

CAN YOU SOLVE OUR PUZZLE?

Algebra can seem a bit confusing at times so we've found a fun way to help you work out a problem, using shapes as well as numbers. Remember, with algebra problems, it's about using logic to work things out rather than trying to guess!

Take your time and work through each stage of the problem.

When you think you've finished, check your answer to see if it makes sense.

Clue: The answers can usually be put back into the equations to make sure they work.

Good luck!

**HINT: THE SAME NUMBER,
THE SAME SHAPE.**

$$\color{magenta}{\spadesuit}^3 = 64$$

$$\color{magenta}{\spadesuit} + \color{green}{\heartsuit} = 9$$

$$[\color{magenta}{\spadesuit} \times \color{green}{\heartsuit}] \times \color{blue}{\clubsuit} = 60$$

$$\color{blue}{\clubsuit} = ?$$

ANSWER:

Now it's your turn to make up an algebra puzzle like this one.

- Choose three shapes (the same number, the same shape)
- Create three equations using addition, subtraction, multiply, divide, squared, cubed, equals signs
- Check that your answers make sense

CAN YOU SOLVE OUR CODE-BREAKING PUZZLE?

Codes are a great way to try out your powers of logic. Sometimes they can be really complicated! Ours is quite simple if you know the rules. All you need to do is re-order the alphabet but in a different place on the grid.

So, if C now = Z, it is logical to expect D is now the next letter after Z. Try and think what that might be. Once you have worked this out, the rest of the letters will follow.

Now work out what the letters spell and work out the answer.

Happy code-breaking!

A	B	C Z	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

VHYHQ SOXV WZR

ANSWER:

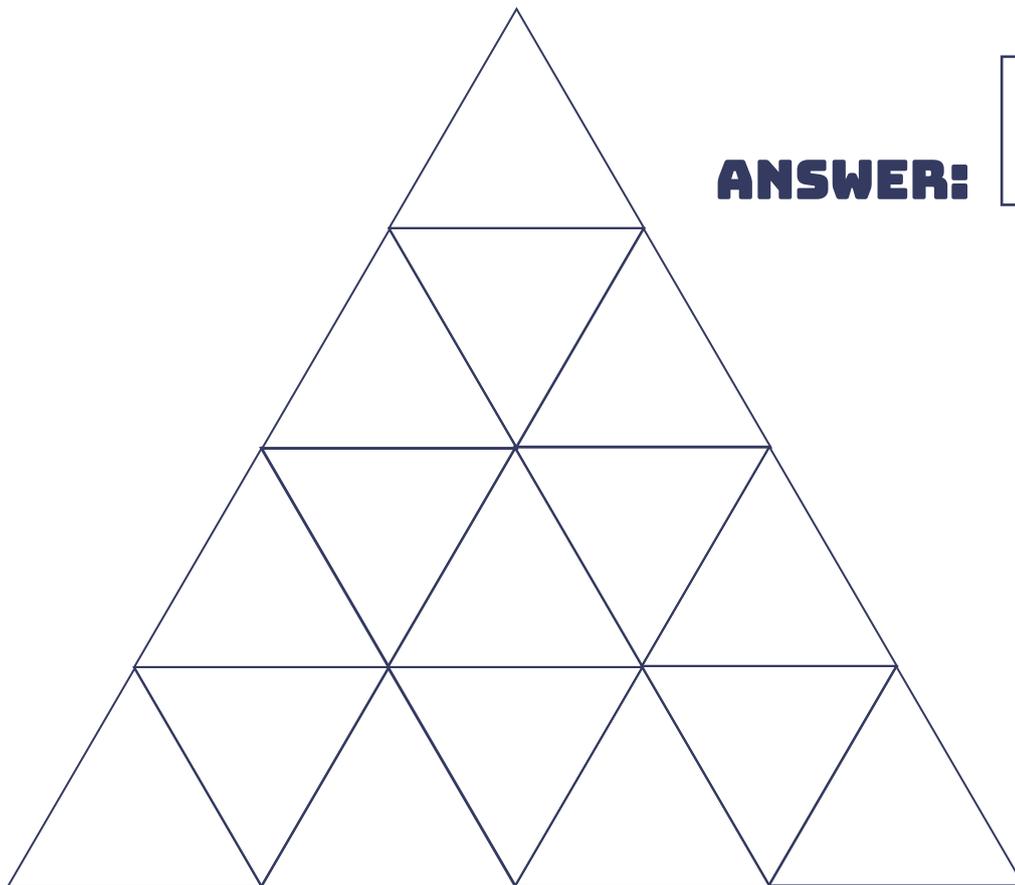
How easy are some codes to crack? What makes some codes more difficult than others? What top tips do you have on code-writing and breaking. Try to answer these questions with other students and then run a question and answer session.

