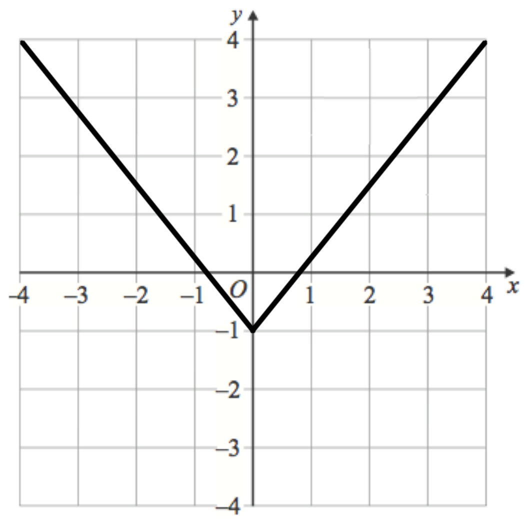
1st January Higher Plus 5-a-day

Prove $(2n + 2)^2 - (2n + 1)$ is always odd for all positive values of n.

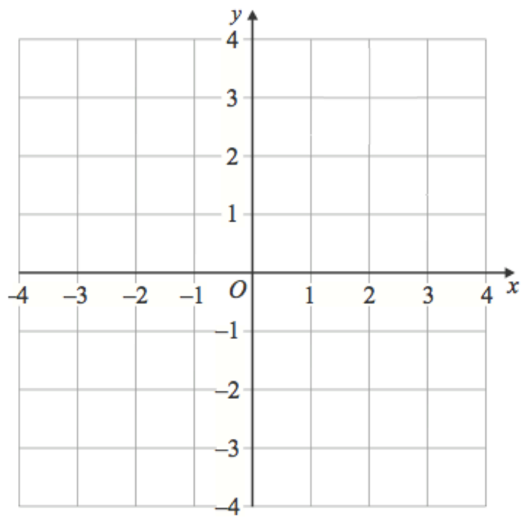
Rationalise the denominator

$$\frac{3 + \sqrt{2}}{\sqrt{3}}$$

Shown is f(x)



Sketch the function f(x + 1)



f(x) = 3x + 2

g(x) = x^2

Find fg(x)

Find gf(5)

Corbettmaths

Solve the simultaneous equations

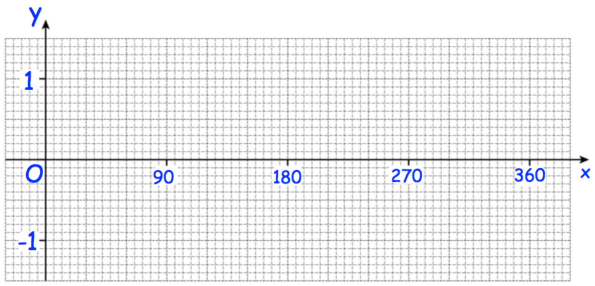
$y = x^2 - 1$

$x = 5 - y$

Work out

$\sqrt{200} + \sqrt{50}$

Sketch $y = \sin x$ for $0° \leq x \leq 360°$



Solve $x^2 - 2x - 15 > 0$

Find the nth term of

10, 12, 16, 22, 30 … ...

3rd January	Higher Plus 5-a-day
Work out $25^{-0.5}$	
Prove $(5n+2)^2-(5n-1)^2$ is always a multiple of 3, if n is a positive integer.	
Rationalise the denominator $\dfrac{\sqrt{3}}{\sqrt{2}}$	
Find the equation of the line that is perpendicular to 3x + y = 8 and passes through the point (1, 5)	
Simplify $\left(81x^8\right)^{-\frac{3}{4}}$	

Corbettmaths

4th January **Higher Plus 5-a-day**

Corbettmaths

Solve the simultaneous equations

$x + y = 3$

$x^2 + y^2 = 5$

Ramy saves some of his pocket money each week.

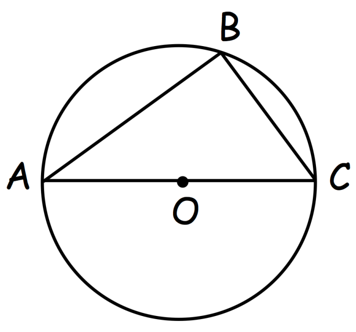
He saves 10p in week 1,
16p in week 2, 22p in week 3 and so on for 40 weeks.

Find the amount he saves in week 40.

Calculate his total savings over the 40 weeks.

Rationalise the denominator of

$$\frac{\sqrt{5}}{\sqrt{3}+2}$$



Prove that the angle in a semi-circle is always 90°

Corbettmaths

Express $(8+\sqrt{5})^2$ in the form $a+b\sqrt{5}$	
Find the minimum value of $x^2+6x+20$ and the value of x for which it occurs.	
Write the equation of the circle C, with centre O and radius 4.	
Write $2.1\dot{6}\dot{5}$ as a mixed number. Give your answer in its simplest form. Use an algebraic approach.	
Find the nth term of 1, 3, 7, 13, 21, ..., ...	

