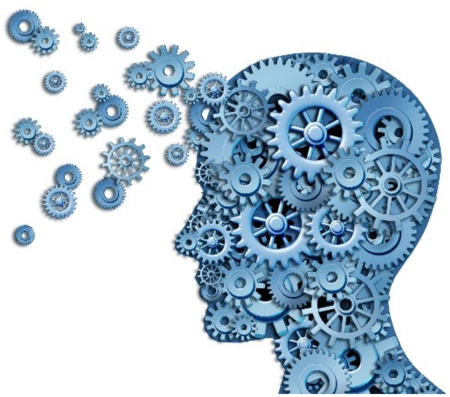
Kettlethorpe
HIGH SCHOOL

MATHS

Year 10 | Delta

Name:

Set:



Unit	Topic	Complete
1	Percentages	
2	Multiplicative Reasoning	
3	Averages	
4	Representing Data	
5	Scatter Graphs	
6	Linear Graphs	
7	Quadratic, Cubic and Other Graphs	
8	Real Life Graphs	
9	Inequalities	
10	Graphs of Trigonometric Functions	
11	Perimeter and Area	
12	3D Shapes	
13	Constructions and Loci	
14	Similarity and Congruence	
15	Further Trigonometry	

Delta Unit 1: Percentages

Prior Knowledge

Express a given number as a percentage of another number, including where the percentage is greater than 100%.

E.G. Express $\frac{57}{60}$ as a percentage $\frac{57}{60} = \frac{19}{20} = \frac{95}{100} =$ 95%

Find a percentage of a quantity.

E.G.: Find 30% of 70

Without calculator 10% = 7, so 30%=7x3=21

With calculator $\frac{30}{100} \times 70 = 21$

Calculate percentage change with or without a multiplier.

E.G. Increase 70 by 30%

Without multiplier, find 30%=21 add this to original 70+21=91

With multiplier 100%+30%=130%=1.3 70x1.3 =91

Find an original quantity after a percentage change.
E.G. Cost of a ticket has been increased by 12.5% to £225, find the original amount.
£225 ÷ 1.125 = £200.

Calculate repeated percentage change.
E.G. George invests £4800 at 3% a year, calculate the amount at the end of 5 years.

$$4800 \times 1.03^5 = £5564.52$$

Reverse Compound Percentages

Example
James invests £6000 for 5 years, at x% a year.
At the end of 5 years, the investment is worth £8029.35.
Work out the value of x.

Answer:
Let y be the multiplier:

$$6000 \times y^5 = 8029.35$$
$$y^5 = \frac{8029.35}{6000}$$
$$y = \sqrt[5]{\frac{8029.35}{6000}}$$
$$y = 1.059999$$

If this is the multiplier then the increase is 6%.

Example 2
Katy invests £2000 for 3 years. She receives interest per year of:
2.5% for the first year.
X% for the second and third year.
There is a total of £2124.46 at the end of the 3 years. Work out the value of x.

Answer: Let y be the multiplier for the second and third year.

$$2000 \times 1.025 \times y^2 = 2124.46$$
$$y = \sqrt{\frac{2124.46}{2000 \times 1.025}}$$
$$y = 1.017999$$

Therefore the increase, x, is 1.8%.

Literacy

Explain how you would find the multiplier to work out a 2.5% decrease.

Reasoning

Chloe is given a 10% pay rise. The next year Chloe is given another 10% pay rise. Her manager says that Chloe's pay has increased by 20% overall. Explain why Chloe's manager is wrong.

Fluency

Percentages of amounts non calculator

1) Find 35% of 160
2) Increase £140 by 15%
3) Decrease 240 kg by 45%

4) The cost of a shirt was reduced by 20% in a sale. The shirt costs £56 in the sale. What was its original price?

Percentages of amounts, calculator allowed, use multipliers to

1) Find 2.3% of £140
2) Increase £270 by 6.5%
3) Decrease 180 kg by 3.5%

4)The cost of a laptop was reduced by 35% in a sale. The laptop costs £325 in the sale. What was its original price?

Problem Solving

James invests £5000 for 4 years, at x% a year.
At the end of 4 years, the investment is worth £5627.54
Work out the value of x

Katy invests £4500 for 3 years. She receives interest per year of:
1.5% for the first year
X% for the second and third year.
There is a total of £4752.03 at the end of the 3 years. Work out the value of x

Delta Unit 2: Multiplicative Reasoning

Prior Knowledge

Use simple unitary proportion.

Understand scaling recipes.

Rearrange formulae.

Solve equations.

Work out best buys.

Use the kinematics formulae.

Fractions and Ratio

The denominator of the fraction is the total number of parts added together.

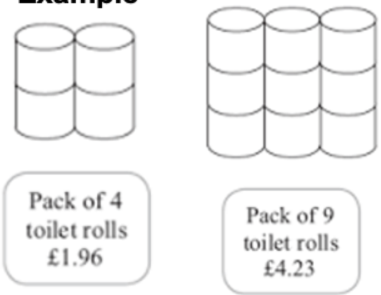
E.G.

$$4 : 3 = \frac{4}{7} : \frac{3}{7}$$

4 + 3 = 7

Best Buys

Example



Which pack offers the best value for money?

We need to work out the cost for 1 toilet roll from each.

Option 1 (9 rolls)
1 toilet roll costs
£4.23 ÷ 9 = 47p

Option 2 (4 rolls)
1 toilet roll costs
£1.96 ÷ 4 = 49p

Conclusion: Option 1 is better value

You must always show your working on these questions.

Simple Compound Measures

You must know and be able to use the formulas and be able to rearrange them when needed.

$$speed = \frac{distance}{time} \qquad density = \frac{mass}{volume}$$

$$pressure = \frac{force}{area}$$

You will also need to be able to convert between their measures, i.e. convert between mph and miles per minute.

Harder Compound Measures

Use a table to help you organise your working out. This is helpful when there are multiple parts to journeys.

Example:
Sienna travels from Birmingham to Leeds at an average speed of 60mph.
She then travels from Leeds to Darlington at an average speed of 40mph.
The distance from Birmingham to Leeds is 150miles.
The distance from Leeds to Darlington is 70 miles.
Calculate Sienna's average speed.

	B TO L	L TO D	TOTAL B TO D
SPEED	60mph	40mph	51.76mph
DISTANCE	150miles	70miles	220miles
TIME	2.5h	1.75h	4.25h

Kettlethorpe HIGH SCHOOL

MATHS
Year 10 | Half-term 1: *Unit 2 Multiplicative Reasoning*

Literacy

Write the definition of density

Write the definition of mass

Reasoning

If wood has density less than $1g/cm^3$ it will float.

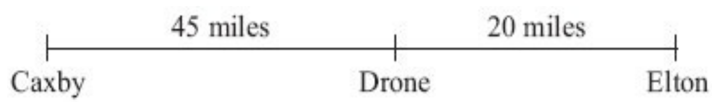
Which of these will be best for building a toy boat?

Plank A	Plank B	Plank C
Volume = $750cm^3$ Mass = 900g	Volume = $0.0152m^3$ Mass = 7.6kg	Volume = $1000cm^3$ Mass = 1.02kg

Fluency

The distance from Caxby to Drone is 45 miles.

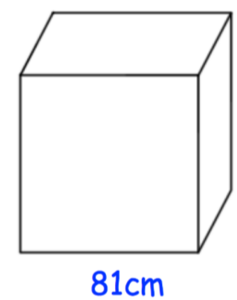
The distance from Drone to Elton is 20 miles.



Colin drives from Caxby to Drone. Then he drives from Drone to Elton.
Colin drives from Caxby to Drone at an average speed of 30 mph.
He drives from Drone to Elton at an average speed of 40 mph.
Work out Colin's average speed for the whole journey from Caxby to Elton.

Problem Solving

The diagram below shows a solid block of ice.



A block of ice weighs ½ tonne.
The block is a cube with side length 81cm.

Find the density of the ice.
Give your answer in kilograms per cubic metre.

Delta Unit 3: Averages

Prior Knowledge

Understand the difference between quantitative and qualitative data.

Understand the difference between continuous and discrete data.

Put data into a frequency table.

Put data into a grouped frequency table.

Find the averages, mode, mean and median for a data set.

Find the range for a data set.

Compare data using an average and range.