CAN YOU WORK OUT THE NUMBER OF TRIANGLES?

Have a look at the triangle below and try to work out how many smaller triangles there are in addition to this. You will need to count triangles of all different sizes so be careful that you don't lose count.

You might want to keep a check of how many triangles you find by writing down the numbers. Remember to check your answers at the end.

Have fun!



ANSWER:

Is it possible to use the rules of this puzzle to other shapes such as:

- Squares
- Rectangles
- 3-D objects

See if you can come up with some new rules around these or try out your own ideas on shapes and tessellations.

CAN YOU WORK OUT HOW MUCH MONEY THE MAGICIAN HAS LEFT?

This is an interesting puzzle for you to work out either in your head or on paper. Either method is acceptable and you might try to do the mental arithmetic first and then check your answers.

A magician goes into a magic store with £2753 in his hand.

Unfortunately he drops twenty of his £50 notes, eight £20 notes, six £10 notes, three £2 coins, three 50 pence pieces and five 5 pence pieces. How much money does he have left?



We all learn early on about addition and subtraction; a little later we learn about multiplication and division. What we never learn about is where numbers come from and who made up the rules. Try to research the following for a talk on Mathematics & History.

- Why ten numbers?
- Why the shapes we have?
- Who made the rules for addition and subtraction

Now present this to your class.

CAN YOU WORK OUT THE DIFFERENT AMOUNTS FOR THE LENGTH AND AREA OF THE SHAPES?

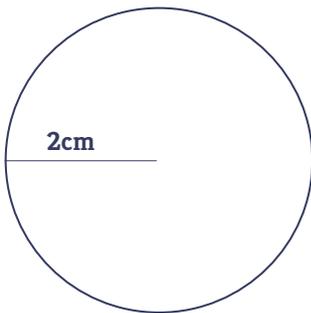
For this puzzle you will probably need a calculator to help you work out the numbers involved. If not then $\pi = 3.14$ for the purpose of your calculations.

You also need to know that the circumference of a circle is $\pi \times d$.

The area of a circle is r^2 .

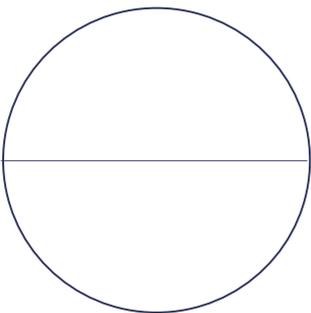
Now you can use this information to help you solve the puzzle below.

Circle 1



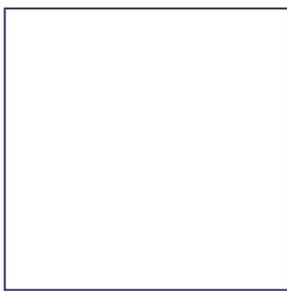
A circle with a horizontal line from the center to the left edge labeled "2cm".

Circle 2



A circle with a horizontal line through the center from the left edge to the right edge.

Square



A square.

The diameter of circle 2 is the circumference of circle 1 (rounded to the nearest whole number).

The area of the square is the same as the area of circle 2 (rounded to the nearest whole number).

Find the length of each side of the square (rounded to the nearest whole number).

ANSWER (TO THE NEAREST WHOLE NUMBER):

Now it's your turn to write a similar puzzle using different shapes. It's probably best if you use the same shapes but change the numbers involved to get a different answer. Check your answer carefully and share the puzzle with another student.

CAN YOU WORK OUT THE DIFFERENT AGES OF THE PEOPLE BELOW?

For this brain-teaser you will need to use both logic and addition/subtraction to work out the answers.

You need to establish the different ages of Brian, Jacob, Susan, Melissa and Emily by adding and subtracting years using the information below.

Brian is 16.

Jacob is 17 years older than Susan.

Susan is 12 years younger than Brian.

Melissa is 24 years older than Emily.

Emily is 13 years younger than Jacob.

ANSWER:

Brian is:

Emily is:

Susan is:

Melissa is:

Jacob is:

If you are feeling confident, see if you can teach the basics of writing number and logic problems to other students in your group or to younger students. See if you can share this effectively by writing down the main lessons to learn.

CAN YOU WORK OUT THE PRICE OF THE YUM-YUMS?

