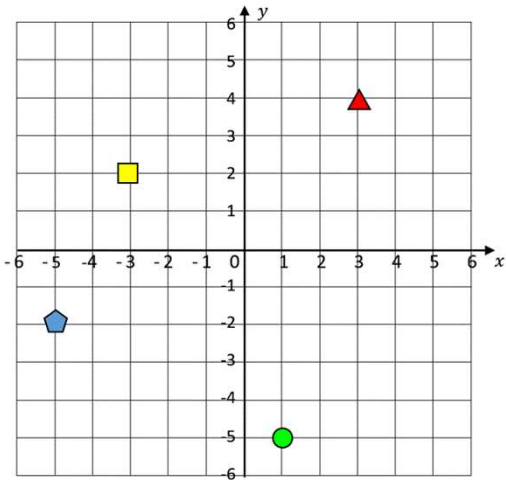


Coordinates in Four Quadrants



"Along the corridor, and up the stairs", meaning along the horizontal x-axis & up the vertical y-axis

- Red Triangle = (3,4)
- Yellow Square = (-3,2)
- Green Circle = (1,-5)
- Blue Pentagon = (-5,-2)

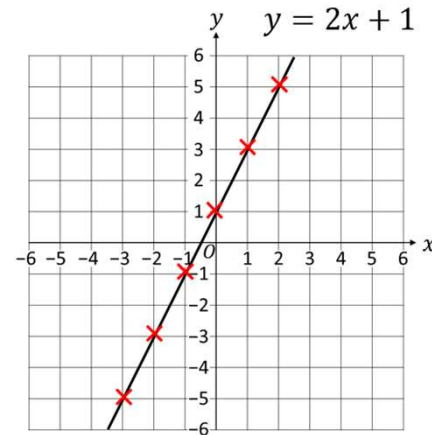
Drawing Linear (Straight-Line) Graphs

1) Complete a Table of Values.

x	-3	-2	-1	0	1	2	3
y	-5	-3	-1	1	3	5	7

2) Plot each pair of values as coordinates.

3) Join the points to make a line.



Parallel Lines

Example: Find the equation of a line parallel to $2x + y = 4$, that crosses the y-axis at 3.

1. Rearrange the equation in the form $y = mx + c$
 $y = 2x + 4$
2. Identify the gradient, in this case 2

Any line with the same gradient is parallel

3. Write c as the y-intercept. The line that has the same gradient and has a y-intercept of 3 is $y = 2x - 3$

Equation of a Straight Line

The general equation of any straight line is:

$$y = mx + c$$

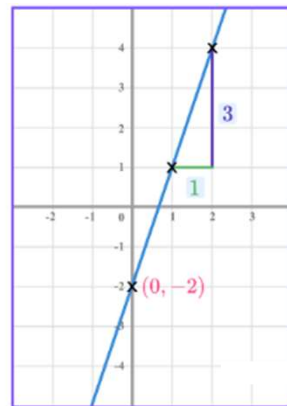
c is the **y-intercept** (where the line crosses the y-axis)

m is the **gradient** (steepness) of the line

Example The graph of the line $y = 3x - 2$

The gradient is 3

The y-intercept is -2, the coordinate (0, -2)



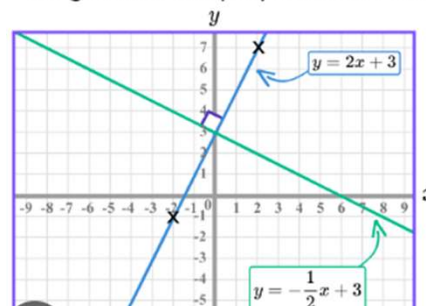
Gradient

The steepness of a line. Calculated as difference along the y-axis divided by difference along the x-axis, or dy/dx .

Perpendicular Lines

Perpendicular lines have gradients that multiply to give -1.

The gradients of perpendicular lines are the **negative reciprocals** of each other.



Example

The line $y = 2x + 3$ has a gradient of 2

The line $y = -\frac{1}{2}x + 3$ has a gradient of $-\frac{1}{2}$

$$2 \times -\frac{1}{2} = \frac{-2}{2} = -1$$

The gradients multiply to give -1

Solving One-Step Equations & Inequalities

To solve any equation or inequality we need to do the inverse of the operation that we see.

$$t + 4 = 10$$

-4 -4

$$t = 6$$

+3 +3

$$c - 3 > 6$$

+3 +3

$$c > 9$$

$$6y < 30$$

÷6 ÷6

$$y < 5$$

x7 x7

$$\frac{m}{7} = 4$$

x7 x7

$$m = 28$$

The inverse of add is subtract and vice versa.

The inverse of multiply is divide and vice versa.

Solving Multi-Step Equations & Inequalities

To solve a two step equation or inequality we need to complete 2 inverse calculations in a specific order.

$$6y + 2 = 32$$

-2 -2

$$6y = 30$$

÷6 ÷6

$$y = 5$$

$$\frac{w-5}{3} \geq 4$$

x3 x3

$$w - 5 \geq 12$$

+5 +5

$$w \geq 17$$

Subtract first because the 2 is separate from the y.

