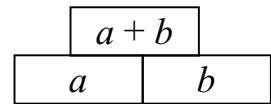
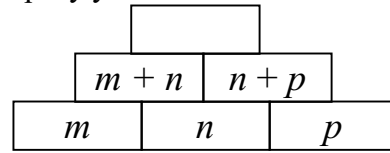


## SAT REVISION, LEVELS 5–7; Algebra 1

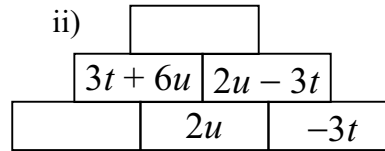
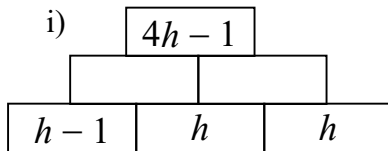
1) In these walls each brick is made by **adding** the **two** bricks underneath it.



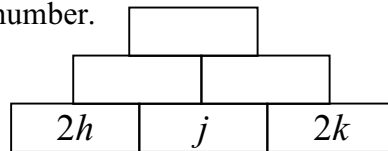
a) Write an expression for the top brick in this wall. Simplify your answer.



b) Fill in the missing expressions in these walls. Simplify your answers.

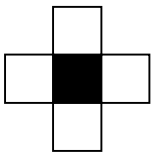


c) In the wall below,  $h, j$  and  $k$  can be any whole numbers. Explain why the top brick of the wall must **always** be an **even** number.

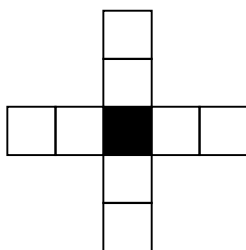


2) Steve is making a series of patterns with black and white square tiles.

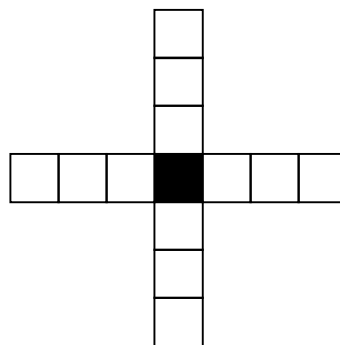
Pattern 1



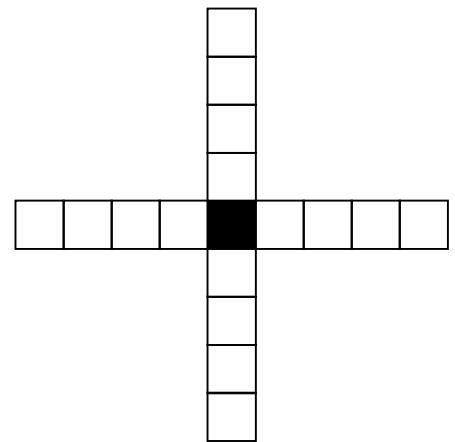
Pattern 2



Pattern 3



Pattern 4



a) Each pattern has 1 **black** tile at the **centre**. Each **new** pattern has more **white** tiles than the one before. How many **more** white tiles does Steve add each time he makes a new pattern?

b) Steve says “The rule for finding the number of tiles in pattern number  $N$  is:

$$\text{number of tiles} = 4 \times N + 1$$

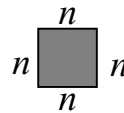
The **1** in Steve’s rule represents the black tile. What does the  $4 \times N$  represent?

c) How many **black** tiles and how many **white** tiles will Steve need for the 15<sup>th</sup> pattern?

d) Steve uses **41** tiles altogether to make a pattern. What is the number of the pattern that he makes?

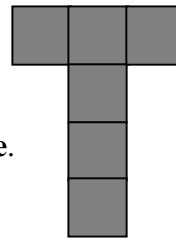
e) Steve has **12** black tiles and **80** white tiles. What is the number of the **biggest** pattern Steve can make?

- 3) This is a square tile with each edge of length  $n$  centimetres.



The **perimeter** of the tile is  $4n$  centimetres.

