

Maths Knowledge Organisers (Set 3 – F)

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

3.52 **7** → 3.53

c) 1 significant figure

3 **5** 2 7 → 4

 **Sparx Learning**

U947, U435,
U298, U731, U965

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

Maths Knowledge Organisers (Set 3 – F)

DECIMALS

Key concepts

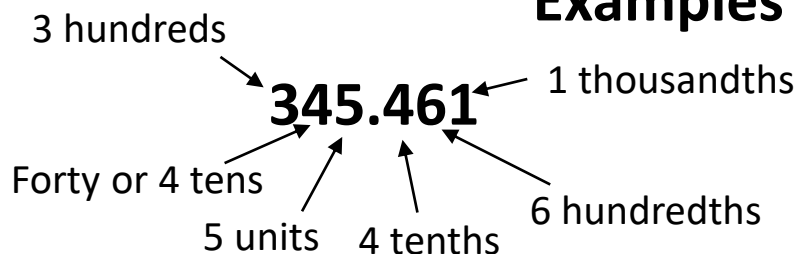
Place value:

Th H T U . t h th

When adding and subtracting decimals we must ensure the decimal places are underneath each other when setting up.

When multiplying decimals, calculate without the decimal point and use estimation to help replace it.

Examples



$$42.8 + 5.32$$

$$\begin{array}{r} 42.80 \\ + 5.32 \\ \hline 48.12 \end{array}$$

$$42.8 - 5.32$$

$$\begin{array}{r} 42.80 \\ - 5.32 \\ \hline 37.48 \end{array}$$

$$42.8 \times 5.3$$

	4	2	.	8	
2	2	0	1	0	4
2	1	2	0	6	2
	6	•	8	4	

$$226.84$$

Estimated answer $40 \times 5 = 200$

 Sparx Learning

U478, U293,
U868,



Key Words

Decimal
Tenths
Hundredths
Thousandths

A) What is the value of the 4 in each number?

1) 498 2) 8746 3) 6.243 4) 1.004

B) Work out:

1) $3.1 + 5.27$ 2) $16.4 - 9.18$ 3) 0.03×500 4) 3.4×5.6
5) 4.79×6.8

ANSWERS: A 1) 4 hundred 2) forty 3) 4 hundredths 4) 4 thousandths
B 1) 8.37 2) 7.22 3) 15 4) 19.04 5) 32.572

Maths Knowledge Organisers (Set 3 – F)

INDICES AND ROOTS

Key Concepts

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

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

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

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

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

Examples

Simplify each of the following:

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

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

$$3) (a^6)^4 = a^{6 \times 4} \\ = a^{24}$$

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

$$5) \frac{5^2 \times 5^6}{5^4} = \frac{5^8}{5^4} \\ = 5^{8-4}$$

$$= 5^4$$

$$6) a^{\frac{1}{2}} = \sqrt{a}$$

$$7) 9^{\frac{1}{2}} = \sqrt{9} \\ = 3 \text{ or } -3$$

$$8) 2^{-3} = \frac{1}{2^3} = \frac{1}{8}$$

 **Sparx Learning**

**U851, U235,
U694, U985**

Key Words

Powers
Roots
Indices
Reciprocal

Simplify:

$$1) a^3 \times a^2 \quad 2) b^4 \times b \quad 3) d^{-5} \times d^{-1} \quad 4) m^6 \div m^2 \quad 5) n^4 \div n^4$$

$$6) \frac{8^4 \times 8^5}{8^6} \quad 7) \frac{4^9 \times 4}{4^3} \quad 8) (3^2)^5 \quad 9) 81^{\frac{1}{2}} \quad 10) 5^{-2}$$

Maths Knowledge Organisers (Set 3 – F)

FACTORS, MULTIPLES AND PRIMES

Key Concepts

Prime factor decomposition

Breaking down a number into its prime factors

Highest common factor

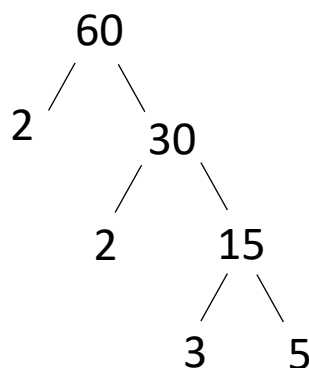
Finding the largest number which divides into all numbers given

Lowest common multiple

Finding the smallest number which both numbers divide into

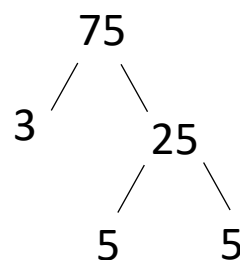
Examples

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



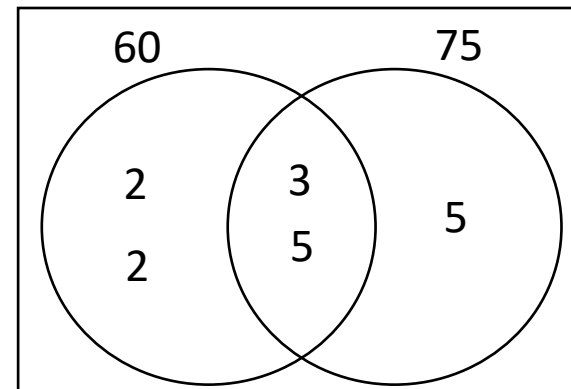
$$2 \times 2 \times 3 \times 5$$

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



$$3 \times 5 \times 5$$

$$3 \times 5^2$$



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

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

 Sparx Learning

U739, U250

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

Maths Knowledge Organisers (Set 3 – F)

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) $5(y + 6) \equiv 6y + 30$ 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 $c = 3$
 $A = 2^2 + 3$
 $A = 4 + 3$
 $A = 7$

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 $e = 2$

 Sparx Learning

U613, U585, U144

Key Words

Substitute
Equation
Formula
Identity
Expression

Maths Knowledge Organisers (Set 3 – F)

ALGEBRAIC EXPRESSIONS

Key Concepts

When collecting like terms involving addition or subtraction, add/subtract the numbers in front of the letters.

If the like terms are multiplied, multiply the numbers in front of the letters and put the letters next to each other.

If the like terms are divided, divide the numbers in front of the letters.

