21 Expressions and equations

Notesheet 1

Expressions with variables

1 Find the value of the expression $\mathbf{3a + 15}$ for different values of the variable $\boldsymbol{a}$:

if $\boldsymbol{a} = \mathbf{1}$ then $\mathbf{3a + 15} =$ if $\boldsymbol{a} = \mathbf{10}$ then $\mathbf{3a + 15} =$
if $\boldsymbol{a} = \mathbf{0.5}$ then $\mathbf{3a + 15} =$ if $\boldsymbol{a} = \mathbf{1000}$ then $\mathbf{3a + 15} =$

2 What is the smallest value the expression can have?
Explain.
What is the largest?
Explain.

3 Let the value of the expression be about 25.
About how much will the unknown $\boldsymbol{a}$ be?
How did you work that out?

4 Suppose you want to work as accurately as you can.
If $\mathbf{3a + 15 = 25}$, how do you find the value of the unknown $\boldsymbol{a}$?

5 Jean is solving another equation $\mathbf{6b + 2 = 11}$
She is breaking and building expressions. She writes: $\mathbf{6b + 2 = 11 = 9 + 2}$
Why do you think that helps her?

Jean breaks the $\mathbf{6b}$ into $\mathbf{2b + 2b + 2b}$ and the $\mathbf{9}$ into _____ + _____ + _____
Complete the solution to find the value of the unknown $\boldsymbol{b}$.

Solve the equation $\mathbf{6b + 2 = 11}$ in another way.

6 Use a similar method to solve the equation $\mathbf{4n + 20 = 32}$

21 Expressions and equations

Notesheet 2

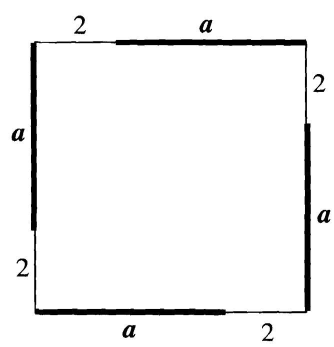
Equations

1 Solve the equation $3x + 5 = 2x + 9$

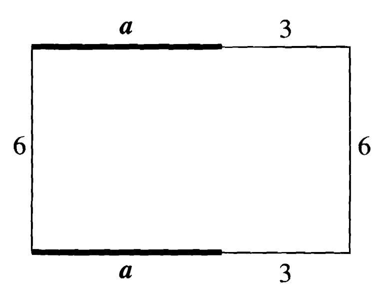
2 Solve: $5d - 6 = 3d + 12$

3 Pritesh is solving $3(2p + 1) = 5p + 8$
He writes: $2p + 1 + 2p + 1 + 2p + 1 = 5p + 8$
Why is this OK?
How can he use this to find the value of p?

4 Four rods of unknown length a were used to make the perimeter of a square, with an extra 2 foot length on each side.
Write an expression for the perimeter.



Two of the same rods were used in the perimeter of this rectangle.
Write an expression for the perimeter.



The perimeter of the square and the perimeter of the rectangle are exactly the same length.
Construct and solve an equation to find the length of the rod a.

