6:

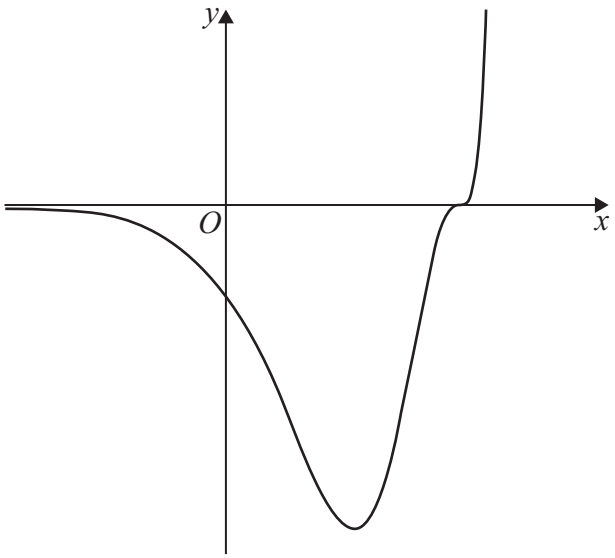

Figure 2

Figure 2 shows a sketch of the curve with equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = (2x - 3)^3 \mathrm{e}^{4x-2}$$

(a) Show that

$$\mathrm{f}'(x) = 2(Px + Q)(2x - 3)^n \mathrm{e}^{4x-2}$$

where P, Q and n are constants to be found.

(4)

(b) Hence find

(i) the x coordinates of the stationary points on the curve with equation $y = \mathrm{f}(x)$,

(ii) the range of the function g defined by

$$\mathrm{g}(x) = 8(2x - 3)^3 \mathrm{e}^{4x-2} \qquad x \leqslant \frac{3}{2}$$

(*Solutions relying entirely on calculator technology are not acceptable.*)

(4)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 8 marks)

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

(a) Write $\sin 4\theta$ in the form

$$\sin\theta\cos\theta(P + Q\sin^n\theta)$$

where P, Q and n are constants to be found.

(3)

(b) Use the result from part (a) to show that, for $x \neq \frac{k\pi}{2}$ where $k \in \mathbb{Z}$, the equation

$$\sec x \sin 4x = 5\sin^3 x \cot x$$

can be written in the form

$$4\sec^2 x - 5\tan x - 8\tan^2 x = 0$$

(3)

(c) Use the result from part (b) to solve, for $0 < x < \pi, x \neq \frac{\pi}{2}$, the equation

$$\sec x \sin 4x = 5\sin^3 x \cot x$$

giving the answers in radians to 3 significant figures.

(4)

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