For this brain-teaser you will need to use both logic and addition/subtraction to work out the answers.

There are lots of different mathematical skills which you will also need which are indicated on the receipt from a trip to the sweet shop.

You know the final total of this expensive day out as well as most of the items on the list. The question is, how much does it really cost to buy nine exploding Yum Yums?

The Future Is Sweet
23 Green Street
New London, London

23/04/2063 1:17pm

QTY	DESC	AMT

3	Levitating Lollipops	$\pounds 1.6 \times 10^2$
5	Acid Allsorts	42% of total
2	Electric Edibles	$\sqrt{16}$
8	Fire-breathing Fudge	$480 \div 16$
3	Xtra X-Ray Fruit Chews	4×8
4	Mind-reading Melon Gums	1/5 of total
9	Exploding Yum-Yums	?

TOTAL: $\pounds 960$		

ANSWER:

Is it better to learn mathematics using ideas such as shopping lists or just complete lots of sums? Give a brief talk to your fellow students, weighing up each side of the argument and drawing some conclusions.

CAN YOU WORK OUT THE PIGPEN CODE TO SOLVE THE NUMBER PROBLEM?

This is a different kind of code, based on letters of the alphabet being replaced by shapes and dots, as shown in the four grids below. Without the grids the message would be very difficult to solve!

Very carefully work out the letters. For example V = S, as you can see from the third grid below.

Once you have translated the letters, they will make a sum for you to solve.

<p> √Γ·> >Γ◻◻√ >√◻ ◻Γ^Γ◻◻◻ ◻◻ >◻◻◻◻ ◻Γ◻<√ >√◻ </p> <p> _____ _____ _____ _____ </p>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr><td>A</td><td>B</td><td>C</td><td>J</td><td>K</td><td>L</td></tr> <tr><td>D</td><td>E</td><td>F</td><td>M</td><td>N</td><td>O</td></tr> <tr><td>G</td><td>H</td><td>I</td><td>P</td><td>Q</td><td>R</td></tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr><td colspan="3" style="text-align: center;">S</td></tr> <tr><td>T</td><td></td><td>U</td></tr> <tr><td colspan="3" style="text-align: center;">V</td></tr> </table> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr><td colspan="3" style="text-align: center;">W</td></tr> <tr><td>X</td><td></td><td>Y</td></tr> <tr><td colspan="3" style="text-align: center;">Z</td></tr> </table>	A	B	C	J	K	L	D	E	F	M	N	O	G	H	I	P	Q	R	S			T		U	V			W			X		Y	Z		
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If you are interested in codes and their use, you could do some research on 'The History of Coding'. This could include looking at:

- Codes in Ancient Civilisations
- Different types of codes through history
- Code-breaking machines

You could make this into a presentation to your Maths group.

CAN YOU WORK OUT THE SENTENCE USING THE SECRET CODE BELOW?

Do you like writing codes? Do you like breaking codes? In the puzzle below a secret message has been sent so that the enemy cannot decipher it. Only you have access to the secret code grid which will allow you to break this.

Try using the code to write a message in return.

A	B	C	D	E	F	G	H	I	J	K	L	M
√	△	Σ	∥	☺	≥	♪	Ω	⌠	e	∞	≈	€
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
⌞	☀	€	∏	♀	♂	♠	♣	♥	♦	♪	ℓ	∂

CODE MESSAGE:

€ ≈ ☺ √ ♂ ☺ ♂ ☺ ⌞ ∥ € ☀ ⌞ ☺ ℓ.
♦ Ω √ ♠ ⌠ ♂ ℓ ☀ ♣ ♀ ⌞ √ € ☺ ?

ANSWER:

_____ ?

If you enjoyed using our code, then you could try making up one of your own, using the symbols which we have used or by choosing your own.

Remember that each letter needs its own symbol and be very careful when you're writing your message, not to make any mistakes. It could be very dangerous to get something wrong!

