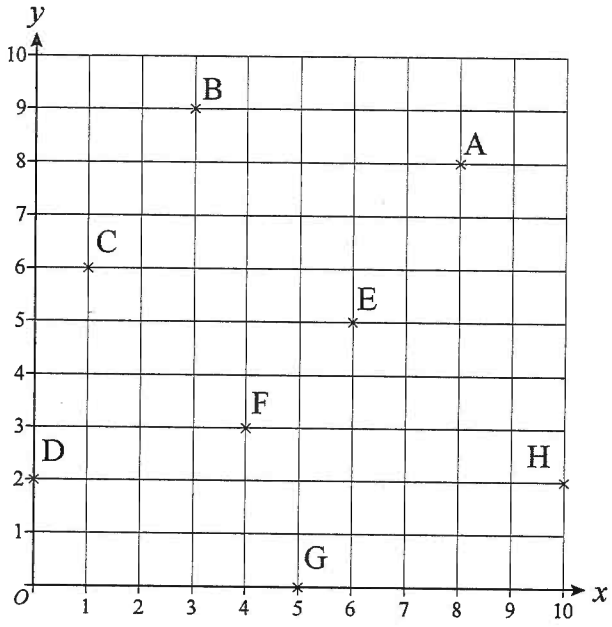
# Core Maths

## Assumed Knowledge Practice Questions

## Algebra

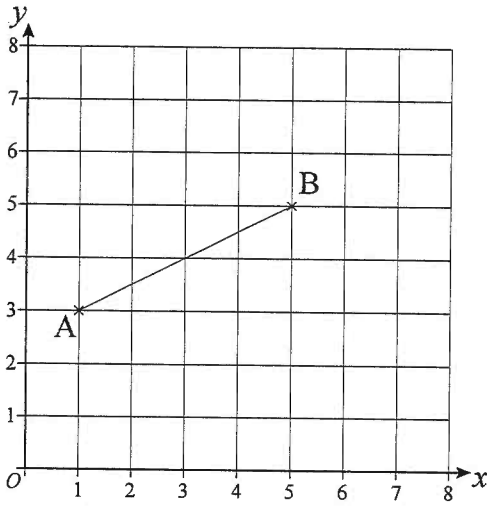
# Coordinates

1. Write down the coordinates of the points $A$ to $H$.




2. a) Write down the coordinates of: (i) $A$ (ii) $B$

   b) Write down the coordinates of the midpoint of the line $AB$.




3. Using the pair of axes,

   a) Plot the points $A(2, 0)$, $B(4, 0)$, $C(5, 2)$ and $D(3, 2)$.

   b) Join the points in order, to form a shape and name the shape.

   $M$ is the midpoint of the line segment $AC$.

   c) Find the coordinates of $M$.

