Trig graphing and transformations
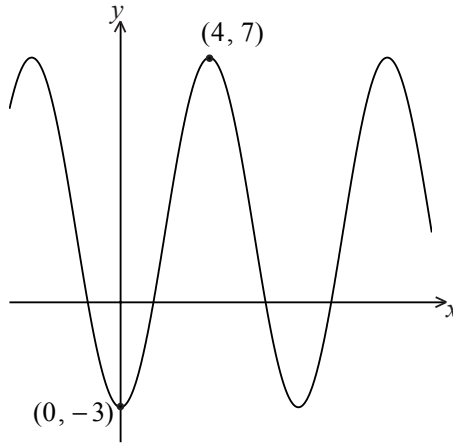
1) The graph of $y = p\cos qx + r$, for $-5 \le x \le 14$, is shown below.

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 marks]*

(b) The equation $y = k$ has exactly **two** solutions. Write down the value of k.　　*[1 mark]*

2) Consider $g(x) = 3\sin 2x$.
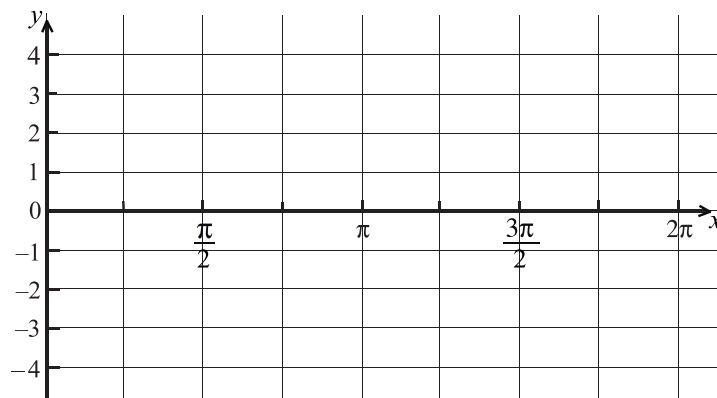
(a) Write down the period of g.　　　　　　　　　　　　　　　　　　*[1 mark]*

. . . .

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(b) On the diagram below, sketch the curve of g, for $0 \le x \le 2\pi$.　　　　　*[3 marks]*
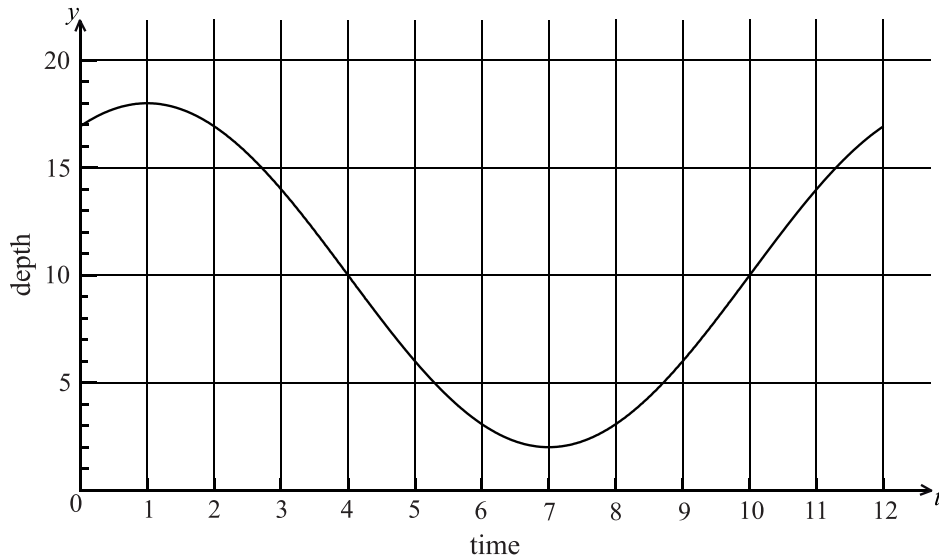

(c) Write down the number of solutions to the equation $g(x) = 2$, for $0 \le x \le 2\pi$.　　*[2 marks]*

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3)

The following graph shows the depth of water, y metres, at a point P, during one day. The time t is given in hours, from midnight to noon.


(a)   Use the graph to write down an estimate of the value of t when

   (i)   the depth of water is minimum;

   (ii)   the depth of water is maximum;

   (iii)   the depth of the water is increasing most rapidly.   *[3 marks]*

(b)   The depth of water can be modelled by the function $y = A\cos\big(B(t-1)\big)+C$.

