject content we will look at:

- Finding fractions of amounts
- How to find percentage increases and decreases using the ratio tables method

Task 1: Retrieval Practice

Eric has answered this question correctly.

Q: Convert 27/60 to a percentage.

A:

$$\frac{27}{60} = \frac{9}{20} = \frac{45}{100} \rightarrow 45\%$$

1: What is meant by the word 'percentage'?

2: Using Eric's answer, write 27/60 as a decimal.

Your turn

Q: Convert 28/80 to a percentage.

A:

3: Complete the sentence describing Eric's method.

Eric converted the fraction to a percentage by…

Calculate the following, giving your answers as percentages.		
a) 14 out of 20	b) 14 out of 35	c) 12 out of 75
d) 2 red, 6 blue. ___% red?	e) 6 red, 10 blue. ___% red?	f) 38 red, 42 blue. ___% blue?
m) $\frac{2}{5}+\frac{1}{10}$	n) $\frac{4}{5}-\frac{3}{20}$	o) $\frac{1}{4}+\frac{1}{5}$
p) $\frac{9}{20}-\frac{3}{10}$	q) $\frac{13}{20}+\frac{1}{10}$	r) $\frac{3}{4}-\frac{17}{25}$
s) $\frac{6}{25}+\frac{1}{4}$	t) $\frac{3}{20}-\frac{3}{25}$	u) $\frac{3}{50}+\frac{3}{4}$

Task 2: Practice makes permanent

1) $\frac{1}{6}$ is 7
what is $\frac{1}{7}$?

2) $\frac{1}{4}$ is 7
what is $\frac{2}{7}$?

3) $\frac{2}{5}$ is 6
what is $\frac{1}{3}$?

4) $\frac{3}{8}$ is 9
what is $\frac{1}{3}$?

5) $\frac{3}{4}$ is 15
what is $\frac{4}{5}$?

6) $\frac{2}{3}$ is 14
what is $\frac{5}{7}$?

7) $\frac{5}{7}$ is 20
what is $\frac{3}{4}$?

8) $\frac{3}{8}$ is 15
what is $\frac{1}{2}$?

9) $\frac{2}{3}$ is 18
what is $\frac{2}{9}$?

10) $\frac{5}{9}$ is 10
what is $\frac{1}{3}$?

Task 3: Practice makes permanent

Complete the tables.

Fill in the gaps			
%	Find	Increase by	Decrease by
42%	× 0.42	× 1.42	× 0.58
37%			
8%			
108%			
218%			
21.8%			

Fill in the gaps			
%	Find	Increase by	Decrease by
		× 1.5	
			× 0.15
	× 0.105		
		× 1.05	
			× 0.995
		× 2.05	

Tutorial 4 – Algebraic fractions and reverse percentages

In this tutorial we will use:

The subject content we will look at:

- Adding and subtracting fractions with uncommon denominators and mixed numbers
- Adding and subtracting algebraic fractions
- Solving reverse percentages

Task 1: Retrieval Practice

Remember in our previous lessons we used the 'ratio table' method to answer questions about percentages. We can also use the 'ratio table' method when working with fractions.

See if you can answer these questions using a table.

1. Write 48 out of 54 as a fraction in its simplest form
2. Find an equivalent fraction to $\frac{4}{7}$ that has a denominator greater than 100, but as close to it as you can.
3. Find $\frac{3}{8}$ of 112
4. Solve $\frac{1}{3} + \frac{3}{4}$

Task 2: Thinking time

Q1.

Mr Kay is drawing a pie chart to represent people's favourite colours. $\frac{3}{5}$ of the people he asked said blue was their favourite colour. What angle would the segment of pie chart have?

Q2.

Mr Kay is drawing a pie chart to represent people's favourite colours. $\frac{3}{5}$ of the people he asked said blue was their favourite colour. What percentage of the people did not choose blue as their favourite colour?

Q3.

A number is increased by 60% to 3620. What was the original number?

Q4.

$\frac{3}{5}$ of a number is 60. What is the number?

