

# 1 Calculations

## Section 1: Basic calculations

### HOMEWORK 1A

**Solve these problems using written methods. Set out your solutions clearly to show the methods you chose.**

- How many 12-litre containers can be completely filled from a tanker containing 783 litres?
- A train is travelling at a constant 64 mph.
  - How far does it travel in  $1\frac{1}{2}$  hours?
  - How long does it take to travel 336 miles?



#### Tip

64 mph means the train travels 64 miles each hour.

- A train starts a journey with 576 people on board.  
 At the first station 23 people get on and 14 get off.  
 At the second station 76 people get off and no one gets on.  
 At the third station a further 45 people get on.  
 How many people are on the train after the third station?
- Henry goes shopping with £125. He spends £26 on a DVD, £38.19 on a jumper and gets three books at £2.85 each. He buys nothing else. How much does he have left when he returns home?
- If six cups of coffee cost £11.70 and three cups of tea cost £4.23, how much would four cups of coffee and five cups of tea cost?
- Find the difference between the product of 17 and 51 and the sum of 156 and 652.

### HOMEWORK 1B

- What do you need to add to each number to make 7?  
 a 8                      b 13                      c -2
- What would you subtract from each number to get a result of -12?  
 a 8                      b 6                      c -4
- 7 is multiplied by another number to get each result. Work out what the other number is in each case.  
 a 14    b -98    c -49    d 343    e -7
- By what would you divide -96 to get the following results?  
 a 8    b -8    c 2    d  $-\frac{1}{2}$     e -256
- Here is a set of integers  $\{-7, -5, -1, 2, 7, 11\}$ .
  - Find two numbers with a difference of 7.
  - Find two numbers with a product of -7.
  - Find three numbers with a sum of 4.
  - Find two numbers that, when divided, will give an answer of -1.
- 'Two more than -8' is added to 'the product of 8 and 5 less than 3'. What is the result?

## Section 2: Order of operations

### HOMEWORK 1C

- Simplify.
 

a $6 \times 11 + 4$	b $6 \times (11 - 2)$
c $5 + 11 \times 2$	d $(3 + 12) \times 4$
e $25 + 6 \times 3$	f $8 \times 3 \div (4 + 2)$
g $(14 + 7) \div 3$	h $43 + 2 \times 8 + 6$
i $24 \div 4 \times (8 - 5)$	j $16 - \frac{8}{2} + 5$

## GCSE Mathematics for Edexcel (Higher)

- 2 Use the numbers listed to make each number sentence true.
- a  $\square - \square \div \square = \square$       1, 18, 6, 4  
 b  $\square - \square \div \square = \square$       8, 7, 3, 2  
 c  $\square \div (\square - \square) - \square = \square$       2, 3, 4, 7, 15



## Tip

Learn the rules about order of operations.

- 3 Insert brackets into each calculation to make it true.
- a  $4 \times 5 + 7 = 48$       b  $35 - 20 \times 8 = 120$   
 c  $48 \div 4 \times 3 - 4 = -12$



## Tip

Remember: Brackets change the order of operations.

- 4 Each box represents an operation. Fill in the missing operations to make these statements true.
- a  $12 \square (36 \square 32) = 3$       b  $95 \square (13 \square 8) = 19$
- 5 Work out without using a calculator.
- a  $\frac{10 \times \sqrt{25}}{3^2 + 4^2}$       b  $\frac{6^2 \times \sqrt{4}}{2^2 \times 3^2}$   
 c  $\frac{\sqrt{4} + 5^2}{3^2 \times \sqrt{81}}$       d  $\frac{6^2 + 8^2}{12^2 - (4^2 \times \sqrt{9}) + 2^2}$

## Section 3: Inverse operations

## HOMEWORK 1D



## Tip

Remember: The inverse is the 'opposite' operation that reverses the effect of an operation.

- 1 Find the additive inverse of each of these numbers.
- a 7    b 6    c 200    d -7    e -21    f -36

- 2 By what number would you multiply each of these to get an answer of 1?  
 a 4    b 12    c -5    d  $\frac{1}{2}$     e 7    f  $\frac{1}{8}$
- 3 Use inverse operations to check the results of each calculation. Correct those that are incorrect.
- a  $50 \times 5 - 8 = 227$       b  $16 + 5 \times 8 - 12 = 50$   
 c  $(28 + 53) \times 4 = 264$       d  $(432 - 148) \div 4 = 71$
- 4 Use inverse operations to find the missing values in each of these calculations.
- a  $\square + 564 = 729$       b  $\square + 389 = 786$   
 c  $\square - 293 = 146$       d  $132 \times \square = -3564$   
 e  $-8 \times \square = 392$       f  $\square \div 30 = 4800$
- 5 The formula for finding the area of a triangle is  $A = \frac{bh}{2}$ . Find the height of a triangle with an area of  $72 \text{ cm}^2$  and a base length of 8 cm.