Solve the simultaneous equations

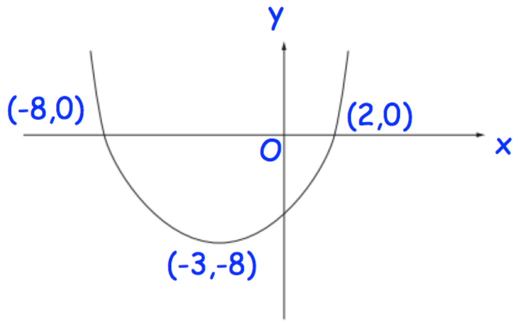
$$2y - x + 3 = 0$$

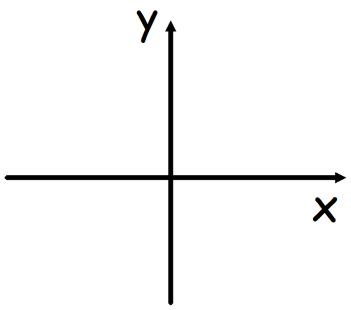
$$x^2 + xy = 0$$

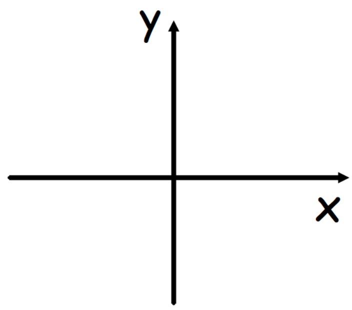
Shown is a sketch of the graph
y = f(x).

(a) Sketch $-f(x)$
(b) Sketch $f(x + 1)$

Label known coordinates







The line l_1 has equation $y = 4x - 10$
The line l_2 has equation $x + y = 20$

The lines l_1 and l_2 intersect at the point C.
The lines l_1 and l_2 cross the line y = 2 at the points A and B.

Find the area of triangle ABC.

A circle has equation
$x^2 + y^2 = 400$

Find the equation of the tangent to the circle at the point (16, –12)

Corbettmαths

Expand and simplify

$(x + 2)(x + 5)(2x - 1)$

The line l_1 has equation $y = 4x + 3$

The line l_2 has equation
$5x + 2y - 9 = 0$

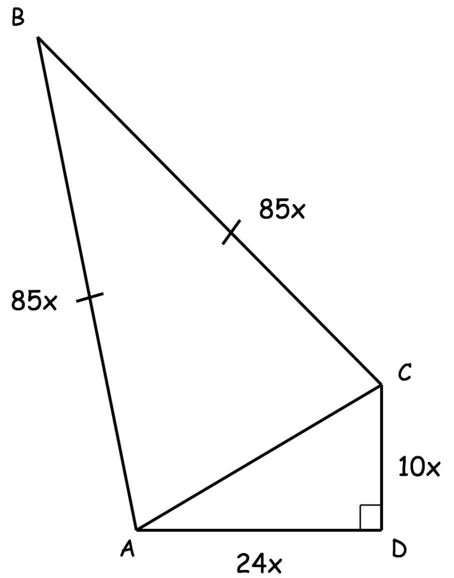
Find the gradient of line l_2

Find the coordinates of the point of intersection of l_1 and l_2

Given that

$16^x = 4^{10-x}$

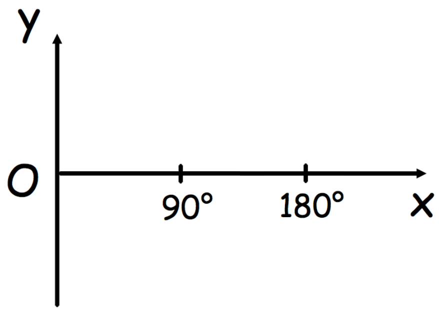
Find the value of x



Show the area of ABCD is $1212x^2$

8th January **Higher Plus 5-a-day**

Corbettmaths

Which number has no reciprocal?	
Find the coordinates of the points where $y = 2x^2 - 7x + 3$ crosses each axis.	
Sketch $y = tan x$ for $0° \leq x \leq 180°$	
Solve the simultaneous equations $x^2 + y^2 = 9$ $y = x + 3$	
Given that $125^x = 25^{(x+5)}$ Find x	

Corbettmaths

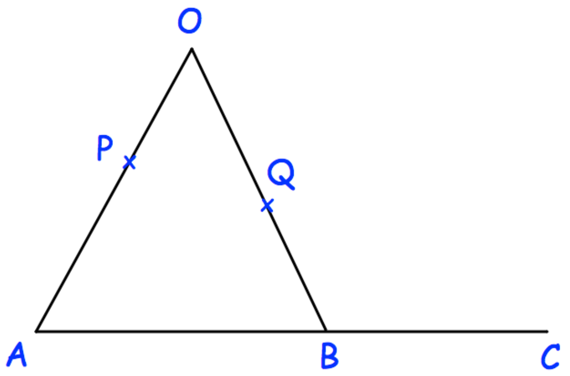
Simplify

$$\frac{18x^{\frac{5}{4}}}{6x}$$

Find the equation of the straight line passing through B(–2, 8) and C(1, 0).

Give your answer in the form
ax + by + c = 0
where a, b and c are integers.

Express $3x^2 + 12x + 13$ in the form
$a(x + b)^2 + c$



AOB is a triangle.
P is a point on AO.