Task 3: Practice makes permanent

1. $\frac{3x}{2} + \frac{4x}{5}$
2. $1\frac{1}{2} + 1\frac{1}{3}$
3. $2\frac{1}{2} + 2\frac{1}{3}$
4. $\frac{x}{2} + \frac{x}{5}$
5. $1\frac{x}{2} + 1\frac{2x}{2}$
6. $\frac{5x}{5} - \frac{x}{2}$
7. $2\frac{1}{2} - 1\frac{1}{3}$
8. $3\frac{1}{5} - 2\frac{1}{2}$
9. $\frac{5}{x^2} + \frac{2}{x}$
10. $2\frac{2x}{2} - 1\frac{x}{2}$

Task 4: Practice makes permanent

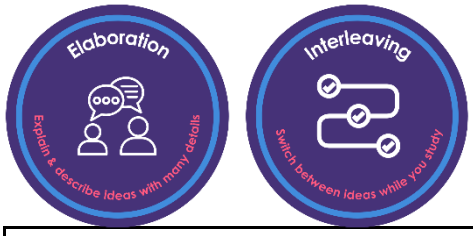
Q1. At a shop there is a 25% off sale. I buy a coat that was originally priced at £48. How much does the coat cost now in the sale?	Q2. I buy 990g of carrots, which is 10% more than last week. How much did I buy then?
Q3. There are 42 sweets in Bag A which is 30% less sweets than in Bag B. How many sweets are in Bag B?	Q4. My food bill is £65 but I have a coupon for 40% off. How much is my bill now?

Tutorial 5 – Percentage profits and solving problems involving fractions

In this tutorial we will use:

The subject content we will look at:

- Solving percentage profit problems, continuing to use our ratio table method
- Applying the ratio method to solving a range of different problems involving fractions



Task 1: Thinking time

Q1. A company announces a 2.41% pay rise. Arthur is currently paid £23.74 per hour. What is his new salary?	Q2. A company announces a 2.41% pay rise. Merlin's new salary is £23.74 per hour. What was his salary before the increase?
Q3. A company announces a 2.41% pay rise. Lancelot's salary has increased by £23.74. How much was he paid before?	Q4. A company announces a 2.41% pay rise. Percival was paid £23.74 per hour. His new salary is £25 per hour. Did he get the same pay rise as everyone else?

Task 2: Practice makes permanent

1. A baby weighed 4.8 kg and six weeks later her weight had increased to 6.0 kg. Find the percentage increase.
2. A new car cost £11 500 and one year later it was sold for £8625. Find the percentage reduction in the value of the car.
3. An investor bought some shares at a price of £7.36 each. The price of the shares dropped to £5.52. Find the percentage loss.
4. After a special offer the price of baked beans was increased from 15p per tin to 21p per tin. Find the percentage increase in the price.

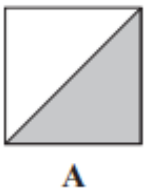
Task 3: Practice makes permanent

1. The height of Zak is 1.86 metres. The height of Fred is 1.60 metres. Write the height of Zak as a fraction of the height of Fred. Give your answer in its simplest form
2. The range of a set of numbers is $15\frac{1}{4}$. The smallest number is $-2\frac{7}{8}$. Work out the largest number.
3. Ahmed has some pies. On Monday he eats $\frac{1}{2}$ of the pies. On Tuesday he eats $\frac{1}{3}$ of the remaining pies. On Wednesday he eats $\frac{1}{4}$ of what's left and then finally gives a $\frac{1}{5}$ of the pies remaining to his friend Will. Will gets 15 pies. How many pies did Ahmed have to start with?
4. Express as a single fraction

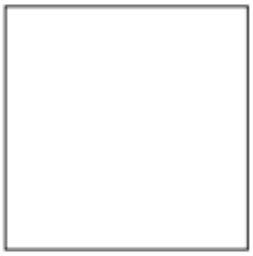
$$\frac{2x+3}{x}+\frac{x-1}{2x}$$

Task 4: Challenge

Here are two squares, **A** and **B.**



A



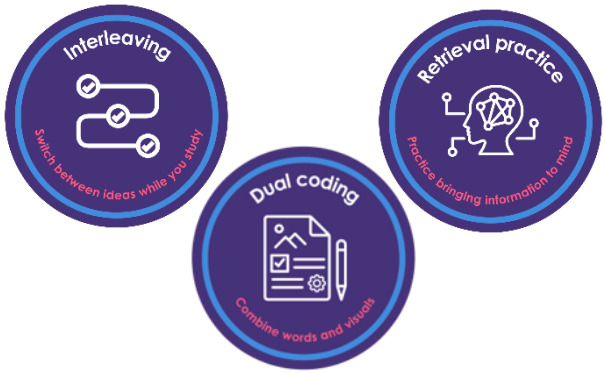
B

The length of the side of square **A** is 50% the length of the side of square **B.**

Express the area of the shaded region of square **A** as a percentage of the area of square **B**.