Examples

Simplify the following expressions:

$$1) \quad 4p + 6t + p - 2t = 5p + 4t$$

$$2) \quad 3 + 2t + p - t + 2 = 5 + t + p$$

$$3) \quad f + 3g - 4f = 3g - 3f$$

$$4) \quad f^2 + 4f^2 - 2f^2 = 3f^2$$

$$5) \quad 6a \times 3b \times 2c = 36abc$$

$$6) \quad \frac{9b}{3} = 3b$$

Questions

Simplify:

$$1) \quad 7p + 3q + p - 3q$$

$$3) \quad m - 8g - 5m$$

$$5) \quad 2a \times 5b \times 4c$$

$$7) \quad \frac{36p}{12}$$

$$2) \quad 5 + 4t + 3p - 2t + 7$$

$$4) \quad b^2 - 7b^2 + 2b^2$$

$$6) \quad 8m \times 3n \times 2m$$

$$8) \quad \frac{6t}{18}$$

 Sparx Learning

U105, U103

Key Words

Simplify

Term

Collect

Maths Knowledge Organisers (Set 3 – F)

EXPAND AND SIMPLIFY BRACKETS

Key Concepts

Expanding brackets

Multiply the number outside the brackets with EVERY term inside the brackets

Factoring expressions

Take the highest common factor outside the bracket.

Examples

Expand and simplify where appropriate

$$1) \quad 7(3 + a) = 21 + 7a$$

$$2) \quad 2(5 + a) + 3(2 + a) = 10 + 2a + 6 + 3a \\ = 5a + 16$$

$$3) \text{ Factorise } 9x + 18 = 9(x + 2)$$

$$4) \text{ Factorise } 6e^2 - 3e = 3e(2e - 1)$$

 Sparx Learning

U179, U365

Key Words

Expand
Factorise
Simplify

Questions

1) Expand and simplify

$$(a) 3(2 - 7f) \quad (b) 5(m - 2) + 6 \quad (c) 3(4 + t) + 2(5 + t)$$

2) Factorise

$$(a) 6m + 12t \quad (b) 9t - 3p \quad (c) 4d^2 - 2d$$

ANSWERS: 1) (a) $6 - 21f$ (b) $5m - 4$ (c) $22 + 5t$ 2) (a) $6(m + 2t)$ (b) $3(3t - p)$ (c) $2d(2d - 1)$

Maths Knowledge Organisers (Set 3 – F)

PROPERTIES OF SHAPES

Key Concepts

Lines of symmetry

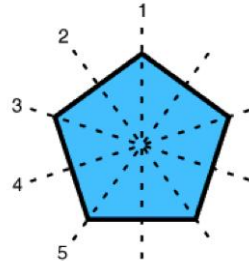
The number of lines that cut an image in half such that each half of the figure is the mirror image of the other half.

Order of rotation

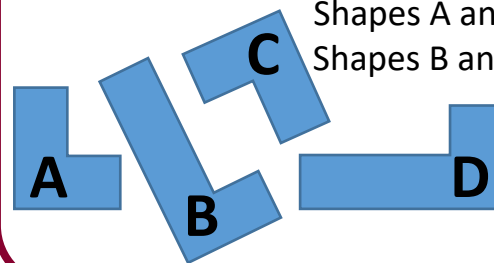
The number of times a figure fits into itself in one complete rotation of 360 degrees.

Congruent shapes

Images that are identical to one another. They can be flipped or rotated, not enlarged.

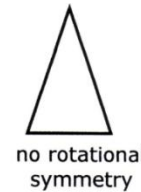


This regular polygon has 5 lines of symmetry

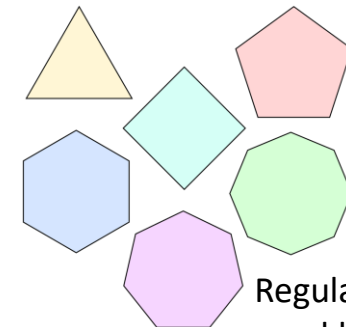
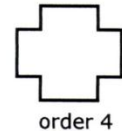
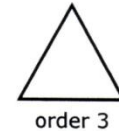
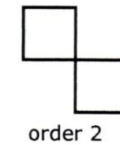


Shapes A and C are congruent.
Shapes B and D are congruent.

Examples



Order of rotation



Regular shapes have equal lengths of sides and equal angles.

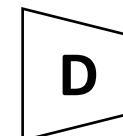
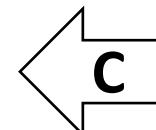
 Sparx Learning

U121, U849

Key Words

Rotation
Symmetry
Congruent
Regular
Irregular

- 1) How many lines of symmetry does shape B have?
- 2) What is the order of rotation of shape E?
- 3) Which shape is congruent to shape A?
- 4) Which shape is regular?



Questions

Maths Knowledge Organisers (Set 3 – F)

TYPES OF ANGLE AND ANGLES IN POLYGONS

Key Concepts

Regular polygons have equal lengths of sides and equal angles.

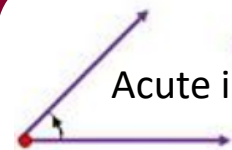
Angles in polygons

Sum of interior angles
 $= (\text{number of sides} - 2) \times 180$

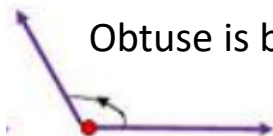
Exterior angles of **regular** polygons = $\frac{360}{\text{number of sides}}$

Types of angle

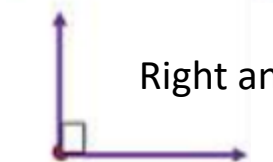
There are four types which need to be identified – acute, obtuse, reflex and right angled.



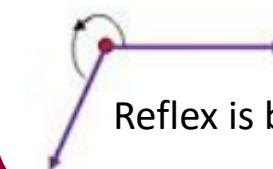
Acute is less than 90°



Obtuse is between 90° and 180°



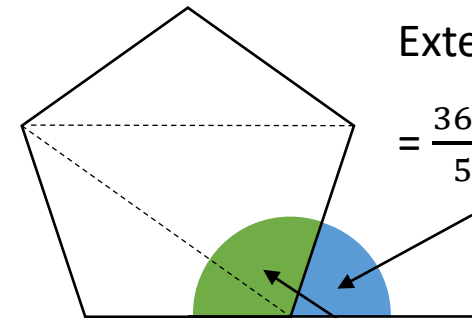
Right angled is 90°



Reflex is between 180° and 360°

Examples

Regular Pentagon



Exterior angles

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

$$\begin{aligned} \text{Sum of interior angles} &= (5 - 2) \times 180 \\ &= 540^\circ \end{aligned}$$

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

 **Sparx Learning**
U447,
U732, U427

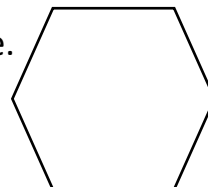
 **DELTA**
 Academies Trust

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.



Maths Knowledge Organisers (Set 3 – F)

ANGLE FACTS INCLUDING ON PARALLEL LINES

Key Concepts

Angles in a **triangle equal 180°**.

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

Vertically opposite angles are equal in size.

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

Base angles in an isosceles triangle are equal.

Alternate angles are equal in size.