$\overrightarrow{AB} = 2\mathbf{a}$ $\overrightarrow{AO} = 6\mathbf{b}$

$AP : PO = 2 : 1$

Find the vector $\overrightarrow{OB}$ in terms of **a** and **b**

Q is the midpoint of OB.
B is the midpoint of AC.
Show PQC is a straight line.

Given

$$2^y = \frac{1}{8}$$

Find y

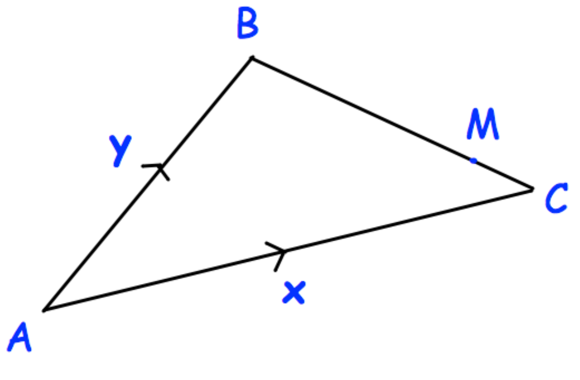
Show the equation $x^2 - 4x + 1 = 0$ can be written in the form

$$x = 4 - \frac{1}{x}$$

Starting with $x_0 = 3$, use the iteration formula

$$x_{n+1} = 4 - \frac{1}{x_n}$$

twice to find an estimate of the solution of $x^2 - 4x + 1 = 0$



ABC is a triangle.

M lies on BC such that $BM = \frac{4}{5}BC$

Express these vectors in terms of **x** and **y**

Express these vectors in terms of **x** and **y**

$\overrightarrow{BC}$

$\overrightarrow{BM}$

$\overrightarrow{AM}$

Corbettmaths

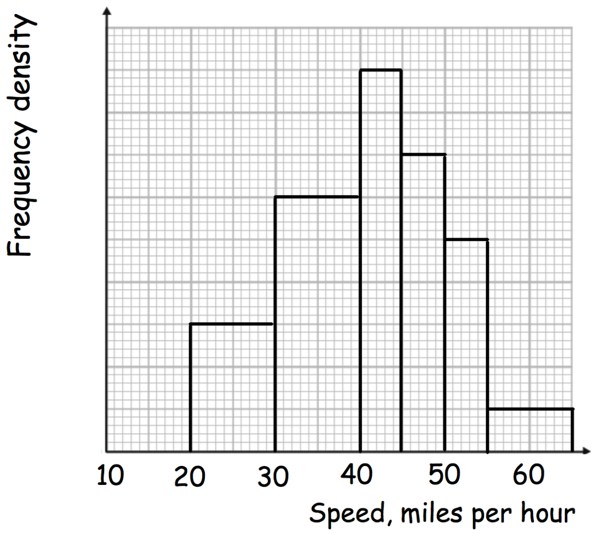
Simplify $\dfrac{\left(6x^{\frac{1}{2}}\right)^3}{2x}$

Work out

$\left(1\dfrac{11}{25}\right)^{-\frac{1}{2}}$

Solve $2x^2 - 5x + 3 < 0$

The histogram shows the speeds, in miles per hour, of cars on a road.



14 cars were travelling over 50 mph.

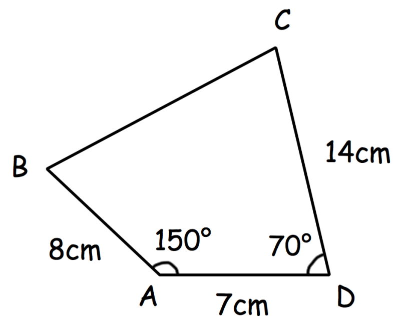
Calculate an estimate of the number of cars that were travelling between 42 and 49 mph.

Solve the simultaneous equations

$x = 3y + 6$
$3xy = 24 - x$

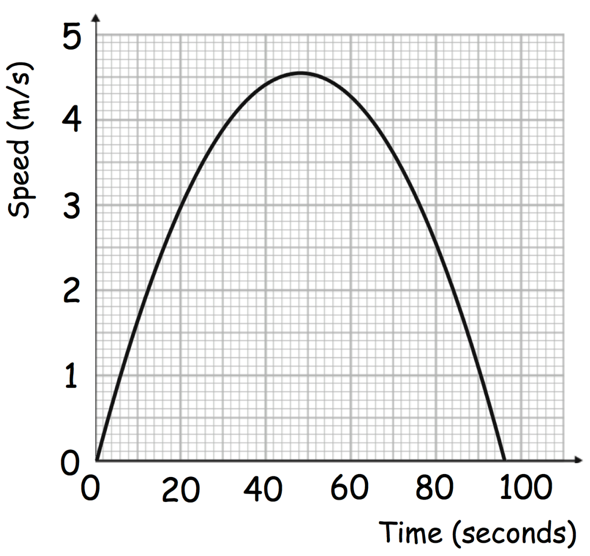
Write $x^2 + 8x + 17$ in the form $(x + a)^2 + b$

Find the coordinates of the turning point of $y = x^2 + 8x + 17$



Calculate the length BC.

