Year 8 Maths Knowledge Organiser (H)

Half term 1

FOUR OPERATIONS WITH INTEGERS & DECIMALS

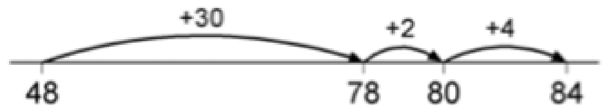
Key Words

Place Value: The value a digit takes when placed in a particular position of a number.

Add Sum Total All together Plus In all	Multiply Product Times Twice Total Multiplied by
Subtract Remain Difference Less than Fewer How many more Minus	Divide Quotient Goes into Split Equally Each

Examples

48 + 36 = 84



$$\begin{array}{r} 258 \\ +\ 87 \\ \hline 345 \\ \hline {\scriptstyle 1\,1} \end{array}$$

$$\begin{array}{r} \cancel{4}^{3}\ {}^{1}5\ - \\ \underline{2\ \ 8} \\ \underline{1\ \ 7} \end{array}$$

$$\begin{array}{r} 38 \\ \underline{\times\ 7} \\ 56 \\ \underline{210} \\ \underline{266} \end{array}$$

74 – 27 = 47 worked by counting back:

$$3\overline{)2\ 9\ {}^{2}1}\quad = 9\ 7$$

56 × 27

×	20	7	
50	1000	350	1350
6	120	42	162
			1512
			1

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Clip Numbers

1-22, 141-146, 47

Tip

Multiplication and addition are associative, so you can work them out in any order.
So 3 × 4 is the same as 4 × 3.
4 + 3 is the same as 3 + 4

Questions

1) a) 49 + 37 b) 125 + 69 c) 5.6 + 24.8
2) a) 64 – 28 b) 134 – 57 c) 16.2 – 9.5
3) a) 7 × 146 b) 34 × 67 c) 2.9 × 7.2 4) a) 294 ÷ 7 b) 192 ÷ 6

ANSWERS: 1) a) 86 b) 194 c) 30.4 2) a) 36 b) 77 c) 6.7
3) a) 1022 b) 2278 c) 20.88 4) a) 42 b) 32

INTEGERS, ROUNDING AND PLACE VALUE

Key Concepts

Digits are the individual components of a number.

Integers are whole numbers.

Rounding rules:
A value of 5 to 9 rounds the number up.
A value of 0 to 4 keeps the number the same.

Examples

Order the following numbers starting with the smallest:

1) 5, -3, 4, 7, -2
-3, -2, 4, 5, 7

2) 0.067 0.6 0.56 0.65 0.605
Rewrite 0.067, 0.600, 0.560, 0.650, 0.605
0.067 0.56 0.6 0.605 0.65

Round 3.527 to:

a) 1 decimal place
3 . 5 2 7 → 3.5

b) 2 decimal places
3 . 5 2 7 → 3.53

c) 1 significant figure
3 . 5 2 7 → 4

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1 – 3, 31 – 32

Key Words

Integer	Even
Digit	Odd
Decimal place	
Significant figures	

A) Order the following numbers starting with the smallest:
1) 6, -2, 0, -5, 3   2) 0.72, 0.7, 0.072, 0.07, 0.702

B) Round the following numbers to the given degree of accuracy
1) 14. 1732 (1 d.p.)   2) 0.0568 (2 d.p.)   3)3418 (1 S.F)

ANSWERS: A1) -5, -2, 0, 3, 6 2) 0.07, 0.072, 0.7, 0.702, 0.72
B1) 14.2 2) 0.06 3) 3000

CALCULATIONS, CHECKING AND ROUNDING

Key Concepts

A value of 5 to 9 rounds the number up.

A value of 0 to 4 keeps the number the same.

Estimation is a result of rounding to one significant figure.

Examples

Round 3.527 to:

a) 1 decimal place

3 . 5 | 2 7 → 3.5

b) 2 decimal places

3 . 5 2 | 7 → 3.53

c) 1 significant figure

3 | . 5 2 7 → 4

Estimate the answer to the following calculation:

$$\frac{46.2 - 9.85}{\sqrt{16.3 + 5.42}}$$

$$\frac{50 - 10}{\sqrt{20 + 5}}$$

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

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17,56,130

Key Words

Integers
Operation
Negative
Significant figures
Estimate

A) Round the following numbers to the given degree of accuracy

1) 14.1732 (1 d.p.) 2) 0.0568 (2 d.p.) 3) 3418 (1 S.F)

B) Estimate:

1) $\sqrt{4.09 \times 8.96}$

2) $25.76 - \sqrt{4.09 \times 8.96}$

3) $\sqrt[3]{26.64} + \sqrt{80.7}$

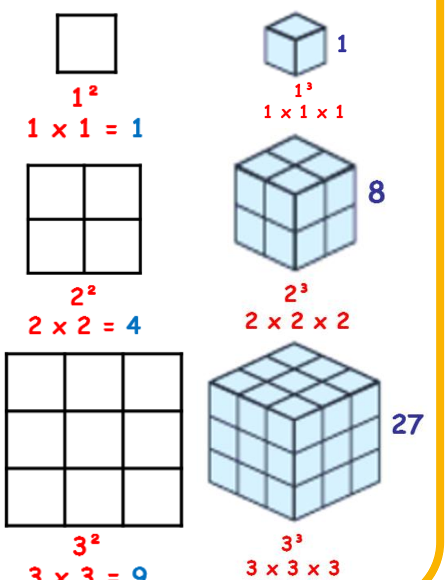
4) $\dfrac{\sqrt{6.91 \times 9.23}}{3.95^2 \div 2.02^3}$

ANSWERS A 1) 14.2 2) 0.06 3) 3000 B 1) 6 2) 24 3) 12 4) 4

POWERS AND ROOTS

Key Concept

Square numbers | **Cube numbers**



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Clip Numbers

27-30, 99-101

Key Words

Square: A square number is the result of multiplying a number by itself.

Cube: A cube number is the result of multiplying a number by itself twice.

Root: A root is the reverse of a power.

Prime number: A prime is a number that has only two factors which are 1 and itself.

Reciprocal: This is found by doing 1 divided by the number.

Factor: A number that fits into another number exactly.

Tip

A number with an odd amount of factors must be a square number.

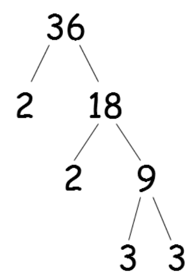
Examples

What is 2^4 ? $2 \times 2 \times 2 \times 2 = 16$

What is $\sqrt{64}$? $8^2 = 64$, so $\sqrt{64} = \pm 8$

What is the reciprocal of 5? $\frac{1}{5}$

Write 36 as a product of prime factors



$$36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$$

Product means 'multiply'

Questions

1) a) 2^5 b) 3^3 c) 1^{17} d) $\sqrt{81}$ e) $\sqrt{16}$ f) $\sqrt[3]{64}$

2) Find the reciprocal of: a) 4 b) $\frac{1}{3}$ c) 0.25

3) Write 72 as a product of primes.

ANSWERS: 1) a) 32 b) 27 c) 1 d) ± 9 e) ± 4 f) 4

2) a) $\frac{1}{4}$ b) 3 c) 4 3) $2^3 \times 3^2$

INDICES AND ROOTS

Key Concepts

$$a^m \times a^n = a^{m+n}$$

$$a^m \div a^n = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$a^{-m} = \frac{1}{a^m}$$

Examples

Simplify each of the following:

1) $a^6 \times a^4 = a^{6+4}$
$= a^{10}$

2) $3^6 \times 3^5 = 3^{6+5}$
$= 3^{11}$

3) $a^6 \div a^4 = a^{6-4}$
$= a^2$

4) $9^6 \div 9^3 = 9^{6-3}$
$= 9^3$

5) $(a^6)^4 = a^{6\times 4}$
$= a^{24}$

6) $(3a^4)^3 = 3^3 a^{4\times 3}$
$= 27a^{12}$

7) $a^{-1} = \frac{1}{a^1}$

8) $a^{-2} = \frac{1}{a^2}$

9) $a^{\frac{1}{2}} = \sqrt[2]{a^1} = \sqrt{a}$

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102 – 110

Key Words

Powers
Roots
Indices
Reciprocal

Write as a single power: 1) $a^3 \times a^2$ 2) $b^4 \times b$ 3) $d^{-5} \times d^{-1}$ 4) $m^6 \div m^2$ 5) $n^4 \div n^4$ 6) $\frac{8^4 \times 8^5}{8^6}$ 7) $\frac{4^9 \times 4}{4^3}$

Evaluate : 1) $(3^2)^5$ 2) 2^{-2} 3) $81^{\frac{1}{2}}$ 4) $27^{\frac{1}{3}}$

ANSWERS: 1) a^5 2) b^5 3) d^{-6} 4) m^4 5) 1 6) 8^3 7) 4^7

1) 3^{10} 2) $\frac{1}{4}$ 3) 9 4) 3

FACTORS, MULTIPLES AND PRIMES

Key Concepts

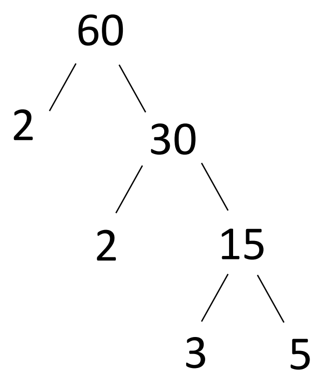
Prime factor decomposition
Breaking down a number into its prime factors

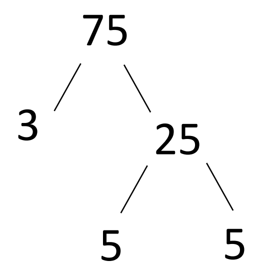
Highest common factor
Finding the largest number which divides into all numbers given

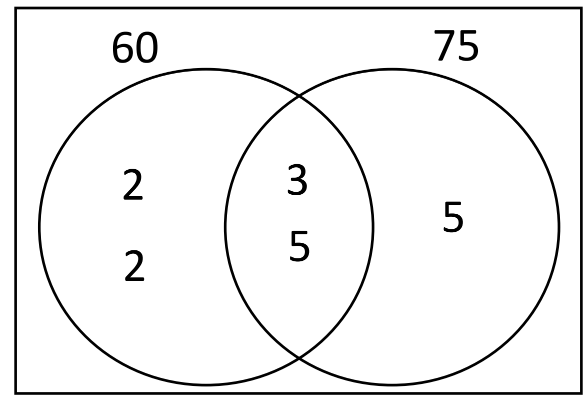
Lowest common multiple
Finding the smallest number which both numbers divide into

Examples

Find the **highest common factor** and **lowest common multiple** of 60 and 75:







$2 \times 2 \times 3 \times 5$

$2^2 \times 3 \times 5$

$3 \times 5 \times 5$

3×5^2

HCF – Mulitiply all numbers in the intersection
$= 3 \times 5 = 15$

LCM – Multiply all numbers in the Venn diagram
$= 2 \times 2 \times 3 \times 5 \times 5 = 300$

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29 – 32,34,35

Key Words

Factor
Multiple
Prime
Highest Common Factor
Lowest Common Multiple

Questions

1) Write 80 as a product of its prime factors
2) Write 48 as a product of its prime factors
3) Find the LCM and HCF of 80 and 48

ANSWERS: 1) $2^4 \times 5$ 2) $2^4 \times 3$ 3) LCM = 240 and HCF = 16

STANDARD FORM

Key Concepts

We use standard form to write a very large or a very small number in scientific form.