## Chapter 1 review

- 1 Bonita and Kim travel for  $3\frac{1}{2}$  hours at 48 km/h. They then travel a further 53 km. What is the total distance they have travelled?
- 2 On a page of a newspaper there are eight columns of text. Each row contains a maximum of 38 characters (spaces between words count as characters). Each column has a total of 168 rows.
- a What is the maximum number of characters that can appear on a page?  
 b The average word length is six characters and each word needs a space after it. Estimate the number of words that can fit on a page.
- 3 A theatre has seats for 2925 people. How many rows of 75 is this?
- 4 Two numbers have a sum of -12 and a product of -28. What are the numbers?

- 5 Jadheja's bank account was overdrawn. She deposited £750 and this brought her balance to £486.  
 By how much was her account overdrawn to start with?



- 6 We use the formula  $F = 2C + 32$  to convert temperatures from Celsius to Fahrenheit. Without using a calculator, find the temperature in degrees Celsius when it is:  
 a  $78^\circ\text{F}$                       b  $120^\circ\text{F}$

# 2 Shapes and solids

## Section 1: 2D shapes

### HOMEWORK 2A

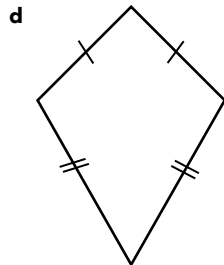
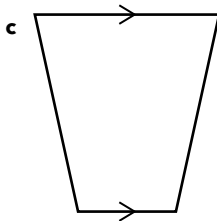
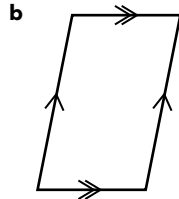
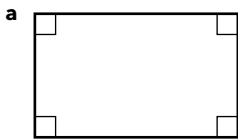
- 1 What is the correct mathematical name for each of the following shapes:
- a a plane shape with four sides
  - b a polygon with six equal sides
  - c a polygon with five vertices and five equal internal angles
  - d a plane shape with ten equal sides and ten equal internal angles?



**Tip**

Learn the names of shapes and be clear which are regular and which are irregular.

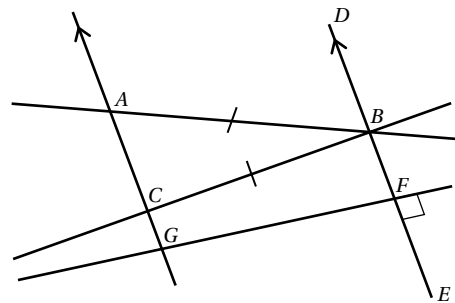
- 2 What are the names of the following shapes?



- 3 Name the shape given the following properties:
- a a four-sided shape with two pairs of equal and opposite sides but no right angles
  - b a four-sided shape with only one pair of parallel sides
  - c a triangle with two equal angles
  - d a triangle with all sides and angles equal
  - e a four-sided shape with two pairs of equal and adjacent sides.

### HOMEWORK 2B

- 1 Look at this diagram.  
 Say whether the following statements are true or false.



- a  $AG$  is parallel to  $DE$ .
- b  $ABC$  is an isosceles triangle.
- c  $DE$  is perpendicular to  $BC$ .
- d  $AG$  is perpendicular to  $GF$ .
- e  $AB$  is perpendicular to  $AG$ .
- f  $AB$  and  $GF$  are parallel.

## GCSE Mathematics for Edexcel (Higher)

- 2 Draw and correctly label a sketch of each of the following shapes:
- triangle  $ABC$  with a right angle at  $A$  and  $AB = AC$
  - quadrilateral  $PQRS$  with two pairs of opposite equal angles, none of which are right angles, and two pairs of opposite equal sides with different lengths
  - quadrilateral  $ABCD$  where  $AB$  is parallel to  $CD$  and angle  $ABC$  is a right angle.

## Section 2: Symmetry

## HOMEWORK 2C

- 1 How many lines of symmetry do the following shapes have:
- a square
  - a kite
  - a regular hexagon
  - an equilateral triangle?



## Tip

Line symmetry cuts a shape in half so that one side is a mirror image of the other.

- 2 Give an example of a shape that has rotational symmetry of order:
- 2
  - 3
  - 4
- 3 Which of the following letters have rotational symmetry of order greater than 1?

N I C K

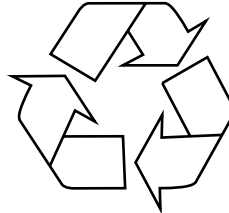


## Tip

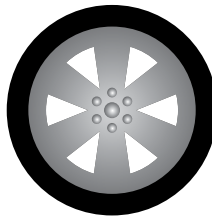
Rotational symmetry is when the shape looks exactly the same after a rotation.

- 4 What is the order of rotational symmetry for each of these pictures?

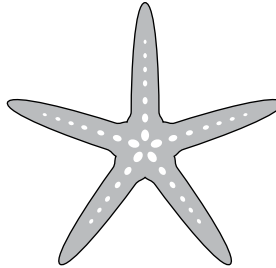
a



b



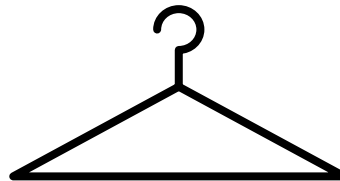
c



## Section 3: Triangles

## HOMEWORK 2D

- 1 What type of triangle do you see in this coat hanger? Explain how you decided without measuring.



