Knowledge Organisers and Practice questions

Autumn term test covers Topics 1 – 3
Spring term test covers Topics 1 – 6
Summer term test covers Topics 1 – 9
Topics 10 – 11 will be assessed in year 8

Year 7 Mathematics

Topic	Title		
1	Number and calculations	Identify types of number – squares, cubes, square roots, primes	◯
		Written calculations with integer/decimal values $(+ \ - \times \div)$	◯
		Calculations with negative numbers $(+ \ - \times \div)$	◯
		Order of operations (BIDMAS)	◯
2	Factors and multiples	Identify factors and multiples of values	◯
		Break a number up into its prime factors (prime factorisation) and find the HCF / LCM of two values	◯
		Round to decimal places and significant figures	◯
		Estimate solutions using rounded values to 1sf	◯
3	Area and Volume	Calculate the area of a rectangle, triangle, parallelogram, trapezium	◯
		Calculate the area and circumference of a circle	◯
		Calculate missing lengths and areas of compound shapes	◯
		Calculate the volume and surface area of a prism	◯
4	Charts and averages	Complete tally charts and bar charts	◯
		Plot and interpret scatter graphs, including drawing and using the Line of Best Fit	◯
		Draw and interpret pie charts	◯
		Calculate Mean, Median, Mode and Range of a set of data	◯
		Compare data using an average and the range	◯
5	Fractions, decimals and percentages	Find equivalent fractions; convert between mixed and improper fractions	◯
		Combine fractions $(+ \ - \times \div)$ in context	◯
		Convert between FDP and compare/order values	◯
		Calculate fractions or percentages of amounts with/without a calculator	◯
		Increase and decrease values by a fraction or percentage of an amount	◯

Year 7 Mathematics

Topic	Title		
6	Expressions	Substitution into expressions and formula;	◯
		Simplifying expressions:	◯
		Expanding single brackets; Factorising into a bracket	◯
7	Shapes and Angles	Properties of quadrilaterals; Length and angle measurements;	◯
		Angles about a point, on a straight line and in a triangle;	◯
		Angles on parallel lines – alternate, corresponding and opposite	◯
8	Ratio	Simplifying ratio; sharing into a ratio and shared problems	◯
		Ratio with ingredients/recipes,	◯
		Maps, scale diagrams and prices;	◯
9	Equations	Solve linear equations including brackets and fractions	◯
		Form and solve linear equations	◯
10	Sequences	Pattern recognition and continuation;	◯
		nth term of linear sequences	◯
		Write a sequence or specific term using the nth term	◯
		Work with diagrams and patterns as sequences	◯
11	Graphs	Identify coordinates and midpoints of line segments	◯
		Plot accurately a linear graph equation	◯
		Calculate gradients and equations of straight lines	◯
		Identify parallel lines	◯

Year 7 Topic 1 Number and Calculations Student Knowledge Organiser

Key words and definitions

Odd numbers– a number ending in 1, 3, 5, 7 or 9, can not be divided by 2

Even numbers – a number ending in 2, 4, 6, 8 or 0, can be divided by 2

Prime numbers – a number that can only be divided by 1 and itself

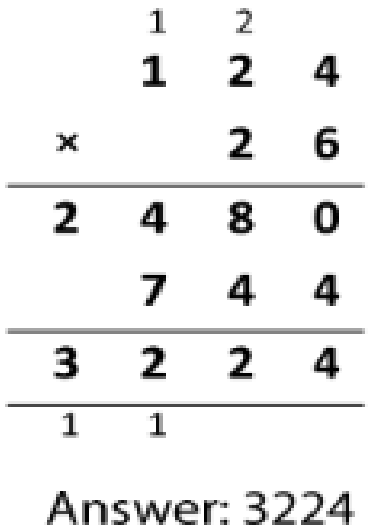
Square numbers– multiply by itself, e.g. 2 x 2 = 4 written as 2^2

Cube numbers – multiply by itself 3 times e.g. 2 x 2 x 2 = 8 written as 2^3

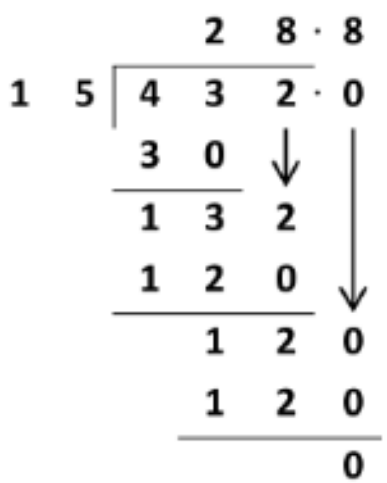
Factors – numbers which divide into another number with no remainder

Multiples – answers to times tables

Multiplication and division



Answer: 3224



Answer: 28·8

Types of numbers

Here are a list of numbers
23, 24, 27, 28, 31, 33, 34, 35

a) List the prime numbers 23, 31
Can only be divided by 1 and itself, 24, 28, 34 can be divided by 2, 27 and 33 are in the 3 times table (and others), 35 is in the 5 times table

b) Find the cube number 27
1 x 1 x 1 = 1, 2 x 2 x 2 = 8, 3 x 3 x 3 = 27

BIDMAS – Order of operation

B	Brackets	10 × (4 + 2) = 10 × 6 = 60
I	Indices	$5 + 2^2 = 5 + 4 = 9$
D	Division	10 + 6 ÷ 2 = 10 + 3 = 13
M	Multiplication	10 - 4 × 2 = 10 - 8 = 2
A	Addition	10 × 4 + 7 = 40 + 7 = 47
S	Subtraction	10 + 2 - 3 = 5 - 3 = 2

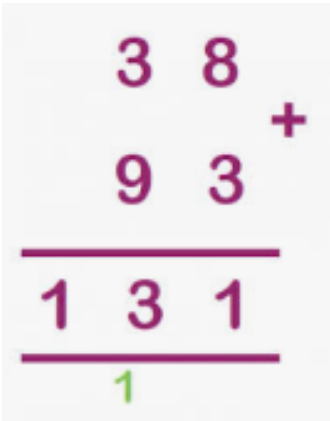
Using a given number fact

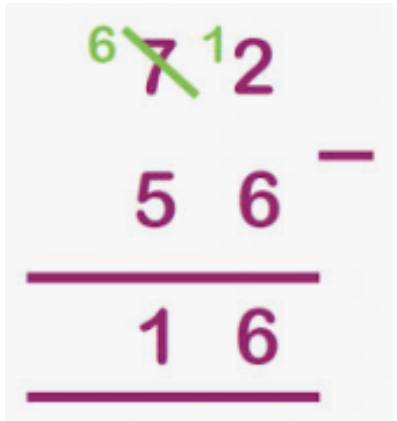
Given that 37 x 432 = 15984

3.7 x 4.32 = 19.984
3.7 is 10 times smaller than 37, 4.32 is 100 times smaller than 432. So the answer is 1000 times smaller than 15984

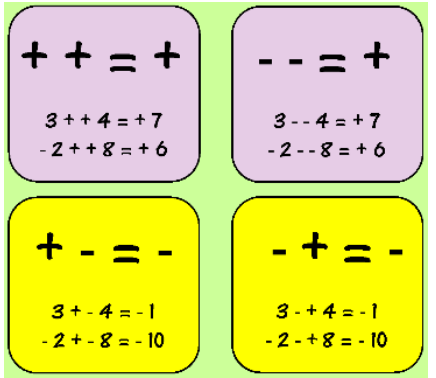
159.84 ÷ 43.2 = 3.7 Rearrange original 15984 ÷ 432 = 37
159.84 is 100 smaller than 15984, 43.2 is 10 times smaller than 432. So the answer is 10 times smaller than 37

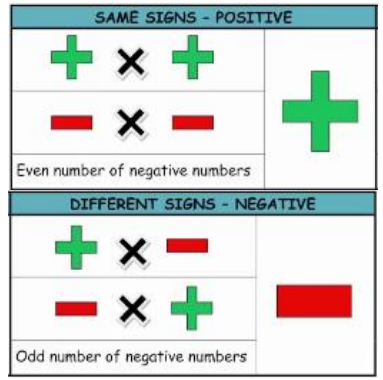
Addition and subtraction





Negative numbers - directed





Year 7 Topic 1 Number and Calculations Practice Questions

Addition and subtraction

1) 34 + 57
2) 237 + 645
3) 64 – 37
4) 234 – 148
5) 2.3 + 5.7
6) 5.9 – 3. 6
7) 2.45 + 4.6
8) 10 – 3.29

Multiplication and division

1) 6 x 7
2) 3 x 17
3) 234 x 27
4) 2.4 x 3.57
5) 28 ÷ 7
6) 5096 ÷ 14
7) 9310 ÷ 15
8) 1.24 ÷ 0.4

BIDMAS

1) 3 x 4 + 5
2) $4 + 8 \times 3^2$
3) $(5 + 2)^2 \times 2$
4) 12 – 15 + 7
5) 5 x 21 ÷ 3
6) (4 + 2) ÷ (10 – 7)

Using a given number fact

Given that 49 x 253 = 12397

1) 4.9 x 25.3
2) 490 x 2.53
3) 123.97 ÷ 49
4) 1239.7 ÷ 253
5) 50 x 253

Types of number

2 5 8 10 13 14 16 18 64 From the list of numbers find,

1) An odd number
2) A multiple of 6
3) A square number
4) A cube number
5) Both a cube and square number
6) A prime number
7) A multiple of 7
8) Any factors of 16

Negative numbers

1) -3 x –4
2) -6 + -3
3) +18 ÷ -3
4) 6 - -5

Applying knowledge

Neil buys 30 pens, 30 pencils, 30 rulers and 30 pencil cases.

