Maths Starters and Enders

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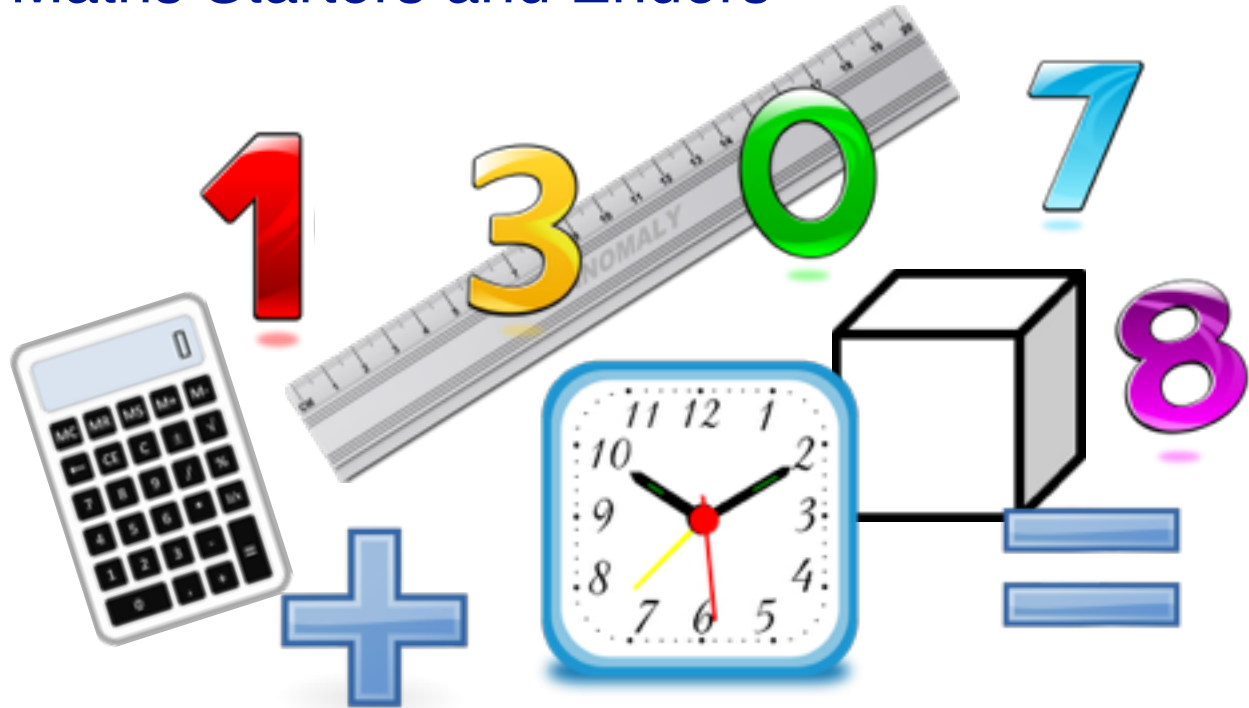
Welcome to the pack

The Education and Training Foundation has produced some cards with maths activities that you can use at the start or end of prison workshops, training or education sessions.

All the problems are also intended to help people to develop their communication skills, especially their verbal communication skills. This is particularly important for employability. Being skilful when communicating verbally supports people to seek and keep job and training opportunities and navigate their lives and learning.

You will find the following in this pack:

• Toolbox - listing some resources that will be useful

• Communication abilities valued by employers

• Mathematical Development: Guiding Principles – the Bishop ideas

• Mapping of the Bishop ideas to our activities

• Activity cards (1 - 12)

• Links to further ideas and support

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Toolbox

You'll need the following resources in your maths communication 'toolbox':

Scrap paper		Calculator		Trade magazines	
Pencils/ pens		Pictures of things relevant to the work/ training you do		Set of number cards	
Dice		Just people (talking)		Tape measure	

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Employability skills valued by employers

Research by the University of Kent[1] has identified the top ten employability skills:

1. Verbal communication
2. Teamwork
3. Commercial awareness
4. Analysing and investigating
5. Self-motivation
6. Drive
7. Written communication
8. Planning and organising
9. Flexibility
10. Time management

Good **verbal communication** sits at the top of this list because: "Almost every job will involve talking to colleagues or customers at some point and employees should be able to express themselves clearly, confidently and concisely, tailoring their style to their audience. Communication is not all about talking, the best employees will be able to listen to what people are saying, process it and act on it."

