

Post-16 GCSE Maths: basic skills questions

Teacher guidance and rationale

v2.0 – August 2023

The three sets of basic skills questions measure learners' ability with addition, subtraction, multiplication, division, fractions, decimals, percentages, scale and ratio. These nine basic skills underpin and form the cornerstones of the entire GCSE Maths specification.

Although a learner has achieved a grade 1, 2 or 3 at GCSE, they may still have difficulty with some basic maths skills, which in turn hinders progress in more advanced skills. Each question in these Basic Skills sets will help identify where those difficulties lie, either a gap in a learner's knowledge or a misconception.

It is essential to identify which maths skills your learners can do and which they can't. Early diagnosis of problems with the nine basic skills will enable you to intervene and encourage confidence early in the course. Once the basics are in place, swifter progress can be made. There is evidence that stronger fluency in these basic skills will enhance learners' problem-solving ability as one relies upon the other.

Alternative methods

In GCSE Maths, marks will be awarded for 'any valid mathematical method' demonstrated. Within the basic maths skills, it is useful for any teacher to have a toolbox of alternative methods for learners to use if they have problems with traditional methods.

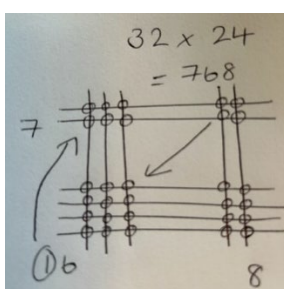
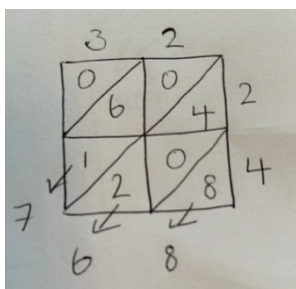
Once you have identified that a post-16 learner struggles with the basics then it may benefit them to try an alternative method.

Having a range of alternative approaches or ways to 'look again' or re-vision the maths can be a light bulb moment for many learners. Seeing a calculation in a different way and finally being successful at it may bring down some of the barriers that are built up when the basics are not grasped.

There are many efficient alternative methods that will help make learners successful in areas of maths that they may have previously struggled with.

For example:

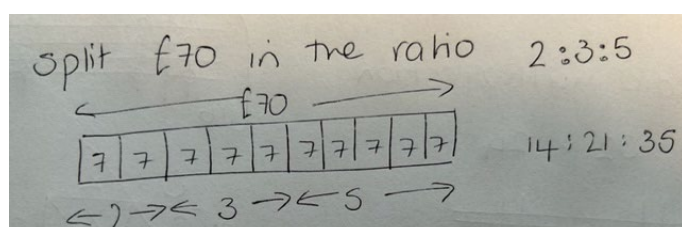
- Napier's bones or Vedic multiplication for multiplication



- the fraction frame for adding or subtracting

$$\frac{1}{3} + \frac{2}{7} = \frac{13}{21}$$

- manipulatives and bar models for percentages and ratio



- ratio tables for multiplication, division, conversions as well as for scale (they have many uses)

32 x 24

1	10	20	2	4
32	320	640	64	128

	640	
+	128	
	768	

These methods are designed to help learners become successful at the basics quickly, not to develop deep conceptual understanding. Success builds success, and conceptual understanding can come later, after procedural success.

By working with the basics and emphasising number work early in the resit year, confidence can be developed and achievement can be rapid. Low confidence is one of the proven barriers to learning that a resitter has.

Sharing methods between learners

Group work can help you discover which methods learners find easiest and most efficient.

Develop confidence by asking learners to share their method(s) and determine which is the most logical or efficient method. This makes the person sharing feel confident and supports them in making errors. Turning a question from a closed one to an open one will help develop a willingness to explore alternative methods. Unwillingness to make mistakes is a natural part of anxiety over maths.

For example:

The answer to 18×50 is 90

How many different ways can we find to show this?

Fundamental maths facts

Added to the difficulties that GCSE resitters may have with the basic maths skills there is a tranche of fundamental maths facts that resitters really should know by now, but often don't.

