

**Year 7 Maths  
Knowledge Organiser  
(H)**

**Half Term 1**

# PLACE VALUE, DECIMALS & USING SCALES

## Key Concept

Multiply/Divide by powers of 10

10 000	1000	100	10	1	●	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
					●			

### Multiplying

X 10  
X 100  
X 1000

digits move LEFT 1 space  
digits move LEFT 2 spaces  
digits move LEFT 3 spaces



### Dividing

÷ 10  
÷ 100  
÷ 1000

digits move RIGHT 1 space  
digits move RIGHT 2 spaces  
digits move RIGHT 3 spaces



## Key Words

**Decimal:** A number that contains a point.

**Metric measure:** The unit used to measure length, mass etc.

**Scale:** The conversion to convert between drawings and real life sizes.

## Examples

### Ordering Decimals

0.3, 0.21, 0.305, 0.38, 0.209

Add zero's so that they all have the same number of decimal places.

0.300, 0.210, 0.305, 0.380, 0.209

Then they can be placed in order:

0.209, 0.21, 0.3, 0.305, 0.38

### Multiplying/Dividing by powers of 10

$3.4 \times 100$

100	10	1	●	$\frac{1}{10}$
		3	●	4
3	4	0	●	

Red arrows indicate the movement of digits: from 3 in the 10s place to 3 in the 100s place, and from 4 in the 1s place to 4 in the 100s place.

 hegartymaths

13-16, 46, 691,  
864

## Tip

- Add digits when ordering decimals.
- The number of zero's tells you the number of places to move the digits.

## Questions

- Order 1.52, 1.508, 1.5, 1.05, 1.51
- Work out a)  $1.35 \times 10$  b)  $0.6 \times 100$  c)  $4.5 \div 100$
- Convert a) 36 mm to cm b) 7 cm to mm c) 450 cm to m  
d) 620 g to kg e) 4.2 kg to g f) 0.7 kg to g

ANSWERS: 1) 1.05, 1.5, 1.508, 1.51, 1.52 2) a) 13.5 b) 60 c) 0.045  
3) a) 3.6cm b) 70mm c) 4.5m d) 0.62kg e) 4200 f) 700g

# 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

$$3.5\overset{|}{\underset{|}{2}}7 \rightarrow 3.5$$

b) 2 decimal places

$$3.52\overset{|}{\underset{|}{7}} \rightarrow 3.53$$

c) 1 significant figure

$$3\overset{|}{\underset{|}{5}}27 \rightarrow 4$$

## 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)

# DECIMALS

## Key concepts

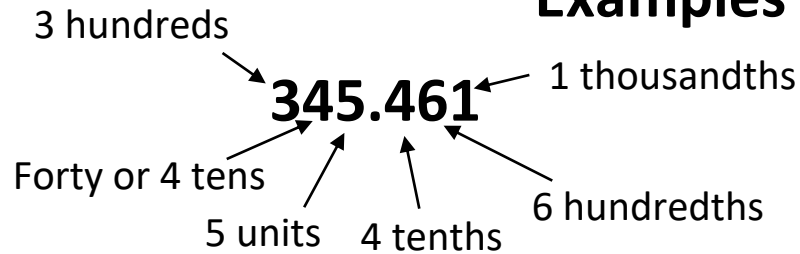
Place value:

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  $40 \times 5 = 200$

hegartymaths

102 - 110

## 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)  $0.03 \times 500$    4)  $3.4 \times 5.6$





5)  $4.79 \times 6.8$

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

# FOUR OPERATIONS WITH INTEGERS & DECIMALS

## Key Words

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

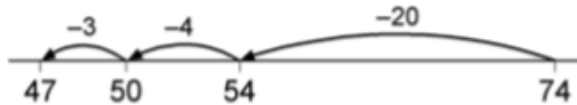
 Add Sum Total All together Plus In all	 Multiply Product Times Twice Total Multiplied by
 Subtract Remain Difference Less than Fewer How many more Minus	 Divide Quotient Goes into Split Equally Each

## Examples

$$48 + 36 = 84$$



$$74 - 27 = 47 \text{ worked by counting back:}$$



$$\begin{array}{r} 97 \\ 3 \overline{)292} \\ \underline{30} \phantom{0} \\ 29 \phantom{0} \\ \underline{27} \phantom{0} \\ 20 \phantom{0} \\ \underline{21} \\ 1 \end{array}$$

$$\begin{array}{r} 258 \\ + 87 \\ \hline 345 \\ 11 \end{array}$$

$$\begin{array}{r} 3415 \\ - 28 \\ \hline 17 \end{array}$$

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

$$56 \times 27$$

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

 **hegartymaths**

**Clip Numbers**

**1-22, 141-146, 47**

### Tip

Multiplication and addition are associative, so you can work them out in any order.

So  $3 \times 4$  is the same as  $4 \times 3$ .

$4 + 3$  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)  $7 \times 146$    b)  $34 \times 67$    c)  $2.9 \times 7.2$    4) a)  $294 \div 7$    b)  $192 \div 6$

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

# ORDER OF OPERATIONS

## Key Concept

**B** Brackets

**I** Indices

**D** Division

**M** Multiplication

**A** Addition

**S** Subtraction

If a calculation contains the looped calculations work from left to right.

 **hegarty**maths

24, 39-44, 120,  
150, 181-189

## Key Words

**Operation:** In maths these are the functions  $\times \div + -$ .

**Commutative:** Calculations are commutative if changing the order does not change the result.

**Associative:** In these calculations you can re-group numbers and you will get the same answer.

**Indices:** These are the squares, cubes and powers.

## Tip

- Put brackets around the calculations which need to be done first.
- Indices also includes roots.

## Examples

$$\begin{array}{r} 5 \times 4 - 8 \div 2 \\ \underbrace{\hspace{1.5cm}} \quad \underbrace{\hspace{1.5cm}} \\ 20 \quad - \quad 4 \quad = \quad 16 \end{array}$$

$$\begin{array}{r} (2^2 + 6)^2 \times 4 - 8 \\ \downarrow \\ (4 + 6)^2 \times 4 - 8 \\ \downarrow \\ (10)^2 \times 4 - 8 \\ \downarrow \\ 100 \times 4 - 8 \\ \downarrow \\ 400 - 8 = 392 \end{array}$$

## Questions

- 1)  $7 - 10 \div 2$
- 2)  $4^3 - 13 \times 4$
- 3)  $21 \div 7 - 2$
- 4)  $12 \div (7 - 3)$
- 5)  $20 \div 2^2$
- 6)  $(16 - 13) \div 3$
- 7) Place brackets to make the calculation work  $20 \div 5 - 3 = 10$

ANSWERS: 1) 2 2) 12 3) 1 4) 3 5) 5 6) 1 7)  $20 \div (5 - 3) = 10$

# FACTORS, MULTIPLES AND PRIMES

## Key Concept

### Factors:

Find these in pairs

**12**

1, 12

2, 6

3, 4

### Multiples:

Start with the number itself

**7** – 7, 14, 21, 28, ...

## Key Words

**Factor:** The numbers which fit into a number exactly.

**Multiple:** The numbers in the times table.

**Prime:** Numbers which have only two factors which are 1 and itself.

**Highest Common Factor:** The highest factor which is common for both numbers.

**Lowest Common Multiple:** The smallest multiple which is common to both numbers.

## Examples

### Lowest Common Multiple (LCM)

Q - Find the LCM of 6 and 7:

6 – 6, 12, 18, 24, 30, 36, **42**, 48, 54, 60, ...