Below is the speed-time graph for the journey between two stops on a miniature locomotive



Work out an estimate of the acceleration of the locomotive at 20 seconds.

Work out an estimate for the distance travelled by the locomotive during the journey.

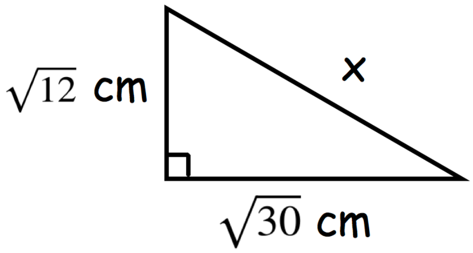
Corbettmaths

$6x + 4y = 7y - x$

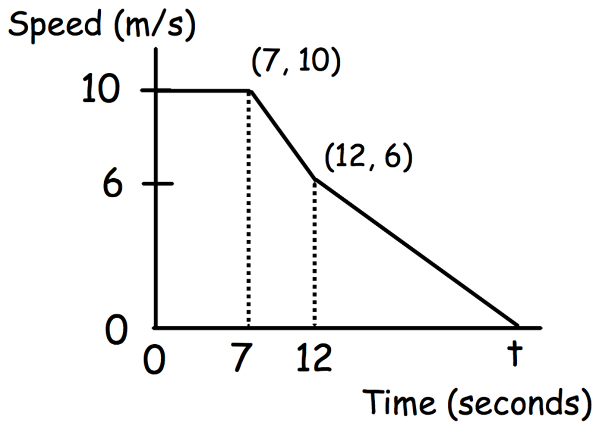
Find the ratio x : y

Solve

$x^2 - 5x + 4 > 0$



Find x



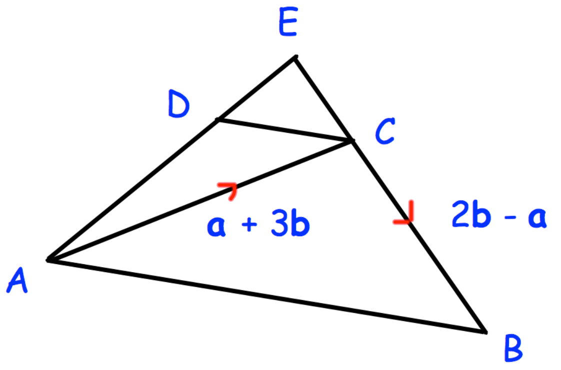
The average speed from 0 to t seconds was 5.96m/s

Find t

Find the rate of deceleration from 12 to t seconds.

Corbettmaths

Find the value of $32^{\frac{2}{5}}$



$\overrightarrow{AC} = \mathbf{a} + 3\mathbf{b}$ $\overrightarrow{CB} = 2\mathbf{b} - \mathbf{a}$

$\overrightarrow{DE} = \frac{1}{5}\mathbf{a}$

Find the vector $\overrightarrow{AB}$

$\overrightarrow{EC} = \frac{1}{5}\overrightarrow{CB}$

Prove DC is parallel to AB

Expand and simplify

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

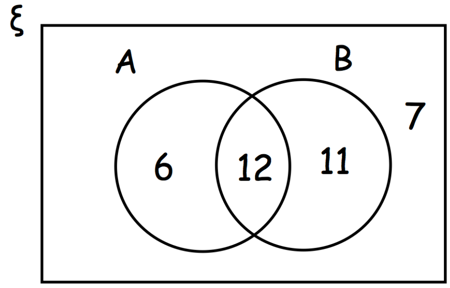
Write

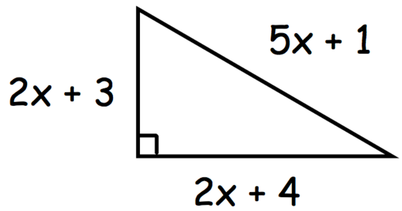
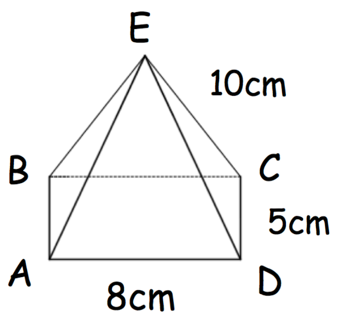
$\frac{4}{\sqrt{5}} - \sqrt{2\frac{2}{9}}$

in the form k√5

15th January **Higher Plus 5-a-day**

Corbettmaths

Factorise completely $x^3 - 25x$	
The square of w is 5 Write down the value of w^5	
	Find the probability of B given A.
There are 9 students in Class A and 16 students in Class B. Class A and Class B sat a test. The mean score for the 9 students in Class A was y The mean score for all 25 students was 72	Find an expression, in terms of y, for the mean score for the students in Class B.
A curve has equation $y = ax^2 + bx + c$ The curve crosses the x-axis at (3, 0) and (4, 0) The curve crosses the y-axis at (0, 12)	Find the values of a, b and c.