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[1] www.kent.ac.uk/careers/sk/top-ten-skills.htm

Mathematical Development: Guiding Principles – the Bishop Ideas

In 1991, Alan Bishop[2] suggested that six types of - often overlapping - activity tend to lead to the development of mathematics in all cultures. Here's his list, with some notes to explain his thinking. We've included all these types of mathematical activity in the pack:

Counting: numbers; place value; fractions; number names
Locating: north/south/east/west; up/down; angles; circle; backwards/forwards
Measuring: faster/slower; area; money; heavy/light; centimetre
Designing: properties of shapes; symmetry; ratio; proportion
Playing: puzzles; paradoxes; imagined reality; rule-bound activity
Explaining: similarities; logical explanation; generalisations

Tips for tackling the activities:

- Drawing a sketch might help; or jotting down any mathematical words that come to mind as you read the activity.
- Does this activity remind you of others you have done? What ideas did you use then?
- If you're stuck, try making up a problem which is like our activity, but easier; then go back to the original problem.
- Some are slow-burn; have a go, discuss it with other people, look for inspiration in the library, have another go.

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[2] Bishop, A. (1991) *Mathematical Enculturation - A Cultural Perspective on Mathematics Education*, Dordrecht: Kluwer Academic Publishers

Mapping the Activities to the Bishop ideas

Title	Bishop's ideas
Favourite number	Counting, explaining
Drawing	Designing, playing, explaining
Tomasz goes to the gym	Counting, measuring
What's the question?	Counting, measuring
Asking about work	Counting, playing, explaining
Juggling jugs	Counting, measuring, locating, designing, playing, explaining
Reading between the lines	Counting
How much?	Counting
Talking numbers	Counting, locating, explaining
Clocking the time	Counting, measuring, playing, explaining
Making 100	Counting
Painting cubes in your head	Counting, locating, designing, explaining

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Activity 1 – Favourite number
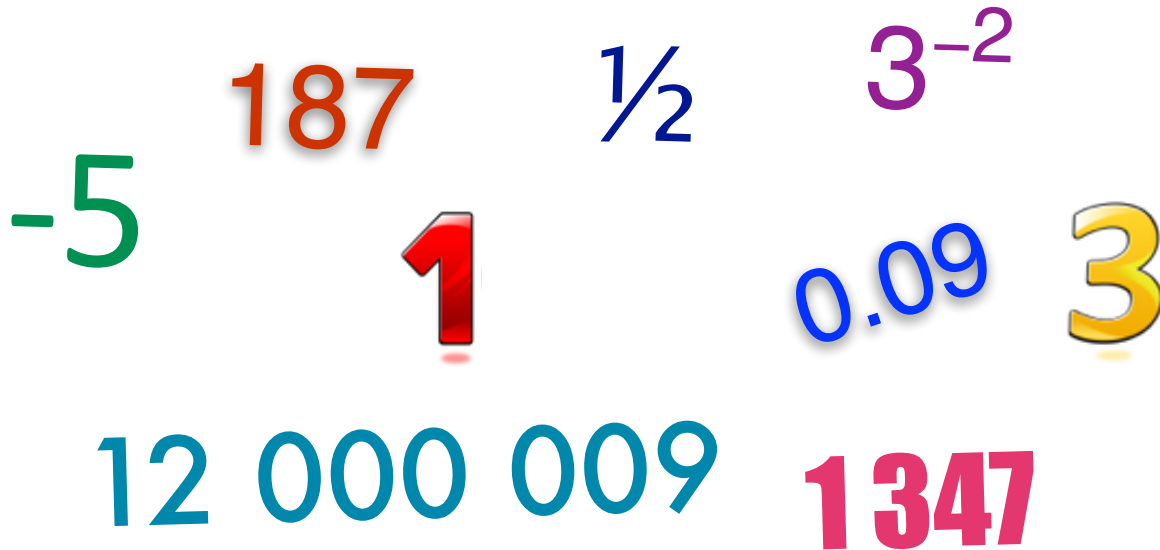
187

½

3^{-2}

-5

1

0.09

3

12 000 009

1347

This activity will probably involve the Bishop ideas **Counting** and **Explaining**

Activity

You will need…

Think of a number you like / find interesting / really do not like.