Median and Mode from Frequency Table

Here is a table showing the number of goals scored in 10 football matches.

Number of goals	Frequency
0	2
1	2
2	5
3	1

Mode = 2 (the class with highest frequency)

The **median** is the class containing the 5.5th data point.

Number of goals	Frequency	Cumulative
0	2	2
1	2	2 + 2 = 4
2	5	4 + 5 = 9
3	1	9 + 1 = 10

The 5.5th data is set is the category for 2, therefore the median is 2.

Mean from Frequency Table

To find the mean, you need to find the total number of goals scored.

Number of goals, g	Frequency, f	g x f
0	2	0
1	2	2
2	5	10
3	1	3

Total goals 0 + 2 + 10 + 3 = 15.

Mean = 15 ÷ 10 = 1.5 goals per game.

Remember
When the data is grouped like below, we estimate the mean using the midpoint for each interval.

Length (/, cm)	Midpoint (M)	Frequency, f	M x f
10</≤20	15	10	150
20</≤40	30	30	900
40</≤50	45	20	900

Estimated total length = 150 + 900 + 900 = 1950.

Estimated Mean = 1950 ÷ 60 = 32.5 goals per game.

Literacy

Explain the meaning of quantitative and qualitative data.

Reasoning

Decide if the statements are true or false. Give a reason for each of your answers.

Score	Frequency
11	3
12	3
13	2
14	3
15	1

A The data set contains exactly 10 values.

B The median is 13 becuase it's in the middle of: 11, 12, 13, 14, 15.

C The mean can't be 12.7 because only whole numbers could be scored.

D The mean score is 2.4.

E The data is discrete.

F The modal value is 3.

Fluency

Calculate the mean, median and mode from each table.

(a)

Age	Frequency
5	2
6	2
7	5
8	1

(b)

Number of phones	Frequency
0	1
1	3
2	2
3	0
4	4
5	0

(c)

Mass	Frequency
$20 < m \leq 25$	12
$25 < m \leq 30$	24
$30 < m \leq 35$	17
$35 < m \leq 40$	15
$40 < m \leq 45$	4

(d)

Height	Frequency
$120 < h \leq 130$	51
$130 < h \leq 140$	120
$140 < h \leq 150$	66
$150 < h \leq 160$	59
$160 < h \leq 170$	4

Problem Solving

Test Scores		
	BOYS	GIRLS
Mean	32 marks	40 marks
Range	18	15

Compare the distributions of boys and girls test scores.

Delta Unit 4: Representing Data

Prior Knowledge

Understand the difference between quantitative and qualitative data, and also between continuous and discrete data.

Compare data using an average and range.

Draw and interpret composite and dual bar charts.

Draw and interpret pie charts.

Misleading Graphs

When reading graphs, make sure they:

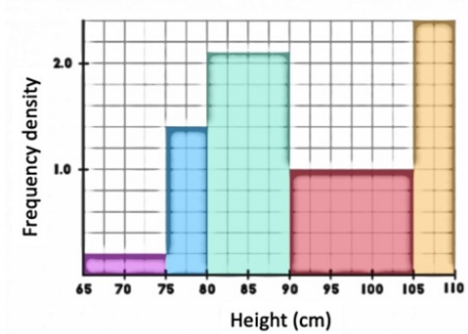
- Have accurate scales.
- Tell you the total (pie charts).
- Represents the full picture.
- Plotted correctly.

Constructing a Histogram

Histograms are used to represent continuous data. We plot bars that are the width of the classes, but for the height, we use frequency density, which is given by the formula:

$$Frequency\ density = \frac{frequency}{class\ width}$$

HEIGHT (CM)	FREQUENCY	CLASS WIDTH	FREQUENCY DENSITY
$65 < h \leq 75$	2	10	2/10 = 0.2
$75 < h \leq 80$	7	5	7/5 = 1.4
$80 < h \leq 90$	21	10	21/10 = 2.1
$90 < h \leq 105$	15	15	15/15 = 1
$105 < h \leq 110$	12	5	12/5 = 2.4



Interpret Histograms

When Given a Histogram the key is to remember frequency = Area.

Example:
The following Histogram represents the speeds at which people were travelling, estimate the number of people travelling between 10mph and 40mph.

We need to calculate the area of the two rectangles.

Rectangle 1 = 10 x 2 = 20 people
Rectangle 2 = 20 x 6 = 120 people

So in total 140 people travelled between 10mph and 40mph

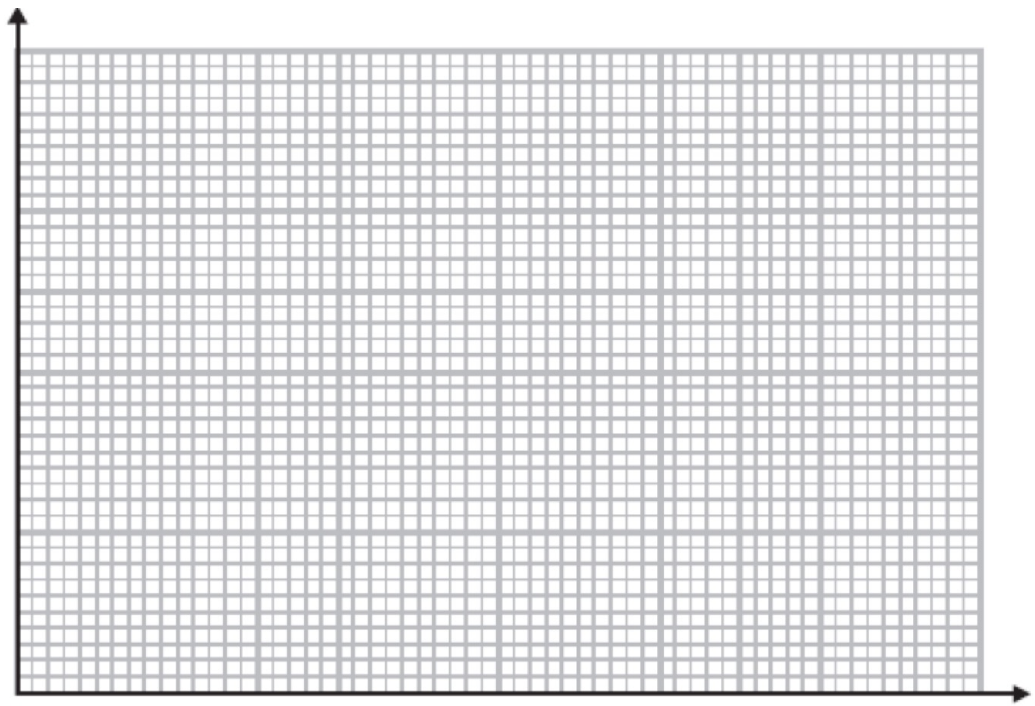
LITERACY

Explain the meaning of discrete and continuous data.

FLUENCY AND REASONING

a) Draw a histogram to represent the heights of trees in metres.

Height (h metres)	Frequency
$0 < h \leq 2$	7
$2 < h \leq 4$	14
$4 < h \leq 8$	18
$8 < h \leq 16$	24
$16 < h \leq 20$	10



b) John says 25% of trees are greater than 10m. Is he correct?

Use your histogram to check.

Delta Unit 5: Scatter Graphs

Prior Knowledge

Plot coordinates.

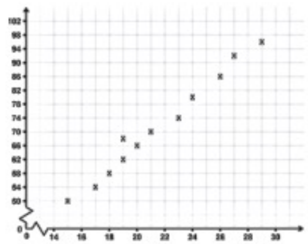
Read diagrams.

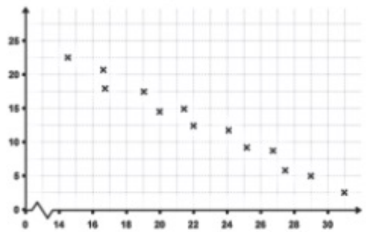
Plot a scatter graph.

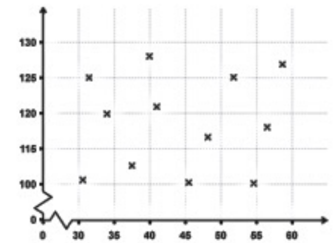
Interpreting Correlation

A frequency polygon is used to plot grouped data, it is plotted as mid-point against frequency, the points are then joined using a ruler.