Price list	
pens	6 for 82p
pencils	15 for 45p
rulers	10 for £1.25
pencil cases	37p each

What is the total amount of money Neil spends?

The price list shows the normal price of some items in a catalogue.

Normal Price	
Bubble bath	£3.00
Shower gel	£2.95
Soap	£2.50
Hand cream	£3.50

There is a special offer.
Joanna can buy any 3 **different** items from the list for a total price of £5

Work out the most money she can save.

Year 7 Topic 2 Factors and Multiples Student Knowledge Organiser

Key words and definitions

Factors – numbers which divide into another number with no remainder

Multiples – answers to times tables

Prime factor decomposition – write a number as a product of its prime factors

Rounding – make a number simpler but still close to the original number

Significant figures – the importance of each single digit in a number

Approximate – estimate calculations by rounding each number to 1 significant figure first

Factors and Highest common factor

To find the factors of a number, find all of the numbers that can divide exactly into that number with no remainders
To find the HCF of two or more numbers, find the factors of each number and then find the highest number that appears in both lists

16 → 1, 2, 4, 8, 16

24 → 1, 2, 3, 4, 6, 8, 12, 24

So the highest common factor of 16 and 24 is 8

Multiples and LCM

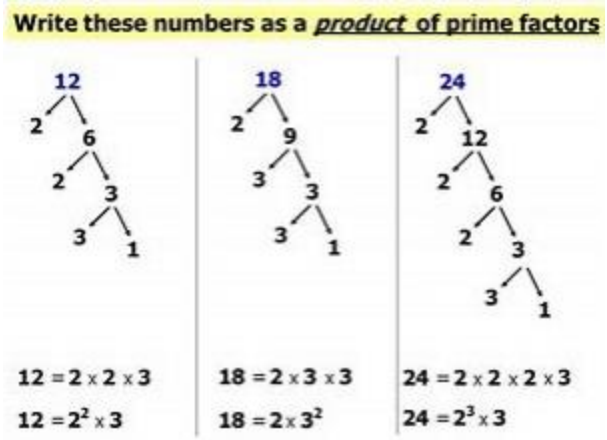
To find multiples of a number, list the answers in that ties table.
To find the LCM of two or more numbers, find multiples of each number then loo for the lowest number in each list

Multiples of 3:
0, 3, 6, 9, 12, 15, 18, 21, 24 ...

Multiples of 4:
0, 4, 8, 12, 16, 20, 24, 28 ...

The LCM of 3 and 4 is 12.

Prime factor decomposition



Significant figures

Rounding to 1.s.f

304.2 ≈ 300 18.97 ≈ 20 2.47 ≈ 2 0.3901 ≈ 0.4

Approximate calculations

Round each number to 1 significant figure then calculate

19 x 1.73 ≈ 40
20 x 2

98.1 x 41.8 ≈ 4000
100 x 40

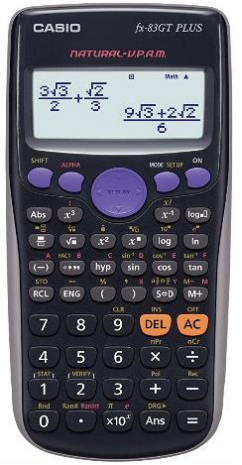
73.8 ÷ 4.85 ≈ 14
70 ÷ 5 = 14

$\frac{(82.1+17.3)}{(11.4)} \approx 10$
$\frac{80+20}{10} = \frac{100}{10}$

$\frac{4.1\times6.4}{3.25+4.91} \approx 3$
$\frac{4\times6}{3+5} = \frac{24}{8}$

$\frac{22.03\times38.4}{0.179} =$

Using a calculator



Be familiar with, and be able to use the following keys – this is not an exhaustive list.

Brackets keys

Change between fraction and decimal form


Fraction key


Find the square root of a number

Press to square a number

Year 7 Topic 2 Factors and Multiples Practice Questions

Types of numbers

Here is a list of 8 numbers.

15 16 17 18 20 22 24 29

(a) Write down a prime number

.....

(b) Write down a factor of 30

.....

(c) Write down a multiple of 3, which is even.

.....

Here is a list of numbers

6 10 11 16 24 30 40

(a) Write down a multiple of 20

.....

(b) Write down a factor of 12

.....

(c) Write down a prime number

.....

Product of prime factors

Write 28 as the product of its prime factors.

Write 18 as the product of its prime factors.

Express 36 as a product of its prime factors.

Express 144 as the product of its prime factors.
Write your answer in index form.

Problems

Jenny is organising a barbecue.
There are 30 bread rolls in a pack.
There are 16 sausages in a pack.
She needs **exactly** the same number of bread rolls as sausages.
What is the smallest number of each pack she must buy?
You **must** show all your working.

Tom, Sam and Matt are counting drum beats.
Tom hits a snare drum every 2 beats.
Sam hits a kettle drum every 5 beats.
Matt hits a bass drum every 8 beats.
Tom, Sam and Matt start by hitting their drums at the same time.
How many beats is it before Tom, Sam and Matt **next** hit their drums at the **same** time?

Polly Parrot squawks every 12 seconds.
Mr Toad croaks every 21 seconds.
They both make a noise at the same time.
After how many seconds will they next make a noise at the same time?

Year 7 Topic 3 Area and Volume Student Knowledge Organiser

Key words and definitions

Area – the area of a 2D shapes is the amount of space inside it

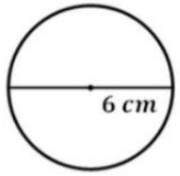
Perimeter – the perimeter is the total distance around the outside of a shape

Circumference – the distance around the outside of a circle

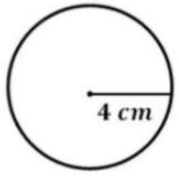
Surface area – sum of the areas of all the faces in a 3D shape

Volume – the amount of 3D space occupied by an object

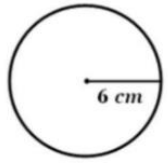
Area and Circumference



$C = \pi d$
$= 3.142 \times 6 \text{ cm}$
$= 18.85 \text{ cm}$

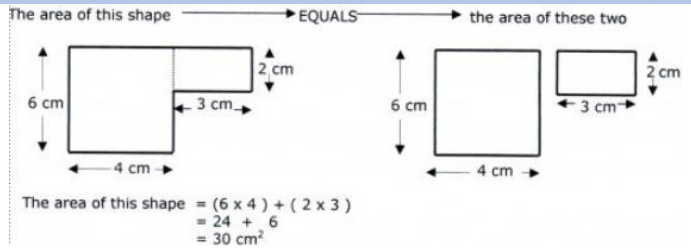


$C = 2\pi r$
$= 2 \times 3.142 \times 4 \text{ cm}$
$= 25.14 \text{ cm}$

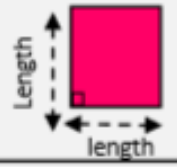
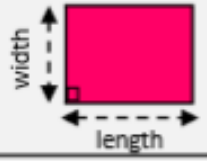
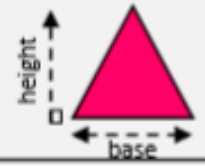
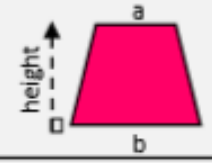
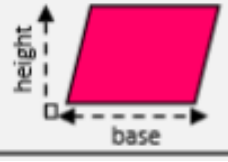


$A = \pi r^2$
$= 3.142 \times 6^2$
$= 3.142 \times 36$
$= 113.11 \text{ cm}^2$

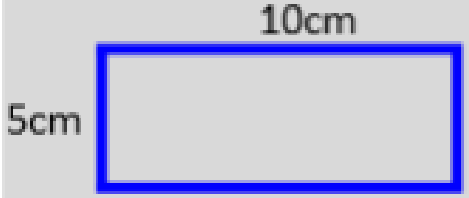
Compound area



Area

SQUARE A = Length²	
RECTANGLE A = Length x width	
TRIANGLE A = ½ Base x height*	
TRAPEIZUM A = ½ (a + b) x height*	
PARALLELOGRAM A = Base x height*	

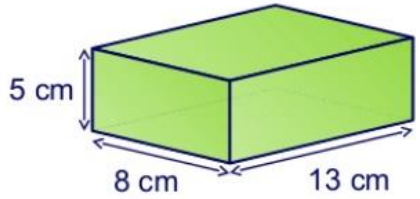
Perimeter



Add the sides
10 + 10 + 5 + 5
= 30cm

Volume of a cuboid

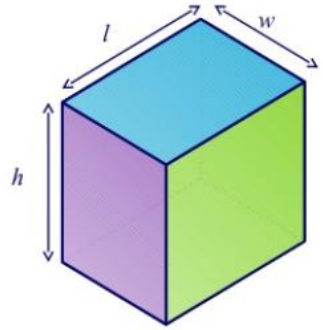
What is the volume of this cuboid?