Divide because it is the inverse of multiplying.

Multiply first because the entire expression is divided by 3.

Add because it is the inverse of subtracting.

Solving Equations with Variables on Both Sides

To solve an equation or inequality with unknowns on both sides we need to collect all of the same terms together, still by looking at the inverse.

$$5x - 20 \leq 3x + 4$$

-3x -3x

$$2x - 20 \leq 4$$

+20 +20

$$2x \leq 24$$

÷2 ÷2

$$x \leq 12$$

We subtract 3x from both sides because it is the smaller term of x.

Then solve like a normal two step equation.

$$2x - 10 = 5x + 2$$

-2x -2x

$$-10 = 3x + 2$$

-2 -2

$$-12 = 3x$$

÷3 ÷3

$$-4 = x$$

We subtract 2x from both sides because it is the smaller term of x.

Then solve like a normal two step equation.

Solving Quadratic Equations by Factorising

Factorising quadratics is the opposite of expanding brackets and is used to solve quadratic equations. Most quadratic expressions require two brackets in the form $(x + p)(x + q)$

Example Factorise $x^2 + 2x - 15$

Factor pairs of 15 are 1 and 15
3 and 5

We choose the factor pair 3 and 5 as these can be used to make 2 by addition or subtraction.

$$x^2 + 2x - 15 = (x + 5)(x - 3)$$

Solving Equations with Brackets

We must expand the bracket first and then solve by doing the inverse of the operations. We use the same method for inequalities.

$$3(2x + 5) = 39$$

Expand brackets first.

$$6x + 15 = 39$$

-15 -15

$$6x = 24$$

÷6 ÷6

$$x = 4$$

The inverse of +15 is -15.

The inverse of x 6 is ÷6.

Solving Quadratics Using the Quadratic Formula

Quadratic equation in standard form

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

Quadratic Formula

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

Solving Simultaneous Equations

$$2x = -3y + 16$$

$$5x - 4y = -6$$

- "Line up" the variables.

$$2x + 3y = 16$$

$$5x - 4y = -6$$
- Determine which variable to eliminate. Make the coefficients opposites.

$$2x + 3y = 16 \quad \rightarrow \quad 10x + 15y = 80$$

$$5x - 4y = -6 \quad \rightarrow \quad -10x + 8y = 12$$
- Add straight down. (One variable should be eliminated.)
- Solve the resulting equation.

$$10x + 15y = 80$$

$$+ \quad -10x + 8y = 12$$

$$23y = 92$$

$$y = 4$$
- Substitute this result into either of the original equations.
- Solve for the variable to find the ordered pair solution.

$$2x + 3(4) = 16$$

$$x = 2$$
- Check the solution in both original equations.

Unit 6: Ratio & Proportion 1

Key Words

- **Equivalent** – of equal value
- **Fraction** – represents how many parts per whole
- **Ratio** – a statement of how two (or more) numbers compare
- **Proportion** – a statement that links two ratios

Conversions Between Currencies

£1 = 90 Rupees

For every £1 I have 90 Rupees

£10 = 900 Rupees

Convert 630 Rupees into Pounds

£7 = 630 Rupees

$630 \div 90 = 7$

Ratios in the Form 1:n or n:1

This is asking you to simplify a ratio down until the part indicated represents 1.

Show the ratio 4:20 in the ratio of 1:n

The question states that this part has to be 1 unit. Therefore Divide by 4

4 : 20

1 : 5

This side has to be divided by 4 too – to keep in proportion

the n part does not have to be an integer for this type of question

Converting Between Ratios & Fractions

Trees: Flowers

3 : 7

Fraction of trees: $\frac{3}{10}$

Fraction of flowers: $\frac{7}{10}$

Best Buys

4 pens costs £2.60

10 pens costs £6.00

1 pen costs... $£2.60 \div 4 = £0.65$

10 pens costs... $£6.00 \div 10 = £0.60$

1-pound buys... $4 \div 2.60 = 1.54 \text{ pens}$

10 pounds buys... $10 \div 6 = 1.67 \text{ pens}$

Dividing in a Ratio

James: Lucy

3 : 4

James and Lucy share £350 in the ratio 3:4. Work out how much each person earns

Model the Question

Whole: £350

7 parts to share between (3 James, 4 Lucy)

Find the value of one part: $£350 \div 7 = £50$

Put back into the question

James = $3 \times £50 = £150$

Lucy = $4 \times £50 = £200$

We can solve problems when the total is provided, but also if we know only one value, or if we know the difference between the two values:

B = 40

A : B

3 : 5

$\frac{40}{5} = 8$

24 : 40

Difference = 40

A : B

3 : 5

$\frac{40}{2} = 20$

60 : 100

Ratio & Scale

A picture of a car is drawn with a scale of 1:30

The car image is 10cm

Image : Real life

1cm : 30cm

10cm : 300cm