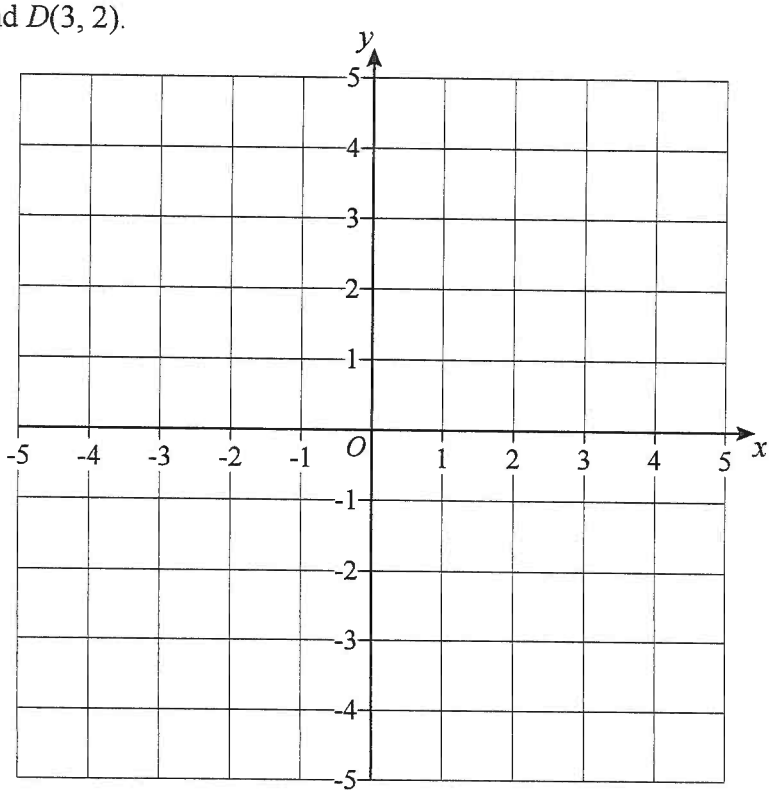
4. Using the same pair of axes,

   a) Plot the points $R(-1, -2)$, $S(1, 1)$ and $T(-1, 2)$.

   b) Join $R$ to $S$ and $S$ to $T$.

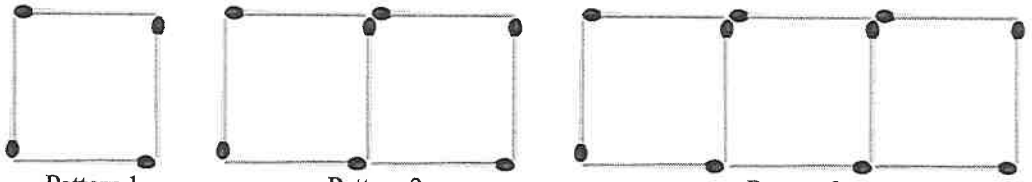
   $RSTU$ is a kite.

   c) Write the coordinates of point $U$.



# Number Sequences

1) Here are some patterns made from matchsticks



Pattern 1 Pattern 2 Pattern 3

a) Draw pattern 4.

b) How many matchsticks are used in
(i) Pattern 5

(ii) Pattern 10

c) Which pattern will have 46 matchsticks?

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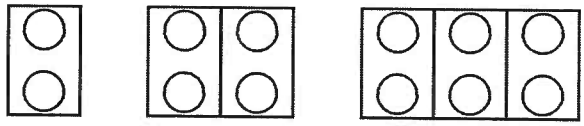
2) A pattern is made of rectangles and circles



Pattern 1 Pattern 2 Pattern 3

a) Draw pattern 4.

b) Complete the table below.

| **Pattern number** | 1 | 2 | 3 | 4 | 5 | 10 |
|---|---|---|---|---|---|---|
| **Number of rectangles** | 1 | 2 | | | | |
| **Number of circles** | 2 | 4 | | | | |
| **Total rectangles + circles** | 3 | 6 | | | | |

c) Which pattern will have 64 circles?

d) Which pattern will have a total (rectangles + circles) of 90?

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3) For each of the following sequences write down the next two terms.

a) 5, 10, 15, 20...

b) 9, 16, 23, 30...

c) 27, 23, 19, 15...

d) 12, 7, 2, –3...

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4) Look at this number sequence: 4, 10, 16, 22...
The 50th term of the sequence is 298.

a) Write down the 51st term.

b) Will 643 be a term in this sequence?
Explain your answer.

# Nth Term

1. Write down the first 5 terms and the 10th term of the following sequences:

*eg.* $2n + 1$ *3, 5, 7, 9, 11.....21*

a) $2n + 2$

b) $3n + 1$

c) $n + 3$

d) $7n$

e) $3n - 1$

f) $7n - 3$

2. Find the $n^{th}$ term of the following sequences:

a) 5, 10, 15, 20...

b) 5, 8, 11, 14...

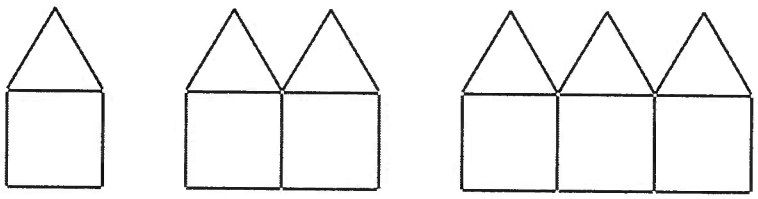
c) 1, 8, 15, 22...

d) 22, 18, 14, 10...

e) –3, 3, 9, 15...

f) 4, –1, –6, –11...