23 Rates of change

Notesheet 1

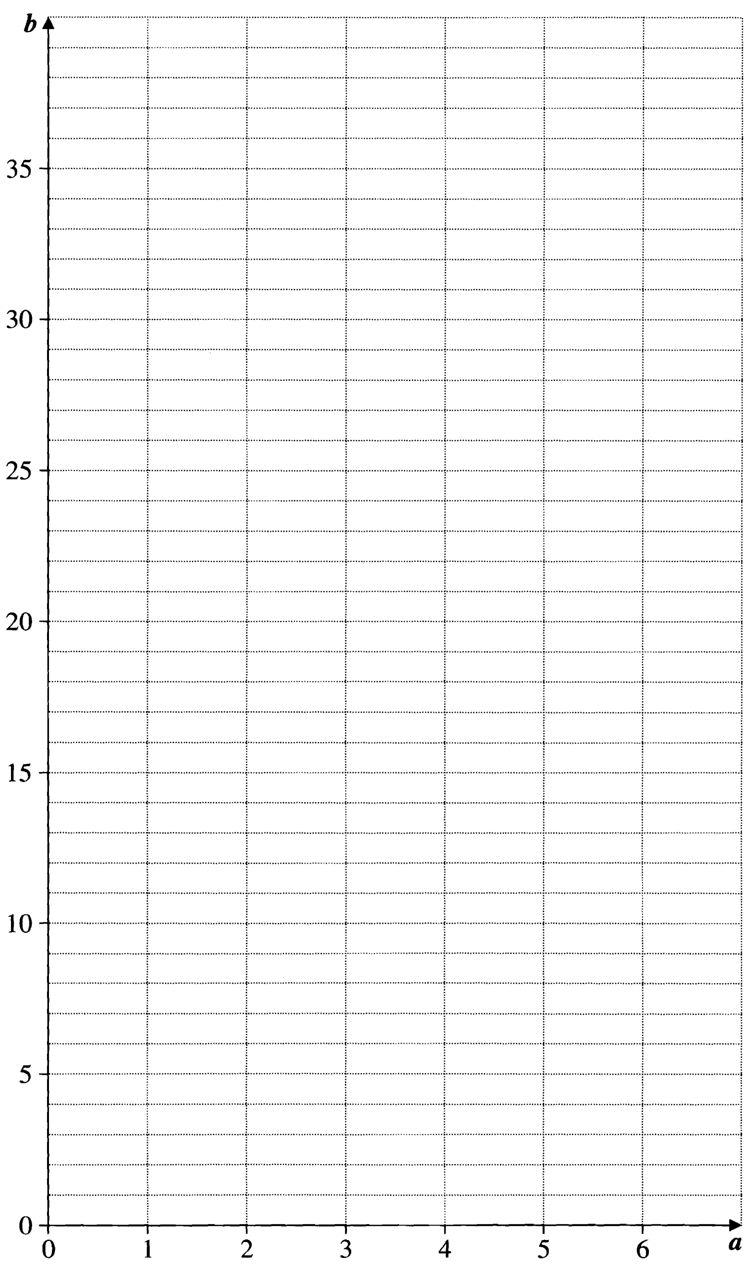
1 Fill the table for the function $\boldsymbol{b} = \boldsymbol{4a}$.

2 How is $\boldsymbol{b}$ changing?

3 Is there a pattern in the changes?

4 Plot the graph of the function $\boldsymbol{b} = \boldsymbol{4a}$.

a	$b = 4a$	Change in b
0	0	4
1	4	
2	8	
3	–	
4	–	
5	20	
6	–	



5 Start from the point (1,4)
Draw across the **step** from $\boldsymbol{a} = \boldsymbol{1}$ to $\boldsymbol{a} = \boldsymbol{2}$.
Draw up the matching **rise** of $\boldsymbol{b}$.
Draw up the **step** and **rise** starting from the point (4,?).

6 Look at the **rise** in $\boldsymbol{b}$ for the same **step** in $\boldsymbol{a}$, from different starting points of the graph. What can you say about the steps and rises?

23 Rates of change

Notesheet 3

Steady rising and rising ever faster

1 Here is the height of a **weather balloon** as it rises.
Fill in the table.

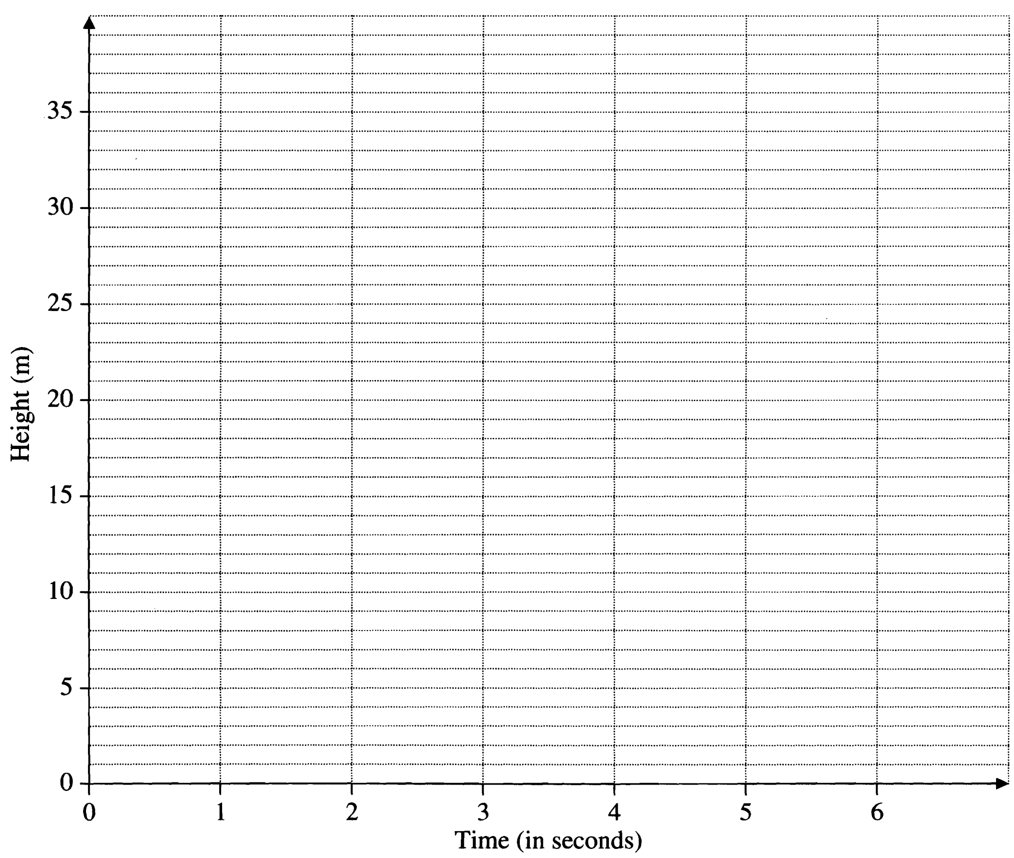
Time (seconds)	Height (metre)	Change in height
0	0	6
1	6	
2	12	
3	18	
4	24	
5	30	
6	36	