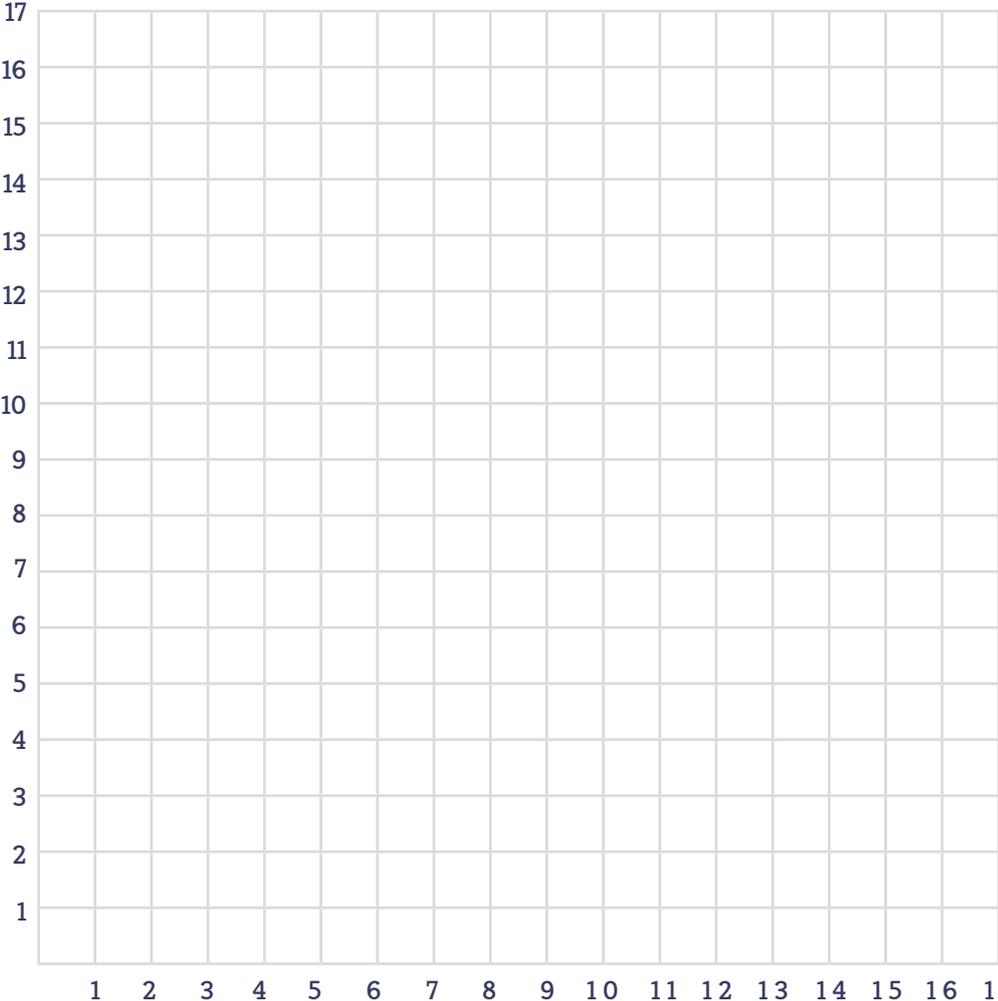
Now you can share your secret message with all the other code-breakers in your group.

Good luck!

CAN YOU WORK OUT THE EQUATION BY PLOTTING THE COORDINATES BELOW?

You have been given a grid with X and Y axes as well as a large number of coordinates which you must plot on to the grid. When you have successfully plotted the coordinates, they will spell out an equation which you must then solve.

Remember the X coordinate comes first, followed by the Y coordinate. You must also be very precise in plotting the coordinates to make sure your answer makes sense!



Plot the following coordinates: (2,8) (2,9) (2,10) (2,11) (2,12) (4,10) (5,9) (5,10) (5,11) (6,10) (8,8) (8,9) (8,10) (8,11) (8,12) (10,9) (10,11) (11,9) (11,11) (12,9) (12,11).

Now join all the coordinates which are close to each other to create numbers or symbols.

Now you have a simple equation which you can solve!

ANSWER:

If you are feeling confident, see if you can teach the basics of plotting co-ordinates on to a graph to other students in your group or to younger students. See if you can share this effectively by writing down the main lessons to learn.

CAN YOU WORK OUT THE ALGEBRA EQUATION BY WORKING OUT THE SUM?

You have been given an equation which has an unknown factor which we call X.

All you have to do is work out the amount of X. This is slightly more difficult than you might think, because we have X on both sides of the equation.

Remember the rules for equations which is to group the different amounts of X or other numbers by adding or subtracting to both sides of the equation.

If you can't remember how to do this, have a chat with your teacher to remind you.

$$10X - 12 = 3X + 79$$

ANSWER:

$$X = 11$$

Why do we learn algebra? Why do we use algebra? Is it useful in later life? Try to answer these questions as part of a talk on 'Mathematics for Life'. This should be short and interesting!

CAN YOU WORK OUT THE DIRECTIONS FOR GETTING TO YOUR FINAL DESTINATION?

You have been given a map of somewhere in the universe below with some very precise directions for you to follow, as captain of the space ship.

