1. (a) Show that $\frac{\sin 2\theta}{1+\cos 2\theta} = \tan \theta$.

(2)

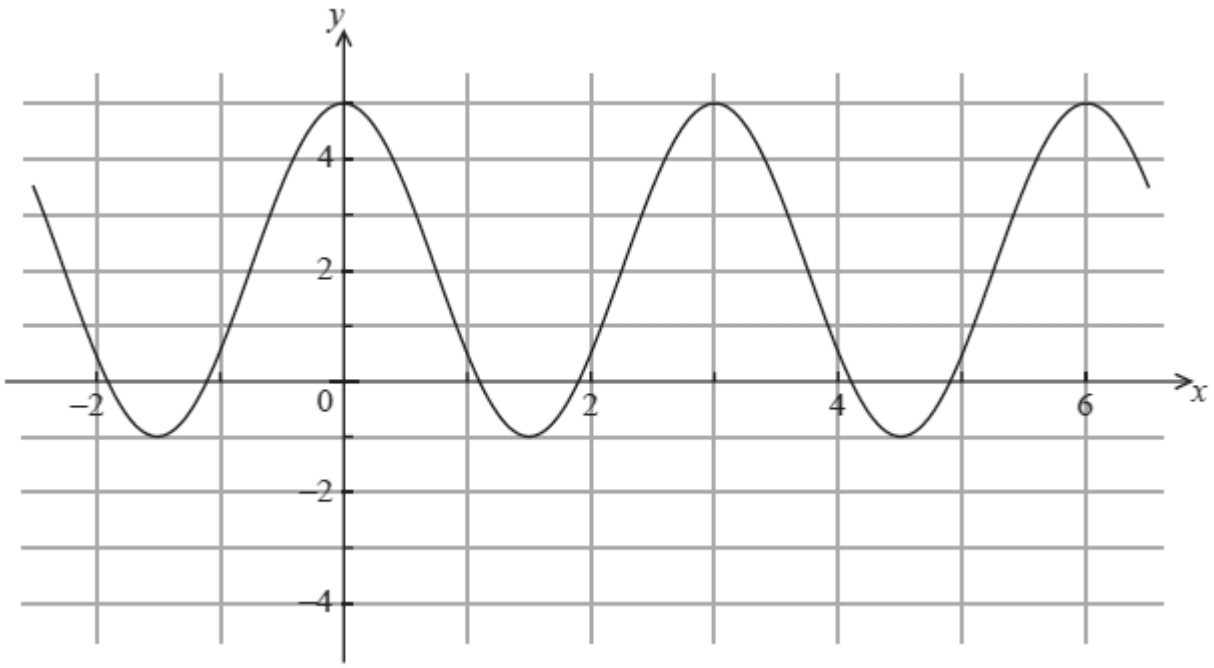
(b) Hence find the value of $\cot\frac{\pi}{8}$ in the form $a + b\sqrt{2}$, where $a, b \in \mathbb{Z}$.

(3)
(Total 5 marks)

2. If x satisfies the equation $\sin\left(x+\frac{\pi}{3}\right) = 2\sin x \sin\left(\frac{\pi}{3}\right)$, show that $11 \tan x = a + b\sqrt{3}$, where $a, b \in \mathbb{Z}^+$.

(Total 6 marks)

3. The graph below shows $y = a\cos(bx) + c$.



Find the value of a, the value of b and the value of c.

(Total 4 marks)

4. Consider the function $f: x \to \sqrt{\frac{\pi}{4} - \arccos x}$.

(a) Find the largest possible domain of *f*.

(4)

(b) Determine an expression for the inverse function, f^{-1}, and write down its domain.

(4)

(Total 8 marks)

5. (a) Show that $\arctan\left(\frac{1}{2}\right) + \arctan\left(\frac{1}{3}\right) = \frac{\pi}{4}$.

(2)

(b) Hence, or otherwise, find the value of arctan (2) + arctan (3).

(3)

(Total 5 marks)

6. In triangle ABC, AB = 9 cm, AC =12 cm, and $\hat{B}$ is twice the size of $\hat{C}$.

Find the cosine of $\hat{C}$.

(Total 5 marks)

7. The depth, *h* (*t*) metres, of water at the entrance to a harbour at *t* hours after midnight on a particular day is given by

$$h(t) = 8 + 4\sin\left(\frac{\pi t}{6}\right), 0 \le t \le 24.$$

(a) Find the maximum depth and the minimum depth of the water.

(3)

(b) Find the values of *t* for which $h(t) \ge 8$.

(3)

(Total 6 marks)

8. Solve $\sin 2x = \sqrt{2}\cos x$, $0 \leq x \leq \pi$.

(Total 6 marks)

9. The obtuse angle B is such that $\tan B = -\frac{5}{12}$. Find the values of

(a) $\sin B$;

(1)

(b) $\cos B$;

(1)

(c) $\sin 2B$;

(2)

(d0 $\cos 2B$.

(2)

(Total 6 marks)

10. Given that $\tan 2\theta = \frac{3}{4}$, find the possible values of $\tan \theta$.

(Total 5 marks)

11. Let $\sin x = s$.

(a) Show that the equation $4 \cos 2x + 3 \sin x \operatorname{cosec}^3 x + 6 = 0$ can be expressed as $8s^4 - 10s^2 + 3 = 0$.

(3)

(b) Hence solve the equation for x, in the interval $[0, \pi]$.

(6)
(Total 9 marks)

12. (a) If $\sin (x - \alpha) = k \sin (x + \alpha)$ express $\tan x$ in terms of k and α.

(3)

(b) Hence find the values of x between 0° and 360° when $k = \frac{1}{2}$ and $\alpha = 210°$.

(6)
(Total 9 marks)

13. The angle θ satisfies the equation $2 \tan^2 \theta - 5 \sec \theta - 10 = 0$, where θ is in the second quadrant. Find the value of $\sec \theta$.

(Total 6 marks)