7 – 7, 14, 21, 28, 35, **42**, 49, 56, ...

LCM = 42

### Highest Common Factor (HCF)

Q – Find the HCF of 18 and 24

18 – 1, 2, 3, **6**, 9, 18

24 – 1, 2, 3, 4, **6**, 8, 12, 24

HCF = 6



Clip Numbers

**4, 6, 10, 26 – 34**

## Tip

There is only one even prime number which is the number 2. This can be used to help solve lots of problems.

## Questions

- 1) List the first 5 multiples of: a) 7 b) 12 c) 50
- 2) List the factors of: a) 12 b) 15 c) 16
- 3) a) Find the LCM of 5 and 7 b) Find the HCF of 20 and 16

ANSWERS: 1) a) 7, 14, 21, 28, 35 b) 12, 24, 36, 48, 60 c) 50, 100, 150, 200, 250  
2) a) 1, 2, 3, 4, 6, 12 b) 1, 3, 5, 15 c) 1, 2, 4, 8, 16  
3) a) 35 b) 4



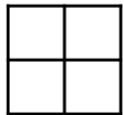
# Types of Numbers & Prime Factorisation

## Key Concept

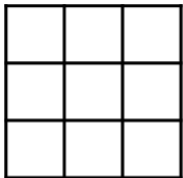
Square numbers



$$1^2 \\ 1 \times 1 = 1$$



$$2^2 \\ 2 \times 2 = 4$$



$$3^2 \\ 3 \times 3 = 9$$

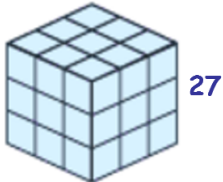
Cube numbers



$$1^3 \\ 1 \times 1 \times 1$$



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



$$3^3 \\ 3 \times 3 \times 3$$

## 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.

**Factor:** A number that fits into another number exactly.

## Tip

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

## Examples

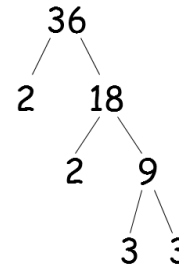
What is  $2^4$  ?

$$2 \times 2 \times 2 \times 2 = 16$$

What is  $\sqrt{64}$  ?

$$8^2 = 64, \text{ so } \sqrt{64} = \pm 8$$

Write 36 as a product of prime factors



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

Product means 'multiply'

 hegartymaths

Clip Numbers  
27-30, 99-101

## Questions

- 1) a)  $2^5$    b)  $3^3$    c)  $1^{17}$    d)  $\sqrt{81}$    e)  $\sqrt{16}$    f)  $\sqrt[3]{64}$
- 2) Write 72 as a product of primes.

ANSWERS:   1) a) 32   b) 27   c) 1   d)  $\pm 9$    e)  $\pm 4$    f) 4  
2)  $2^3 \times 3^2$

# HCF & LCM USING FACTOR DECOMPOSITION

## 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

 hegartymaths

29 – 32,34,35

## Key Words

Factor

Multiple

Prime

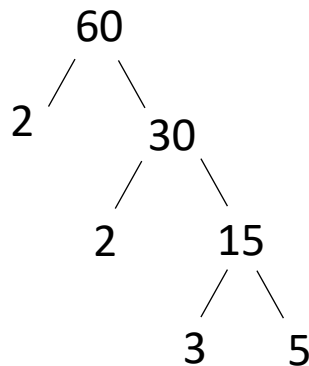
Highest Common Factor

Lowest Common

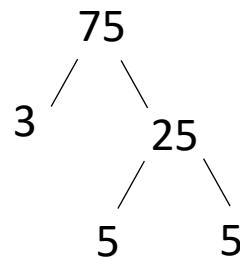
Multiple

## Examples

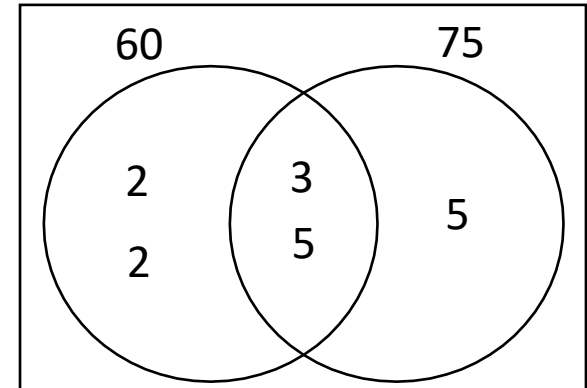
Find the **highest common factor** and **lowest common multiple** of 60 and 75:



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



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



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

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

## 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

# Half Term 2

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

 hegartymaths

153, 189

## 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  $e = 2$

(d) equation

(c) identity

(b) expression

ANSWERS: 1) (a) formula  
(b) expression  
(c) identity  
(d) equation

8

2

# 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.

 hegartymaths

151 – 152, 156 – 157

## Key Words

Simplify  
Term  
Collect

## 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:

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

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

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

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

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

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

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

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

ANSWERS: 1)  $8p$       2)  $12 + 2t + 3p$

5)  $40abc$       6)  $48m^2n$       7)  $3p$

3)  $-4m - 8g$

4)  $-4b^2$

8)  $\frac{t}{3}$

# 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.

 hegartymaths

160, 161, 168, 189,  
105, 106

## Key Words

Expand  
Factorise  
Simplify

## Examples

Expand and simplify where appropriate

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

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

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

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

## Questions

### 1) Expand and simplify

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

### 2) Factorise

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

# SOLVING EQUATIONS

## Key Concept

### Inverse Operations

Operation	Inverse
+	-
-	+
$\times$	$\div$
$\div$	$\times$
$x^2$	$\sqrt{x}$

## Key Words

**Unknown:** A letter which represents a number we do not know the value of.

**Terms:** The numbers and letters in the expression or equation.

**Inverse:** The operation which will do the opposite.

## Examples

$x + 9 = 16$ $-9 \quad -9$ $x = 7$	$x - 12 = 20$ $+12 \quad +12$ $x = 32$	$\frac{x}{3} = 5$ $\times 3 \quad \times 3$ $x = 15$	$2x + 5 = 14$ $-5 \quad -5$ $2x = 9$ $\div 2 \quad \div 2$ $x = 4.5$
--	--	--	--

$\frac{x}{4} - 2 = 4$ $+2 \quad +2$ $\frac{x}{4} = 6$ $\times 4 \quad \times 4$ $x = 24$	$2(3x + 5) = -14$ <b>expand</b> $6x + 10 = -14$ $-10 \quad -10$ $6x = -24$ $\div 6 \quad \div 6$ $x = -4$
--	---



Clip Numbers  
177 - 184

## Tip

Answers can be:

- Integers
- Decimals
- Fractions
- negatives

## Questions

- 1)  $x + 8 = 19$     2)  $y - 25 = 15$     3)  $2y = 82$     4)  $\frac{t}{4} = 7$   
 5)  $\frac{p}{2} - 6 = 2$     6)  $3(2x - 3) = 15$

# SEQUENCES

## Key Concepts

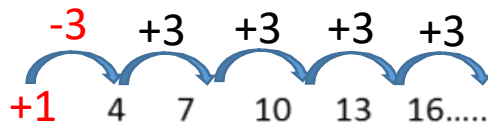
**Arithmetic or linear sequences**  
increase or decrease by a common amount each time.

