DISTANCE-TIME GRAPHS
Algebra

Key Concepts

A **distance-time** graph plots time against the distance away from a starting point.

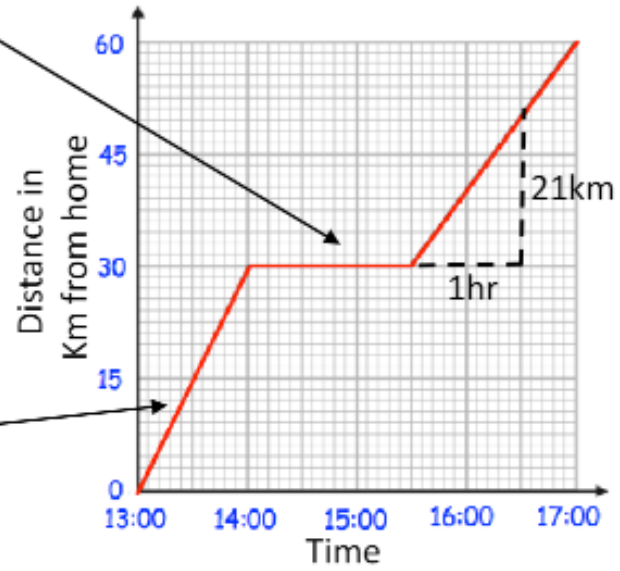
Speed can be calculated from these graphs by finding the gradient of the graph.

Horizontal lines are sections where the object is stationary.

Examples

Horizontal sections are where the object is stationary

Diagonal lines show the object moving away from home or moving closer to home



$$Speed = \frac{distance}{time}$$

$$Speed = \frac{21}{1}$$

$$Speed = 21km/h$$

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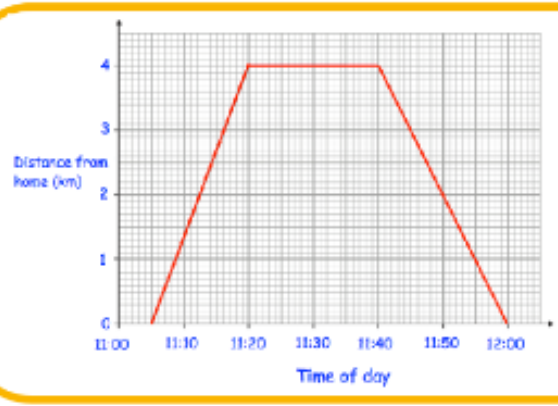
Key Words

Distance
Time
Speed
Gradient
Stationary



A distance-time graph shows the journey of someone from home to the shop and back again.

1) How long were they at the shop for?
2) How far away from home is the shop?
3) How far did they travel in total?
4) What speed did they travel on the way to the shop in km/h?

ANSWERS: 1) 20 minutes 2) 4km 3) 8km 4) 16km/h

EQUATION OF A LINE BETWEEN 2 POINTS
Algebra

Key Concepts

Equation of a line is usually seen in the format:

$$y = mx + c$$

m = gradient
c = y-intercept

Examples

Find the equation of the line between the coordinates (1,1) and (3,5).

Type your text

$$y = mx + c$$

$$m = \frac{5-1}{3-1} = \frac{4}{2} = 2$$

$$y = 2x + c$$

Substitute in one of the coordinates to find c

I have chosen to substitute in (3,5).

$$5 = (2 \times 3) + c$$

$$-1 = c$$

$$y = 2x - 1$$

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Key Words
Gradient
Intercept
Equation

1) Find the equation of the line between the coordinates (2,5) and (5,11).
2) Find the equation of the line between the coordinates (5,3) and (7,11).

ANSWERS: 1) $y = 2x + 1$ 2) $y = 4x - 17$

SEQUENCES
Algebra

Key Concepts

Arithmetic or linear sequences increase or decrease by a common amount each time.
Geometric series has a common multiple between each term.
Quadratic sequences include an n^2. It has a common second difference.
Fibonacci sequences are where you add the two previous terms to find the next term.

Linear/arithmetic sequence:

-3 +3 +3 +3 +3

+1 4 7 10 13 16.....

a) State the nth term

$3n + 1$

Difference — The 0th term

b) What is the 100th term in the sequence?

$3n + 1$

$3 \times 100 + 1 = 301$

c) Is 100 in this sequence?

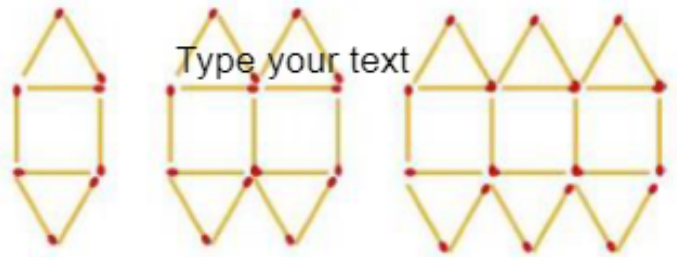
$3n + 1 = 100$

$3n = 99$

$n = 33$

Yes as 33 is an integer.