Positive correlation means as one variable increases so does the other variable.
Negative correlation means as one variable increases the other variable decreases.
No correlation means there is no relationship between the two variables.







Remember: Correlation does not mean causation! Buying ice cream won't increase the temperature

Interpolation and Extrapolation

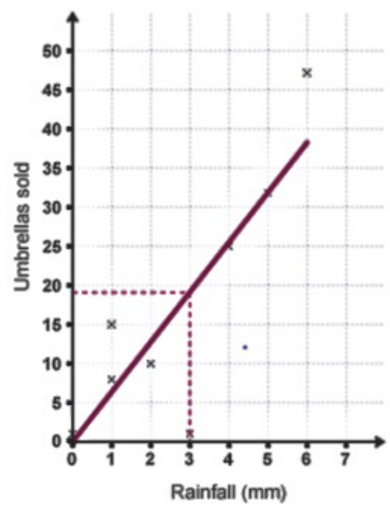
Scatter diagrams can be used to make estimates, first we need to draw a line of best fit.

Example: For the data in the example, estimate how many umbrellas would be sold when there is 3mm of rain.

Therefore reading from our line of best fit, we'd estimate 19 umbrellas to be sold.

This is **interpolation** as it is within the data range we have.

When we are asked to do this outside of the data range, like for example if we were asked to estimate for 10mm of rain, this is called **extrapolation** and is less accurate as we have no data in this range.



LITERACY

Explain what is meant by extrapolation and interpolation.

FLUENCY AND REASONING

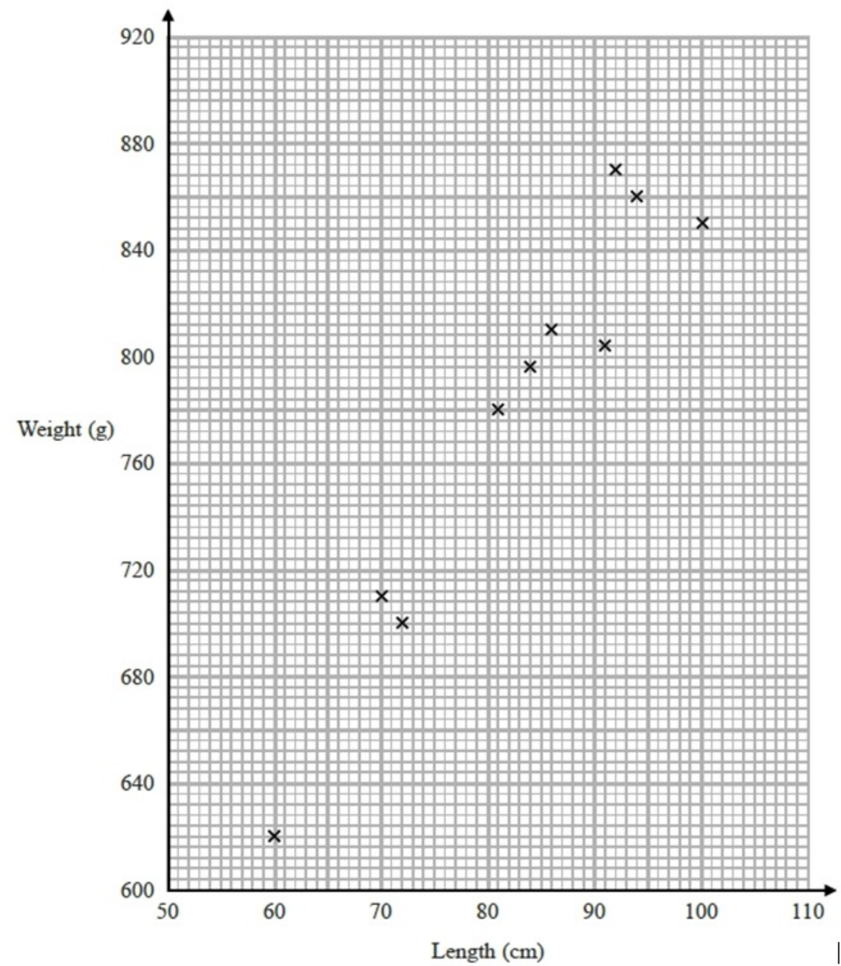
The scatter graph shows information about 10 adult snakes of the same type.
It shows the length and weight of each snake.

An adult snake of this type has a weight of 740 g.
(a) Use the scatter graph to estimate the length of this snake.

Another snake measured 68cm and had a weight of 848g
(b) Show this information on the scatter graph.

(c) This snake is an outlier, give a possible reason for this.

Steven wants to estimate the weight of an adult snake of length 110 cm.
He says he will draw a line of best fit and read off the weight at 110 cm.
(b) Explain what is wrong with his method.



Delta Unit 6: Linear Graphs

Prior Knowledge

Plot Linear graphs.

Identify the gradient ,m, of a linear graph.

Find the equation of a straight-line graph in the form y=mx + c.

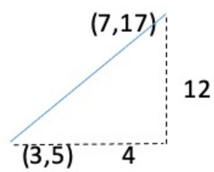
Identify parallel lines, they have the same gradient.

Identify perpendicular lines, remember the gradients are the negative reciprocal of one another.

Equation of a Line Given Two Points

To find the equation of a line between two points, first it's good to draw a picture, find the gradient between the two points, then use this in the equation for m and use one point to find the intercept.

E.G. Find the equation of the line that passes through the points (3,5) and (7, 19).



Gradient = $\frac{17-5}{7-3} = \frac{12}{4} = 3$ so y = 3x + c

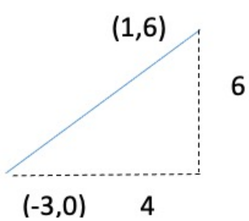
5 = 3 x 3 + c

5 = 9 + c

Answer y = 3x - 4

Application

E.G. *A* has coordinates (−3, 0), *B* has coordinates (1, 6), *C* has coordinates (5, 2)
Find an equation of the line that passes through *C* and is perpendicular to *AB*.
Give your equation in the form *ax* + *by* = *c* where *a*, *b* and *c* are integers.



Gradient AB = $\frac{6-0}{1--3} = \frac{6}{4} = \frac{3}{2}$

$0 = \frac{3}{2} \times 3 + c$

$0 = \frac{9}{2} + c$

$-4.5 = c$

New gradient perpendicular to $\frac{3}{2}$ so is $-\frac{2}{3}$

Goes through (5,2) so $2 = -\frac{2}{3} \times 5 + c$

$2 = -\frac{10}{3} + c$

$\frac{16}{3} = c \quad y = -\frac{2}{3}x + \frac{16}{3} \rightarrow 3y = -2x + 16$

Literacy

Give the definitions of the words parallel and perpendicular.

Reasoning

A line has the equation y = 2x - 3.

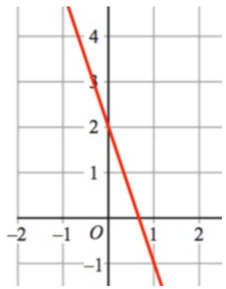
Student A says: the perpendicular gradient is -2

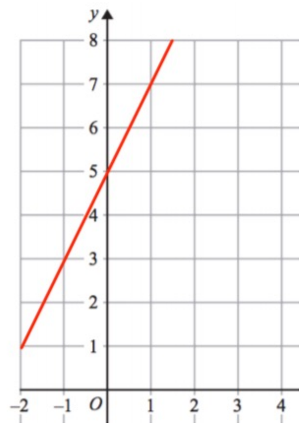
Student B Says: the perpendicular gradient is $\frac{1}{2}$

Comment on their answers

Fluency

Find the equations of these lines.





Find the equation of the line that passes through the points (4, 7) and (6,15)

Write down the equation of each of the following line parallel to y = 3x + 5 and passing through (0, 2)

Write down the equation of each of the following line perpendicular to y = 2x + 4 and passing through (0, 3)

Problem Solving

Do the points (1, 4), (4, 10) and (9, 20) lie in a straight line?

Delta Unit 7: Quadratic, Cubic and Other Graphs

Prior Knowledge

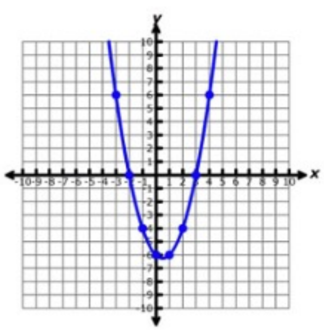
Plot linear graphs.