**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      Go back a term

b) What is the 100<sup>th</sup> term in the sequence?

$$3n + 1$$

$$3 \times 100 + 1 = 301$$

c) Is 100 in this sequence?

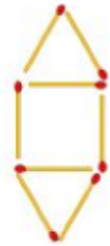
$$3n + 1 = 100$$

$$3n = 99$$

$$n = 33$$

Yes as 33 is an integer.

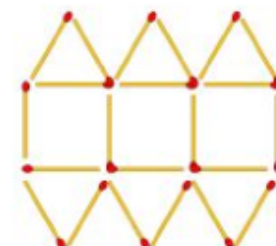
Pattern 1



Pattern 2



Pattern 3



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

$$7n + 1$$

Pattern 1	Pattern 2	Pattern 3
8	15	22

+1

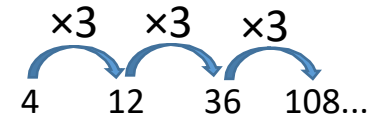
-7      +7      +7

## Examples

Linear sequences with a picture:

State the nth term.

Geometric sequence e.g.



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:  $3^2 + 4 = 13$

## Key Words

Linear  
Arithmetic  
Geometric  
Sequence  
Nth term

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

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

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



# PLOTTING AND INTERPRETING GRAPHS

## Key Concept

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

If  $a = 5$  and  $b = 2$

$a + b =$	$5 + 2 = 7$
$a - b =$	$5 - 2 = 3$
$3a =$	$3 \times 5 = 15$
$ab =$	$5 \times 2 = 10$
$a^2 =$	$5^2 = 25$

## Key Words

**Intercept:** Where two graphs cross.

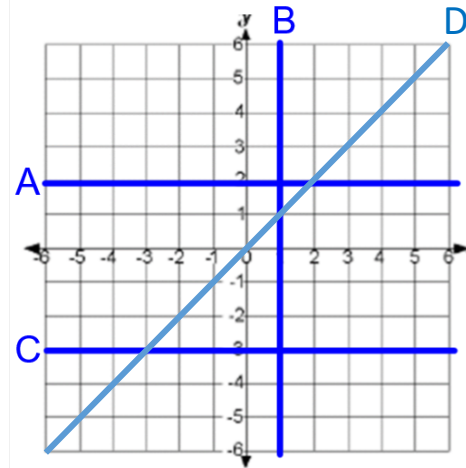
**Gradient:** This describes the steepness of the line.

**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.

## Examples

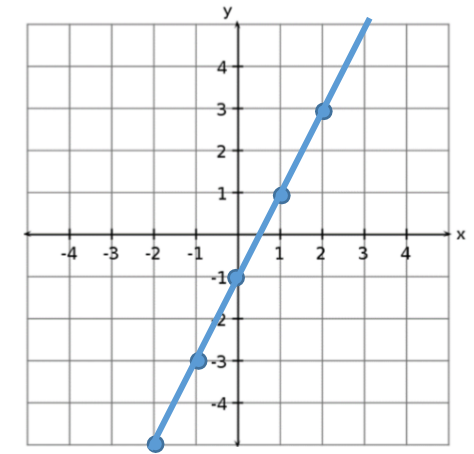


A:  $y = 2$     B:  $x = 1$

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.

hegartymaths

Clip Numbers

206 - 210, 251

## Tip

Parallel lines have the same gradient.

## Formula

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

## 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)  $m = -5, c = -3$

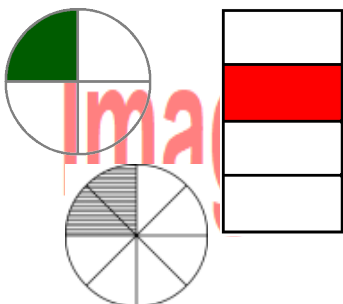
b)  $m = 6, c = 4$

c)  $m = 4, c = -3$

**Half Term 3**

# UNDERSTANDING FRACTIONS

No



## Key Words

**Fraction:** A fraction is made up of a numerator (top) and a denominator (bottom).

**Equivalence:** Two fractions are equivalent if one is a multiple of the other.

**Simplify:** Cancel a fraction down to give the smallest numbers possible.

$$\frac{3}{24}$$

÷ 3



$$\frac{1}{8}$$

÷ 3



$$\frac{1}{8}$$

1 ●	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
0 ●	3	4	

No Image

No Image

$$\frac{6}{7} \rightarrow 7 \overline{) 6.85714}$$

 hegartymaths

Clip Numbers

58, 59, 73, 74, 77

## Tip

- A larger denominator does not mean a larger fraction.

- To find equivalent fractions multiply/divide the numerator and denominator by the same number.

## Questions

- Simplify a)  $\frac{42}{96}$  b)  $\frac{64}{120}$  2) Write as a decimal a)  $\frac{2}{7}$  b)  $\frac{3}{8}$
- Write as a fraction a) 0.48 b) 0.166 c) 0.308
- a)  $\frac{3}{5}$  of 35 b)  $\frac{2}{9}$  of 45 c)  $\frac{5}{11}$  of 121

No Image

# FRACTIONS

## Key Concepts

No  
Image

 hegarty  
61, 63-70

Convert into an improper fraction  
 ←→  
 Find a common denominator  
 ←→  
 Convert back into a mixed number  
 ←→

**Key Words**  
 Fraction  
 Equivalent  
 Reciprocal  
 Numerator  
 Denominator  
 Improper/Top heavy  
 Mixed number

## Examples

No Image      No Image      No Image      No Image

Find the reciprocal of the second fraction...  
 ...and multiply

No Image      No Image      No Image





No Image

# FOUR OPERATIONS WITH FRACTIONS

No  
Image

## Key Words

**Fraction:** A fraction is made up of a numerator (top) and a denominator (bottom).

 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

## Tip

- A larger denominator **does not** mean a larger fraction.
- To find equivalent fractions multiply/divide the numerator and denominator by the same number.