3. Here are some patterns made from sticks.



Pattern 1 Pattern 2 Pattern 3

a) Draw pattern 4 in the space, below..

b) How many sticks are used in

(i) pattern 10

(ii) pattern 20

(iii) pattern 50

c) Find an expression, in terms of $n$, for the number of sticks in pattern number $n$.

d) Which pattern number can be made using 301 sticks?

# Substitution

1) Work out the value of $5x$ when
a) $x = 2$ b) $x = 6$ c) $x = 10$

2) Work out the value of $3x$ when
a) $x = -2$ b) $x = 10$ c) $x = -12$

3) Work out the value of $x^2$ when
a) $x = 3$ b) $x = -4$ c) $x = -10$

4) Work out the value of $2x^2$ when
a) $x = 5$ b) $x = -4$ c) $x = 10$

5) Work out the value of $3x + 5$ when
a) $x = 2$ b) $x = 6$ c) $x = -1$

6) Work out the value of $4 + 2x$ when
a) $x = 7$ b) $x = -1$ c) $x = -3$

7) Work out the value of $3x + 2y$ when
a) $x = 1$ and $y = 2$ b) $x = 4$ and $y = 3$ c) $x = 5$ and $y = -4$

8) Work out the value of $6x - 3y$ when
a) $x = 2$ and $y = 1$ b) $x = 1$ and $y = -2$ c) $x = -3$ and $y = 4$

9) Work out the value of $3x^2 + 4y$ when
a) $x = 1$ and $y = 5$ b) $x = -2$ and $y = 2$ c) $x = 3$ and $y = -2$

10) Using the formula $P = H \times R$, where $P$ is the total pay, $H$ is the number of hours worked, and $R$ is the hourly rate of pay.
Work out the total pay ($P$) of the following people:
a) Betty worked 10 hours at £7 per hour
b) John worked 15 hours and is paid £9 per hour
c) Mike worked for 90 minutes at £16 an hour.

11) The equation of a straight line is given as $y = 3x + 2$
a) Work out the value of $y$ when
(i) $x = 0$
(ii) $x = 1$
(iii) $x = 2$
b) What is the value of $x$ when $y = 17$?

# Algebraic Simplification

1) Simplify

a) $x + x$

b) $x \times x$

c) $3x + 2x$

d) $3x \times 2x$

e) $2x^2y^3 + 4x^2y^3$

f) $2x^2y \times 3xy^3$

2) Simplify

a) $x + y + x + y$

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

c) $6y + 2x - 2y - 3x$

d) $5p - 3q + p + 2q$

3) Expand and simplify

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

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

c) $5(x + y) + 3(2x - y)$

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

e) $4(2p + q) - 3(2p - q)$

f) $3(4x - 2y) + 2(x + 2y)$

g) $6(x - 3y) - 2(2x - 5y)$

4) Expand and simplify

a) $5(3p + 2) - 2(4p - 3)$

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

5) a) Simplify $pq + 2pq$

b) Simplify $5x + 3y - x - 4y$

6) a) Simplify $6a + 5b - 3b + a$

b) Simplify $x^4 + x^4$

7) a) Simplify $x + y + x + y + x$

b) Simplify $t^2 + t^2 + t^2$

8) a) Simplify $a^3 \times a^3$

b) Simplify $3x^2y \times 4xy^3$

9) a) Simplify $3d + e - d + 4e$

b) Simplify $3x^2 - x^2$

c) Simplify $5t + 8d - 2t - 3d$

d) Simplify $4t \times 2q$

10) The table shows some expressions.

| $2(p + p)$ | $2p \times p$ | $3p + 2p$ | $2 + 2p$ | $2p + 2p$ |
|---|---|---|---|---|
| | | | | |