Solve linear equations.

Substitute into quadratic expressions.

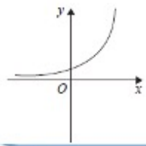
Complete a table of values for and plot a quadratic graph.
E.G. plot the graph of $y = x^2 - x - 6$

x	y
−3	6
−2	0
−1	−4
0	−6
1	−6
2	−4
3	0
4	6



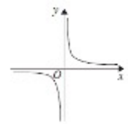
Key Graphs

There are key graphs that you need to be able to recognise and know the general form of.



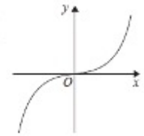
Exponential

$y = a^x$



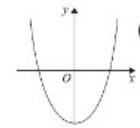
Reciprocal

$y = \frac{a}{x}$



Cubic

$y = x^3$



Quadratic

$y = x^2$

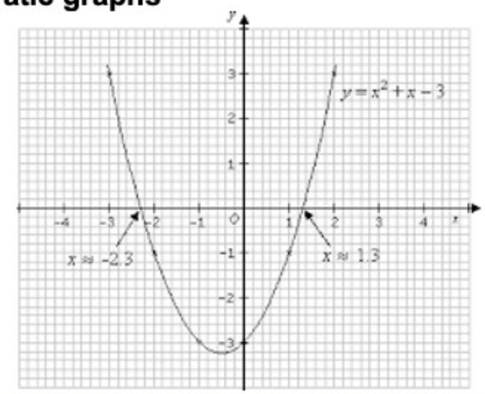
Solutions from quadratic graphs

When given a graph of a quadratic function, the roots, also known as the solutions, can be estimated by finding where the function crosses the x-axis.

E.G.

Given the graph of the function

$y = x^2 + x - 3$, roots $x = -2.3$ *or* $x = 1.3$

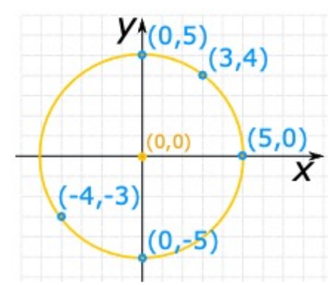


Equation of a circle

The equation of a circle comes in a general form of $x^2 + y^2 = r^2$

The circle is centred on the origin and has a radius of r.

E.G.
Draw the graph with the equation $x^2 + y^2 = 25$.

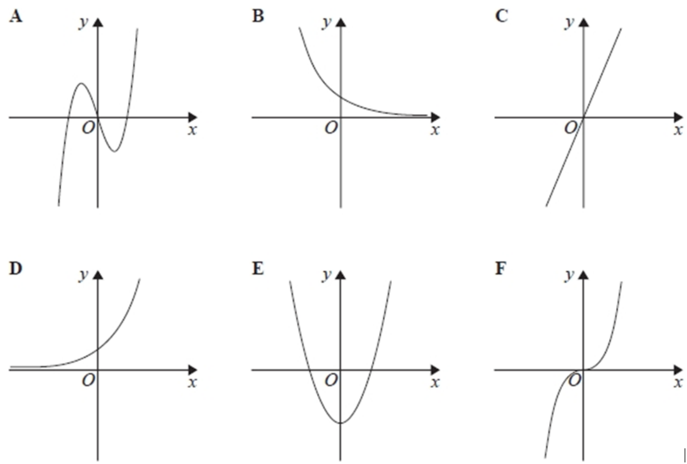


Literacy

Explain what roots of an equation means.

Fluency

Here are six graphs. Give the name of each type of graph.



Write down the letter of the graph that could have the equation

1) $y = 2^x$

2) $y = x^3 - 3x$

3) $y = 3x$

4) $y = x^3 - 3x$

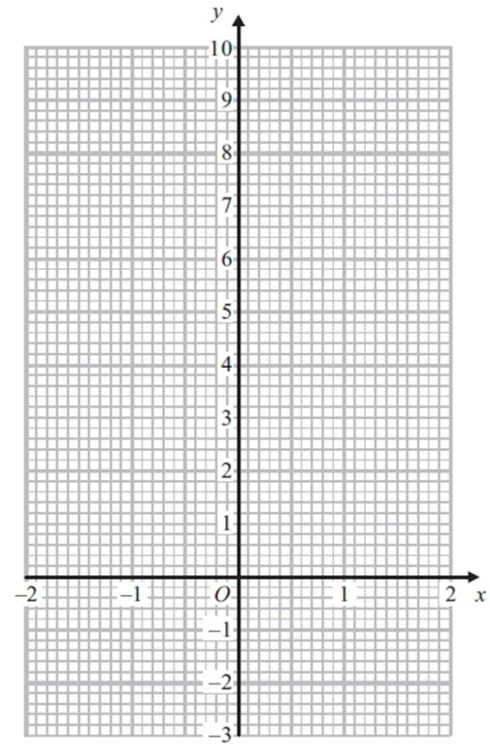
5) $y = x^2 - 5$

Problem Solving Reasoning

Complete the table of values for $y = 2x^2 - 1$

x	-2	-1	0	1	2
y	7			1	

On the grid below, draw the graph of $y = 2x^2 - 1$ for values of x from $x = -2$ to $x = 2$



Use your graph to write down estimates of the solutions of the equation $2x^2 - 1 = 0$

Delta Unit 8: Real Life Graphs

Prior Knowledge

Plot coordinates in all 4 quadrants.

Find the mid-point of a line segment.

Use Pythagoras on right-angle triangles.

Use a conversion graph.

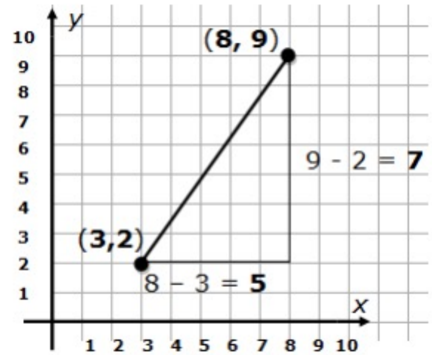
Draw and interpret distance-time graphs.

Distance Between Two Points

The distance between two points, can be seen as a right angle triangle, so we can use Pythagoras to find the distance between two points.

E.G.
Find the distance between the points (3,2) and (8,9)

$$\sqrt{7^2+5^2} = \sqrt{74} = 8.60232 \ldots.$$



Real Life Graphs

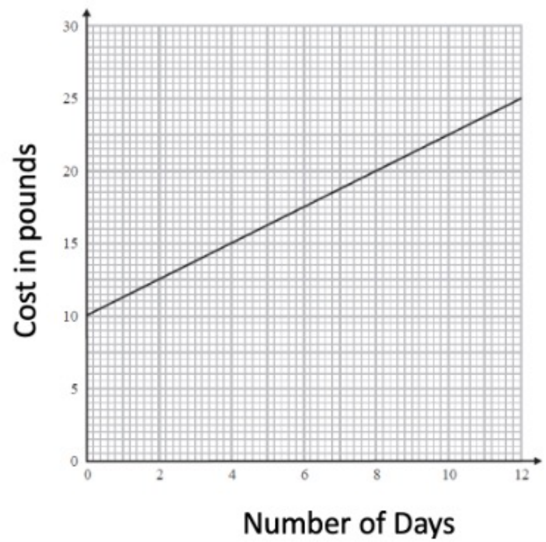
E.G.
The graph shows the cost of hiring a chainsaw from saws r us.
The company charge a fixed charge plus a daily charge.

Calculate the fixed and daily charge.

Answers:
Fixed charge = Starting price for 0 days (the y intercept) this is £10.

Daily charge = This can be calculated by working out the difference from one day to the next. Day 0 = £10, Day 2 = £12.50.

12.50 -10 = 2.50   2.50 ÷ 2 = £1.25   Daily charge = £1.25



Literacy

Give the definitions of speed and velocity.

Reasoning

A, B and C are three points.

Point A has coordinates (−5, 4).

Point B has coordinates (0, 10).

Point B is the midpoint of A and C.