## Examples

$$+ \quad \frac{3}{5} + \frac{2}{7}$$

Make the denominators the same

$$\begin{array}{c} \frac{3}{5} + \frac{2}{7} \\ \times 7 \quad \times 5 \\ \frac{21}{35} + \frac{10}{35} = \frac{31}{35} \end{array}$$

$$- \quad \frac{3}{5} - \frac{2}{7}$$

$$\begin{array}{c} \frac{3}{5} - \frac{2}{7} \\ \times 7 \quad \times 5 \\ \frac{21}{35} - \frac{10}{35} = \frac{11}{35} \end{array}$$

4 Rules  
Fractions

$$\times \quad \frac{3}{5} \times \frac{2}{7}$$

Just multiply the tops and bottoms

$$= \frac{3 \times 2}{5 \times 7} = \frac{6}{35}$$

$$\div \quad \frac{3}{5} \div \frac{2}{7}$$

Flip the second fraction and change to a times

$$\frac{3}{5} \times \frac{7}{2} = \frac{21}{10}$$

 hegartymaths

Clip Numbers

61 – 70

No  
Image

No  
Image

# FRACTIONS OF AN AMOUNT

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

 hegartymaths

61, 63-70

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

## Examples

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**

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

# 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  $\pm$  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?

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

 hegartymaths

84-90

## 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%

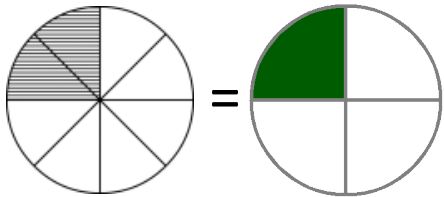
# RATIO

## Key Concept

$$2 \text{ parts} \rightarrow 2:6 \leftarrow 6 \text{ parts}$$

$$=$$

$$1:3$$



$$= \frac{1}{3}$$

## 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.

## Examples

Simplify 60 : 40 : 100

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

$$\div 10$$

$$6 : 4 : 10$$

$$\div 2$$

$$3 : 2 : 5$$

Write 2 : 5 in the form 1 : n

$$\begin{array}{ccc} & 2 : 5 & \\ \div 2 \swarrow & & \searrow \div 2 \\ & 1 : 2.5 & \end{array}$$

Share £45 in the ratio 2 : 7

$$45 \div 9 = 5$$

$$\text{£}10 : \text{£}35$$

$$2 : 7$$

5	5
5	5
=10	5
	5
	5
	5
	5
	=35

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

$$\text{£}12 : \text{£}30$$

$$2 : 5$$

6	6
6	6
}	6
}	6
}	6
}	6
}	6
=12	=30

$$18 \div 3 = 6$$

**hegartymaths**

Clip Numbers

328 – 335

## Tip

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

## 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.

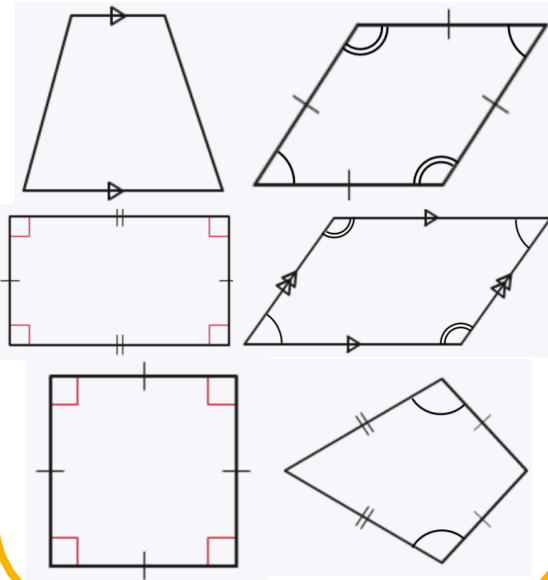
ANSWERS: 1) a) 5 : 7 b) 3 : 2 c) 8 : 11 2) a) 1 : 2 b) 1 : 1.5 c)  $1 : x + 1$   
3) 24 : 40 4)  $\frac{1}{5}$



**Half Term 4**

# PROPERTIES OF SHAPES

## Key Concept Quadrilaterals



## Key Words

**Angle:** This is formed by two lines, joined by a common endpoint.

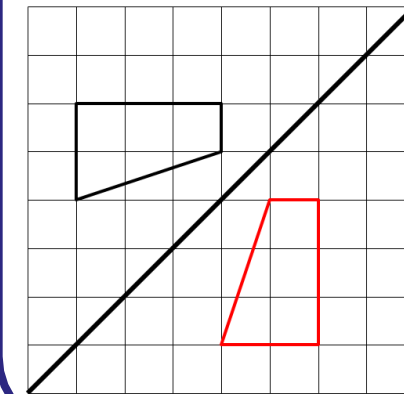
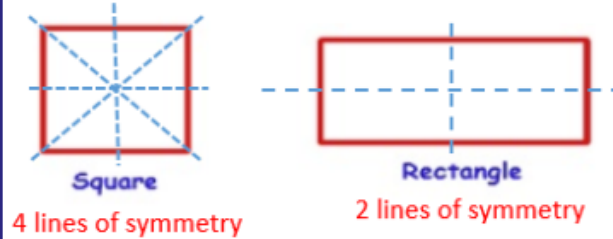
**Symmetry:** A shape has symmetry if there is a line which forms two equal parts which are a mirror image of each other.

**Reflection:** This is where a shape is flipped.

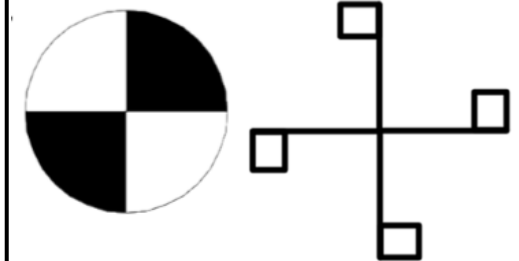
**Rotation:** This is where a shape is turned.

## Examples

### Lines of symmetry and reflection



### Rotational Symmetry



 **hegartymaths**

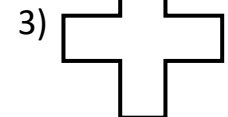
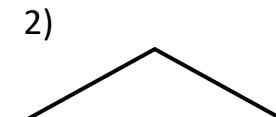
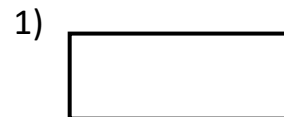
Clip Numbers

457-460, 639-649, 822  
-828

## Tip

- The smallest the order of rotational symmetry can be, is 1.
- To see if a line of symmetry works fold along the line and see if the both halves lie exactly on top of each other.

**Questions** - For the shapes below draw on their lines of symmetry and state their order of rotational symmetry.








ANSWERS: 1) 2 lines of symmetry, order = 2 2) 1 line of symmetry, order = 1 3) 4 lines of symmetry, order = 4.

# PERIMETER

## Key Concept

### 2D Shapes

	Parallelogram
	Trapezium
	Right-angled triangle
	Isosceles triangle
	Equilateral triangle

## Key Words

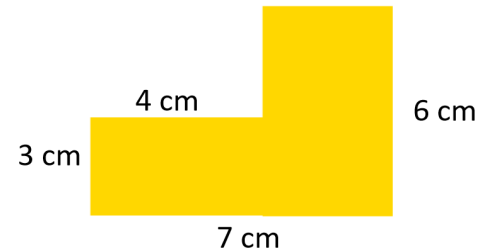
**Perimeter:** The distance around the outside of the shape.  
**Unit of measure:** This could be any unit of length cm, inch, m, foot, etc.