Must be $\times 10$

b is an integer

$$a \times 10^{b}$$

Must be $1 \leq a < 10$

Examples

Write the following in **standard form**:

1) 3000 = 3×10^{3}

2) 4580000 = 4.58×10^{6}

3) 0.0006 = 6×10^{-4}

4) 0.00845 = 8.45×10^{-3}

Calculate the following, write your answer in **standard form**:

1) $(3 \times 10^{3}) \times (5 \times 10^{2})$

$$\left.\begin{array}{l} 3 \times 5 = 15 \\ 10^{3} \times 10^{2} = 10^{5} \end{array}\right\} \quad \begin{array}{l} 15 \times 10^{5} \\ = 1.5 \times 10^{6} \end{array}$$

2) $(8 \times 10^{7}) \div (16 \times 10^{3})$

$$\left.\begin{array}{l} 8 \div 16 = 0.5 \\ 10^{7} \div 10^{3} = 10^{4} \end{array}\right\} \quad \begin{array}{l} 0.5 \times 10^{4} \\ = 5 \times 10^{3} \end{array}$$

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121 – 129

Key Words

Standard form

Base 10

Links

Science

A) Write the following in standard form:

1) 74 000 2) 1 042 000 3) 0.009 4) 0.000 001 24

B) Work out:

1) $(5 \times 10^{2}) \times (2 \times 10^{5})$ 2) $(4 \times 10^{3}) \times (3 \times 10^{8})$

3) $(8 \times 10^{6}) \div (2 \times 10^{5})$ 4) $(4.8 \times 10^{2}) \div (3 \times 10^{4})$

ANSWERS: A1) 7.4×10^{4} 2) 1.042×10^{6} 3) 9×10^{-3} 4) 1.24×10^{-6}

B1) 1×10^{8} 2) 1.2×10^{12} 3) 4×10 4) 1.6×10^{-2}

Half term 2

SIMPLIFYING & MANIPULATING ALGEBRA

Key Concept

Formula

$$v = u + at$$

Expression

$$f^2 + f^2 + f^2$$

Equation

$$34 = 12 + 6t$$

Identity

$$c \times c = c^2$$

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Clip Numbers

154-169, 548-550

Key Words

Formula: A rule written using symbols that describe a relationship between different quantities.
Expression: Shows a mathematical relationship whereby there is no solution.
Equation: A mathematical statement that shows that two expressions are equal.
Identity: A relation which is true. No matter what values are chosen.

Tip

When expanding brackets be careful with negatives.

Examples

Simplify:

$4a + 3b - a + 2b$

$= 3a + 5b$

Expand and simplify:

$9a - 2(3a - 4)$

$9a - 6a + 8$

$3a + 8$

Factorise:

$9x^2 + 6x$

Factorising is the opposite of expanding brackets

$3x$ is common to both terms

$3x(3x + 2)$

Expand and simplify:

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

$8a + 4b - 2a - 6b$

$6a - 2b$

Questions

1) $5x + 3y - 2x + 4y$ 2) $2p - 6q + 2q + 4p$ 3) $12b - 3(2b + 5)$
4) Factorise a) $4x + 10$ b) $8a^2 - 10a$

ANSWERS: 1) $3x + 7y$ 2) $6p - 4q$ 3) $6b - 15$ 4) a) $2(2x + 5)$ b) $2a(4a - 5)$

EXPRESSIONS/EQUATIONS/IDENTITIES AND SUBSTITUTION

Key Concepts

A **formula** involves two or more letters, where one letter equals an **expression** of other letters.

An **expression** is a sentence in algebra that does NOT have an equals sign.

An **identity** is where one side is the equivalent to the other side.

When **substituting** a number into an expression, replace the letter with the given value.

Examples

1) $5(y + 6) \equiv 5y + 30$ is an identity as when the brackets are expanded we get the answer on the right hand side
2) $5m - 7$ is an expression since there is no equals sign
3) $3x - 6 = 12$ is an equation as it can be solved to give a solution
4) $C = \frac{5(F - 32)}{9}$ is a formula (involves more than one letter and includes an equal sign)
5) Find the value of $3x + 2$ when $x = 5$

   $(3 \times 5) + 2 = 17$
6) Where $A = b^2 + c$, find A when $b = 2$ and $c = 3$

   $A = 2^2 + 3$

   $A = 4 + 3$

   $A = 7$

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153, 154, 189, 287

Key Words

Substitute

Equation

Formula

Identity

Expression

Questions

1) Identify the equation, expression, identity, formula from the list (a) $v = u + at$ (b) $u^2 - 2as$ (c) $4x(x - 2) = x^2 - 8x$ (d) $5b - 2 = 13$

2) Find the value of $5x - 7$ when $x = 3$

3) Where $A = d^2 + e$, find A when $d = 5$ and $e = 2$

ANSWERS: 1) (a) formula (b) expression (c) identity (d) equation
2) 8 3) $A = 27$

EXPANDING AND FACTORISING

Key Concepts

Expanding brackets
Where every term inside each bracket is multiplied by every term all other brackets.

Factorising expressions
Putting an expression back into brackets. To “factorise fully” means take out the HCF.

Difference of two squares
When two brackets are repeated with the exception of a sign change. All numbers in the original expression will be square numbers.

Examples

Expand and simplify:

1) $4(m + 5) + 3$

$= 4m + 20 + 3$

$= 4m + 23$

2) $(p + 2)(2p - 1)$

$= p^2 + 4p - p - 2$

$= p^2 + 3p - 2$

3) $(p + 3)(p - 1)(p + 4)$

$= (p^2 + 3p - p - 3)(p + 4)$

$= (p^2 + 2p - 3)(p + 4)$

$= p^3 + 4p^2 + 2p^2 + 8p - 3p - 12$

$= p^3 + 6p^2 + 5p - 12$

Factorise fully:

1) $16at^2 + 12at \ = 4at(4t + 3)$

2) $x^2 - 2x - 3 \ = (x - 3)(x + 1)$

3) $6x^2 + 13x + 5$

$= \ 6x^2 + 3x + 10x + 5$

$= \ 3x(2x + 1) + 5(2x + 1)$

$= \ (3x + 5)(2x + 1)$

4) $4x^2 - 25$

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

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160-166, 168, 169,223-228

Key Words

Expand
Factorise fully
Bracket
Difference of two squares

A)Expand:

1) $5(m - 2) + 6$ 2) $(5g - 4)(2g + 1)$ 3) $(y + 1)(y - 2)(y + 3)$

B) Factorise:

1) $5b^2c - 10bc$ 2) $x^2 - 8x + 15$ 3) $3x^2 + 8x + 4$ 4) $9x^2 - 25$

ANSWERS: A 1) $5m - 4$ 2) $10g^2 - 3g - 4$ 3) $y^3 + 2y^2 - 5y - 6$

B 1) $5bc(b - 2)$ 2) $(x - 3)(x - 5)$ 3) $(3x + 2)(x + 2)$ 4) $(3x + 5)(3x - 5)$

REARRANGE AND SOLVE EQUATIONS

Key Concepts

Solving equations:
Working with inverse operations to find the value of a variable.

Rearranging an equation:
Working with inverse operations to isolate a highlighted variable.

In solving and rearranging we **undo the operations** starting from the last one.

Examples

For each step in solving an equation we must do the **inverse** operation

Solve:

$5(x-3) = 20$

Expand

$5x - 15 = 20$

$+15 \qquad +15$

$5x = 35$

$\div 5 \qquad \div 5$

$x = 7$

Solve:

$12 = 3x - 18$

$+18 \qquad +18$

$30 = 3x$

$\div 3 \qquad \div 3$

$x = 10$

Solve:

$7p - 5 = 3p + 3$

$-3p \qquad -3p$

$4p - 5 = 3$

$+5 \qquad +5$

$4p = 8$

$\div 2 \qquad \div 2$

$p = 2$

Rearrange to make r the subject of the formulae :

$$Q = \frac{2r - 7}{3}$$

$\times 3 \qquad \times 3$

$$3Q = 2r - 7$$

$+7 \qquad +7$

$$3Q + 7 = 2r$$

$\div 2 \qquad \div 2$

$$\frac{3Q + 7}{2} = r$$

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177-186, 280-284, 287

Key Words

Solve

Rearrange

Term

Inverse operation

1) Solve $7(x + 2) = 35$

2) Solve $4x - 12 = 28$

3) Solve $4x - 12 = 2x + 20$

4) Rearrange to make x the subject:

$$y = \frac{3x + 4}{2}$$

ANSWERS: 1) $x = 3$ 2) $x = 10$ 3) $x = 16$ 4) $x = \frac{2y - 4}{3}$

INEQUALITIES

Key Concepts

Inequalities show the **range** of numbers that satisfy a rule.

$x < 2$ means x is less than 2
$x \leq 2$ means x is less than or equal to 2
$x > 2$ means x is greater than 2
$x \geq 2$ means x is greater than or equal to 2

On a **number line** we use circles to highlight the key values:

○ is used for less/greater than
● is used for less/greater than or equal to

Examples

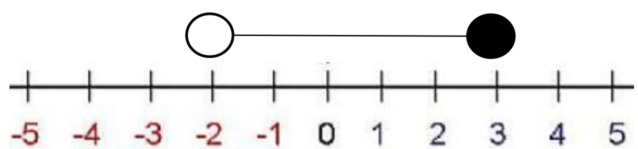
a) State the values of n that satisfy:

$$-2 < n \leq 3$$

Cannot be equal to 2   Can be equal to 3

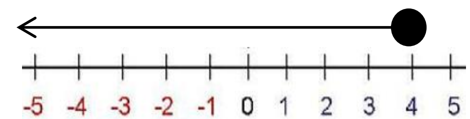
-1, 0, 1, 2, 3

b) Show this inequality on a number line:



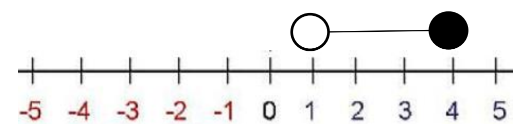
Solve this inequality and represent your answer on a **number line:**

$5x - 6 \leq 14$
+6   +6
$5x \leq 20$
÷5   ÷5
$x \leq 4$



Solve this inequality and represent your answer on a **number line:**

$4 < 3x + 1 \leq 13$
-1   -1
$3 < 3x \leq 12$
÷3   ÷3
$1 < x \leq 4$



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265-272

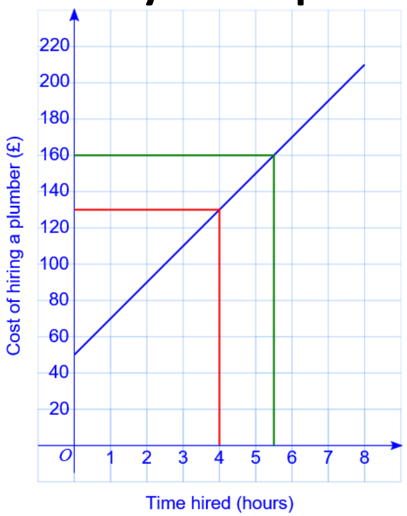
Key Words
Inequality
Greater than
Less than
Represent
Number line

