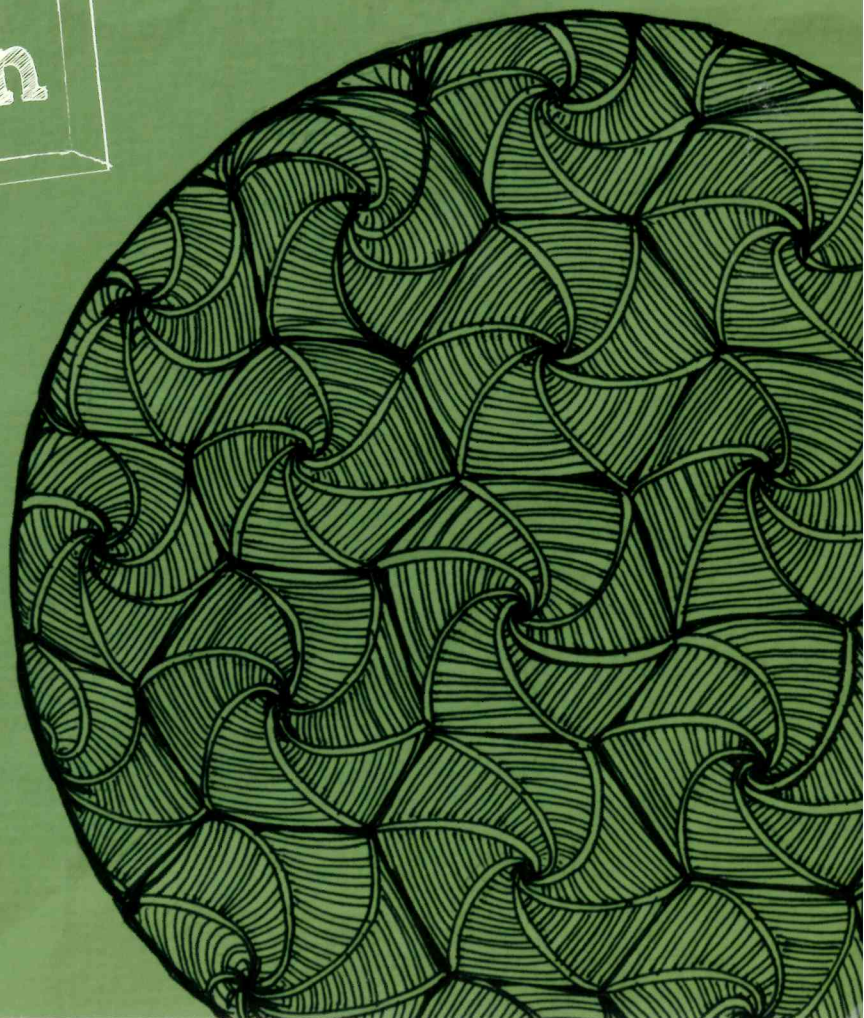
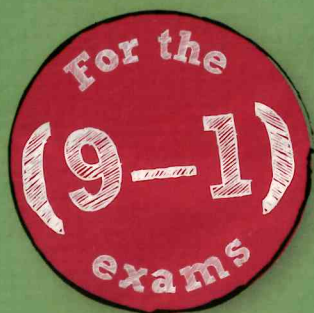


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Mathematics

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REVISION WORKBOOK

Series Consultant: Harry Smith

Author: Navtej Marwaha

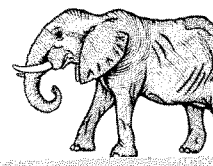
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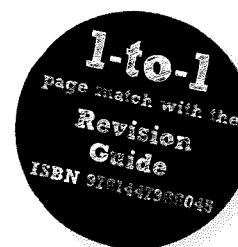
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A small bit of small print

Edexcel publishes Sample Assessment Material and the Specification on its website. This is the official content and this book should be used in conjunction with it. The questions in 'Now try this' have been written to help you practise every topic in the book. Remember: the real exam questions may not look like this.

Collecting like terms



1 formula equation expression term

Choose a word from the list above to best describe each of the following.

(a) $3x + y$

(b) $v = u + at$

(c) $3x + 4 = 6$

..... (1 mark) (1 mark) (1 mark)



2 Simplify

(a) $x + x + x + x + x$

(b) $3xy + 5xy - 2xy$

Guided

=x (1 mark)

=xy (1 mark)



3 Simplify

(a) $x + y + x + y + x + x$

=x +y (1 mark)

(b) $8ab - 3ab$

=ab (1 mark)

(c) $5t + 6v - 4t + 5v$

= $5t - 4t + 6v + 5v =$ t +v (1 mark)

(d) $6c + 2d - 3c - 4d$

= $6c - 3c + 2d - 4d =$ c -d (1 mark)



4 Simplify

(a) $5x - 3x$

(b) $4t^2 - t^2$

..... (1 mark)

..... (1 mark)

(c) $4a + 5b - a + 3b + 7$

(d) $6x - 3y - 5x - 4y$

..... (2 marks)

..... (2 marks)



5 Simplify

(a) $5n - 2n$

(b) $6p + 8q + 2q - 9q$

..... (1 mark)

..... (1 mark)

(c) $3m - 4n + 6n + 2n$

(d) $5 + 3a + 7b - a - b$

..... (2 marks)

..... (2 marks)



6 Simplify

(a) $y^2 + y^2$

(b) $5x^2 + 3x - 2x^2 - x$

..... (1 mark)

..... (2 marks)

Simplifying expressions



1 Simplify

(a) $y \times y$

(b) $3m \times t$

$= y \dots\dots\dots$ (1 mark)

$= 3 \times m \times t = \dots\dots\dots$ (1 mark)

Guided



2 Simplify

(a) $w \times w \times w \times w$

(b) $4 \times 7 \times d$

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

(c) $5 \times 6k$

(d) $5j \times 8k$

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)



3 Simplify

(a) $5x \times 3x$

(b) $2e \times 3f$

$= 5 \times 3 \times x \times x = \dots\dots\dots$ (1 mark)

$= 2 \times 3 \times e \times f = \dots\dots\dots$ (1 mark)

(c) $8a \div 2$

Work out $8 \div 2$.

(d) $24ab \div 3a$

Divide the number parts and then the letter parts.

$= \frac{8a}{2} = \dots\dots\dots$ (1 mark)

$= \frac{24ab}{3a} = \dots\dots\dots$ (1 mark)

Guided



4 Simplify

(a) $7g \times 5h$

(b) $2t \times 2t \times 2t$

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

(c) $36xy \div 12y$

(d) $28xyz \div 7xz$

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)



5 Simplify

(a) $2a \times 3b \times 4c$

(b) $48mnp \div 6mn$

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)



6 The table shows some expressions.

$4x \div 2y$	$2(x \times y)$	$2x \times 2y$	$4xy \div 2$	$x \times y$

Two of the expressions always have the same value as $2xy$.

Tick (✓) the boxes underneath the two expressions.

(2 marks)

Algebraic indices



1 Simplify and leave your answers in index form.

(a) $a^3 \times a^6$

Add the powers.

(b) $a^9 \div a^6$

Subtract the powers.

..... (1 mark)

..... (1 mark)

(c) $\frac{a^{12}}{a \times a^7}$

First work out the power of a in the denominator.

(d) $(a^3)^4$

Multiply the powers.

..... (2 marks)

..... (2 marks)



2 Simplify and leave your answers in index form.

(a) $\frac{t^2 \times t^6}{t^5}$

(b) $\frac{t^{12}}{t^5 \times t^4}$

..... (2 marks)

..... (2 marks)

(c) $\frac{t^7 \times t^6}{t \times t^4}$

(d) $\frac{t^8 \times t^{-6}}{t \times t^{-5}}$

..... (2 marks)

..... (2 marks)



Guided

3 Simplify

(a) $(x^3)^4$

(b) $(4x^2)^3$

..... (1 mark)

$= 4x^2 \times 4x^2 \times 4x^2 =$ (2 marks)

(c) $(2x^3)^3$

(d) $3x^2 \times 4x^5$

..... (2 marks)

$= 3 \times \dots \times x^{\dots + \dots} =$ (2 marks)

(e) $3x^2y \times 4x^5y^4$

(f) $18x^3y^5 \div 6xy^2$

..... (1 mark)

..... (2 marks)



4 Find the value of x .

(a) $p^4 \times p^x = p^{12}$

(b) $p^{12} \div p^x = p^7$

(c) $(p^3)^x = p^{15}$

$x =$ (1 mark) $x =$ (1 mark) $x =$ (1 mark)



5 Find the value of x .

$$q^5 \times q^{2x} = \frac{q^{10} \times q^6}{q^8}$$

$x =$ (2 marks)

Substitution



1 The rule given in the box can be used to work out the distance a train travels.

A train has a speed of 80 km/h and travels for 3 hours.

Use the rule to work out the distance the train travels.

$$\text{distance} = \text{speed} \times \text{time}$$

..... km (1 mark)



2 Work out the value of

Use BIDMAS to find the correct value.

(a) $5x + 3$ when $x = 4$

(b) $2x - 3$ when $x = -4$

$= 5 \times \dots + 3 = \dots$ (2 marks)

$= 2 \times \dots - 3 = \dots$ (2 marks)



3 Work out the value of

(a) $4a + 3b$ when $a = 4$ and $b = 6$

(b) $3a - 5b$ when $a = 3$ and $b = -2$

..... (2 marks)

..... (2 marks)



4 Work out the value of

Use BIDMAS to find the correct value.

(a) $3a + ax$ when $a = 3$ and $x = -5$

$= 3 \times \dots + \dots \times \dots = \dots$

$+ \times - = -$

(2 marks)

(b) $4t^2$ when $t = -5$

$= 4 \times (\dots)^2 = 4 \times \dots \times \dots = \dots$

$- \times - = +$

(2 marks)



5 Work out the value of

Use BIDMAS to find the correct value.

(a) $4(2x - 4y)$ when $x = 3$ and $y = -5$

..... (2 marks)

(b) $3m + 5(p - n)$ when $m = 6$, $n = 2$ and $p = 3$

..... (2 marks)

(c) $9t - \frac{1}{2}at^2$ when $a = 2$ and $t = 4$

..... (2 marks)



6 Abbie and Lisa are trying to work out the energy of a ball when it is dropped.

They use the following formula where $m = 2$ and $v = 3$

Abbie works out the value of E to be 9

and Lisa works out the value of E to be 18.

Who is correct? Give a reason for your answer.

$$E = \frac{1}{2}mv^2$$

You will need to show some working to justify your answer.

..... (2 marks)

Formulae



- 1 The time in minutes needed to cook a joint of meat is given by the formula in the box.
Work out the time needed to cook a 5 kg joint of meat.

$$\text{Time} = \text{Weight in kg} \times 4 + 30$$

Substitute the value for the weight of the joint into the formula.

Use BIDMAS to find the correct value.

Time = $\times 4 + 30 =$ (2 marks)



- 2 Andy the carpenter charges £25 for each hour he works at a job plus £50 callout charge. The amount Andy charges, in pounds, can be worked out using this formula. Andy works for five hours at a job. Work out how much Andy charges.

$$\text{Charge} = \text{Number of hours worked} \times 25 + 50$$

£..... (2 marks)



Guided

- 3 The height of a growing tree is given by the formula $h = 3t + 12$. Work out the value of h when $t = 6$.

Substitute the value of t into the formula.

Use BIDMAS to find the correct value.

$h = 3 \times$ $+ \dots =$ (2 marks)



- 4 A formula involving force, mass and acceleration is $F = ma$. Work out the value of F when $m = 12$ and $a = 3$.

$F =$ (2 marks)



- 5 This formula is used in physics to calculate impulse: $I = mu - mv$. Work out the value of I when $m = 6$, $u = 8$ and $v = 5$.

$I =$ (2 marks)



Guided

- 6 A formula to work out the velocity of a ball is $v = u + at$. Work out the value of v when $u = -20$, $a = 9$ and $t = 8$.

Substitute the values u , a and t into the formula.

Use BIDMAS to find the correct value.

$v =$ $+ \dots \times \dots =$ (2 marks)



- 7 You can use this formula to convert degrees Celsius, C , into degrees Fahrenheit, F . Use the formula to convert -20°C into $^\circ\text{F}$.

$$F = 1.8C + 32$$

..... $^\circ\text{F}$ (2 marks)



- 8 Given that $y = 3x^2 - 4x + 3$ show that when $x = -2$, the value of y is 23.

The question says 'show that' so you need to write out all your working clearly.

(2 marks)

Writing formulae



- 1 A can of lemonade costs g pence. A bag of sweets cost h pence.
Harry buys four cans of lemonade and five bags of sweets.
Write down a formula, in terms of g and h , for the total cost, C pence.

Guided

$C = 4 \times \dots + 5 \times \dots = 4 \dots + 5 \dots$ (2 marks)



- 2 Aliya plays a game with black counters and white counters. The number of points for a black counter is 10 and the number of points for a white counter is 20.
Aliya has m black counters and n white counters.
Her total number of points is S .
Write down a formula for S in terms of m and n .