## Tip

Learn the properties of the different types of triangle.

- 2 a What type of triangle is this?



- b Explain why this triangle cannot be isosceles.

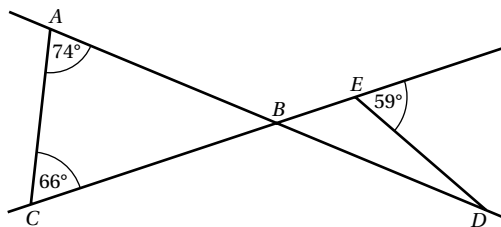
- 3 State whether the following triangles are possible. How did you decide?

- a side lengths 6 cm, 8 cm, 10 cm  
 b side lengths 12 cm, 4 cm, 5 cm  
 c side lengths 7 cm, 11 cm, 5 cm  
 d side lengths 35 cm, 45 cm, 80 cm

- 4 Two angles in a triangle are  $27^\circ$  and  $126^\circ$ .

- a What is the size of the third angle?  
 b What type of triangle is this?

- 5 Look at the diagram below.



Work out the following:

- a angle  $ABC$    b angle  $BED$    c angle  $BDE$ .



Tip

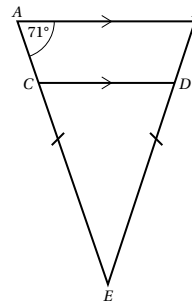
Use the properties of triangles and angles to answer this question.

- 6 An isosceles triangle  $PQR$  with  $PQ = QR$  has a perimeter of 80 cm. Find the length of  $PQ$  if:

- a  $PR = 24$  cm  
 b  $PR = 53$  cm

- 7 Find the missing angles in the following isosceles triangle, given that line  $CD$  is parallel to line  $AB$ .

Give reasons for your answers.



- a Angle  $ABD$    b Angle  $CED$    c Angle  $BDC$

- 8 Triangle  $ABC$  is isosceles and has two angles of  $(2x - 5)^\circ$  and one of  $(2x - 10)^\circ$ .

Calculate the size of each angle.

- 9 Triangle  $PQR$  has angle  $PQR = (6x + 12)^\circ$  and angle  $QRP = (4x + 8)^\circ$ .

Angle  $RPQ = 2 \times$  angle  $QRP$ .

Find the value of  $x$  and hence the size of each angle in the triangle.

## Section 4: Quadrilaterals

### HOMEWORK 2E



Tip

Make sure you learn the names and properties of all the quadrilaterals.

- 1 Identify the quadrilateral from the description.

There may be more than one correct answer.

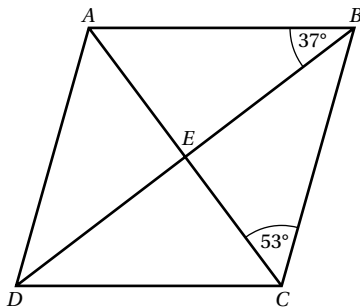
- a All sides are equal.  
 b Diagonals cross at right angles.  
 c One pair of sides is parallel.  
 d Two pairs of sides are parallel and equal in length.

- 2 Molly says that all four-sided shapes have at least one pair of equal or parallel sides.

Is she right?

## GCSE Mathematics for Edexcel (Higher)

- 3 A kite  $ABCD$  has an angle  $ABC$  of  $43^\circ$  and the opposite angle  $ADC$  of  $75^\circ$ .  
 What size are the other two angles?
- 4 One pair of triangles has the angles  $36^\circ$ ,  $54^\circ$  and  $90^\circ$ , while another pair has the angles  $24^\circ$ ,  $66^\circ$  and  $90^\circ$ . The length of the shortest side in each of the four triangles is the same.  
 Imagine all four triangles placed together so that the right angles meet at the same point.
- What shape has been formed?
  - What are the sizes of the four angles of this new shape?
- 5
- Write down the names of all the quadrilaterals.
  - Which quadrilaterals have at least two equal sides?
  - Which quadrilaterals have at least one pair of parallel sides?
  - Which quadrilaterals have rotational symmetry of order 1?
- 6 The diagram shows a rhombus.



Calculate.

- |               |               |
|---------------|---------------|
| a Angle $BAE$ | b Angle $EBC$ |
| c Angle $EDA$ | d Angle $ADC$ |
- 7 The quadrilateral  $ABCD$  is a parallelogram such that  $AB$  is parallel to  $CD$  and  $AD$  is parallel to  $BC$ .  
 If angle  $DAB = (4x + 7)^\circ$  and angle  $ADC = (2x + 8)^\circ$ , find the value of  $x$  and hence the size of angles  $DAB$  and  $ADC$ .
- 8 The quadrilateral  $PQRS$  has diagonals  $SQ$  and  $PR$  that meet at point  $T$ .  
 Angle  $SPT = 3x^\circ$ ,  $RSP = 4x^\circ$ ,  $QRS = x^\circ$ ,  
 $PQR = 4x^\circ$  and  $TPQ = 3x^\circ$ .

Find the value of  $x$  and hence the size of angles  $SPQ$ ,  $PQR$ ,  $QRS$  and  $RSP$ .  
 What shape is  $PQRS$ ?