You will need to use your knowledge of mathematics very carefully to understand and obey the instructions, so that you end up in the right place.

Make sure that your worksheet is printed to scale or you'll get lost!

Picture is drawn to scale.



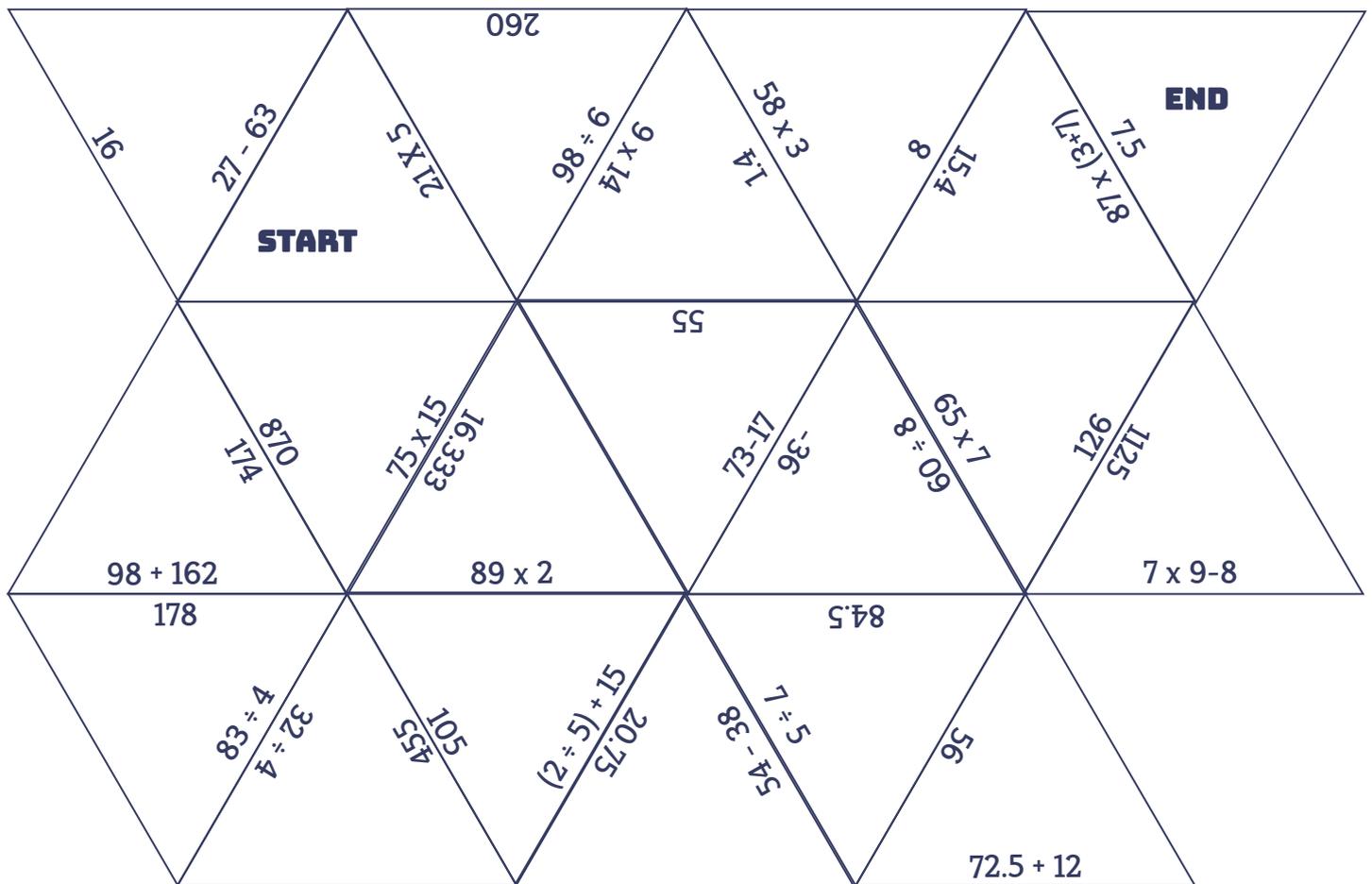
You are at the red cross. 1cm = 10 million kilometres. Draw your route onto this map to reveal the final number. Head towards Abamos until the spaceship is 40 million kilometres away, making sure to stay equidistant from Serameyer and Malnez as a guide. Then make a right-angled turn towards Garciabba. Once you are within 1 million kilometres, head clockwise around Garciabba, staying the same distance away until you have travelled half way round.