**Two** of the expressions **always** have the same value as 4p.
Tick the boxes underneath the **two** expressions.

11) Expand and simplify

(i) $4(x + 5) + 3(x - 6)$

(ii) $3(2x - 1) - 2(x - 4)$

(iii) $5(2y + 2) - (y + 3)$

# Expanding and Simplifying Brackets

1) Expand these brackets

a) $2(x+3)$

b) $3(2x+4)$

c) $5(3p-2q)$

d) $4(x^2+2y^2)$

e) $r(r-r^2)$

2) Expand and simplify

a) $(x+1)(x+2)$

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

c) $(2x+1)(3x+2)$

3) Expand and simplify

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

b) $(x-1)(x+4)$

c) $(x-3)(x-2)$

4) Expand and simplify

a) $(2p+3)(p-2)$

b) $(3t-2)(2t+3)$

c) $(2x-5)(3x-2)$

5) Expand and simplify

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

b) $(2p+q)(3p+2q)$

6) Expand and simplify

a) $(2x+1)^2$

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

c) $(2p+q)^2$

# Factorisation

1) Factorise

a) $2x + 4$

b) $2y + 10$

c) $3x + 12$

d) $3x - 6$

e) $5x - 15$

2) Factorise

a) $p^2 + 7p$

b) $x^2 + 4x$

c) $y^2 - 2y$

d) $p^2 - 5p$

e) $x^2 + x$

3) Factorise

a) $2x^2 + 6x$

b) $2y^2 - 8y$

c) $5p^2 + 10p$

d) $7c^2 - 21c$

e) $6x^2 + 9x$

4) Factorise

a) $2x^2 - 4xy$

b) $2t^2 + 10tu$

c) $6x^2 - 8xy$

d) $3x^2y^2 + 9xy$

# Solving Equations

Solve the following equations

1) $2p - 1 = 13$

2) $4y + 1 = 21$

3) $6x - 7 = 32$

4) $x + x + x + x = 20$

5) $x + 3x = 40$

6) $5(t - 1) = 20$

7) $4(5y - 2) = 52$

8) $4(y + 3) = 24$

9) $20x - 15 = 18x - 7$

10) $4y + 3 = 2y + 10$

11) $2x + 17 = 5x - 4$

12) $2x + 7 = 16 - 4x$

13) $5(x + 3) = 2(x + 6)$

14) $4(2y + 1) = 2(12 - y)$

15) $7 - 3x = 2(x + 1)$

16) $\frac{x - 3}{2} = 5$

17) $\frac{2x + 4}{3} = 7$

18) $\frac{40 - x}{3} = 4 + x$

# Changing the Subject of a Formula

1) Make $c$ the subject of the formula.

$a = b + cd$

2) Make $t$ the subject of the formula.

$u = v + 2t$

3) Make $n$ the subject of the formula.

$M = 3n + 5$

4) Make $z$ the subject of the formula.

$x = 3y + z$

5) $r = 5s + 3t$

a) Make $t$ the subject of the formula.

b) Make $s$ the subject of the formula.

6) Rearrange $y = 3x + 1$ to make $x$ the subject.

7) Rearrange $y = \frac{1}{2}x + 2$ to make $x$ the subject.

8) Rearrange $y = \frac{1}{3}x + 1$ to make $x$ the subject.