This **T-shape** is made with 6 square tiles.



- a) Write an **expression** for the **perimeter** of the **T-shape**.

The expression should be a **number multiplied by  $n$** .

- b) The perimeter of the T-shape is 28 centimetres.

Use your expression from part a) to write an **equation** involving  $n$ .

Solve your equation to find  $n$ .

- 4) Four people play a game with counters. Each person starts with one or more bags of counters. Each bag has  $m$  counters in it.

The table shows what happened during the game.

	<b>Start of game</b>	<b>During game</b>	<b>End of game</b>
<b>Lisa</b>	3 bags	lost 5 counters	$3m - 5$
<b>Ben</b>	2 bags	won 3 counters	$2m + 3$
<b>Cal</b>	1 bag	lost 2 counters	
<b>Fiona</b>	4 bags	won 6 counters and lost 2 counters	

- a) Copy and complete the table to show how many counters **Cal** and **Fiona** had at the end of the game.

- b) At the end of the game, **Lisa** and **Ben** had the **same** number of counters. Write an **equation** to show this.

- c) Solve this equation to find  $m$ , the number of counters in each bag at the start of the game.

- 5) Class 9H were playing a number game. Jane said “*Multiplying my number by 4 and then subtracting 5 gives the same answer as multiplying my number by 2 and then adding 1.*”

- a) Sarah called Jane’s number  $x$  and formed an equation:  $4x - 5 = 2x + 1$ .

Solve this equation and write down the **value** of  $x$ .

- b) Aled said “*Multiplying my number by 2 and then adding 5 gives the same answer as subtracting my number from 23.*”

Call Aled’s number  $y$  and form an equation involving this number  $y$ .

Work out the value of Aled’s number.

- c) Sarah thought of two numbers which she called  $a$  and  $b$ .

She wrote down this information about them in the form of equations:  $a + 3b = 25$   
 $2a + b = 15$

Solve these **simultaneous equations** to find the values of  $a$  and  $b$ .

ANSWERS.

- 1) a)  $m + 2n + p$ ,                      b) i)  $2h - 1, 2h$ , ii)  $3t + 4u, 8u$ ,  
c) top brick =  $2h + 2j + 2k$  which is a sum of even numbers and must therefore be even.
- 2) a) 4,    b) the number of white tiles,  
c) 1 black, 60 white,    d) pattern 10,    e) pattern 20.
- 3) a)  $14n$ ,    b)  $14n = 28, n = 2$ .
- 4) a) Cal =  $m - 2$ , Fiona =  $4m + 4$ ,                      b)  $3m - 5 = 2m + 3$ ,    c)  $m = 8$ .
- 5) a)  $x = 3$ ,    b)  $2y + 5 = 23 - y, y = 6$ ,    c)  $a = 4, b = 7$ .

## SAT REVISION, LEVELS 5–7; Algebra 2

- 1) A sequence of dot-patterns is shown:
- |           |           |           |           |
|-----------|-----------|-----------|-----------|
| Pattern 1 | Pattern 2 | Pattern 3 | Pattern 4 |
| **        | **        | **        | **        |
|           | *****     | *****     | *****     |
|           |           | *****     | *****     |
|           |           |           | *****     |

a) Copy and complete the following table:

Pattern number	Number of dots
1	2
2	7
3	12
4	17
5	.....
6	.....

b) Harry thinks the rule for the number of dots is:

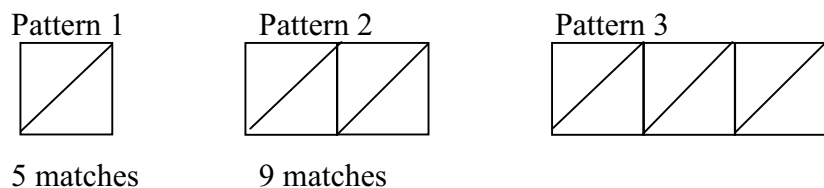
*“Multiply the pattern number by 4 and then subtract 2”*

Show clearly that Harry is **incorrect**.

c) Using the letter  $N$  to stand for the pattern number and  $D$  to stand for the number of dots, write down the actual rule, using algebra, in the form:

$$D = \dots\dots\dots$$

2) The following patterns are made from match sticks.



a) How many matches are there in pattern 4 ?