Write it down.

Now think about what that number means to you / why you chose it. Personal stuff, mathematical stuff, personal mathematical stuff, whatever. Maybe it's your birthday, the biggest prime number yet discovered, a useful irrational number, the biggest even number under 1 million, the number of the first house you lived in, a number that was very important to Mayan mathematicians, a number whose shape you like. . . .

Discuss your choice with others in the group.

Activity 2 – Drawing

Rectangle.

Square

Not a semi-circle.

Letter 'E' on its side.

Triangle with sides all different lengths.

Spiral with each leg twice as long as the previous one.

Square

a semi-circle.
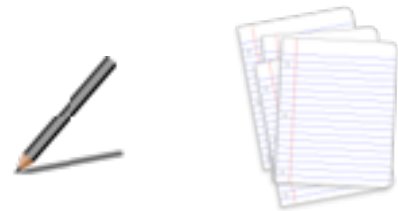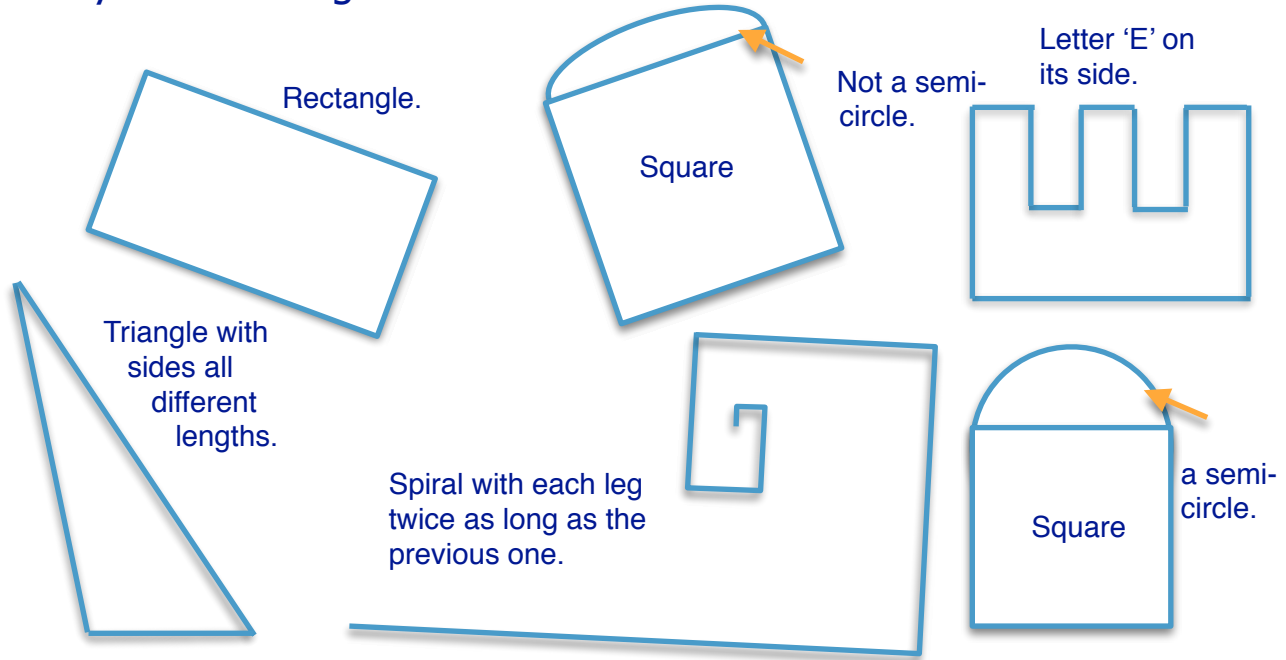
This activity will probably involve the Bishop ideas **Designing**, **Playing** and **Explaining**

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Activity

Work with a partner, sitting back to back.