Tutorial 6 – Interpreting and comparing ratios

In this tutorial we will use:



The subject content we will look at:

- How to represent ratios in different ways
- How to write equivalent ratios, simplify ratios and write ratios as fractions and percentages

Task 1: Retrieval Practice (with calculator)

A kitten weighs 120 grams when born. The kitten's weight increases by 11% every day for the first week. Joe says the kitten will more than double in weight during the first week. Is Joe correct? Justify your answer	A car is purchased for £11,500. In its first year, the value of the car decreased by 15%. Each year after that, it decreased by 10%. What is the value at the	An antique vase bought for £500 lost 5.5% of its value each year. In how many years' time was it worth less than £400?	
A number is increased by 20%. This results in the number being increased by 15. What was the original number?	What is 10% of 20% of 30% of £40?	There is 1 litre of tea in a teapot. Alex pours 275ml of the tea into a cup. What percentage of the tea has Alex poured	Becca and Tia both invest £5000 into savings accounts. Becca's account earns 4.5% simple interest per annum. Tia's account earns 4% compound interest per annum. Which account will
What is the percentage profit for a CD player bought for $50 and sold for $75?	Which is bigger? 23% of £48 48% of £23	In a year Josh spent 30% of his salary on rent, 2/5 of his salary on food, ¼ of his salary on bills He saved the rest of his salary. Josh spent £3600 on bills. Work out how much	
$\frac{2}{5x} - \frac{1}{x}$	$\frac{x+1}{4} - \frac{x}{12}$	$\frac{5}{8}$ is 35 What is $\frac{9}{14}$?	$\frac{3}{8}$ is 27 What is $\frac{7}{18}$?

Task 2: Practice makes permanent

Amanda has 8 pens and 12 pencils in her bag.

a) Represent this pictorially.

b) What is the ratio of pencils to pens?

c) What is the simplified ratio of pens to pencils?

d) What is the simplified ratio of pencils to pens?

e) What fraction are pens?

f) What fraction are pencils?

g) What is the percentage of pencils in the bag?

Task 3: Your Turn

1. Prove that for the ratio 3:4, $\frac{3}{7} \div \frac{4}{7} = \frac{3}{4}$
2. Given c:d = 3:4. Write an equation linking c and d and then rearrange this equation, so c is in terms of d.
3. The ratio of red to green sweets in a bag is 9:2. If r is the number of red sweet and g is the number of green sweets, work out a formula for r in terms of g.

Task 4: Practice makes permanent

1. 3a = b, find the ratio of a:b
2. 4x = 5y, find the ratio of x:y
3. 6x+4y = 7y – x, find the ratio x:y
4. Given that $\frac{a}{b} = \frac{2}{3}$ and $\frac{b}{c} = \frac{4}{5}$, find a:b:c

Tutorial 7 – Solving ratio problems

In this tutorial we will use:

The subject content we will look at:

- How to share ratios in a variety of contexts
- Solving ratio problems

Task 1: Retrieval Practice (with calculator)

A kitten weighs 120 grams when born. The kitten's weight increases by 11% every day for the first week. Joe says the kitten will more than double in weight during the first week. Is Joe correct? Justify your answer

A car is purchased for £11,500. In its first year, the value of the car decreased by 15%. Each year after that, it decreased by 10%. What is the value at the

An antique vase bought for £500 lost 5.5% of its value each year. In how many years' time was it worth less than £400?

A number is increased by 20%. This results in the number being increased by 15. What was the original number?

What is 10% of 20% of 30% of £40?

There is 1 litre of tea in a teapot. Alex pours 275ml of the tea into a cup. What percentage of the tea has Alex poured?

Becca and Tia both invest £5000 into savings accounts. Becca's account earns 4.5% simple interest per annum. Tia's account earns 4% compound interest per annum. Which account will

What is the percentage profit for a CD player bought for $50 and sold for $75?

Which is bigger?

23% of £48
48% of £23

In a year Josh spent 30% of his salary on rent, 2/5 of his salary on food, ¼ of his salary on bills
He saved the rest of his salary.
Josh spent £3600 on bills.
Work out how much money he saved.