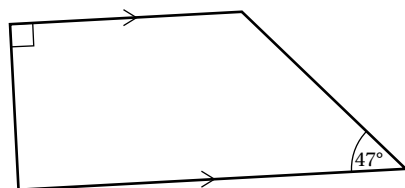
## Section 5: 3D objects

## HOMEWORK 2F

- 1 Imagine a solid made by fixing six square-based pyramids to a cube, where the square bases of the pyramids have the same side length as the cube.  
 How many vertices, edges and faces would this solid have?
- 2 How many vertices, edges and faces do the following have:
- a tetrahedron
  - a hexagonal prism
  - a prism with an L-shaped cross-section?
- 3 A rectangular-based pyramid is sliced parallel to the base.  
 Describe the two shapes created.

## Chapter 2 review

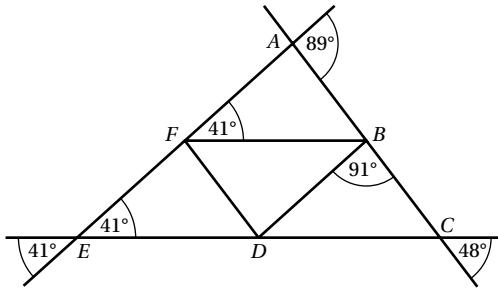
- 1 True or false?
- A triangle with two equal angles is called isosceles.
  - A cuboid has 8 vertices, 6 faces and 10 edges.
  - A pair of lines that meet at precisely  $90^\circ$  are described as perpendicular.
  - Every square is a rhombus.
  - Every rectangle is a parallelogram.
  - Every square is a rectangle.
- 2 Describe all the symmetrical features of a rectangle.
- 3 Find the unknown angles in this trapezium.



3 2D representations of 3D shapes

- 4 In the diagram below  $AC$  is parallel to  $FD$  and  $AE$  is parallel to  $BD$ .  $FB$  and  $EC$  are also parallel.

Find the missing angles. Give reasons for your answers.



- a Angle  $FAB$                       b Angle  $ABF$   
 c Angle  $BDC$                       d Angle  $FBD$

- 5 Draw a diagram and prove that the exterior angle of a triangle is equal to the sum of the two opposite interior angles.
- 6 Starting with a bisected acute angle, prove that a triangle formed by drawing a straight line parallel to one arm of the angle, from any point on the bisector of the angle, will be isosceles.
- 7 Point  $P$  is on the side  $BC$  of an isosceles triangle  $ABC$ , where  $AB = AC$ . A line perpendicular to  $BC$  is drawn through  $P$  that cuts side  $AB$  at  $Q$ . Side  $CA$  continues beyond the triangle and meets the perpendicular line at  $R$ .

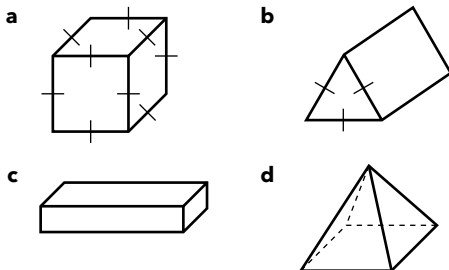
Prove that triangle  $QAR$  is isosceles.

# 3 2D representations of 3D shapes

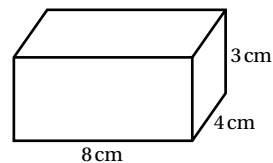
## Section 1: 3D objects and their nets

### HOMEWORK 3A

- 1 What shape/s are the faces of these solids:  
 a a cube  
 b a pentagonal-based pyramid  
 c a pentagonal prism  
 d a cylinder  
 e a trapezoidal prism?
- 2 Sketch a possible net for each of the following solids.



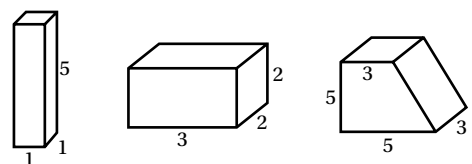
- 3 Draw an accurate net of this cuboid and use it to build a model of the object.



## Section 2: Drawing 3D objects

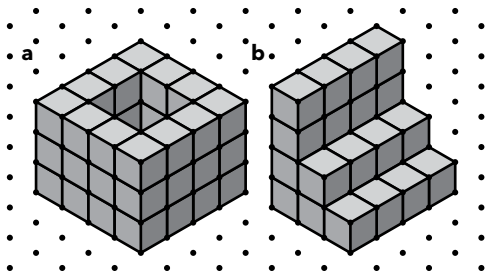
### HOMEWORK 3B

- 1 Draw these shapes on isometric grid paper. The dimensions are given as distances between the dots on the paper.