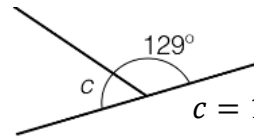
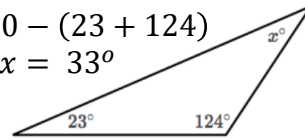
Corresponding angles are equal in size.

Allied/co-interior angles are equal 180°.

Examples

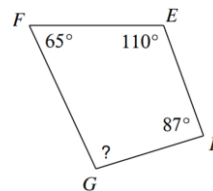
$$x = 180 - (23 + 124)$$

$$x = 33^\circ$$



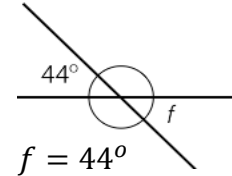
$$c = 180 - 129$$

$$c = 51^\circ$$

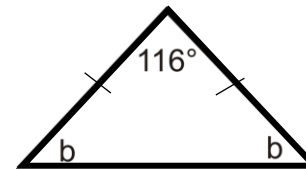


$$? = 360 - (65 + 110 + 87)$$

$$? = 98^\circ$$



$$f = 44^\circ$$



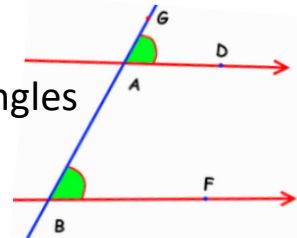
$$b = (180 - 116) \div 2$$

$$b = 32^\circ$$



Alternate angles are equal

Corresponding angles are equal



Allied/co-interior angles equal 180°

 **Sparx Learning**

**U390, U730, U826,
U628**

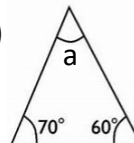
Key Words

Angle
Vertically opposite
Straight line
Alternate
Corresponding
Allied
Co-interior

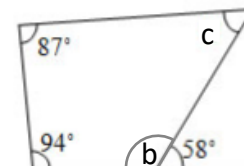
Questions

Calculate the missing angle:

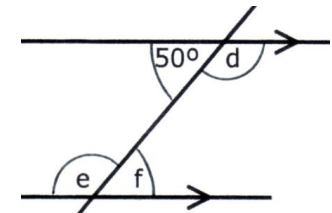
a)



b)



c)



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

Maths Knowledge Organisers (Set 3 – F)

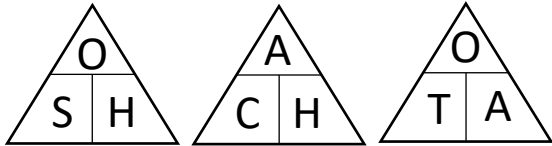
PYTHAGORAS AND TRIGONOMETRY

Key Concepts

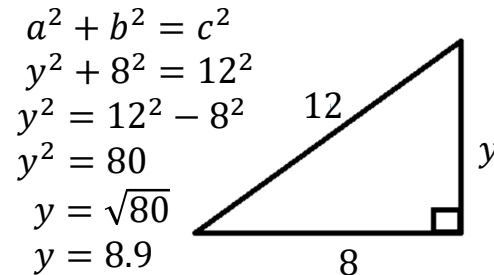
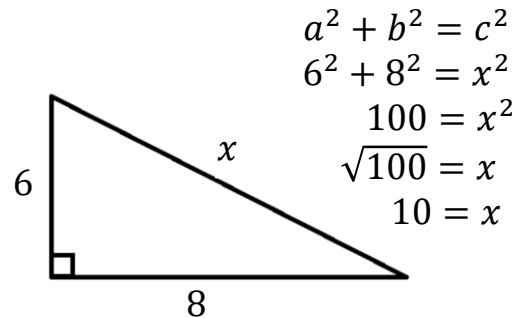
Pythagoras' theorem and basic trigonometry both only work with **right angled triangles**.

Pythagoras' Theorem – used to find a missing length when two sides are known
 $a^2 + b^2 = c^2$
 c is always the hypotenuse (longest side)

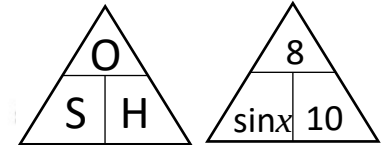
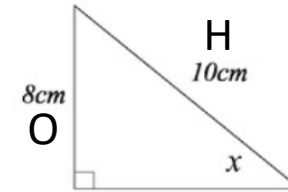
Basic trigonometry SOHCAHTOA –
 used to find a missing side or an angle



Pythagoras' Theorem

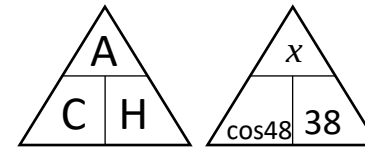


Examples



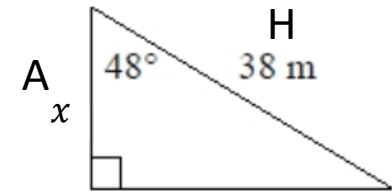
$$\sin x = \frac{8}{10}$$

$$x = \sin^{-1}\left(\frac{8}{10}\right) = 53.1^\circ$$



$$\cos 48 = \frac{x}{38}$$

$$x = 38 \times \cos 48 = 25.4m$$



 Sparx Learning

U385, U605, U283,
U545

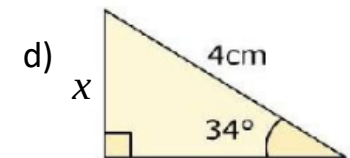
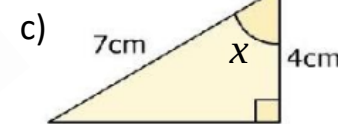
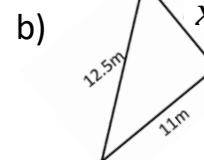
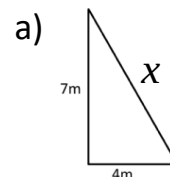
 DELTA
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Key Words

Right angled triangle
 Hypotenuse
 Opposite
 Adjacent
 Sine
 Cosine
 Tangent

Questions

Find the value of x.