$\frac{2}{5x} - \frac{1}{x}$

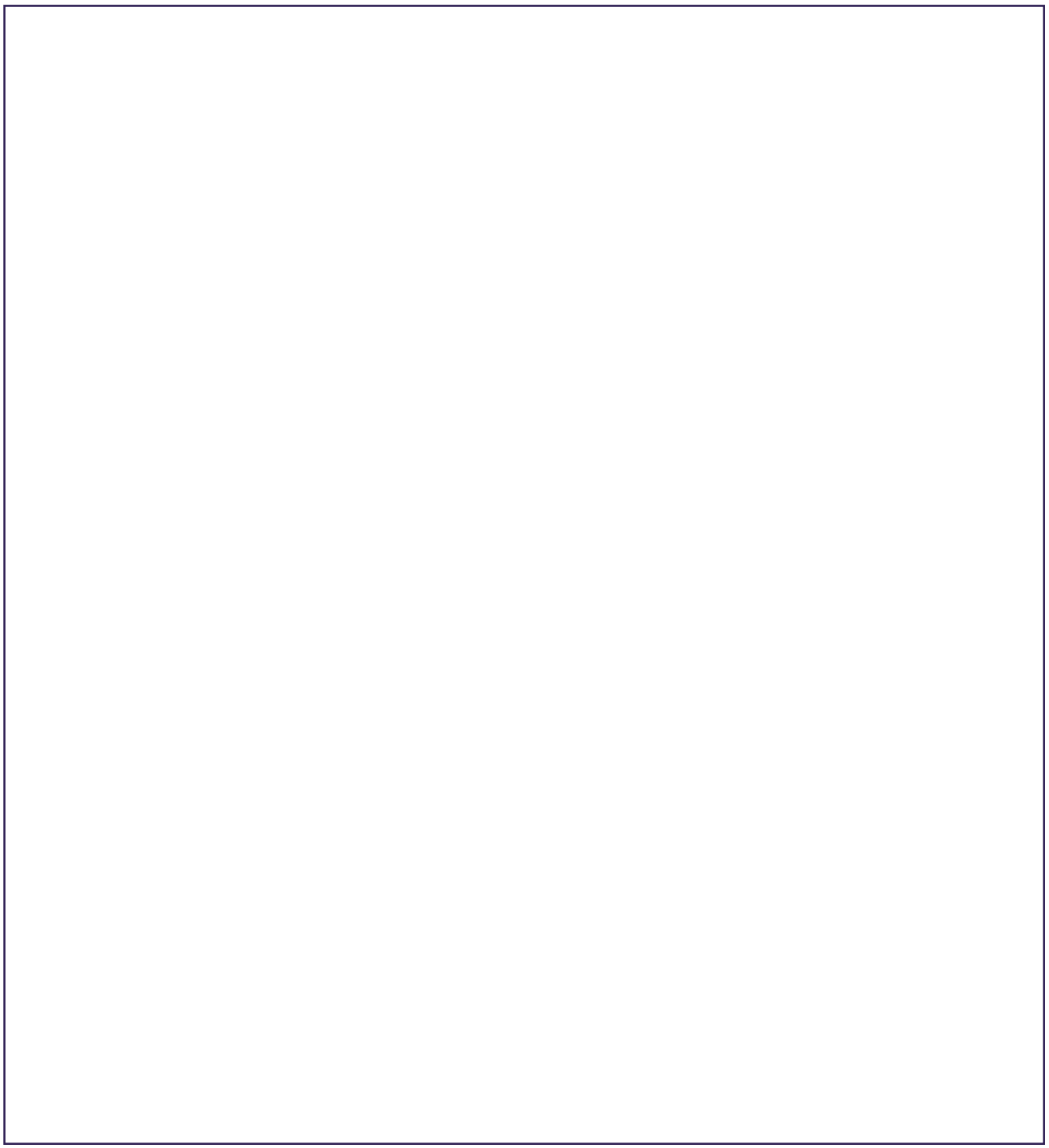
$\frac{x+1}{4} - \frac{x}{12}$

$\frac{5}{8}$ is 35

What is $\frac{9}{14}$?

$\frac{3}{8}$ is 27

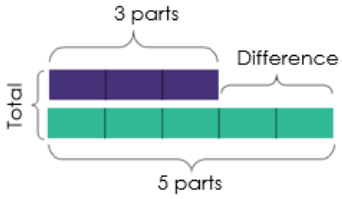
What is $\frac{7}{18}$?



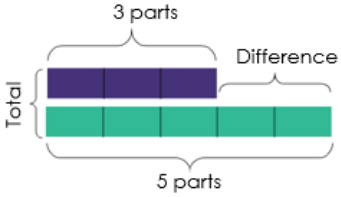
Task 2: Practice makes permanent

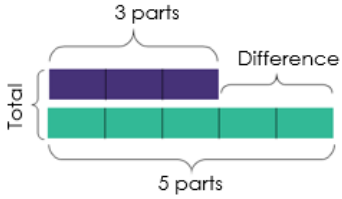
Anne and Bob share some money in the ratio 3:5

If the total shared was £120, what else can you work out?