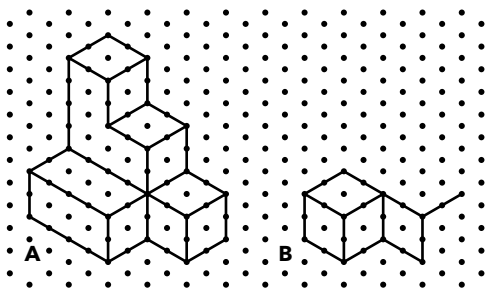


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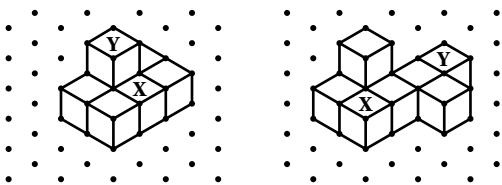
- 2 Assuming no blocks are missing, how many blocks would you need to build each of the following solids?



- 3 Copy diagram B and complete it to show the same object as A from the given orientation.



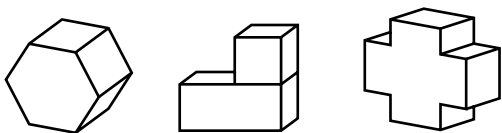
- 4 In each of the following solids, block X is moved and placed on top of block Y. Draw the resulting solids on isometric grid paper.



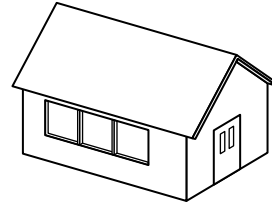
Section 3: Plan and elevation views

HOMEWORK 3C

- 1 Draw a plan view, front elevation and side elevation from the right of each of the following solids.

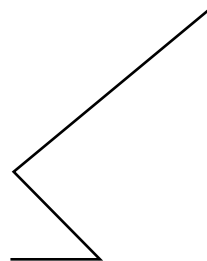


- 2 Draw the plan, front and side elevation from the right of this building.

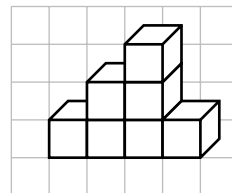


Chapter 3 review

- 1 Sketch and label the net of:  
 a a cube with edges 4 cm long  
 b a cuboid with a square face of side 2 cm and a length of 4 cm.
- 2 These are the first three edges of a drawing of a prism. Copy and complete the diagram including the hidden edges.



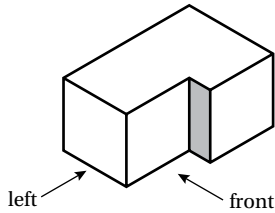
- 3 This solid has been drawn on a squared grid. Redraw it on an isometric grid.



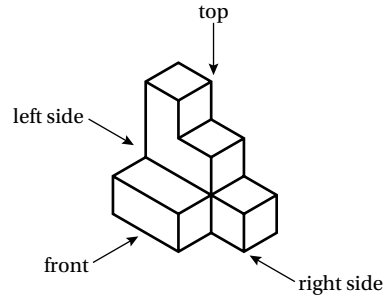


## 4 Properties of whole numbers

- 4 a Draw this solid on an isometric grid. Show the hidden edges on your diagram.  
 b Draw the plan view, front elevation and side elevation from the left of this solid.



- 5 This solid is built from  $1 \text{ cm}^3$  cubes. Draw an accurate plan view, front elevation and side elevation from the right.



# 4 Properties of whole numbers

## Section 1: Reviewing number properties

### HOMEWORK 4A

- 1 Write down the factors of the following numbers:  
 a 24    b 36    c 81    d 53
- 2 Look at the numbers in this list:  
 4    15    8    25    7    16    12    9  
 6    23    36    96    27    3    1
- Choose and write down the numbers in the list that are:
- a odd            b even            c prime  
 d square        e cube            f factors of 12  
 g multiples of 4  
 h common factors of 24 and 36  
 i common multiples of 3 and 4.



#### Tip

Learn the words for different types of number.

- 3 Write down:  
 a the next four odd numbers after 313  
 b the first four consecutive even numbers after 596

- c the square numbers between 40 and 100 inclusive  
 d the factors of 43  
 e four prime numbers between 30 and 50  
 f the first five cube numbers  
 g the first five multiples of 7  
 h the factors of 48.

- 4 Say whether the results will be odd or even or could be either:  
 a the product of two odd numbers  
 b the sum of two odd numbers  
 c the difference between two odd numbers  
 d the square of an even number  
 e the product of an odd and an even number  
 f the cube of an even number.

### HOMEWORK 4B

- 1 Write these sets of numbers in ascending order.  
 a 476    736    458    634    453    4002  
 b 1707    1770    1708    1870    1807  
 c 345    543    453    354    534    435  
 d 245    54    -245    -254    -2004    205
- 2 What is the value of the 6 in each of these numbers?  
 a 46                    b 673                    c 265  
 d 16877                e 64475                f 1654782  
 g 6035784

## GCSE Mathematics for Edexcel (Higher)

- 3 What is the biggest and smallest number you can make with each set of digits?  
 Use each digit only once in each number.
- a 3, 0 and 7  
 b 6, 5, 1 and 9  
 c 2, 3, 5, 0, 6 and 7  
 d What is the difference between the biggest and smallest numbers in each question?
- 4 Place the symbol =, < or > in each box to make each statement true.
- a  $4 \square 5$                       b  $3 + 5 \square 8$   
 c  $9 \square 3 + 2$                     d  $3 - 7 \square - 2$

## Section 2: Prime factors

## EXERCISE 4C

- 1 Identify the prime numbers in each set.
- a 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20  
 b 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110
- 2 Express the following numbers as a product of their prime factors.  
 Use the method you prefer. Write your final answers using powers.
- a 48    b 75    c 81    d 315    e 560  
 f 2310    g 735    h 1430    i 32    j 625  
 k 864



## Tip

Remember each number has a unique set of prime factors.

