

2:

In this question you must show all stages of your working.
Solutions relying entirely on calculator technology are not acceptable.

$$f(x) = 7 \cos x - 24 \sin x$$

- (a) Express $f(x)$ in the form $R \cos(x + \alpha)$ where R and α are constants, $R > 0$

$$\text{and } 0 < \alpha < \frac{\pi}{2}$$

Give the exact value of R and give the value of α , in radians, to 3 decimal places.

(3)

$$g(x) = \frac{5}{90 - 3f(2x)}$$

- (b) Using the answer to part (a), find

(i) the minimum value of $g(x)$, giving your answer as a fully simplified fraction,

(ii) the smallest positive value of x for which this minimum value occurs, giving your answer to 3 decimal places.

(4)

8:

In this question you must show all stages of your working.
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- (a) Prove that

$$\tan 3x \equiv \frac{3 \tan x - \tan^3 x}{1 - 3 \tan^2 x} \quad x \neq (2n + 1) \frac{\pi}{6} \quad n \in \mathbb{Z} \quad (3)$$

- (b) Hence solve, for $0 < \theta < \frac{\pi}{2}$

$$\frac{3 \tan \theta - \tan^3 \theta}{1 - 3 \tan^2 \theta} = 2 \sec^2 3\theta - 8$$

giving your answers to 2 decimal places.

(5)

9.

In this question you must show all stages of your working.
Solutions relying entirely on calculator technology are not acceptable.

(a) Express

$$6 \sin^2 \theta \cot 2\theta + 4 \sin \theta \cos \theta$$

in terms of $\sin 2\theta$ and $\cos 2\theta$ only.

(3)

(b) Hence show that the equation

$$3 \cot 2\theta - 14 = 6 \sin^2 \theta \cot 2\theta + 4 \sin \theta \cos \theta$$

can be written in the form

$$5 \sin^2 2\theta + 14 \sin 2\theta - 3 = 0$$

(3)

(c) Hence solve, for $0 < x < 90^\circ$, the equation

$$3 \cot 2x - 14 = 6 \sin^2 x \cot 2x + 4 \sin x \cos x$$

giving your answers to one decimal place.

(3)