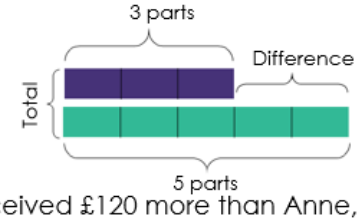


If Anne received £120, what else can you work out?





If Bob received £120, what else can you work out?



If Bob received £120 more than Anne, what else can you more out?

Task 3: Solving ratio problems

Q1. £360 is shared between Abby, Ben, Chloe and Denesh.

The ratio of the amount Abby gets to the amount Ben gets is 2:7.

Chloe and Denesh each get 1. 5 times the amount Abby gets. Work out the amount of money that Ben gets.

Q2. A delivery company has a total of 160 cars and vans.

the number of cars : the number of vans = 3:7

Each car and each van runs on electricity or diesel or petrol.

$\frac{1}{8}$ of the cars use electricity. 25% of the cars use diesel. The rest of the cars use petrol.

Work out the number of cars that use petrol. You must show all your working.

Task 4: Practice makes permanent

Q1. A shop sells packs of black pens, packs of red pens and packs of green pens.

There are

2 pens in each pack of black pens

5 pens in each pack of red pens

6 pens in each pack of green pens

On Monday,

number of packs of black pens sold : number of packs of red pens sold : number of packs of green pens sold = 7 : 3 : 4

A total of 212 pens were sold.

Work out the number of green pens sold.

Q2. Costcorp sells packets of mints to shop owners. On Monday, three shop owners buy mints from Costcorp. Each shop owner buys small packets, medium packets and large packets of mints.

Alan buys 400 packets of mints. 32% are small packets, 40% are large packets.

Beryl buys 500 packets of mints. $\frac{3}{10}$ are small packets, $\frac{1}{10}$ are large packets.

Charlie buys 150 small packets of mints so that

number of small packets : number of medium packets = 3:4

Work out the total number of medium packets of mints these shop owners buy.

You must show all your working.

Q3. Natalie makes potato cakes in a restaurant. She mixes potato, cheese and onion so that

weight of potato : weight of cheese : weight of onion = 9:2:1

Natalie needs to make 6000g of potato cakes. Cheese costs £2.25 for 175g.

Work out the cost of the cheese needed to make 6000g of potato cakes.

Q4. Rosie, Matilda and Ibrahim collect stickers.

number of stickers Rosie has : number of stickers Matilda has : number of stickers Ibrahim has = 4 : 7 : 15

Ibrahim has 24 more stickers than Matilda. Ibrahim has more stickers than Rosie.

How many more?

Task 5: Challenge

A bag of wine gums has three times as many red sweets as black sweets.

25% of the reds are dented.

50% of the blacks are dented.

20 of the sweets in the bag are dented.

How many sweets are in the bag?

Tutorial 8 – Understanding direct proportion

In this tutorial we will use:

The subject content we will look at:

- How to write a ratio in the form 1:n or n:1
- Using ratios in the form 1:n and n:1 to solve proportional questions

Task 1: Retrieval Practice (with calculator)

A kitten weighs 120 grams when born. The kitten's weight increases by 11% every day for the first week. Joe says the kitten will more than double in weight during the first week. Is Joe correct? Justify your answer.

A car is purchased for £11,500. In its first year, the value of the car decreased by 15%. Each year after that, it decreased by 10%. What is the value at the end of the third year?

An antique vase bought for £500 lost 5.5% of its value each year. In how many years' time was it worth less than £400?

A number is increased by 20%. This results in the number being increased by 15. What was the

What is 10% of 20% of 30% of £40?

There is 1 litre of tea in a teapot. Alex pours 275ml of the tea into a cup. What percentage of the tea has Alex

Becca and Tia both invest £5000 into savings accounts. Becca's account earns 4.5% simple interest per annum. Tia's account earns 4% compound interest per annum.

What is the percentage profit for a CD player bought for $50 and sold

Which is bigger?

23% of £48

48% of £23

In a year Josh spent 30% of his salary on rent, 2/5 of his salary on food, ¼ of his salary on bills
He saved the rest of his salary.
Josh spent £3600 on

$\frac{2}{5x} - \frac{1}{x}$

$\frac{x+1}{4} - \frac{x}{12}$

$\frac{5}{8}$ is 35

What is $\frac{9}{14}$?

$\frac{3}{8}$ is 27

What is $\frac{7}{18}$?