- 3 A number is expressed as  $13 \times 23 \times 7$ .  
 What is the number?
- 4 a What are the factors of 7120?  
 b What are the factors of 2279?  
 c What do you notice about the factors of 2279?  
 d Did it take longer to find the factors of 2279 or 7120?
- 5 a Calculate  $31 \times 67$ .  
 b What are the factors of 2077?

## Section 3: Multiples and factors

## HOMEWORK 4D

- 1 Find the lowest common multiple (LCM) of the given numbers.
- a 12 and 16    b 15 and 20    c 12 and 20  
 d 24 and 30    e 3, 4 and 6    f 5, 7 and 10
- 2 Find the highest common factor (HCF) of the given numbers.
- a 18 and 24    b 36 and 48    c 27 and 45  
 d 14 and 35    e 21 and 49    f 36 and 72
- 3 Find the LCM and the HCF of the following numbers using prime factors.
- a 28 and 98    b 75 and 20    c 144 and 24  
 d 54 and 12    e 214 and 78
- 4 Amjad has two long pieces of timber.  
 One piece is 64 metres, the other is 80 metres.  
 He wants to cut the long pieces of timber into one collection of shorter pieces of equal length.  
 What is the longest he can make each piece?



## Tip

Think carefully – is it the HCF or the LCM you need to find?

- 5 Two desert flowers have a cycle of 11 and 15 years respectively when they are in bloom.  
 How many years are there between the occasions when they bloom simultaneously?
- 6 Rochelle has 20 pieces of fruit and 55 sweets to share among the pupils in her class.  
 Each student gets the same number of pieces of fruit and the same number of sweets.  
 What is the largest possible number of students in her class?

- 7 Mr Singh wants to tile a rectangular patio with dimensions  $5.4\text{ m} \times 9.6\text{ m}$  with a whole number of identical square tiles. Mrs Singh wants the tiles to be as large as possible.
- What is the largest possible square tile that will fit exactly along both dimensions? Show your working.
  - Find the area of the largest possible tile in  $\text{cm}^2$ . Show your working.
  - How many tiles will they need to tile the patio? Show your working.

## Chapter 4 review

- 1 Is 243 a prime number? Explain how you worked out your answer.

- 2 Find the HCF and the LCM of 18 and 45 by listing the factors and multiples.
- 3 Express 675 as a product of prime factors, giving your final answer in power notation.
- 4 Determine the HCF and LCM of the following by prime factorisation.
- a 64 and 104                      b 54 and 80
- 5 Nick starts training for a triathlon on Monday 2 May. He swims and cycles on this day. He decides to swim every third day, run on Wednesdays and Saturdays and cycle every fourth day.

On which date in May will he swim, run and cycle on the same day?

# 5 Introduction to algebra

## Section 1: Using algebraic notation

### HOMEWORK 5A

- 1  $5x$ ,  $3x^2$  and  $7y$  are the three terms of an expression. Write down the expression using addition and subtraction as the operations.
- 2 Write an expression for the following statements using the conventions for algebra.



#### Tip

Remember: Letters represent numbers.

- A number  $x$  is multiplied by 4 and has 3 added to it.
- A number  $x$  is multiplied by 2 and added to  $y$  multiplied by 5.
- A number  $x$  is squared and 7 is subtracted from this. This is then multiplied by 3.
- A number  $x$  is cubed and added to a number  $y$  squared. Then this is all divided by 2.
- A number  $x$  has 2 subtracted from it and the result is divided by 3.

- 3 Match these statements to their correct algebraic expression.

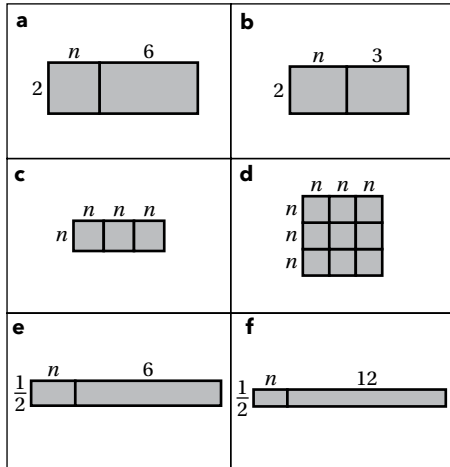
A number $x$ is multiplied by 2 and has 7 added to it. The result is divided by 3.	$3x - 7$
A number $x$ is squared, then multiplied by 3 and added to a number $y$ , multiplied by 7.	$x^2 + 3x$
A number $x$ is multiplied by 3 and has 7 taken from the result.	$3x^2 + 7y$
A number $x$ is added to a number $y$ and the result is multiplied by 3.	$\frac{2x + 7}{3}$
A number $x$ is squared and then added to the original number multiplied by 3.	$3(x + y)$

- 4 Simplify these expressions.