Sam says Point C has coordinates (-2.5, 7)

Explain Sam's mistake and give the correct coordinates for Point C.

Fluency

Find the mid-point of each pair of coordinate.

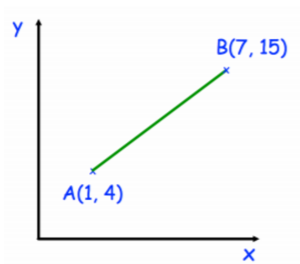
1) (2 , 3) and (0 , 11)

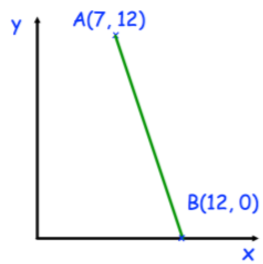
2) (5 , 10) and (-1 , 12)

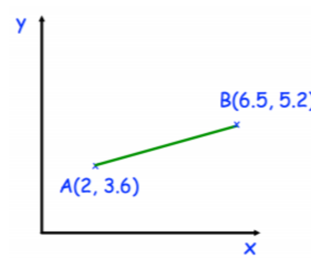
2) 3) (-1 , 5) and (-2 , -2)

Calculate the distance between the two points.

Answers to 2 d.p. where appropriate.

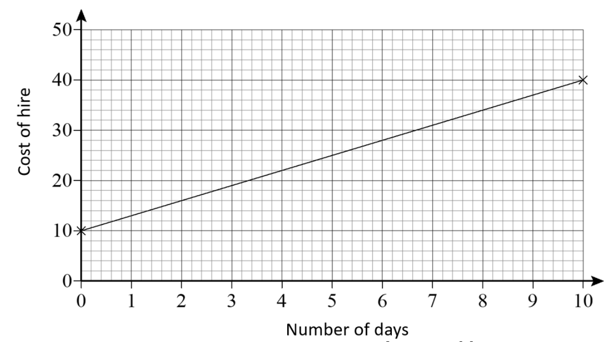






Problem Solving

The graph shows the cost of hiring a rotivator from tools r us.



The company charge a fixed charge plus a daily charge.

Calculate the fixed and daily charge

Delta Unit 9: Inequalities

Prior Knowledge

Know what integer means (whole number).

Use inequality notation.
- < means less than
- ≤ means less than or equal to
- > Means more than
- ≥ means more than or equal to

Solve linear equations.

Substitute into expressions.

Factorise expressions.

Solving Inequalities

Solve using the balancing method.

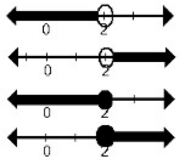
E.G. Solve $5x - 24 > 11$

$$5x - 24 > 11$$
$$+24 \quad +24$$
$$5x > 35$$
$$\div 7 \quad \div 7$$
$$x > 7$$

Solving inequalities gives a range of answers, rather than an individual solution.

Representing Inequalities on a Number Line

We can represent inequalities on a number line, hollow means not included, filled in means included.



$x < 2$, *x is less than 2*
$x > 2$ *x is greater then 2*
$x \leq 2$ *x is less than or equal to 2*
$x \geq 2$ *x is greater than or equal to 2*

Solving Two linear Inequalities

With a grouped inequality you do the same to all 3 sides

E.G.
Give the integers such that,
$3 < 2x - 5 \leq 11$

$$2 < 2x - 5 \leq 11$$
$$+5 \quad +5 \quad +5$$
$$7 < 2x \leq 16$$
$$\div 2 \quad \div 2 \quad \div 2$$
$$3.5 < x \leq 8$$

The integers (whole numbers) which satisfy this inequality are:
4, 5, 6, 7, 8

Solving Quadratic Inequalities

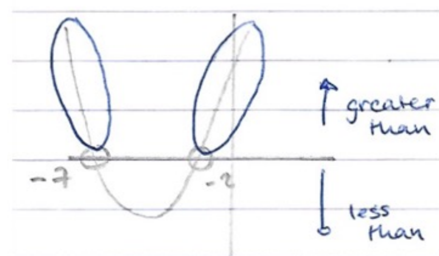
E.G.
Solve the inequality $x^2 - 5x - 14 \geq 0$
1) Use the quadratic formula to solve the quadratic.

$a = 1$
$b = -5$
$c = -14$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{+5 \pm \sqrt{(-5)^2 - 4(1)(-14)}}{2(1)}$$

$x_1 = 7 \qquad x_2 = -2$

2) Sketch the graph of the solutions and identify the correct part of the graph.



3) Use the graph to identify the solution.
$x \leq -7$ or $x \geq -2$

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MATHS

Year 10 | Half-term 4: *Unit 9 Inequalities*

Literacy

Write the definition of Inequality

Use the word inequality within a sentence.

Reasoning

Q. Solve $7 - 4x > 15$

Ama gives the following solution

$11 - 8x > 15$ (-7)

$8x > 4$ (÷8)

$x > 2$

Comment on Ama's solution.

Fluency

List the integer solutions for the following:

1) $-2 < x \leq 5$ 2) $4 \geq x > -4$ 3) $-3 \leq 2x \leq 10$

Solve the following:

1) $2x + 7 \leq 15$ 2) $4x + 13 \geq 6$ 3) $5x - 2 \geq 2x + 13$

4) $2(x + 7) \leq 5(2x + 3)$ 5) $7 - 3x < 19$

Problem Solving

1) Given that a and b are integers such that

$10 < 2a < 22$

$-3 < b < 6$

and $a + b = 9$

Find all the possible values of a.

2) Bianca, Bob and Valentina have completed some Hegarty tasks. Bianca has completed 40 more than Bob. Valentina has completed 3 times as many as Bob.

Together Bob and Bianca have completed twice as many as Valentina.

Calculate the least number of tasks Bob could have completed.

Delta Unit 10: Graphs of Trigonometric Functions

Prior Knowledge

Know the trigonometric ratios.

Know the exact values of the ratios for 0^0, 30^0, 45^0, 60^0, 90^0.

Be able to plot graphs.

Substitute values into a formula.

Solve one-step and two-step equations.

Transformations of Graphs

The graphs can be either translated or reflected.

Translations

F(x + a) moves the graph horizontally a to the left.

F(x) + a moves the graph vertically a up.

Reflections

-F(x) reflects the graph in the x-axis.

F(-x) reflects the graph in the y-axis.

Solving Trigonometric Equations

Trigonometric equations have infinite answers, and you can use the cyclic nature of the graph to find the other solutions.

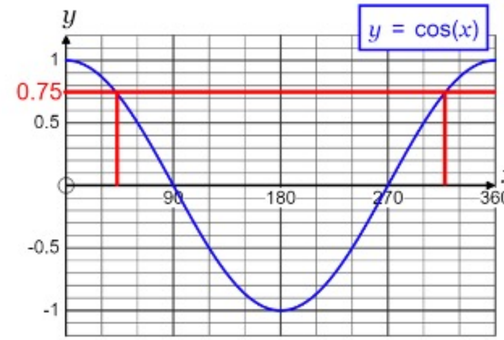
E.G.

Solve $cos(x) = 0.75$ for 0≤x≤360. Give your answers to 1 decimal place.

$\cos(x) = 0.75$

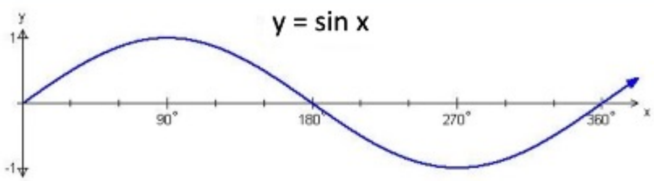
On a calculator:

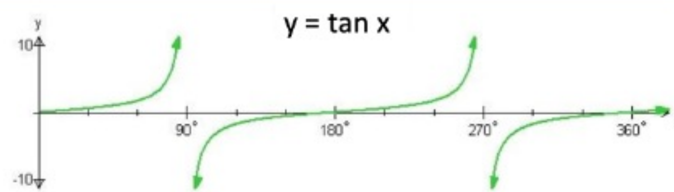
$x = cos^{-1}(0.75)$
$= 41.41°$

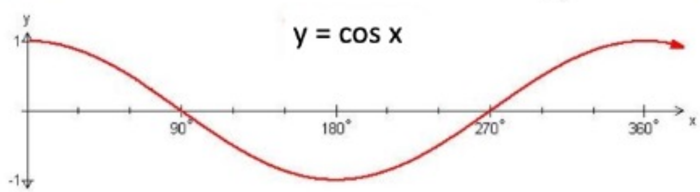


Using the cyclic nature of the graph we find the other value by 360 – 41.410 = 318.59. The solutions are 41.4 and 318.6.