Volume of cuboid
= length × width × height
= 5 × 8 × 13
= **520 cm³**

Surface area of a cuboid

We can find the formula for the surface area of a cuboid as follows.



Surface area of a cuboid =

$2 \times lw$	Top and bottom
$+ 2 \times hw$	Front and back
$+ 2 \times lh$	Left and right side

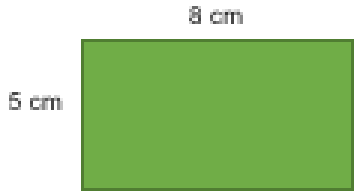
$= 2lw + 2hw + 2lh$

Year 7 Topic 3 Area and Volume Student Knowledge Organiser

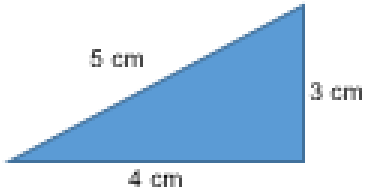
Area and perimeter

Calculate the area and perimeter of the following shapes:

1)

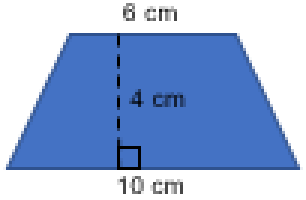


2)



Calculate the area of the following shapes:

3)



Circles

Calculate the area and circumference of the following shapes:

1)

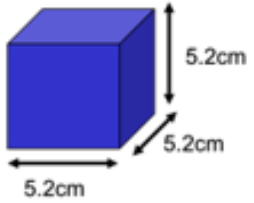
2)

Surface Area

1) How many vertices does a cube have?

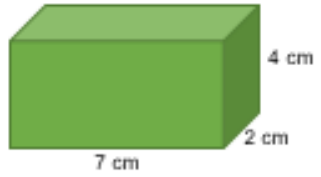
2) Draw the net of a cube

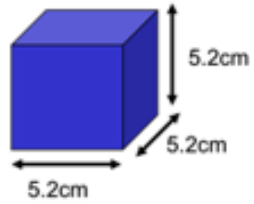
3) Calculate the surface area of the following:



Volume

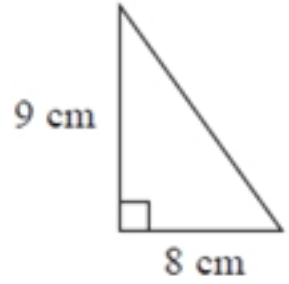
Calculate the volume of the following

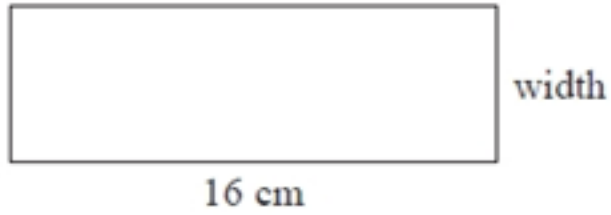




Problem Solving

Here are a triangle and a rectangle.





The area of the rectangle is 6 times the area of the triangle.

Work out the width of the rectangle.

Year 7 Topic 4 Charts and Averages Student Knowledge Organiser

Key words and definitions

Primary data – data collected first hand, in a survey or experiment

Secondary data – data collected by someone else

Discrete – can only take certain values, usually something you can count

Continuous – data that can be measured, can take any value

Average – a typical value for some data, see mean, mode and median

Distribution – how data is spread out, takes account of average & range

Averages

Mode
Most common

Mean
Sum of values / Number of values

Median
Middle value in ascending order

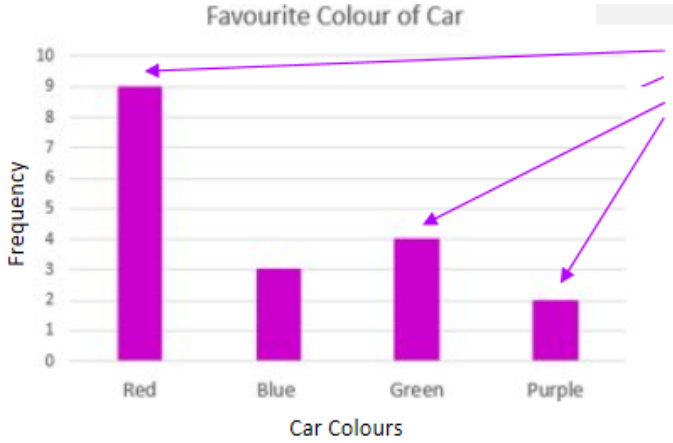
Average	Advantages	Disadvantages
Mean	Every value makes a difference	Affected by extreme values
Median	Not affected by extreme values	May not change if a data value changes
Mode	Easy to find. Not affected by extreme values. Can be non-numerical	There may not be one. There may be more than one.

Tally Charts and bar charts

Complete a tally chart for the most popular colour of car

Red, blue, red, green, red, purple, red, green, red, purple, green, blue, red, green, blue, red, red, red

Colour	Tally	Frequency
Red	𝍸 IIII	9
Blue	III	3
Green	IIII	4
Purple	II	2



The number of red, blue, green and purple cars is the **frequency (height of the bars).**

IMPORTANT

The **bars** are the **SAME width**

The **gaps** between the bars are the **SAME width**

Both axes are **labelled**

The graph has a **title**

Frequency starts at 0

Range

Range

Largest value – smallest value

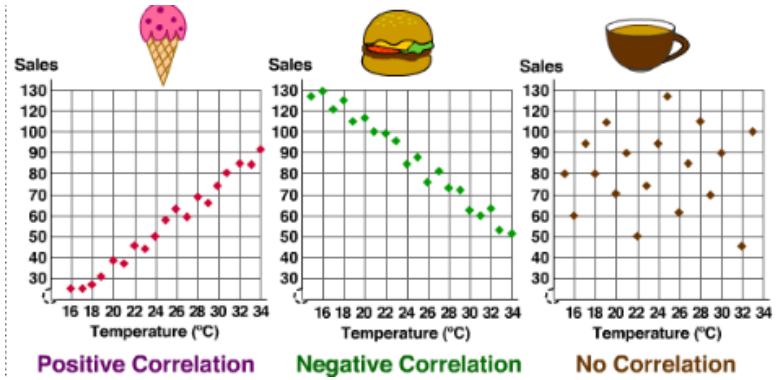
Pie chart

1	Sum (add up) the frequency
2	360° ÷ frequency 360° ÷ 72 = 5
3	Multiply each category x5 to find sector size

Fish	Frequency	
Perch	10	x 5 = 50°
Bream	23	x 5 = 115°
Carp	39	x 5 = 195°
TOTAL	72	360°
360° ÷ 72 = 5		

Draw an accurate pie chart to show this information.
This table give information about then number of fish in a lake.

Scatter graphs



Year 7 Topic 4 Charts and averages Student Knowledge Organiser

Averages

1) Here are fifteen numbers.
10 12 13 15 15 17 19 20 20 20 21 25 25 25 25

a) Find the mode.

b) Find the median.

c) Work out the range.

2) A rugby team played 7 games.
Here is the number of points they scored in each game.
3 5 8 9 12 12 16

a) Find the median.