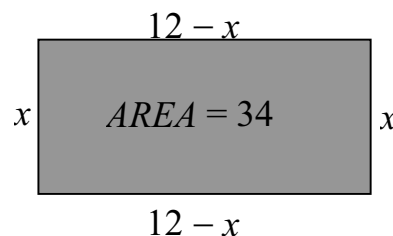
b) Copy and complete the formula for the number of matches in the  $N^{\text{th}}$  pattern:

*Number of matches in the  $N^{\text{th}}$  pattern = .....*

c) Which Pattern number will contain 61 matches?

3) Lucy makes a rectangle, out of card, with an area of  $34 \text{ cm}^2$ . The sides of Lucy’s rectangle are  $x \text{ cm}$  and  $(12 - x) \text{ cm}$ .

She wants to find a value of  $x$  so that  $x(12 - x) = 34$ .



Use trial and improvement to find the value of  $x$  to 1 decimal place.

4) The table below shows values of  $x$  and  $y$  for the equation  $y = x^2 + x - 5$ .

a) Copy and complete the table.

$x$	-2	-1	0	1	2	3
$y$				-3	1	7

b) The value of  $y$  is 0 for a value of  $x$  between 1 and 2. Use trial and improvement to find the value of  $x$ , to 1 decimal place, that gives the value of  $y$  closest to 0.

- 5) Karen is trying to find the radius of a circle which has an area equal to that of a square of side 4 cm. She tried circles of radius' 4 cm, 3 cm and 2 cm and started to make a table to find a solution.

$r$	Area of circle of radius $r$
4	50.265482cm <sup>2</sup>
3	28.274334cm <sup>2</sup>
2	12.566371cm <sup>2</sup>

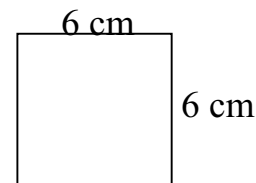
- a) Show how Karen got her AREA for the circle of radius 4 cm.
- b) Explain why the table shows that Karen's required circle has a radius between 2 cm and 3 cm.
- c) Copy the table and use trial and improvement to find the required radius, to **one** decimal place, which gives the required area for the circle.
- 6) The formula  $\frac{x}{\sqrt{x^2 + y^2}}$  is used when calculating angles in a right-angled triangle.
- a) For a particular triangle, Sarah chooses the values  $x = 4$  and  $y = 6.5$ .  
Work out the value of  $\frac{4}{\sqrt{4^2 + 6.5^2}}$ . **Write down the buttons you pressed on your calculator.**
- b) For a second, different triangle, Sarah chooses the values  $x = 3.2$  and  $y = 7.4$ .  
Work out the value of the above formula using these new values of  $x$  and  $y$ .

- 7) The formula  $\frac{\sqrt{3}}{\sqrt{3y^2 - x^2}}$  is associated with certain tetrahedrons..

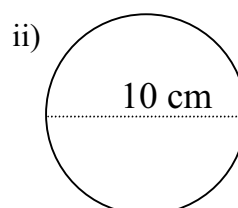
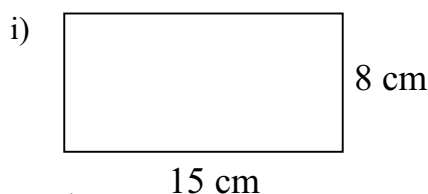
- a) For a particular tetrahedron, Sarah chooses the values  $y = 10$  and  $x = 6.5$ .  
Work out the value of  $\frac{\sqrt{3}}{\sqrt{3 \times 10^2 - 6.5^2}}$ . **Write down the buttons you pressed**
- b) For a second, different tetrahedron, Sarah chooses the values  $y = 13.2$  and  $x = 7.4$ .  
Work out the value of the above formula using these new values of  $y$  and  $x$ .