Gallileo Gallilei was a great Italian mathematician during the Renaissance. He was also a keen astronomer and would have enjoyed this puzzle! See if you can find out a little bit more about him and his mathematics. Now give a brief talk as part of a series in your class on great mathematicians.

CAN YOU WORK OUT THE CORRECT ORDER FOR THE TRIANGLES IN THE JIGSAW PUZZLE?

Print out the triangle puzzle below and then cut it up into lots of different triangles.

When you have done this, you need to match the triangle edges so that each sum matches each question! The triangles fit together to form the shape of a number, and that's your answer!



ANSWER:

If you got the puzzle right, then very well done. Now you have the idea of making a mathematics jigsaw puzzle, try out some other ideas using triangles or other shapes.

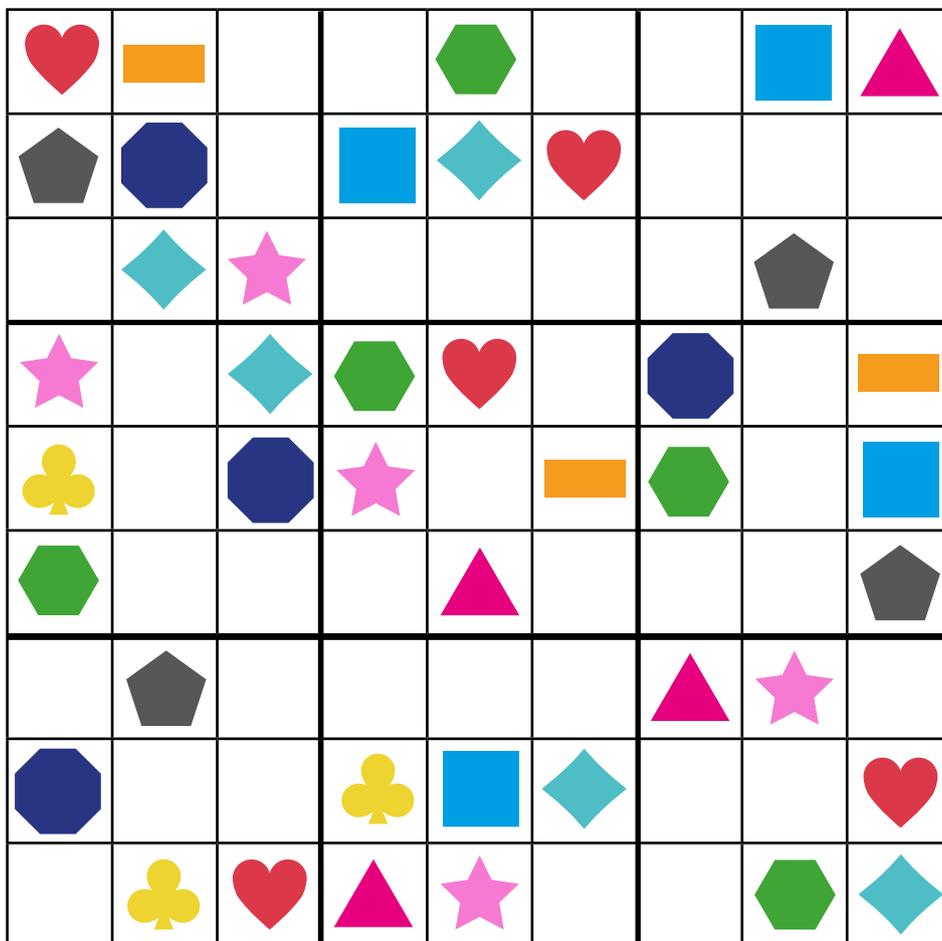
You can make your jigsaw puzzle as simple or as complicated as you like and then challenge other students to complete it. Have fun!

CAN YOU WORK OUT THIS SUDOKU PUZZLE?

You might have seen other Sudoku puzzles in the newspapers or puzzle books but this puzzle has a new twist. It doesn't have numbers but has symbols and colours in each square.

If you don't know the rules of solving a Sudoku puzzle here they are:

- Each row must contain a symbol only once
- Each column must contain a symbol only once
- Each of the nine smaller squares must contain a symbol only once



To make your own Sudoku, draw a grid with nine times nine boxes like the one above. Then fill in the boxes to follow the rules above. You should then begin removing shapes. Begin by removing one shape from each column, row and 3x3 square. The more you remove, the harder the puzzle will be to solve, so think about how difficult you want the puzzle to be.

Now try out your Sudoku with others!