Simplify $(125x^6)^{\frac{2}{3}}$	
A bag contains 10 sweets. 5 sweets are red. 3 sweets are yellow. 2 sweets are green. Two sweets are taken from the bag without replacement.	Work out the probability that the two sweets are different colours.
w is directly proportional to c squared When w = 16, c = 2 Find the value of c when w = 28c – 49	
Shown is a right angle triangle. Find the value of x	
	Shown is a rectangular based pyramid. The apex E is directly over the centre of the base. Calculate angle between the face ABE and the base ABCD

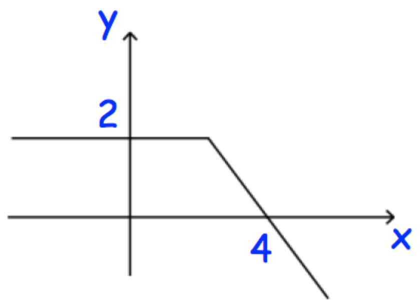
Corbettmaths

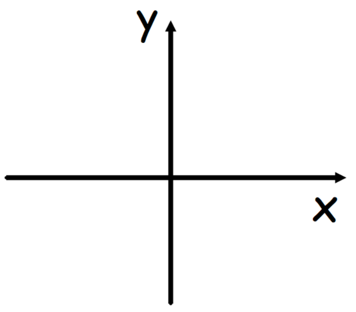
Simplify fully

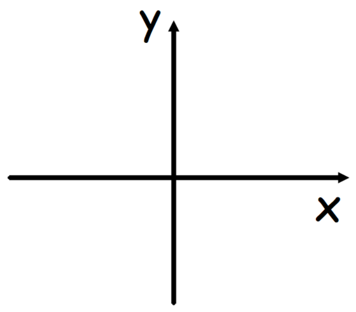
$$\frac{4x^2 - 25}{6x^2 - 11x - 10}$$

Shown is the graph of the function y = f(x)

Sketch
(a) f(x + 1)
(b) f(–x)







A formula for the area of a regular hexagon with side length x is given.

$$\text{Area} = \frac{3}{2}\sqrt{3}\,x^2$$

Prove this formula.

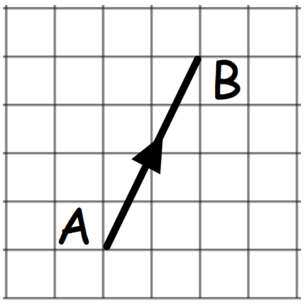
The straight line l_1 has equation
3x + y – 1 = 0
The straight line l_2 is perpendicular to line l_1 and passes through the point (8, 2)

Find the equation of l_2 in the form
y = mx + c

18th January **Higher Plus 5-a-day**

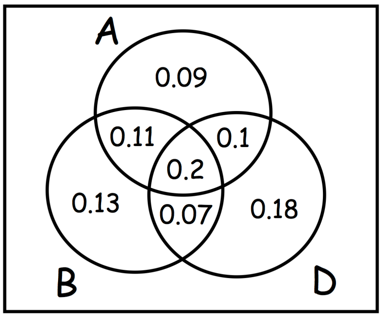
Corbettmaths

Rearrange $y + 3 = x(y + 2)$ to make y the subject of the formula.



$\overrightarrow{AB} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$

Write down a vector that is perpendicular to AB and the twice the length



Work out $P(A' \cap D')$

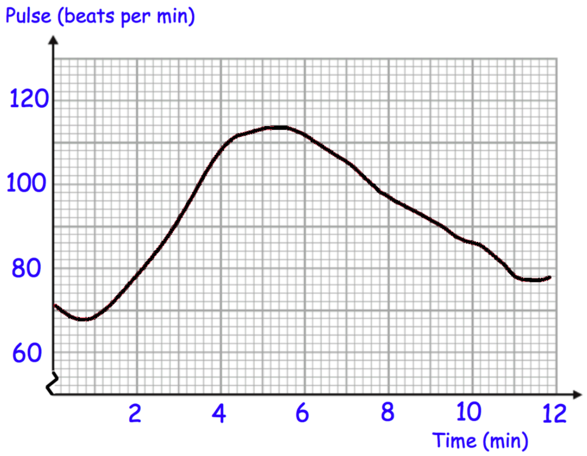
Factorise

$14x^2 + 31xy - 10y^2$

After a reduction of 3% in the original price, a motorbike is sold for £700.

Both of these values are correct to one significant figure.

Calculate the greatest possible original price before the reduction was applied.

19th January	**Higher Plus 5-a-day**
The events A and B are mutually exclusive. P(A) = 0.5 P(B) = 0.4 Find P(A∪B)	
Write in the form $a\sqrt{b}$, where a and b are integers to be found. $$\frac{24}{\sqrt{6}}$$	
Prove algebraically that the sum of the squares of any two odd numbers is always even.	
 	Work out the rate at which the pulse is increasing at four minutes. Include units. Work out the rate at which the pulse is decreasing at seven minutes. Include units.

20th January **Higher Plus 5-a-day**

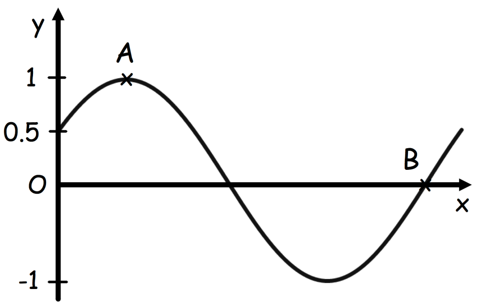
Corbettmaths

The point (12, 5) lies on a circle with centre (0, 0)

Write down the coordinates of another three points on the circle.