- 8) The compactness value,  $C$ , of a shape can be calculated using the formula:  $C = \frac{4A}{\pi K^2}$ .  
The **area** of the shape is  $A$ .  
The **distance** between two points in the shape that are **furthest apart** is  $K$ .

- a) **Calculate** the compactness value for this square.  
{The distance  $K$  is the length of a diagonal.}



- b) **Calculate** the compactness value for these shapes:



ANSWERS.

1) a) 22, 27, b) check on pattern 2 for example,

c)  $D = 5N - 3$ .

2) a) 17, b)  $4N + 1$ , c) 15<sup>th</sup> pattern.

3)  $x = 4.6$  or  $7.4$ .

4) a) 

$x$	-2	-1	0	1	2	3
$y$	-3	-5	-5	-3	1	7

 b)  $x = 1.8$ .

5) a)  $\pi \times 4^2$  etc. b) the required area of  $16 \text{ cm}^2$  lies between the areas of the circles obtained when  $r = 2$  and  $r = 3$  etc.

c)  $r = 2.3 \text{ cm}$ .

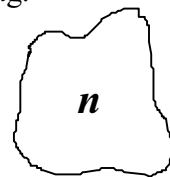
6) a) 0.524097425, b) 0.39691115.

7) a) 0.107885055, b) 0.080067498.

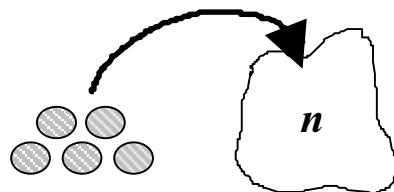
8) a) 0.636619772, b) i) 0.528680779, ii) 1.

## SAT Topic sheet: Expressing formulas symbolically

- 1) a) Elin has a bag of marbles. You cannot see how many marbles are inside the bag.  
Call the number of marbles which Elin starts with in her bag  $n$ .

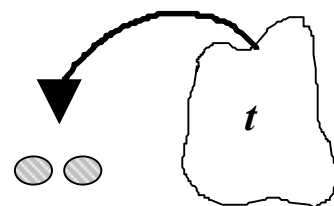


Elin puts **5 more** marbles **into** her bag.



Write an expression to show the total number of marbles in Elin's bag now.

- b) Ravi has another bag of marbles.  
Call the number of marbles which Ravi starts with in his bag  $t$ .

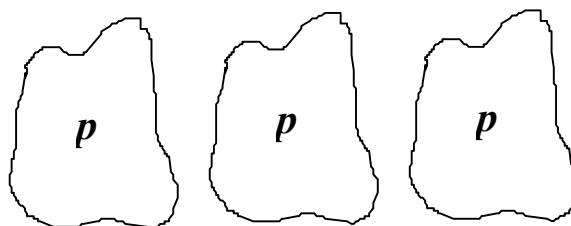


Ravi takes **2** marbles **out** of his bag.

Write an expression to show the total number of marbles in Ravi's bag now.

- c) Jill has **3** bags of marbles.

Each bag has  $p$  marbles inside.



Jill takes some marbles out.

Now the total number of marbles in Jill's 3 bags is  $3p - 6$ .

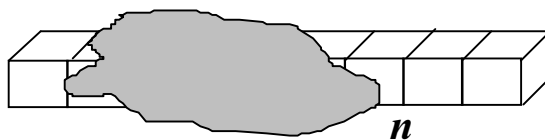
**Some** of the statements below **could** be **true**. For each statement, state whether it could or could not be true.

- Jill took **2** marbles out of **one** of the bags, and **none** out of the other bags.
- Jill took **2** marbles out of **each** of the bags.
- Jill took **3** marbles out of **one** of the bags, and **none** out of the other bags.
- Jill took **3** marbles out of each of **two** of the bags, and **none** out of the other bag.
- Jill took **6** marbles out of **one** of the bags, and **none** out of the other bags.
- Jill took **6** marbles out of each of **two** of the bags, and **none** out of the other bag.

