

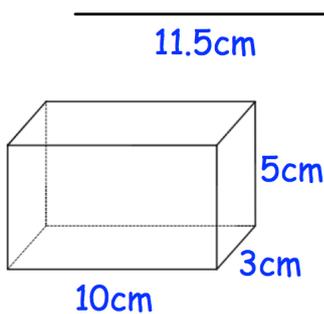


Ciara has a box of 1200 counters. She takes out 40 counters and 7 of them were red. Ciara then returns the counters to the box.

Use this information to estimate how many of the counters in the box are red.

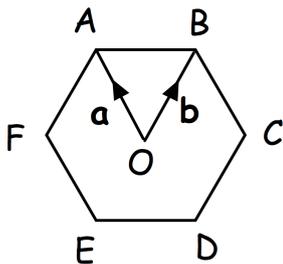
Simplify fully

$$\frac{x^2 + 8x}{x^2 - 64}$$



Is it possible to fit a thin, straight rod that is 11.5cm entirely inside the box?

ABCDEF is a regular hexagon.



Find in terms of **a** and **b** the vector

\vec{BA}

Find in terms of **a** and **b** the vector

\vec{FC}

Find in terms of **a** and **b** the vector

\vec{ED}



The width of a rectangle is 50cm, correct to 2 significant figures.
The length of a rectangle is 115cm, correct to 3 significant figures.

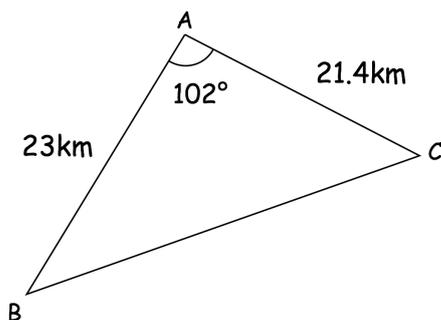
Calculate the lower bound for the area of the rectangle.

What percentage of a distribution lies between the lowest value and the upper quartile?

Find the coordinates of the point where the straight lines $y = 2x$ and $y = x + 5$ meet.

The population of a country increases by $x\%$ each year.
At the beginning of 2017 the population of the country was 24,000,000
At the beginning of 2020 the population was 26,996,736

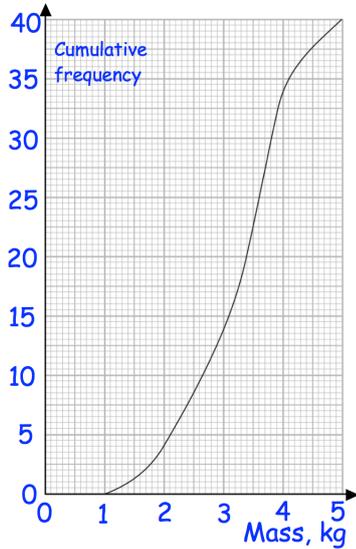
Find the value of x



Find the area of triangle ABC.



The cumulative frequency graph shows information about the mass of 40 penguins.



Estimate the median mass.

Estimate how many penguins have a mass between 2kg and 4kg.

Freddie and Martha have dentist appointments.

The probability that Freddie is on time to his appointment is 0.9
 The probability that both Freddie and Martha are on time to their appointments is 0.72

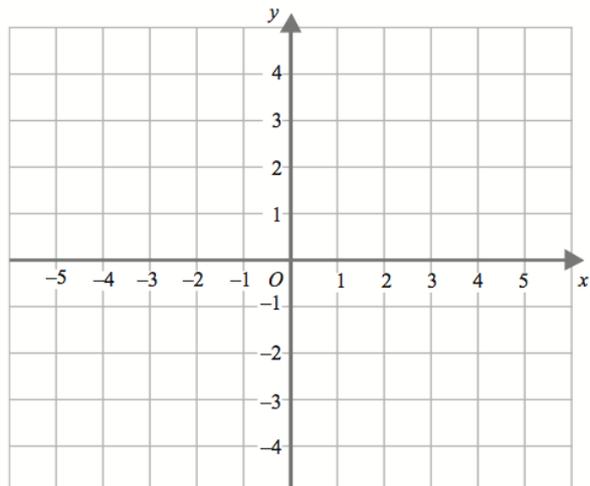
Find the probability that both people are late for their appointments

On the grid, clearly label the region which satisfies all three inequalities below

$$y < 2$$

$$y > 2x - 1$$

$$x + y + 3 > 0$$





Simplify fully

$$\frac{\sqrt{84}}{\sqrt{7}}$$

m is an irrational number such that

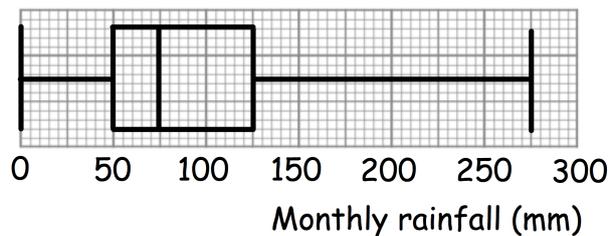
$$3 < m < 4$$

Write down a possible value of m

Simplify $(3w^7)^3$

The box plot shows information about the monthly rainfall in a city over 100 years.

Find the range

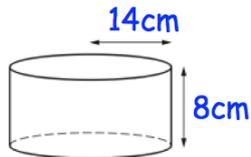


Jonah and Ruby look up how much rainfall there was in the months that they were born.

What is the probability both months had less than 50mm of rainfall?



Solve $3x^2 - 75 = 0$



A solid metal cylinder is melted down and the metal is made into solid spheres of radius 4cm.

How many spheres are made?

Tyrone invests £500 in a savings account that pays 2% compound interest.

How many years will it take for Tyrone to earn at least £600 in interest?

In a netball league there are 8 teams. Each team plays each other team once.