Version 1: Pick a shape on the front of this card and describe it – but don't use any of the words on the front of this card. Ask your partner to draw the shape from your description. The drawing doesn't have to be the same size as yours, just the same shape.

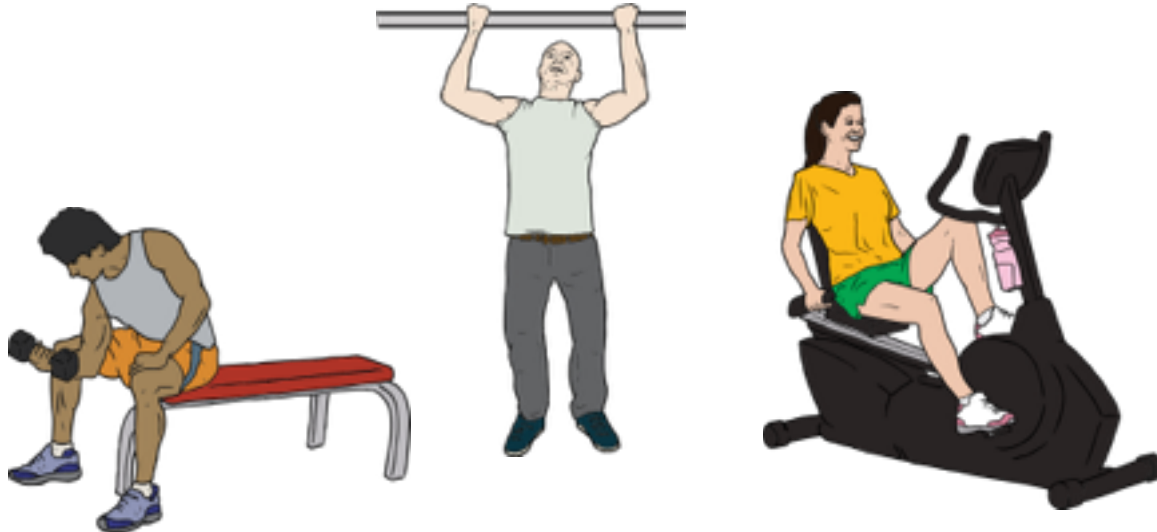Version 2: Pick a shape. The "drawer" can ask yes / no questions to identify what they need to draw.

Or work with two teams.
Pick a shape. Each team in turn can ask you yes / no questions to help them draw the shape, and the winner is the team who finishes first – with a correct shape of course!

You will need…

Activity 3 - Tomasz went to the gym

This activity will probably involve the Bishop ideas **Counting** and **Measuring.**

Activity

Read *this story* and ask each person to decide whether the statements are "reasonable" or "crazy/ wrong". Discuss and award points: +1 point for each crazy or downright wrong statement spotted, but -2 points if somebody says a statement is crazy/wrong but the group disagrees. Maximum score wins.

Tomasz went to the gym. On his first day, he did 5 sit-ups and 1 press-up, lifted 150kg and ran for 60 minutes. Next day he walked for 2 hours, lifted 20kg and did 60 sit-ups. Then he had one free day, and on the fifth day he lifted 150g and did a 50k race in the gym.

Now discuss your answers with other learners, agree which statements are "crazy or downright wrong" and which are "false crazies", and work out who scored most points.

Now try to make up more stories like this, with a mixture of reasonable and crazy statements.

You will need…

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Activity 4 – What's the question?

187   92   348

55

70   9   3

0   128   347   11

This activity will probably involve the Bishop ideas **Counting**, **Measuring** and **Explaining**

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Activity

Work with two teams. Teams can have one or more people; it doesn't really matter.

Pick a number – anything from 0 to 10,000. Tell the teams your number, and tell them that this is "the answer". Ask each team to write down what the question might be. Give them a time limit and challenge them to write down as many questions as possible. For example, if your number is 15, the "questions" might be "8 + 7" or "50% of 30" or "297 – 282" or "the length of a rectangle with area 30cm^2 and width 2cm". Tell the teams that they will be checking each others' questions, so they need to write clearly. When time's up, ask each team to check the other team's questions, or check them yourself. The winner is the team with the highest number of correct "questions".

Variations: try using negative numbers, or fractions or decimals.