**Dimensions:** The lengths which give the size of the shape.

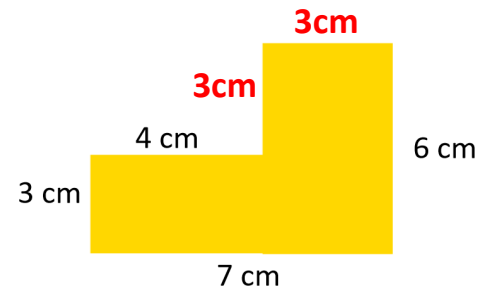
**Compound shape:** A shape made up of two composite shapes

## Example

Find the perimeter



**Step 1** – Find the missing lengths.



**Step 2** – Add the lengths

$$3 + 4 + 3 + 3 + 6 + 7 = \underline{26 \text{ cm}}$$

 hegarty

Clip Numbers

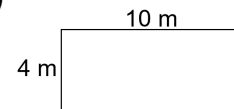
534-550, 691, 822

## Tip

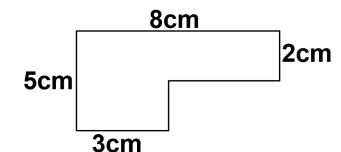
- Always include units with your answer.

**Questions** – Find the perimeter of each shape to 1dp

1) a)



b)

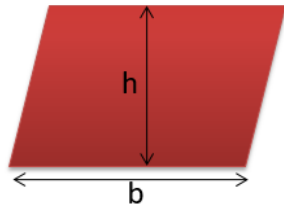


# AREA

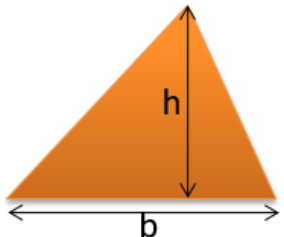
## Key Concepts Area



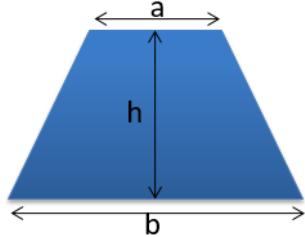
$$A = l \times w$$



$$A = b \times h$$



$$A = \frac{1}{2} (b \times h)$$



$$A = \frac{1}{2} (a + b)h$$

## Key Words

**Area:** The amount of square units that fit inside the shape.

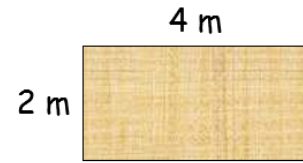
**Perimeter:** The distance around the outside of the shape.

**Dimensions:** The lengths which give the size of the shape.

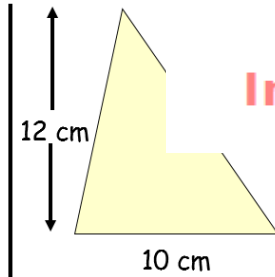
**Shapes:**

Rectangle, Triangle, Parallelogram, Trapezium, Kite.

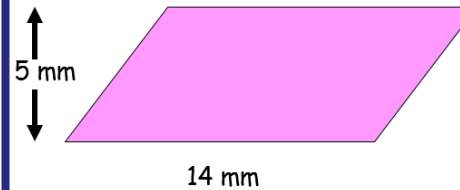
## Examples



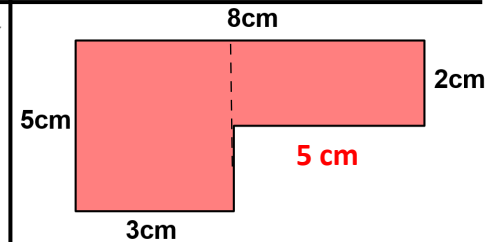
No Image



No Image



No Image



No Image

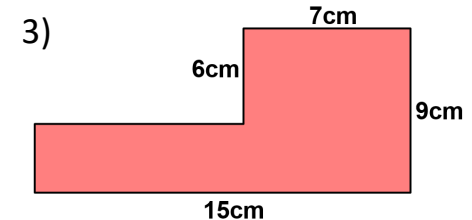
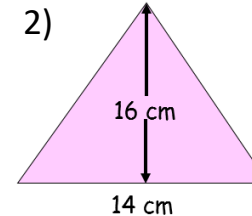
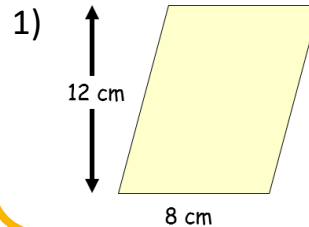


Clip Numbers  
554 – 559

## Tip

Always remember units. These units are squared for area.  $\text{mm}^2$ ,  $\text{cm}^2$ ,  $\text{m}^2$ , etc

## Questions – Find the area.

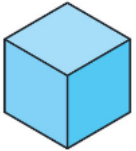


ANSWERS: 1)  $96 \text{ cm}^2$  2)  $112 \text{ cm}^2$  3)  $87 \text{ cm}^2$

# 3D SHAPES, CAPACITY AND VOLUME

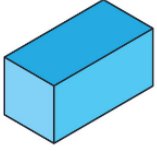
## Key Concept

Cube



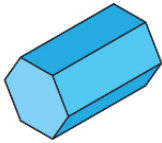
Faces – 6  
Edges – 12  
Vertices – 8

Cuboid



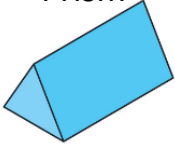
Faces – 6  
Edges – 12  
Vertices – 8

Hexagonal Prism



Faces – 8  
Edges – 18  
Vertices – 12

Triangular Prism



Faces – 5  
Edges – 9  
Vertices – 6

## Key Words

**Volume:** The amount of space that an object occupies.

**Capacity:** The amount of space that a liquid occupies.

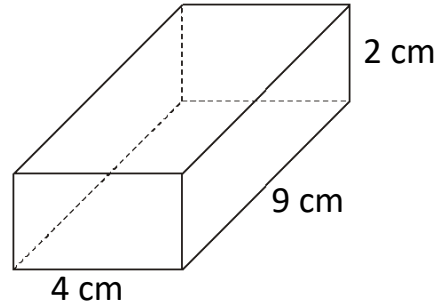
**Cuboid:** 3D shape with 6 square/rectangular faces.

**Vertices:** Angular points of shapes.

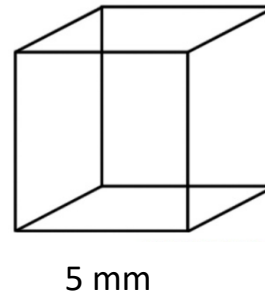
**Face:** A surface of a 3D shape.

**Edge:** A line which connects two faces on a 3D shape.

## Examples



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



$$\begin{aligned} \text{Volume} &= 5 \times 5 \times 5 \\ &= 125\text{mm}^3 \\ \text{or} \\ \text{Volume} &= 5^3 \\ &= 125\text{mm}^3 \end{aligned}$$

 hegarty**maths**

Clip Numbers

568-571,698,699

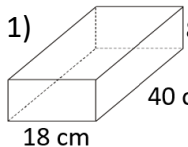
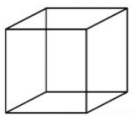
## Tip

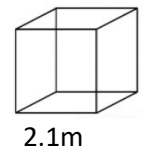
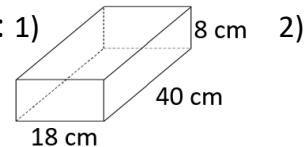
Remember the units are cubed for volume.