2 Here is the height of a rocket as it rises.
Fill in the table.

Time (seconds)	Height (metre)	Change in height
0	0	1
1	1	
2	4	
3	9	
4	16	
5	25	
6	36	

3 Plot the graph for the balloon.

4 Plot the graph for the rocket.



5 Describe the **difference** in the way the balloon and the rocket rise.

6 What can you say about the speed of rising of the rocket between say, 1 and 2 seconds and between 3.5 and 4.5 seconds?

23 Rates of change

Notesheet 2

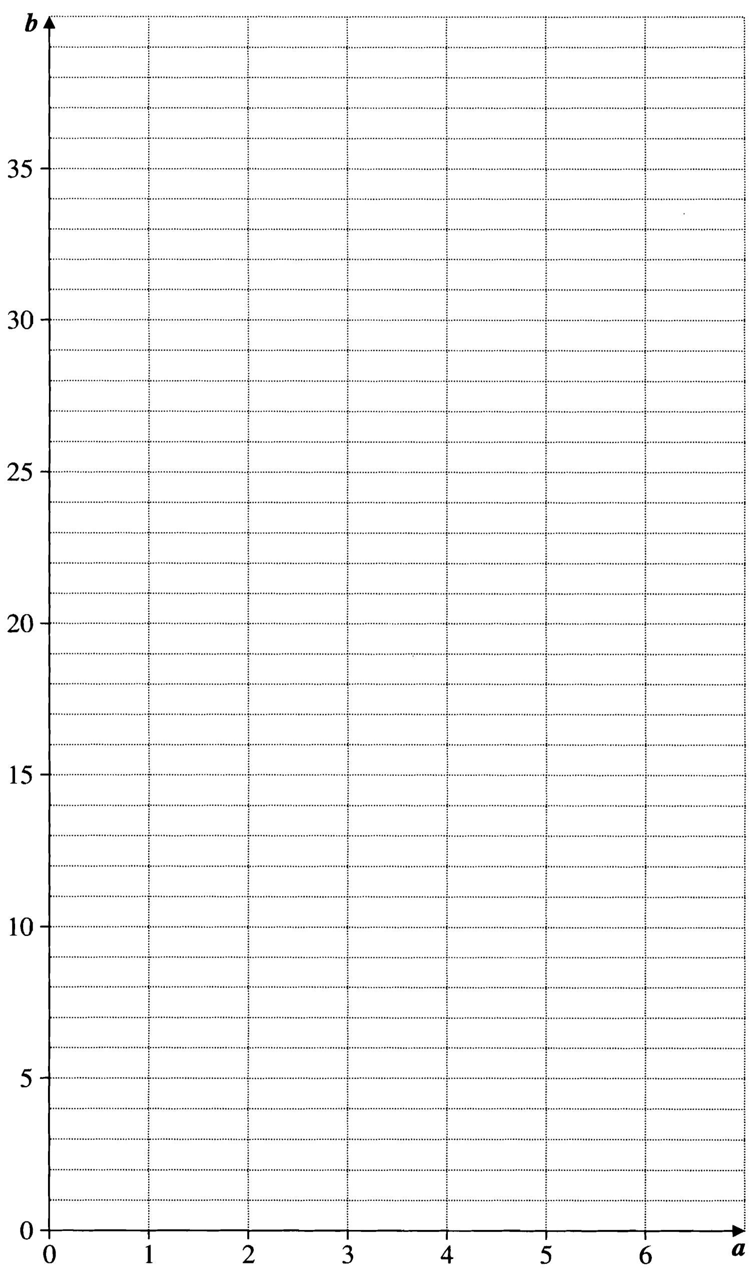
1 Fill the table for the function $\boldsymbol{b} = \boldsymbol{a}^2$.