1) State the values of n that satisfy: $-3 \leq n < 2$
2) Solve $4x - 2 \leq 6$ and represent your answer on a number line
3) Solve $5 < 2x + 3 \leq 9$ and represent your answer on a number line

ANSWERS: 1) -3, -2, -1, 0, 1   2) $x \leq 2$ 3) $1 < x \leq 3$

APPLIED GRAPHS

Key Concept

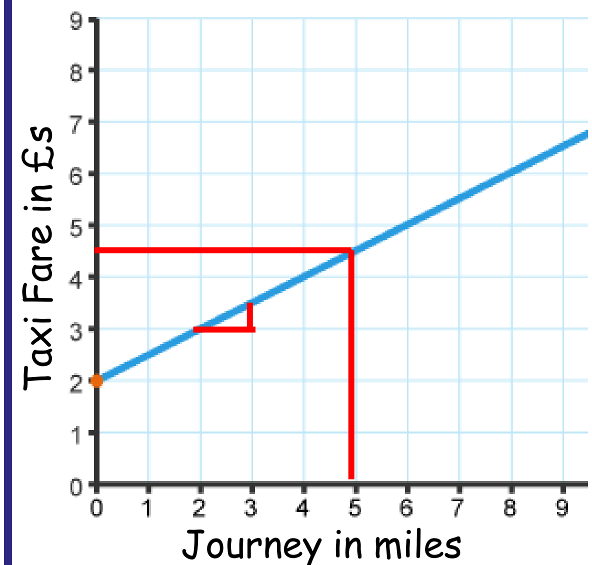


Gradient – The extra cost incurred for every extra hour.
y-intercept – The minimum payment to the plumber.

Key Words

Conversion graph: A graph which converts between two variables.
Intercept: Where two graphs cross.
y-intercept: Where a graph crosses the y-axis.
Gradient: The rate of change of one variable with respect to another. This can be seen by the steepness.
Simultaneous: At the same time.

Examples



What is the minimum taxi fair?
£2, this is the y-intercept.

What is the charge per mile?
50p, every extra mile adds on 50p.

How much would a journey of 5 miles cost?
£4.50, See line drawn up from 5 miles to the graph, then drawn across to find the cost.

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207-209, 218, 219, 712, 713

Tip

The solution to two linear equations with two unknowns is the coordinates of the intercept (where they cross).

Questions

1) For the graph above a) A journey is 8 miles, what is its cost?
b) A journey cost just £3, how far was the journey?
2) Draw a graph to show the exchange rate £1 = $1.4.

ANSWERS: 1) a) £6 b) 2 miles

STRAIGHT LINE GRAPHS AND EQUATION OF A LINE

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:

$$y = mx + c$$

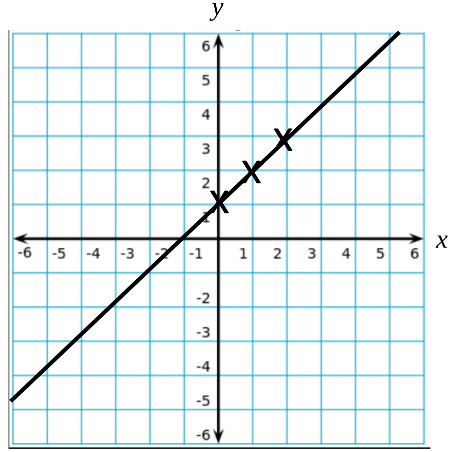
m is the **gradient** i.e. the steepness of the graph.

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

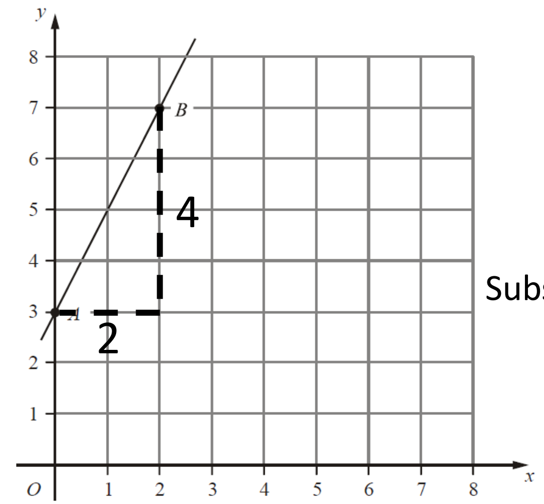
Examples

Plot the graph of $y = x + 1$

x	**0**	**1**	**2**
y	1	2	3



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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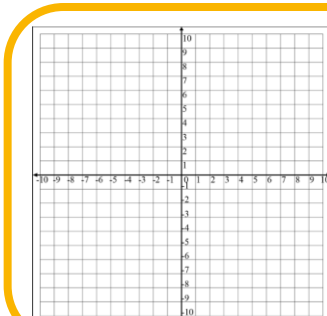
199,200,205,207-211,214

Key Words

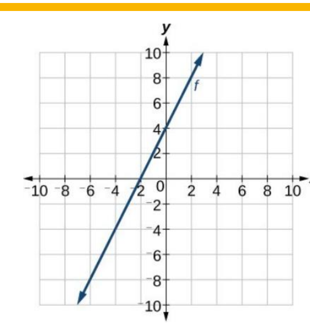
Coordinate

Gradient



1) Plot the line $y = 3x - 2$

2) Find the equation of the line for the attached graph.



ANSWERS: 2) $y = 2x + 4$

PLOTTING AND INTERPRETTING GRAPHS

Key Concept

Substitution – This is where you replace a number with a letter

If a = 5 and b = 2

a + b =	5 + 2 = 7
a – b =	5 – 2 = 3
3a =	3 × 5 = 15
ab =	5 × 2 = 10
a^2 =	5^2 = 25

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Clip Numbers

206 - 210, 251

Key Words

Intercept: Where two graphs cross.
Gradient: This describes the steepness of the line.
y-intercept: Where the graph crosses the y-axis.
Linear: A linear graph is a straight line.
Quadratic: A quadratic graph is curved, u or n shape.

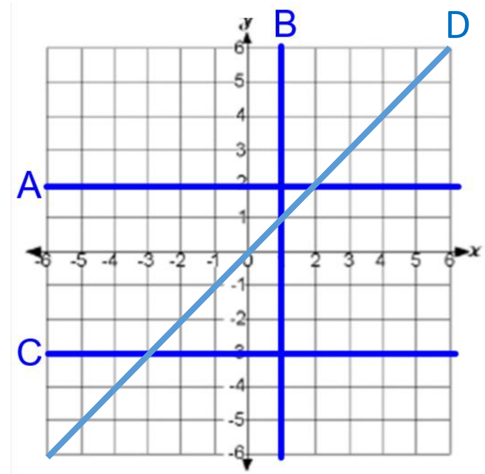
Tip

Parallel lines have the same gradient.

Formula

$$Gradient = \frac{difference\ in\ y's}{difference\ in\ x's}$$

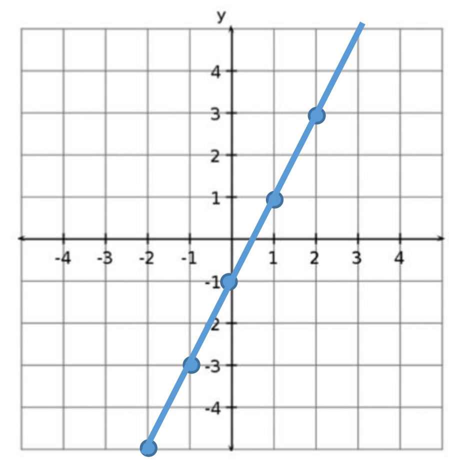
Examples



A: y = 2 B: x = 1
C: y = -3 D: y = x

Draw the graph of y = 2x - 1

X	- 2	- 1	0	1	2
Y	-5	-3	-1	1	3



Notice this graph has a gradient of 2 and a y-intercept of -1.

Questions

1) What are the gradient and y-intercept of:
a) y = 4x – 3 b) y = 4 + 6x c) y = - 5x – 3
2) Draw the graph of y = 3x – 2 for x values from -3 to 3 using a table.

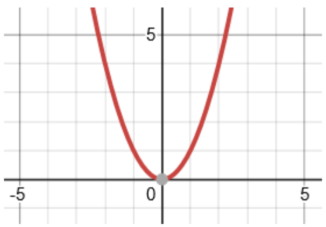
ANSWERS: 1) a) m = 4, c = -3 b) m = 6, c = 4 c) m = -5, c = -3

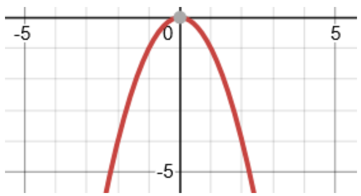
QUADRATIC GRAPHS

Key Concepts

A quadratic graph will always be in the shape of a parabola.

$y = x^2$ $\qquad$ $y = -x^2$

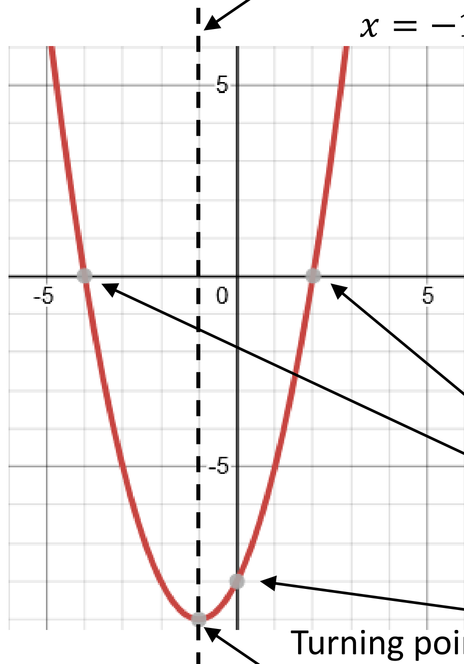




The roots of a quadratic graph are where the graph crosses the x axis. The roots are the solutions to the equation.

Examples

Line of symmetry
$x = -1$



Turning point
$(-1, -9)$

$$y = x^2 + 2x - 8$$

A quadratic equation can be solved from its graph.
The roots of the graph tell us the possible solutions for the equation.
There can be 1 root, 2 roots or no roots for a quadratic equation. This is dependant on how many times the graph crosses the x axis.

