

2. Let $a = \sin b$, $0 < b < \frac{\pi}{2}$.

[5 marks]

Find, in terms of b , the solutions of $\sin 2x = -a$, $0 \leq x \leq \pi$.

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Consider the function $f(x) = 2 \sin^2 x + 7 \sin 2x + \tan x - 9$, $0 \leq x < \frac{\pi}{2}$.

3a. Determine an expression for $f'(x)$ in terms of x .

[2 marks]

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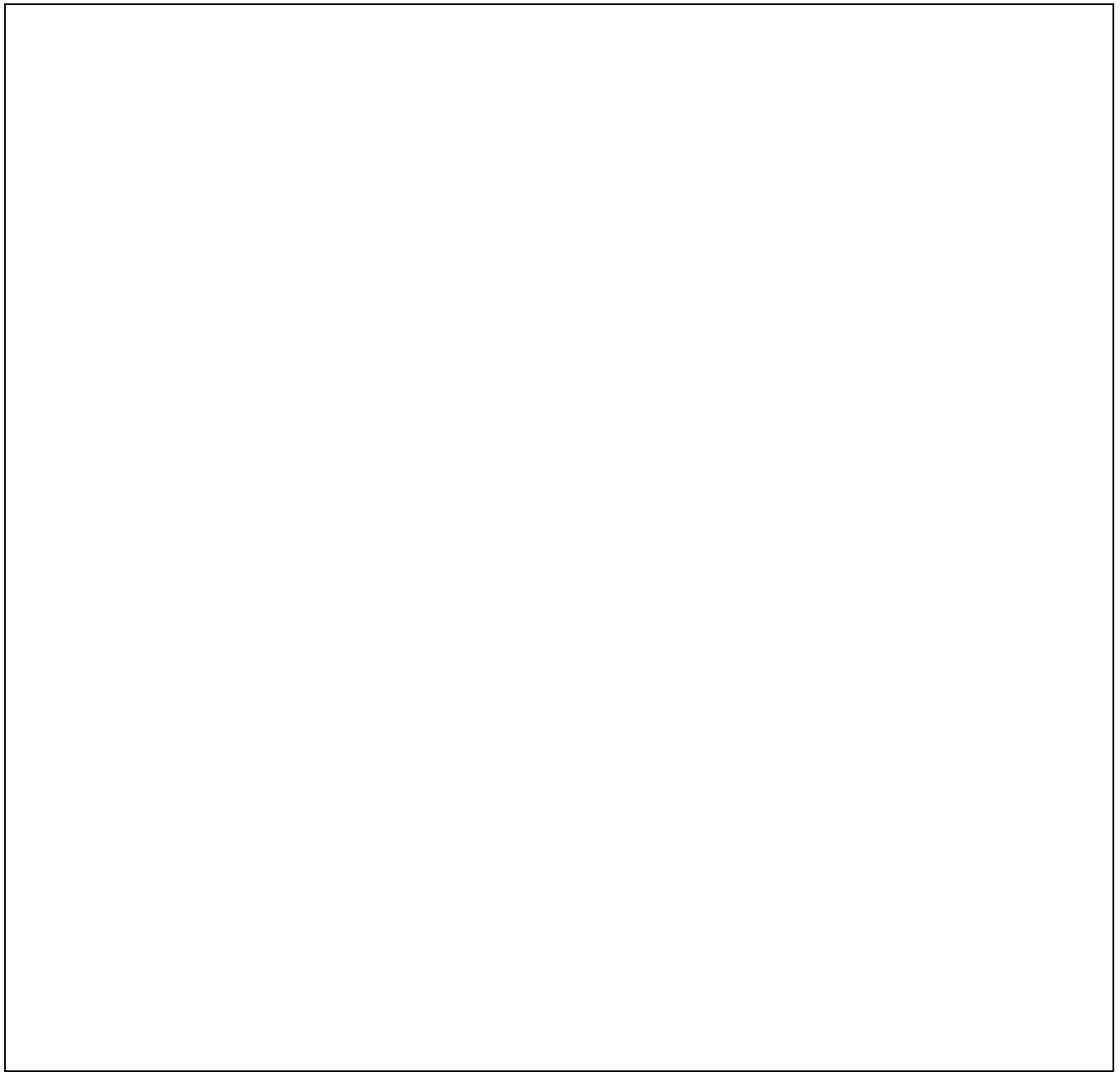
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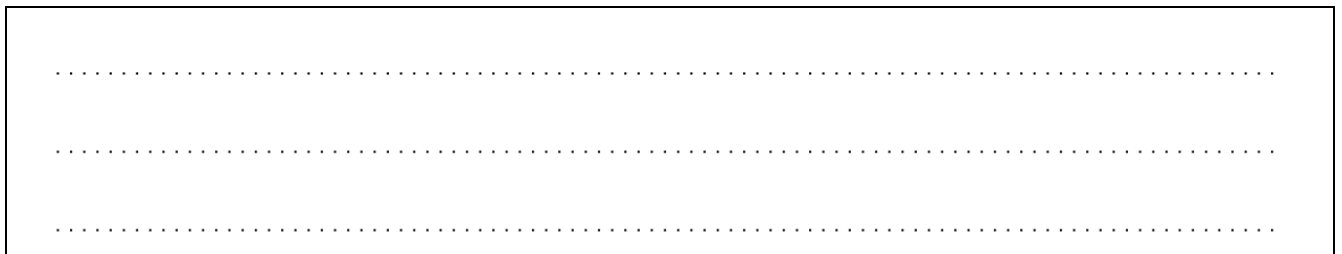
3b. Sketch a graph of $y = f'(x)$ for $0 \leq x < \frac{\pi}{2}$.

[4 marks]



3c. Find the x -coordinate(s) of the point(s) of inflexion of the graph of $y = f(x)$, labelling these clearly on the graph of $y = f'(x)$.

[2 marks]



Let $u = \tan x$.

3d. Express $\sin x$ in terms of u .

[2 marks]

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3e. Express $\sin 2x$ in terms of u .

[3 marks]

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3f. Hence show that $f(x) = 0$ can be expressed as $u^3 - 7u^2 + 15u - 9 = 0$ [2 marks]

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3g. Solve the equation $f(x) = 0$, giving your answers in the form $\arctan k$ [3 marks]
where $k \in \mathbb{Z}$.

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4a. Show that $\cot 2\theta = \frac{1 - \tan^2 \theta}{2 \tan \theta}$. [1 mark]

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Consider the function $g(x) = 4 \cos x + 1$, $a \leq x \leq \frac{\pi}{2}$ where $a < \frac{\pi}{2}$.

- 8a. For $a = -\frac{\pi}{2}$, sketch the graph of $y = g(x)$. Indicate clearly the maximum and minimum values of the function. [3 marks]

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- 8b. Write down the least value of a such that g has an inverse. [1 mark]

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- 8c. For the value of a found in part (b), write down the domain of g^{-1} . [1 mark]

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10a. Find the value of $\sin \frac{\pi}{4} + \sin \frac{3\pi}{4} + \sin \frac{5\pi}{4} + \sin \frac{7\pi}{4} + \sin \frac{9\pi}{4}$.

[2 marks]

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10b. Show that $\frac{1 - \cos 2x}{2 \sin x} \equiv \sin x$, $x \neq k\pi$ where $k \in \mathbb{Z}$.

[2 marks]

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