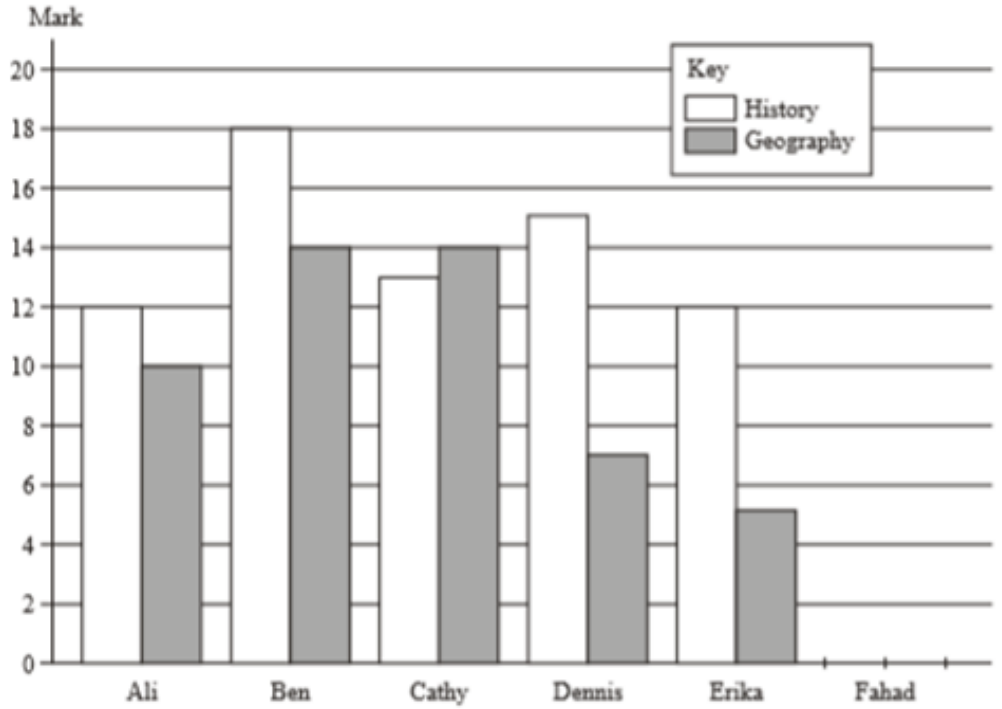
The rugby team played another game.
They scored 11 points.

b) Find the median number of points scored in these 8 games.

3) The mean of eight numbers is 41
The mean of two of the numbers is 29
What is the mean of the other six numbers?

Bar Carts

Six students each sat a history test and a geography test.
The marks of five of the students, in each of the tests, were used to draw the bar chart.



(a) How many marks did Ali get in his history test?

.....

(b) How many marks did Dennis get in his geography test?

.....

(c) One student got a lower mark in the history test than in the geography test.
Write down the name of this student.

Pie charts

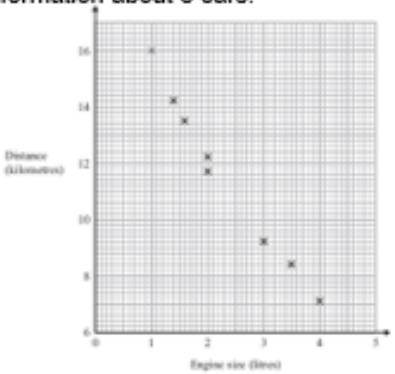
Harry asked each student in his class how they travelled to school that day.
He used the results to draw this pie chart.

How did most of the students travel to school?

Harry asked a total of 24 students.
Work out the number of students who cycled to school.

Scatter Graphs

The scatter graph shows some information about 8 cars.



What type of correlation does the scatter graph show?

A car has an engine size of 2.5 litres.
Estimate the distance travelled on one litre.

Year 7 Topic 5 Fractions, decimals and percentages Student Knowledge Organiser

Key words and definitions

Fraction – represents part(s) of a whole

Percentage – how many parts per hundred

Equivalent – equal in value

Improper – a fraction where the numerator (top number) is larger than the denominator (bottom number)

Fraction, decimal and percentage equivalence

Fractions	Decimals	Percentages
$\frac{1}{5}$	0.2	20%
$\frac{3}{4}$	0.75	75%
$\frac{1}{8}$	0.125	12.5%
$\frac{1}{2}$	0.5	50%

Equivalent fractions

$\frac{6}{48} \xrightarrow{\div 2} \frac{3}{24} \xrightarrow{\div 3} \frac{1}{8}$

Addition and subtraction of fractions

Add	$\frac{1}{2}+\frac{1}{3}=\frac{1\times3}{2\times3}+\frac{1\times2}{3\times2}=\frac{3}{6}+\frac{2}{6}=\frac{5}{6}$	6 is the lowest common denominator for 2 and 3
Subtract	$\frac{7}{8}-\frac{1}{3}=\frac{7\times3}{8\times3}-\frac{1\times8}{3\times8}=\frac{21}{24}-\frac{8}{24}=\frac{13}{24}$	24 is the lowest common denominator for 8 and 3

Multiplying and dividing fractions

Multiply	$\frac{3}{4}\times\frac{1}{3}=\frac{3}{12}=\frac{1}{4}$	Multiply the numerators, multiply the denominators and the then simplify if possible
Divide	$\frac{1}{2}\div\frac{1}{3}=\frac{1}{2}\times\frac{3}{1}=\frac{3}{2}=1\frac{1}{2}$	Turn the 2nd fraction over (reciprocal) and change the sign to multiplication

Finding a fraction of an amount

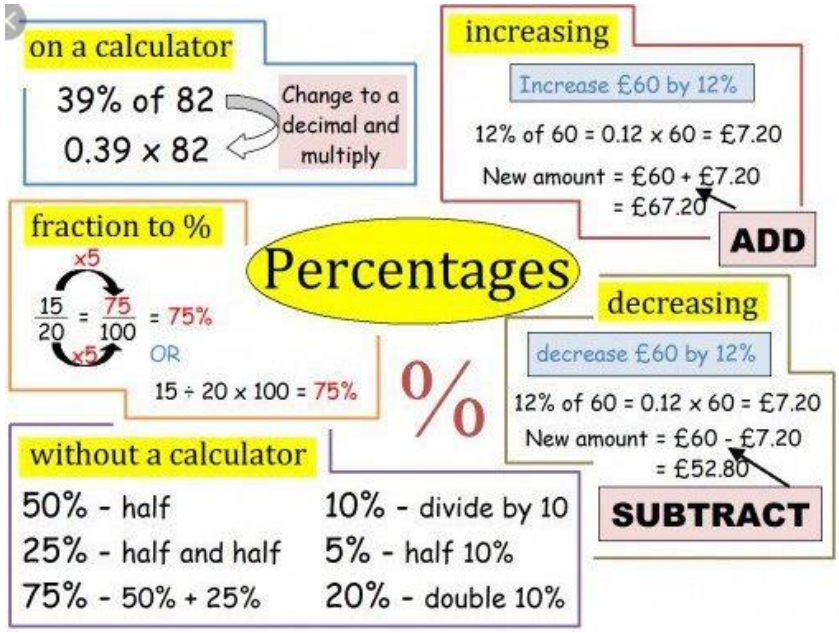
When we work out a fraction of an amount we

multiply by the numerator
and
divide by the denominator

For example,

$\frac{2}{3}$ of 18 litres = 18 litres ÷ 3 × 2
= 6 litres × 2
= 12 litres

Finding a percentages



Improper fractions and mixed numbers

Improper to mixed number & visa versa

$\frac{14}{3}$ How many 3's fit into 14? $4\frac{2}{3}$

$7\frac{2}{5}$ $(5\times7)+2=$ $\frac{37}{5}$

Year 7 Topic 5 Fractions, decimals and percentages Student Knowledge Organiser

Simplifying Fractions

1) Simplify $\frac{9}{18}$

2) Simplify $\frac{12}{20}$

3) Simplify $\frac{16}{24}$

4) Write as an improper fraction $2\frac{3}{4}$

5) Write as a mixed number $\frac{27}{6}$

Calculating with fractions

Give your answers in their simplest form.

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

2) $\frac{5}{12} \times \frac{6}{15}$

3) $\frac{16}{27} \div \frac{8}{9}$

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

Equivalent fractions

1) Complete the table below.

Fraction	Decimal	Percentage
½		
	0.6	
		15%
¼		

2) Would you rather have ¾, 70% or 0.72 of a pizza? Why?

Percentage of an amount

1) Calculate 40% of 600 ml.

2) Calculate 67% of £120.

3) Bobby went to the shop and there was a 20% sale. He was going to buy a top for £24. How much does he save?

4) Sarah went to the shop and there was a 15% sale. She was going to buy a CD for £8. How much does she save?

Year 7 Topic 6 Expressions Student Knowledge Organiser

Key words and definitions

Expression – numbers, symbols and operators grouped together

Term – number or variable or numbers and variables multiplied together

Equation – a mathematical statement that shows two things are equal

Expand – multiply to remove brackets

Factorise – the reverse of expanding, taking out a common factors

Substitution – putting numbers in place of letters

Simplify – collect like terms

Simplifying expressions

Simplifying

3e + 6r - e +5t

2e + 11t

If there is **no sign** in front of the term, it is *POSITIVE*

Substitution

Evaluate 3a - 2b, for a = 10 and b = 4

$3a - 2b \quad (a = 10 \quad b = 4)$

$= 3(10) - 2(4)$

$= 30 - 8$

$= 22$ ✓

Expand a single bracket

Expanding single brackets

3 (x + 2)

3x + 6

Common misconceptions

3 (x + 2)

3x + 5 ✗ This is incorrect

The last term has been **added INSTEAD of multiplying.**

Solve simple equations

Balancing method

8a - 5 = 11

+5 +5

8a = 16

÷8 ÷8

a = 2

Function machine method

8a - 5 = 11

a → x 8 → - 5 → 11

2 ← ÷ 8 ← + 5 ← 11

a = 2

Factorising

4x+16

4 is a factor of both 4 and 16.