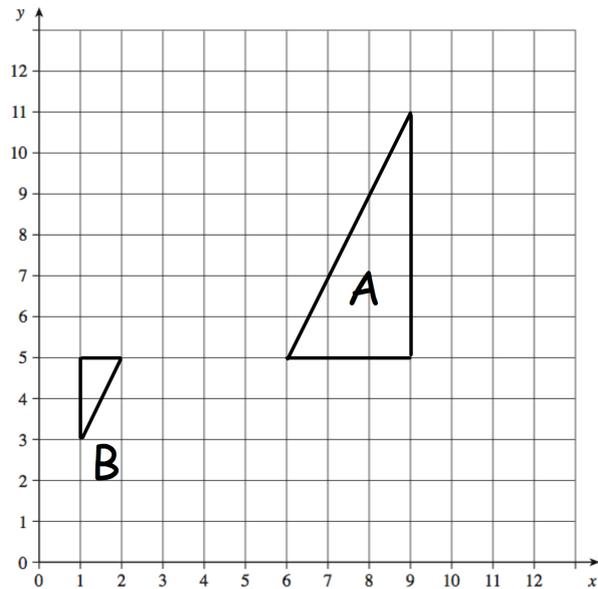
Work out the total number of matches played.

In 1892 a woman's age was the square root of the number of the year of her birth.

When was she born?



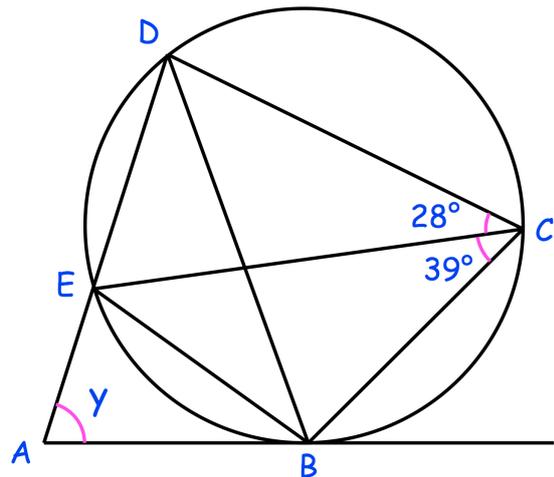
Describe fully the single transformation that maps shape A onto shape B



Work out $196^{\frac{1}{2}}$

Shown below is cyclic quadrilateral BCDE
AB is a tangent to the circle.
AED is a straight line.

Work out the size of angle y.



Solve $2x^2 + 5x - 12 = 0$



$$\text{Solve } 3x^2 - 7x + 4 = 0$$

$$\sqrt{192} = 2\sqrt{y}$$

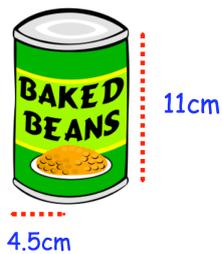
Find y

A can of baked beans has a paper label wrapped around the outside. The can has a height of 11cm and radius of 4.5cm.

The label covers the entire height of the can.

The label has a 1cm overlap vertically so that it can be stuck together

Calculate the area of the label.



The length of a rectangular field is eight times its width.

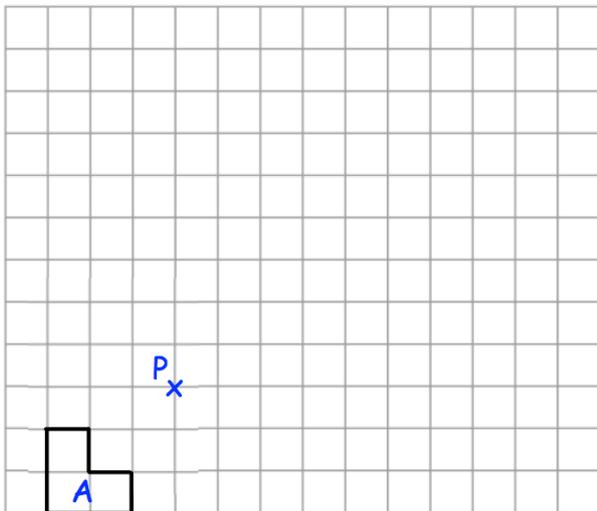
The area of the field is 1800m^2

Find the perimeter of the field.



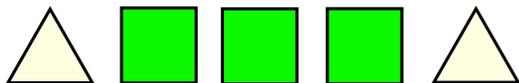
Solve, giving your answers to one decimal place.

$$x^2 - 6x - 20 = 0$$



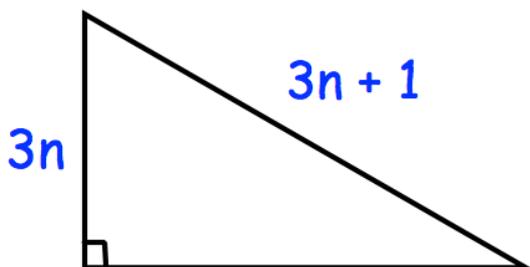
Enlarge shape A by scale factor -2 , using the point P as centre of enlargement.

Write down the gradient of a line that is perpendicular to $y = 8x - 2$



Sophie selects a shape at random, then replaces it. She then selects another.

Find the probability that she selects one of each shape.



Find an expression for the third side.



Calculate the distance between the coordinates $(-11, -2)$ and $(-2, 7)$.

Give your answer correct to 1 decimal place.