ANSWERS: a) 8.06m b) 5.94m c) 55.15° d) 2.34cm

Maths Knowledge Organisers (Set 3 – F)

FRACTIONS, DECIMALS AND PERCENTAGES

Key Concepts

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

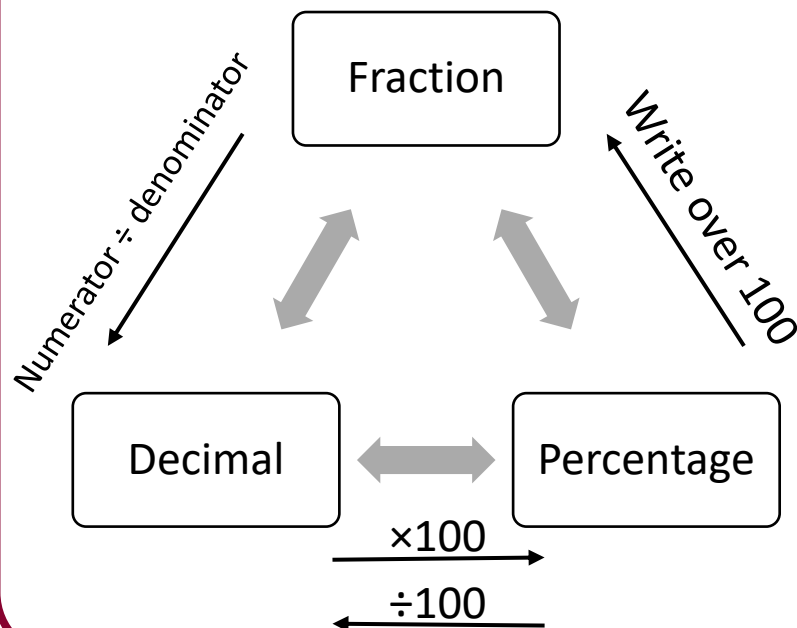
A **decimal** is a number written using a system of counting based on the number 10.

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
$\times 20 \downarrow$	$\downarrow$	$\times 100 \downarrow$	$\times 10 \downarrow$	$\times 100 \downarrow$
$\frac{60}{100}$			$\frac{70}{100}$	
$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$	$\downarrow$
60%	62%	67%	70%	66.5%
$\frac{3}{5}$	62%	0.665	0.67	$\frac{7}{10}$

 **Sparx Learning**
U888, U550

Key Words

Fraction
Decimal
Percentage
Division
Multiply

- Convert the following into percentages:
a) 0.4 b) 0.08 c) $\frac{6}{20}$ d) $\frac{3}{25}$
- 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% $\frac{4}{5}$

Maths Knowledge Organisers (Set 3 – F)

FRACTIONS

Key Concepts

$$\frac{x}{y} \rightarrow \begin{array}{l} \text{Numerator} \\ \text{Denominator} \end{array}$$

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:

$$65 \div 5 = 13$$

$$13 \times 4 = 52$$

Divide by the denominator

Multiply this by the numerator

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

$$52 \div 4 = 13$$

$$13 \times 5 = 65$$

Divide by the numerator

Multiply this by the denominator

Order these fractions in ascending order:

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

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

 **Sparx Learning**
U646, U746

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: $\frac{2}{3}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{7}{12}$

Maths Knowledge Organisers (Set 3 – F)

4 OPERATIONS WITH FRACTIONS

Key Concepts

An **improper fraction** is when the numerator is larger than the denominator e.g. $\frac{20}{12}$

Converting from a mixed number into an improper fraction:

$$2 \frac{3}{5} = \frac{(2 \times 5) + 3}{5} = \frac{13}{5}$$

A **reciprocal** is the value that when multiplied by another gives the answer of 1.

Eg. $\frac{1}{8}$ is the reciprocal of 8.
 $\frac{2}{5}$ is the reciprocal of $\frac{5}{2}$

$$1 \frac{2}{3} + 2 \frac{1}{4}$$

$$= \frac{5}{3} + \frac{9}{4} \quad \text{Convert into an improper fraction}$$

$$= \frac{20}{12} + \frac{27}{12} \quad \text{Find a common denominator}$$

$$= \frac{47}{12}$$

$$= 3 \frac{11}{12} \quad \text{Convert back into a mixed number}$$

$$2 \frac{2}{3} - 1 \frac{1}{4}$$

$$= \frac{8}{3} - \frac{5}{4}$$

$$= \frac{32}{12} - \frac{15}{12}$$

$$= \frac{17}{12}$$

$$= 1 \frac{5}{12}$$

$$1 \frac{1}{3} \times 2 \frac{3}{4}$$

$$= \frac{4}{3} \times \frac{11}{4}$$

$$= \frac{44}{12}$$

$$= 3 \frac{8}{12}$$

$$2 \frac{1}{3} \div 1 \frac{3}{5}$$

$$= \frac{7}{3} \div \frac{8}{5} \quad \text{Find the reciprocal of the second fraction....}$$

$$= \frac{7}{3} \times \frac{5}{8} \quad \text{...and multiply}$$

$$= \frac{35}{24}$$

$$= 1 \frac{11}{24}$$

Examples

 **Sparx Learning**

U736, U793, U475,
U224, U544, U538

Key Words

Fraction
Equivalent
Reciprocal
Numerator
Denominator
Improper/Top heavy
Mixed number

Calculate:

1) $1 \frac{2}{3} + 2 \frac{3}{4}$

2) $3 \frac{3}{4} - 1 \frac{1}{3}$

3) $3 \frac{1}{5} \times 1 \frac{2}{3}$

4) $1 \frac{3}{5} \div 2 \frac{7}{10}$

What is the reciprocal of:

5) $\frac{2}{3}$ 7) 0.75

6) 9

ANSWERS A 1) $4 \frac{17}{12}$ 2) $2 \frac{12}{5}$ 3) $5 \frac{1}{3}$ 4) $\frac{16}{27}$ 5) $\frac{3}{2}$ 6) $\frac{1}{9}$ 7) $\frac{4}{7}$

Maths Knowledge Organisers (Set 3 – F)

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 $\times$ percentage
as a decimal

Calculating percentage increase/decrease:

Amount $\times (1 \pm \text{percentage as a decimal})$

Calculating a percentage – non calculator:

Calculate 32% of 500g:

$$\begin{aligned} 10\% &\rightarrow 500 \div 10 = 50 \\ 30\% &\rightarrow 50 \times 3 = 150 \\ 1\% &\rightarrow 500 \div 100 = 5 \\ 2\% &\rightarrow 5 \times 2 = 10 \end{aligned} \quad \begin{aligned} 32\% &= 150 + 10 \\ &= 160\text{g} \end{aligned}$$

Calculating a percentage – calculator:

Calculate 32% of 500g:

$$\begin{aligned} \text{Value} &\times (\text{percentage} \div 100) \\ &= 500 \times 0.32 \\ &= 160\text{g} \end{aligned}$$

Percentage change:

Examples

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

$$\begin{aligned} \text{Value} &\times (1 - \text{percentage as a decimal}) \\ &= 80 \times (1 - 0.35) \\ &= £52 \end{aligned}$$

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

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

 **Sparx Learning**

U554, U349,
U773, U671

Key Words

Percent
Increase/decrease
Appreciate
Depreciate
Multiplier
Divide

- 1) Write the following as a decimal multiplier: a) 45% b) 3% c) 2.7%
- 2) Calculate 43% of 600 without using a calculator
- 3) Calculate 72% of 450 using a calculator
- 4a) Decrease £500 by 6%
b) Increase 65g by 24%
c) Increase 70m by 8.5%

ANSWERS 1a) 0.45 b) 0.03 c) 0.027 2) 258 3) 324 4a) £470 b) 80.6g c) 75.95m

Maths Knowledge Organisers (Set 3 – F)

PERCENTAGES AND INTEREST

Key Concepts

Calculating percentages of an amount without a calculator:

10% = divide the value by 10

1% = divide the value by 100

Per annum is often used in monetary questions meaning **per year**.