## Formula

*Cuboid Volume* =  $l \times w \times h$   
*Cube Volume* =  $l \times w \times h$  or  
*Cube Volume* =  $w^3$

## Questions

Find the volume of these shapes: 1)  2) 



# PLANS AND ELEVATIONS

## Key Concepts

A 3 dimensional shape can be mathematically drawn from **three view points**:

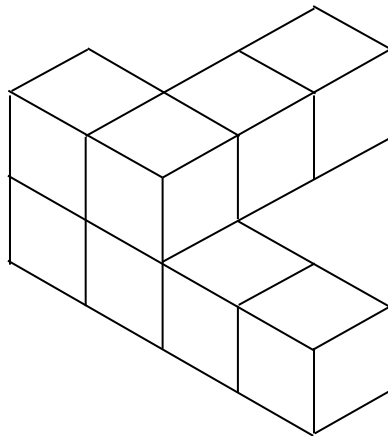
Side view

Front view

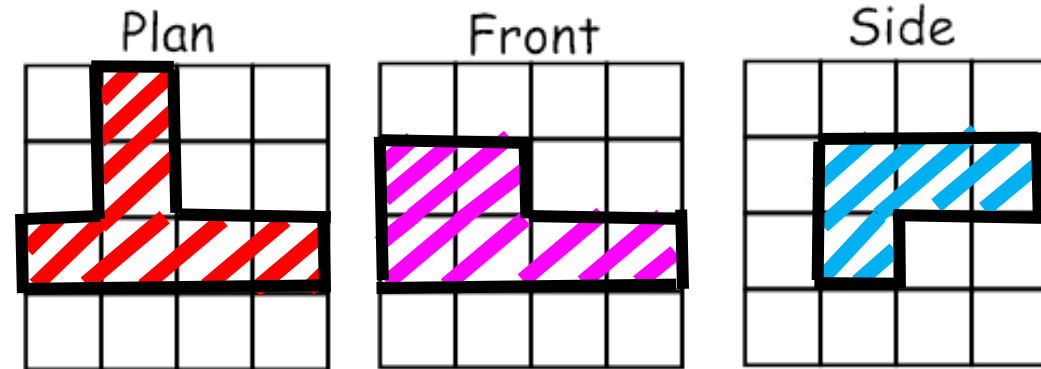
Plan view – from above

They are drawn as 2 dimensional representations

Draw this 3D shape from the side view, the front view and the plan view.



## Examples



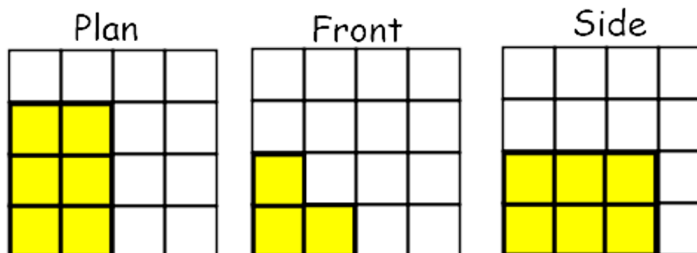
## Key Words

Elevation

Plan

Side

Front



Sketch the 3D shape that has these three views.

# MEASURING AND DRAWING ANGLES

## Key Concepts

### Types of angle

There are four types which need to be identified:

- Acute
- Obtuse
- Reflex
- Right - angled

**Measuring** – Align centre, Align 0, count up

**Drawing** - Measure, mark, connect, label

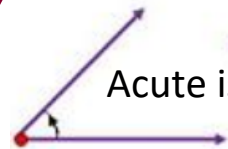
 hegartymaths

455, 456

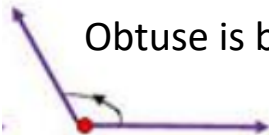
## Key Words

Acute  
Obtuse  
Right angle  
Reflex

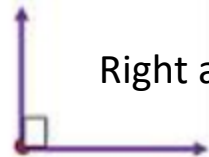
## Examples



Acute is less than  $90^\circ$



Obtuse is between  $90^\circ$  and  $180^\circ$



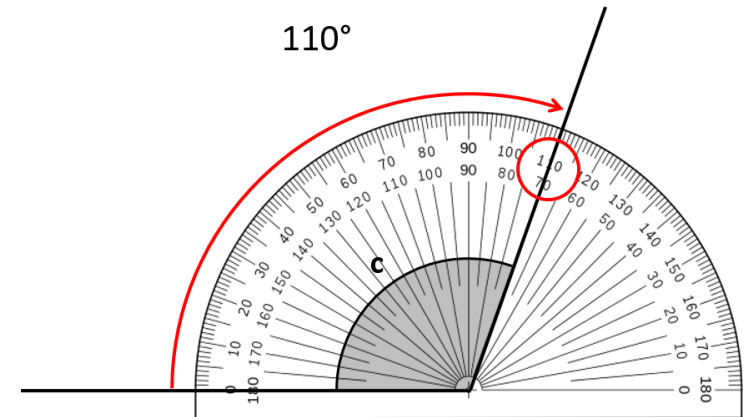
Right angled is  $90^\circ$



Reflex is between  $180^\circ$  and  $360^\circ$

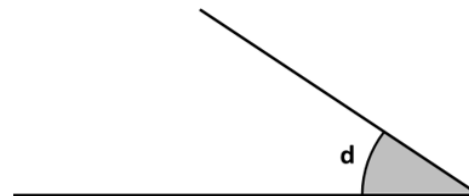
Construct an angle of  $150^\circ$  :

What is the size of angle  $c$ ?

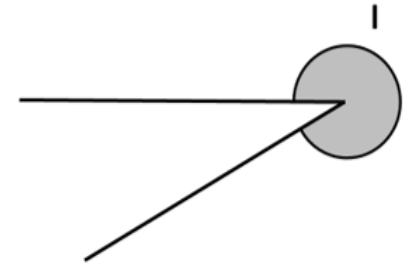


## Questions

1)



2)



**Half Term 5**



# ANGLE FACTS

## Key Concepts

Angles in a **triangle equal 180°**.

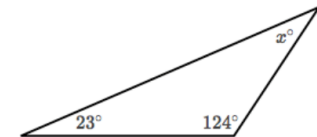
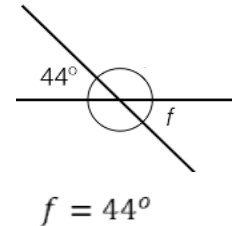
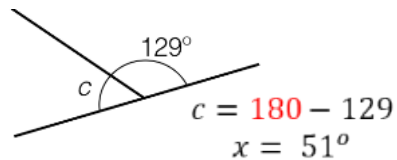
Angles in a **quadrilateral equal 360°**.

**Vertically opposite angles** are equal in size.

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

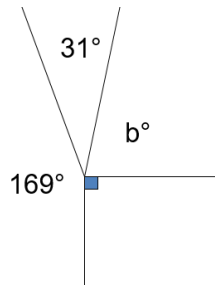
**Base angles in an isosceles triangle** are equal.