You will need…

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Activity 5 – Asking about work

This activity will probably involve the Bishop ideas **Counting**, **Designing**, and **Explaining**

Activity

Somebody offers you a job which will pay £1,000,000 for 20 days' work.

At the start of Day 1, they offer you a choice. You can have the £1,000,000 at the end of Day 1, or you can get paid £1 at the end of Day 1, £2 at the end of Day 2 and so on, doubling your pay each day. What will you choose?

Could you explain your thinking using a graph of some kind?

You will need...

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Activity 6 - Juggling jugs

This activity will probably involve the Bishop ideas **Counting**, **Measuring**, **Locating**, **Designing**, **Playing** and **Explaining**

Activity

You'll need...

You've got a jug that holds 5 litres and another that holds 3 litres. Could you use them to measure out 4 litres? You can fill either jug from a tap as often as you like.

Some more problems to try:

- Using these two jugs, could you measure out 1, 2, 6, 7 etc litres?

- You have four jugs of 9, 7, 4 and 2 litres capacity. The 9 litre jug is full of wine, the others are empty. Can you divide the wine into three equal quantities?

- Make up some new problems, e.g. two jugs holding 5 and 6 litres; can you measure out 7 litres? Can you see any patterns which help you predict whether or not a problem is going to be solvable?

Activity 7 – Reading between the lines

Carpet deal!

Reduced by 50%!

Then another 10% off!

Just off A102 (Junction 11) at the Croft Retail Park. Open 7 days a week.

This activity will probably involve the Bishop ideas **Counting** and **Explaining**

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Activity

Carpet reduced by 50%!

Then another 10% off!

Sam read this advert and said "So if the carpet cost £300 to start with, the final price will be £120". Sonya thought it would be £135. Who's right?

Here's another teaser:

Rail fares went up by 10% last year, but this year they're going down by 10%. So, we're back where we started?

Can you come up with some similar teasers yourself?

You will need...

Activity 8 - Trade magazines

Bishop Ideas: This activity will involve **Counting** and **Explaining**

Activity

Look through one of the trade magazines and find a job that you might like. Work out how much you would earn per day / per week / per month / per year (whichever seems most suitable to that job). Now estimate how much you'd pay in taxes and National Insurance, and how much you'd need to spend on general living costs. Does the job look attractive now? Could you do any training or qualifications that could help you get promotion or get a better-paid job?

Look through one of the trade magazines and, assuming you work for yourself, think of a job that a client might ask you to do. Estimate, using information from the magazine, how much the job might cost you to do. And then work out what you might ask the client to pay.

You will need…

Activity 9 – Talking numbers

one, two, three, four, five, six, seven, eight, nine, ten

één, twee, drie, vier, vijf, zes, zeven, acht, negen, tien

aon, dó, trí, ceathair, cúig, sé, seacht, ocht, naoi, deich

один, два, три, чотири, п'ять, шість, сім, вісім, дев'ять, десять

एक, दो, तीन, चार, पाँच, छ:, सात, आठ, नौ, दस

This activity will probably involve the Bishop ideas **Counting**, **Locating** and **Explaining**

Activity

In a group (this works best if you arrange yourselves in a circle or a line), in turn say the number "0" in whatever languages you know.
Then go round again, with everybody saying the number "1" etc.
Can you hear any similarities between the languages?

Move together with people whose number words sound most similar - you might be surprised by some of the connections. For example, some French and Italian number words sound fairly similar, as do Bengali and Irish number words. Any ideas about why this might be?

If you know how to write the numbers "0" to "10" in different scripts, make a list in your script and compare with other people's scripts.

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Activity 10 – Clocking the time

This activity will probably involve the Bishop ideas **Counting**, **Measuring**, **Playing** and **Explaining**

Activity

You will need…

1. 1 January 2006 was a Sunday. What day was 1 January 2007? 2008? 2009? When did 1 January fall on Sunday again?

2. One clock is running one minute per hour too fast. Another is running two minutes too slow. They are synchronised at noon on Sunday. How long will it take before one of them is an hour ahead of the other?

3. Albert Einstein is looking at two clocks with 24hr displays. One goes forward at twice the normal speed; the other goes at the normal speed, but backwards. At 1300, both clocks are showing the correct time. When will they next be in agreement?