Depreciation means that the value of something is going down or reducing.

Examples

Simple interest:

Joe invest £400 into a bank account that pays 3% **simple interest** per annum. Calculate how much money will be in the bank account after 4 years.

$$3\% = £4 \times 3 \\ = £12$$

$$4 \text{ years} = £12 \times 4$$

$$\text{Interest} = £48$$

$$\text{Total in bank account} = £400 + £48 \\ = £448$$

Compound interest:

Joe invest £400 into a bank account that pays 3% **compound interest** per annum. Calculate how much money will be in the bank account after 4 years.

$$\begin{aligned} \text{Value} \times (1 \pm \text{percentage as a decimal})^{\text{years}} \\ = 400 \times (1 + 0.03)^4 \\ = 400 \times (1.03)^4 \\ = £450.20 \end{aligned}$$

 **Sparx Learning**
U544,
U332, U988

Key Words

Percent
Depreciate
Interest
Annum
Simple
Compound
Multiplier

- 1) Calculate a) 32% of 48 b) 18% of 26
- 2) Kane invests £350 into a bank account that pays out simple interest of 6%. How much will be in the bank account after 3 years?
- 3) Jane invests £670 into a bank account that pays out 4% compound interest per annum. How much will be in the bank account after 2 years?

Maths Knowledge Organisers (Set 3 – F)

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:

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

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

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

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

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

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

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

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

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

 **Sparx Learning**
U851, U235,
U694

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) $27^{\frac{1}{3}}$

Maths Knowledge Organisers (Set 3 – F)

STANDARD FORM

Key Concepts

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

Must be $\times 10^b$
b is an integer

$$a \times 10^b$$

Must be $1 \leq a < 10$

Examples

Write the following in **standard form**:

1) $3000 = 3 \times 10^3$

2) $4580000 = 4.58 \times 10^6$

3) $0.0006 = 6 \times 10^{-4}$

4) $0.00845 = 8.45 \times 10^{-3}$

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

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

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

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

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

 **Sparx Learning**

U330, U534,
U264, U290

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 4) 1.6×10^{-2}

Maths Knowledge Organisers (Set 3 – F)

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 $c = 3$
 $A = 2^2 + 3$
 $A = 4 + 3$
 $A = 7$

 **Sparx Learning**
U613, U585, U144

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 $e = 2$

Maths Knowledge Organisers (Set 3 – F)

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.

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

Solve:

$$\begin{array}{l} 12 = 3x - 18 \\ +18 \qquad +18 \\ 30 = 3x \\ \div 3 \qquad \div 3 \\ x = 10 \end{array}$$

Solve:

$$\begin{array}{l} 5(x - 3) = 20 \\ \text{Expand} \\ 5x - 15 = 20 \\ +15 \qquad +15 \\ 5x = 35 \\ \div 5 \qquad \div 5 \\ x = 7 \end{array}$$

Solve:

$$\begin{array}{l} 7p - 5 = 3p + 3 \\ -3p \qquad -3p \\ 4p - 5 = 3 \\ +5 \qquad +5 \\ 4p = 8 \\ \div 2 \qquad \div 2 \\ p = 2 \end{array}$$

Examples

Rearrange to make r the subject of the formulae :

$$\begin{array}{l} Q = \frac{2r - 7}{3} \\ \times 3 \qquad \times 3 \\ 3Q = 2r - 7 \\ +7 \qquad +7 \\ 3Q + 7 = 2r \\ \div 2 \qquad \div 2 \\ \frac{3Q + 7}{2} = r \end{array}$$

 **Sparx Learning**
U755, U325, U870,
U556,

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) $x = \frac{2y - 4}{3}$

DELTA

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Maths Knowledge Organisers (Set 3 – F)

EQUATIONS IN CONTEXT

Key Concepts

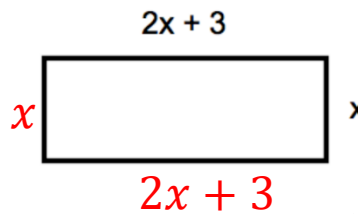
Algebra can be used to support us to find unknowns in a **contextual problem**.

We can always apply a letter to an unknown quantity, to then **set up an equation**.

It will often be used in area and perimeter problems and angle problems in geometry.

Solve to find the value of x when the perimeter is 42cm.

HINT: Write on all of the lengths of the sides.



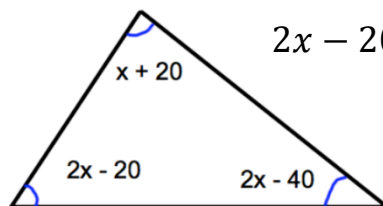
$$2x + 3 + 2x + 3 + x + x = 42$$

$$6x + 6 = 42$$

$$6x = 36$$

$$x = 6$$

We know the perimeter is 42cm



$$2x - 20 + x + 20 + 2x - 40 = 180$$

$$5x - 40 = 180$$

$$5x = 220$$

$$x = 44$$

Angles in a triangle sum to 180°

Examples

Jane is 4 years older than Tom.
David is twice as old as Jane.
The sum of their ages is 60.
Using algebra, find the age of each person.

$$\text{Tom} = x \longrightarrow 12$$

$$\text{Jane} = x + 4 \longrightarrow 12 + 4 = 16$$

$$\text{David} = 2x + 8 \longrightarrow (2 \times 12) + 8 = 32$$

$$x + x + 4 + 2x + 8 = 60$$

$$4x + 12 = 60$$

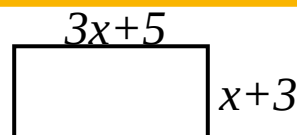
$$4x = 48$$

$$x = 12$$

 **Sparx Learning**
U599

Key Words

Solve
Term
Inverse
operation



1) If the perimeter is 40cm. What is the length of the longest side?

2) Jane is 12 years older than Jack.
Sarah is 3 years younger than Jack.
The sum of their ages is 36.
Using algebra, find the age of each person.