# Drawing Straight Line Graphs

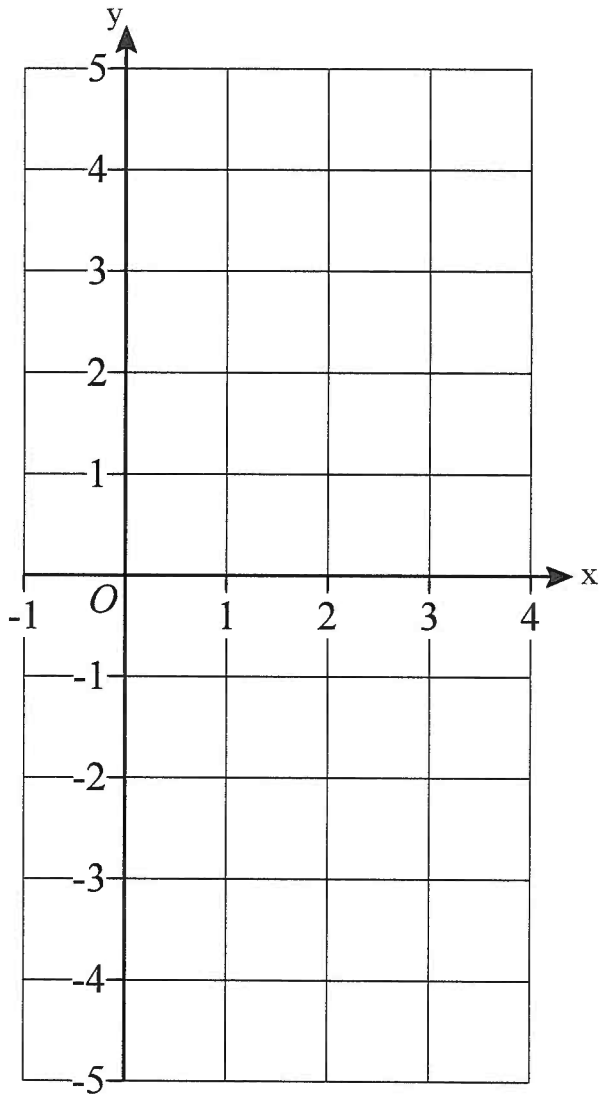
1) a) Complete the table of values for $y = 2x - 3$

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

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$

d) Use your graph to work out the value of x when $y = 4.5$

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

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

b) Using the axes on the right, again, draw the graph of $y = 2 - x$

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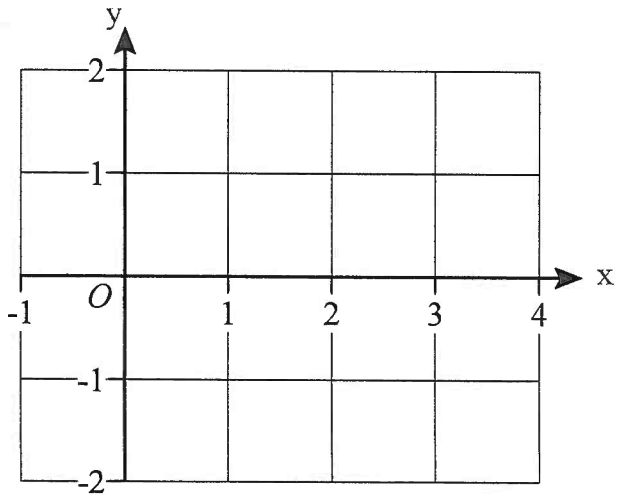
3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

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

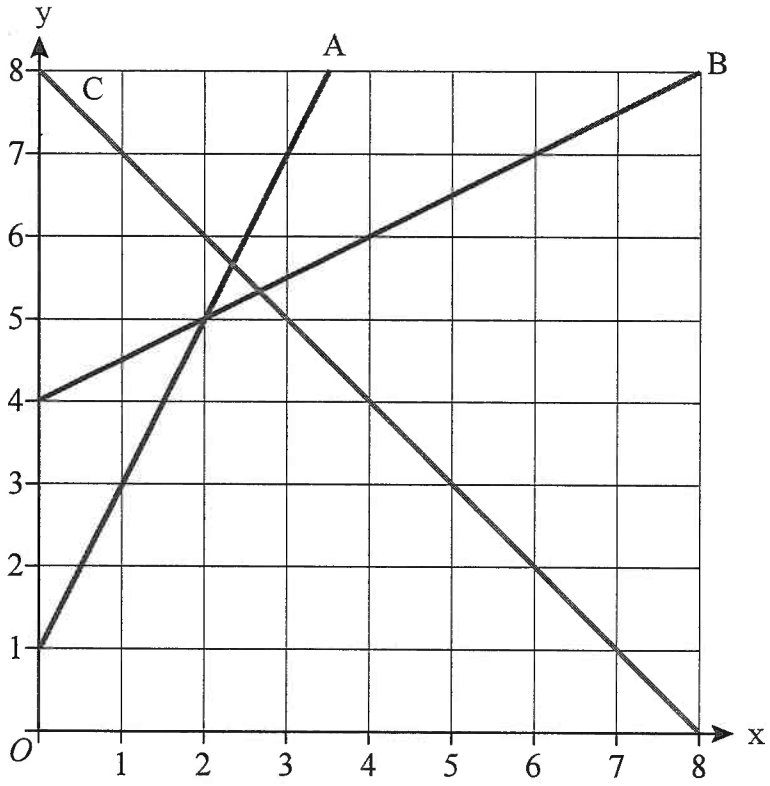
b) Draw the graph of $y = \frac{1}{2}x - 1$