Simplify

$$\frac{x^2 - 3x}{7} \times \frac{14}{x^2 + 5x - 24}$$

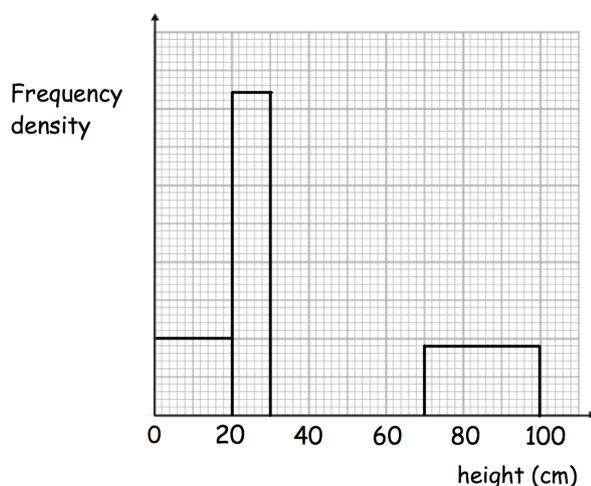
Two containers are mathematically similar.

The height of container A is 5cm.
The height of container B is 10cm

The volume of B is 240cm^3

What is the volume of A?

The histogram and table each contain some information about the height of tree planted in a forest.



Height (h cm)

Frequency

$0 < h \leq 20$

800

$20 < h \leq 30$

$30 < h \leq 40$

1200

$40 < h \leq 70$

1800

$70 < h \leq 100$

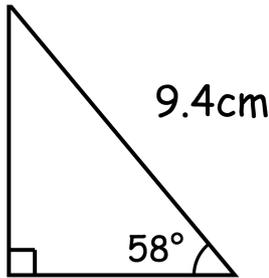
Complete the table and histogram



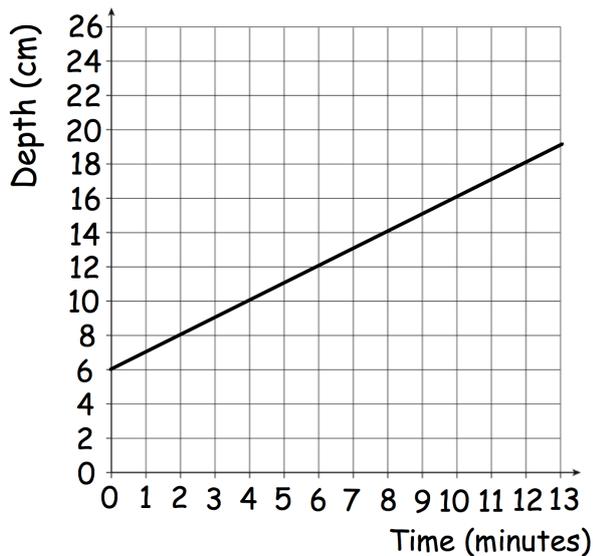
The number of visitors that a museum had last year was 9.2×10^5 .

This year, the museum has had 1.3×10^6 visitors.

Calculate the percentage increase.



Calculate the area of the right angled triangle.



Water is poured into a swimming pool for 13 minutes
 The graph shows the depth of the water in the swimming pool.
 What is the rate of change of the depth of the water?
 Give your answer in cm/min.

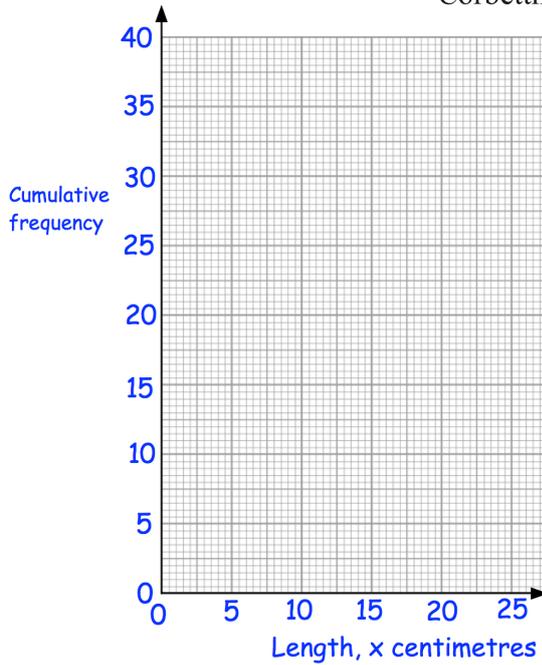
Another swimming pool contains water that is 24cm deep.
 It is emptied at a rate of 3cm/min.
 Show this on the graph.

Shapes A, B and C are similar.
 The height of shape A is 8cm
 The height of shape C is 4cm
 The ratio of the surface area of shape B to the surface area of shape C is 25:9

Work out the ratio of the volume of shape A to shape B.



Length, x cm	Frequency
$0 < x \leq 5$	2
$5 < x \leq 10$	6
$10 < x \leq 15$	19
$15 < x \leq 20$	10
$20 < x \leq 25$	3



Draw a cumulative frequency graph for this information.

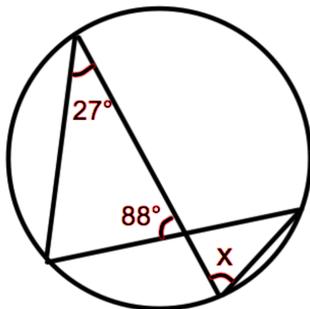
Find an estimate for the median length.

<p>Offer 1 30% extra free</p>	<p>Offer 2 30% off the price</p>
<p>Offer 3 Buy one get one half price</p>	

The jar usually contains 500g of coffee. Which offer is best value for money?