ANSWERS: 1) $x = 3$ therefore the longest length is 14cm 2) Jack = 9, Jane = 21, Sarah = 6

Maths Knowledge Organisers (Set 3 – F)

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

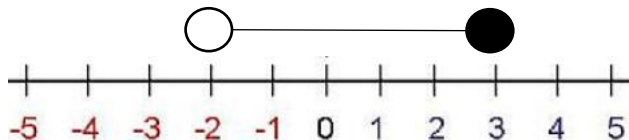
a) State the values of n that satisfy:

$$-2 < n \leq 3$$

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:

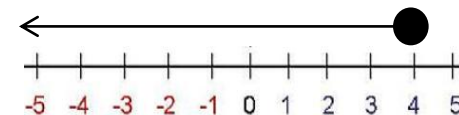
$$5x - 6 \leq 14$$

$$+6 \quad +6$$

$$5x \leq 20$$

$$\div 5 \quad \div 5$$

$$x \leq 4$$



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

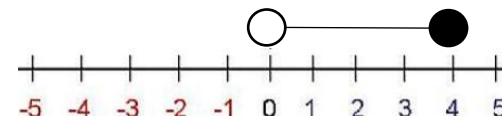
$$4 < 3x + 1 \leq 13$$

$$-1 \quad -1$$

$$3 < 3x \leq 12$$

$$\div 3 \quad \div 3$$

$$1 < x \leq 4$$



Sparx Learning
U509, U759, U738,
U145

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) $1 < x \leq 3$

Maths Knowledge Organisers (Set 3 – F)

SEQUENCES

Key Concepts

Arithmetic or linear sequences

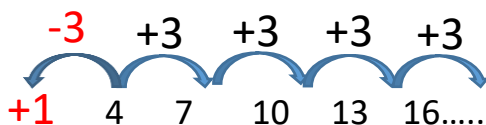
increase or decrease by a common amount each time.

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:



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?

$$3n + 1 = 100$$

$$3n = 99$$

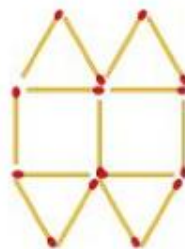
$$n = 33$$

Yes as 33 is an integer.

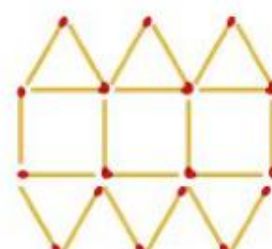
Pattern 1



Pattern 2



Pattern 3



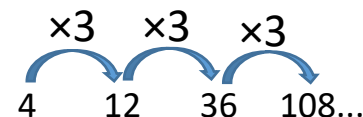
Hint: Firstly write down the number of matchsticks in each image:

$$7n + 1$$

Pattern 1	Pattern 2	Pattern 3
8	15	22

+1
-7 +7 +7

Geometric sequence e.g.



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: $3^2 + 4 = 13$

Examples

Linear sequences with a picture:

State the nth term.

Sparx Learning
 U498, U530, U958

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

Maths Knowledge Organisers (Set 3 – F)

DIVIDING AN AMOUNT INTO RATIOS

Key Concepts

An amount can be divided into a given ratio.

Red : Green
1 : 3

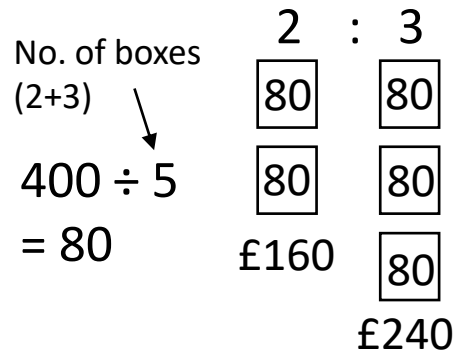
For every 1 red there are 3 greens.

A ratio can be converted into fractions.

Red : Green
1 : 3

$\frac{1}{4}$ are red and $\frac{3}{4}$ are green.

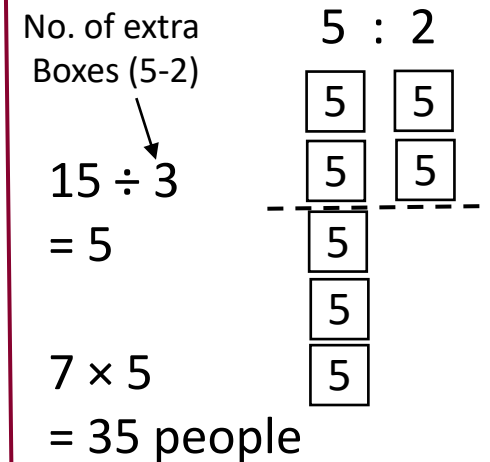
A woman has £400. She is going to split her money between her two children in the ratio 2:3. How much does each child receive?



Child 1 receives £160 and Child 2 receives £240.

There are boys and girls at a party in the ratio 5:2.

There are 15 more boys than girls. Calculate the number of people at the party.



Examples

 **Sparx Learning**

**U687, U176, U577,
U753**

 **DELTA**
Academies Trust

Key Words

Ratio
Divide
Parts

- 1) Ann made some cakes. She made vanilla cakes and chocolate cakes in the ratio 2:9. What fraction of the cakes were chocolate?
- 2) Share £25 in the ratio 7:3
- 3) Katy and Becky share some money in the ratio 2:1. Katy receives £10 more than Becky. How much do they each receive?
- 4) Claire and John share some money in the ratio 3:2. Claire receives £18. How much does John receive?

ANSWERS 1) $\frac{11}{9}$ 2) £17.50, £7.50 3) £20, £10 4) £12

Maths Knowledge Organisers (Set 3 – F)

RATIO AND DIRECT PROPORTION

Key Concepts

To calculate the **value** for a single item we can use the **unitary method**.

When working with best value in monetary terms we use:

$$\text{Price per unit} = \frac{\text{price}}{\text{quantity}}$$

In recipe terms we use:

$$\text{Weight per unit} = \frac{\text{weight}}{\text{quantity}}$$

If 20 apples weigh 600g. How much would 28 apples weigh?

$$600 \div 20 = 30\text{g} \rightarrow \text{weight of 1 apple}$$

$$30 \times 28 = \mathbf{840\text{g}}$$

Box A has 8 fish fingers costing £1.40.
Box B has 20 fish fingers costing £ 3.40.
Which box is the better value?



$$A = \frac{\pounds 1.40}{8} = \pounds 0.175$$

$$B = \frac{\pounds 3.40}{20} = \pounds 0.17$$

Therefore Box B is better value as each fish finger costs less.

Examples

The recipe shows the ingredients needed to make 10 Flapjacks.
How much of each will be needed to make 25 flapjacks?