4(x+4)

Year 7 Topic 6 Expressions Student Knowledge Organiser

Simplifying

a) $3x + 6y - 4y + 2x$

b) $y + y$

c) $3p \times 5q$

d) $p \times p \times p \times p$

Substituting

1) Find $3x + 5y$ when $x = 4$ and $y = 2$

2) Find abc when $a = 2$, $b = 3$ and $c = 5$

3) Find $7s - 2t$ when $s = 4$ and $t = -3$

4) Find $4(2n - 3)$ when $n = 5$

Expanding

1) $3(a + 4)$

2) $5(c + 6b)$

3) $4(x - 3y)$

4) $a(a + 5)$

5) $x(4y - 2x)$

Expanding and simplifying

1) $4(2x + 3y) + 2(x + 2y)$

2) $5(a + 3b) - 3(a - b)$

3) $4(x + 4) - 2x(x + 5)$

Factorising

1) $3x + 33$

2) $5y + 25$

3) $4a - 18$

4) $x^2 + 4x$

Writing expressions

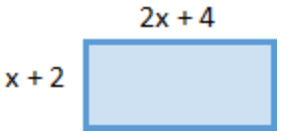
My age is C, write expressions for the ages of the members of my family if:

a) My brother is 3 years older than me

b) My sister is 2 years younger than me

c) My mum is double my age

Write an **expression** for the **area** of the rectangle.



Year 7 Topic 7 Shapes and angles Student Knowledge Organiser

Key words and definitions

Triangle – a three sided shape

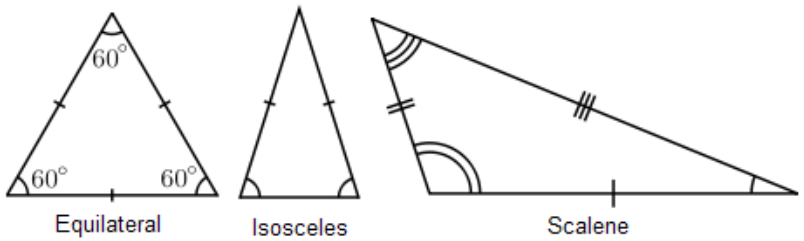
Quadrilateral – a general name for a four sided shape

Parallel lines – lines which never meet, they stay the same distance apart

Plan view – looking down on an object from above

Elevation – view from the front or side of an object

Types of triangles



Angles in parallel lines

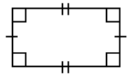
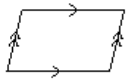
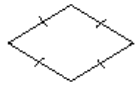
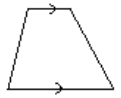
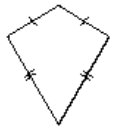
Corresponding Angles

Corresponding angles are equal.
They can be found in F shapes.

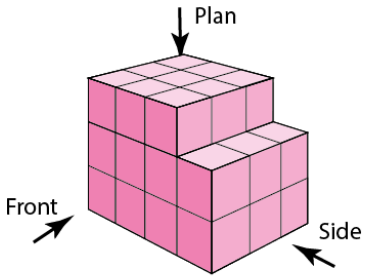
Alternate Angles

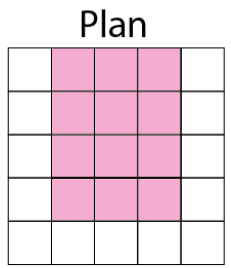
Alternate angles are equal.
They can be found in Z shapes.

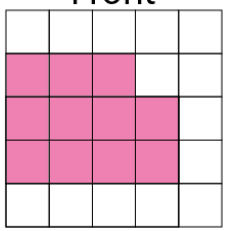
Types of special quadrilaterals

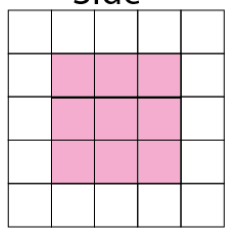
Quadrilateral	*Properties*	
Rectangle	4 right angles and opposite sides equal	
Square	4 right angles and 4 equal sides	
Parallelogram	Two pairs of parallel sides and opposite sides equal	
Rhombus	Parallelogram with 4 equal sides	
Trapezium	Two sides are parallel	
Kite	Two pairs of adjacent sides of the same length	

Plans and elevations



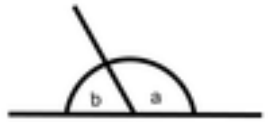






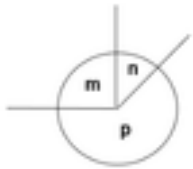
Angle facts

The angles on a straight line add up to 180°.
a + b = 180°



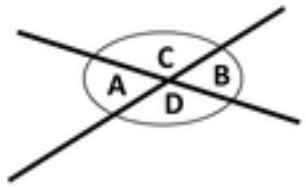
The angles in a triangle add up to 180°.
a + b + c = 180°

The angles at a point add up to 360°.
m + n + p = 360°



The angles in a quadrilateral up to 360°.
w + x + y + z = 360°

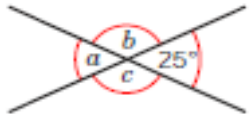
Vertically opposite angles are equal.
A = B
D = C



Year 7 Topic 7 Shapes and angles Practice Questions

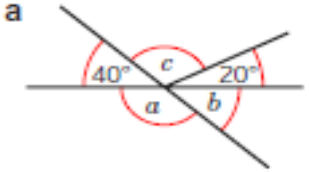
Angles facts

Reasoning Work out the angles marked with letters.
Give your reasons.

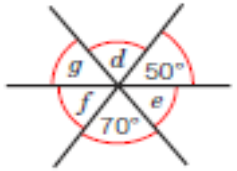


Reasoning Work out the angles marked with letters.
Give reasons for your answers.

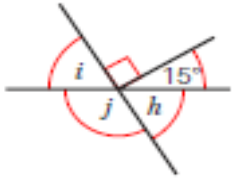
a



b



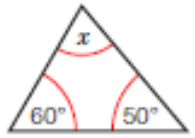
c



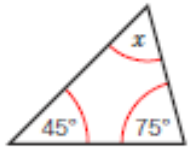
Angles in triangles and quadrilaterals

Calculate the size of each unknown angle.

a



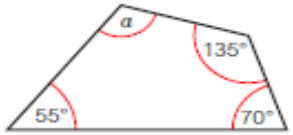
b



c

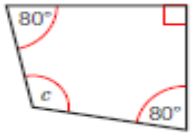
Calculate the size of each unknown angle.

a

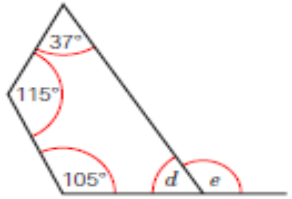


b

c



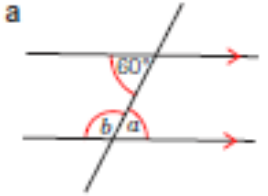
d



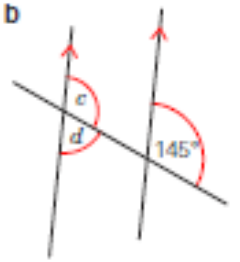
Angles in parallel lines

Reasoning Work out the angles marked with letters.
Give reasons for your answers.

a



b



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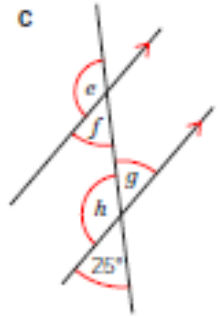
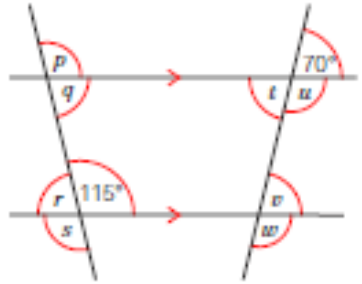


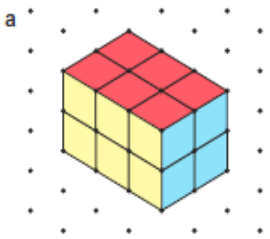
d



Plans and elevations

Draw the plan, the front elevation and the side elevation of each 3D solid on squared paper.

a



b

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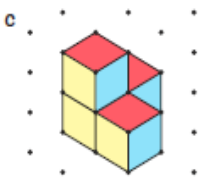
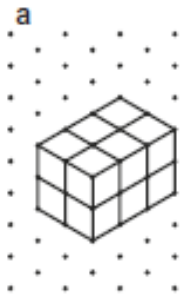


These solids are made from centimetre cubes.
Draw the plan, front elevation and side elevation of each solid on squared paper.

a



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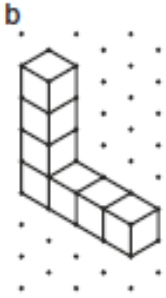
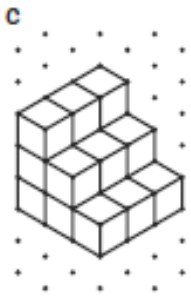
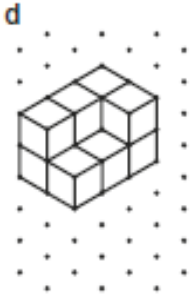


c



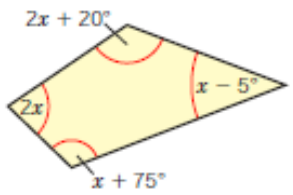
d



Angle problems

The diagram shows a quadrilateral.

a Write an equation in terms of x for the sum of the angles.
b Solve your equation to find the value of x.
c Write down the sizes of the four angles in the quadrilateral.