CAN YOU WORK OUT THE NUMBERS WHICH SHOULD REPLACE THE LETTERS?

This is a simple set of equations in which different numbers have been replaced by letters. Each puzzle is slightly different and you will need to use logic and algebra to help you find the right answers.

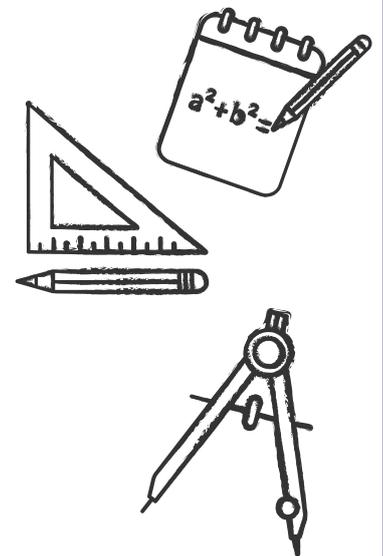
Only one of the equations can be worked out to begin with. Then you need to take those answers and apply them to the other equations until you have four right answers and know what each letter represents as a number.

$$A + D = 5$$

$$D - B = 2$$

$$(C + C) \times 2 = 12$$

$$A + C = 4$$



ANSWER:

A = B = C = D =

Algebra can be really satisfying to solve but what are the rules? Use a mnemonic based on the letters in ALGEBRA to explain this to someone easily.

Hint: You can start each sentence with a simple word. We have done the first two for you as examples!

A (Always)

L (Let)

G

E

B

R

A

CAN YOU WORK OUT THE RIGHT ANSWER TO OUR DICE PUZZLE?

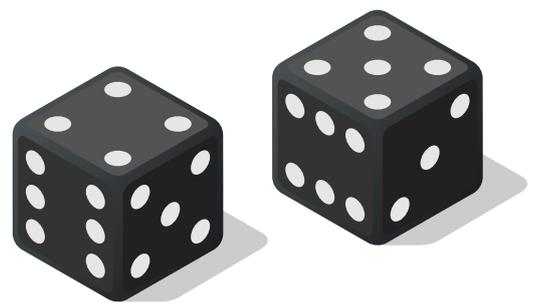
This is a probability question which means we have to use the information supplied to come to a mathematical solution.

The rules of probability should be familiar to you but check with your teacher if you are not sure.

If you've ever played a board game, you might just know the answers already!

Two dice are being rolled. What is the probability of getting

1. 2 sixes
2. 2 ones
3. 2 even numbers



ANSWER:

1 =

2 =

3 =

For a long time probability has been used for games. Investigate some family favourites e.g. Ludo, Snakes & Ladders, Monopoly. Can you explain why the rolling of the die or dice is so important to the outcome of each game and what sort of odds are involved. Feed back the results to your class in an appropriate way.

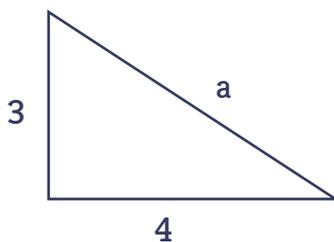
CAN YOU WORK OUT THE RIGHT ANSWER TO OUR SECRET TRIANGLE PUZZLE?

As you will know, there are lots of different rules for working with different sorts of triangles. It's useful to remember a few basics before we begin the problem below:

- A scalene triangle has no equal sides or angles
- A right angle triangle has one angle of 90 degrees
- An isosceles triangle has two equal sides and angles
- An equilateral triangle has three equal sides and angles
- Remember to think about Pythagoras as well!

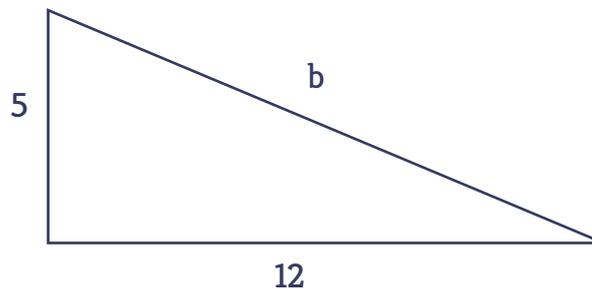
If you use the rules above, you should be able to find the three values for A, B and C and add them together.

Right-angled triangle



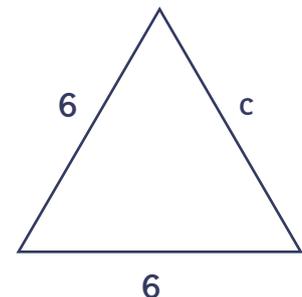
Find a.