Task 2: Practice makes permanent

Write each of these ratios in the form 1:n.

a) 2:12	b) 5:15	c) 10:35
d) 5:2	e) 12:9	f) 20:33
g) 2.5cm:450cm	h) 30p:£1.30	i) 20min:1.4hours

Write each of these ratios in the form n:1.

a) 6:2	b) 15:5	c) 50:10
d) 36:10	e) 17:5	f) 3:10
g) 13:20	h) £4.50:75p	i) 6.4km:2000m

Task 3: Practice makes permanent

Q1. Here is a list of ingredients for making 32 flapjacks:

240g butter

280g brown sugar

500g oats

4 tbsp syrup

Amelia wants to make 20 flapjacks. How much brown sugar should she use?

Task 4: Practice makes permanent

Q1. Beth goes on Holiday to Spain.

The exchange rate is £1 = €1.13

She changes £350 into Euros(€)

How many Euros does she receive?

Q2. Nicole is on Holiday in France.

She spends €14.50 in a café.

The exchange rate is £1 = €1.15.

Calculate how much Nicole spends in pounds (£).

Q3. Frank is travelling from the USA to Germany. Frank wants to book flights which cost $710 and a hotel which costs €45 per night for 12 nights. The exchange rates are:

£1 = €1.14 and $1 =€0.85

Frank can spend no more than £1000. Work out if he is able to book the flight and the hotel.

Q4. George is going on a trip to Vietnam.

He wants to change £750 into Vietnamese dong. George wants to get as many 200,000 dong notes as possible.

The exchange rate is £1 = 29,000 dong.

Work out the greatest number of 200,000 notes that George can get for £750.

Task 5: Thinking time

Q1. I bought 15 boxes of strawberries to make jam. One box of strawberries weighs half a kilo. How many kilos of strawberries did I buy?	Q2. I bought 15 boxes of strawberries to make jam. About 20 per cent of them were bad. What fraction did I have to throw away, in its simplest form?
Q3. I bought 15 boxes of strawberries to make jam. I got 3.5 litres of jam out of the 15 boxes. I have jars that fit 0.6 litres each. How many jars do I need?	Q4. I bought 15 boxes of strawberries to make jam. I got 3.5 litres of jam out of the strawberries. I mix one part of the jam with 4 parts of sugar to make a syrup. How many litres of syrup have I made?

Tutorial 9 – Connecting direct proportion and graphs

In this tutorial we will use:

The subject content we will look at:

- Direct proportion word and algebra problems
- Drawing connections between direct proportion and straight line graphs

Task 1: Retrieval Practice

1. x% of 150 is 63. What is x?
2. What is 40% of 75%?
3. What is half of six-eighths as a percentage?
4. What is 0.985% expressed as a decimal?
5. John scores 42 out of 70 on his test. Peter scored 85 out of 170 on a different test. Who scored the higher percentage?

Task 2: Practice makes permanent (with calculator)

Q1. A is directly proportional to B.

When A = 12, B = 3

(a) Find a formula for A in terms of B

(b) Find the value of A when B=5

(c) Find the value of B when A=36

Q2. A is directly proportional to B^2.

When A = 98, B = 7

(a) Find a formula for A in terms of B

(b) Find the value of A when B=3

(c) Find the value of B when A=72

Q3. A is directly proportional to the square of B.

When A = 6.4, B = 4

(a) Find a formula for A in terms of B

(b) Find the value of A when B=8

(c) Find the value of B when A =78.4

Q4. Y is directly proportional to X.

Complete the table.

X	4	9	12
Y			72

Q5. Y is directly proportional to X. Complete the table

X	2.5	8	
Y	4		50

Q6. The table shows a set of values for X and Y. Y is directly proportional to the square root of X. Complete the table.

Y	X	$\sqrt{x}$
9	25	
36		
y	=	

Q7. The cost, c pounds, of hiring a car is directly proportional to the number of days, d, it is hired. When d= 5, c = 180

(a) Find the value of C, when d=3

(b) Find the value of d when C = 252

Q8. In a spring, the tension (T newtons) is directly proportional to the extension of the spring (y cm). When the tension is 180 newtons, the extension is 4cm.

(a) Find a formula for T in terms of Y.

(b) Work out the tension when the extension is 3cm

(c) Work out the extension, when the tension is 585 newtons.

Q9.

An object when dropped, falls d metres in t seconds. d is directly proportional to the square of t. The object falls 80 metres in 4 seconds. Work out how far the object falls in 9 seconds.