- a  $5 \times 2x$       b  $3a \times 2$       c  $x \times (-5)$   
 d  $3x \times 6y$       e  $3a \times 5b$       f  $-3p \times 3q$   
 g  $16x \div 4$       h  $25y \div 5$       i  $32a^2 \div 4$   
 j  $6 \times 15p \div 20$       k  $27x \div (3 \times 3)$       l  $24y \div (4 \times 2)$

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- 5 Write an expression to represent the area of each of these rectangles.



- 6 Simplify.
- a**  $y^{-2} \times y^6$     **b**  $2a^5 \times 3a^4$     **c**  $a^3 \div a^6$   
**d**  $\frac{18b^9}{6b^2}$     **e**  $\frac{24p^8}{6p^9}$     **f**  $(3a^6)^2$   
**g**  $3x^3y^2 \times 6xy^5 \div 3x^4y^5$     **h**  $10x^0$

**HOMEWORK 5B**

- 1 Given that  $p = 4$  and  $q = 5$ , find the value of these expressions.  
**a**  $4p + 2q$     **b**  $2p - q$     **c**  $3pq$     **d**  $2q + 3p$
- 2 Find the value of each expression when  $e = -2$  and  $f = 6$ .  
**a**  $3e + 2f$     **b**  $-4ef$     **c**  $\frac{100}{e}$     **d**  $6 - 5ef$
- 3 Given that  $x = 4$  and  $y = 3$ , evaluate the following expressions.  
**a**  $3(2x + 3y)$     **b**  $-2(x + 2y)$   
**c**  $3y(2x - y)$     **d**  $5(10 - 2y)$

Section 2: Simplifying expressions

**HOMEWORK 5C**



**Tip**

You cannot add unlike terms, such as  $3a$  to  $4b$ , unless you know the values of  $a$  and  $b$ .

- 1 Which of the following pairs are like terms? Collect where possible.

- a**  $10x$  and  $4a$     **b**  $8b$  and  $-3b$   
**c**  $9m$  and  $6n$     **d**  $-8xy$  and  $-5y$   
**e**  $6pq$  and  $-3p$     **f**  $10x^2$  and  $5x^2$   
**g**  $7x^2$  and  $-7x^2$     **h**  $6x^2$  and  $-2x$   
**i**  $3a^2bc$  and  $4a^2bc^2$

- 2 Write these expressions in their simplest form by collecting like terms.

- a**  $3a + 6b - 7a + 4b$   
**b**  $6a + 9b - 5a - 8b$   
**c**  $4ab + 5b^2 + 7ab - 7b^2$   
**d**  $4m^2 - mn^2 + mn^2 + 6mn$   
**e**  $8cd^3 - 24cd^3 + 5cd^3$   
**f**  $4st^2 - 4s^2t + 7s^2t + 5st^2$

- 3 Copy and complete.

- a**  $4a + \square = 10a$     **b**  $7b - \square = 6b$   
**c**  $12mn + \square = 15mn$     **d**  $17pq + \square = 8pq$   
**e**  $9x^2 - \square = 12x^2$     **f**  $8m^2 - \square = -m^2$   
**g**  $6ab - \square = -2ab$

- 4 Copy and complete.

- a**  $6a \times \square = 18a$     **b**  $7b \times \square = 14b$   
**c**  $4a \times \square = 12ab$     **d**  $7m \times \square = 28mn$   
**e**  $-4b \times \square = 12b^2$     **f**  $6m \times \square = 12m^2n$

- 5 Cancel to the lowest terms to simplify.

- a**  $\frac{6x}{2}$     **b**  $\frac{4a}{12}$     **c**  $\frac{-16m}{24}$   
**d**  $\frac{14x^2}{21}$     **e**  $\frac{9ab}{a}$     **f**  $\frac{4xy}{12xy}$   
**g**  $\frac{5x^2y}{15x}$

Section 3: Multiplying out brackets

**HOMEWORK 5D**

- 1 Expand the brackets and collect any like terms to simplify the following.

- a**  $3(a + 4) - 9$     **b**  $4(a - 3) + 2$   
**c**  $6(b + 4) - 10$     **d**  $4(e - 6) + 17$   
**e**  $3(x - 7) - 4$     **f**  $3a(2a + 5) + 8a$   
**g**  $3b(4b - 7) - 6b$     **h**  $3a(4a + 7) + 5a^2$   
**i**  $5b(4b - 5) - 9b^2$



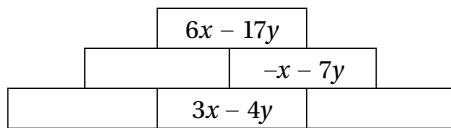
**Tip**

Multiply everything inside the bracket by the number outside.

- 2 Expand and collect like terms for each expression.

- a**  $3(x + 2) + 4(x + 5)$     **b**  $3(4a - 1) + 4(3a - 2)$   
**c**  $4(c + 6) - 3(c + 7)$     **d**  $4(a - 3) - 3(a + 4)$   
**e**  $x(x - 5) + 2(x - 7)$     **f**  $5q(q + 3) - 5(q + 2)$   
**g**  $2y(y + 5) - y(2y + 3)$     **h**  $2x(x - 5) + x(x - 3)$

- 3 Find the missing expressions for the empty boxes.