Expand and simplify

$(x-3)^3$



Shown is the curve

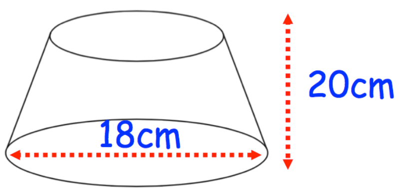
$y = sin(x + 30°)$

Write down the coordinates of A and B

There are 20 sweets in a box.
There are y lemon sweets and the rest of the sweets are orange.

Florence takes out two sweets, at random, from the box.

Find an expression, in terms of y, for the probability that Florence takes two lemon sweets.



Shown is a frustum of a cone that had a perpendicular height of 40cm

Calculate the surface area of the frustum

Corbettmaths

Express as a single fraction.

$$\frac{1}{x+1} + \frac{4}{x-2}$$

Salary (£1000s)	Frequency
0 < s ≤ 10	8
10 < s ≤ 20	48
20 < s ≤ 30	50
30 < s ≤ 50	11
50 < s ≤ 200	3

Calculate an estimate of the median salary

Show the equation

$$x^3 + 3x = 1$$

has a solution between x=0 and x=1

Show the equation

$$x^3 + 3x = 1$$

can be rearranged to give

$$x = \frac{1}{3} - \frac{x^3}{3}$$

Starting with $x_1 = 0$
use the iteration formula

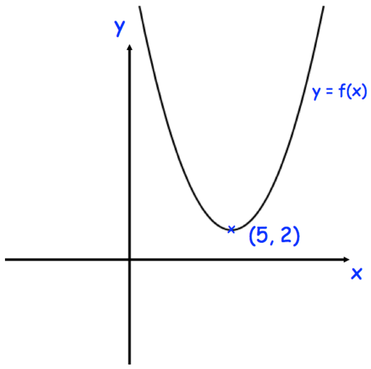
$$x_{n+1} = \frac{1}{3} - \frac{(x_n)^3}{3}$$

three times to find a solution to

$$x^3 + 3x = 1$$

A cuboid has length (x + 9)cm, width (x + 2)cm and height 5cm. The surface area of the cuboid is 400cm².

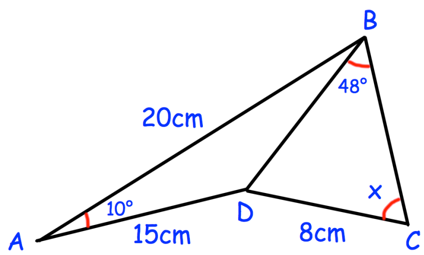
Find the value of x to 1 decimal place.



Shown is the curve with equation y = f(x)
The coordinates of the minimum point of the curve are (5, 2).

Which transformation will have a minimum point of (–5, 2)?

Which transformation will have a minimum point of (8, 2)?



AB = 20cm AD = 15cm CD = 8cm
∠DAB = 10° ∠DBC = 48°

Find x

$$w = \frac{\sqrt{c}}{p}$$

c = 4.24 correct to 2 decimal places
p = 7.88 correct to 3 decimal places

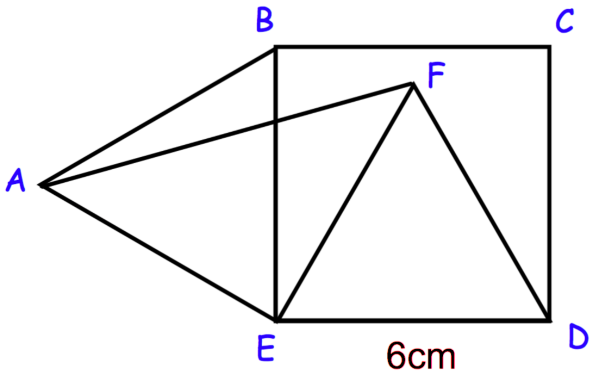
By considering bounds, work out the value of w to a suitable degree of accuracy.

Corbettmaths

Find the minimum point of the graph
$y = x^2 - 6x + 7$

The set of values for x that satisfies a quadratic inequality is
$x < -0.5$ or $x > 1.5$

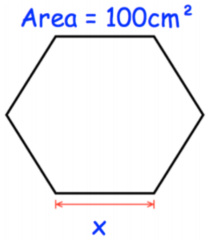
Write down a possible quadratic inequality.



BCDE is a square
DFE and ABE are equilateral triangles

Find the length of AF

Below is a regular hexagon with an area of 100cm²



Find x

Corbettmaths

$$f(x) = \frac{ax+3}{4}$$

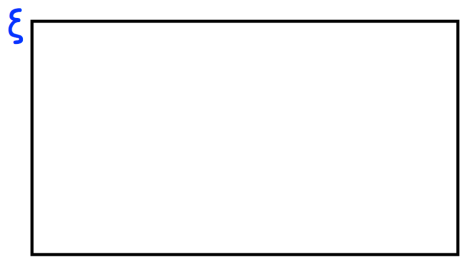
Given

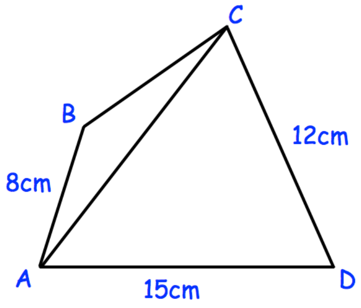
$$f(7) = 6$$

Find a

A PE test has two sections, theory and practical.
Everyone in a class who took the PE test passed at least one section.
65% passed the theory section and 80% passed the practical section.