Roots $x = -4$
$x = 2$

y intercept = -8

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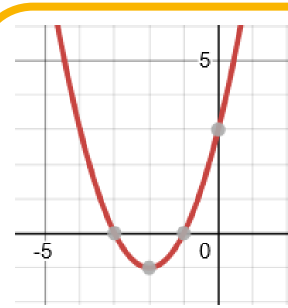
251-256

Key Words

Quadratic
Roots
Intercept
Turning point
Line of symmetry



Identify from the graph of $y = x^2 + 4x + 3$:

1) The line of symmetry
2) The turning point
3) The y intercept
4) The two roots of the equation

ANSWERS 1) $x = -2$ 2) $(-2, -1)$ 3) 3 4) $x = -1$ and $x = -3$

Half term 3

FRACTIONS, DECIMALS AND PERCENTAGES

Key Concepts

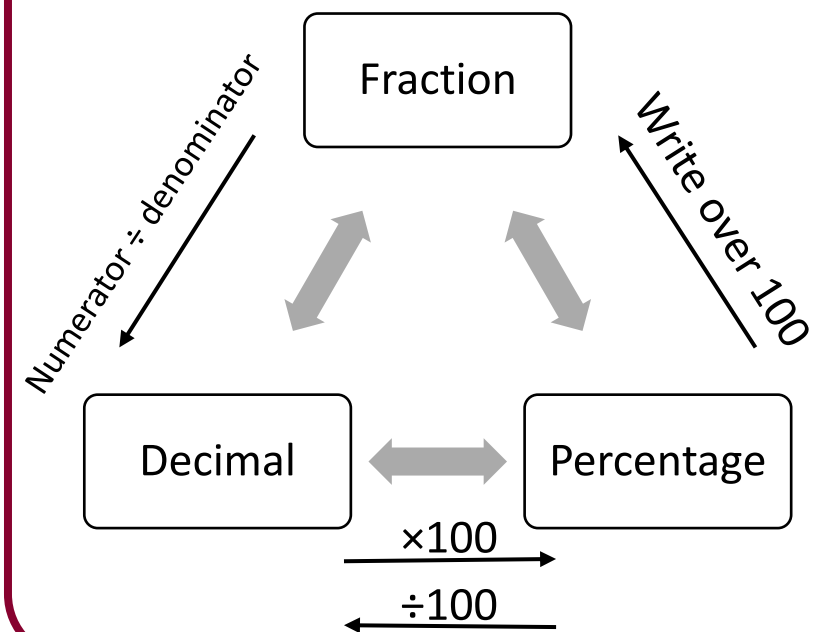
A **fraction** is a numerical quantity that is not a whole number.

A **decimal** is a number written using a system of counting based on the number 10.

Thousands	Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
8	7	6	5	.	4	3	2

A **percentage** is an amount out of 100.

Examples



Order the following in ascending order:

$\frac{3}{5}$ 62% 0.67 $\frac{7}{10}$ 0.665

$\frac{3}{5} \xrightarrow{\times 20} \frac{60}{100} \rightarrow 60\%$

$62\% \rightarrow 62\%$

$0.67 \xrightarrow{\times 100} 67\%$

$\frac{7}{10} \xrightarrow{\times 10} \frac{70}{100} \rightarrow 70\%$

$0.665 \xrightarrow{\times 100} 66.5\%$

60% 62% 67% 70% 66.5%

$\frac{3}{5}$ 62% 0.665 0.67 $\frac{7}{10}$

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73-76, 82-83

Key Words

Fraction
Decimal
Percentage
Division
Multiply

1) Convert the following into percentages:
a) 0.4 b) 0.08 c) $\frac{6}{20}$ d) $\frac{3}{25}$

2) Compare and order the following in ascending order:

$\frac{3}{4}$ 76% 0.72 $\frac{4}{5}$ 0.706

ANSWERS 1a) 40% b) 8% c) 30% d) 12% 2) 0.706 0.72 $\frac{3}{4}$ 76% $\frac{4}{5}$

FRACTIONS

Key Concepts

$\frac{x}{y} \longrightarrow \frac{\text{Numerator}}{\text{Denominator}}$

Equivalent fractions have the same value as one another.

Eg. $\frac{1}{4} = \frac{2}{8} = \frac{3}{12}$

Examples

Calculate $\frac{4}{5}$ of 65:

$65 \div 5 = 13$ — Divide by the denominator

$13 \times 4 = 52$ — Multiply this by the numerator

$\frac{4}{5}$ of a number is 52, what is the original number?

$52 \div 4 = 13$ — Divide by the numerator

$13 \times 5 = 65$ — Multiply this by the denominator

Order these fractions in ascending order:

$\frac{2}{5}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{7}{15}$
$\times 6$	$\times 15$	$\times 5$	$\times 2$
$\frac{12}{30}$	$\frac{15}{30}$	$\frac{25}{30}$	$\frac{14}{30}$
1	3	4	2

To be able to compare fractions we must have a **common denominator**

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61, 63-70

Key Words

Fraction

Equivalent

Reciprocal

Numerator

Denominator

1) Calculate $\frac{2}{7}$ of 56.

2) $\frac{3}{8}$ of a number is 36, what is the original number?

3) Order the following in ascending order: $\frac{2}{3}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{7}{12}$

ANSWERS A 1) 16 2) 96 3) $\frac{3}{8}$ $\frac{7}{12}$ $\frac{2}{3}$ $\frac{5}{6}$

PERCENTAGE CHANGE AND REVERSE PERCENTAGES

Key Concepts

Calculating percentages of an amount without a calculator:

10% = divide the value by 10
1% = divide the value by 100

Calculating percentages of an amount with a calculator:

Amount × percentage as a decimal

Calculating percentage increase/decrease:

Amount × (1 ± percentage as a decimal)

Examples

Percentage change:

A dress is reduced in price by 35% from £80. What is it's **new price**?

$Value \times (1 - percentage\ as\ a\ decimal)$
$= 80 \times (1 - 0.35)$
= £52

A house price appreciates by 8% in a year. It originally costs £120,000, what is the **new value** of the house?

$Value \times (1 + percentage\ as\ a\ decimal)$
$= 120{,}000 \times (1 + 0.08)$
= £129,600

Reverse percentages: This is when we are trying to find out the original amount.

A pair of trainers cost £35 in a sale. If there was 20% off, what was the **original price** of the trainers?

$Value \div (1 - 0.20)$
$= 35 \div 0.8$
= £43.75

A vintage car has increased in value by 5%, it is now worth £55,000. What was it worth **originally**?

$Value \div (1 + 0.05)$
$= 55{,}000 \div 1.05$
= £52,380.95

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88-92, 96

Key Words

Percent
Increase/decrease
Reverse
Multiplier
Inverse

1a) Decrease £500 by 6%
b) Increase 70 by 8.5%
2) A camera costs £180 in a 10% **sale**. What was the **pre-sale** price
3) The cost of a holiday, including **VAT** at 20% is £540. What is the **pre-VAT** price?

ANSWERS A 1a) £470 b) £75.95 2) £200 3) £450

PROFIT AND LOSS

Key Concepts

A person or company makes a **profit** when they have a **financial gain**. It is the difference between the price a product is sold for and the price it was originally bought for. It will be a **positive** value.

A person or company makes a **loss** when they **lose money**. It is the difference between the price a product is sold for and the price it was originally bought for. It will be a **negative** value.

Calculating percentage change:

$$\frac{\textit{sell price} - \textit{original price}}{\textit{orginal price}} \times 100$$

Examples

A house is valued at £200,000 in 2018. It was sold in 2020 for a price of £240,000.
What percentage profit was made on this house?

$$Profit = \frac{240000 - 200000}{200000} \times 100$$

$$= 20\%\ Profit$$

A car originally cost £8500. It was sold to another owner 3 years later for a price of £5000.
What percentage loss was made on this car?

$$Loss = \frac{5000 - 8500}{5000} \times 100$$

$$= -70\%$$

$$= 70\%\ Loss$$

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756-760

Key Words

Profit

Loss

Percentage

Financial

1) A market seller buys a box of apples for £5. He sells all of the apples for a total of £5.50. What is the percentage profit made on the apples?
2) A mobile phone was originally bought for £800. It was resold 2 years later for a price of £350. What was the percentage loss of the phone?

ANSWERS 1) 10% profit 2) 56.25% loss

CONVERSION OF METRIC UNITS

Key Concept

Metric units of **length**:
mm, cm, m, km

Metric units of **weight**:
g, kg

Metric units of **capacity**:
ml, l

All of these units are **metric** units. They will always use conversions of multiples of 10, eg.10, 100, 1000 etc.

Length

$$\text{mm} \underset{\times 10}{\overset{\div 10}{\rightleftarrows}} \text{cm} \underset{\times 100}{\overset{\div 100}{\rightleftarrows}} \text{m} \underset{\times 1000}{\overset{\div 1000}{\rightleftarrows}} \text{km}$$

Capacity

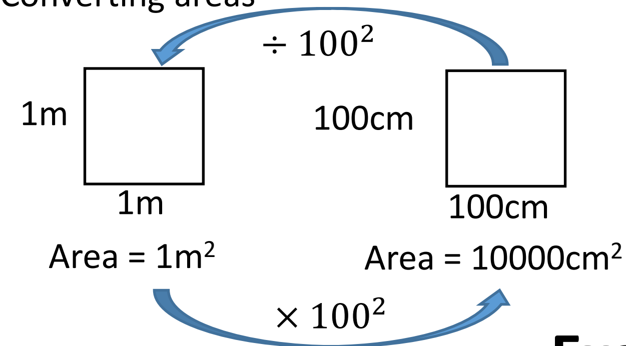
$$\text{ml} \underset{\times 1000}{\overset{\div 1000}{\rightleftarrows}} \text{l}$$

Weight

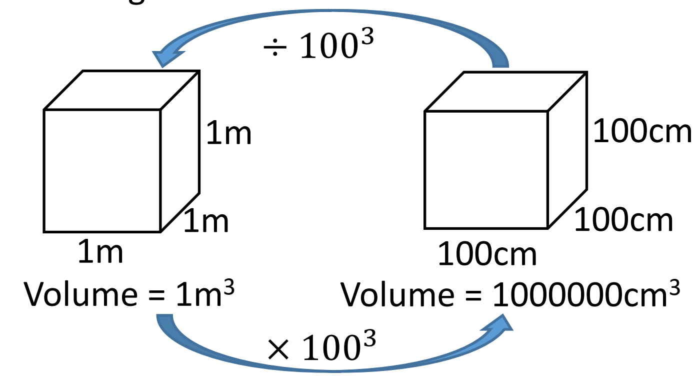
$$\text{g} \underset{\times 1000}{\overset{\div 1000}{\rightleftarrows}} \text{kg}$$

Examples

Converting areas



Converting volumes



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691, 709-710

Key Words

Length
Weight
Capacity
Metric

Convert each of the following:

a) 12cm into mm
b) 1783g into kg
c) 2.5 litres into ml
d) 6.8m into mm
e) 5000000cm^3 into m^3
f) 2m^2 into cm^2

ANSWERS: a) 120mm b) 1.783kg c) 2500ml d) 6800mm e) 5m^3 f) 20000cm^2

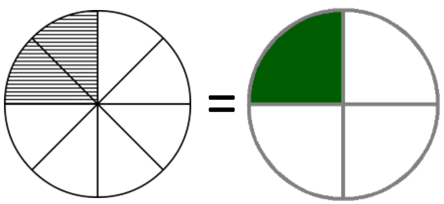
REVIEW OF RATIO

Key Concept

2 parts → 2:6 ← 6 parts

=

1:3



$= \frac{1}{4}$

Clip Numbers

328 – 335

Key Words

Ratio: Relationship between two numbers.