## Examples



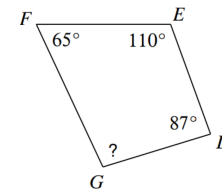
$$x = 180 - (23 + 124)$$

$$x = 33^\circ$$



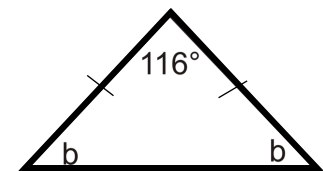
$$169^\circ + 31^\circ + 90^\circ = 290^\circ$$

$$360^\circ - 290^\circ = 70^\circ$$



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

$$? = 98^\circ$$



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

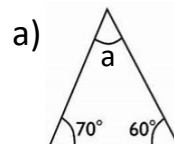
$$b = 32^\circ$$

## Key Words

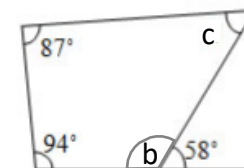
Angle  
Vertically opposite  
Straight line  
Isosceles triangle  
Quadrilateral  
Interior angles

## Questions

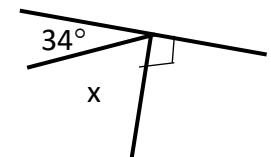
Calculate the missing angle:



b)



c)



# TRIANGLE CONSTRUCTIONS

## Key Concepts

**Construction** – drawing of actual scale

**ASA** – Angle, Side, Angle

**SAS** – Side, Angle, Side

**SSS** – Side, Side, Side

## Key Words

Angle  
Construct  
Compass  
Arc  
Angles  
Protractor

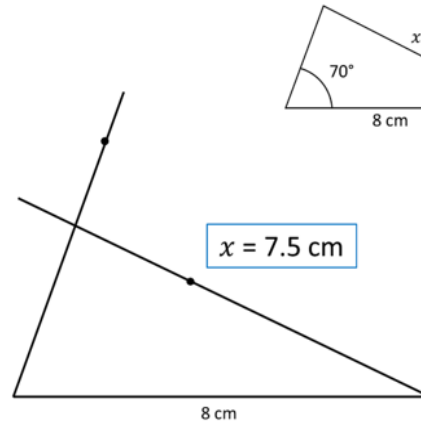
 hegartymaths

477-480, 481-483

## Examples

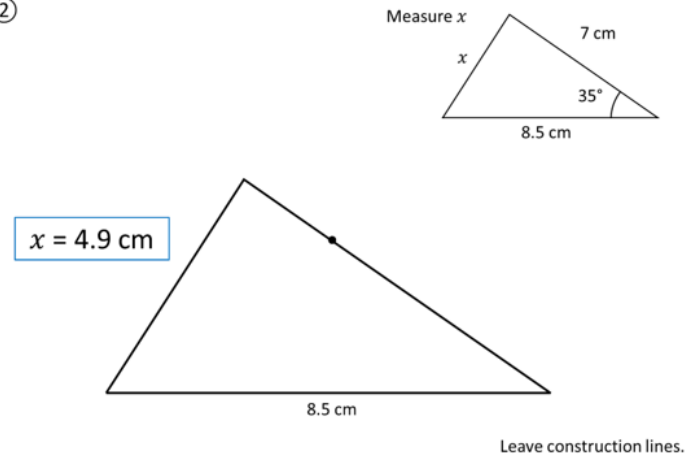
Constructing Triangles: Angle Side Angle

①



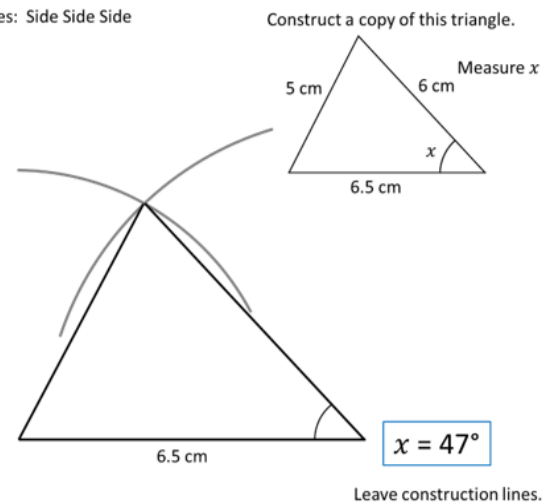
Constructing Triangles: Side Angle Side

②



Constructing Triangles: Side Side Side

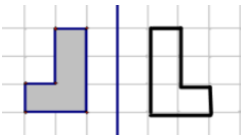
③



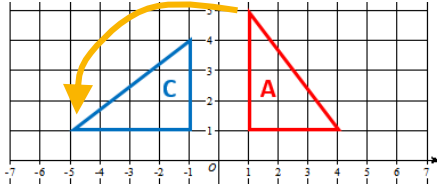
# CO-ORDINATES AND TRANSFORMATIONS

## Key Concept

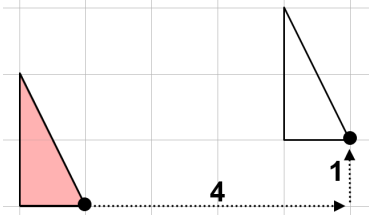
### Reflection



### 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.

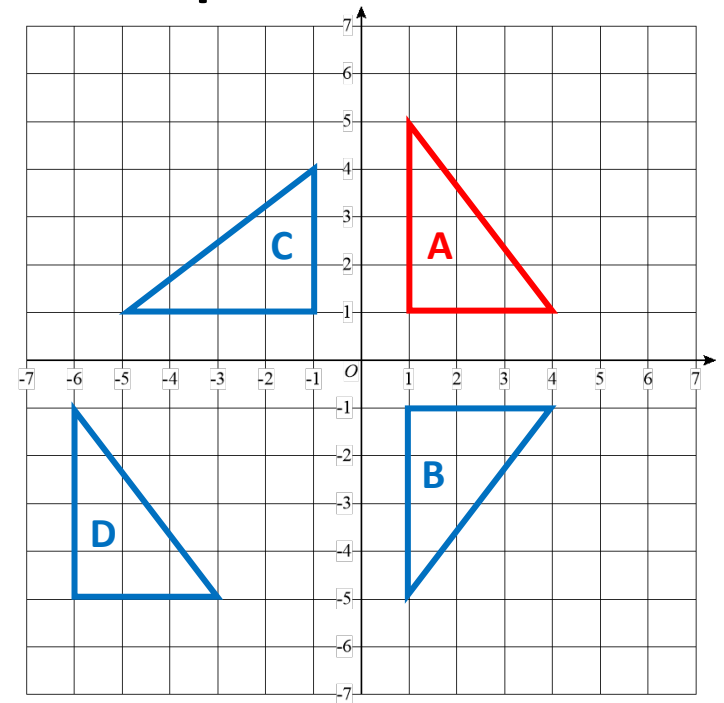
**Translation:** This means a *movement* of the shape.

## 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.



hegarty**maths**

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).

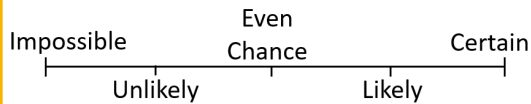
a) Reflect the triangle in the y-axis. b) Translate the triangle  $\begin{pmatrix} -3 \\ -4 \end{pmatrix}$

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

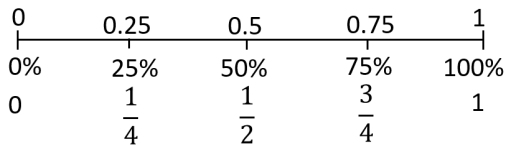
# INTRODUCING PROBABILITY

## Key Concept

### Chance



### Probability



Probabilities can be written as:

- Fractions
- Decimals
- Percentages

hegarty**maths**

Clip Numbers

349 - 359

## 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:** There 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.

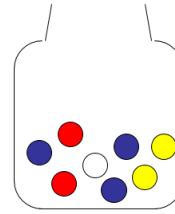
## Tip

Probabilities always add up to 1.