Your formula should start $S =$

..... (2 marks)



- 3 Jayne the electrician charges £30 for each hour she works at a job and a callout charge of £50. Jayne works n hours at a job. She charges P pounds.
Write down a formula for P in terms of n .

Guided

$P = n \times \dots + \dots = \dots + \dots$ (2 marks)



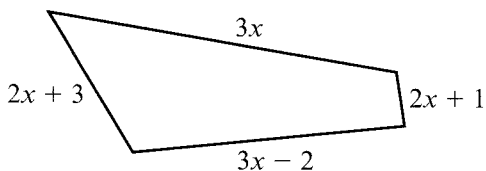
- 4 The cost, in £, of hiring a van can be worked out by using the following rule.
The cost of hiring a van for m days is £ T .
Write down a formula for T in terms of m .

Add 5 to the number of days.
Multiply the answer by 8.

..... (2 marks)



- 5 The diagram shows the lengths of the sides of a quadrilateral. All the lengths are in cm.
Write down a formula, in terms of x , for the perimeter, P cm, of the quadrilateral.



The perimeter is the sum of the lengths of all the sides.

$P = 2x + 3 + \dots + \dots + \dots = \dots$ (2 marks)



- 6 Alex is n years old. Brad is four years older than Alex.
(a) Write down a formula, in terms of n , for Brad's age, B .

..... (1 mark)

The combined age of Alex, Brad and Carl is $5n + 4$.

- (b) Is Carl three times older than Alex? Give a reason for your answer.

..... (2 marks)

Expanding brackets

1 Expand


 Guided

(a) $3(x + 2)$

$= 3 \times x + 3 \times 2$

$= \dots + \dots$ (2 marks)

(d) $6(2x + 3)$

$= 6 \times \dots + 6 \times \dots$

$= \dots + \dots$ (2 marks)

(b) $4(x + 5)$

\dots (2 marks)

(e) $\sqrt{2}(x - \sqrt{2})$

\dots (2 marks)

(c) $3(x + 2)$

\dots (2 marks)

(f) $7(3x - 8)$

\dots (2 marks)

2 Expand



 Guided

(a) $-3(x - 3)$

$= -3 \times x - 3 \times -3$

$= \dots + \dots$ (2 marks)

(d) $-2(2x + 3)$

$= -2 \times \dots + -2 \times \dots$

$= \dots + \dots$ (2 marks)

(b) $-4(x + 3)$

\dots (2 marks)

(e) $-2(4x - 1)$

\dots (2 marks)

(c) $-6(x - 5)$

\dots (2 marks)

(f) $-(2x - 4)$

\dots (2 marks)

3 Expand


 Guided

(a) $x(x + 1)$

$= x \times x + x \times 1$

$= \dots + \dots$ (2 marks)

(d) $3x(2x - 3)$

$= 3x \times \dots + 3x \times \dots$

$= \dots + \dots$ (2 marks)

(b) $x(x + 5)$

\dots (2 marks)

(e) $-x(2x - 3)$

\dots (2 marks)

(c) $2x(x - 9)$

\dots (2 marks)

(f) $-3x(4x - 5)$

\dots (2 marks)

4 Expand and simplify

(a) $4x + 3(x + 2)$

$= 4x + 3 \times x + 3 \times 2$

$= \dots x + \dots x + \dots$

$= \dots x + \dots$

(c) $5(x - 3) + 4(2x + 1)$

\dots (3 marks)

(b) $2(x + 1) + 3(x + 4)$

$= 2 \times x + 2 \times 1 + 3 \times x + 3 \times 4$

$= \dots x + \dots x + \dots + \dots$

$= \dots x + \dots$

(d) $4x(x - 3) + 2x(x - 4)$

\dots (3 marks)

5 $3x(2x - 5) + 2x(7x - 2) = ax^2 + bx$ where a and b are whole numbers.Work out the values of a and b .

$a = \dots$

$b = \dots$ (3 marks)

6 $5x(2 + 3x) - 4x(3x - 2) = px^2 + qx$ where p and q are whole numbers.Work out the values of p and q .

$p = \dots$

$q = \dots$ (3 marks)

Factorising



1 Factorise

(a) $3x + 6$

(b) $6a + 18$

(c) $2p - 6$

$= 3(\dots + \dots)$ (1 mark)

..... (1 mark)

..... (1 mark)

(d) $5y - 15$

(e) $3t + 24$

(f) $4g - 20$

$= 5(\dots - \dots)$ (1 mark)

..... (1 mark)

..... (1 mark)

Guided



2 Factorise

(a) $x^2 + 6x$

(b) $x^2 - 4x$

(c) $x^2 - 9x$

$= x(\dots + \dots)$ (1 mark)

..... (1 mark)

..... (1 mark)

(d) $x^2 - 12x$

(e) $x^2 + 5x$

(f) $x^2 - x$

$= x(\dots - \dots)$ (2 marks)

..... (1 mark)

..... (1 mark)

Guided



3 Factorise fully

(a) $3p^2 + 6p$

(b) $8y^2 - 24y$

(c) $9t^2 - 36t$

$= 3p(\dots + \dots)$ (1 mark)

..... (2 marks)

..... (2 marks)

'Factorise fully' means that you need to take out the highest common factor.

Guided



4 Factorise fully

(a) $4d^2 + 12d$

(b) $6x^2 - 18x$

(c) $7n^2 - 35n$

..... (2 marks)

..... (2 marks)

..... (2 marks)

If you wrote $4d^2 - 12d = 4(d^2 - 3d)$ you would not have factorised fully, because 4 is not the highest common factor of both terms.



5 (a) Here are some factors.

$2x^2 - 3xy$ 3 $3xy$ $3x$ $2x - 3y$ $2x^2 - 3y$

Write down the factors of $6x^2 - 9xy$ from the list.

..... (2 marks)

(b) Write down all the factors of $12mn + 4m^2$.

..... (2 marks)

You will need to use problem-solving skills throughout your exam - be prepared!



PROBLEM SOLVED!



6 Show that when x is a whole number $5(2x + 3) - 4(x - 3)$ is a multiple of 3

1. Expand the brackets.
2. Collect like terms.
3. Factorise.
4. Write a conclusion.

(2 marks)

Linear equations 1



1 Solve

(a) $2x = 32$ ($\div 2$)

(b) $3x = -15$

(c) $-30 = 2q$

$x = \dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

(d) $\frac{v}{-4} = 9$ ($\times -4$)

(e) $10 = \frac{x}{-12}$

(f) $72 = -8n$

$v = \dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)



2 Solve

(a) $x + 4 = 9$ (-4)

(b) $20 = p + 8$

(c) $7 - t = 5$

$x = \dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

(d) $-2 = a - 5$

(e) $h - 4 = 15$

(f) $6 = -k - 40$

The = sign is symmetrical. You can swap the right- and left-hand sides of the equation.

$a - 5 = -2$ ($+5$)

$a = \dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)



3 Solve

(a) $2x - 8 = 4$ ($+8$)

(b) $7p + 30 = 9$

$2x = \dots\dots\dots$ ($\div 2$)

$x = \dots\dots\dots$ (2 marks)

$\dots\dots\dots$ (2 marks)

(c) $4t + 25 = 9$

(d) $2 = 3f + 14$

$\dots\dots\dots$ (2 marks)

$\dots\dots\dots$ (2 marks)

(e) $4 + \frac{h}{3} = 9$ (-4)

(f) $-2 = \frac{c}{3} + 6$

$\frac{h}{3} = \dots\dots\dots$ ($\times 3$)

$h = \dots\dots\dots$ (2 marks)

$\dots\dots\dots$ (2 marks)

4 Tom is planting some tulips. He buys five bags with t tulips. When he opens up the bags he finds nine tulips are damaged.

(a) Write an expression for the number of tulips he can plant.

$\dots\dots\dots$ (1 mark)

(b) He planted 36 tulips. Form an equation in terms of t .

$\dots\dots\dots$ (1 mark)

(c) Solve the equation to find the number of tulips in each bag.

$\dots\dots\dots$ (2 marks)

Linear equations 2



5 Solve

(a) $6x + 3 = 2x + 11$ $(-2x)$

$4x + 3 = 11$ (-3)

$4x = \dots\dots\dots$ $(\div 4)$

$x = \dots\dots\dots$

Collect the x terms on one side.

(3 marks)

(b) $5x + 4 = 3x - 12$

(c) $7t - 12 = 3t - 9$

..... (3 marks)

..... (3 marks)



6 Solve

(a) $3(2x - 1) = 27$

Start by multiplying out the brackets.

(b) $4(2x - 1) = 3x + 6$

..... (3 marks)

..... (3 marks)

(c) $2(6 - x) = 3(2x + 12)$

(d) $\frac{4x + 8}{5} = 4$

..... (3 marks)

..... (3 marks)



7 The diagrams show two rectangular Christmas tags.



$(4x + 1)$ cm

4 cm



$(2x + 3)$ cm

6 cm

Both tags have the same area.
Work out the value of x .

You need to show your working clearly.

$x = \dots\dots\dots$ (3 marks)

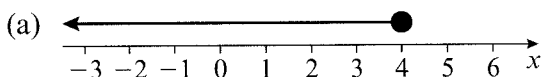
Inequalities



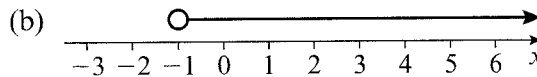
1 Write down the inequalities shown on each number line.

Closed (solid) circles show numbers **are** included.

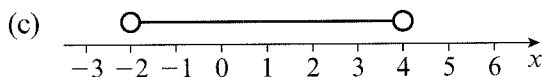
Guided



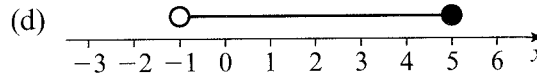
$x \leq \dots\dots\dots$ (1 mark)



$\dots\dots\dots$ (1 mark)



$\dots\dots\dots < x < \dots\dots\dots$ (1 mark)

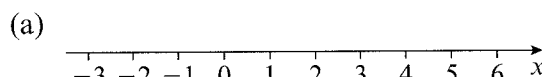


$\dots\dots\dots$ (1 mark)

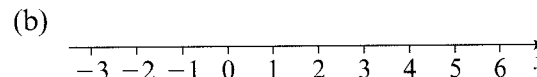


2 Show each inequality on the number line.

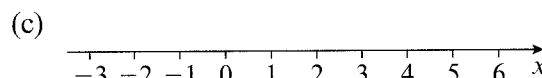
Use an open circle to show if a number is **not** included.



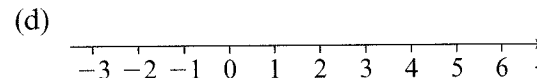
$x \geq 3$ (1 mark)



$x < 4$ (1 mark)



$-2 < x \leq 6$ (1 mark)



$-1 < x < 5$ (1 mark)



3 x is an integer. Write down all the possible values of x .

$-3 < x$ and ≤ 4

Guided

(a) $-3 < x \leq 4$

$x = -2, \dots\dots\dots$ (1 mark)

(b) $-2 \leq x < 3$

$\dots\dots\dots$ (1 mark)

(c) $-4 < x < 2$

$\dots\dots\dots$ (1 mark)



4 These numbers have been rounded. In each case, write an inequality to show the range of possible actual values.

Guided

(a) $a = 180$ (to the nearest 10)

(b) $b = 9000$ (to the nearest thousand)

$175 \leq a < \dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)

(c) $c = 123.5$ (to one decimal place)

(d) $d = 10.8$ (to three significant figures)

$\dots\dots\dots$ (1 mark)

$\dots\dots\dots$ (1 mark)



5 A hospital records the weight of a six month-old baby as 7.83 kg (two decimal places). Poppy and Jeff want to write an inequality to show the range of possible values for the exact weight of the baby, x kg.

Poppy writes $7.825 < x \leq 7.835$

Jeff writes $7.825 \leq x < 7.835$. Who is correct?

$\dots\dots\dots$ (2 marks)

Solving inequalities



Guided

1 Solve

(a) $2x \leq 20$ ($\div 2$)

$x \leq \dots$ (1 mark)

(b) $3x > 15$

\dots (1 mark)

(c) $4x \geq 16$

\dots (1 mark)

(d) $3x \leq -16$

$x \leq \dots$ (1 mark)

(e) $5x - 10 > 0$

\dots (1 mark)

(f) $6x + 4 \geq 0$

\dots (1 mark)



Guided

2 Solve

(a) $3x + 1 \geq 19$ (-1)

$3x \geq \dots$ ($\div 3$)

$x \geq \dots$ (2 marks)

(b) $5x - 8 < 27$

\dots (2 marks)

(c) $5x - 12 > x$

\dots (2 marks)

(d) $4x + 6 \leq 2x$

\dots (2 marks)



3 x is an integer.

Write down all the possible values of x .

'Integer' means 'whole number'.