Ingredients for 10 Flapjacks

80 g rolled oats

60 g butter

30 ml golden syrup

36 g light brown sugar

Method 1: Unitary

$$80 \div 10 = 8$$

$$8 \times 25 = \mathbf{200\text{g}}$$

$$60 \div 10 = 6$$

$$6 \times 25 = \mathbf{150\text{g}}$$

Method 2: 5 flapjacks

$$80 \div 2 = 40$$

$$40 \times 5 = \mathbf{200\text{g}}$$

$$60 \div 2 = 30$$

$$30 \times 5 = \mathbf{150\text{g}}$$

$$30 \div 10 = 3$$

$$3 \times 25 = \mathbf{75\text{g}}$$

$$36 \div 10 = 3.6$$

$$3.6 \times 25 = \mathbf{90\text{g}}$$

$$30 \div 2 = 15$$

$$15 \times 5 = \mathbf{75\text{g}}$$

$$36 \div 2 = 18$$

$$18 \times 5 = \mathbf{90\text{g}}$$

 **Sparx Learning**
U753,
U921, U676

Key Words

Unitary
Best Value
Proportion
Quantity

Ingredients to make 16 gingerbread men

180 g flour
40 g ginger
110 g butter
30 g sugar

1) How much will we need to make 24 gingerbread men?

2) Packet A has 10 toilet rolls costing £3.50.
Packet B has 12 toilet rolls costing £3.60.
Which is better value for money?

3) If 15 oranges weigh 300g. What will 25 oranges weigh?

Maths Knowledge Organisers (Set 3 – F)

DIRECT AND INVERSE PROPORTION

Key Concepts

Variables are **directly proportional** when the **ratio is constant** between the quantities.

Variables are **inversely proportional** when **one quantity increases in proportion to the other decreasing**.

Examples

Direct proportion:

Value of A	32	P	56	20	72
Value of B	20	30	35	R	45

Ratio constant: $20 \div 32 = \frac{5}{8}$

From A to B we will multiply by $\frac{5}{8}$.

From B to A we will divide by $\frac{5}{8}$.

$$P = 30 \div \frac{5}{8} = 48$$

$$R = 20 \times \frac{5}{8} = 12.5$$

Inverse proportion:

Value of A	10	20	14	R	28
Value of B	14	P	10	70	5

$$P = 7$$

$$R = 2$$

 **Sparx Learning**
U721, U610,
U256

Key Words

Direct
Inverse
Proportion
Divide
Multiply
Constant

Complete each table:

1) Direct proportion

Value of A	5	P	22
Value of B	9	28.8	Q

2) Inverse proportion

Value of A	4	P	18
Value of B	9	3	Q

Maths Knowledge Organisers (Set 3 – F)

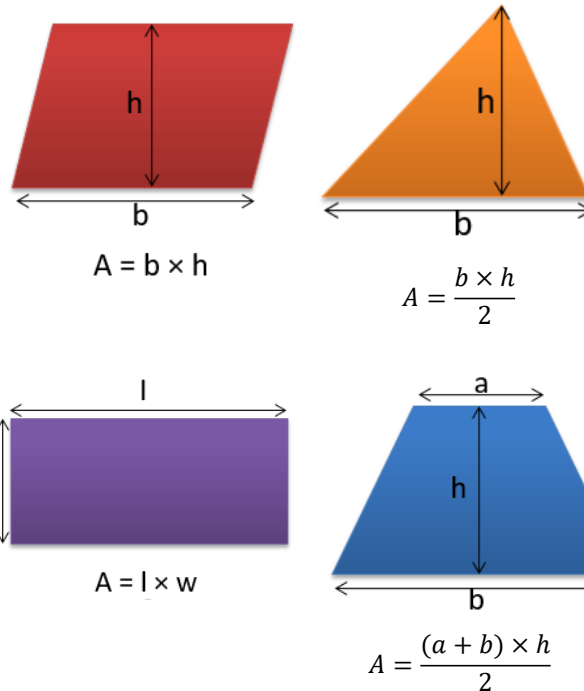
AREA AND PERIMETER OF BASIC SHAPES

Key Concepts

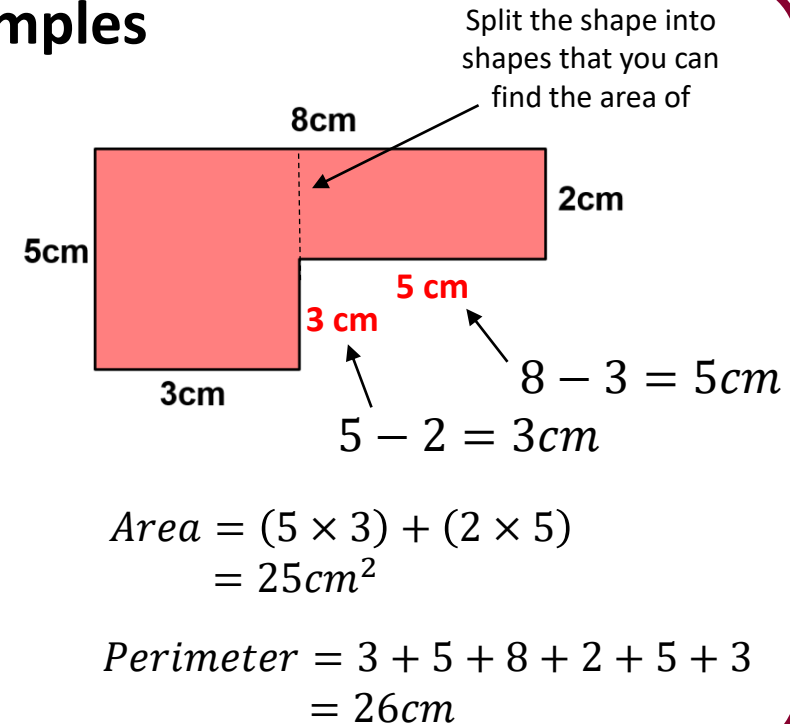
The **area** of a 2D shape is the space inside it. It is measured in units squared e.g. cm^2

The **perimeter** of a shape is the distance around the edge of the shape. Units of length are used to measure perimeter e.g. mm, cm, m

A **compound shape** is a shape made up of others joined together.