For example, knowing that there are:

- 360° around a point
- 180° in a triangle and on a straight line
- 10 mm in 1 cm
- 100 cm in 1 m
- 1000 ml in 1 l
- Days in each month
- Coins and money
- 2^3 means $2 \times 2 \times 2$

It is worth spending time on the pre-requisite maths skills that lead into topics.

For example, working with Pythagoras, making sure that learners know the following:

What the four types of triangle are called

How many degrees are in a right-angle

How a right-angle is marked in a triangle

Which part of the triangle is the hypotenuse

How to square a number

How to find the square root of a number

Set 1 rationale

This is the first set of nine questions in a series of three. It is recommended that you ask learners to complete the three sets individually, early on at the start of the course, ideally once per week.

1 Addition

$$97 + 66 =$$

A classic simple addition that crosses the 100 mark by carrying forward. A number line or partitioning may help if there are difficulties.

2 Subtraction

$$76 - 23 =$$

A number line or subtraction by partitioning may be useful if any difficulty is demonstrated.

3 Multiplication

Write out the seven times tables, from 1×7 to 12×7

This will identify whether the basic times table skills are in place. These underpin many other skills, so it is important to identify gaps early on and put interventions into place.

An effective method is hand multiplication, specifically for 6, 7, 8, 9 and 10 times tables.

4 Division

$$4 \div 8 =$$

This will challenge learners whose natural inclination will be to divide 8 by 4. This would demonstrate an avoidance of division as they do not comprehend the concept in this case.

This can be effectively supported by turning this into a fraction $\frac{4}{8}$ and simplifying.

Often learners are not aware of the connection between division and a fraction.

5 Fractions

$$\frac{2}{5} \times \frac{3}{4} =$$

This will help you identify whether learners can multiply out the fractions and then simplify. Bar modelling or visual modelling can help support this, if any difficulties are presented.

6 Decimals

Which is the bigger number, 0.17 or 0.123?

This question is designed to challenge the misconception of longer decimals being bigger.

Support can be given using a number line, converting to fractions or by making all the decimals the same size by lining up underneath and filling in zeros.

7 Percentages

What is 15% of 120?

This tests the simple process of finding 10% and then halving it and adding them together or finding 1% by dividing by 100 then multiplying by 15.

Bar modelling would also support this.

8 Scale

A road on a map is 10cm long and represents 400m.

What is the scale of the map?

If there is any confusion here you could use an arrow diagram to help organise the information and identify where the multiplying and division is happening, to scale up or down.

There may well be difficulties with conversions between mm, cm, m and km, so some reinforcement of facts may be beneficial.

9 Ratio

Two friends share £150 in the ratio 4:11

How much does each person receive?

This is a classic ratio question that would benefit from a bar model if there is any confusion.

Set 2 rationale

This second set of basic skills questions extends the basics into harder questions or questions that focus on a different skill within that basic set. Again, the focus is on addition, subtraction, multiplication, division, fractions, decimals, percentages, scale and ratio.

1 **Addition**

$$157 + 368 =$$

Carrying forward multiple times may present some issues. Partitioning or number line work will support learners in doing this.

2 **Subtraction**

$$102 - 78 =$$

When learners experience difficulties in subtraction you may hear things like “you can’t take 8 from 2”. It may be a good idea to avoid borrowing or carrying (or exchanging, as it is now called in primary teaching) by approaching subtraction by rounding or subtraction with negatives by partitioning the number into its component parts. A number line may also be of value.

3 **Multiplication**

$$23 \times 34$$

Double digit column multiplication can create some difficulty for some learners. Try Napier’s bones or the grid method as an alternative.

4 **Division**

$$96 \div 4 =$$

If learners struggle with a traditional method you could try halving and doubling strategies, which are now common in primary. Alternatively, convert this division into a fraction and simplify.

5 Fractions

$$\frac{2}{3} \div \frac{4}{5} =$$

The learner may demonstrate ideas such as KFC (Keep the first fraction, Flip the sign, Change the last fraction) without any conceptual understanding.

Other methods, such as the butterfly method or kiss-kiss-smile method, may also be used.

