1 $3x$ is increased by 45% such that it now is the same as $x + 67$.
Find the value of x.

2 Solve the equation $x^{\frac{2}{3}} + 3x^{\frac{1}{3}} - 40 = 0$

3 Solve $3 - 4x - x^2 = 0$ by completing the square and then use your answer to sketch the graph showing all the important points on the parabola.

4 Rearrange the equation $t = ut - \frac{as}{t}$ to make t the subject.

5 Make x the subject of $d = \frac{1}{2}mx^2 - 2x$

6 Expand $\left(3x^2 - \frac{1}{\sqrt{3}}\right)^5$ using binomial expansion.

7 A circle has a radius of 12cm and has its centre at (3,2). A diameter is drawn and goes through the point (5,1). At what points does the drawn diameter meet the circumference of the circle?

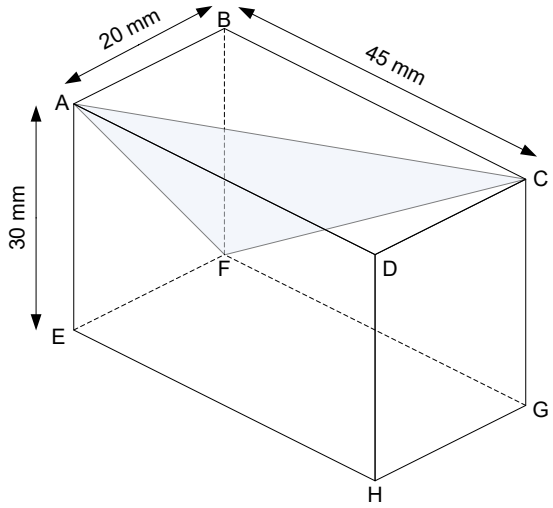
8 Show that $(2x - 3)$ is a factor of $12x^3 + 8x^2 - 49x + 15$.

9 Solve $\frac{3(t+4)}{8} + 2 = \frac{2t}{3}$

10 $f(x) = x^2 - 3$ for the domain $4 \leq x < 9$
Find the range of the function.

If you are given a graph and asked to state the domain and the range: The domain is the extremes of the graph on the x axis and the range is the extremes on the graph on the y-axis.

11 ABCDEFGH is a cuboid.



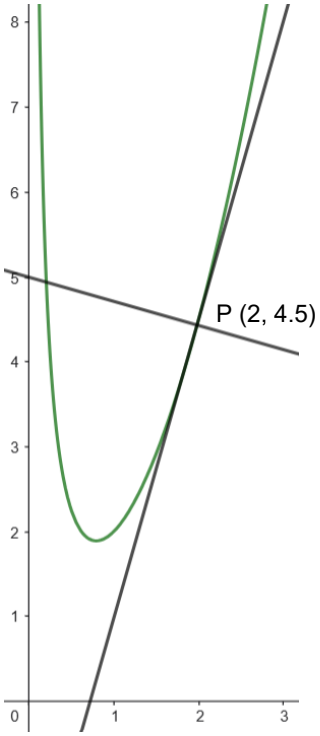
a Find the size of angle AFB and hence the size of angle AFC.

b Find the area of triangle AFC.

12 Differentiate $y = \frac{x^5 + x^2}{x}$

13 Work out the gradient of the curve $y = 3\sqrt{x} - \frac{3}{\sqrt{x}}$ at the point (4,4.5)

14 The figure below shows the curve $y = x^2 + \frac{1}{x}$ for the domain $0 \leq x \leq 4$ and P is the point (2,4.5).



a Find the equation of the tangent on the line at point P

b Find the equation of the normal on the line at point P.

15 For the curve $y = x^3 - 15x + 6$

a. work out the values for which $\frac{dy}{dx} = 0$.

b. Classify the points on the curve with these x-values by finding $\frac{d^2y}{dx^2}$ and remembering <0 is a maximum whereas >0 is a minimum.

c. Work out the corresponding y values.

d. sketch the curve.

16 Describe fully the transformation given by $\begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$

17 Write the matrix which will provide a reflection in the line y=x.

18 Write the matrix which will provide a rotation of 90° clockwise about the origin.

19 Point P (4,-3) is transformed in the matrix $\begin{bmatrix} 3 & -1 \\ -2 & 2 \end{bmatrix}$ and then in the further matrix $\begin{bmatrix} 1 & 0 \\ 3 & -2 \end{bmatrix}$.

a. Work out a matrix for the combined transformation.

b. Work out the co-ordinates of the image of point P.

20 Solve $9^x = 27^{x+2}$

21 The nth term of a sequence $\frac{4n-9}{7n+2}$

a. Find the first two terms in the sequence.

b. Find the value for which the number in the sequence is 0.47

c. Write down the limiting value of the sequence as $n \to \infty$

22 A square of sides 4cm has the same area as an equilateral triangle. Find the perimeter of the equilateral triangle.

23 Solve $15\,Sin\,\theta + 9 = 0$ for $-360° \leq \theta \leq 720°$

Hint: Solve it for the principal value and then add and subtract 180 until you end up outside the range.

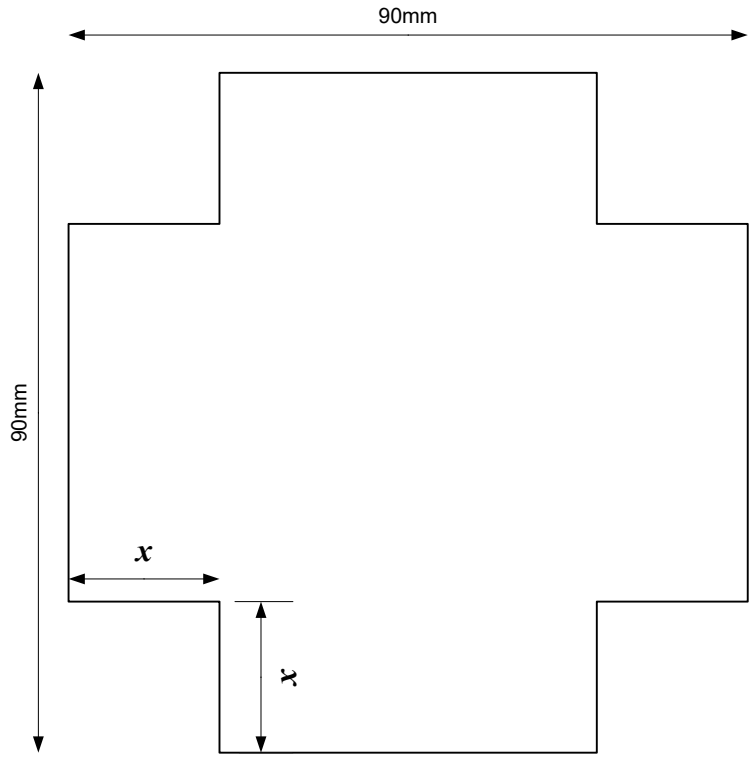
24 Solve the following for $-360° \leq \theta \leq 540°$

a. $tan^2 x - 3\tan x = 0$

b. $1 - 2sin^2 x = 0$

c. $3cos^2 x + 2\cos x - 1 = 0$

25 Below is a net of an open topped box.



a Write an expression for the volume of the box in terms of x.

b Work out $\frac{dV}{dx}$ and $\frac{d^2V}{dx^2}$ and use these to calculate the value of x giving the maximum volume.

c What is the maximum volume?

For Fun: a 1% club question.

Four mice weigh the same as a cat and a duck.

A cat weighs the same as a mouse and a duck.

How many ducks weigh the same as three mice?