   (i)   Show that $A = 8$.

   (ii)   Write down the value of C.

   (iii)   Find the value of B.   *[6 marks]*

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4)   The diagram below shows the graph of $f(x) = 1 + \tan\left(\dfrac{x}{2}\right)$ for $-360° \le x \le 360°$.
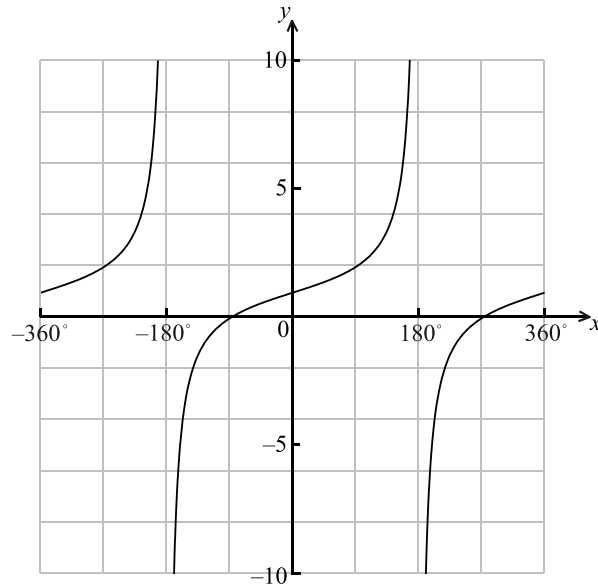
(a)   On the same diagram, draw the asymptotes.   *[2 marks]*
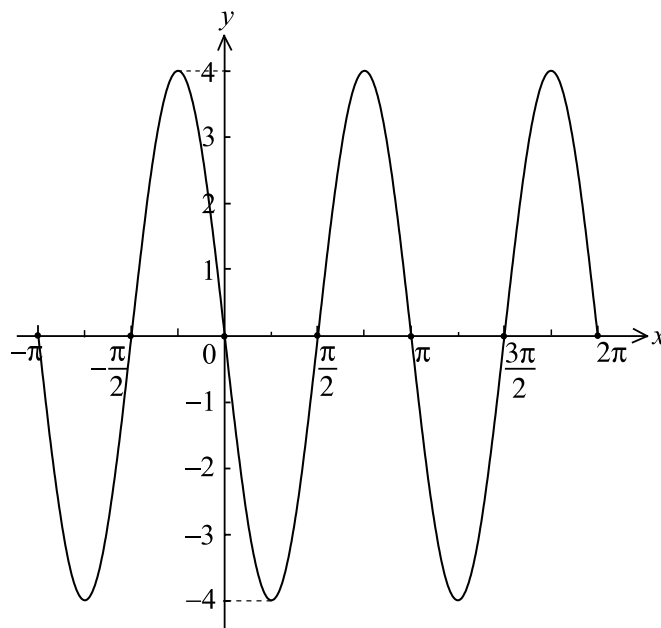
(b)   Write down

     (i)   the period of the function;

     (ii)   the value of $f(90°)$.   *[2 marks]*

(c)   Solve $f(x) = 0$ for $-360° \le x \le 360°$.   *[2 marks]*

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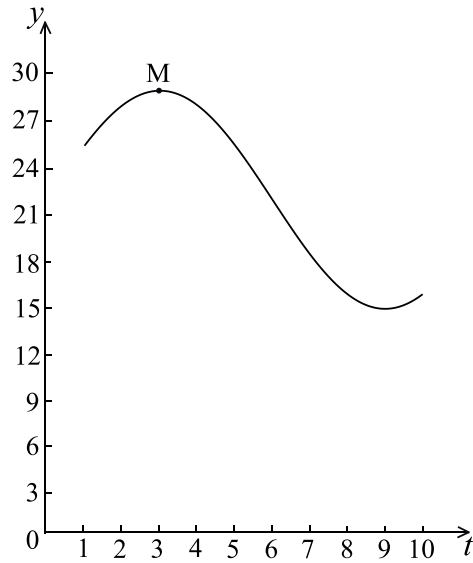

Given that a, b and c are positive, find the value of a, of b and of c.

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6)   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 marks]*

$$\dfrac{1}{2}$$

$$\begin{pmatrix} 3 \\ -10 \end{pmatrix}$$

M' M'

$g(t)$ $g(t) = 7 \cos B(t - C) + D$