Solve

$$\frac{x + 19}{2x - 3} = 4$$



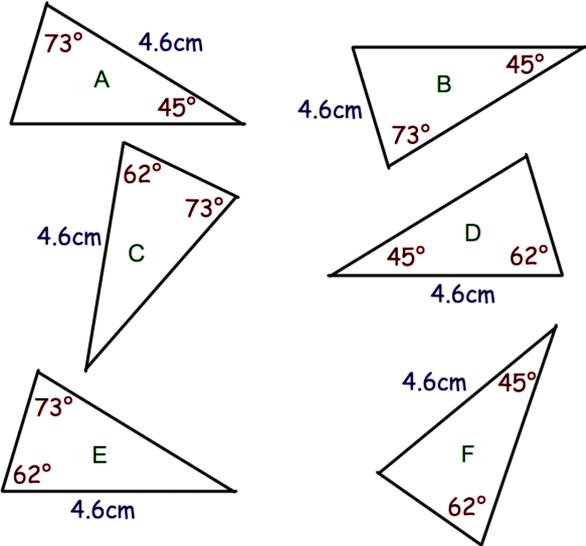
Find x



Omar writes pop, rock and country songs.
 The ratio of rock to country songs is 9:5
 12.5% of the songs are pop songs.
 Omar has written 36 pop songs.

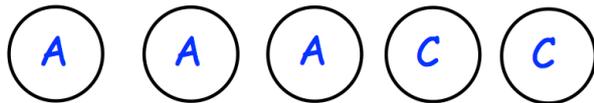
How many rock songs has Omar written?

Which triangles are congruent?



Make w the subject of

$$c = \frac{17(3a - 2w)}{5w}$$



What is the probability that both letters are different?

A counter is selected at random, the letter recorded and the counter put back into the bag. A second is then selected.

Arrange in ascending order

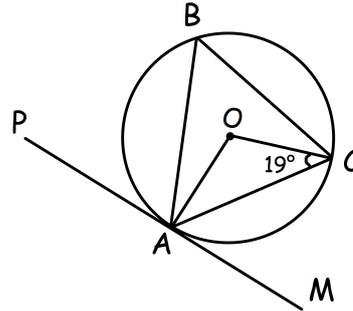
938000 9.4×10^3 10×5^8



The LCM of two numbers is 352
 The HCF of the numbers is 4.
 One of the numbers is 44.

Find the other number.

PM is a tangent to the circle at A.
 Find the size of angle CAM.



The table below shows the probabilities of a spinner landing on its four different colours.

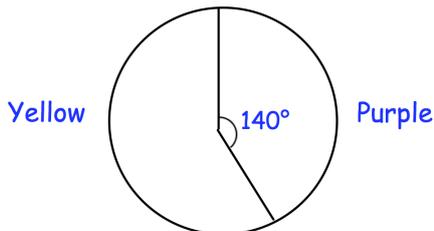
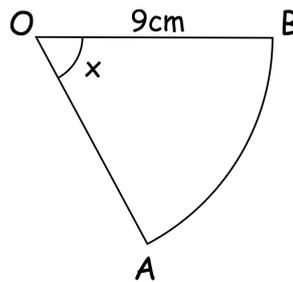
Colour	Red	White	Black	Brown
Probability	$x + 0.3$	x	$2x$	$x + 0.1$

The spinner is spun twice.

Find the probability that the spinner landed on black twice.

The perimeter of sector OAB is 23cm.

Find x



In an election there are two parties to vote for, the Yellow party or the Purple party.

6124 more people voted for the Yellow party than the Purple party.

Work out the total number of voters



Estimate the cube root of 50.

Which of these equations has a rational solution?

Equation 1

$$\frac{3}{4}x^2 = 30$$

Equation 2

$$\frac{2}{25}x^3 = 10$$

Equation 3

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

The probability that Ben goes running on a Sunday is 0.8

The probability that Tomos goes running on a Sunday is 0.7

Calculate the probability that both Ben and Tomos do not go for a run on Sunday.

Roscoe invests £800 in a saving account that pays compound interest of:

2% for the first year

1% for the second year

0.5% for each year after

Work out how many years it will take for Roscoe to have at least £1000 in the savings account.

x	2	4	b
y	20	a	5000

Find a and b .

y is inversely proportional to the square of x



Solve the simultaneous equations

$$\begin{aligned}6x + 4y &= 3 \\ 2x - 3y &= 14\end{aligned}$$

Work out, giving your answer in standard form

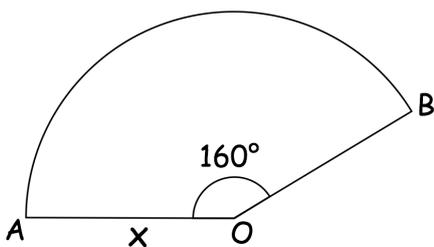
$$(8.2 \times 10^6) - (3.51 \times 10^5)$$

Write as a fraction 6^{-3}

Write down the value of 16^0

Simplify fully

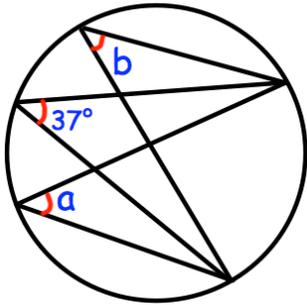
$$\frac{4x^2 - 25}{6x^2 - 11x - 10}$$



The area of sector OAB is 500cm^2
Find x.



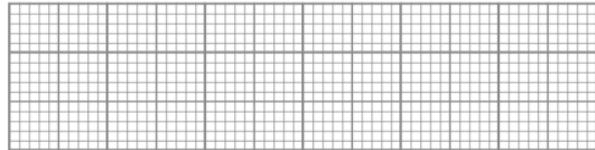
Simplify fully $(5m^2)^3$



Find a and b

Lower Quartile	3.4
Median	3.9
Upper Quartile	4.1
Highest Value	5.4
Range	3.7

Draw a box plot for the information given



Mark writes down the day and the date.
For example, Monday 14th March.

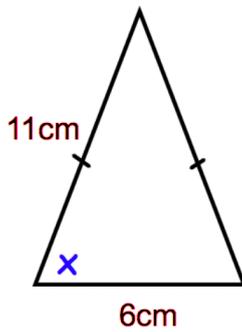
- The day of the week begins with a T.
- The month begins with a vowel.
- The date number is a prime number.