Show this on a Venn diagram





ABCD is a quadrilateral.

AB = 8cm, AD = 15cm and CD = 12cm.
Angle ADC = 78° and angle BAC = 20°

Calculate the length of AC.

Calculate the area of triangle ABC.

Find the set of values of x for which

both $9x - 2 < 18 - x$

and $x^2 - x \geq 20$

Prove that the angles in a triangle add up to 180°. Hint: consider parallel lines.	
A boat sails 4 miles North from A to B. Then the boat sails 5 miles North-East from B to C. The boat then sails directly back to A.	How far does the boat sail in total?
Rationalise the denominator of $\frac{2+\sqrt{3}}{\sqrt{5}-1}$	
x is an obtuse angle. Given $sin(x) = \frac{5}{13}$	Find cos(x)
Expand and simplify $(1+\sqrt{2})(1+\sqrt{3})(2-\sqrt{3})$	

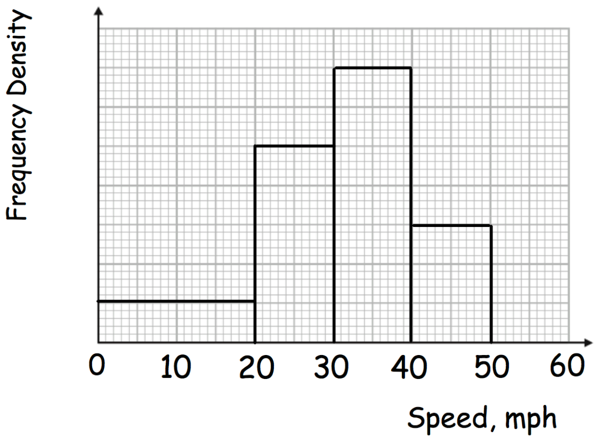
26th January **Higher Plus 5-a-day**

Corbettmaths

Express in the form 2^n

(a) $\frac{1}{16}$

(b) $2\sqrt{2}$



The histogram shows the speeds of cars travelling down a road.
24 cars travelled faster than 40mph.

How many cars travelled less than 20mph?

Estimate how many cars travelled between 25mph and 35mph.

$f(x) = 3x - 5$

Find
$f^{-1}(x)$

The bearing of B from A is x.
x is less than 180°.

Prove the bearing of A from B is (180 + x)°

27th January **Higher Plus 5-a-day**

Corbettmaths

Write $1.2\dot{4}$ as a mixed number.
Use an algebraic approach and give your answer in its simplest form.

Write in the form $a\sqrt{2}$

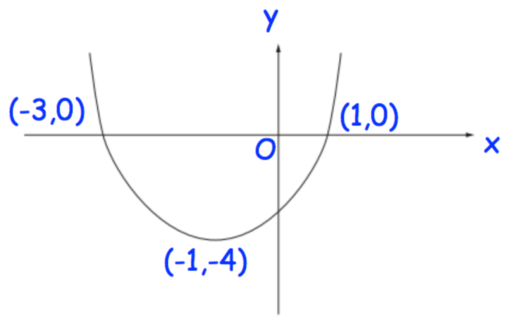
$$\sqrt{72} + \sqrt{3} \times \sqrt{6}$$

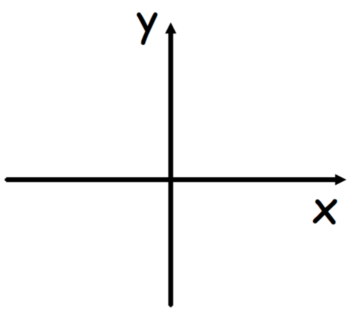
Mass (m kg)	Frequency
40 < m ≤ 45	64
45 < m ≤ 50	74
50 < m ≤ 55	155
55 < m ≤ 60	80
60 < m ≤ 65	26
65 < m ≤ 70	1

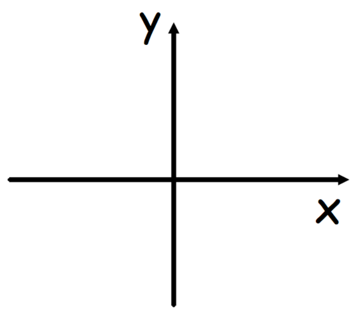
Calculate an estimate of the interquartile range.