## Formula

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

## Examples

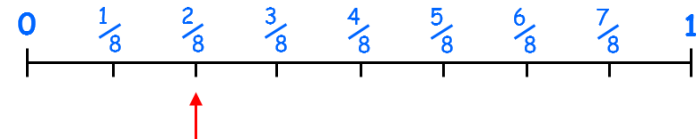


1) What is the probability that a bead chosen will be **yellow**.

Show the answer on a number line.

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

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



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

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

## 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

# Half Term 6

# TYPES OF DATA AND GRAPHS

## Key Concepts

**Qualitative data:** data collected that is described in words **not** numbers.

e.g. race, hair colour, ethnicity.

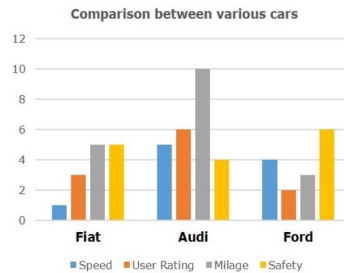
**Quantitative data:** this is the collection of numerical data that is either discrete or continuous.

**Discrete data:** numerical data that is categorised into a finite number of classifications.

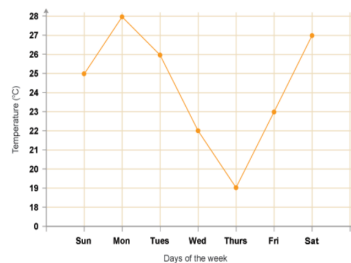
e.g. number of siblings in a family, shoe size, .

**Continuous data:** numerical data that can take any value. This data is usually measured on a large number scale.  
e.g. height, weight, time, capacity.

## Comparative bar charts



## Line graphs



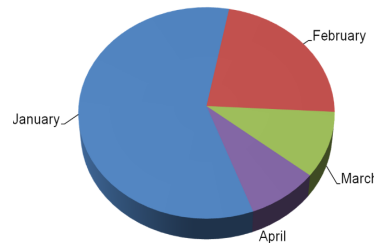
## Examples

### Tally charts

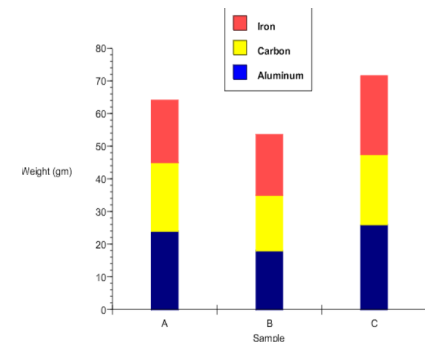
Colour	Tally	Frequency
Red		13
Blue		9
White		24
Black		12
Other		9

### Pie charts

Sales split month wise



## Composite bar charts



## Pictograms



hegarty**maths**

425,426,427,  
430-433,442

## Key Words

Data  
Discrete  
Continuous  
Qualitative  
Quantitative  
Graph

What types of data is each of the following?

- 1) Eye colour
- 2) Time it takes to run 100m
- 3) Number of goals scored in a match
- 4) Length of a car (to the nearest cm)
- 5) Number of pets a person owns

ANSWERS: 1) Qualitative  
2) Continuous, quantitative  
3) Discrete, quantitative  
4) Continuous, quantitative  
5) Discrete, quantitative

# BAR CHARTS AND PICTOGRAMS

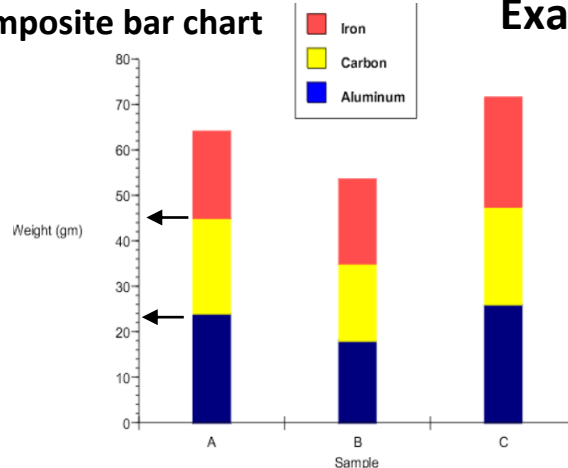
## Key Concepts

**Bar charts** are a visual representation of **categorical data**.

**Composite bar charts** are bar charts that display multiple data points stacked on top of one another.

**Pictograms** use an image relating to a physical object to represent an amount. A **key** must be included to show the value of each picture.

## Composite bar chart



- How much aluminium is in sample A? **24g**
- How much carbon is in sample A?  
 $46 - 24 = 22g$   
 Highest value for carbon in sample A.      Lowest value for carbon in sample A.

## Examples

## Pictogram

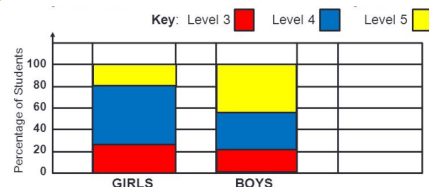


- How many cupcakes were sold on Monday?  
 $5 \times 6 = 30$  cupcakes
- What does half a cupcake represent on the pictogram?  
 $6 \div 2 = 3$  cupcakes
- How many cupcakes were sold on Thursday?  
 $3.5 \times 6 = 21$  cupcakes



425-426

**Key Words**  
 Bar chart  
 Composite  
 Pictogram  
 Key  
 Categorical  
 Data set



- What percentage of boys are level 3?
- What percentage of girls are level 4?



- How many pumpkins were picked by Stanley?
- What does half a pumpkin represent?
- How many pumpkins were picked by Erin?

# AVERAGES

## Key Concepts

There are three types of **average** that we use to analyse and compare data. We can calculate averages from a **discrete data** set.

**Mode** The most common value that appears in the list.

**Median** Once ordered, the middle value.

**Mean** 
$$\frac{\text{Total of all data}}{\text{Number of pieces of data}}$$

The **range** is used to analyse the **spread** of a data set or how **consistent** the data is.

**Range**  
*largest data value – smallest data value*



Clip Numbers

400 – 429

## Key Words

**Frequency:** Total.

**Mean:** Total of data divided by the number of pieces of data.

**Mode:** The value that occurs most frequently.

**Median:** Middle number when they are in order.

**Range:** Difference between the largest and smallest values.

## Examples

5, 9, 9, 9, **11**, 12, 13, 15, 16

No  
Image

## Questions

- 1) Find the mean, mode, median and range of:  
a) 3, 12, 4, 6, 8, 5, 4    b) 12, 1, 10, 1, 9, 3, 4, 9, 7, 9

- 2) For the table:  
a) Draw a bar chart to show the data.  
b) Work out the mean of the data.

Age	Frequency
11	17
12	11
13	8

ANSWERS: 1) a) Mean = 6, Mode = 4, Median = 5, Range = 9    b) Mean = 6.5, Mode = 9, Median = 8, Range = 11    b) 11.75