Part: This is the numeric value '1' of, would be equivalent to.

Simplify: Divide both parts of a ratio by the same number.

Equivalent: Equal in value.

Convert: Change from one form to another.

Tip

Its often useful to write the letters above the ratio. This helps you keep the order the correct way round.

Examples

Simplify 60 : 40 : 100

÷ 10

6 : 4 : 10

÷ 2

3 : 2 : 5

This could have been done in one step by dividing by 20.

Write 2: 5 in the form 1 : n

2 : 5

÷ 2 ÷ 2

1 : 2.5

Share £45 in the ratio 2 : 7

2	7
5	5
5	5
=10	5
	5
	5
	5
	5
	=35

45 ÷ 9 = 5

£10 : £35

Joy and Martin share money in the ratio 2 : 5. Martin gets £18 more than Joy. How much do they each get?

2	5
6	6
6	6
	6
	6
	6
=12	=30

18 ÷ 3 = 6

£12 : £30

Questions

1) Simplify a) 45 : 63 b) 66 : 44 c) 320 : 440
2) Write in the form 1 : n a) 5 : 10 b) 4: 6 c) $x : x^2 + x$
3) Share 64 in the ratio 3 : 5 4) Write the ratio 1 : 4 as a fraction.

ANSWERS: 1) a) 5 : 7 b) 3 : 2 c) 8 : 11 2) a) 1 : 2 b) 1 : 1.5 c) $1 : x + 1$
3) 24 : 40 4) $^1/_5$

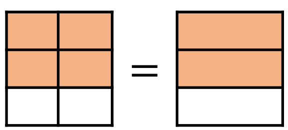
PROPORTION

Key Concept

Proportion states that two fractions or ratios are equivalent.

$$\frac{4}{6} = \frac{2}{3}$$

$$4:2 = 2:1$$



Key Words

Ratio: Relationship between two numbers.

Scale: The ratio of the length in a drawing to the length of the real thing.

Proportion: A name we give to a statement that two ratios are equal.

Exchange rate: The value of one currency for the purpose of conversion to another.

Examples

Write 2: 5 in the form 1 : n

$$2:5 \xrightarrow{\div 2} 1:2.5$$

a:b = 4:5 and b:c = 6:7

Find a:b:c.

The LCM of 5 and 6 is 30

a	:	b	:	c
4	:	5		
		6	:	7
24	:	**30**	:	**35**

×6, × 5

Cake recipe for 6 people.

3 eggs

300g flour

150g sugar

What would you need for 8 people?

÷ 3, ×4

	6	2	8
eggs	3	1	4
flour	300g	100g	400g
sugar	150g	50g	200g

331-340, 707-708, 839-842, 864-871

Tip

Working with ratio or proportion requires multiplying or dividing the numbers. Do not add or subtract.

Questions

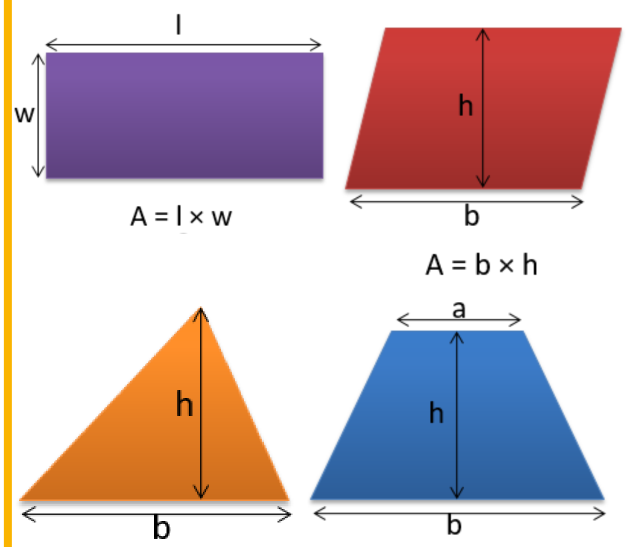
1) Write in the form 1 : n a) 4 : 8 b) 3 : 12 c) 4 : 6
2) a : b = 3 : 10 and b : c = 4 : 12. Find a:b:c.
3) Pancakes for 4 people need 2 eggs, 120g flour and 60ml milk. How much for 6 people?

ANSWERS: 1) a) 1:2 b) 1:4 c) 1:1.5 2) 12:40:120 3) 3 eggs, 180g flour, 90 ml milk.

Half term 4

AREA AND PERIMETER

Key Concepts
Area



A = l × w

A = b × h

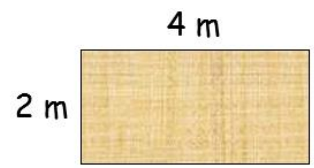
A = ½ (b × h)

A = ½ (a + b)h

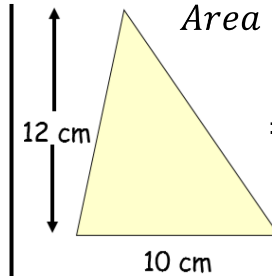
Key Words

Area: The amount of square units that fit inside the shape.
Perimeter: The distance around the outside of the shape.
Dimensions: The lengths which give the size of the shape.
Shapes:
Rectangle, Triangle, Parallelogram, Trapezium, Kite.

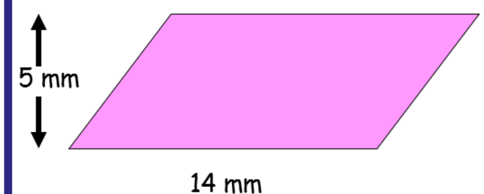
Examples



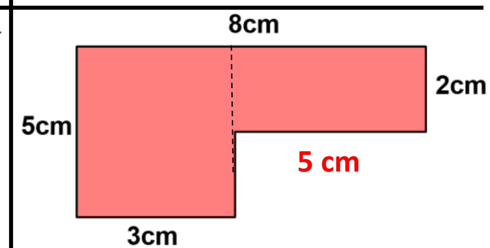
$$Area = 2 \times 4 = 8m^2$$



$$Area = \frac{1}{2}(10 \times 12)$$
$$= 60cm^2$$



$$Area = 5 \times 14$$
$$= 70mm^2$$



$$Area = (5 \times 3) + (2 \times 5)$$
$$= 25cm^2$$

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Clip Numbers

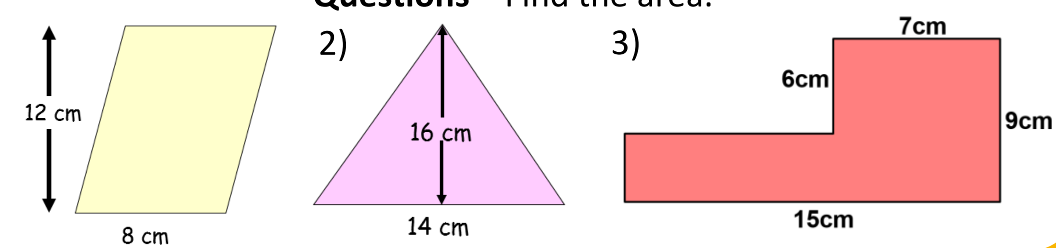
554 – 559

Tip

Always remember units. These units are squared for area.
mm^2, cm^2, m^2, etc

Questions – Find the area.

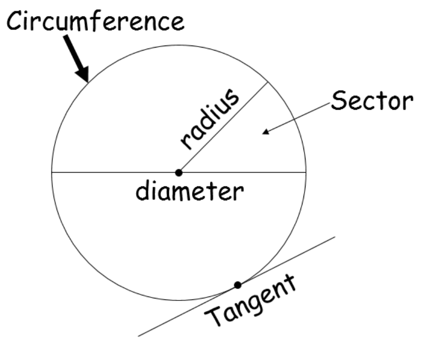
1) 2) 3)

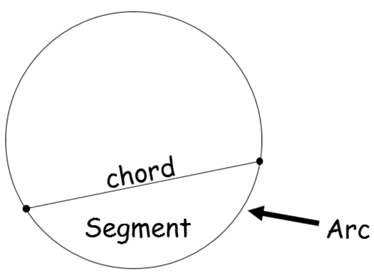


ANSWERS: 1) 96 cm^2 2) 112 cm^2 2) 87 cm^2

CIRCLES AND COMPOUND AREA

Key Concepts





Key Words

Diameter: Distance from one side of the circle to the other, going through the centre.

Radius: Distance from the centre of a circle to the circumference.

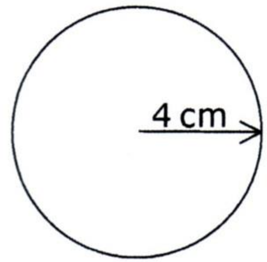
Chord: A line that intersects the circle at two points.

Tangent: A line that touches the circle at only one point.

Compound (shape): More than one shape joined to make a different shape.

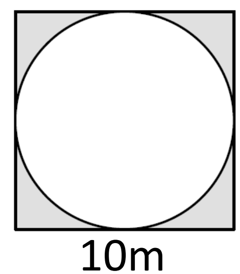
Examples

Find the area and circumference to 2dp.



$$Circumference = \pi \times d$$
$$= \pi \times 8 = 25.13cm$$
$$Area = \pi \times r^2$$
$$= \pi \times 4^2 = 50.27cm^2$$

Find shaded area to 2dp.



$$Square\ area = 10 \times 10$$
$$= 100m^2$$
$$Circle\ area = \pi \times r^2$$
$$= \pi \times 5^2$$
$$= 78.54\ m^2$$
$$Shaded\ area = 100 - 78.54 = 21.46m^2$$

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Clip Numbers

534-547, 556, 9

Tip

If you don't have a calculator you can leave your answer in terms of π.

Formula

$$Circle\ Area = \pi \times r^2$$
$$Circumference = \pi \times d$$

Questions

1) Find to 1dp the area and circumference of a circle with:

a) Radius = 5cm b) Diameter = 12mm c) Radius = 9m

2) Find the area & perimeter of a semi-circle with diameter of 15cm.

ANSWERS: 1) a) A = 78.5cm², C = 31.4cm b) A = 113.1mm², C = 37.7mm c) A = 254.5m², C = 56.5m 2) A = 88.4cm², P = 38.6cm

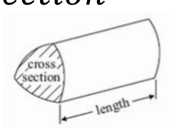
VOLUME AND SURFACE AREA OF PRISMS

Key Concept

The **volume** of an object is the amount of space that it occupies. It is measured in units cubed e.g. cm^3.

To calculate the volume of any prism we use:

$$\begin{matrix} area\ of \\ cross\ section \end{matrix} \times length$$



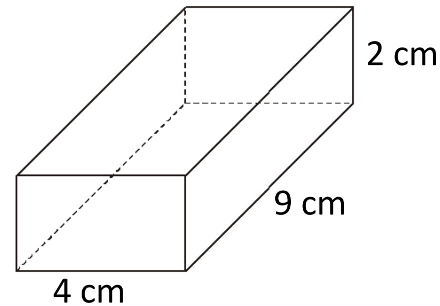
A **prism** is a 3D shape which has a continuous cross-section.

