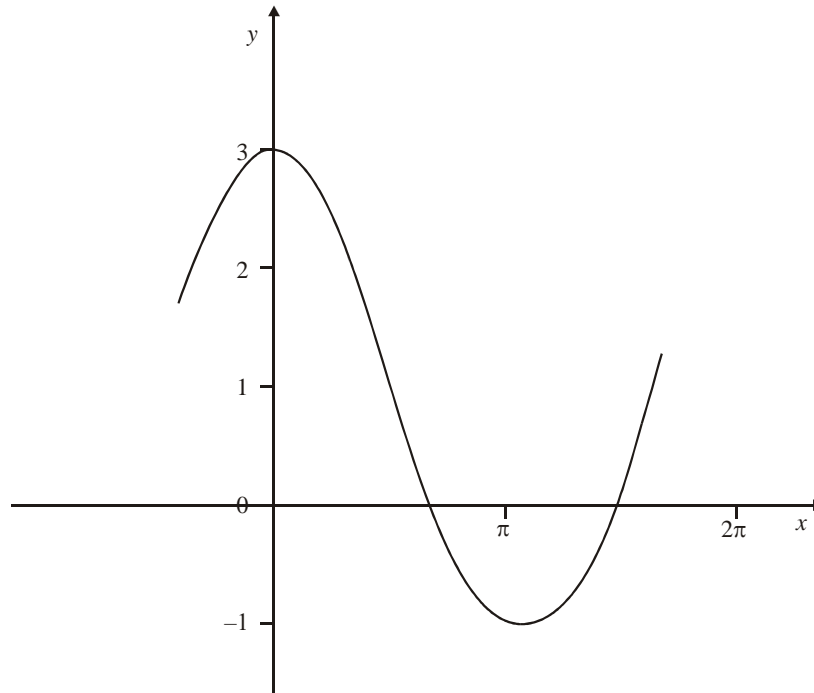1. Part of the graph of $y = p + q \cos x$ is shown below. The graph passes through the points $(0, 3)$ and $(\pi, -1)$.
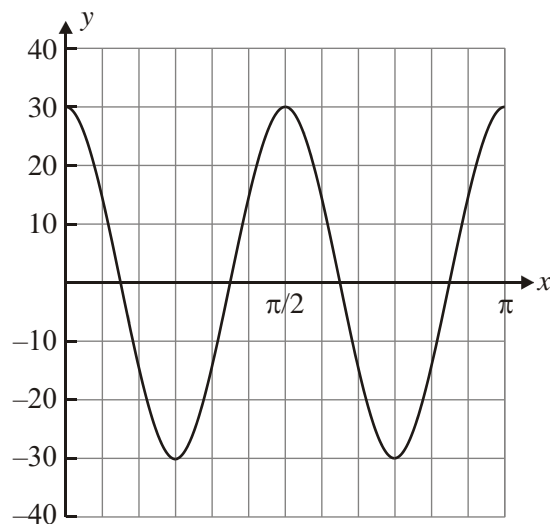

Find the value of

(a) p;

(b) q.

(Total 6 marks)
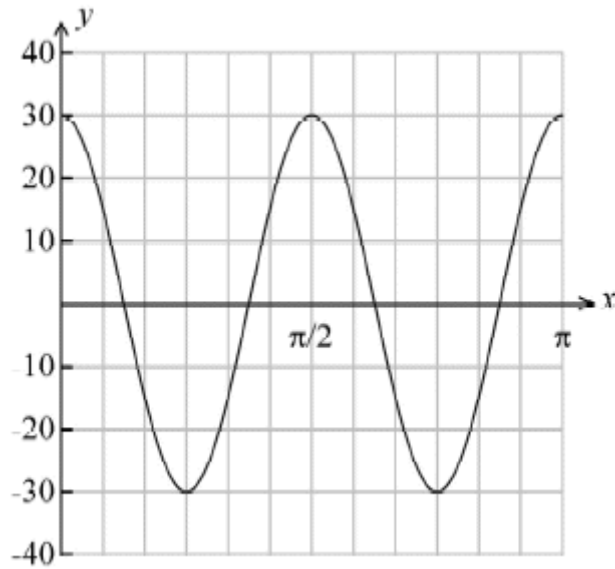
2. The graph of a function of the form $y = p \cos qx$ is given in the diagram below.

(a)   Write down the value of p.

(b)   Calculate the value of q.

(Total 6 marks)

3. The graph of a function of the form $y = p \cos qx$ is given in the diagram below.
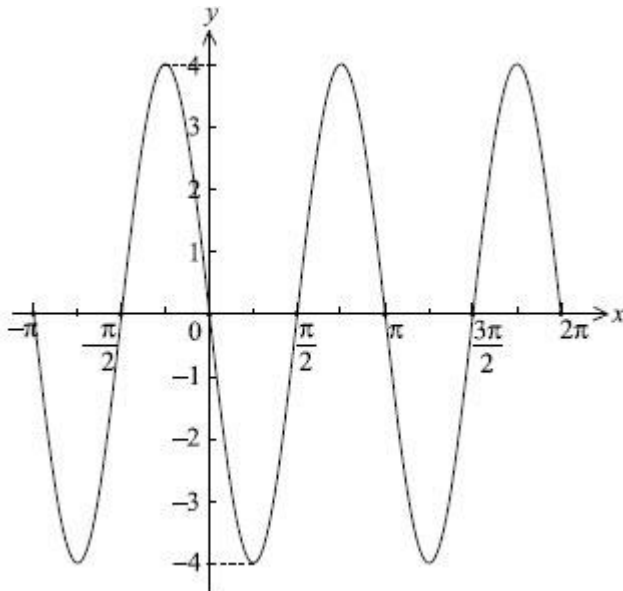

(a) Write down the value of p.