Trigonometric Graphs







The graphs have a cyclic nature in that they repeat over time.

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MATHS

Year 10 | Half-term 4: Unit 10 Graphs of Trigonometric Functions

Literacy

Write the definition of transformation.

Use the word transformation within a sentence.

Reasoning

Arron looks at the graph below (Problem Solving) and says
"$x = 90$ is the only value where $\sin x^\circ = 1$"
Is he correct? Give reasons for your answer.

Fluency

Sketch the following graphs for the values $0 \le \theta \le 360$

1) $y = \sin\theta$ 2) $y = \cos\theta$ 3) $y = \tan\theta$

Find values for θ to make each of the statements correct

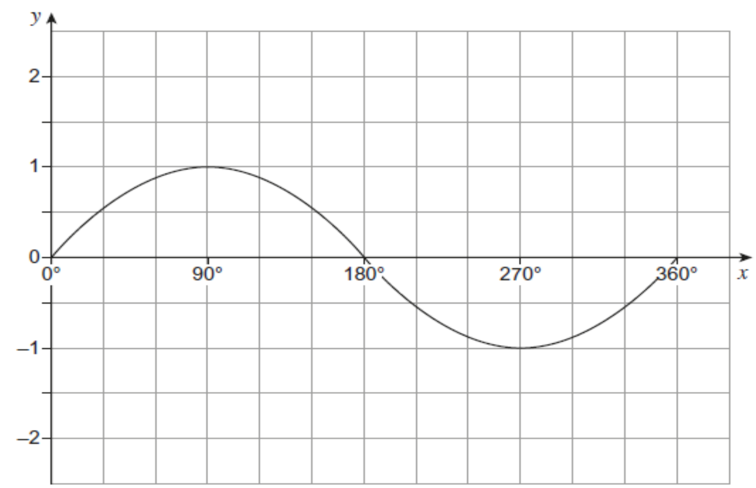
1) $\cos(40) = \cos(\theta)$ 2) $\tan(135) = \tan(\theta)$ 3) $\sin(215) = \sin(\theta)$

Describe the effect of the following transformations on $f(\theta) = \sin\theta$

1) $f(\theta) + 1$ 2) $f(\theta + 90^\circ)$ 3) $-f(\theta - 90^\circ)$

Problem Solving

This is the graph for $y = \sin x^\circ$ for $0 \le x \le 360$.



On the grid draw the graphs for: (label the graphs)

a) $y = 2\sin x^\circ$
b) $y = \sin x^\circ - 1$
c) $y = \sin(x + 90)^\circ$
d) $y = -\sin(x + 180)^\circ + 1$

Delta Unit 11: Perimeter and Area

Prior Knowledge

Perimeter is the distance around the outside of a 2D shape.

Area is the amount of space inside a 2D shape.

Identify the names for parts of a circle.

Calculate the area of basic and compound shapes.

Convert between metric measures for area.

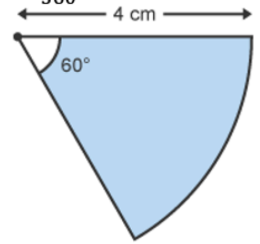
Know the following key formulae:

- Area triangle = ½ x base x perpendicular height
- Area parallelogram = base x perpendicular height
- Area trapezium = ½(a + b) x height
- Area of a circle= πr^2
- Circumference of circle = πd

Area of Sector

The area of a sector is calculated by the formula $\frac{\theta}{360} \times \pi r^2$,

where θ = the angle inside the sector.



E.G

Find the area of the sector enclosed by two radii of 4cm and 60^0.

Area = $\frac{60}{360} \times \pi \times 4^2$ = 8.4cm^2

Arc Length

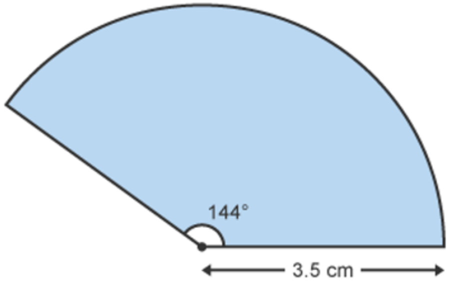
The arc length is calculated by the formula $\frac{\theta}{360} \times \pi 2r$ or $\frac{\theta}{360} \times \pi d$,

where θ = the angle inside the sector.

E.G.

Find the minor arc length, enclosed by radii of 3.5cm and 144^0.

Arc length = $\frac{144}{360} \times \pi \times 2 \times 3.5 = 8.8cm$



Literacy

Write the definition of a Trapezium.

Use the word trapezium within a sentence.

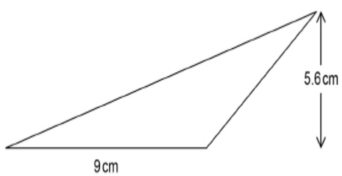
Reasoning

Sameera says that you cannot draw a square that has a perimeter of x cm and an area of x cm^2 (where x is the same value in each case). Is Sameera correct? Give a reason for your answer.

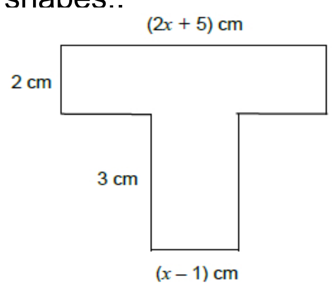
Fluency

Find the area of the following shapes:.

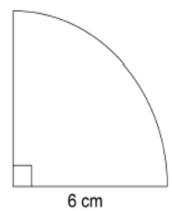
1)



2)



3)



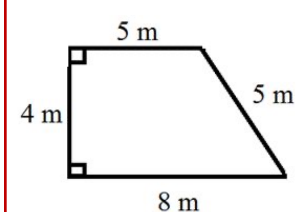
Find the area of a sector with radius 8cm and angle between the two radii of 82°.

Find the arc length of a sector with radius 4.6cm and an angle between the two radii of 145°.

Problem Solving

1) A circular pie is cut in to 8 slices of equal shape. The area of the top of one of these slices is 48cm^2. Find the diameter of the pie.

2) The area of this right-angled trapezium is 26m. Find the perimeter of the trapezium.



Delta Unit 12: 3D Shapes

Prior Knowledge

Volume is the space inside a 3D shape.

Calculate the volume of a prism, including cylinders.

Draw plans and elevations for shapes.

Convert between metric measurements for volume.

Calculate surface area of 3D shapes.

Spheres

If required to calculate the volume or surface area of a sphere then the following formulae will be given.

Volume of sphere = $\frac{4}{3} \times \pi \times r^3$

Surface area of sphere = $4 \times \pi \times r^2$

Volume of Pyramid

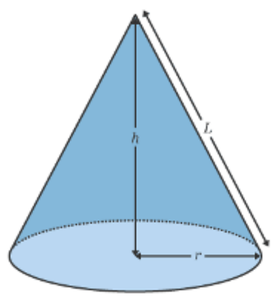
The formula volume of a pyramid will not be given to you. The volume is calculated from the formula.

$\frac{1}{3} \times area\ of\ base \times height$

Remember: a cone is a circular based pyramid

Curved Surface Area of Cones

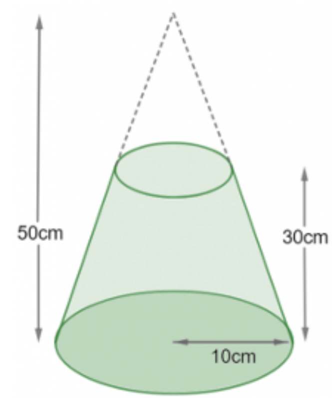
For the curved surface area of a cone the formula is
$\pi \times r \times l$



Remember: for total surface area add the area of the base on.

Frustums

A frustum is a truncated pyramid, to calculate the volume, take the volume of the smaller cone away from the volume of the larger cone.



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MATHS
Year 10 | Half-term 5: *Unit 12 3D Shapes*

Literacy

Write the definition of prism.