Task 3: Thinking time (with calculator)

Q1. Adam and Matt share some money in the ratio 4 : 9. Adam gets £468.

Which of these is the total money shared?

£144	£1053	£1521	£676

Q2. A bag has 120 counters that are red, white or blue. A third are red.

White : Blue = 1 : 4

How many are white?

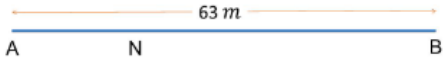
8	20	16	64

Q3. x : y = 3 : 1

Which of these is the equation of y as a function of x?

$y = \frac{x}{4}$	$y = \frac{x}{3}$	y = 3x	y = 4x

Q4. In the diagram, AN : NB 2:7



What is the distance AN?

31.5m	49m	18m	14m

Q5. James and Cameron are watching a film. They pause it with one seventh left to watch.

What is the ratio of how much they have watched to how much they have yet to see?

1:7	7:1	6:1	1:6

Q6. $\frac{1}{2}$ of the counters in a bag are blue. $\frac{3}{10}$ of the counters are red. $\frac{1}{5}$ of the counters are purple. Which of these shows the ratio of blue : red : purple?

5:3:2	1:3:1	2:10:5	1:4:5

Tutorial 10 – Compound measure problems

In this tutorial we will use:

The subject content we will look at:

- Using the ratio table method to solve compound measure problems, such as speed, distance, time; pressure, force, area; density, mass, and volume

Task 1: Retrieval Practice (with calculator)

Look at the table below:

d	4	5	7
t	14	17.5	24.5

Find the relationship between d and t.

Look at the table below:

x	2	4	48
y	12	6	0.5

Find the relationship between x and y.

y is directly proportional to $\sqrt{x}$.
When x=16, y=20.
Find a formula connecting x and y.

P is directly proportional to Q.
When P=22, Q=4.
Find Q when P=77.

Frank buys five tickets for a concert, costing a total of £270. Frank needs two more tickets. How much in total will they cost him?

A recipe for blueberry muffins requires 240g of blueberries for 12 muffins. How many blueberries would I need to make 40 muffins?

Two identical printers take 3 hours to print a book.
How long would it take three printers to print the book?

If C = 8d, calculate the value of d when C = 60.

Solve $\frac{20}{x}=4$

Four chocolate bars cost £3.16. How much does one chocolate bar cost?

Calculate $6\sqrt{a}=30$

Task 2: Practice makes permanent (with calculator)

I travel at a constant speed of 24mph. Find…

A. How long does it take to travel 48 miles?	**B.** How far do you travel in 30 minutes?	**C.** How long does it take to travel 6 miles?
D. How far do you travel in 20 minutes?	**E.** How long does it take to travel 4 miles?	**F.** How far do you travel in 40 minutes?
G. How long does it take to travel 30 miles?	**H.** How far do you travel in 50 minutes?	**I.** How long does it take to travel 52 miles?

Task 3: Challenge (with calculator)

Q1. A box exerts a force of 42 newtons on a floor. The pressure on the floor is 28 newtons/m^2. Calculate the area of the box that is in contact with the floor.	**Q2.** Iris is driving to France for his holiday. He will drive a total distance of 630 miles. Iris sets off at 09:15. It takes him 2.5 hours to travel the first 175 miles. Use this information to estimate the time Iris will arrive.
Q3. Arun drove 42 km from Barcombe to Westray. He then drove 180 km from Westray to Gramsby. Arun's average speed from Barcombe to Westray was 70 km/h. Arun took 144 minutes to drive from Westray to Gramsby. Work out Arun's average speed for his total drive from Barcombe to Gramsby.	**Q4.** Liquid A has a density of 1.2 g/cm^3. Liquid B has a density of 1.5 g/cm^3. 168 g of liquid A and 120 g of liquid B are mixed to make liquid C. Work out the density of liquid C.

Task 4: Spot the mistake

Clive is tackling his compound measures homework and knows that he's made mistakes somewhere.

Can you spot and correct the mistakes Clive has made?

Can you explain what mistakes Clive has made, and maybe give him some tips so that he (hopefully) doesn't make them again?