(a) $-6 < 2x \leq 2$

\dots (3 marks)

(b) $-5 < 3x \leq 13$

\dots (3 marks)



4 Find the integer value of x that satisfies both the inequalities.

$2x - 3 > 5$ and $3x + 4 < 22$

Solve both inequalities first.

\dots (3 marks)

Sequences 1



1 Here are some patterns made from sticks.



Pattern number 1



Pattern number 2



Pattern number 3

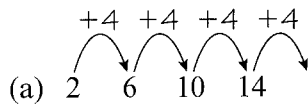
Pattern number 4

Draw pattern number 4 in the space above.

(1 mark)



2 Here are the first four terms of different number sequences. Write down the next two terms for each sequence.



(2 marks)

(b) 3 8 13 18

(2 marks)

(c) 1 3 9 27

(2 marks)

(d) 1 4 9 16

(2 marks)



3 The rule for generating this sequence is 'add two consecutive terms to get the next term'.

$1 + \dots = 4$

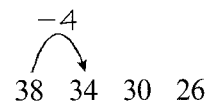
1 4 7

Work out the three missing numbers.

(3 marks)



4 The terms in this sequence decrease by the same amount each time.



(a) Write down the next two terms in this sequence.

..... (2 marks)

(b) Ravina says that 7 is a number in this sequence. Is she correct? Give a reason for your answer.

Look at the numbers in the sequence. Do they have anything in common?

..... (2 marks)



5 Here is a sequence. The third term of the sequence is 11.

..... 11

The rule for this sequence is 'add four to previous term then divide by two'. Work out the first term of the sequence.

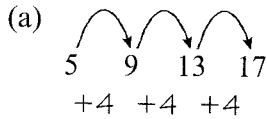
You will need to use problem-solving skills throughout your exam – **be prepared!**

..... (3 marks)

Sequences 2



6 Here are some sequences. Write down the n th term of each linear sequence.



(b) 2 5 8 11

n th term = $4n$ (2 marks) (2 marks)

(c) 2 9 16 23

(d) 8 13 18 23

..... (2 marks) (2 marks)



7 Here are the first five terms of a linear sequence.

4 7 10 13 16

Find an expression, in terms of n , for the n th term of the linear sequence.

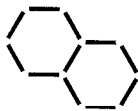
..... (2 marks)



8 Here are some patterns made from sticks



Pattern number 1



Pattern number 2



Pattern number 3

Pattern number 4

(a) Draw pattern number 4 in the space above.

Copy pattern number 3 and then draw in some more sticks to make pattern number 4.

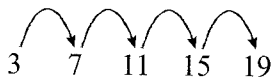
(1 mark)

(b) Write down a formula for the number of sticks, S , in terms of the pattern number, n .

$S =$ (2 marks)



9 Here are the first four terms of an arithmetic sequence.



(a) Find an expression, in terms of n , for the n th term of the sequence.

..... n - (2 marks)

(b) Molly says that 199 is a term in the arithmetic sequence. Is Molly correct? Give a reason for your answer.

Set the n th term of the sequence equal to 199 and solve the equation to find n .
 If n is an integer then the term is part of the sequence.
 If n is not an integer then the term is **not** part of the sequence.

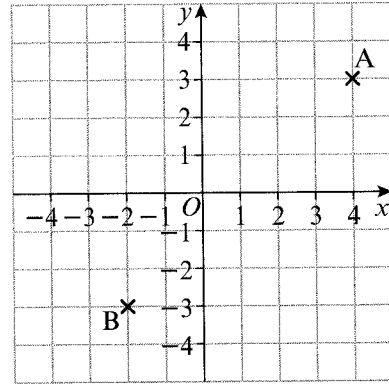
(2 marks)

Coordinates



1 (a) Write down the coordinates of

- (i) point A
(4,)
- (ii) point B
(.....,)



(1 mark)

(1 mark)

Remember the first number is the distance from the origin left or right, the second number is the distance from the origin up or down.

- (b) On the grid, plot the point
 - (i) (4, -2) and label it C
 - (ii) (-1, 3) and label it D.

(1 mark)

(1 mark)



Guided

2 Work out the midpoints for the line segments given by the following pairs of coordinates.

- (a) (3, 6) and (7, 12)

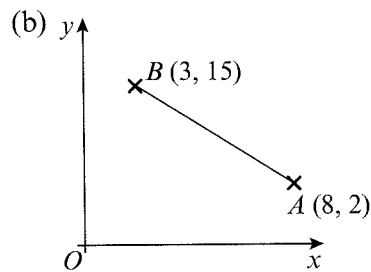
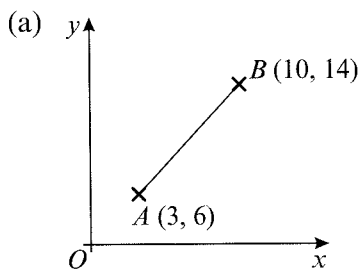
Midpoint = $\left(\frac{3 + 7}{2}, \frac{\dots + \dots}{2}\right) = (\dots, \dots)$ (2 marks)

- (b) (1, 8) and (9, 3) (c) (4, 7) and (-8, 13) (d) (2, -6) and (-10, 12)

..... (2 marks) (2 marks) (2 marks)



3 Work out the midpoints of the following line segments.

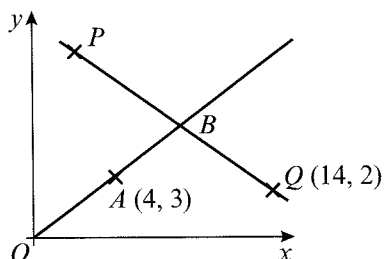


..... (2 marks)



4 Two straight lines are shown.
A is the midpoint of OB and B is the midpoint of PQ.
Show that the coordinates of P are (2, 10)

Start by working out the coordinates of B.

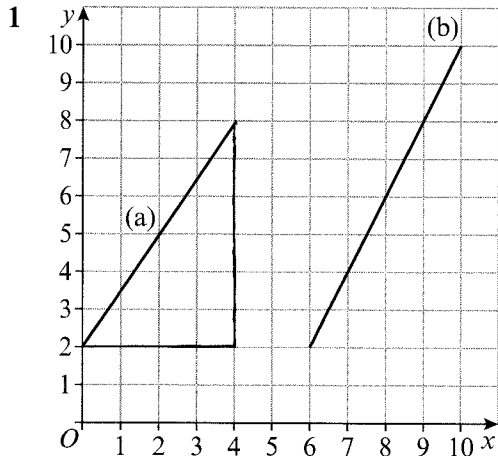


(2 marks)

Gradients of lines



Guided



Work out the gradients of the straight lines shown on the grid.

Draw a triangle on the graph and use it to find the gradient.

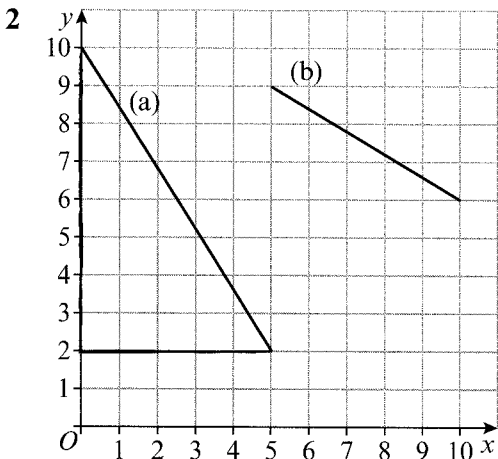
(a) Gradient = $\frac{\text{distance up}}{\text{distance across}}$
 =
 =

(2 marks)

(b) (2 marks)



Guided



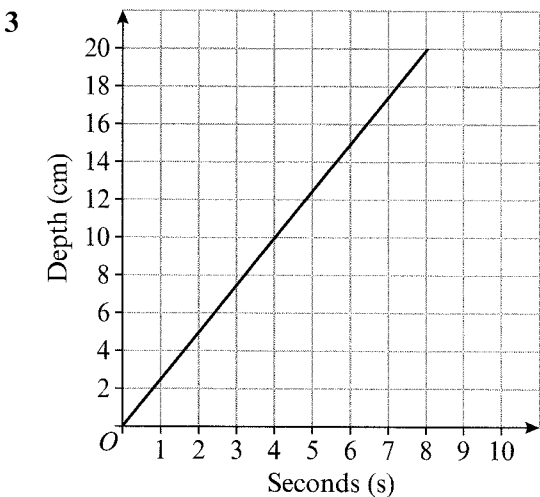
Work out the gradients of the straight lines shown on the grid.

The lines slope down so the gradient is **negative**.

(a) Gradient = $\frac{\text{distance up}}{\text{distance across}}$
 =
 =

(2 marks)

(b) (2 marks)



Kim pours diesel into a container. The graph shows how the depth, in cm, of the diesel changes with time, in seconds. Show that the rate of change of the depth of the diesel is 2.5 cm/s.

Look carefully at the vertical scale.

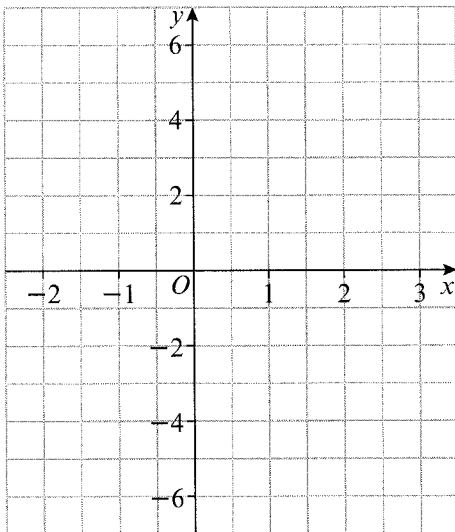
..... (2 marks)

Straight-line graphs 1



1

Guided



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

(a) Complete the table of values for $y = 2x - 1$

Substitute each value for x into the rule $y = 2x - 1$ to find the value of y .

$$x = -2: y = (2 \times -2) - 1$$

$$= \dots - 1 = \dots$$

$$x = 1: y = (2 \times \dots) - 1$$

$$= \dots - 1 = \dots$$

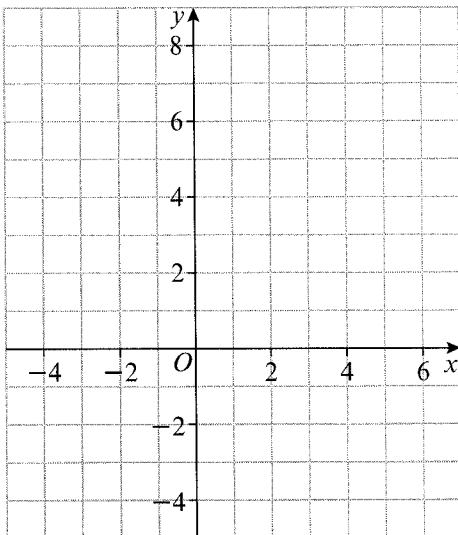
(2 marks)

(b) On the grid draw the graph of $y = 2x - 1$

(2 marks)



2



On the grid draw the graph of $x + y = 5$ for the values of x from -3 to 6 .

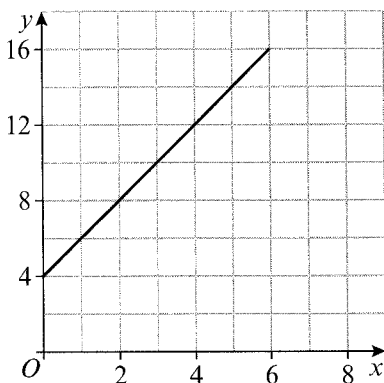
First draw a table of values. The question tells you to use 'values of x from -3 to 6 '. Next work out the values of y .

(2 marks)



3

Guided



Use $y = mx + c$ to find the equation of a straight line.

Find the equation of the straight line.

Draw a triangle on the graph and use it to find the gradient.

$$\text{Gradient} = \frac{\text{distance up}}{\text{distance across}} = \frac{\dots}{\dots}$$

$$= \dots$$

$$y = \dots + \dots$$

(2 marks)

c is the intercept on the y -axis.

Straight-line graphs 2



Guided

4 Find the equation of the straight line with

(a) gradient 3, passing through the point (2, 5)

(b) gradient -2, passing through the point (3, 6)

$y = 3x + c$

$5 = \dots \times \dots + c$

$c = \dots$

$y = \dots x \dots$ (2 marks)

\dots (2 marks)

Substitute the value of the gradient into $y = mx + c$. Then substitute the x -values and y -values given into your equation. Solve the equation to find c . Remember to write your completed equation at the end.

(c) gradient 4, passing through the point (-2, 7)

(d) gradient 4, passing through the point (-1, -6).

\dots (2 marks)

\dots (2 marks)



Guided

5 Find the equation of a straight line which passes through the following points.

(a) (3, 2) and (5, 6)

(b) (-1, 5) and (4, -10)

$m = \dots$

$2 = \dots \times \dots + c$

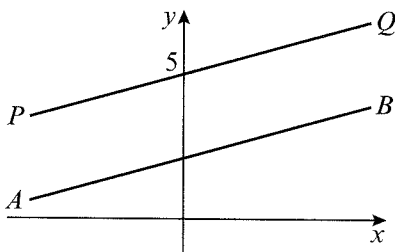
$c = \dots$

$y = \dots x \dots$ (3 marks)

\dots (3 marks)



6



Here are two straight lines.
The equation of line AB is $y = 4x + 1$
Line AB is parallel to line PQ .
Find the equation of line PQ .