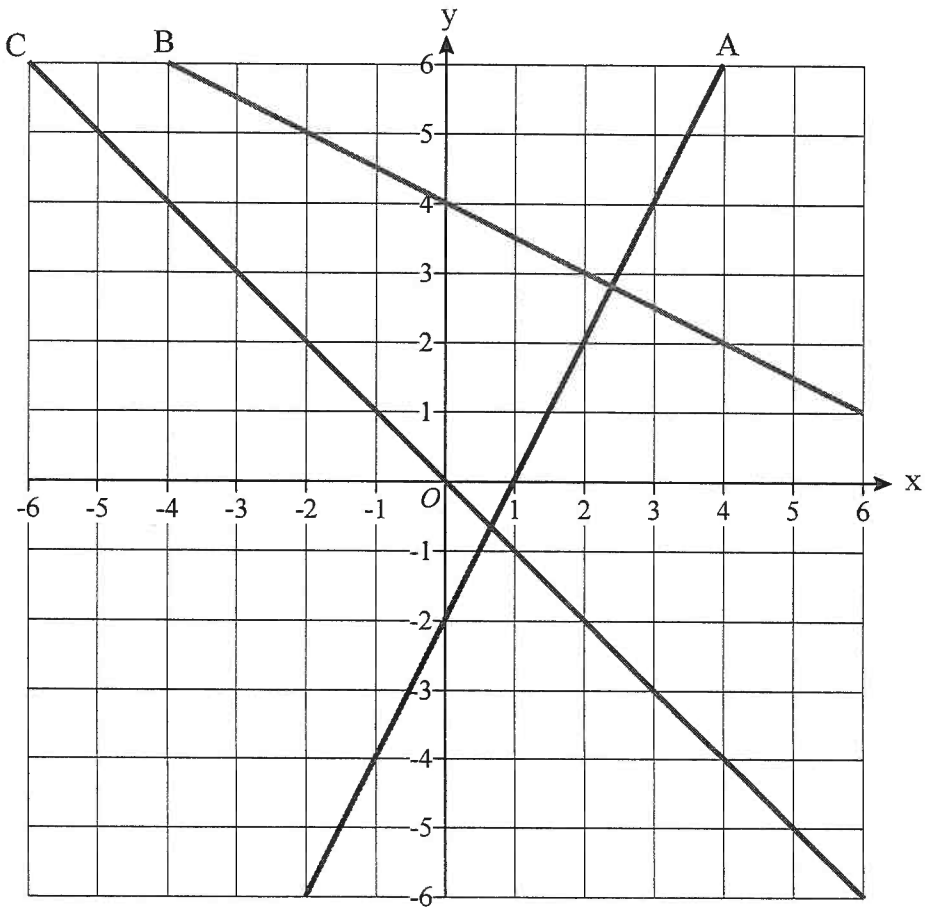

c) Use your graph to find the value of y when $x = 3.5$

# Finding the Equation of a Straight Line

1) Find the equations of lines A, B and C on the axes below




2) Find the equations of lines A, B and C on the axes below

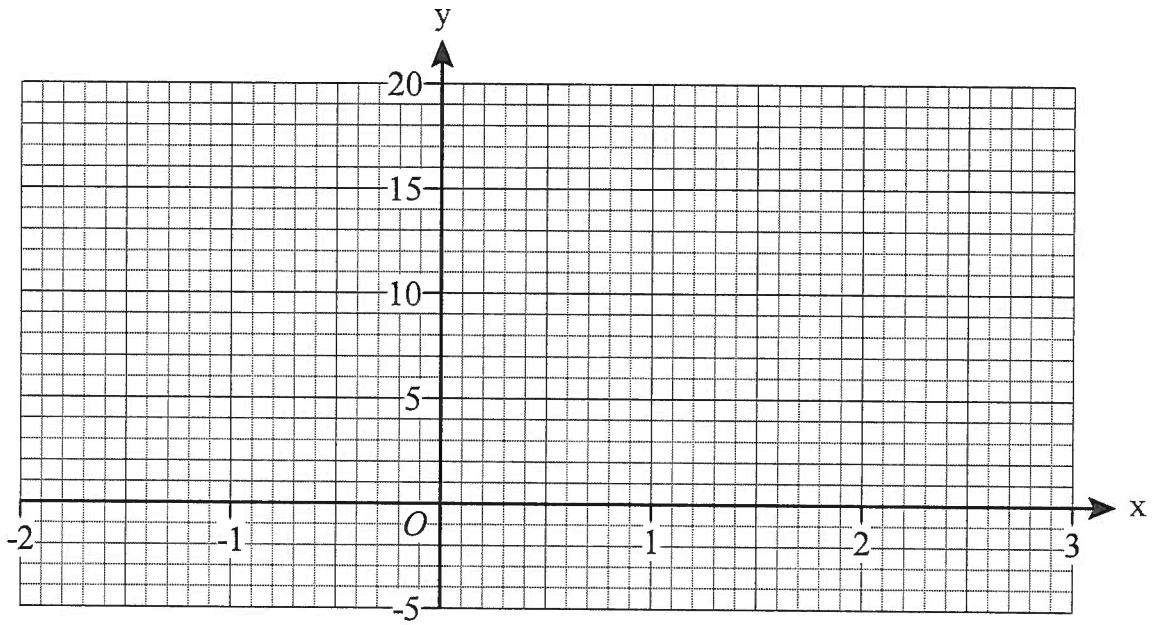


# Drawing Quadratic Graphs

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