2 How is $\boldsymbol{b}$ changing?

3 Describe the **pattern in the changes**.

4 Plot the function $\boldsymbol{b} = \boldsymbol{a}^2$.

a	$b = a^2$	Change in b
0	0	–
1	1	1
2	4	3
3		
4		
5	25	
6		



5 Start with the point (1,1) Draw across the **step** in $\boldsymbol{a}$, and draw up the corresponding **rise** in $\boldsymbol{b}$. Do the same starting from the point (5,?).

6 Look at the **rise** in $\boldsymbol{b}$ for the same **step** in $\boldsymbol{a}$, from different starting points of the graph. What can you say about them?

7 Copy the line for $\boldsymbol{b} = 4\boldsymbol{a}$ on to the same axes as $\boldsymbol{b} = \boldsymbol{a}^2$. What do you notice about the graphs of the two functions?

26 Chunking and breaking-up

Notesheet 1

1 First **scan** the number sentence, then **chunk** to find the total.

199 + 87 + 46 + 24 + 1 + 10 + 3 + 4

2 Scan and then chunk to find the total.

9.5 + 8.2 + 1.5 + 1.8 + 0.2 + 6.5 + 0.5

3 Explain why your method of scanning and chunking is useful, to someone who does not use it. Give an example of your own.

4 Break up the money parts as you want, but use brackets to keep the money parts together. Then do the multiplication by using the parts before adding everything together.

6 × £5.22

5 How would you explain this sort of multiplication by parts to someone who does not know it?

6 Now do:

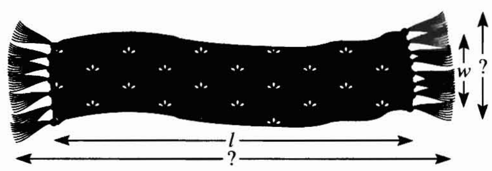
6 and a half times £5.22 (or 6.5 × 5.22)

26 Chunking and breaking-up

Notesheet 3

One pair and two pairs of brackets

A workshop makes silk scarves for a shop.
The shop decides the *final length and width* required for each scarf. Call these l and w.
The workshop calculates the *starting size of the rectangle* of silk by adding 18 cm to the length for the tassels and 4 cm to the width for the edging.
It charges the shop by the area of the starting size of the rectangle of silk used in the scarf.



1 Write an expression for the **starting width** for any size scarf.

Write an expression for the **starting length**.

2 Write a mathematical expression for the **starting area** of any size scarf.

3 Multiply out your answer to question **2** to give four chunks in a new expression.

Write down the meaning of each chunk. (Use arrows, or rings, or colours.)

4 The **price of silk** itself ranges between 25p and 90p for each 100 square cm, depending on its quality.
Estimate a price for silk of an average quality: _______ per 100 square cm.
Choose a **final width** of scarf _______ and a **final length** of scarf _______.
Calculate the cost for the **starting size** of the rectangle of the silk needed.

5 The workshop charges £8 per scarf for working, and adds this to the price of the silk.
Write the expression (not the calculation) for the **price of 12 of your chosen scarves**.

6 Which of the numbers in your expression **can be made into variables**, so that they can be changed from time to time, keeping the expression the same? (Make sure you keep track of what each letter you use stands for.)

26 Chunking and breaking-up

Notesheet 2

Chains and pendants

A jewellers' shop sells gold pendants with gold chains that can be of any length.

A pendant weighs 12 grams, while the chain weighs 0.5 gram per centimetre.

The price per gram of gold changes from day to day. Today the price is £7 exactly.

1 **(a)** Choose a length of chain in cm. _________
Work out the cost of gold in your pendant. _________
(b) Write in words how you can work out the cost of any length chain.

2 Write the cost of a gold pendant with any length chain using symbols.

3 How many **chunks** are there in your expression? _________
Write the meaning of each chunk in your expression.
(Use arrows, or rings, or colours.)

4 The cost of gold in one pendant with chain is £224. Work out its chain length. _________
Explain your working, step by step. (You may want to make an **equation**.)

5 The jeweller charges £15 extra for carving your initials on the pendant.
Calculate the price of your pendant and chain with your initials carved. _________
Write a mathematical expression for the **price for any pendant with initials carved**.

6 The shop makes special pendants in groups of 10 with chain of length L.
Write a mathematical expression of the **total price of gold only for any group of 10 pendants**.