How many different possibilities are there?



Shown is a shape with perimeter $240 + 70\pi$ m

Find the area of the shape.



Find the size of x .

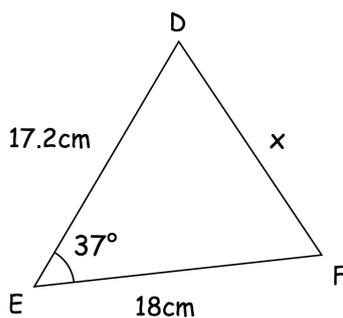
The price of a meal including a 22% tip is £103.70

How much was the tip?

Factorise fully $12x^2 - 75y^2$

The line passing through the points (5, 3) and (8, -6) is perpendicular to the line passing through the points (-1, 2) and (2, c)

Find c



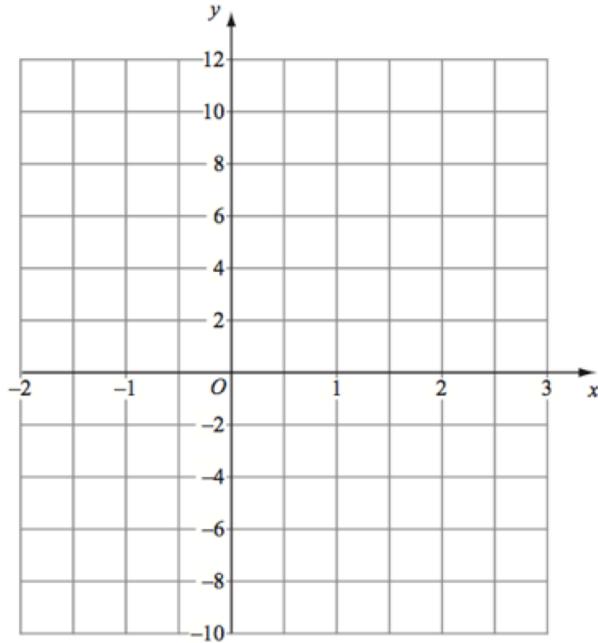
Find the length of DF.



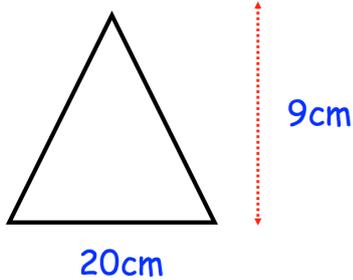
Expand and simplify

$$(2x - 1)^3$$

Draw $y = 2x^2 - 2x - 1$

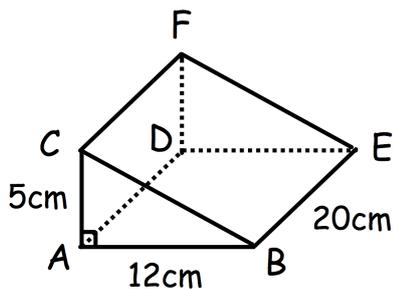


Use your graph to find an estimate of the coordinates of the minimum point of the graph of $y = 2x^2 - 2x - 1$

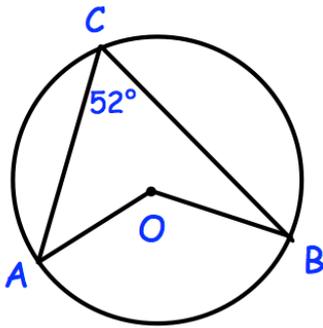


Shown is a triangle with measurements given to 1 significant figure.

Calculate the upper bound for the area

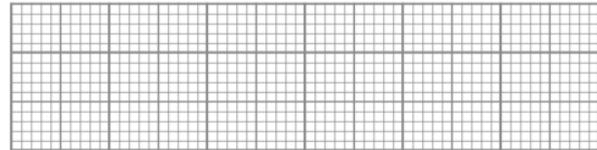


Shown is a triangular prism. ABC is a right angled triangle. Find the length BF.



O is the centre of the circle.
Find angle AOB

The lightest carp in a tank is 2kg.
The lower quartile is 5kg.
The median is 7kg.
The range is 13kg and interquartile range is 8kg.



Draw a box plot to show this information

A class of 10 girls and 15 boys sit a test.

The mean mark for the boys is 75.
The mean mark for the girls is 82.

Work out the mean mark for the whole class.

A rectangular field has:

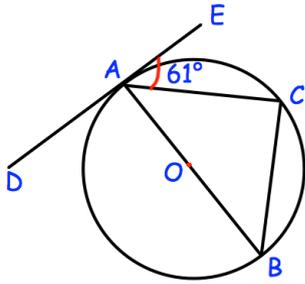
length 160m, to 2 significant figures.
width 81m, to 2 significant figures.

Calculate the upper bound for the area of the field.

$$\mathbf{c} = \begin{pmatrix} -3 \\ q \end{pmatrix} \quad \mathbf{d} = \begin{pmatrix} p \\ 2 \end{pmatrix}$$

$$\text{Given } 4\mathbf{d} - \mathbf{c} = \begin{pmatrix} 5 \\ 10 \end{pmatrix}$$

Work out the values of p and q



AB is the diameter. DE is a tangent at A.

Angle CAE is 61° .

Find angle BAC.

Find angle ABC.