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Activity 11 – Making 100

$=$

$+$

$\div$

1 One 2 Two 3 Three

4 Four 5 Five 6 Six

7 Seven 8 Eight 9 Nine

( )

-

X

This activity will involve the Bishop idea **Counting**

Activity

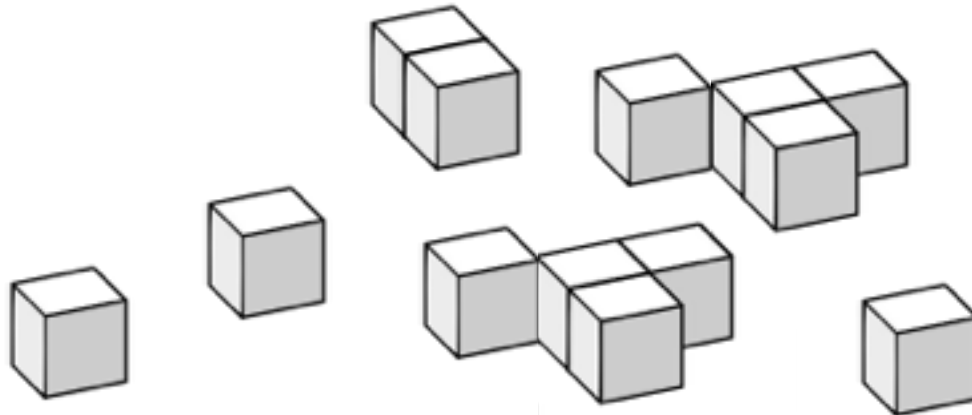Using the digits 1 to 9 once each, together with any symbols like +, x etc, can you make 100?

Spread the number cards out on the table to show your ideas to other people or to work with other people to find more solutions to this puzzle.

There are many solutions to this puzzle; how many can you find?

You will need…

Activity 12 – Painting cubes in your head

This activity will probably involve the Bishop ideas **Counting**, **Locating**, **Designing**, **Explaining**

Activity

Imagine a cube 1cm by 1cm by 1cm.
If you have cubical dice handy, you could use these to get you started – the numbers on the dice don't matter for this activity, and they may not be the right size, but they may help you think about this problem.

Now imagine some of these cubes stuck together to make a cube of side 2cm, and imagine painting the outside of this new cube. How many faces will you have to paint? Now keep going; imagine new cubes of side 3cm, 4 cm etc. Then try to predict how many faces you'd need to paint if you had a 10 cm, 12 cm or 100 cm cube?

You will need…

We hope you've enjoyed these activities.

Here are some others you might enjoy:

- ATM has a huge range of free and priced resources. Many also have teacher notes.

  https://www.atm.org.uk

- nrich also has a huge range of delightful problems. All have teacher notes; and all have solutions, some of which come from learners.

  http://nrich.maths.org

- "Maths4Prisons Mathematical Magic" is a free download with dozens of puzzles and tricks, each with notes to guide the person introducing or supporting the activity. Available as a free download from The Learning and Work Institute www.learningandwork.org.uk (search for Maths4prisons).

We have suggested that a tape measure should be part of the toolkit as it is a useful resource. Can you think of activities that would need a tape measure and submit them to our online problem-solving maths community (coming soon!).

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Support from the Education and Training Foundation

Online Learning Modules

The Education and Training Foundation have developed 11 modules to support teachers and trainers to develop their personal maths confidence and abilities.

The module titles are:

1. Number
2. Algebra
3. Measures
4. Geometry and trigonometry
5. Probability
6. Statistics
7. Language of Maths
8. Geometry and trigonometry
9. Probability and statistics
10. Algebra and graphs in practical situations
11. Graphs and functions plus simultaneous equations

They can be accessed at http://www.foundationonline.org.uk, in the Maths and English section. Teachers and trainers can also self-assess their maths abilities here.

Maths on the Excellence Gateway's Offender Learning Exhibition Site

There are many helpful resources to support maths development in secure estates on the Excellence Gateway, in the **Offender Learning Exhibition Site**.

You can access this at http://offender-learning.excellencegateway.org.uk/maths.