Problem-solving In triangle ABC, ∠ABC is twice the size of ∠BAC and ∠BCA is three times the size of ∠BAC.
Work out the sizes of the three angles in the triangle.

Year 7 Topic 8 Ratio Student Knowledge Organiser

Key words and definitions

Ratio – Measuring how two quantities compare to each other in size

Proportion – comparing two or more things against the whole

Bar model – a pictorial representation of a number to help understanding

Simplify – reduce to its simplest terms

Highest common factor – the highest number that can be divided exactly in to two or more numbers

Simplify ratio

Ratios can be fully **simplified** just like fractions.

To simplify a ratio, divide all of the numbers in the ratio by the same number (**highest common factor**) until they cannot be divided any more.

Simplify: 6 : 12

Divide both by 6

1 : 2

Write in the form 1:n

When asked to write a ratio in the format 1 : n, you need to **divide BOTH sides** by **the ratio where the 1 is.**

Write 7 : 21 in the ratio 1: n

7 : 21 divide both sides by 7

1 : 3

Share in a given ratio

Monty and Mosaurus get A TOTAL of £72 pocket money.

They share it in the **ratio 5 : 3**

How much do they each get?

- **Add the ratios: 3 + 5 = 8**
- **Divide 72 by 8 (72 ÷ 8 = 9)**

Each ONE portion is worth £9

Monty has 5 portions

5 x 9 = £45

Mosaurus has 3 portions

3 x 9 = £27

In a school the ratio of boys to girls is 9 : 4.

There are 270 boys in the school.

How many students are there in the school altogether?

Divide the total number of boys by the boy's ratio

270 ÷ 9 = 30

This gives the number for 1 'portion'

Girls

4 x 30 = 120

Total = 270 + 120 = 390

Recipes

A recipe for 6 people uses 900g of mince. How much mince is needed for

a 12 people

P : M

6 : 900g

×2 → 12 : 1800g ×2

b 3 people

P : M

6 : 900g

÷2 → 3 : 450g ÷2

c 9 people?

6 people + 3 people = 9 people

900 + 450 = 1350g

Exchange rates

The exchange rate is:

£1 buys $2.12

Find how many dollars ($) can be bought for £1500

£1 = $2·12 (×1500)

£1500 =

$ ..... (1)

Maps and scales

6. Each diagram is part of a map. Find the actual distance between the two places for each map. Give your answers in metres.

(a) Scale 1 : 12 500

1 cm : 12 500cm

2.6 cm : 32 500 cm (×2·6)

if 100 cm is 1m

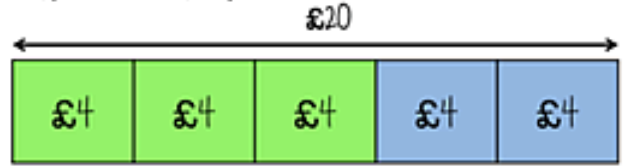
32 500cm is 325 m

32500

Bar modelling

sharing a quantity in a given ratio

share £20 in the ratio 3 : 2



draw bar model showing ratio 3 : 2 and total length £20

find 1 part is £4

answer is £12 : £8

Year 7 Topic 8 Ratio Practice Questions

Simplify ratio

Write the ratio of blue beads to yellow beads for each necklace.
Simplify each ratio if possible. The first one has been started for you.

a 

blue : yellow = 4 : 2 = 2 : ☐

b 

c 

Write each ratio in its simplest form.

a 2 : 20	**b** 25 : 5	**c** 4 : 24	**d** 6 : 30
e 8 : 24	**f** 6 : 10	**g** 30 : 25	**h** 24 : 10
i 16 : 6	**j** 40 : 15		

Write each ratio as a whole number ratio in its simplest form.

a 0.4 : 6 **b** 3.5 : 4.2 **c** 45 : 13.5 **d** 25.6 : 46.4

Discussion What should you multiply by if a number in a ratio has 2 decimal places?

Write each ratio as a whole number ratio in its simplest form.

a 0.25 : 3.1 **b** 1.4 : 0.28 **c** 1.62 : 1.8 **d** 4.8 : 11.2

Which of these ratios are equivalent?

A 36 : 16	**B** 135 : 60
C 28 : 16	**D** 126 : 56
E 49 : 28	

Recipes

Real A recipe for six people uses four eggs. How many eggs are needed for

a 12 people
b 3 people
c 9 people
d 15 people?

A recipe for 4 people uses 6 eggs. How many eggs are needed for

a 8 people **b** 2 people **c** 6 people **d** 10 people?

Scale

Write these conversions as ratios.

a mm : cm	**b** cm : m	**c** km : m
d kg : g	**e** ml : l	**f** m : cm

Complete these conversions.

a 9 m = ☐ cm	**b** 2 cm = ☐ mm	**c** 7 l = ☐ ml
d 5000 m = ☐ km	**e** 200 cm = ☐ m	**f** 30 mm = ☐ cm
g 12000 ml = ☐ l	**h** 10 cm = ☐ mm	**i** 100 m = ☐ km

Complete these conversions.

a 3.6 m = ☐ cm	**b** 2.8 kg = ☐ g	**c** 3.1 cm = ☐ mm
d 8.9 kg = ☐ g	**e** 3900 m = ☐ km	**f** 630 cm = ☐ m
g 84 mm = ☐ cm	**h** 8600 ml = ☐ l	**i** 70 m = ☐ cm

Sharing in a given ratio

Share these amounts between Alice and Ben in the ratios given.
Show how you check your answers.

a £21 in the ratio 2 : 1	**b** £45 in the ratio 2 : 3
c £96 in the ratio 7 : 5	**d** £28 in the ratio 4 : 3
e £72 in the ratio 3 : 5	**f** £60 in the ratio 11 : 4

Talil is going to make some concrete mix.
He needs to mix cement, sand and gravel in the ratio 1 : 3 : 5 by weight.
Talil wants to make 180 kg of concrete mix. Talil has

- 15 kg of cement
- 85 kg of sand
- 100 kg of gravel

Does Talil have enough cement, sand and gravel to make the concrete mix? **(4 marks)**

Ratio problems

Real Hummingbirds eat nectar made from sugar and water in the ratio 1 : 4. How much water is needed for 3 teaspoons of sugar?

Real A recipe for Thai chicken uses Thai sauce and fresh ginger in the ratio 2 : 1. Anna uses 4 tablespoons of Thai sauce. How much ginger does she use?

Finance / Problem-solving Harry invests some money in low-risk and high-risk investments in the ratio 7 : 3.
He invests £1800 into the high-risk investments.
How much money does he invest altogether?
Discussion Is there more than one way to work out the answer to this question?

Year 7 Topic 9 Equations Student Knowledge Organiser

Key words and definitions

Equation – a statement that two things are equal, each side of equals sign

Substitution – replacing an unknown with a number

Unknown – a number we do not know, usually shown by a letter

Solve – find the value of a variable that makes an equation true

Expand – multiply out the brackets

Inverse – doing the opposite function

Substitution

Evaluate 3a - 2b, for a = 10 and b = 4

$3a - 2b \quad (a = 10 \quad b = 4)$

$= 3(10) - 2(4)$

$= 30 - 8$

$= 22$ ✓

Simple equations

Solve the equation $x - 3 = 7$

$x - 3 = 7$ — Visualise the equation as balanced scales.

$x - 3 + 3 = 7 + 3$ — The inverse of −3 is + 3. Do this to both sides to keep the equation balanced.

$x = 7 + 3$

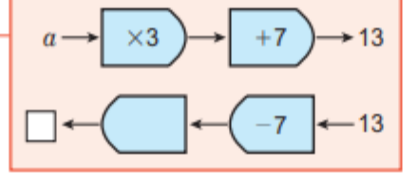
$x = 10$

Check: $x - 3 = 10 - 3 = 7$ ✓

3 term equations

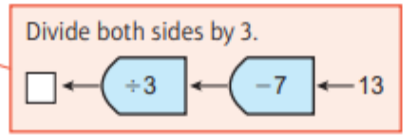
Solve the equation $3a + 7 = 13$

$3a + 7 - 7 = 13 - 7$ — Subtract 7 from both sides.



$3a = 6$

$\frac{3a}{3} = \frac{6}{3}$ — Divide both sides by 3.