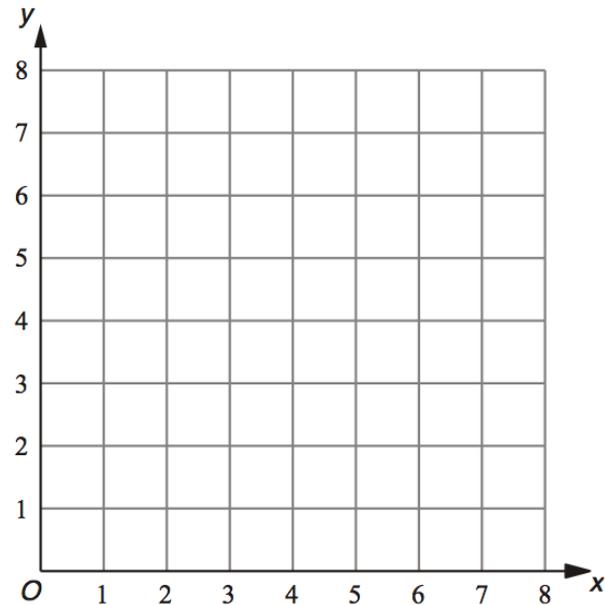
A region R satisfies the inequalities

$$x + y \leq 5$$

$$x > 3$$

$$y \leq 1$$

Show this region on the grid.



Make w the subject of

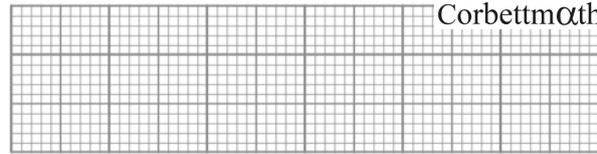
$$8(w - 3a) = 3w + 7$$

In a school, all students are taught either French, German or Spanish.
The ratio of the number of students taught French to those taught German is 3:4
The ratio of the number of students taught French to taught Spanish is 12:11

Find the ratio of the number of students taught Spanish to taught German.



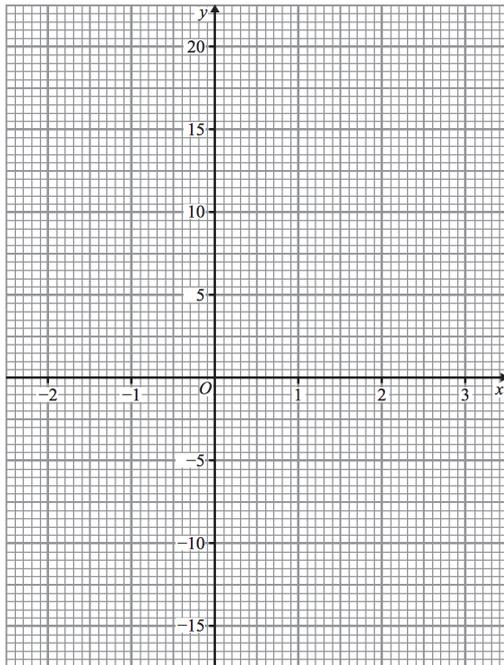
Lowest	68kg
Lower Quartile	74kg
Median	82kg
Upper Quartile	88kg
Highest	100kg



Draw a box plot to show this information

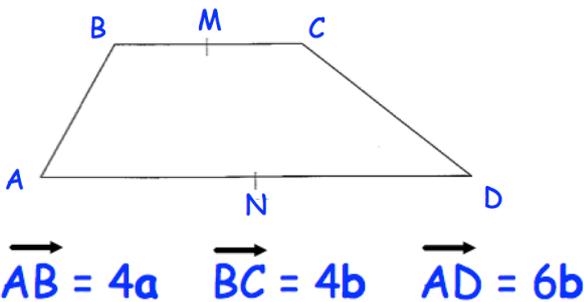
A car travels at 50mph, correct to 1 significant figure.
It covers a distance of 300 miles, correct to 2 significant figures.

Calculate the **least** possible time taken.



Draw the graph of $y = x^3 - 2$ for the values of x from -2 to 2 .

Use your graph to find an approximate answer to $x^3 - 3 = 0$



M is the midpoint of BC.
N is the midpoint of AD.

Find \vec{MN}



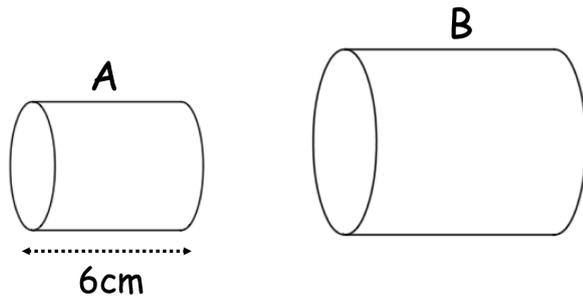
$$(x + 4)^2 \equiv x^2 + 8x + 16$$

$$(x + 4)^2$$

$$(x + 4)^2 < 10$$

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

Circle the expression



The surface area of A is 500cm^2
 The surface area of B is 2000cm^2

The length A is 6cm.

Find the length of B.

A ball is dropped from h metres.
 After each bounce the ball reaches 60%
 of its previous height.
 After its third bounce it reaches a height
 of 0.648m.

Find h

Show

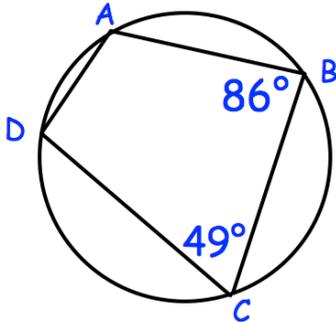
$(n + 4)^2 - (n + 2)^2$ is always a
 multiple of 4 for all positive integer
 values of n .

Factorise $11x^2 - 23x - 30$



Work out $8000^{\frac{1}{3}}$

Work out $32^{\frac{7}{5}}$



Find angle BAD.

Find angle ADC.

Tim sells strawberry and raspberry jam. He sells the jam in two different sizes of jar: small and large. 80% of the jam that Tim sells is strawberry. 70% of the strawberry jam sold is in small jars. 10% of the raspberry jam sold is in large jars.

What percentage of the jam sold is in small jars?