Examples



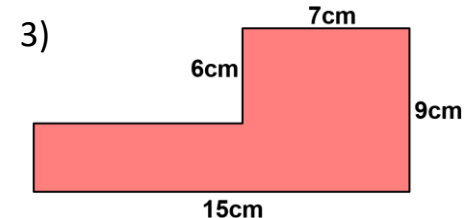
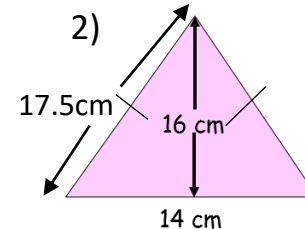
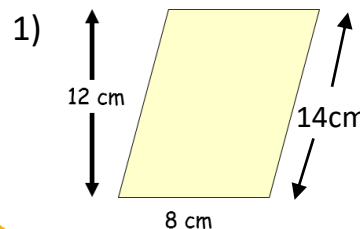
Sparx Learning

U993, U351,
U343, U265

Key words

Area
Perimeter
Base
Height
Width
Length

Calculate the area and perimeter of each shape:



ANSWERS: 1) $A = 96\text{ cm}^2$ $P = 44\text{ cm}$ 2) $A = 112\text{ cm}^2$ $P = 49\text{ cm}$ 3) $A = 87\text{ cm}^2$ $P = 48\text{ cm}$

Maths Knowledge Organisers (Set 3 – F)

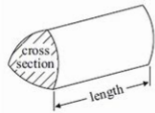
VOLUME AND SURFACE AREA OF PRISMS

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:

$\text{area of cross section} \times \text{length}$

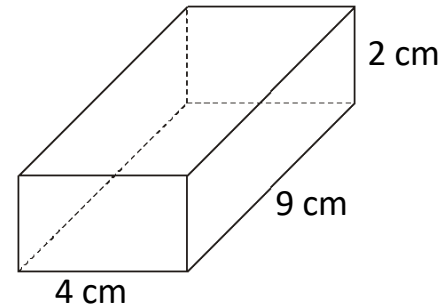


A **prism** is a 3D shape which has a continuous cross-section.

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 .

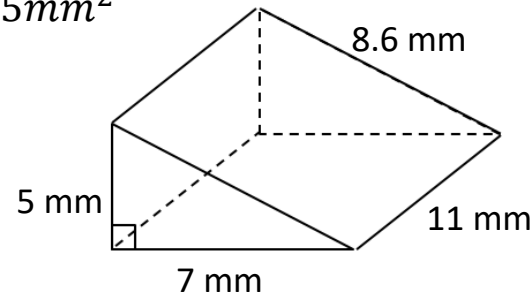
Examples

$$\begin{aligned}\text{Volume} &= 4 \times 9 \times 2 \\ &= 72\text{cm}^3\end{aligned}$$



$$\begin{aligned}\text{Area of triangle} &= \frac{5 \times 7}{2} \\ &= 17.5\text{mm}^2\end{aligned}$$

$$\begin{aligned}\text{Volume} &= 17.5 \times 11 \\ &= 192.5\text{mm}^3\end{aligned}$$



Surface area:

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

Surface area:

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

 Sparx Learning

U786, U174

Key Words

Volume

Capacity

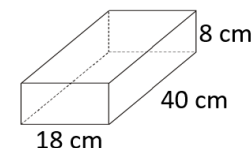
Prism

Surface area

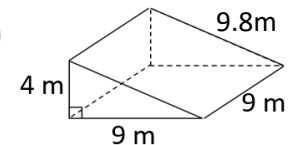
Face

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 = 241.2 m^2

Maths Knowledge Organisers (Set 3 – F)

CONVERSION OF METRIC UNITS

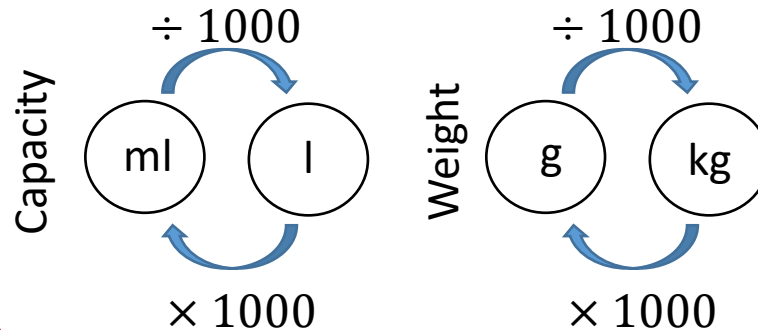
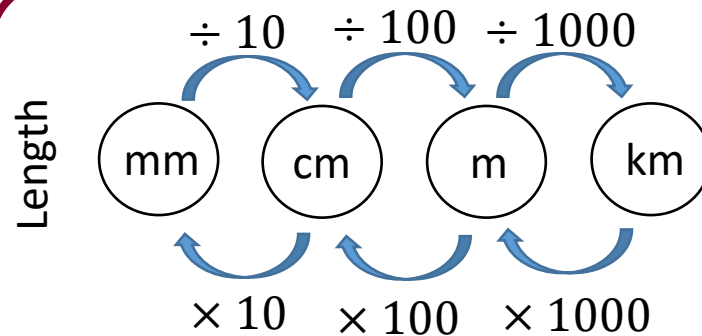
Key Concept

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

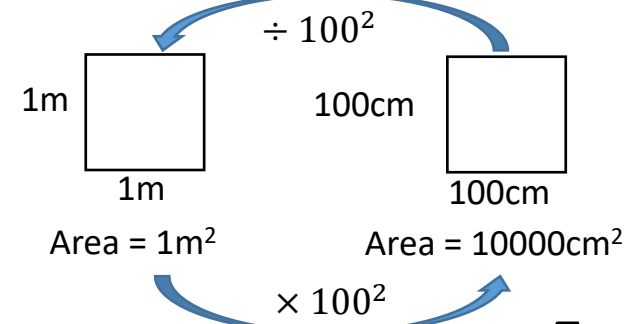
Metric units of **weight**:
g, kg

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

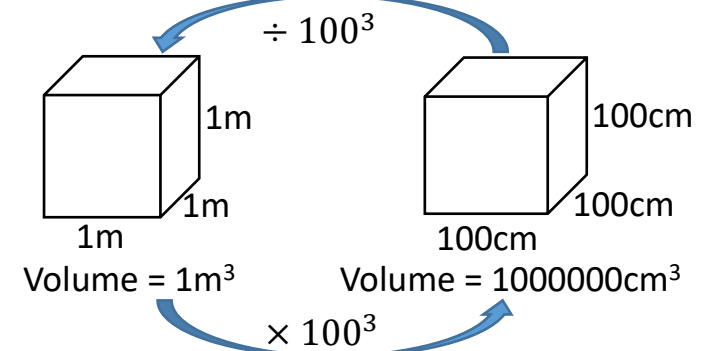
All of these units are **metric** units. They will always use conversions of multiples of 10, eg. 10, 100, 1000 etc.



Converting areas



Converting volumes



Examples

Sparx Learning
U497, U388,
U248, U468

Key Words

Length
Weight
Capacity
Metric

Convert each of the following:

- 12cm into mm
- 1783g into kg
- 2.5 litres into ml

- 6.8m into mm
- 5000000cm³ into m³
- 2m² into cm²

ANSWERS: a) 120mm b) 1.783kg c) 2500ml d) 6800mm e) 5m³ f) 20000cm²