Pattern 1 Pattern 2 Pattern 3



Hint: Firstly write down the number of matchsticks in each image:

$7n + 1$

Pattern 1	Pattern 2	Pattern 3
8	15	22

+1

-7 +7 +7

Examples

Linear sequences with a picture:

State the nth term.

Geometric sequence e.g. ×3 ×3 ×3

4 12 36 108...

Quadratic sequence e.g. $n^2 + 4$ Find the first 3 numbers in the sequence

First term: $1^2 + 4 = 5$

Second term: $2^2 + 4 = 8$

Third term: $3^2 + 4 = 13$

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Key Words
Linear
Arithmetic
Geometric
Sequence
Nth term

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

a) Find the nth term b) Calculate the 50th term c) Is 120 in the sequence?

2) $n^2 - 5$ Find the first 4 terms in this sequence

ANSWERS: 1a) $7n - 6$ b) 344 c) 18 so yes as n is an integer 2) -4, -1, 4, 11

SOLVING QUADRATICS
Algebra

Key Concepts

We can solve quadratic equations in 4 different ways:

$$ax^2 + bx + c = 0$$

Factorising – put into brackets first

Completing the square

$$\left(x + \frac{b}{2}\right)^2 + c - \left(\frac{b}{2}\right)^2 = 0$$

Quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Graphically

Example

Factorising only required for Foundation :

$$x^2 + 7x + 10 = 0$$

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

$$Either: x + 2 = 0$$
$$x = -2$$

$$Or: \ x + 5 = 0$$
$$x = -5$$

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Key Words

Solve
Quadratic
Equation
Factorise
Completing the Square
Quadratic formula

1) Solve by factorising: $x^2 + 6x + 8 = 0$

ANSWERS: 1) $x = -2, x = -4$ 2) $x = \sqrt{6} - 4, x = -\sqrt{6} - 4$ 3) $x = 0.11, x = -9.11$

STRAIGHT LINE GRAPHS AND EQUATION OF A LINE
Algebra

Key Concepts

Coordinates in 2D are written as follows:

x is the value that is to the left/right

(x, y)

y is the value that is to up/down

Straight line graphs always have the equation:

$$y = mx + c$$

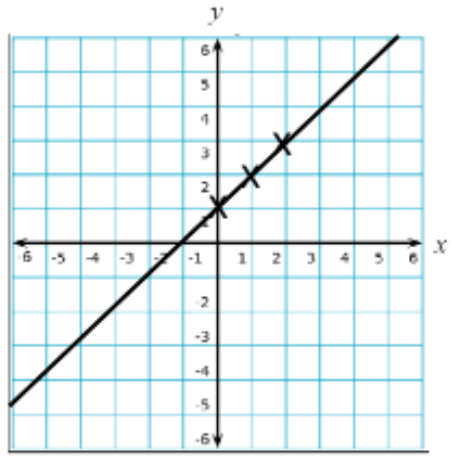
m is the **gradient** i.e. the steepness of the graph.

c is the **y intercept** i.e. where the graph cuts the y axis.

Parallel lines always have the same **gradient**.

Plot the graph of $y = 2x + 1$

x	0	1	2
y	1	2	3



Examples of lines parallel to this graph are: $y = 2x - 3$ or $y = 2x + 7$

Examples

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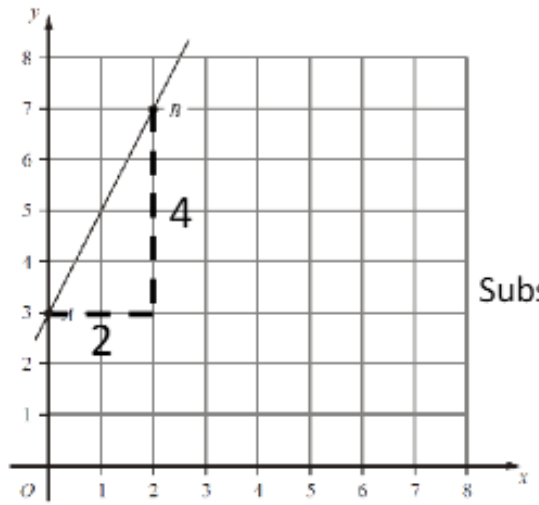

Calculate the equation of this line:

$$y = mx + c$$

$$m = \frac{4}{2}$$

$$= 2$$

$$y = 2x + c$$

Substitute in a coordinate: (2,7)

$$7 = (2 \times 2) + c$$

$$3 = c$$

$$y = 2x + 3$$

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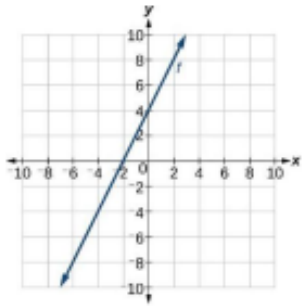
Key Words

Coordinate

Gradient

Parallel

1) Plot the line $y = 3x - 2$
2) Find the equation of the line for the attached graph.
3) State the equation of a line that would be parallel to this line.



ANSWERS: 2) $y = 2x + 4$ 3) Any line that has a gradient of 2