Simplify $\frac{\sqrt{34}}{\sqrt{17}}$

Solve the simultaneous equations

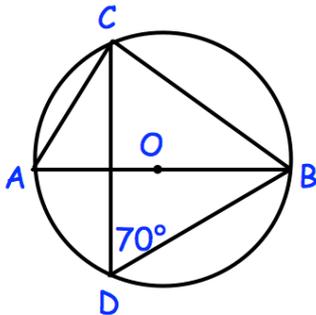
$$\frac{2}{3}x + \frac{1}{2}y = -1$$

$$x - y = 16$$



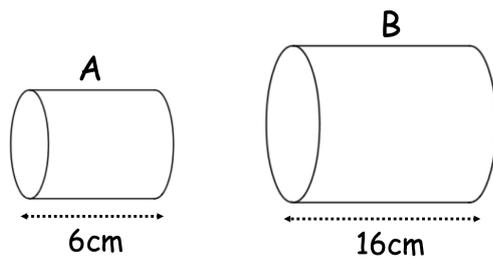
$$\frac{12}{17}$$

Write as a decimal to 6 decimal places (non-calculator).



AB is the diameter. O is the centre. Find angles

- (a) CAB (b) ABC



The volume of A is 200cm^3 .

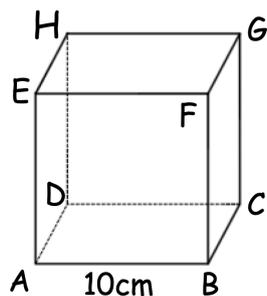
Find the volume of B.

A and B are similar.

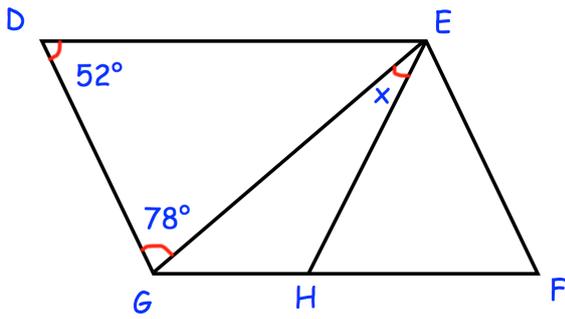
W is directly proportional to the square of M.

When $W = 80$, $M = 2$.

Work out W when $M = 6$.



Can a 12cm rod fit into cube ABCDEFGH?



DEFG is a parallelogram
EH = EF

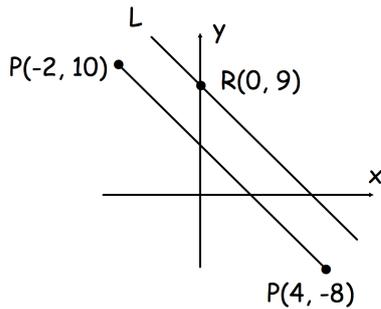
Find x

Factorise

$$x^2 - y^2$$

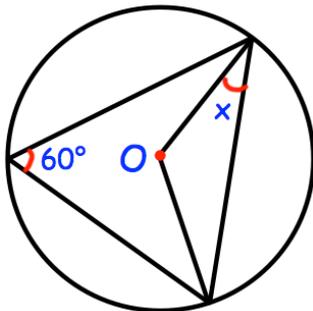
Factorise

$$2x^2 + 17x + 21$$



Line L and PQ are parallel.

Find the equation of L.



Find x

A radioactive substance decays with time.
The mass of the substance reduces by 8% each year.

How many years will it take for 400kg of the substance to decay to a mass of less than 20kg?



Find the gradient of the line with equation $2x - 4y = 7$

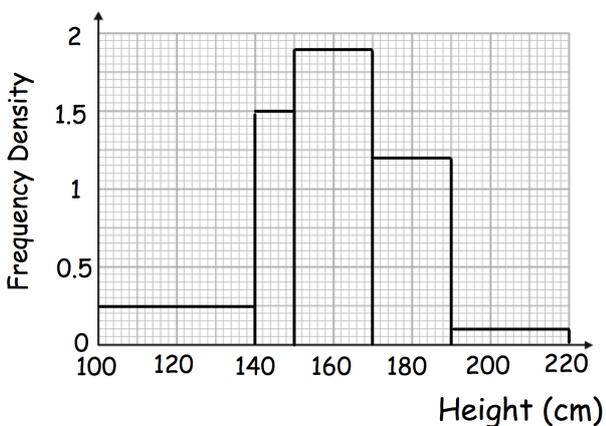
The length of a side of a regular pentagon is 1200mm, correct to 2 significant figures.

Work out the upper bound for the perimeter of the pentagon.

An ordinary dice is rolled four times.

What is the probability of obtaining a 6 four times?

The histogram shows the heights of some people.



Use the histogram to complete the frequency table.

Height (cm)	Frequency
$100 < h \leq 140$	
$140 < h \leq 150$	15
$150 < h \leq 170$	
$170 < h \leq 190$	
$190 < h \leq 220$	



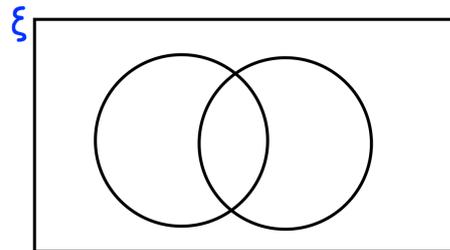
120 people are surveyed.

60 people liked tea and coffee.