| x | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| y | 14 | | 0 | | | 9 |

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3




c) Use the graph to find the value of y when $x = -1.5$

d) Use the graph to find the values of x when $y = 4$

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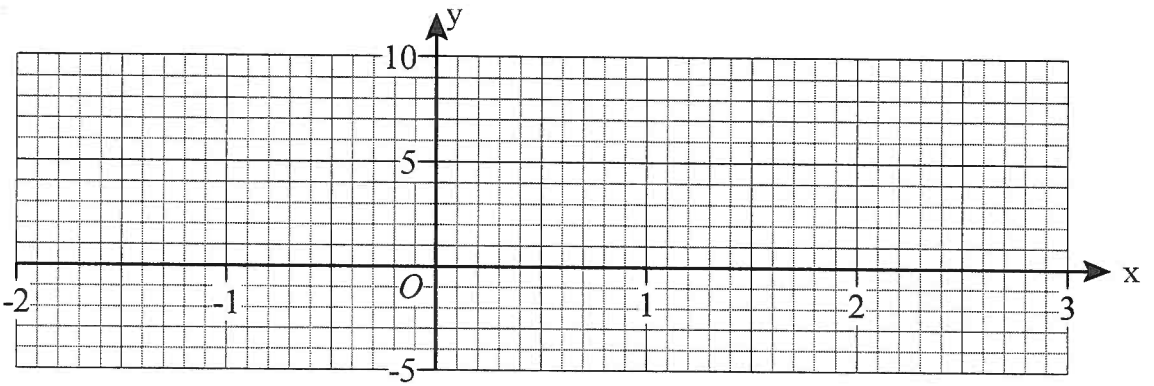
2) a) Complete the table of values for $y = x^2 - 2x$

