Maths: Algebraic Thinking

This week we are looking at solving puzzles that will develop the skills you need to understand algebra. Algebra doesn't just mean equations and letters like, but is all about skill of working out something that is unknown from clues.

Monday: Working Backwards

- When we work backwards we use the inverse operations to 'undo' a calculation. This skill helps you to solve algebra problems when you get older.
- What is the inverse of: a) halving? b) adding? c) dividing?

(Answer for parents: a) doubling b) subtracting c) multiplying)

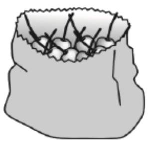
- Play a I'm thinking of a number game with someone: I'm thinking of a number. I double it, then subtract 5. My answer was 135. What was my number?
- Solve these empty box calculations by working backwards: □ + 578 = 2309 □ x 9 = 270 □ ÷ 4 = 92 □ - £5.99 = £8.76

Year 6 super challenge!

Can you have a go at this word problem, using the working backwards strategies you have been practicing?

16
[2010]

Sarah had a bag of cherries.



She ate 5 cherries, then gave half of what she had left to Liam.

Liam ate 5 of his cherries, then gave half of what he had left to Amy.

Amy got 2 cherries.

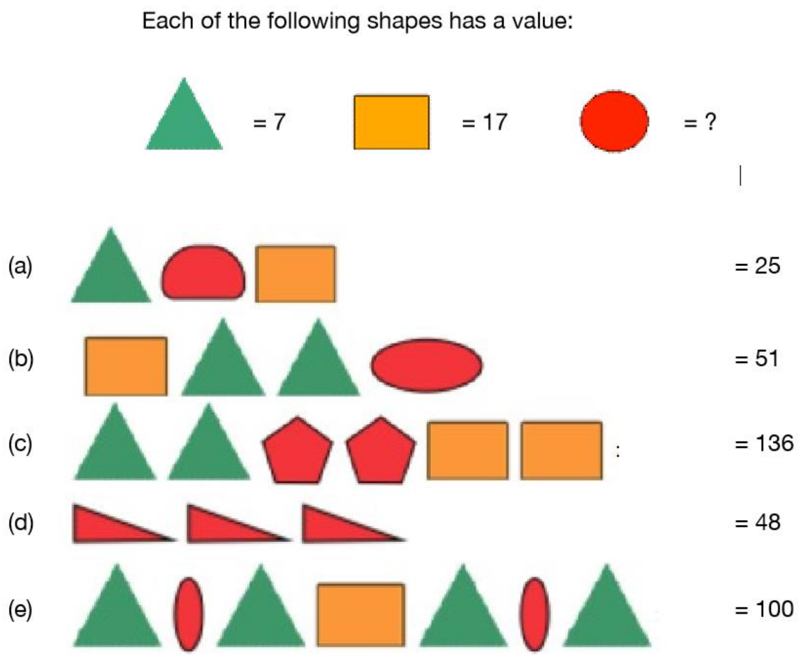
How many cherries did Sarah have in her bag at the start?

Show your method

[2 marks]

Tuesday: Super Shapes

- This problem will require you to use your working backwards skills from yesterday.



- Can you work out the value of the red shape in each calculation?
- Hint: First substitute in the values you know for the green triangle and yellow rectangle. Then you will need to use your working backwards skills (inverse operations) to find out what they red shape must be worth. Once you have an answer, check it into the calculation and seeing if it works.
- If you prefer, you can download and print a version of this below. There is also a more advanced challenge that Year 5 & 6 might like to try!

Year 6: You may like to challenge yourself further with substituting values to find the answer to a calculation, this is a key skill of algebra. Can you crack the Maths code? All you need to do is substitute in the value for each letter and complete the complete the mathematical calculation. For example, if b is worth 3 and the calculation said 'b- 3', we would substitute in what b is worth, so our new calculation is 3-3, which is 0.There are few rules with algebra to remember. If a letter is directly next to a letter, for example 3b, this means you have to multiply whatever B is worth by 3. Any letter direcltly next to a number, means you will have to multiply whatever the letter is worth by the number it is next to. If the letter is above a line (a bit like a fraction), this is asking you to divide whatever the letter is worth by the number below. Using this information, can you crack the code?

Mathematics Code Breaker

In the following expressions, a = 5, b = 3, c = 10, d = 100. Substitute into each expression to get your answer. Then look at the table below to see which letter your answer represents. Fill that into the blanks underneath to reveal a **HILARIOUS** maths joke.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

$17 + a$ $c - 3$ $b - 3$ $b + c + 6$ $\frac{d}{10}$ $b + 5$ $c + b$ $13 - c$ $5b - 1$ $2b - 1$ $3a + 4$ $2c - 3$ $\frac{400}{d}$ $\frac{c}{2} - 1$

____ ____ ____ ____   ____ ____ ____ ____   ____ ____   ____ ____ ____ ____

$\frac{9}{b}$ $\frac{d}{a} - 6$ $3a - 11$ $6b$ $\frac{d}{10} - c$ $4b$ $c - 2a$ $4a - 1$ $c - b$ $\frac{d}{a} - 2$

____ ____ ____ ____   ____   ____ ____ ____ ____ ____

$2c - 1$ $\frac{d}{25}$ $d - 100$ $\frac{c}{a}$ $2c - 13$ $½c - 1$ $b^2 + 8$ $d \div c \div a$ $2c - b^2$ $a^2 - 17$ $3(a - 1)$ $\frac{d}{c^2}$

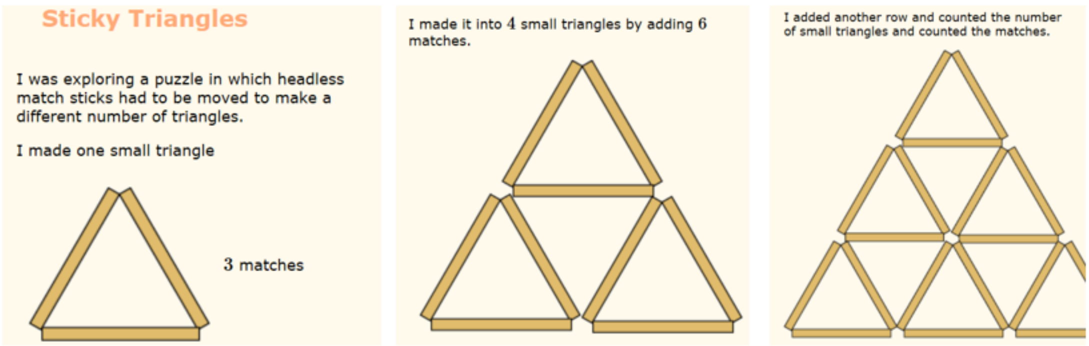
____ ____ ____ ____ ____ ____ ____   ____ ____ ____ ____ ____ ?

$b^3 - 3b$ $a^2 - 1$ $c + 2$ $d - 88$ $b^2 - a$ $7b - 2$ $bc - 13$ $b^2 + 3a$

____ ____ ____ ____ ____ ____ ____ ____ !!

Wednesday: Triangle Investigation

- You can explore today's puzzle using matchsticks, cocktails sticks, felt pens or anything else similar you have at home. You can also simply draw the lines.



How many matches does each triangle in the pattern use?
How can you record your investigation?
What patterns can you see?
Is there a link between the number of rows and the total number of matches?
Is there a link between the number of small triangles and the total number of matches?
Is there a way of predicting how many will be in the 10th pattern without making it?

- If you get struck, try a table like this to record your results:

row	number of triangles	number of sticks

Year 6: We can use algebra as a way of expressing or finding a rule for a pattern, allowing us to find for instance the 100th number of a pattern, without writing on drawing out the sequence up to 100.

For example,

Have a look at the squares and circles pattern below:

We can express these patterns using algebra. In the first picture of the first pattern, there is 1 square and 4 circles. I could record this in my table. In the 2nd picture, there are 2 squares and 6 circles and in the 3rd picture, there are 3 squares and 9 circles. After you have entered this information into your table, you may be able to spot a pattern. I found for the first pattern, the number of squares is multiplied by 2 and another 2 is added to find the total number of circles.

If you take the first picture 1 square x 2 = 2

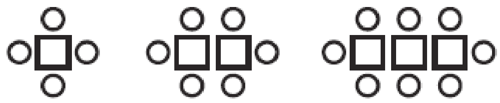
2+ 2 = 4 circles.

I could express this pattern using algebra

$C = 2S + 2$

(C= Circle)

(Remember, when you put a number directly next to a letter, you are showing that the number substituted for the letter should be multiplied by the number next to it.



S			
C			

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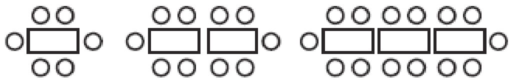

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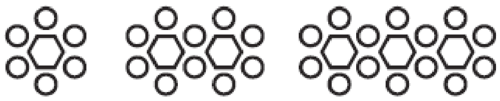

S			
C			

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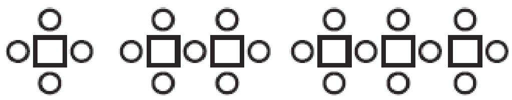

S			
C			

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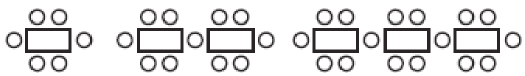

S			
C			

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Can you have a go at expressing the rest of the patterns with an algebraic equation. I will include the answers for you to check back with.

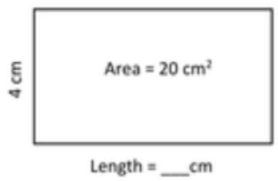
Super challenge: Can you work out the algebraic equation for the Sticky triangles pattern?

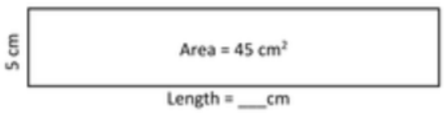
<u>Thursday: Using algebra for area & perimeter.</u>

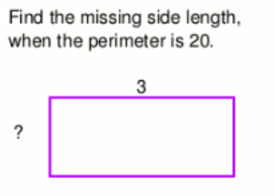
Today we are going to look at area and perimeter. Remember, perimeter is the length around the whole of the shape, which can be worked out by adding each length of the shape together. Area is space inside of a shape and can be worked out by multiplying the length by the width of the shape.

The area of a rectangle can be worked out using an algebraic formula: area = length x width. The perimeter of a rectangle can also be worked out: perimeter = (2 x length) + (2 x width)

- Using this knowledge you can work out missing dimensions on rectangles. Similar to the work on Monday & Tuesday, you will need to substitute what you know into the formula and then work backwards to find the missing information.
- If a rectangle has an area of 36 cm^2 and the rectangle is 4cm wide, what is its length?
- If a rectangular field has a perimeter of 40 metres and one of the sides is 10m long, how long is the other side?







Year 6: Can you fill in this table, using the formulae you know to work out perimeter and area?

Remember:

Area = lw (length x width)

Perimeter = 2 (l + w) or 2 lots of length plus width.

Length	Width	Perimeter	Area
8cm	5cm		
7cm			$21cm^2$
	6cm	32cm	
9cm		26cm	
	10m		$200m^2$
12m			$24m^2$
	8m		$120m^2$

Friday: Can you use the skills you have learnt this week to solve these problems?

Plenty of Pens

rainbow pens = 15p each
plain pencils = 10p each

BRONZE: Amy went into the shop with £2.50 to spend. She left with 40p change and some pencils. How many pencils did she buy?

SILVER: Emily went into the shop with £2.50 to spend. She left with 40p change and bought a mixture of pens and pencils. How many of each might she have bought? Can you find more than one solution?

GOLD: Jenny went into the shop with £2.50 to spend. She left with 40p change. She bought four times as many pens as she did pencils. How many of each did she buy?

Year 6: Can you have a go at these questions, using the algebraic knowledge we have used this week?

Algebra Word Problems

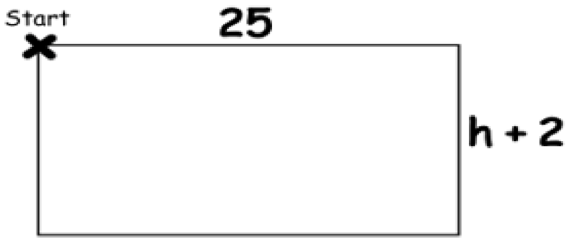
1) Andy buys ***k*** packets of crisps. Laura buys 2 more packets of crisps than Andy.
   a. Write an expression for the total number of packets of crisps.

   b. There were 14 packets of crisps bought altogether. How many did Andy buy?

   c. Each packet of crisps cost 60p. How much did they each spend?

2) Katie has 3 times more sweets in her bag than James. If they have 36 sweets altogether, how many sweets do they each have?

3) I walk around the edge of a field. I start at the point marked with a cross and walk around the field until I get back to where I started.



(in metres)

   a. How far would I have walked if ***h*** = ***10***?

   b. If I walked a total of 78 metres, what would the value of ***h*** be?

4) On a Saturday a Taxi driver charges £10 plus 50 pence per mile. If he drives a passenger 100 miles, how much will the passenger have to pay?