**Tip**

Each box is made by adding together the two boxes immediately below it.

Section 4: Factorising expressions

**HOMEWORK 5E**

- 1 Factorise.  
**a**  $6e + 3f$                       **b**  $20v + 35w$   
**c**  $hj - hk$                       **d**  $n^2 - 4n$
- 2 Factorise.  
**a**  $fg + 3f$                       **b**  $8cd - 6c^2$   
**c**  $15ef + 10f^2$                   **d**  $3gh + 5g - 4g^2$
- 3 Factorise.  
**a**  $4(3 + 2d) + c(3 + 2d)$     **b**  $m(1 - n) - 2(1 - n)$   
**c**  $8c(2 + d) - 3(2 + d)$

Section 5: Solving problems and algebraic proof

**HOMEWORK 5F**

- 1 a Copy and complete this magic square, filling in the missing expressions.

$3n + 8$	$3n - 13$	$3n + 2$
	$3n - 1$	

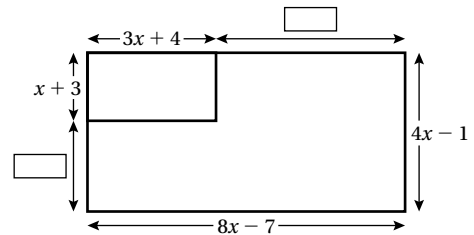
- b Write an expression for the magic number.



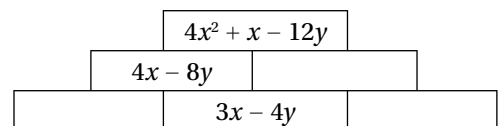
**Tip**

In a magic square all the rows and columns add up to the same value.

- 2 A large rectangle contains a smaller rectangle.



- a Write an expression for each of the unknown lengths.  
**b** Write an expression for the perimeter of the small rectangle.  
**c** Write an expression for the perimeter of the large rectangle.  
**d** Write an expression for the perimeter of the compound shape formed by removing the small rectangle from the large rectangle.
- 3 Complete the pyramid by finding the missing expressions.



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- 4 Which of the following are always true or sometimes true?  
 If the answer is sometimes, state when it is true.

	Always true	Sometimes true when...
$x + 4 = 7$		
$3x - 4 = 4 - 3x$		
$2x - 4 = 2y - 4$		
$3(n - 4) = 3n - 12$		
$x^2 + 3x + 4 = 4 + x(x + 3)$		

- 5 Follow the instructions and record your answer at each stage.

Think of a number.
Multiply it by 3.
Add 1 to the result.
Multiply the answer by 2.
Add 10 to the result.
Divide the answer by 6.
Take away the number you first thought of.
Your answer is 2.

Prove that the result will always be 2.

- 6 A sequence begins with two numbers,  $a$  and  $b$ .  
 The next number in the sequence is always found by adding the previous term to double the term before the previous term.
- Prove that the 7th number in the sequence is always  $22a + 21b$ .
  - If  $a$  and  $b$  are  $-3$  and  $2$ , what would the value of the 7th number be?

Chapter 5 review

- 1 The expression  $6(x + 3) - 4(x - 3)$  simplifies to  $a(x + b)$ . Work out the values of  $a$  and  $b$ .

- 2 Simplify the following expressions fully by collecting like terms where possible.

a  $4(x + 3) + 8x - 5x + 12 + 7x$   
 b  $4(x - 3) + 3(x - 4)$   
 c  $2x(x - 3) + 3x - x^2$     d  $\frac{21x^3}{3x} + \frac{6x^3}{x}$   
 e  $2x(3x + 8) - 8x$     f  $4a(4a - 3) - 4b$   
 g  $4a(5a - 6) + 3a^2$     h  $3x(4x - 5) - 5x^2$

- 3 Which of these are identities?

a  $6x + 4 = 3x + 2$     b  $5xy + 3 = 3 + 5xy$   
 c  $x^2 = 2x$     d  $x(y + 7) = xy + 7x$



Tip

Remember an identity in  $x$  is true for all values of  $x$ .

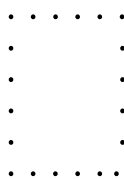
- 4 a Prove algebraically that the sum of four consecutive whole numbers is not divisible by 4.  
 b What generalisation can you make about the sum of four consecutive whole numbers?
- 5 Prove algebraically that if  $n$  is an even number, then  $n^2$  must also be even.



Tip

All even numbers are  $2m$ , where  $m$  is any whole number.

- 6 If two numbers,  $a$  and  $b$ , are even prove that  $ab$  is divisible by 4.
- 7 Prove algebraically that the sum of any three consecutive even numbers is a multiple of 6.
- 8 Dots are arranged to represent the perimeter of a square, as in the diagram below:



If  $n$  is the number of dots on a side, show that the total number of dots can be expressed as  $4(n - 1)$ ,  $4(n - 2) + 4$ ,  $4n - 4$  or  $2(n - 2) + 2n$