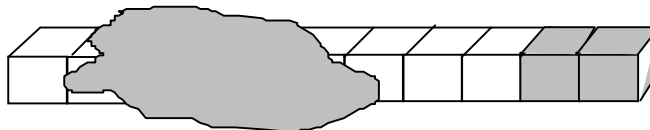
- 2) Jo is planting a small orchard. She plants **cherry** trees, **plum** trees, **apple** trees and **pear** trees.  
 $n$  stands for the number of **cherry** trees Jo plants.

- Jo plants the **same** number of **plum** trees as **cherry** trees. How many **plum** trees does she plant?
- Jo plants **twice** as many **apple** trees as **cherry** trees. How many **apple** trees does she plant?
- Jo plants **7 more** **pear** trees than **cherry** trees. How many **pear** trees does she plant?
- How many trees does Jo plant **altogether**? Write your answer as simply as possible.

- 3) Jenny is holding a row of cubes. You cannot see exactly how many cubes she is holding. Call the number of cubes she is holding  $n$ .



- a) She joins on **two more** cubes.

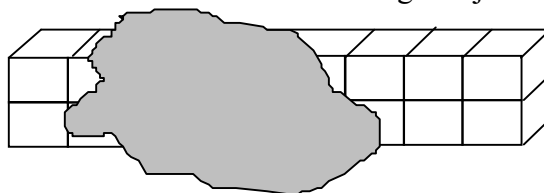


Write an expression for the total number of cubes she is holding now.

- b) Jenny starts again with  $n$  cubes. **One** cube is **removed**.

Write an expression for the total number of cubes she is holding now.

- c) Jenny starts again with  $n$  cubes. **Another row** of the same length is joined on.



Write an expression for the total number of cubes she is holding now.

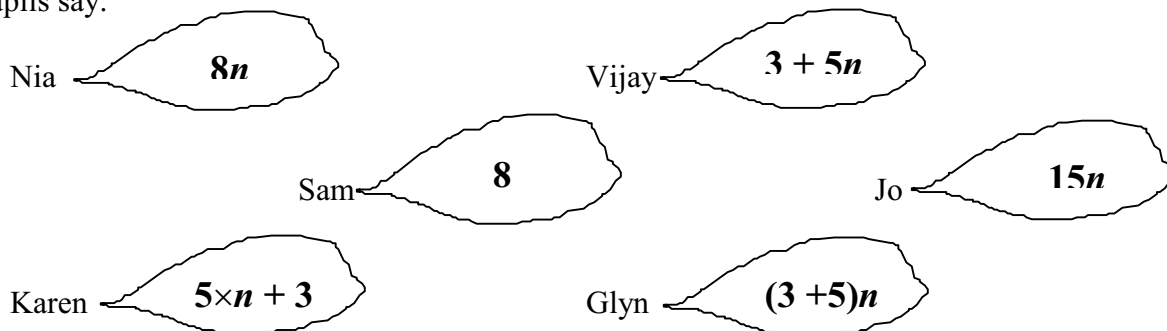
- d) Jacob also has some cubes in his hands. In one hand there are  $2n - 1$  cubes.  
In the other hand there are  $2(n - 1)$  cubes.  
Is Jacob holding the same number of cubes in each hand? **Explain your answer.**

- 4) A teacher has 5 bags of marbles and 3 extra marbles. Each bag has  $n$  marbles inside.



She asks: 'How many marbles are there altogether?'

The pupils say:



- a) Name one pupil who is **right**.                      b) Name another pupil who is **right**.
- c) There are 88 marbles altogether. Fill in one pupils right answer to help you complete the equation:

..... = 88.

Solve the equation to find  $n$ , the number of marbles in a bag.

ANSWERS.

- 1) a)  $n + 5$ , b)  $t - 2$ , c) b, d and e could be true.
- 2) a)  $n$ , b)  $2n$ , c)  $n + 7$ , d)  $5n + 7$ .
- 3) a)  $n + 2$ , b)  $n - 1$ , c)  $2n$ , d) No.
- 4) a) Vijay or Karen, b) Karen or Vijay, c)  $n = 17$ .