$a = 2$

Check: $3a + 7 = 3 \times 2 + 7 = 13$ ✓

Equations with brackets

$2(4p + 1) = 18$ {Use Distributive Law}

$8p + 2 = 18$ {Subtract 2 from both sides}

$8p + 2 - 2 = 18 - 2$

$8p = 16$ {Divide both sides by 8}

$\frac{8p}{8} = \frac{16}{8}$

$p = 2$

Unknown on both sides

Solve $4d + 17 = 8d - 3$

$4d + 17 = 8d - 3$ — Visualise the equation as balanced scales. Subtract $4d$ from both sides.

$-4d \quad -4d$

$17 = 4d - 3$

$17 + 3 = 4d - 3 + 3$ — The inverse of −3 is + 3. Do this to both sides.

$20 = 4d$ — Divide both sides by 4.

$5 = d$

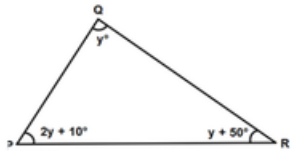
$d = 5$

Check: LHS = $4d + 17 = 4 \times 5 + 17 = 37$

RHS = $8d - 3 = 8 \times 5 - 3 = 37$ ✓

Forming and solving equations

PQR is a triangle. Form and solve an equation to find the value of y.



What do the angles in a triangle add up to?

180

How can we write an equation for this?

$2y + 10 + y + y + 50 = 180$

Can we collect like terms?

$4y + 60 = 180$

$4y = 120$

$y = 30$

Year 7 Topic 9 Equations Practice Questions

Simple equations

Solve

a $a + 3 = 4$ b $c - 6 = 4$

c $15 = g + 4$ d $21 + h = 23$

e $11 = k - 6$ f $l - 7 = 14$

Solve

a $4h = 40$ b $3m = 15$

3 term equations

Solve these equations.

a $2a + 1 = 5$ b $2a - 1 = 5$

c $3a + 2 = 8$ d $3a + 5 = 4$

e $7f - 12 = 9$ f $-5c + 12 = 2$

g $3a + 1 = 8$ h $2p - 4 = -5$

i $8t + 2 = -3$

Equations with brackets

Expand and solve

a $5(a - 5) = 70$ b $6(b + 5) = 30$

c $3(d - 5) = 15$ d $3(2d - 5) = 27$

e $4(m - 4) = 12$ f $9(b - 11) = 9$

g $7(4 - c) = 35$ h $-2(e + 2) = -10$

i $-3(7 - f) = -3$

Solve

a $\frac{3c + 4}{3} = 2$

b $\frac{4g - 5}{5} = 3$

c $\frac{5g + 7}{4} = 6$

Unknowns on both sides

Solve these equations.

a $2a + 9 = a + 5$ b $8b + 9 = 3b + 14$ c $4d + 17 = 8d - 3$

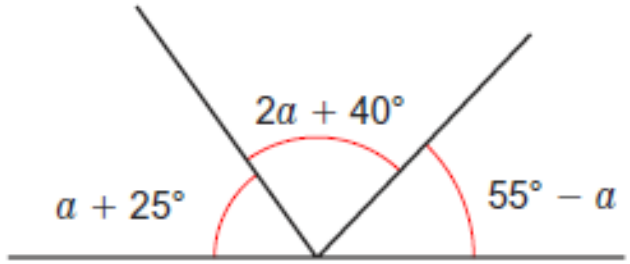
d $6v - 7 = 3v + 7$ e $3e = 7e - 18$ f $2h + 7 = 8h - 1$

Solve these equations.

a $40 - 3x = 1$ b $9 - 5x = 3x + 1$ c $1 - 6x = 9 - 7x$

d $8 + 3x = 1 - 4x$ e $13 - 2x = 3 - 7x$ f $3 - 9x = 5 - 6x$

Form and solve



Find the value of a.

Reasoning The length of a rectangle is 3 cm greater than its width. The perimeter of the rectangle is 54 cm.

Find its length.

Year 7 Topic 10 Sequences Student Knowledge Organiser

Key words and definitions

Sequence – a list of numbers or patterns in a special order

Pattern – things arranged following a rule

nth term – a formula to help you find any term in a sequence

Position-to-term – this is another way of saying the nth term

Term-to-term – find the next number in a sequence if you know the previous one

Linear – a sequence which increase/decrease by the same amount each time

Using a term-to-term rule

Find the next term in the sequence 28, 37, 46, 55, 64, ___.

① ② ③ ④ ⑤ ⑥

28, 37, 46, 55, 64, 73, ...

+9 +9 +9 +9 +9

ARITHMETIC SEQUENCE

Answer 73

nth term of a linear sequence

3 8 13 18 23

+5 +5 +5 +5

1. Find the *difference* between each term:
   5
2. Always put 'n' next to it (n = term number)
   5n
3. Add or subtract to get the first term in the sequence?
   5-2 = 3

The nth term is **5n -2**

Geometric sequence

A geometric sequence is one where to get from one term to the next you multiply by the same number each time. This number is called the *common ratio, r*.

Eg 1 2 3 4

2, 10, 50, 250 ...

x5 x5 x5

r=5

Sequences from patterns

Shape number	1	2	3	4	5	6	7	8	9	10	50
Number of matchsticks	3	5	7	9	11	13	15	17	19	21	101
Function rule	Number of matchsticks = Shape number x 2 + 1										

Finding missing terms

Find the missing terms and rule for: 48, ___, 70 , ___, 92

48 → 70 (2 jumps!) gives us: Add 22

So our rule for one jump is half this → Add 11 (common diff = +11)

Number after 48 → 48 + 11= 59

[CHECK: 59 → 59 + 11 = 70!]

Number after 70 → 70 + 11 = 81

Year 7 Topic 10 Sequences Practice Questions

Term to term rules

Write down the next two terms in each sequence.

a 1.5, 2, 2.5, 3, ☐, ☐

b $-\frac{2}{3}, -\frac{1}{3}, 0, \frac{1}{3}$, ☐, ☐

c 3.5, 2.7, 1.9, 1.1, ☐, ☐

d −1.5, −2.5, −3.5, −4.5, ☐, ☐

e $\frac{3}{5}, -\frac{1}{5}, -1, -1\frac{4}{5}$, ☐, ☐

f −10.6, −9.9, −9.2, −8.5, ☐, ☐

Use the first term and the term-to-term rule to generate the first five terms of each sequence.

a start at 3 and add 0.4

b start at 10 and subtract 0.2

c start at 7 and add 3

d start at 7 and add 2

e start at −3 and add 2

f start at −7 and subtract 5

In a Fibonacci sequence, the term-to-term rule is 'add the two previous terms to get the next one'. Write the next 3 terms in each Fibonacci sequence.

a 1, 1, 2, 3, 5, ...

b 3, 3, 6, 9, 15, ...

c 5, 5, 10, 15, 25, ...

Patterns

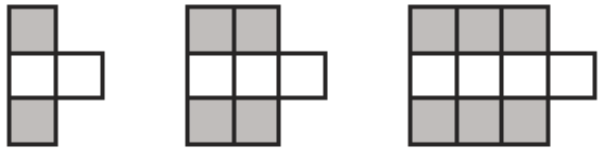
Here are some patterns made from white centimetre squares and grey centimetre squares.

a Draw pattern 4.

b Find the number of grey squares in Pattern 6.

A pattern has 20 grey squares.

c Work out how many white squares there are in this pattern.



Pattern 1 Pattern 2 Pattern 3

(4 marks)

Patterns and nth term

Here is a pattern made from dots.

4 7 10

a Draw the next pattern in the sequence.

b Copy and complete this table for the numbers of dots used to make the patterns.

Pattern number	1	2	3	4	5	6
Number of dots						

c Write, in terms of n, the number of dots needed for pattern n.

d How many dots are needed for pattern 30?

(5 marks)

nth term

Find the nth term for each sequence.

a 2, 5, 8, 11, 14, 17, ...

b 2, 6, 10, 14, 18, 22, ...

c 2, 7, 12, 17, 22, 27, ...

d 5, 7, 9, 11, 13, 15, ...

e 19, 17, 15, 13, 11, 9, ...

f 20, 18, 16, 14, 12, 10, ...

For each sequence, explain whether each number in the brackets is a term in the sequence or not.

a 2, 5, 8, 11, 14, ... (50, 66)

b 5, 8, 11, 14, 17, ... (50, 62)

c 1, 5, 9, 13, 17, ... (101, 150)

d 4, 9, 14, 19, 24, ... (168, 169)

e 40, 35, 30, 25, 20, ... (85, 4)

f 5, 11, 17, 23, 29, ... (119, 72)

Q6a hint Work out the nth term
☐n − ☐ = 50
n = ☐

Using the nth term given, find the 20th term.

a $2n$

b $3n + 1$

c $11 - 3n$

Q7 hint Use a function machine to help you visualise.

Find the nth term for each sequence. Use it to work out the 10th term.

a 1, 3, 5, 7, ...

b 3, 6, 9, 12, ...

c 10, 8, 6, 4, ...

d 3, 7, 11, 15, ...