Find the gradient of AB .
Find the value of the y -intercept for PQ .
Use $y = mx + c$ to find the equation of a straight line.

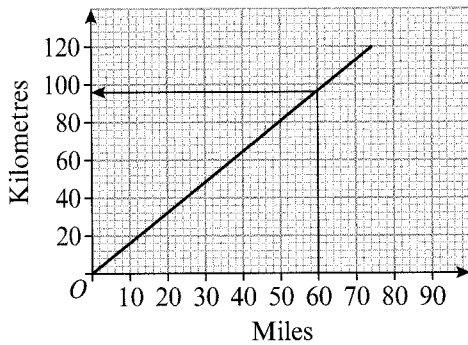
\dots (2 marks)

Real-life graphs



1

Guided



You can use this graph to change between miles and kilometres.

(a) Use the graph to change 60 miles into kilometres.

60 miles = kilometres **(1 mark)**

Draw a vertical line from 60 miles to the line and then draw a horizontal line across to the kilometres.

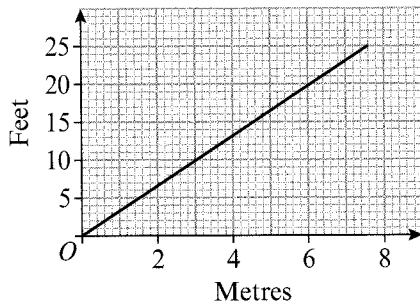
(b) The distance from Rome to Lyon is 660 miles.
The distance from Rome to Marseille is 950 kilometres.
Is Rome closer to Lyon or closer to Marseille?
You must show all of your working.

The horizontal scale on the graph does not go up to 660 miles. Use your answer to part (a) to work out 660 miles in kilometres, then write a conclusion.

(3 marks)



2



You can use this graph to change between feet and metres.

(a) Use the graph to change 15 feet into metres.

.....m **(1 mark)**

Amy and Sandeep are throwing a shot putt.

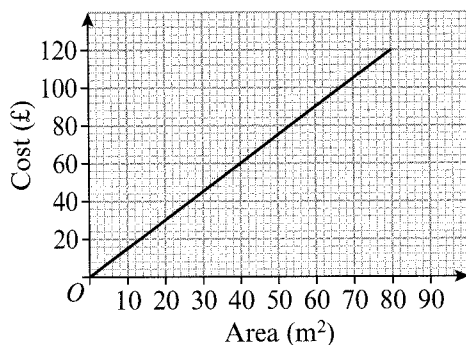
(b) Amy throws the shot putt 18 feet and Sandeep throws it 6 metres.
Who throws the shot putt the furthest? You must show all of your working.

(3 marks)



3 Lisa lays lawns in gardens of different areas.

She uses this graph to work out the cost of laying the lawn.



(a) She lays down 40 m² of lawn.
Use the graph to find the cost of laying the lawn.

£..... **(1 mark)**

(b) Lisa says, 'My price increases by £1.50 for every square metre.'
Is there evidence available to support this statement?

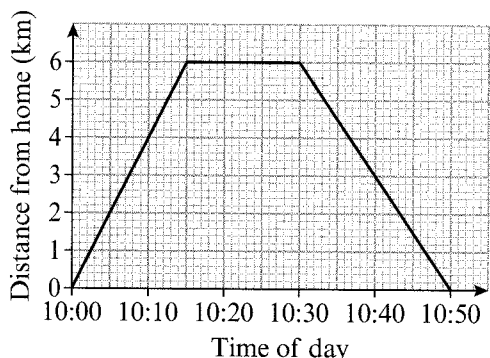
..... **(3 marks)**

Distance–time graphs



Guided

1 Becky cycled from her home to the shop. She went into the shop. She then cycled back home. Here is a distance–time graph for Becky’s complete journey.



(a) What time did Becky start her journey?

Start time =

..... (1 mark)

(b) What is the distance from Becky’s home to the shop?

After how many kilometres does she stop?

..... km (1 mark)

(c) How many minutes was Becky in the shop?

This is where the graph is horizontal.

..... (1 mark)

(d) Work out Becky’s average speed for her return journey.

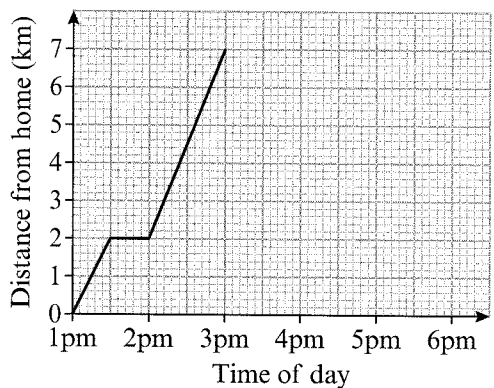
$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{\dots\dots\dots}{\dots\dots\dots} = \dots\dots\dots \text{ km/h}$$

(2 marks)



Guided

2 Gary left home at 1 pm to go for a walk. The distance–time graph represents part of Gary’s journey.



(a) Gary stopped for a break at 1.30 pm.

Write down how many minutes Gary stopped for.

..... (1 mark)

(b) How far was Gary from home at 2 pm?

Draw a line up from 2 pm and then across to the vertical axis.

..... (1 mark)

Gary had a rest at 3 pm for one hour. He then walked home at a steady speed. His walk home took him one and a half hours.

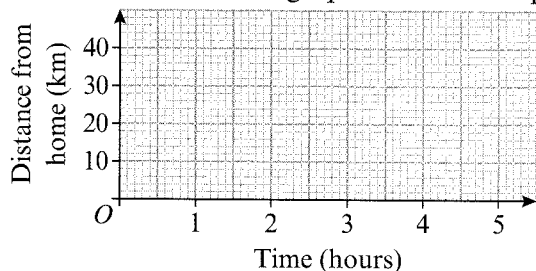
(c) Complete the distance–time graph.

(2 marks)



3 Nisha drives 40 km from her home to her grandparent’s home. The journey took one hour. She spent three hours at their house, then drove home at a steady speed. Her journey home took 30 minutes.

(a) Draw a distance–time graph of Nisha’s trip.



(2 marks)

(b) Work out Nisha’s average speed for her return journey.

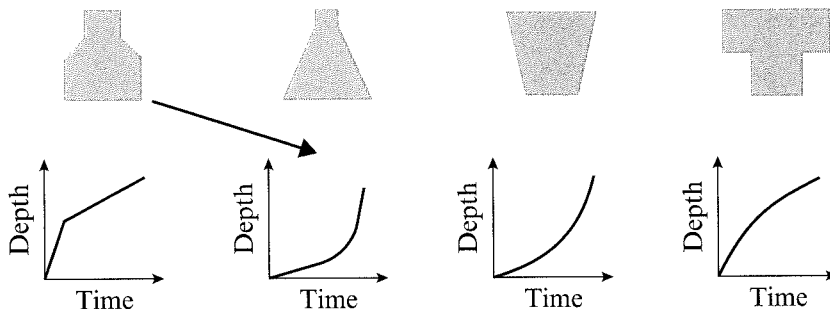
..... km/h (2 marks)

Rates of change



- 1 Here are four flasks. Rachael fills each flask with water. The graphs show the rate of change of the depth of the water in each flask as Rachael fills it. Draw a line from each flask to the correct graph. One line has been drawn for you.

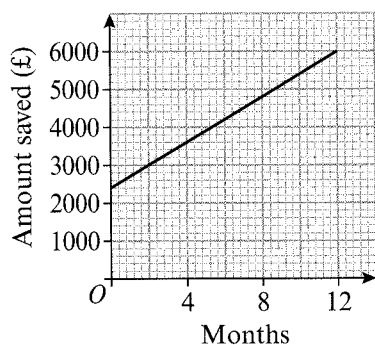
Guided



(2 marks)



- 2 The graph shows how much money there was in Dan's savings account over the last 12 months.



- (a) How much money was there at the start?

£..... (1 mark)

- (b) Work out the gradient of the line.

Draw a triangle on the graph and use it to find the gradient.

..... (2 marks)

- (c) Interpret the value of the gradient.

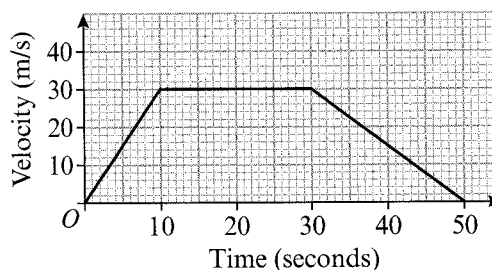
..... (1 mark)



- 3 Here is a velocity-time graph of a car.

Guided

Draw a triangle on the graph and use it to find the gradient.



- (a) What is the rate of change of velocity in the first 10 seconds?

Gradient = $\frac{\text{distance up}}{\text{distance across}}$ = = m/s^2
 (2 marks)

- (b) Describe what is happening to the car between 10 seconds and 30 seconds.

This is where the graph is horizontal.

..... (1 mark)

- (c) What is the rate of change of velocity in the last 20 seconds?

..... m/s^2 (2 marks)

Expanding double brackets



Guided

1 Expand and simplify

'Expand' means 'multiply out the brackets'.

(a) $(x + 3)(x + 5)$

$= x(x + 5) + 3(x + 5)$

$= x^2 + \dots + \dots + \dots$

$= x^2 + \dots + \dots$

This is the 'one at a time' method. You can use any method you like to expand the brackets.

(2 marks)

(b) $(x + 3)(x + 2)$

(c) $(x + 1)(x + 4)$

..... (2 marks)

..... (2 marks)

(d) $(x + 2)(x - 5)$

(e) $(x - 2)(x - 5)$

..... (2 marks)

..... (2 marks)

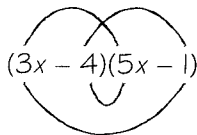


Guided

2 Expand and simplify

This is the 'FOIL' method. Multiply the First terms, then the Outside terms, then the Inside terms, then the Last terms.

(a) $(3x - 4)(5x - 1)$



$= 15x^2 - \dots - \dots + \dots$

$= 15x^2 - \dots + \dots$ (2 marks)

(b) $(8x - 3)(2x - 1)$

(c) $(7x - 5)(4x - 5)$

..... (2 marks)

..... (2 marks)

(d) $(x + 3)^2$

(e) $(2x - 5)^2$

..... (2 marks)

..... (2 marks)



3 n is a whole number. Show that $(n + 1)^2 - n^2$ is always an odd number.

(2 marks)

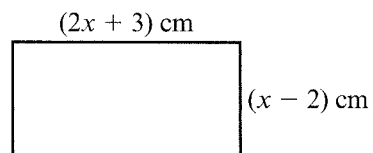


4 x and y are integers. Show that $x^2 + y^2 - (x - y)^2$ is always an even number.

(2 marks)



5 The diagram shows a rectangle with length $(2x + 3)$ cm and width $(x - 2)$ cm. The area of the rectangle is A square centimetres. Show that $A = 2x^2 - x - 6$

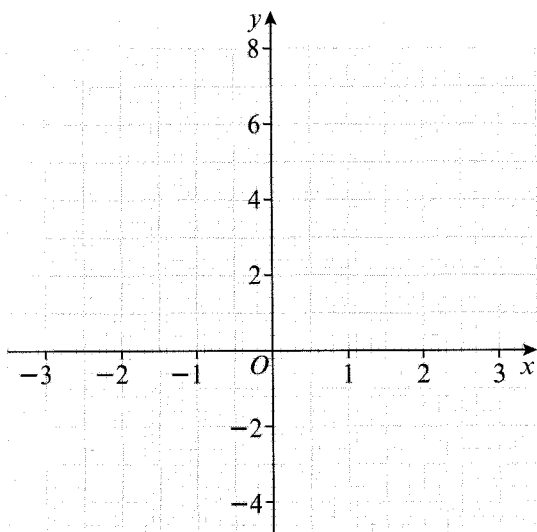


(2 marks)

Quadratic graphs



Guided



1 (a) Complete the table of values for $y = x^2 - 2$

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

Substitute each value of x into the formula $y = x^2 - 2$ to find the value of y .

$$x = -3: y = (-3 \times -3) - 2$$

$$= \dots - 2$$

$$= \dots$$

$$x = 1: y = (1 \times \dots) - 2$$

$$= \dots$$

(2 marks)

(b) On the grid draw the graph of $y = x^2 - 2$

(2 marks)

(c) Write down the coordinates of the turning point.

The turning point is the point where the direction of the curve changes.

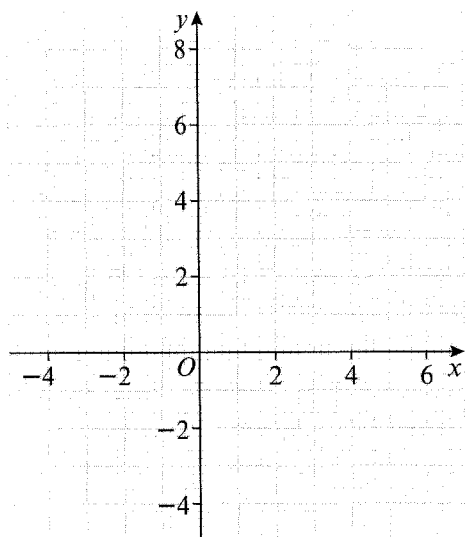
..... (1 mark)

(d) Use your graph to find the value of y when $x = 2.5$

(1 mark)



Guided



2 (a) Complete the table of values for $y = x^2 - 4x + 3$

x	-1	0	1	2	3	4	5
y			0				

Substitute each value for x into the rule $y = x^2 - 4x + 3$ to find the value of y .

$$x = -1: y = (-1 \times -1) - (4 \times -1) + 3 = \dots$$

$$x = 3: y = (3 \times \dots) -$$

$$(4 \times \dots) + 3$$

$$= \dots$$

(2 marks)

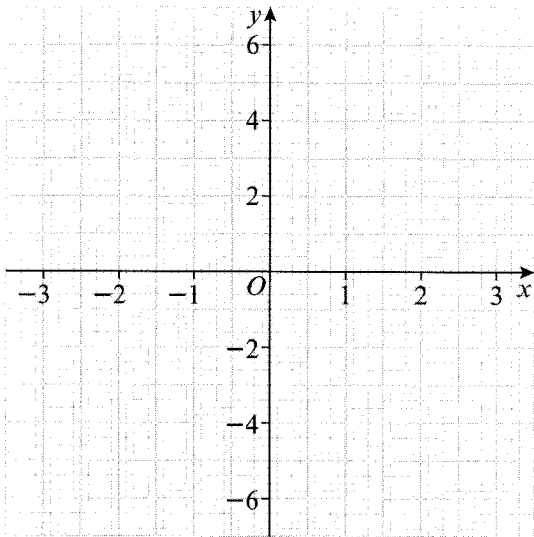
(b) On the grid draw the graph of $y = x^2 - 4x + 3$

(2 marks)

(c) Write down the coordinates of the turning point.

..... (2 marks)

Using quadratic graphs



1 (a) Complete the table of values for $y = x^2 - x - 4$

x	-3	-2	-1	0	1	2	3
y				-4			

$x = -2: y = (-2 \times -2) - (-2) - 4$
 $= \dots\dots\dots$

$x = 1: y = (1 \times 1) - (1) - 4$
 $= \dots\dots\dots$ **(2 marks)**

(b) On the grid draw the graph of $y = x^2 - x - 4$ **(2 marks)**

(c) Use your graph to write down an estimate for
 (i) the minimum value of y

The minimum value of y is the point where the direction of the curve changes.

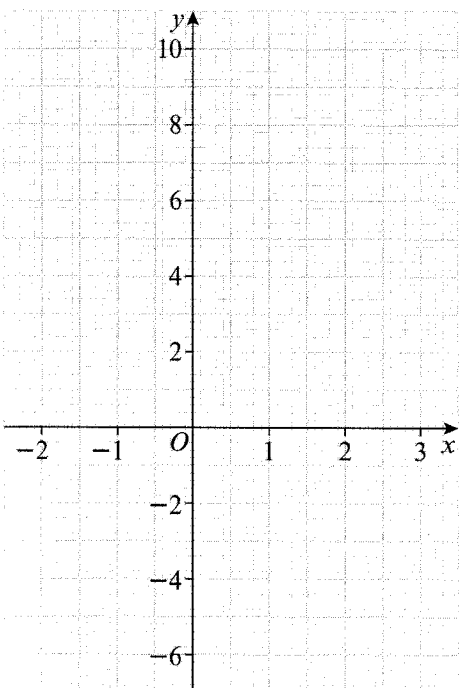
..... **(1 mark)**

(ii) the solutions of $x^2 - x - 4 = 0$

..... **(2 marks)**

(d) Comment on the accuracy of your estimates.

..... **(1 mark)**



2 (a) Complete the table of values for $y = 8 + 3x - 2x^2$

x	-2	-1	0	1	2	3
y		3				

$x = -2: y = 8 + (3 \times -2) - (2 \times -2 \times -2)$
 $= \dots\dots\dots$

$x = 3: y = 8 + (3 \times 3) - (2 \times 3 \times 3)$
 $= \dots\dots\dots$ **(2 marks)**

(b) On the grid draw the graph of $y = 8 + 3x - 2x^2$ **(2 marks)**

(c) Write down the coordinates of the turning point.
 **(2 marks)**

Factorising quadratics



1 Factorise

Guided

(a) $x^2 + 4x + 3$

..... \times = +3 + = +4

$x^2 + 4x + 3 = (x + \text{.....})(x + \text{.....})$ **(2 marks)**

You need to find two numbers that multiply to give 3 and add up to give 4.

(b) $x^2 + 11x + 10$

(.....) \times (.....) = +10 (.....) + (.....) = +11

$x^2 + 11x + 10 = (x \text{.....})(x \text{.....})$ **(2 marks)**

(c) $x^2 + 6x + 5$

(d) $x^2 - 11x + 10$

(e) $x^2 - 12x + 20$

..... **(2 marks)** **(2 marks)** **(2 marks)**

(f) $x^2 - 9x + 14$

(.....) \times (.....) = +14 (.....) + (.....) = -9

$x^2 - 9x + 14 = (x \text{.....})(x \text{.....})$ **(2 marks)**



2 Factorise

(a) $x^2 + 6x - 7$

(b) $x^2 + 4x - 5$

(c) $x^2 - 2x - 15$

..... **(2 marks)** **(2 marks)** **(2 marks)**



3 Factorise

(a) $x^2 - 13x + 22$

(b) $x^2 - 6x - 16$

(c) $x^2 - 14x + 40$

..... **(2 marks)** **(2 marks)** **(2 marks)**



4 Factorise

(a) $x^2 - 9$

$a = x, b = 3$

$x^2 - 9 = (x + \text{.....})(x - \text{.....})$ **(2 marks)**

This is a difference of two squares. You can use the rule $a^2 - b^2 = (a + b)(a - b)$

(b) $x^2 - 144$

(c) $x^2 - 81$

(d) $x^2 - 64$

..... **(2 marks)** **(2 marks)** **(2 marks)**

(e) $x^2 - 1$

(f) $x^2 - 169$

..... **(2 marks)** **(2 marks)**

Quadratic equations



1 Solve

(a) $x^2 - 3x = 0$

..... (x -) = 0

$x = 0$ or $x = \dots\dots\dots$ (2 marks)

Guided

Find the values of x that make each factor equal to 0. The first factor is just x so one solution is x = 0

(b) $x^2 + 5x = 0$

(c) $x^2 - 7x = 0$

..... (2 marks)

..... (2 marks)



2 Solve

(a) $x^2 + 6x + 8 = 0$

$(x + 2)(x + \dots\dots\dots) = 0$

$x = -2$ or $x = \dots\dots\dots$

The first factor is $x + 2$, so the first solution is $x = -2$

(2 marks)

(b) $x^2 - 7x + 12 = 0$

(c) $x^2 + 9x + 20 = 0$

..... (2 marks)

..... (2 marks)

(d) $x^2 + 8x + 7 = 0$

(e) $x^2 - 2x - 24 = 0$

$(x \dots\dots\dots)(x \dots\dots\dots) = 0$

$x = \dots\dots\dots$ or $x = \dots\dots\dots$

..... (2 marks)

..... (2 marks)



3 Solve

Use the rule for the difference of two squares: $a^2 - b^2 = (a + b)(a - b)$

(a) $x^2 - 4 = 0$

$(x + \dots\dots\dots)(x - \dots\dots\dots) = 0$

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ (2 marks)

(b) $x^2 - 25 = 0$

(c) $x^2 - 49 = 0$

..... (2 marks)

..... (2 marks)

(d) $x^2 - 121 = 0$

(e) $x^2 - 9 = 0$

..... (2 marks)

..... (2 marks)



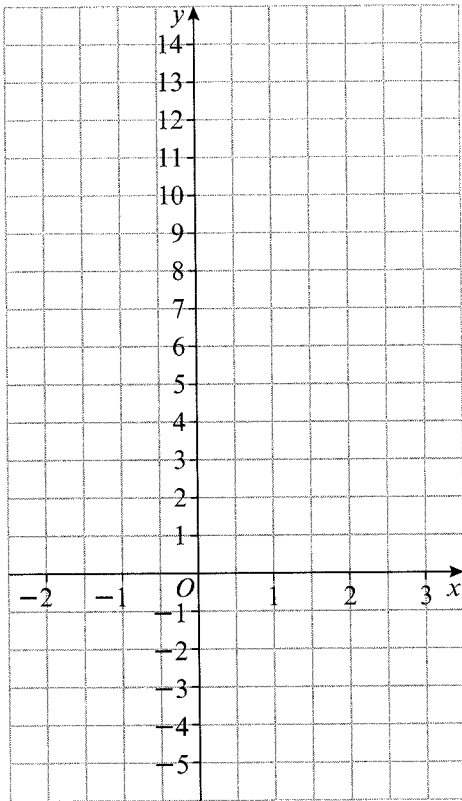
4 The sum of the squares of two consecutive numbers is 221. Find the two positive numbers.

..... (3 marks)

Cubic and reciprocal graphs



Guided



1 (a) Complete the table of values for $y = x^3 - 4x - 2$

x	-2	-1	0	1	2	3
y		1				13

Substitute each value for x into the rule $y = x^3 - 4x - 2$ to find the value of y .

$x = -2: y = (-2 \times -2 \times -2)$

$- (4 \times -2) - 2 = \dots\dots\dots$

$x = 1: y = (1 \times 1 \times 1) - (4 \times 1) - 2$

$= \dots\dots\dots$

(2 marks)

(b) On the grid draw the graph of $y = x^3 - 4x - 2$

(2 marks)

(c) Write down the coordinates of the turning points.

.....

(2 marks)

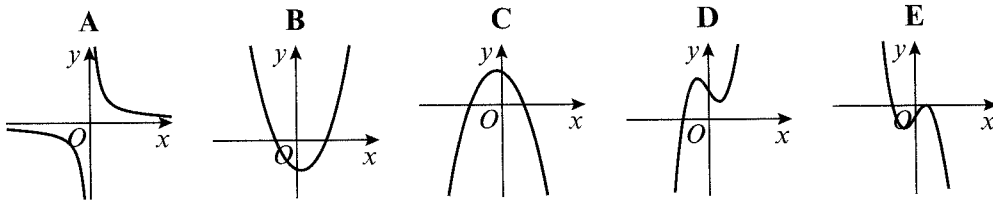
(d) Use your graph to find estimates of the solutions to the equation $x^3 - 4x - 2 = -3$

Draw the line $y = -3$ on the graph. Find the x -coordinates of the points of intersection with the curve.

..... (2 marks)



2



Write down the letter of the graph which could have the equation

(i) $y = x^2 - x - 6$

(ii) $y = x^3 - 3x + 5$

(iii) $y = \frac{1}{x}$

..... (1 mark)

..... (1 mark)

..... (1 mark)

(iv) $y = 6 - x - x^2$

(v) $y = 2 + 3x - x^3$

..... (1 mark)

..... (1 mark)

Simultaneous equations



1 Solve the simultaneous equations

Label the equations (1) and (2).

Guided

(a) $2x + 5y = 16$ (1)
 $5x - 2y = 11$ (2)

(1) $\times 5$ gives $x +$ $y =$ (3)

(2) $\times 2$ gives $10x - 4y = 22$ (4)

(3) $-$ (4) gives

..... $y =$

$y =$

Substitute $y =$ in (1)

$2x + 5 \times$ $= 16$

$x =$

$x =$, $y =$ (3 marks)

(b) $3x + 2y = 11$
 $2x - 5y = 20$

$x =$, $y =$ (3 marks)

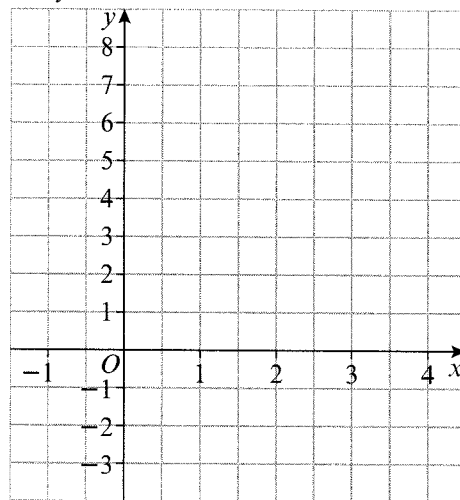
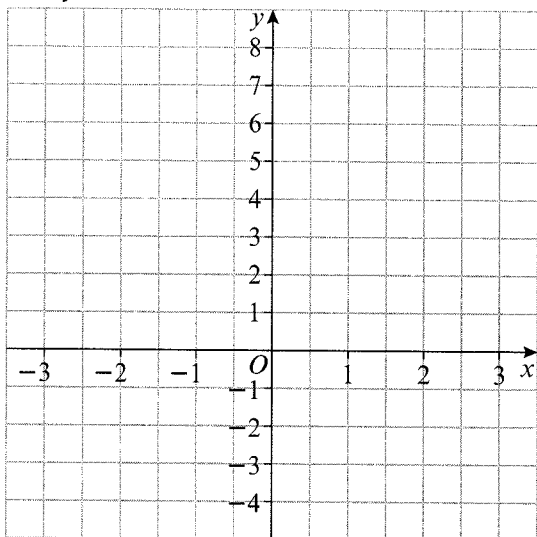


2 By drawing two suitable straight lines on the coordinate grid below, solve the simultaneous equations

Guided

(a) $x + y = 5$
 $y = 3x + 1$

(b) $2x + y = 5$
 $x + y = 3$



For each equation choose three x -values and then find the corresponding y -values. Plot these points and draw a straight line through the three points. The solution to the simultaneous equations is the point where the lines cross.

(a) $x =$, $y =$ (4 marks)

(b) $x =$, $y =$ (4 marks)

Rearranging formulae



- 1 A straight line has equation $3y = 4x + 3$. The point P lies on the straight line. P has y -coordinate of 5. Work out the x -coordinate of P .

Guided

Substitute $y = 5$ into $3y = 4x + 3$ and solve the equation to find x .

$$3 \times \dots = 4x + 3$$

$$\dots - \dots = 4x$$

$$x = \dots \div \dots = \dots \quad (2 \text{ marks})$$



- 2 Mandy wants to work out the time in seconds taken for a ball to reach the ground by using the formula $v = u + at$. She knows that $v = 30$, $u = 5$ and $a = 10$. Work out the time taken, t , for the ball to reach the ground.

$$t = \dots \quad (3 \text{ marks})$$



- 3 Make the letter in the brackets the subject of each formula.

(a) $v = u + 10t$ (t)

(b) $m = 6n + 19$ (n)

$$v - \dots = 10t \quad (\div 10)$$

$$\dots = t$$

$$t = \dots \quad (2 \text{ marks})$$

$$n = \dots \quad (2 \text{ marks})$$

(c) $d = ut + at^2$ (u)

(d) $P = A - 6D$ (D)

$$u = \dots \quad (2 \text{ marks})$$

$$D = \dots \quad (2 \text{ marks})$$



- 4 Make the letter in the brackets the subject of each formula.

(a) $s = \frac{d}{t}$ (t)

(b) $d = \sqrt{\frac{5h}{4}}$ (h)

$$t = \dots \quad (2 \text{ marks})$$

$$h = \dots \quad (2 \text{ marks})$$

(c) $s = \frac{1}{2}(u + v)t$ (t)

(d) $v^2 = u^2 + 2as$ (s)

$$t = \dots \quad (2 \text{ marks})$$

$$s = \dots \quad (2 \text{ marks})$$



- 5 Make the letter in the brackets the subject of each formula.

(a) $P = h(2 + n)$ (n)

(b) $t = 3(1 - 2x)$ (x)

$$n = \dots \quad (3 \text{ marks})$$

$$x = \dots \quad (3 \text{ marks})$$

Using algebra



Guided

1 Tom plants some rhubarb seeds in his allotment. He plants seven rows of these seeds. In each row there are x seeds. A few months later he finds insects have eaten nine seeds. After this he has 96 rhubarb plants left in total.

(a) Write down an equation using this information.

$7 \times \dots - \dots = \dots$ (1 mark)

(b) Work out how many rows of seeds Tom planted.

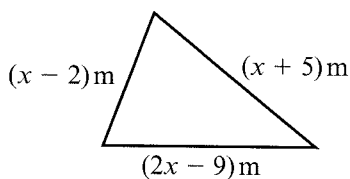
Solve the equation.

..... (2 marks)



Guided

2 The diagram shows a triangular playground.



The total perimeter of the playground is 54 m. Work out the value of x .

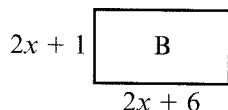
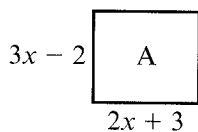
$(x - 2) + \dots + \dots = 54$

Form an equation, then simplify and solve it.

..... (3 marks)



3 The diagram shows two rectangular gardens. All the measurements are in metres.



Both gardens have the same perimeter. Work out the width and height of garden A.

..... (3 marks)



4 A square has side length $2x$ cm. An equilateral triangle has side length $(2x + 4)$ cm. The perimeter of the square is equal to the perimeter of the equilateral triangle. Work out the value of x .

$x = \dots$ (3 marks)

Identities and proof



- 1 Show that $(2n - 1)^2 + (2n + 1)^2 \equiv 2(4n^2 + 1)$

Multiply out the brackets.

$$(2n - 1)^2 = (2n - 1)(2n - 1) = \dots\dots\dots$$

$$(2n + 1)^2 = (2n + 1)(2n + 1) = \dots\dots\dots$$

Guided

Add the brackets together and then factorise.

(2 marks)



- 2 Show that the sum of any four consecutive integers is always a multiple of 2.

You need to use algebra – it's not enough to just try this with four numbers.

You can represent any four consecutive integers as $n, n + 1$, and so on.

$$n + (n + 1) + \dots\dots\dots + \dots\dots\dots$$

$$= \dots\dots\dots n + \dots\dots\dots$$

$$= \dots\dots\dots (\dots\dots\dots n + \dots\dots\dots)$$

$\dots\dots\dots$ is a factor so the total expression must be a multiple of $\dots\dots\dots$ (3 marks)



- 3 Given that $5(x - c) = 4x - 5$ where c is an integer, show that x is a multiple of 5.

Multiply out the brackets and then rearrange to make x the subject.

(3 marks)



- 4 Show that

(a) $(x - 1)^2 \equiv x^2 - 2x + 1$

- (b) Hence, or otherwise, show that

$$(x + 1)^2 + (x - 1)^2 \equiv 2(x^2 + 1)$$

(2 marks)

(2 marks)



- 5 (a) Show that the sum of any three **consecutive** even numbers is always a multiple of 6.

- (b) Give an example to show that the sum of any three even numbers is not necessarily a multiple of 6.

Guided

Write your even numbers as $2n, 2n + 2$ and $2n + 4$.

You don't need to use algebra for part (b). Just find three consecutive numbers whose sum is not a multiple of 6.

(3 marks)

(1 mark)

Problem-solving practice 1



- 1 Tom cleaned his swimming pool. He hired a cleaning machine to do this job. The cost of hiring the cleaning machine was £35.50 for the first day and then £18.25 for each extra day. Tom's total cost of hiring the machine was £163.25. For how many days did Tom hire the machine?

..... days (3 marks)



- 2 The coordinates of three vertices of a square are (2, 1), (2, 5) and (6, 5). Write down the coordinates of the:

(a) missing vertex.

(b) centre of the square.

..... (1 mark)

..... (2 marks)



- 3 A gardener charges £15 for each hour he works at a job plus £25. The cost, in £, of the job can be worked out using the formula

$$\text{Cost} = \text{number of hours worked} \times 15 + 25$$

(a) The gardener works seven hours. Work out the total cost.

£..... (2 marks)

(b) He charges £115 for one job. How many hours did he work?

..... hours (2 marks)



- 4 Dan and Jay are measuring the distance when a ball is rolled. They use the formula $s = ut + 5t^2$ where $u = 4$ and $t = 2$. Dan works out the value of s to be 28 and Jay works out the value of s to be 108. Who is correct? Give a reason for your answer.

..... (3 marks)



- 5 Here are some patterns made using sticks.



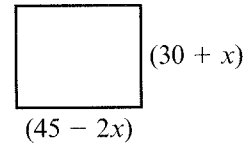
Anjali says that for pattern number 10 there will be 32 sticks. Is she correct?

..... (1 mark)

Problem-solving practice 2



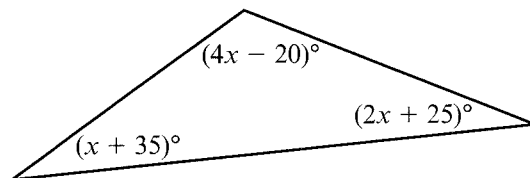
- 6 The diagram shows a square.
Find the length of one side of the square.



..... (2 marks)



- 7 ABC is a triangle. Work out the size of the smallest angle.



.....° (3 marks)



- 8 (a) Write down the equation of a straight line that is parallel to $y = 5x + 4$

..... (1 mark)

- (b) Write down the equation of the straight line that is parallel to $y = 3x + 5$
and which passes through (4, 7).

..... (2 marks)

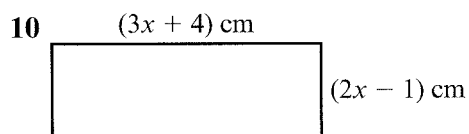


- 9 Here are the first five terms of a linear sequence.

2 5 8 11 14

34 cannot be a term in this linear sequence. Explain why.

..... (3 marks)



The diagram shows a rectangle with length $(3x + 4)$ cm and width $(2x - 1)$ cm.
The area of the rectangle is A square centimetres.

Show that $A = 6x^2 + 5x - 4$

(2 marks)

- 4 (a) 8.5625 (b) 9
 5 (a) 1.248005424 (b) 1.25
 6 (a) 2.798083024 (b) 2.8

17. Standard form 1

- 1 (a) 4.5×10^4 (b) 0.000034 (c) 2.8×10^7
 2 (a) 5.67×10^5 (b) 5.67×10^{-5} (c) 5.67×10^{10}
 3 (a) 6.74×10^6 (b) 7.3×10^6 (c) 6.2×10^6
 4 (a) 2.05×10^8 (b) 7.5×10^7
 5 9.3×10^4

18. Standard form 2

- 6 (a) 1.8×10^4 (b) 2×10^{20}
 7 (a) 7.01×10^4 (b) 7.52×10^5
 8 (a) 1.12×10^{10} (b) 4.48×10^8 (c) 7×10^{10}
 9 1.44×10^8
 10 15000

19. Counting strategies

- 1 (A,2), (A,3), (R,1), (R,2), (R,3), (T,1), (T,2), (T,3)
 2 (C,P), (C,G), (C,B), (L,P), (L,G), (L,B), (V,P), (V,G), (V,B)
 3 (W,X), (W,Y), (W,Z), (X,Y), (X,Z), (Y,Z)
 4 6
 5 6
 6 20

20. Problem-solving practice 1

- 1 2, 5, 13, 17 (there are other possibilities, for example, 2, 3, 11, 19)
 2 £7
 3 (a) 10 cups of coffee
 4 (a) 12600
 (b) She is incorrect, $72 \times 6 = 432$, she needs 7 vans
 5 $\frac{2}{3}$
 6 60 boxes

21. Problem-solving practice 2

- 7 27
 8 6
 9 18 cm
 10 9 am
 11 $(4.86 \times 10^{-5}) \times (6.2 \times 10^4) = 3.01 \approx 3$ m
 12 $\frac{14}{5}$

ALGEBRA

22. Collecting like terms

- 1 (a) Expression (b) Formula (c) Equation
 2 (a) $5x$ (b) $6xy$
 3 (a) $4x + 2y$ (b) $5ab$ (c) $t + 11v$ (d) $3c - 2d$
 4 (a) $2x$ (b) $3t^2$ (c) $3a + 8b + 7$ (d) $x - 7y$
 5 (a) $3n$ (b) $6p + q$ (c) $3m + 4n$ (d) $2a + 6b + 5$
 6 (a) $2y^2$ (b) $3x^2 + 2x$

23. Simplifying expressions

- 1 (a) y^2 (b) $3mt$
 2 (a) w^4 (b) $28d$ (c) $30k$ (d) $40jk$
 3 (a) $15x^2$ (b) $6ef$ (c) $4a$ (d) $8b$
 4 (a) $35gh$ (b) $8t^3$ (c) $3x$ (d) $4y$
 5 (a) $24abc$ (b) $8p$
 6 $2(x \times y)$ and $4xy \div 2$

24. Algebraic indices

- 1 (a) a^9 (b) a^3 (c) a^4 (d) a^{12}
 2 (a) t^3 (b) t^3 (c) t^8 (d) t^6
 3 (a) x^{12} (b) $64x^6$ (c) $8x^9$ (d) $12x^7$
 (e) $12x^7y^5$ (f) $3x^2y^3$
 4 (a) 8 (b) 5 (c) 5
 5 1.5

25. Substitution

- 1 240 km
 2 (a) 23 (b) -11

- 3 (a) 34 (b) 19
 4 (a) -6 (b) 100 (c) 12
 5 (a) 104 (b) 23 (c) 20
 6 Abbie is correct, $\frac{1}{2} \times 2 \times 3^2 = 9$