Right-angled triangle



Find b.

Equilateral triangle



Find c.

Now find the value of $a + b + c$.

ANSWER:

A = B = C = TOTAL =

It is always really helpful to draw shapes like this, especially if you apply the logic and measure carefully.

See if you can create a triangle puzzle like the one above and share it with other students.

CAN YOU WORK OUT THE CODE TO HELP SOLVE THE EQUATION?

This is a slightly different code-breaking problem as you need to crack the code to solve the mathematics problem and then apply that information somewhere else.

We might call it a puzzle process!

See if you can crack each part of the process and come up with the final answer

Z = 1, Y = 2, X = 3, W = 4, V = 5 and so on is the code.

When you have the code clear in your head, apply it to the following information:

$$(A - C) + (F + Z) = \text{Answer 1}$$

$$(G + E) - C = \text{Answer 2}$$

$$(B + D) - A = \text{Answer 3}$$

Now write down the three number code.

ANSWER:

1 = **2 =** **3 =**

If you are feeling confident, see if you can teach the basics of code-writing and code-breaking to other students in your group or to younger students. See if you can share this effectively by writing down the main lessons to learn.

CAN YOU WORK OUT THE ANSWERS TO SOLVE THE BIGGER PUZZLE?

It is important to be able to process numbers in your head so try this puzzle without a calculator. You can always check your answers later.

In this situation, a very important box needs to be opened by putting a code into a padlock. There are four numbers in the code, starting with the smallest number and ranging to the largest.

You need to work out the sums to see what those numbers are!

$$(9 + 6 - 7) - (2 \times 4) = ?$$

$$(20 - 17) \times (2 + 1) = ?$$

$$\sqrt{81} + (0.5 \times 6) - 4 = ?$$

$$(7 \times 2) - \sqrt{9} - \sqrt{16} = ?$$



ANSWER:

If you did get the right answer without a calculator, that's great. Your brain is a brilliant computer, especially with numbers and words.

What are the rules of doing mathematical sums in your head? Do you have any personal paths which you follow? Can you find out what other students do? When you have done your research, share your thoughts by doing a presentation on 'Mental Arithmetic For All'.

CAN YOU WORK OUT THE BINARY NUMBERS IN THE EQUATION AND SOLVE IT?

Binary numbers are a different way of showing the same amounts as we generally use. In this puzzle, though, we have made it even more complicated than before by replacing binary numbers with letters.

You might want a quick reminder on the rules of binary numbers before we go any further on this particular puzzle!

64	32	16	8	4	2	1
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If we want to create a number like 7, we need to see how this is composed of the numbers above. e.g. $4 + 2 + 1$ would be the answer, If we use a number from the grid, we mark it as 1. If we don't use it, we mark it as 0. Therefore 7 becomes 111. If we wanted 6 e.g. $4 + 2 + 0$ in binary it would be 110.

In our puzzle below, the extra problem is that $b = 1$ and $a = 0$ in binary format. Can you solve the problem?

$$\mathbf{baab \times bbb \div babab = ?}$$

ANSWER:

Some people wonder why we have binary numbers. It might be a question you have asked yourself. Investigate the answers and find out:

- Who invented binary numbers?
- Why were they invented?
- Are they of practical use in the modern world?

Make a short presentation using an appropriate method to your class.

PUZZLE 1

3

PUZZLE 2

9

PUZZLE 3

26

PUZZLE 4

£1525.25

PUZZLE 5

12 (to the nearest whole number).

PUZZLE 6

Brian is 16; Susan is 4; Jacob is 21; Emily is 8; Melissa is 32.

PUZZLE 7

£138.80

PUZZLE 8

4, 7 & 9

PUZZLE 9

Please send money. What is your name?

PUZZLE 10

2

PUZZLE 11

13

PUZZLE 12

You should be directly underneath Garciabb at a distance of 1cm.

PUZZLE 13

The triangles should form the shape of a number 2.

PUZZLE 14

Check you have obeyed all the rules and you have the right answer. If not, have another go!

PUZZLE 15

A = 1, B = 2, C = 3, D = 4

PUZZLE 16

1. $\frac{1}{36}$ 2. $\frac{1}{36}$ 3. $\frac{1}{4}$

PUZZLE 17

A = 5, B = 13, C = 6 Total = 24

PUZZLE 18

C(Coding) I(Is) E(Excellent)

PUZZLE 19

0789

PUZZLE 20

9 multiplied by 7 divided by 21 = 3