1 Sketch the graph of $y = 9 - x^2$. [3]

2
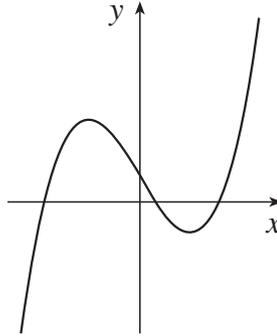
Fig. 13

Fig. 13 shows a sketch of the curve $y = f(x)$, where $f(x) = x^3 - 5x + 2$.

   (i) Use the fact that $x = 2$ is a root of $f(x) = 0$ to find the exact values of the other two roots of $f(x) = 0$, expressing your answers as simply as possible. [6]

   (ii) Show that $f(x - 3) = x^3 - 9x^2 + 22x - 10$. [4]

   (iii) Write down the roots of $f(x - 3) = 0$. [2]

3 You are given that $f(x) = x^3 + 9x^2 + 20x + 12$.

   (i) Show that $x = -2$ is a root of $f(x) = 0$. [2]

   (ii) Divide $f(x)$ by $x + 6$. [2]

   (iii) Express $f(x)$ in fully factorised form. [2]

   (iv) Sketch the graph of $y = f(x)$. [3]

   (v) Solve the equation $f(x) = 12$. [3]

4 **(i)** Sketch the graph of $y = x(x-3)^2$. [3]

  (ii) Show that the equation $x(x-3)^2 = 2$ can be expressed as $x^3 - 6x^2 + 9x - 2 = 0$. [2]

  (iii) Show that $x = 2$ is one root of this equation and find the other two roots, expressing your answers in surd form.

  Show the location of these roots on your sketch graph in part **(i)**. [8]

5 **(i)** Find the equation of the line passing through A $(-1, 1)$ and B $(3, 9)$. [3]

  (ii) Show that the equation of the perpendicular bisector of AB is $2y + x = 11$. [4]

  (iii) A circle has centre $(5, 3)$, so that its equation is $(x-5)^2 + (y-3)^2 = k$. Given that the circle passes through A, show that $k = 40$. Show that the circle also passes through B. [2]

  (iv) Find the x-coordinates of the points where this circle crosses the x-axis. Give your answers in surd form. [3]

PhysicsAndMathsTutor.com