26. Formulae

- 1 50 minutes
 2 £175
 3 30
 4 36
 5 18
 6 52
 7 -4°F
 8 $y = 3x^2 - 4x + 3$
 $y = 3(-2)^2 - 4(-2) + 3$
 $y = 12 + 8 + 3$
 $y = 23$

27. Writing formulae

- 1 $4g + 5h$
 2 $S = 10m + 20n$
 3 $P = 30n + 50$
 4 $T = 8(m + 5)$
 5 $P = 10x + 2$
 6 (a) $B = n + 4$
 (b) Yes, because Carl is $3n$ years old

28. Expanding brackets

- 1 (a) $3x + 6$ (b) $4x + 20$ (c) $3x + 6$
 (d) $12x + 18$ (e) $\sqrt{2x} - 2$ (f) $21x - 56$
 2 (a) $-3x + 9$ (b) $-4x - 12$ (c) $-6x + 30$
 (d) $-4x - 6$ (e) $-8x + 2$ (f) $-2x + 4$
 3 (a) $x^2 + x$ (b) $x^2 + 5x$ (c) $2x^2 - 18x$
 (d) $6x^2 - 9x$ (e) $-2x^2 + 3x$ (f) $-12x^2 + 15x$
 4 (a) $7x + 6$ (b) $5x + 14$ (c) $13x - 11$
 (d) $6x^2 - 20x$
 5 $a = 20, b = -19$
 6 $p = 3, q = 18$

29. Factorising

- 1 (a) $3(x + 2)$ (b) $6(a + 3)$ (c) $2(p - 3)$
 (d) $5(y - 3)$ (e) $3(t + 8)$ (f) $4(g - 5)$
 2 (a) $x(x + 6)$ (b) $x(x - 4)$ (c) $x(x - 9)$
 (d) $x(x - 12)$ (e) $x(x + 5)$ (f) $x(x - 1)$
 3 (a) $3p(p + 2)$ (b) $8y(y - 3)$ (c) $9t(t - 4)$
 4 (a) $4d(d + 3)$ (b) $6x(x - 3)$ (c) $7n(n - 5)$
 5 (a) $2x^2 - 3xy, 3, 3x, 2x - 3y$
 (b) $4, (3mn + m^2), 4m, (3n + m), m, (12n + 4m)$
 6 $10x + 15 - 4x + 12$
 $= 6x + 27$
 $= 3(2x + 9)$

30. Linear equations 1

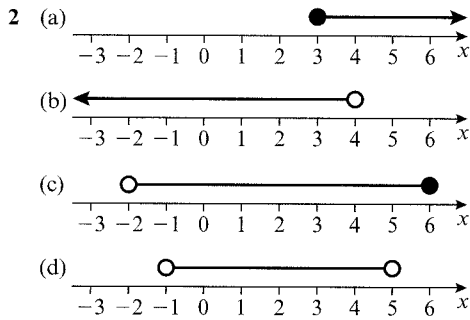
- 1 (a) 16 (b) -5 (c) -15
 (d) -36 (e) -120 (f) -9
 2 (a) 5 (b) 12 (c) 2
 (d) 3 (e) 19 (f) -46
 3 (a) 6 (b) -3 (c) -4
 (d) -4 (e) 15 (f) -24
 4 (a) $5t - 9$ (b) $36 = 5t - 9$ (c) 9

31. Linear equations 2

- 5 (a) 2 (b) -8 (c) $\frac{3}{4}$
 6 (a) 5 (b) 2 (c) -3 (d) 3
 7. $\frac{7}{2}$

32. Inequalities

- 1 (a) $x \leq 4$ (b) $x > -1$
 (c) $-2 < x < 4$ (d) $-1 < x \leq 5$




- 3 (a) $x = -2, -1, 0, 1, 2, 3, 4$
 (b) $x = -2, -1, 0, 1, 2$
 (c) $x = -3, -2, -1, 0, 1$
- 4 (a) $175 \leq a < 185$
 (b) $8500 \leq b < 9500$
 (c) $123.45 \leq c < 123.55$
 (d) $10.75 \leq d < 10.85$
- 5 Jeff is correct

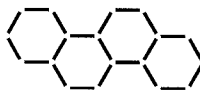
33. Solving inequalities

- 1 (a) $x \leq 10$ (b) $x > 5$ (c) $x \geq 4$
 (d) $x \leq -\frac{16}{3}$ (e) $x > 2$ (f) $x \geq -\frac{2}{3}$
- 2 (a) $x \geq 6$ (b) $x < 7$ (c) $x > 3$
 (d) $x \leq -3$
- 3 (a) $x = -2, -1, 0, 1$
 (b) $x = -1, 0, 1, 2, 3, 4$
- 4 $x = 5$

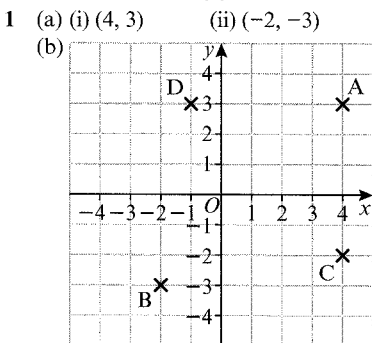
34. Sequences 1

- 1 
- 2 (a) 18, 22 (b) 23, 28 (c) 81, 243 (d) 25, 36
- 3 1, 3, 4, 7, 11, 18
- 4 (a) 22, 18
 (b) Ravina is incorrect. All terms end in even digits.
- 5 32

35. Sequences 2

- 6 (a) $4n + 1$ (b) $3n - 1$ (c) $7n - 5$ (d) $5n + 3$
- 7 $3n + 1$
- 8 (a) 
- (b) $S = 5n + 1$
- 9 (a) $4n - 1$
 (b) $4n - 1 = 199$
 $4n = 200$
 $n = 50$
 n is an integer therefore 199 is part of the sequence

36. Coordinates

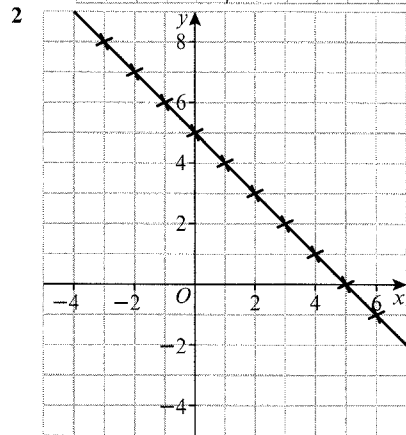
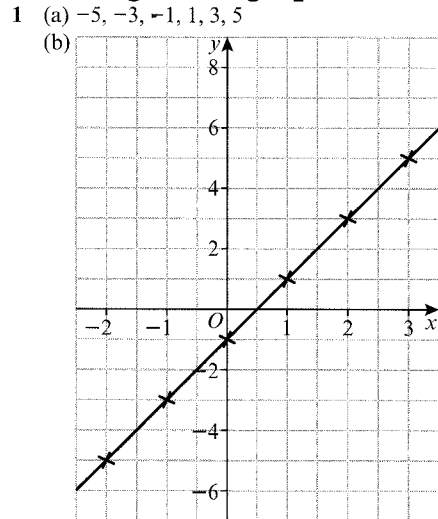


- 2 (a) (5, 9) (b) $(5, \frac{11}{2})$ (c) (-2, 10) (d) (-4, 3)
- 3 (a) $(\frac{13}{2}, 10)$ (b) $(\frac{11}{2}, \frac{17}{2})$
- 4 B (8, 6) and then P (2, 10)

37. Gradients of lines

- 1 (a) $\frac{3}{2}$ (b) 2
- 2 (a) $-\frac{8}{5}$ (b) $-\frac{3}{5}$
- 3 (a) $\frac{20}{8} = 2.5$ cm/s

38. Straight-line graphs 1



3 $y = 2x + 4$

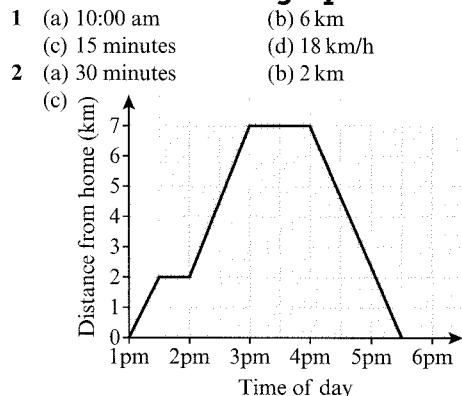
39. Straight-line graphs 2

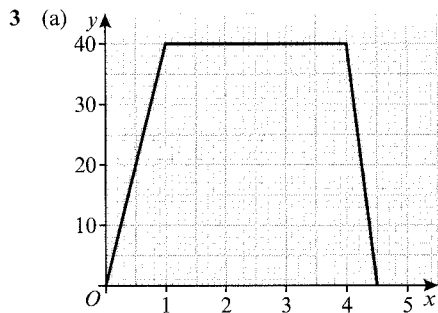
- 4 (a) $y = 3x - 1$ (b) $y = -2x + 12$
 (c) $y = 4x + 15$ (d) $y = 4x - 2$
- 5 (a) $y = 2x - 4$ (b) $y = -3x + 2$
- 6 $y = 4x + 5$

40. Real-life graphs

- 1 (a) 96 km (b) Marseille
- 2 (a) 4.6 m (b) Sandeep
- 3 (a) £60 (b) Yes, gradient = 1.5

41. Distance-time graphs

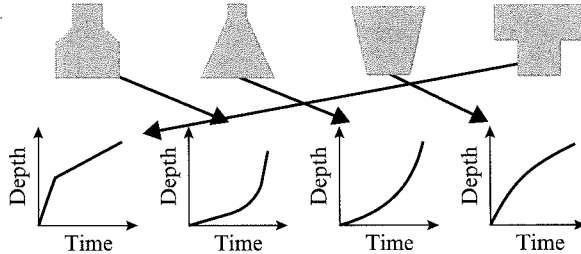




(b) 80 km/h

42. Rates of change

1



- 2 (a) £2400 (b) 300
 (c) For every month, Dan saves £300
 3 (a) 3 m/s^2 (b) The velocity is constant
 (c) -1.5 m/s^2

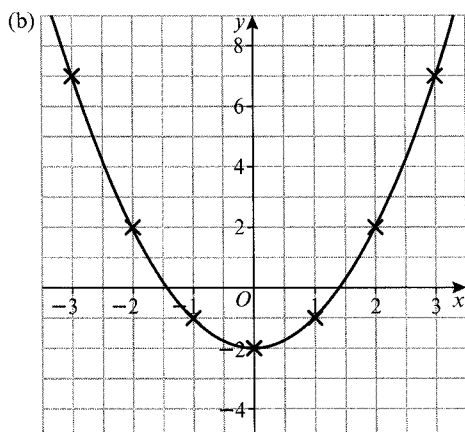
43. Expanding double brackets

- 1 (a) $x^2 + 8x + 15$
 (b) $x^2 + 5x + 6$
 (c) $x^2 + 5x + 4$
 (d) $x^2 - 3x - 10$
 (e) $x^2 - 7x + 10$
 2 (a) $15x^2 - 23x + 4$
 (b) $16x^2 - 14x + 3$
 (c) $28x^2 - 55x + 25$
 (d) $x^2 + 6x + 9$
 (e) $4x^2 - 20x + 25$
 3 $n(n+1) + 1(n+1) - n^2$
 $= n^2 + 2n + 1 - n^2$
 $= 2n + 1$ which is odd.
 4 $x^2 + y^2 - (x^2 - 2xy + y^2)$
 $= 2xy$ which is even
 5 $(2x+3)(x-2)$
 $= 2x^2 - 4x + 3x - 6$
 $= 2x^2 - x - 6$

44. Quadratic graphs

1 (a)

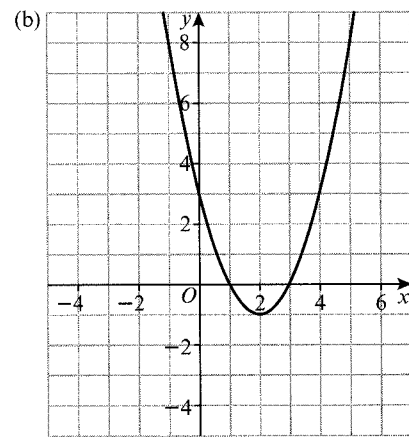
x	-3	-2	-1	0	1	2	3
y	7	2	-1	-2	-1	2	7



(c) (0, -2) (d) 4

2 (a)

x	-1	0	1	2	3	4	5
y	8	3	0	-1	0	3	8

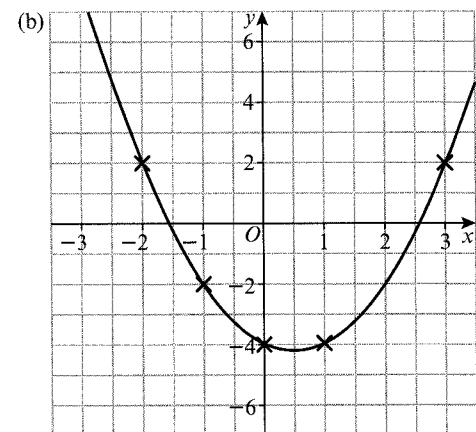


(c) (2, -1)

45. Using quadratic graphs

1 (a)

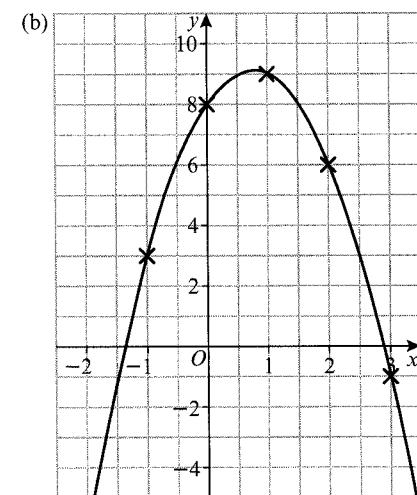
x	-3	-2	-1	0	1	2	3
y	8	2	-2	-4	-4	-2	2



(c) (i) -4.25 (ii) -1.6, 2.6
 (d) It uses a graphical method so not accurate

2 (a)

x	-2	-1	0	1	2	3
y	-6	3	8	9	6	-1



(c) (0.8, 9.1)

46. Factorising quadratics

- 1 (a) $(x+1)(x+3)$ (b) $(x+10)(x+1)$
 (c) $(x+5)(x+1)$ (d) $(x-10)(x-1)$
 (e) $(x-2)(x-10)$ (f) $(x-7)(x-2)$
 2 (a) $(x+7)(x-1)$ (b) $(x+5)(x-1)$
 (c) $(x-5)(x+3)$

- 3 (a) $(x-11)(x-2)$ (b) $(x-8)(x+2)$
 (c) $(x-4)(x-10)$
 4 (a) $(x-3)(x+3)$ (b) $(x-12)(x+12)$
 (c) $(x-9)(x+9)$ (d) $(x-8)(x+8)$
 (e) $(x-1)(x+1)$ (f) $(x-13)(x+13)$

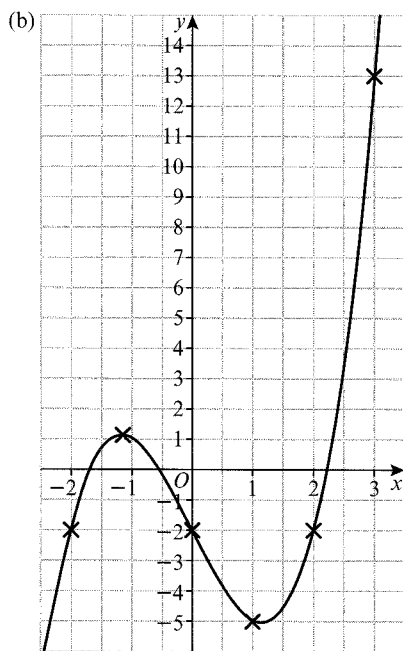
47. Quadratic equations

- 1 (a) $x=0, x=3$ (b) $x=0, x=-5$
 (c) $x=0, x=7$
 2 (a) $x=-4, x=-2$ (b) $x=4, x=3$
 (c) $x=-5, x=-4$ (d) $x=-1, x=-7$
 (e) $x=6, x=-4$
 3 (a) $x=-2, x=2$ (b) $x=-5, x=5$
 (c) $x=-7, x=-7$ (d) $x=-11, x=11$
 (e) $x=-3, x=3$
 4 10 and 11

48. Cubic and reciprocal graphs

1 (a)

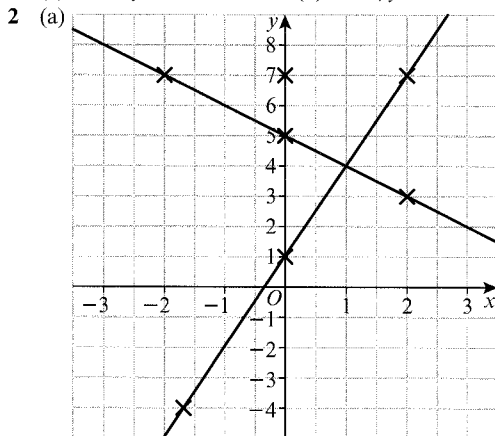
x	-2	-1	0	1	2	3
y	-2	1	-2	-5	-2	13



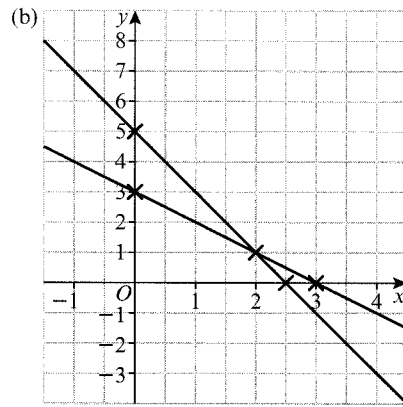
- (c) $(-1.2, 1.1), (1.2, -5.1)$
 (d) $x=-2.1, x=0.24$ and $x=1.8$
 2 (i) B (ii) D (iii) A (iv) C (v) E

49. Simultaneous equations

- 1 (a) $x=3, y=2$ (b) $x=5, y=-2$



$x=1, y=4$



$x=2, y=1$

50. Rearranging formulae

- 1 $x=3$
 2 $t=2.5$ seconds
 3 (a) $t = \frac{1}{10}(v-u)$ (b) $n = \frac{1}{6}(m-19)$
 (c) $u = \frac{1}{t}(d-at^2)$ (d) $D = \frac{1}{6}(A-P)$
 4 (a) $t = \frac{d}{s}$ (b) $h = \frac{4d^2}{5}$
 (c) $t = \frac{2s}{(u+v)}$ (d) $s = \frac{(v^2-u^2)}{2a}$
 5 (a) $n = \frac{P}{h} - 2$ (b) $x = \frac{1}{2} - \frac{t}{6}$

51. Using algebra

- 1 (a) $7x-9=96$ (b) 15
 2 15 m
 3 16 m and 15 m
 4 6 cm

52. Identities and proof

- 1 $(2n-1)^2 = (2n-1)(2n-1) = 4n^2 - 4n + 1$
 $(2n+1)^2 = (2n+1)(2n+1) = 4n^2 + 4n + 1$
 $(2n-1)^2 + (2n+1)^2 = 4n^2 - 4n + 1 + 4n^2 + 4n + 1$
 $= 8n^2 + 2 = 2(4n^2 + 1)$
 2 $n + (n+1) + (n+2) + (n+3) = 4n + 6 = 2(2n+3)$ therefore a multiple of 2
 3 $5(x-c) = 4x-5$
 $5x-5c = 4x-5$
 $x = 5c-5$
 $x = 5(c-5)$ therefore x is a multiple of 5
 4 (a) $(x-1)^2 \equiv (x-1)(x-1) \equiv x^2 - 2x + 1$
 (b) $(x+1)^2 \equiv x^2 + 2x + 1$
 $(x+1)^2 + (x-1)^2 \equiv x^2 + 2x + 1 + (x^2 - 2x + 1)$
 $\equiv 2x^2 + 2 \equiv 2(x^2 + 1)$
 5 (a) $2n + 2n + 2 + 2n + 4 = 6n + 6 = 6(n+1)$ therefore always multiple of 6
 (b) 2, 6, 8

53. Problem-solving practice 1

- 1 8 days
 2 (a) (6, 1) (b) (4, 3)
 3 (a) £130 (b) 6 hours
 4 Dan is correct
 $4 \times 2 + 5 \times 2^2 = 8 + 5 \times 4 = 8 + 20 = 28$
 5 $4n + 2 = 32$
 $4n = 30$
 $n = 7.5$
 She is not correct

54. Problem-solving practice 2

- 6 35
 7 55°
 8 (a) $y = 5x + k$ where k is any number
 (b) $y = 3x - 5$

- 9 n th term is $3n - 1$
 $3n - 1 = 34$
 $3n = 35$
 $n = \frac{35}{3}$
 n is not an integer therefore 34 is not a term in this linear sequence
- 10 $(3x + 4)(2x - 1) = A$
 $6x^2 - 4 + 8x - 3x = A$
 $6x^2 + 5x - 4 = A$

RATIO & PROPORTION

55. Percentages

- 1 (a) 4.5 (b) 11
 2 (a) 62.5% (b) 20%
 3 (a) £7.68 (b) £103.68
 4 £13 200
 5 37.5%
 6 (a) 30.8%
 (b) $\frac{30}{100} \times 140 = 42$ (French)
 $\frac{60}{100} \times 180 = 108$ (German)
 $\frac{150}{320} \times 100 = 46.9\% = 47\%$

56. Fractions, decimals and percentages

- 1 (a) $\frac{6}{25}$ (b) $\frac{16}{25}$ (c) $\frac{18}{25}$
 2 (a) $\frac{3}{10}$, 61%, 0.62 (b) 0.32, 33%, $\frac{7}{20}$
 (c) 37%, 0.38, $\frac{2}{5}$
 3 £575
 4 48
 5 $\frac{30}{100} \times £2100 = £630$ (Amy)
 $\frac{1}{3} \times £1800 = £600$ (Bhavna)
 Amy saves the most money each month

57. Percentage change 1

- 1 (a) 74.88 (b) 131.04 (c) 84.48 (d) 275.88
 2 £126.90
 3 (a) 20% (b) 30% (c) 35% (d) 10%
 4 (a) 34.8% (b) 28%
 5 £23 320

58. Percentage change 2

- 6 Kelly-air
 7 Postland
 8 Footworld

59. Ratio 1

- 1 (a) 3 : 2 (b) 27 : 8 (c) 7 : 8
 2 (a) 20 : 30 (b) 100 : 250 : 400
 3 cheese = 16 g, peppers = 24 g
 4 Paul = 48 miles, Faye = 60 miles
 5 (a) 1 part is 24, $24 \times 3 = £72$
 (b) $(3 \times 24) + (4 \times 24) + (9 \times 24) = £384$

60. Ratio 2

- 6 (a) 28 g (b) 40 g
 7 £4400
 8 $48 \div 12 = 4$
 Flour = 20, margarine = 16 and sugar = 12
 Flour = $1825 \div 20 = 91.25$, margarine = $700 \div 16 = 43.75$
 and sugar = $250 \div 12 = 20.83$
 Therefore, maximum, number of cakes = 20

61. Metric units

- 1 (a) 4.5 cm (b) 720 mm (c) 3500 m
 (d) 5300 g (e) 4300 ml (f) 0.48 g
 2 (a) 150 mm (b) 2.8 cm (c) 1.8 kg
 (d) 2.8 km (e) 0.053 litres (f) 145 000 mg
 3 16
 4 80
 5 No, can only fit 19

62. Reverse percentages

- 1 £60
 2 £33 250
 3 £33 600
 4 No, Kate earned £518.52 last year
 5 Alison invested £1650 and Nav invested £1680. Nav invested more than Alison.

63. Growth and decay

- 1 £17 569.20
 2 $n = 3$
 3 (a) £12 528.15 (b) £6332.78
 4 (a) 6.5% (b) £2815.71
 5 It is worth £110.74

64. Speed

- 1 8.9 m/s
 2 425 km/h
 3 3 hours 20 minutes
 4 240 000 m
 5 $35 \div 0.25 = 140$ km/h
 140 is greater than 130
 6 Karen has the lower average speed
 7 100 m race

65. Density

- 1 0.875 g/cm³
 2 147 g
 3 10 375 cm³
 4 432 g
 5 5666.4 g
 6 Gavin is not correct, it is bronze

66. Other compound measures

- 1 400 N/m²
 2 18 750 N/m²
 3 0.00625 m²
 4 35 minutes
 5 $12 \text{ cm} \times 100 \text{ cm} \times 100 \text{ cm} = 120 000 \text{ cm}^3$
 $120 000 \div 2 = 60 000$
 $60 000 \text{ cm}^3 = 60 000 \text{ ml}$
 ml : seconds
 $250 : 1$
 $60000 : 240$
 240 seconds is 4 minutes

67. Proportion

- 1 £2.80
 2 £8.25
 3 32
 4 20
 5 8 days
 6 £16
 7 Large Medium
 £ : g £ : g
 $4.80 : 200$ $4.50 : 175$
 $0.024 : 1$ $0.026 : 1$
 The large basket is better value for money

68. Proportion and graphs

- 1 1170
 2 7.5
 3 $x = \frac{1}{2y}$
 4 (a) 5
 (b) The graph is a straight line passing through the origin / there is a constant increase / as extension increases, force increases
 5 (a) 2 (b) As pressure increases, volume decreases

69. Problem-solving practice 1

- 1 Statistics
 2 False, $(122 \div 500) \times 100 = 24.4\%$
 3 Nile is cheaper
 4 $5400 \div 900 = 6$
 $\frac{1}{6}$ of $\frac{1}{5}$ of 900 = 30 ml