There may be very little conceptual understanding of this skill but as long as the learner is successful first, an interest in how it works may develop with some clever questioning and discussion prompts.

6 Decimals

What is the value of the 8 in 1.286?

This question challenges the understanding of place value. It may be an idea to build place value models/visuals together to reconfirm understanding.

7 Percentages

What is 7% of 75?

This is a more complex percentage calculation requiring multiple steps. Bar modelling may support.

8 Scale

The length of a seesaw is 5m.

If it is to be drawn on a plan of a playground, how long will it be if the scale is 1:100?

An arrow diagram may help organise the information in this question if the learner is presenting difficulty in conversions between unit and applying scale.

9 Ratio

Two friends receive some money in the ratio of 2:3

If £39 is the largest amount, what did the other friend get?

A bar model may help if there is any difficulty in answering.

Set 3 rationale

This third set of questions either builds on the questions in Sets 1 and 2 or turns the question around to better challenge understanding.

It moves learners on to identify a launch level and helps determine immediate interventions to be given.

1 Addition

$$875 + 326 =$$

This crosses the 1000 mark with an emphasis on carrying forward, increasing the complexity.

Number lines work or partitioning may assist.

2 Subtraction

$$1016 - 358 =$$

This question has points where learners may struggle with carrying/borrowing/exchanging. Partitioning or subtraction through rounding and subtraction through negatives may be good alternatives.

3 Multiplication

$$24.3 \times 17.6 =$$

Introducing decimals may cause some difficulty – an alternative method such as Napier's bones may help.

4 Division

$$1200 \div 48 =$$

This long division question may be easier to comprehend if the division is treated as a fraction to be simplified.

5 Fractions

$$\frac{1}{5} + \frac{3}{4} =$$

Adding and subtracting fractions can cause difficulty. A good alternative is to use the fraction frame. This method does exactly the same as the conventional common denominator approach but presents it in a more visual form.

6 Decimals

$$0.2 \times 0.3 =$$

A classic misconception may arise where learners do not recognise that the answer will be smaller. A very common error is to say 0.6.

You can support by working backwards from 2×3 to 0.2×3 being 10 times smaller and so on.

7 Percentages

What is 12.5% of 80?

Learners may go through the process of finding 10% and then 1% and so on. This involves multiple steps.

If learners can recognise equivalences between fractions, decimals and percentages quickly then the answer is quicker to find.

It's more efficient to see that 12.5% is $\frac{1}{8}$ and $\frac{1}{8}$ of 80 is 10.

8 Scale

If 100 km is represented by 10 cm on a map, what is the scale?

This question challenges conversions between cm and km and multiplying up and down in tens. Arrow diagrams will support this as well as revisiting units sitting around a metre measurement.

9 Ratio

Two friends receive some money in the ratio of 4:9

One friend receives £150 more than the other.

How much money was there at the start?

A bar model may help if there is any difficulty in answering this question.

Set 1 answers

1 163

2 53

3 $1 \times 7 = 7$
 $2 \times 7 = 14$
 $3 \times 7 = 21$
 $4 \times 7 = 28$
 $5 \times 7 = 35$
 $6 \times 7 = 42$
 $7 \times 7 = 49$
 $8 \times 7 = 56$
 $9 \times 7 = 63$
 $10 \times 7 = 70$
 $11 \times 7 = 77$
 $12 \times 7 = 84$

4 $\frac{1}{2}$ or 0.5

5 $\frac{6}{20}$, equivalent to $\frac{3}{10}$

6 0.17

7 18

8 1:4000

9 £40 and £110

Set 2 answers

1 525

2 24

3 782

4 24

5 $\frac{10}{12}$, equivalent to $\frac{5}{6}$

6 0.08 or $\frac{8}{100}$

7 5.25

8 5 cm

9 £26

Set 3 answers

- | | |
|---|-----------------|
| 1 | 1201 |
| 2 | 658 |
| 3 | 427.68 |
| 4 | 25 |
| 5 | $\frac{19}{20}$ |
| 6 | 0.06 |
| 7 | 10 |
| 8 | 1:1 000 000 |
| 9 | £390 |