The **surface area** of an object is the sum of the area of all of its faces. It is measured in units squared e.g. cm^2.

Examples

$$\boldsymbol{Volume} = 4 \times 9 \times 2$$

$$= \mathbf{72cm^3}$$



$\boldsymbol{Surface\ area}$:

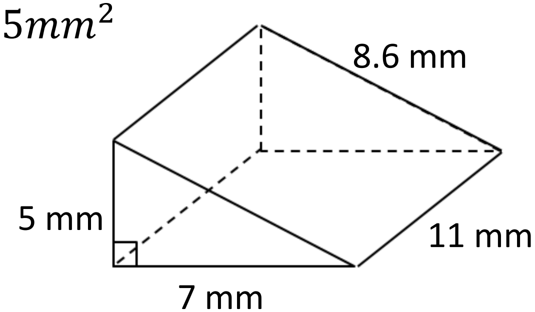
$$\begin{aligned} Front &= 4 \times 2 = 8 \\ Back &= 4 \times 2 = 8 \\ Side\ 1 &= 9 \times 2 = 18 \\ Side\ 2 &= 9 \times 2 = 18 \\ Bottom &= 4 \times 9 = 36 \\ Top &= 4 \times 9 = 36 \\ Total &= \mathbf{124cm^2} \end{aligned}$$

$$Area\ of\ triangle = \frac{5 \times 7}{2}$$

$$= 17.5mm^2$$

$$\boldsymbol{Volume} = 17.5 \times 11$$

$$= \mathbf{192.5mm^3}$$



$\boldsymbol{Surface\ area}$:

$$\begin{aligned} Front &= \frac{7 \times 5}{2} = 17.5 \\ Back &= \frac{7 \times 5}{2} = 17.5 \\ Side &= 5 \times 11 = 55 \\ Bottom &= 7 \times 11 = 77 \\ Top &= 11 \times 8.6 = 94.6 \\ Total &= \mathbf{261.6cm^2} \end{aligned}$$

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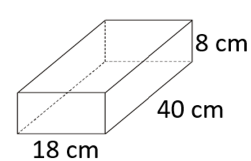
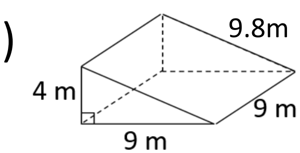
568-571, 584-586

Key Words

Volume
Capacity
Prism
Surface area
Face

Find the volume and surface area of each of these prisms:

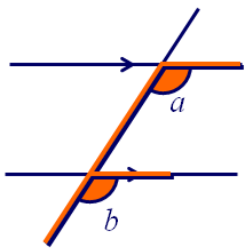
1) 

2) 

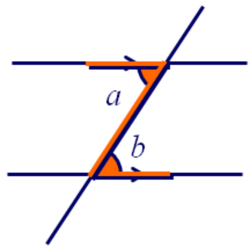
ANSWERS: 1)Volume = 5760 cm^3 Surface area = 2368 cm^2 2) Volume = 162 m^3 Surface area = 241.2m^2

PARALLEL LINES AND ANGLES

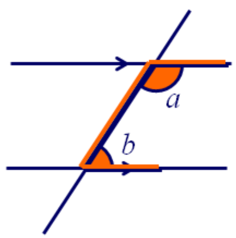
Key Concepts



Corresponding angles are equal.



Alternate angles are equal.



Co-interior angles add to 180°.

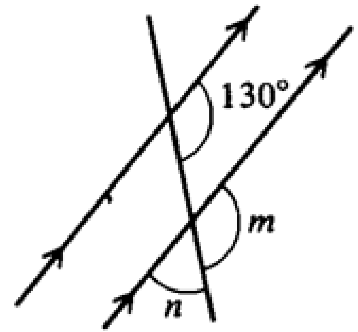
Key Words

Intersect: Two lines which cross.

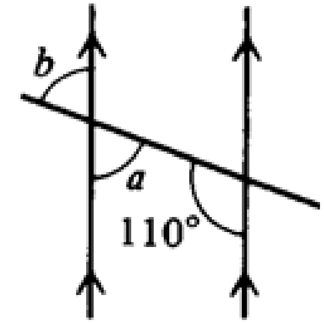
Parallel: Two lines which never intersect. Marked by an arrow on each line.

Transversal: A line which intersects two parallel lines.

Examples



m = 130° as corresponding angles are equal.
n = 50° as angles on a line add to 180°



a = 70° as co-interior angles add to 180°
b = 70° as vertically opposite angles are equal

hegartymaths

Clip Numbers

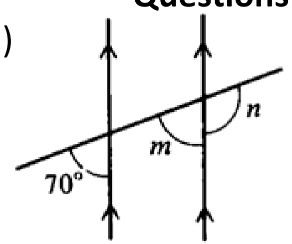
480-491

Tip

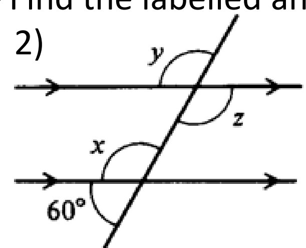
These angle properties can be used alongside all the other angle properties that you have learnt.

Questions – Find the labelled angles, give reasons.

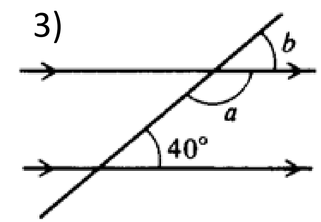
1)



2)



3)



ANSWERS: 1) m = 70°, n = 110° 2) x = 120°, y = 120°, z = 120° 3) a = 140°, b = 40°

ANGLE FACTS INCLUDING ON PARALLEL LINES

Key Concepts

Angles in a **triangle equal 180º**.

Angles in a **quadrilateral equal 360º**.

Vertically opposite angles are equal in size.

Angles on a **straight line equal 180º**.

Base angles in an isosceles triangle are equal.

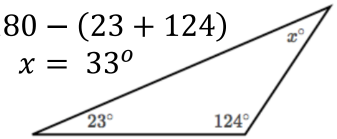
Alternate angles are equal in size.

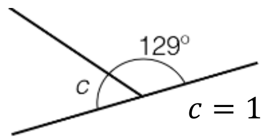
Corresponding angles are equal in size.

Allied/co-interior angles are equal 180º.

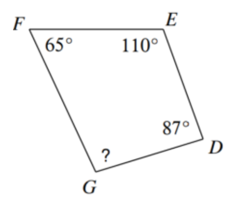
Examples

$x = 180 - (23 + 124)$
$x = 33^o$

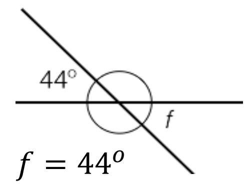




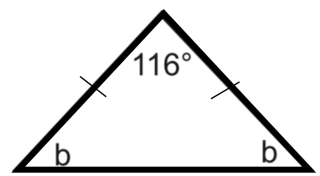
$c = 180 - 129$
$x = 51^o$



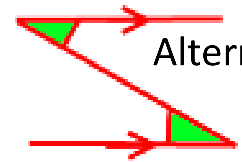
$? = 360 - (65 + 110 + 87)$
$? = 98^o$



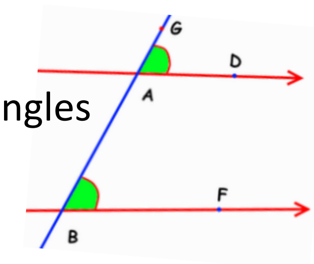
$f = 44^o$



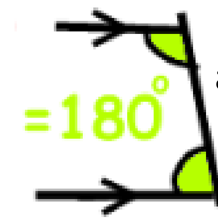
$b = (180 - 116) \div 2$
$b = 32^o$



Alternate angles are equal



Corresponding angles are equal



Allied/co-interior angles equal 180º

hegartymaths

477-480, 481-483

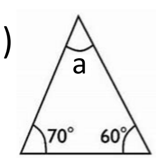
Key Words

Angle
Vertically opposite
Straight line
Alternate
Corresponding
Allied
Co-interior

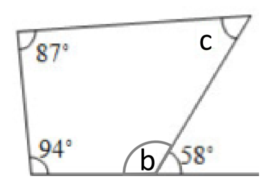
Questions

Calculate the missing angle:

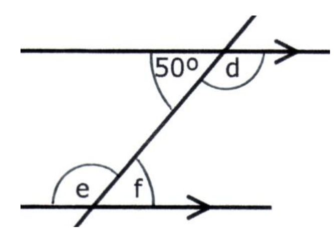
a)



b)



c)



ANSWERS: 1) a=50º 2) b=122º c=57º 3) d=130º e=130º f=50º

Half term 5

TYPES OF ANGLE AND ANGLES IN POLYGONS

Key Concepts

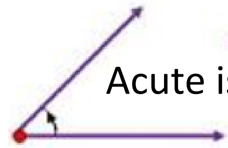
Regular polygons have equal lengths of sides and equal angles.

Angles in polygons
Sum of interior angles
$= (number\ of\ sides - 2) \times 180$

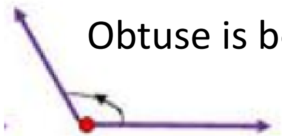
Exterior angles of **regular** polygons = $\frac{360}{number\ of\ sides}$

Types of angle
There are four types which need to be identified – acute, obtuse, reflex and right angled.

Examples



Acute is less than 90°

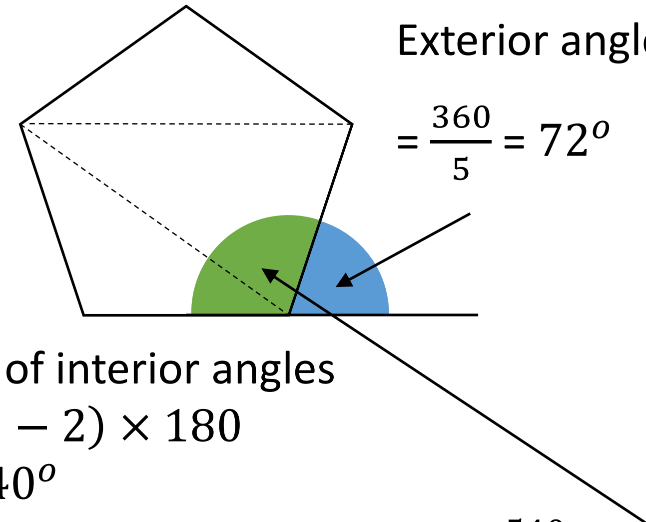


Obtuse is between 90° and 180°

Right angled is 90°

Reflex is between 180° and 360°

Regular Pentagon



Exterior angles

$= \frac{360}{5} = 72^o$

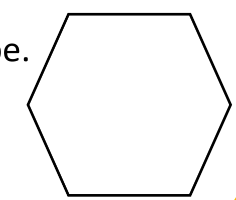
Sum of interior angles
$= (5 - 2) \times 180$
$= 540^o$

Interior angle = $\frac{540}{5} = 108^o$

hegartymaths
455, 456, 560-564

Key Words
Polygon
Interior angle
Exterior angle
Acute
Obtuse
Right angle
Reflex

Questions
1) Calculate the sum of the interior angles for this regular shape.
2) Calculate the exterior angle for this regular shape.
3) Calculate the size of one interior angle in this regular shape.