Use the word prism within a sentence.

Reasoning

Jamal says "if a cone and a sphere have the same volume and also the same radius, then the height of the cone is bigger than the radius". Is he correct? How much more is the height compared to the radius?

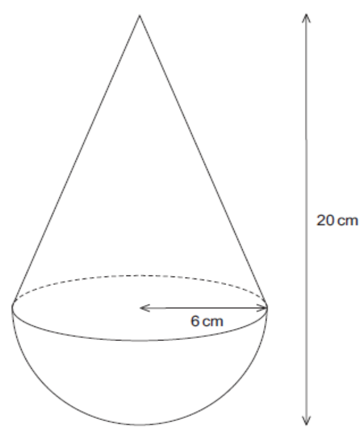
Fluency

Find the volume and surface area of the following shapes:

1) A sphere with **diameter** of 9m

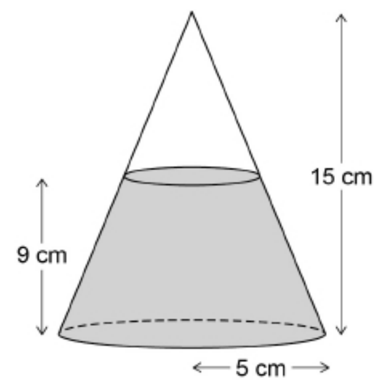
2) A cone with radius of 3.8cm and height 9cm.

Calculate the total volume of this 3D shape.



Problem Solving

The conical shaped container is partially filled with water, so that the water has depth of 9cm.What is the volume of the water in the container?



Delta Unit 13: Constructions and Loci

Prior Knowledge

Using a compass. Using a protractor. Draw and use Loci. Draw plans and elevations of 3D shapes.

Construct a perpendicular bisector. Construct an angle bisector. Estimate lengths from scale diagrams.

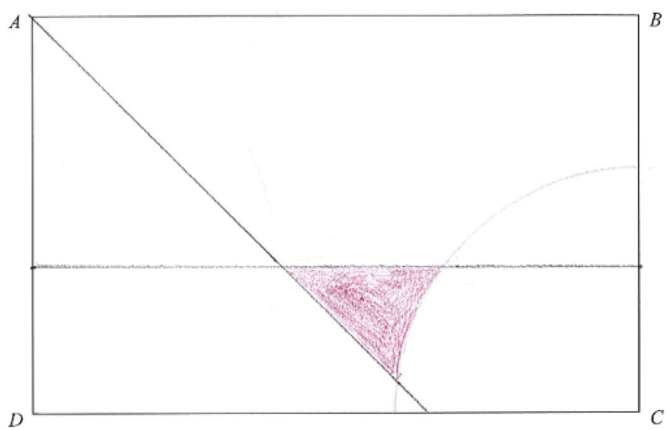
Measure and use bearings. Know that the perpendicular from a point to a line is the shortest distance to the line.

Draw triangles accurately using a protractor and compass.

Using Loci to Find Regions on Scale Diagrams

Jane wants to plant a tree in the garden. It needs to be at least 5m from C. Nearer to AB than AD and less than 3m from DC.

On the diagram, shade the region where Jane should plant the tree.



Arc radius around C.

Bisector of Ab and AD to find points nearer AB than AD.

Line as a loci from DC to show close enough to DC.

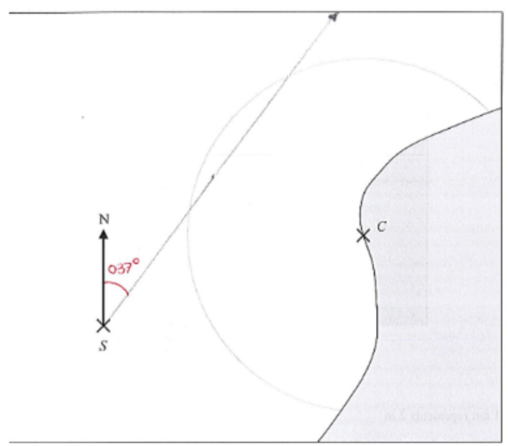
Region shaded red.

Bearings and Loci

Here is a map. S is the position of a ship. C is a point on the coast.

Ships must not sail within 500m of C.
The ship is on a bearing of 037°.

Will the shop sail closer than 500m of C?



Circle around C to represent the area close enough to the ship.

Then the bearing is shown as well.

Yes, as the ships course does intersect the region.

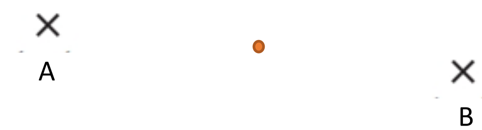
Literacy

Write the definition of Loci

Use the word loci within a sentence

Reasoning

Nathan was asked to show all the points equidistant from A and B. Comment on his response.



Fluency

Find the following bearings

1) The bearing of A from B is 138°. What is the bearing of B from A?
2) The bearing of C from D is 284°. What is the bearing of D from C?
3) The bearing of E from F is 082°. What is the bearing of F from E?

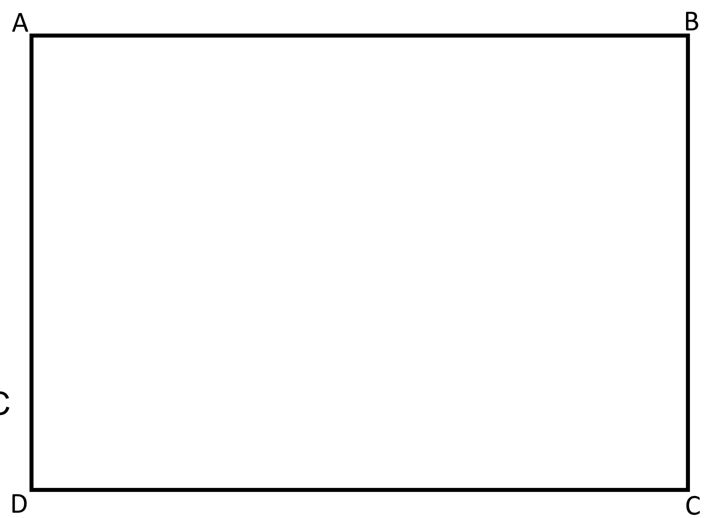
Label the region R,

that is:

Closer to AB than CD

Closer to CD than AD

More than 3cm from C



Problem Solving

Ship A sails on a bearing of 060° at 25km an hour.
Ship B sails on a bearing of 285° at 40km an hour.
If both boats set off at the same time, how far apart are they after 4 hours?
Use a scale of 1cm = 30km

Delta Unit 14: Similarity and Congruency

Prior Knowledge

Understand ratios.

Know angle rules.

Construct a geometric argument with angles.

Understand properties of triangles.

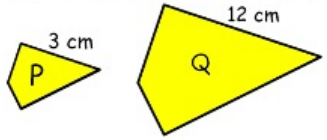
Know that enlarging a shapes sides by scale factor 2, doesn't increase the area by scale factor 2.

Apply similarity to 2D shapes to find missing sides.

Area Scale factor

The area scale factor for 2 shapes is the square of the linear scale factor.

E.G.
Quadrilaterals P and Q are similar, the area of P is 10cm^2. Calculate the area of Q.



$$LSF = \frac{12}{3} = 4$$

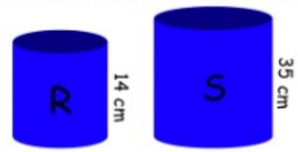
$$ASF = 4^2 = 16$$

New area = 16 x 10 = 160cm^2

Volume scale factor

The volume scale factor for 2 shapes is the cube of the linear scale factor.

E.G.
Quadrilaterals R and S are similar, the volume of R is 40cm^3. Calculate the volume of S.



$$LSF = \frac{35}{14} = 2.5$$

$$VSF = 2.5^3 = 15.265$$

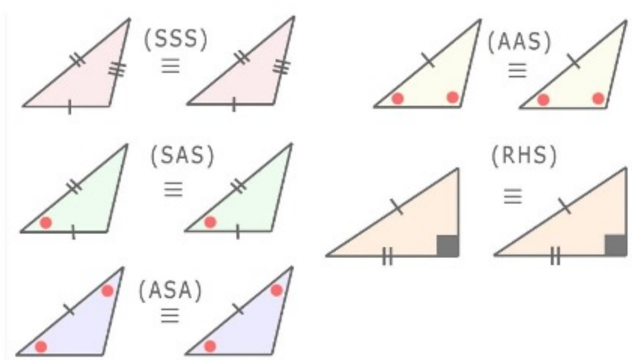
New volume = 40 x 15.265 = 625cm^3

Congruency

In order to prove 2 triangles are congruent they must share 3 pieces of information.