Shown is the graph of the function y = f(x)

Sketch
(a) –f(x)
(b) f(x + p) where $0 < p < 1$

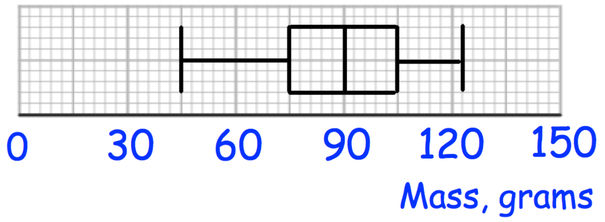






Solve the inequality

$5x^2 < 45$

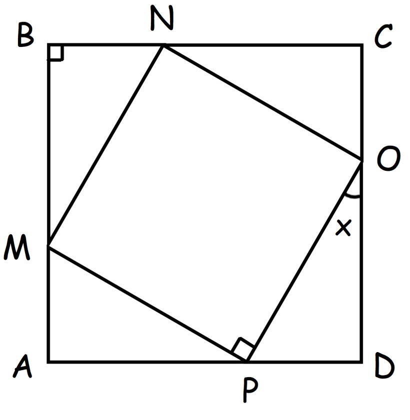


The box plot shows information about the masses of apples in a box

Jack picks three apples at random, one at a time, replacing each before picking the next.
Find the probability that he chooses two over 90g and one under 75g.

The minimum point of a quadratic graph in the form $y = x^2 + ax + b$ is $(-2, -10)$.

Find a and b.

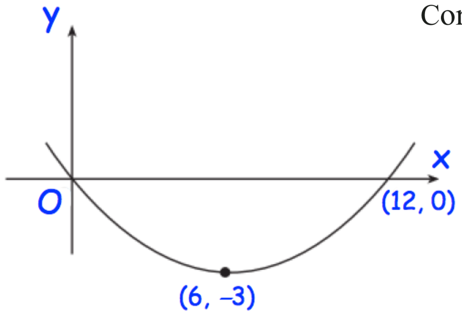


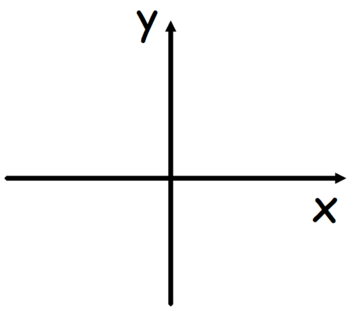
ABCD and MNOP are squares.

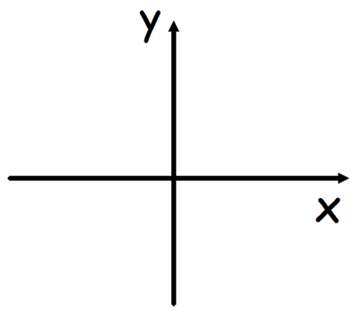
Prove triangles POD and MAP are congruent.

Shown is the graph of the function
y = f(x)

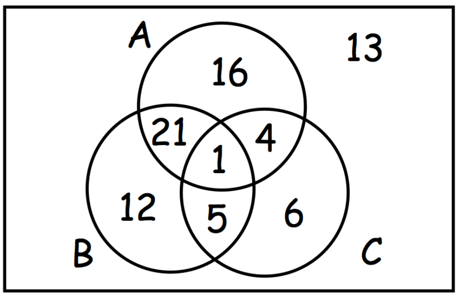
Sketch
(a) f(–x)
(b) f(x) + 3



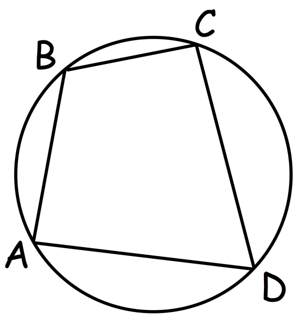




Find the coordinates where the line $2x - y + 3 = 0$ and the curve $y = x^2 - x - 7$ intersect



Find the probability of A given not B.



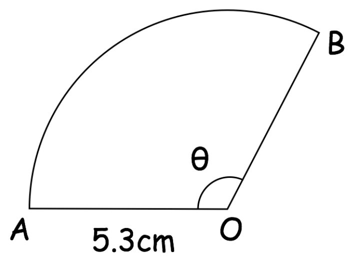
Prove the opposite angles in a cyclic quadrilateral add to 180°

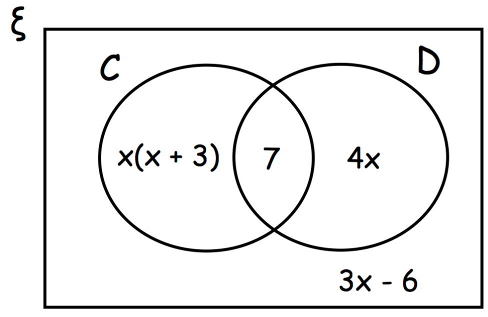
Make y the subject of the formula

$$c = w - 4ay^3$$

The perimeter of sector AOB is 22.81cm.

Find θ





ξ = 40 students
C = students who own a cat
D = students who own a dog

A student is chosen at random.
They own a dog.
Work out the probability that they own a cat

A group of 10 people enter a room.

Each person shakes hands with all the other people in the room once.

How many handshakes are there in total?

31st January	Higher Plus 5-a-day
Expand and simplify $(2x+3)^3$	
Make m the subject of the formula $E = mgh + \frac{1}{4}mv^2$	
Calculate the sum of the first 50 odd numbers	
Solve the inequality $12x^2 + 7x + 1 \leq 0$	
How many regular polygons have integer interior angles?	

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