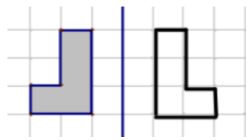


ANSWERS: 1) 720° 2) 60° 3) 120°

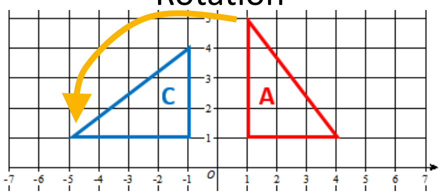
CO-ORDINATES AND TRANSFORMATIONS

Key Concept

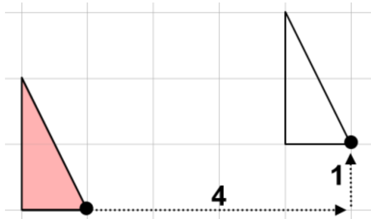
Reflection



Rotation



Translation



Key Words

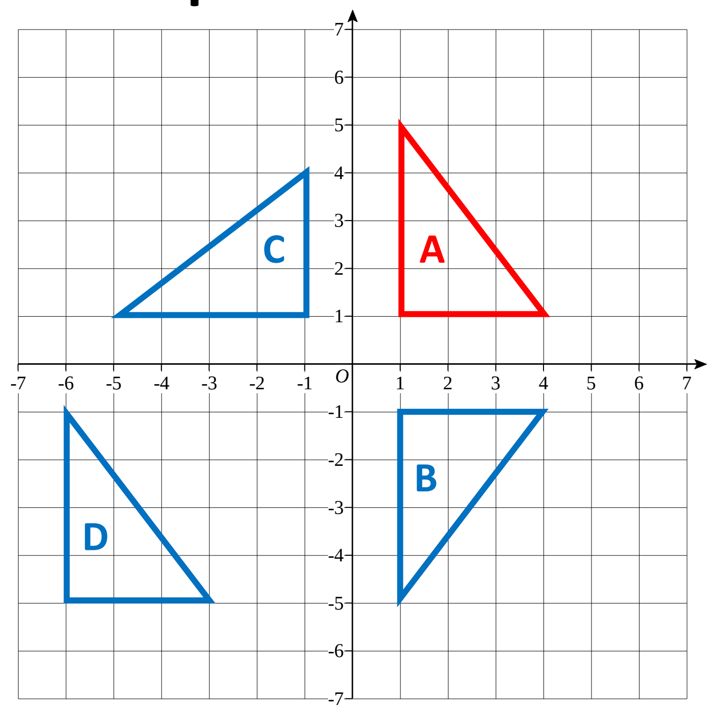
Co-ordinate: A pair of numbers which describe the position on a grid.
Transformation: This means the shape has ‘changed’.
Reflection: This means a shape has been flipped.
Rotation: This means a shape has been turned.
Translation: This means a *movement* of the shape.

Examples

a) Reflect A in the x-axis, label it B.

b) Rotate A 90°, anti-clockwise about (0,0), label it C.

c) Translate A in the vector $\begin{pmatrix}-7\\-6\end{pmatrix}$, label it D.



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Clip Numbers

199, 205, 637-657

Tip

- Use **tracing paper** to avoid mistakes.
- When describing transformations, look at how many marks are available and see if you have put enough to get the marks.

Questions

Draw a grid like the one above.
Plot a triangle with vertices (6,2), (3, 2) and (4, 5).
a) Reflect the triangle in the y-axis. b) Translate the triangle $\begin{pmatrix}-3\\-4\end{pmatrix}$

ANSWERS: a) (-6,2), (-3,2) and (-4,5) b) (1,1), (0,-2) and (3,-2)

REFLECTION, ROTATION AND TRANSLATION

Key Concepts

A **reflection** creates a mirror image of a shape on a coordinate graph. The mirror line is given by an equation eg. $y = 2, x = 2, y = x$. The shape does not change in size.

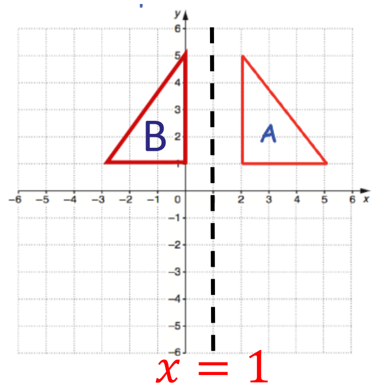
A **rotation** turns a shape on a coordinate grid from a given point. The shape does not change size but does change orientation.

A **translation** moves a shape on a coordinate grid. Vectors are used to instruct the movement:

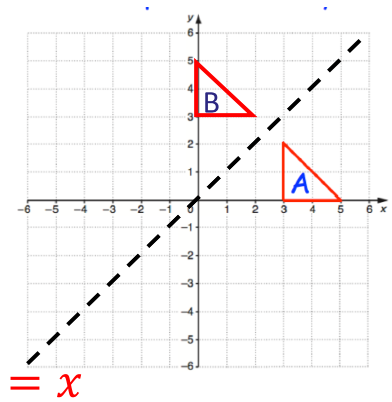
$\begin{pmatrix} x \\ y \end{pmatrix}$ — x: Positive-Right, Negative - Left; y: Positive-Up, Negative - Down

Examples

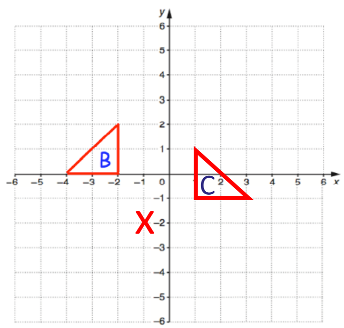
Reflect shape A in the line $x = 1$. Label it B.



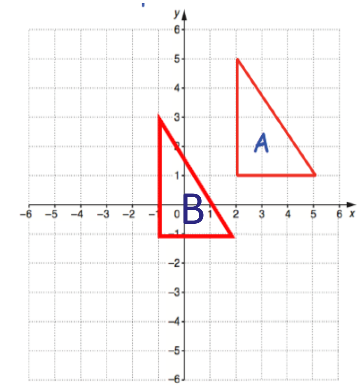
Reflect shape A in the line $y = x$. Label it B.



Rotate shape B from the point (-1, -2)



Translate shape A by $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$. Label it B



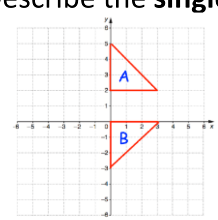
hegartymaths

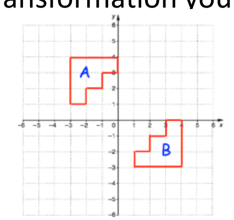
637-641, 652, 653,654,648-650

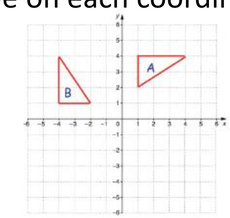
Key Words

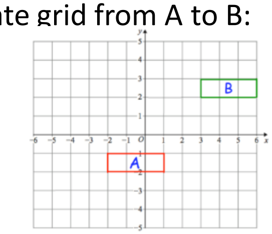
Rotate
Clockwise
Anticlockwise
Centre
Degrees
Reflect
Mirror image
Translate
Vector

Describe the **single** transformation you see on each coordinate grid from A to B:









ANSWERS: a) reflection, $y = 1$ b) reflection $y = x$ c) rotation, centre (0,0), 90° anticlockwise d) translation $\begin{pmatrix} 5 \\ 4 \end{pmatrix}$

ENLARGEMENT

Key Concepts

An **enlargement** changes the size of an image using a scale factor from a given point.

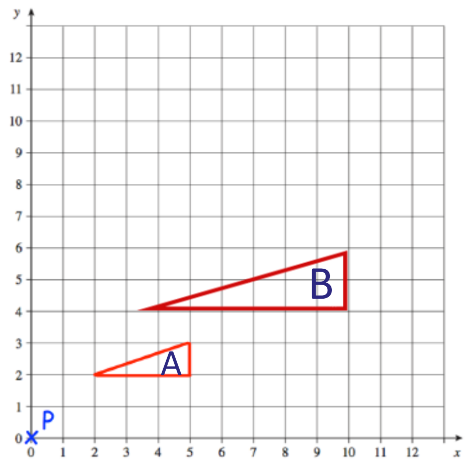
A **positive scale factor** will increase the size of an image.

A **fractional scale factor** will reduce the size of an image.

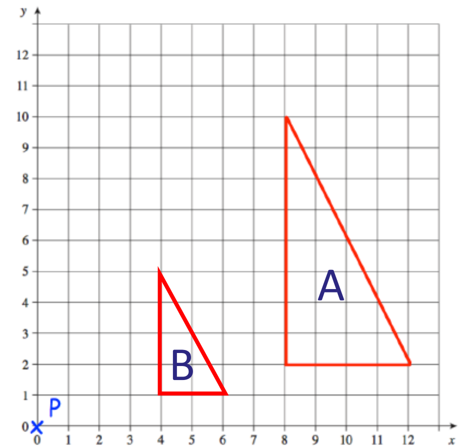
A **negative scale factor** will place the image on the opposite side of the centre of enlargement, with the image inverted.

Examples

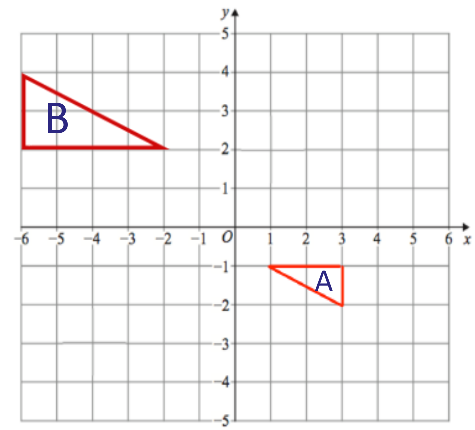
Enlarge shape A by scale factor 2 from point P.



Enlarge by scale factor $\frac{1}{2}$ from point P.



Enlarge by scale factor -2 from (0,0).



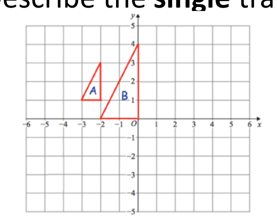
hegartymaths

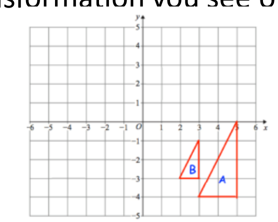
637,638,650, 642-645, 651

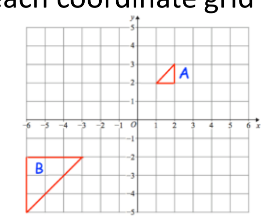
Key Words

Enlargement
Scale factor
Centre
Positive
Negative

Describe the **single** transformation you see on each coordinate grid from A to B:





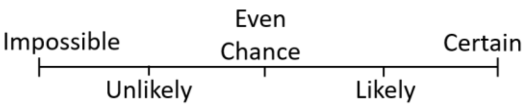


ANSWERS: a) enlarge, centre (-4,2) scale factor 2 b) enlarge, centre (1,-2) scale factor $\frac{1}{2}$
c) enlarge, centre (0,1) scale factor -3

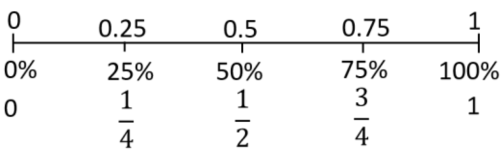
REVIEW OF PROBABILITY

Key Concept

Chance



Probability

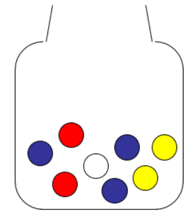


Probabilities can be written as:
- Fractions
- Decimals
- Percentages

Key Words

Probability: The chance of something happening as a numerical value.
Impossible: The outcome cannot happen.
Certain: The outcome will definitely happen.
Even chance: The are two different outcomes each with the same chance of happening.
Expectation: The amount of times you expect an outcome to happen based on probability.