A proof must contain 3 bullet points, each stating the link and why they are the same.

Reasons can be given in the question r by shared side.



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MATHS

Year 10 | Half-term 6: *Unit 14 Similarity and Congruency*

Literacy

Write the definition of Similar

Use the word similar within a sentence

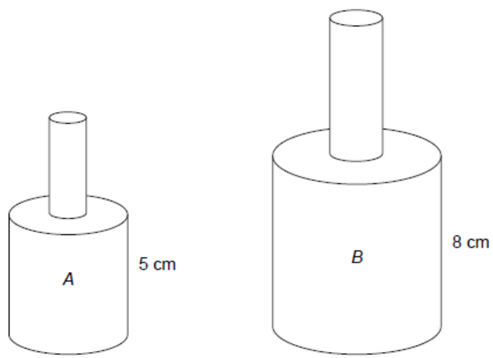
Reasoning

A and B are similar cubes. The length of each edge on cube A is
y cm and the length of each edge on cube B is $2y$ cm.
Ken says "Everything about Cube B is twice as big as Cube A"
Comment on Ken's statement.

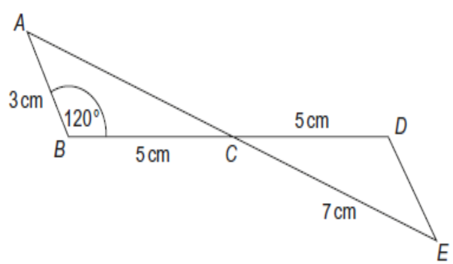
Fluency

1) A and B are similar solids.

The surface area of shape B is 400cm^2. Find the surface area of A.



2) Prove that triangles ABC and CDE are similar.



Problem Solving

Chocopuffs are sold in small and large boxes.
The boxes are similar cuboids.
Volume of A : Volume of B = 8 : 125
The front of the larger box has an area of 500cm^2.
What is the area of the front of the smaller box?

Delta Unit 15: Further Trigonometry

Prior Knowledge

Know the trigonometric ratios.

Know the exact values of the ratios for 0^0, 30^0, 45^0, 60^0, 90^0.

Substitute values into a formula.

Solve one-step and two-step equations.

Rearrange formulae.

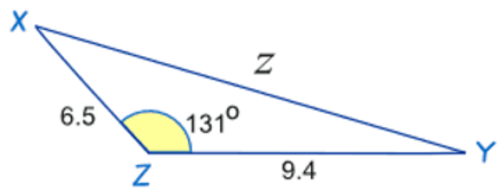
Cosine Rule

Formula:

$a^2 = b^2 + c^2 - 2bc\text{Cos}(A)$ or $\text{Cos}(A) = \frac{b^2 + c^2 - a^2}{2bc}$

Used when working with 3 sides and 1 angle.

E.G. Find the length of Z to 1 decimal place.



$$z^2 = x^2 + y^2 - 2xy\text{Cos}(Z)$$
$$z = \sqrt{9.4^2 + 6.5^2 - 2 \times 9.4 \times 6.5 \times \text{Cos}(131)}$$
$$z = 14.5182785943$$
$$z = 14.5\text{cm}^2$$

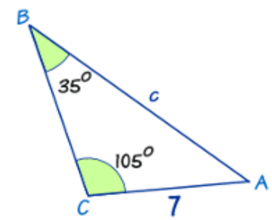
Sine Rule

Formula:

$\frac{a}{\text{Sin}(A)} = \frac{b}{\text{Sin}(B)} = \frac{c}{\text{sin}(C)}$ or $\frac{\text{Sin}(A)}{a} = \frac{\text{Sin}(B)}{b} = \frac{\text{Sin}(C)}{c}$

Used when working with 2 sides and 2 angle.

E.G. Find the length of c to 1 decimal place

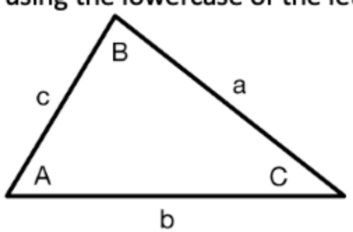


$$\frac{c}{\text{Sin}(C)} = \frac{b}{\text{Sin}(B)} \quad \text{so} \quad \frac{c}{\text{Sin}(105)} = \frac{7}{\text{Sin}(35)}$$
$$c = \frac{7 \times \sin(105)}{\sin(35)} = 11.7882820066$$

C=11.8

Label a Non-Right Angled Triangle

Use A,B,C to label angles, the opposite sides are labelled using the lowercase of the letter.



Area of Non-Right Angled Triangle

Formula: $\text{Area} = \frac{1}{2} a \times b \times \text{Sin}(C)$ (formula can be rearranged).

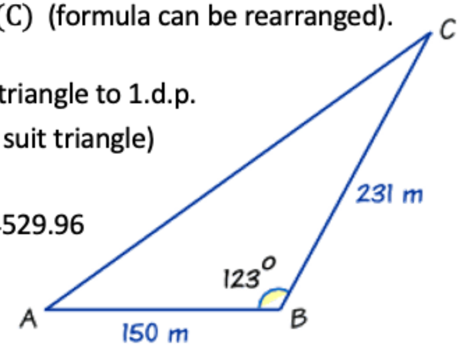
E.G.

Find the area of the following triangle to 1.d.p.

$\frac{1}{2} c \times a \times Sin(B)$ (switched to suit triangle)

$\frac{1}{2} 150 \times 231 \times Sin(123) = 14529.96$

14530m² (1.d.p.)



Kettlethorpe
HIGH SCHOOL

MATHS

Year 10 | Half-term 6: *Unit 15 Further Trigonometry*

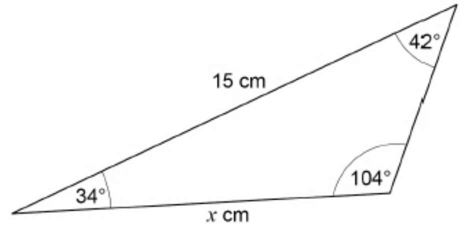
Literacy

Write the definition of Cosine

Use the word cosine within a sentence

Reasoning

1) Find the value of *x*.



Sinead starts by writing

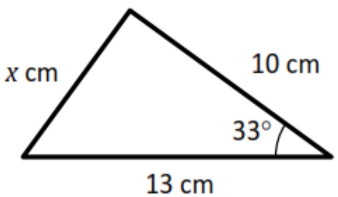
$$\frac{\sin 42}{} = \frac{\sin 34}{x} = \frac{\sin 104}{15}$$

Comment on her work so far.

Fluency

1) Calculate the area of the following triangles. Give your answers to

a)

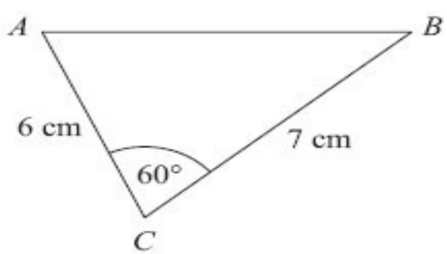


b) Triangle XYZ has the following properties:

XZ = 7.8m   YZ = 5.7m

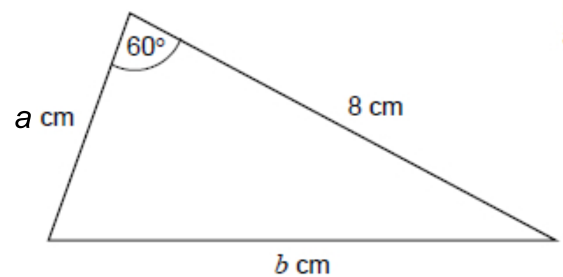
Angle XZY = 114°

2) Find the length of the side AB.



Problem Solving

The area of this triangle is $20\sqrt{3}$ cm^2.



a) Find the value of a.
b) Find the value of b.