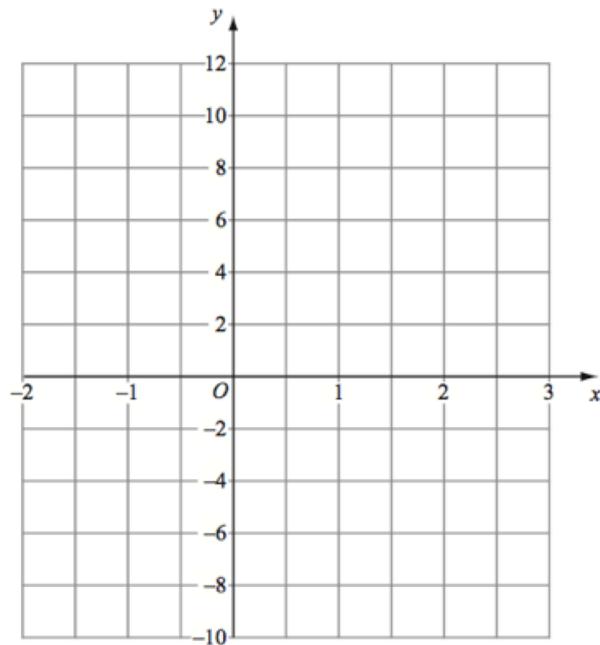
75% of the people who liked tea, also liked coffee.

9 people did not like either tea or coffee.

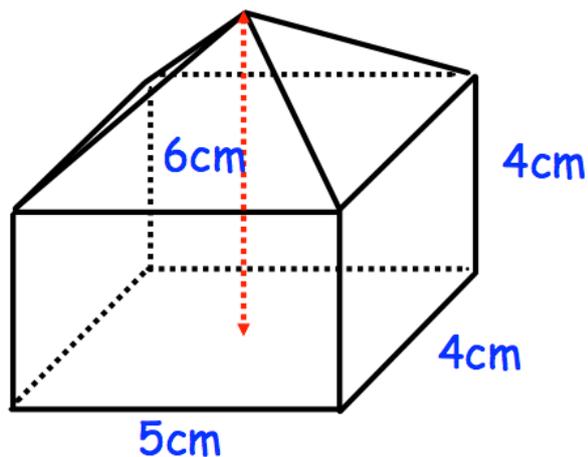
Complete the Venn diagram.



On the grid, draw $y = 2x^2 + x - 8$ from $x = -2$ to $x = 2$



Using your graph, solve
 $2x^2 + x - 8 = -4$



Shown is a container made of a pyramid and a cuboid.

90cm^3 of water is poured into the container.

How high above the base of the container will the water reach?



The bearing of Leek from Milton is 304°

Find the bearing of Milton from Leek.

Jay is organising a party.
People will sit at circular tables.

Each table has a diameter of 110cm
Each person needs 70cm around the circumference of the table.

140 people will be at the party.

How many tables are needed?

Solve, to 2 decimal places

$$4x^2 - 3x - 9 = 0$$

Here are six number cards.



Charlie takes a card at random and then replaces it. Charlie then takes a second card at random.

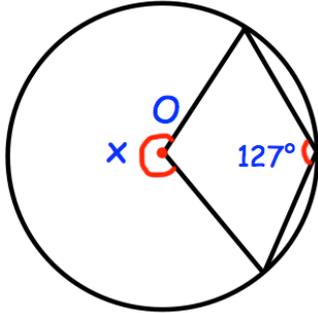
Work out the probability that the two cards will add together to give 9.

Write $0.0\dot{3}\dot{9}$ as a fraction



Work out the value of 2500^3

Give your answer in standard form.



Find x

Megan has £8000 to invest for 5 years.

Nationbank: 3% interest for the first year and then 0.5% compound interest each year after.

Moneyworld: 1% compound interest each year

Which of these accounts should Megan choose?

Helicopter A leaves Newtown and flies 60 miles east and then 10 miles south and arrives at Billington.

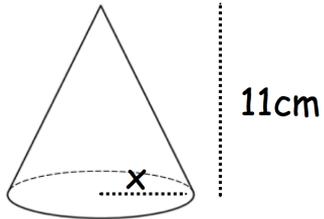
What is the bearing of Billington from Newtown?

Work out $81^{-\frac{3}{4}}$



$$w = \frac{9x(a + c)}{cd}$$

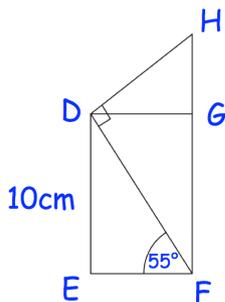
Make c the subject.



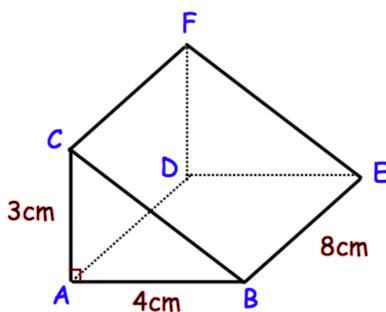
The volume of the cone 612cm^3
Find the radius of the base of the cone.

Solve, giving your answers to one decimal place.

$$x^2 - x - 11 = 0$$



DE = 10cm
Angle DFE = 55°
Find the length of DH



Shown below is a triangular prism.
Triangle ABC is a right angled triangle.
Find the length of CE.



Here are the first and third terms of a Fibonacci-type sequence

d e — — —

Work out an expression in terms of d and e for the fifth term

A full fish tank has sprung a leak, at the base of the tank. 5% of the water is lost every minute.

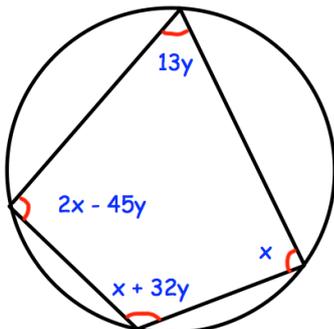
How much water is lost from the tank after ten minutes?

Solve $x^2 - 9x - 11 = 0$
giving your answers to 1 decimal place.

Liquid A has a density of 0.85g/cm^3
Liquid B has a density of 1.2g/cm^3

200g of liquid A and 30g of liquid B are mixed for make liquid C.

Work out the density of liquid C.



Find x and y