Find the first term over 100 for each sequence.

a 9, 18, 27, 36, 45, ...

b 7, 10, 13, 16, 19, ...

c 4, 9, 14, 19, 24, ...

d 10, 15, 20, 25, 30, ...

Q9 hint
Solve nth term = 100

Year 7 Topic 11 Graphs Student Knowledge Organiser

Key words and definitions

Co-ordinate – values that show an exact position. First number tells you how far along, second number how far up or down

Mid points – a point that divides a line segment in two equal parts

Straight line graphs – plotting a constant rate of change between two variables

Distance-time graphs – describes a journey where the gradient will give the speed.

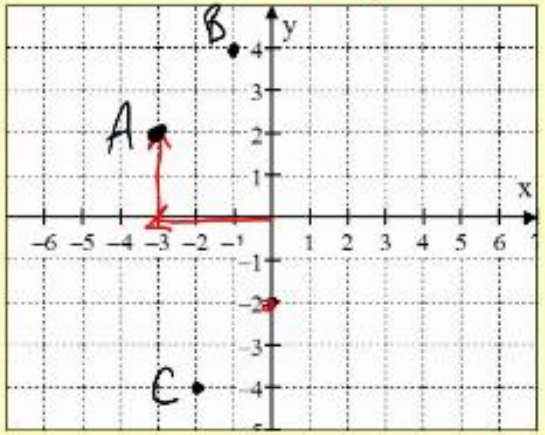
Plotting co-ordinates

Plot the following points.

(x, y)

(x, y)

1. A(-3, 2)
2. B(-1,4)
3. C(-2,-4)
4. D(0,-2)
5. E(3,0)



Drawing a straight line graph

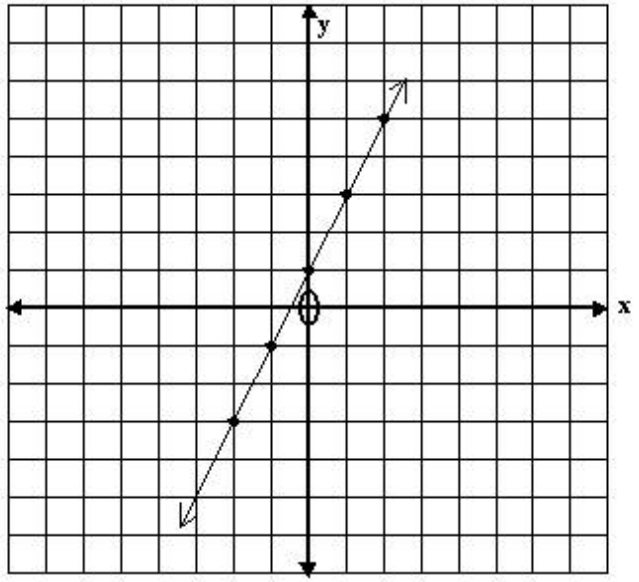
e.g. $y = 2x + 1$

x	2x + 1	y
-2	2(-2) + 1	-3
-1	2(-1) + 1	-1
0	2(0) + 1	1
1	2(1) + 1	3
2	2(2) + 1	5

Choose values for x.

Calculated y values

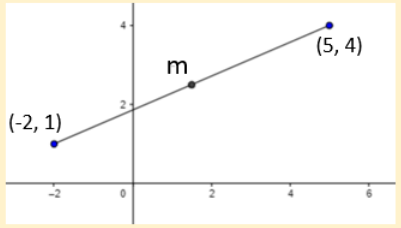
The points to plot are:
(-2,-3) (-1,-1) (0,1) (1,3) (2,5)



Finding a mid-point

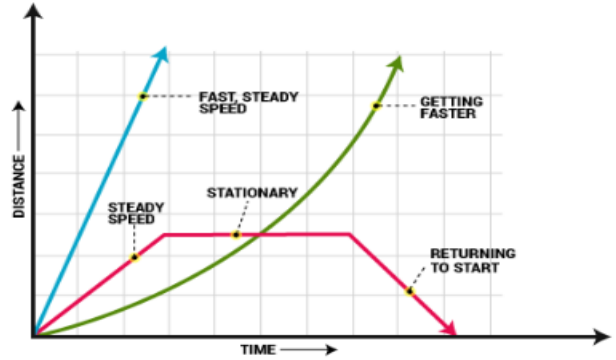
Midpoint Formula

$$\text{Midpoint} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$



$$m = \left(\frac{-2+5}{2}, \frac{1+4}{2}\right)$$
$$= \left(\frac{3}{2}, \frac{5}{2}\right)$$
$$= (1.5, 2.5)$$

Distance time graphs



Year 7 Topic 11 Graphs Practice Questions

Coordinates and midpoints

Reasoning a David uses this rule to generate coordinates.
The x-coordinate is always 1, no matter what the y-coordinate is.
Which of these coordinate pairs satisfy David's rule?
(1, 5), (5, 1), (1, 1), (–1, 3), (1, 0), (1, 4), (3, 1), (1, 2)

b Draw a coordinate grid from –5 to +5 on both axes.
Plot the points from part **a** that satisfy David's rule.
Reflect What do you notice about the points you have plotted?

c Charlie uses this rule to generate coordinates.
The x-coordinate is always 3, for any y-coordinate.
Charlie generates the coordinates (3, 0), (3, –2), (3, 4) and (3, 2).
Where do you expect these points to be on the grid?

d Plot the points on the same grid. Were you correct?

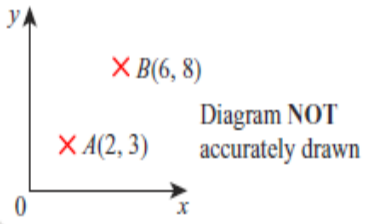


Diagram **NOT** accurately drawn

The point A has coordinates (2, 3).
The point B has coordinates (6, 8).
M is the midpoint of the line AB.
Find the coordinates of M. **(2 marks)**
June 2014, Q1, 1MA0/2H

Work out the midpoints of the line segments with these start and end points.

a (3, 5) and (7, 9) b (2, 7) and (5, 10)
c (–3, 4) and (1, 6) d (–2, –5) and (0, 3)

Straight line graphs

a Copy and complete the tables of values for these straight-line graphs.

i

x	–3	–2	–1	0	1	2	3
$y = x + 1$			0	1			

ii

x	–3	–2	–1	0	1	2	3
$y = 2x - 3$			–5	–3			

b Draw a coordinate grid with –3 to +3 on the x-axis and –8 to +8 on the y-axis.
Draw and label the graphs of $y = x + 1$ and $y = 2x - 3$, using your tables of values from part **a**.

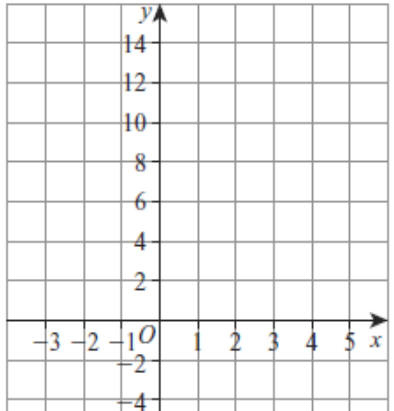
Draw and label these straight-line graphs for $x = -3$ to $+3$.
Copy the coordinate grid from **Q6**. Draw all four graphs on the same grid.

a $y = 3x - 2$ b $y = 2x + 4$
c $y = 4x - 6$ d $y = 0.5x + 1$

a Complete the table of values for $y = 2x + 2$

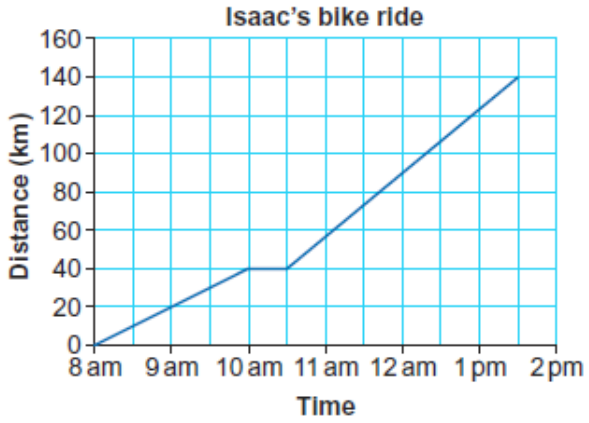
x	–2	–1	0	1	2	3	4
y	–2				6		

b On the grid, draw the graph of $y = 2x + 2$ **(4 marks)**



Distance time graphs

This distance–time graph shows Isaac's journey on his bicycle.



a How far did Isaac ride his bike on the first part of the journey?
b At what time did he stop to rest?
c How long did the first part of his journey take?
d What was his average speed on the first part of the journey?
e How many minutes did Isaac rest for?
f How long did the last part of his journey take?
g How far did he ride on the last part of the journey?
h What was his average speed for the last part of the journey?