<table>
<tr><td colspan="2">Question 1:

A car travelled at 60kph for 30 minutes. How far did the car go in total?</td></tr>
<tr><td>Clive's answer:

60kph for 30 minutes

Answer:

60×0.3=18km</td><td>Your answer:</td></tr>
<tr><td colspan="2">What mistake has Clive made?</td></tr>
<tr><td colspan="2">Question 2:

I split a long journey into two parts. The first part lasted 5 hours and I averaged 40kph. The second part lasted 3 hours and I averaged 50kph. What was my average speed over the whole journey?</td></tr>
<tr><td>Clive's answer:

First part: 40kph, second part: 50kph

To calculate the average: add up and divide by how many there are

Answer: 45kph</td><td>Your answer:</td></tr>
<tr><td colspan="2">What mistake has Clive made?</td></tr>
</table>

Tutorial 11 – Practice of all topics covered

In this tutorial you will look at:

- Recap all the skills learnt
- Identify how the study strategies can be used in other subjects

Start

Jack, Kate and Lila share some money in the ratio 5:9:6. In total, Jack and Kate receive £56. Work out the amount of money Lila receives.

Three-quarters of the junior members of a golf club are boys and the rest are girls. What is the ratio of boys to girls among these members?

What is S + U + M if S is 25% of 60, 60 is 80% of U, and 80 is m% of 25?

Given that 3b=7a, work out the ratio a:b.

The time, T seconds, it takes a water heater to boil some water is directly proportional to mass of water, m kg, in the water heater. When m = 250, T = 600, find T when m = 400.

A silver chain has a volume of 5 cm³. The density of silver is 10.5 grams per cm³. Work out the mass of the silver chain.

Cheryl's savings increase by 40% for 3 years until she has £65,856. How much did she start with?

This is a list of ingredients for making some fruit cocktail for 4 people:
50 ml orange juice
70 g kiwi puree
How much Orange Juice is needed for 18 people?

There are 20 students in a class. 12 of the students are girls. Find the ratio of the number of girls to the number of boys. Give your ratio in the form n:1.

On weekdays it costs £6.50 per hour to hire a tennis court. On Saturdays the cost is 30% more. How much does it cost to hire for 2 hours on a Saturday?

Dave bought a phone in Canada. The cost of the phone was £280. The exchange rate is £1 = $1.41. Work out the cost of the phone in dollars.

Joseph's flock has 55% sheep compared to goats. What is the ratio of goats to sheep in the flock? Give your answer in its simplest form.

Purple paint is made from using red paint and blue paint in the ratio 1:2. Write an equation for y in terms of x to show the relationship between the amount of red paint (y) and the amount of blue paint (x).

Milk is sold in three different sizes of bottle. A 2-pint bottle of milk costs £0.62.
A 4-pint bottle of milk costs £1.60. A 9-pint bottle of milk costs £3.15. Which bottle of milk is the best value for money?

Dave hired a car in the United States. The cost of hiring the car was $685. The exchange rate is £1 = $1.37. Work out the cost of hiring the car in pounds.

Colin, Dave, and Emma share money. Colin gets $\frac{3}{10}$ of the money. Emma and Dave share the rest of the money in the ratio 3:2. What is Dave's share of the money?

Alexandra buys a new car for £14,150. The value of this car will depreciate by 1.25% each year. Work out how much Alexandra's car will be worth in 14 years.

In a box of pens, there are three times as many red pens as green pens and two times as many green pens as blue pens. For the pens in the box, write down the ratio of the number of red pens to the number of green pens to the number of blue pens.

Naomi is given a 10% pay decrease. Her new wage is £252 per week. What would be her weekly wage if she had a 10% pay increase instead?

Anya flew from Kuala Lumpur to Singapore. The average speed for the journey was 248 km/h. The journey time was 1 hour 15 mins. Work out the distance from Kuala Lumpur to Singapore.

The price of a computer increases from £323 to £358.53. Determine the percentage change.

Helen's savings increased from £155 to £167.40. Work out the percentage increase in Helen's savings.

Liquid A has a density of 0.7g/cm³. Liquid B has a density of 1.6g/cm³. 140g of liquid A and 128g of liquid B are mixed to make liquid C. Work out the density of liquid C.

Finish

Tutorial 12 – Final Reflections

In this tutorial you will look at:

- Reflecting on Make your Mark
- Learning Assessment 2

Task 1: Reflection Activity

Flip back to this activity in tutorial 2. Which methods did you use to solve these problems, and how would you answer them now?

Task 2: Reflecting on Make your Mark

Which part of the programme did you like the most?
Which part was most challenging?
Which study strategy did you find the most useful?

Congratulations!

You've reached the end of Make your Mark! This means you have completed 12 hours of tutoring with a university student in Maths. You have worked on developing your subject knowledge and study skills which can be applied in your future school studies.

Acknowledgements

This course was designed in partnership between the University of Sussex and The Brilliant Club. With particular thanks to Caroline Peters for supporting with the course design.

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