(2)

(b) Calculate the value of q.

(4)

(Total 6 marks)

4. Let $f(x) = a \sin b(x - c)$. Part of the graph of f is given below.

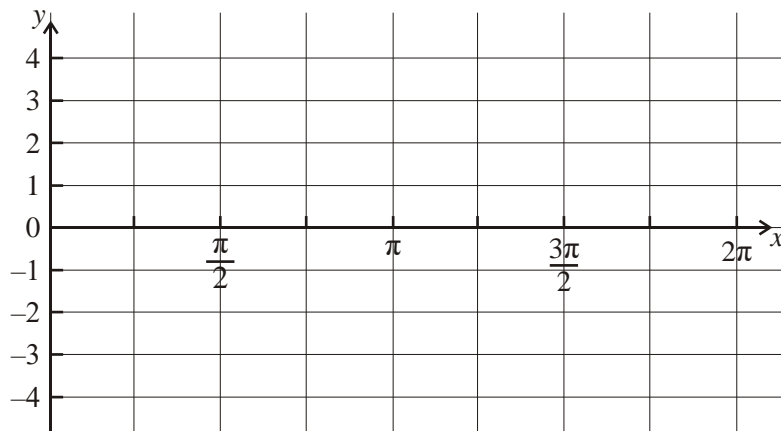Given that a, b and c are positive, find the value of a, of b and of c.

(Total 6 marks)

5. Consider $g(x) = 3 \sin 2x$.

    (a)   Write down the period of g.

        (1)

    (b)   On the diagram below, sketch the curve of g, for $0 \le x \le 2\pi$.
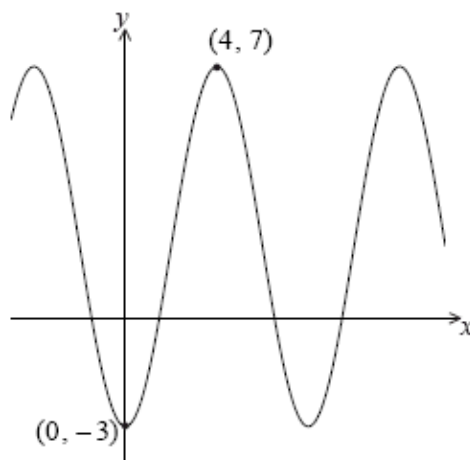

        (3)

    (c)   Write down the number of solutions to the equation $g(x) = 2$, for $0 \le x \le 2\pi$.

        (2)

        (Total 6 marks)

6. The graph of $y = p \cos qx + r$, for $-5 \le x \le 14$, is shown below.

    There is a minimum point at $(0, -3)$ and a maximum point at $(4, 7)$.

    (a)   Find the value of

        (i) p;

        (ii) q;

        (iii) r.

        (6)

    (b)   The equation $y = k$ has exactly **two** solutions. Write down the value of k.

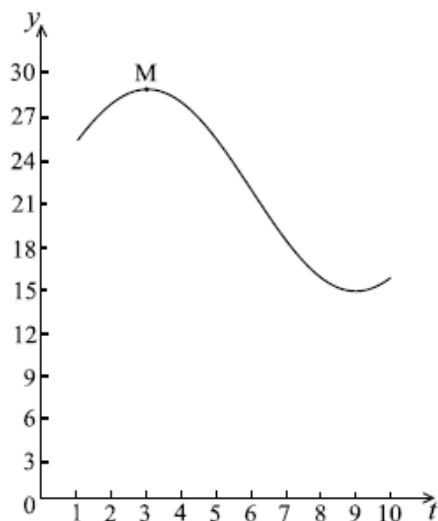   **(1)**

        (Total 7 marks)

7. Let $f(x) = \sin 2x$ and $g(x) = \sin(0.5x)$.

    (a) Write down

        (i)   the minimum value of the function f;

        (ii)   the period of the function g.

    (b) Consider the equation $f(x) = g(x)$.

        Find the number of solutions to this equation, for $0 \leq x \leq \dfrac{3\pi}{2}$.

(Total 6 marks)

8. Let $f(t) = a \cos b\,(t - c) + d, \, t \geq 0$. Part of the graph of $y = f(t)$ is given below.

When $t = 3$, there is a maximum value of 29, at M.
When $t = 9$, there is a minimum value of 15.

    (a)   (i)   Find the value of a.

        (ii)   Show that $b = \dfrac{\pi}{6}$.

        (iii) Find the value of d.

        (iv) Write down a value for c.

(7)

The transformation P is given by a horizontal stretch of a scale factor of $\dfrac{1}{2}$, followed by a translation of $\begin{pmatrix} 3 \\ -10 \end{pmatrix}$.

    (b) Let M′ be the image of M under P. Find the coordinates of M′.

(2)

The graph of g is the image of the graph of f under P.

    (c) Find $g(t)$ in the form $g(t) = 7 \cos B(t - C) + D$.

(4)

    (d) Give a full geometric description of the transformation that maps the graph of g to the graph of f.

(3)

(Total 16 marks)