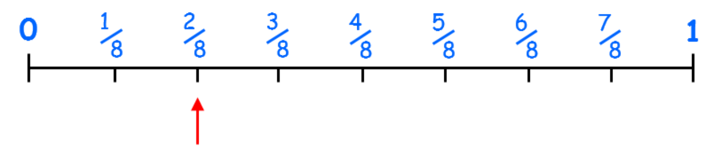
Examples



1) What is the probability that a bead chosen will be **yellow**.
Show the answer on a number line.

$$Probability = \frac{Number\ of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

$$P(Yellow) = \frac{2}{8} = \frac{1}{4}$$



2) How many **yellow** beads would you **expect** if you pulled a bead out and replaced it 40 times?

$$\frac{1}{4} \times 40 = \frac{1}{4} of 40 = 10$$

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Clip Numbers
349 - 359

Tip
Probabilities always add up to 1.

Formula

$$Expectation = Probability \times no. of\ trials$$

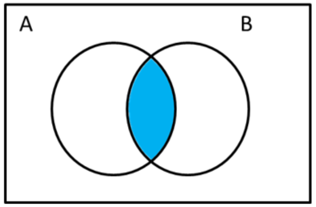
Questions

In a bag of skittles there are 12 red, 9 yellow, 6 blue and 3 purple left.
Find: a) P(Red) b) P(Yellow) c) P(Red or purple) d) P(Green)

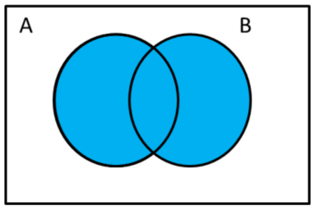
ANSWERS: 1) a) $\frac{12}{30} = \frac{2}{5}$ b) $\frac{9}{30} = \frac{3}{10}$ c) $\frac{15}{30} = \frac{1}{2}$ d) 0

FURTHER PROBABILITY

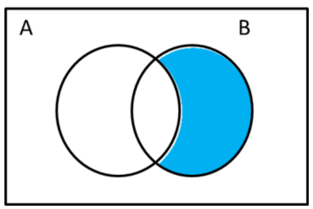
Key Concept



P(A ∩ B)



P(A ∪ B)



P(A′ ∩ B)

hegartymaths

359,360, 374-388, 422-424

Key Words

Probability: The chance of something happening as a numerical value.

Impossible: The outcome cannot happen.

Certain: The outcome will definitely happen.

Even chance: The are two different outcomes each with the same chance of happening.

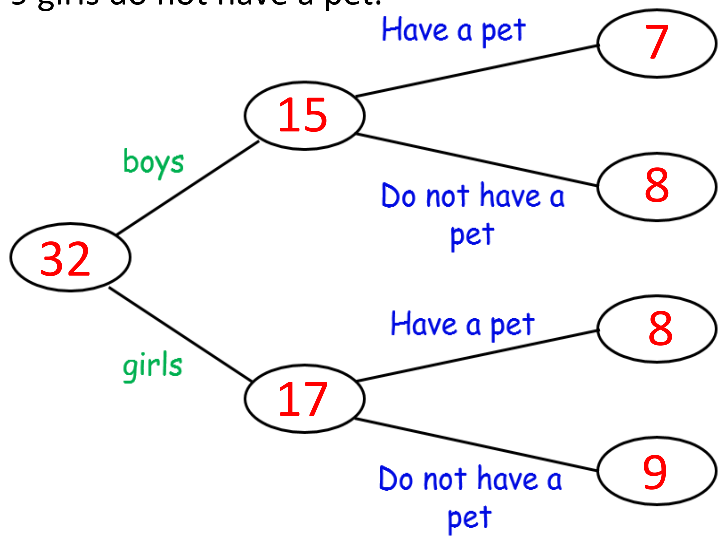
Mutually Exclusive: Two events that cannot both occur at the same time.

Formula

$$P(A \cap B) = P(A) \times P(B)$$
$$P(A \cup B) = P(A) + P(B)$$
$$or \quad (non\ ME) \quad P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

Examples

In Hannah's class there are 32 students.
15 of these students are boys.
7 of the boys have a pet.
9 girls do not have a pet.



$$P(boy) = \frac{15}{32}$$

$$P(Girl\ with\ pet) = \frac{8}{32}$$

Questions

1) Draw a two-way table for the question above.
2) Find the probability that a pupil chosen is a boy with no pets.
3) A girl is chosen, what is the probability she has a pet?

ANSWERS: 2) $\frac{8}{32}$ 3) $\frac{8}{17}$

Half term 6

TWO WAY TABLES

Key Concept

A **two way table** is used to represent categorised data.

Examples

This **two way table** gives information on how 100 students travelled to school.

	Walk	Car	Other	Total
Boy	15	25	14	54
Girl	22	8	16	46
Total	37	33	30	100

Always double check that your rows and columns add up to the total value.

hegartymaths

422-424

Key Words

Two way table

Compare

Complete a two way table using this information:
Felicity asked 100 students how they came to school one day. Each student walked or came by bicycle or came by car.
49 of the 100 students are girls.
10 of the girls came by car.
16 boys walked.
21 of the 41 students who came by bicycle are boys.
Work out the total number of students who walked to school.

PIE CHARTS AND SCATTER-GRAPHS

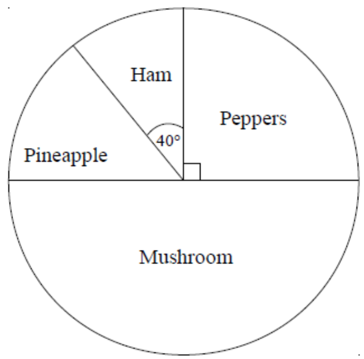
Key Concepts

Pie charts use angles to represent proportionally the quantity of each group involved.

Pie charts can only be compared to one another when populations are given.

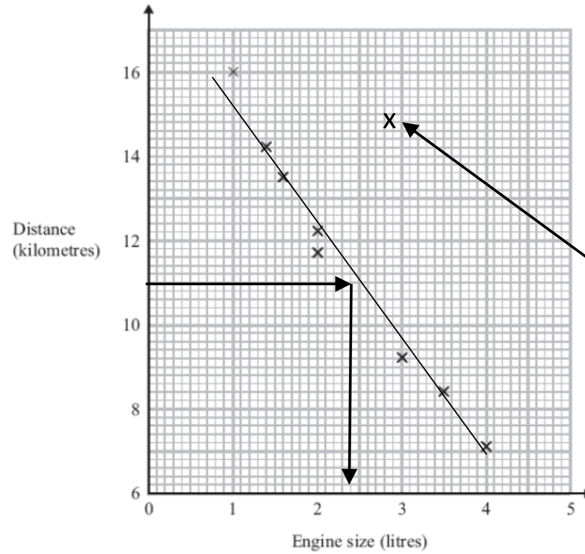
Scatter-graphs show the relationship between two variables. This relationship is called the **correlation**.

Examples



Topping	Frequency	Angle of Sector
Peppers	18	90°
Mushroom	36	180°
Pineapple	10	50°
Ham	8	40°
	72	360°

$$\frac{360}{72} = 5 \quad \times 5$$



A scatter-graph is drawn to show the relationship between the engine size of a car and how far it can travel.

This graph shows negative correlation.

This is an outlier.

We draw a line of best fit through the middle of the data points to read from to estimate readings. For example, estimating the engine size of a car that can travel 11km would be 2.5 litres.

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427-429, 453,454

Key Words

Pie chart

Scatter-graph

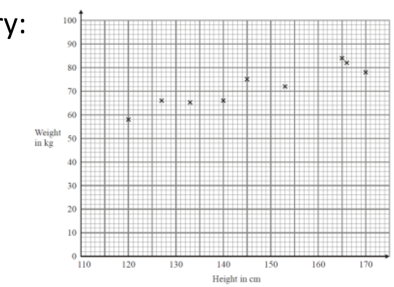
Correlation

Outlier

Variable

1) Calculate the angle for each category:

Region	Frequency
Southern England	9
London	23
Midlands	16
Northern England	12
Total	60



2a) What type of correlation is shown?
b) Using a line of best fit estimate the weight when the height is 135cm.

ANSWERS: 1) 54, 138, 96, 72 2) a) positive b) 64kg-66kg

AVERAGES FROM A TABLE

Key Concepts

Modal class (mode)
Group with the highest frequency.

Median group
The median lies in the group which holds the $\frac{total\ frequency+1}{2}$ position. Once identified, use the cumulative frequency to identify which group the median belongs from the table.

Estimate the mean
For grouped data, the mean can only be an estimate as we do not know the exact values in each group. To estimate, we use the midpoints of each group and to calculate the mean we find $\frac{total\ fx}{total\ f}$.

Examples

Length (L cm)	Frequency (f)	Midpoint (x)	fx
$0 < L \leq 10$	10	5	$10 \times 5 = 50$
$10 < L \leq 20$	15	15	$15 \times 15 = 225$
$20 < L \leq 30$	23	25	$23 \times 25 = 575$
$30 < L \leq 40$	7	35	$7 \times 35 = 245$
Total	55		1095

a) Estimate the mean of this data.
step 1: calculate the total frequency
step 2: find the midpoint of each group
step 3: calculate $f \times x$
step 4: calculate the mean shown below

$$\frac{Total\ fx}{Total\ f} = \frac{1095}{55} = 19.9\text{cm}$$

b) Identify the modal class from this data set. ***" the group that has the highest frequency "***
Modal class is $20 < x \leq 30$

c) Identify the group in which the median would lie. Median $= \frac{Total\ frequency+1}{2} = \frac{56}{2} = 28th\ value$

" add the frequency column until you reach the 28th value " Median is the in group $20 < x \leq 30$

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414-418

Key Words
Midpoint
Mean
Median
Modal

Cost (£C)	Frequency	Midpoint	
$0 < C \leq 4$	2		
$4 < C \leq 8$	3		
$8 < C \leq 12$	5		
$12 < C \leq 16$	12		
$16 < C \leq 20$	3		

From the data:
a) Identify the modal class.
b) Identify the group which holds the median.
c) Estimate the mean.

ANSWERS: a) $12 < C \leq 16$ b) $\frac{25+1}{2} = 13^{th}$ value is in the group $12 < C \leq 16$ c) $\frac{294}{25} = £11.76$