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

b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3

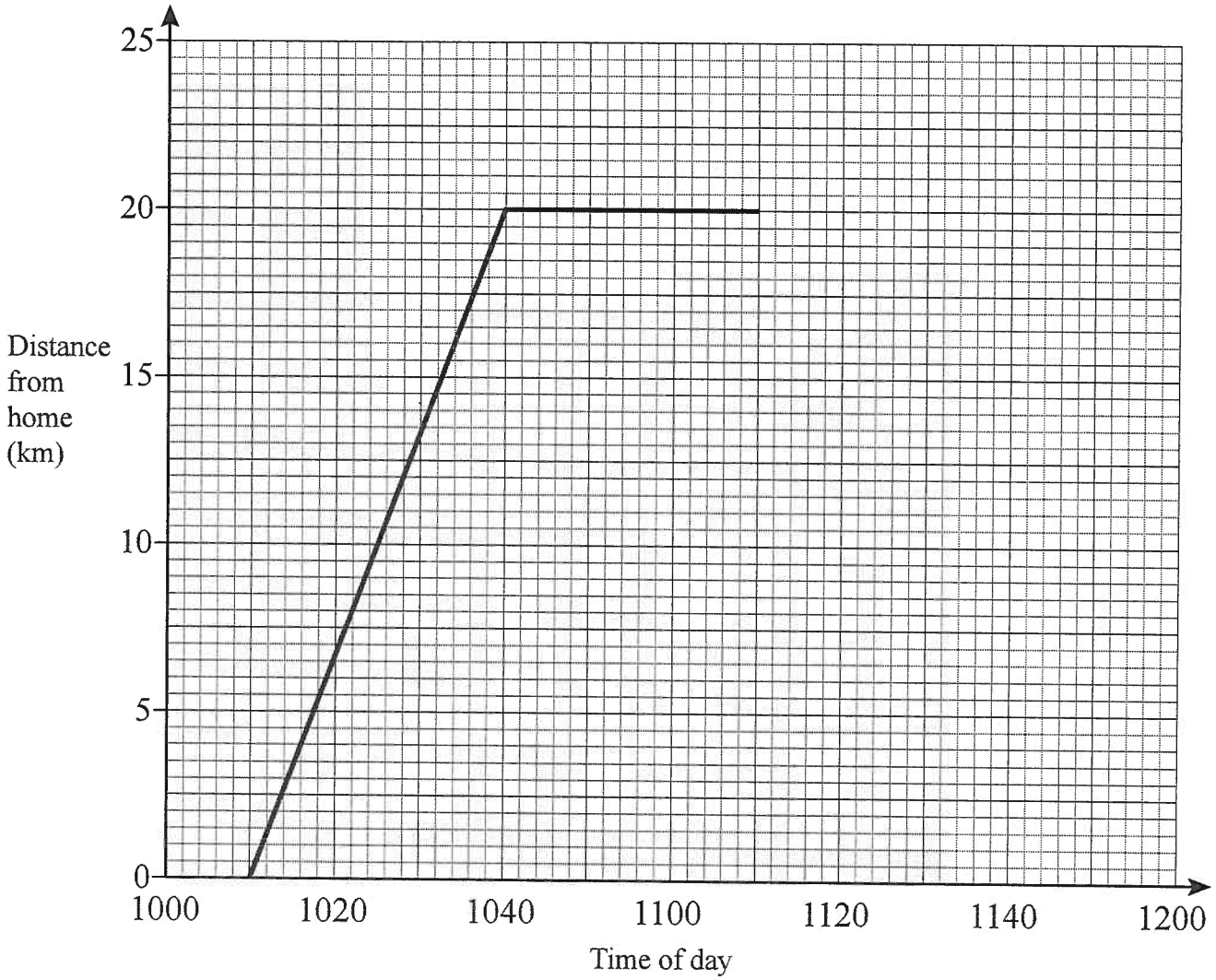



c) (i) On the same axes draw the straight line $y = 2.5$

(ii) Write down the values of x for which $x^2 - 2x = 2.5$

# Real Life Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.




a) At what time did Sarah leave home?

b) How far was Sarah from home at 10 30?

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house.

Sarah returned home at a steady speed.
She arrived home at 11 50

d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour.

f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour.