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**8.** **In this question you must show all stages of your working.**

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

(a) Express $8\sin x - 15\cos x$ in the form $R\sin(x - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$

Give the exact value of $R$, and give the value of $\alpha$, in radians, to 4 significant figures.

**(3)**

$$f(x) = \frac{15}{41 + 16\sin x - 30\cos x} \qquad x > 0$$

(b) Find

(i) the minimum value of $f(x)$

(ii) the smallest value of $x$ at which this minimum value occurs.

**(4)**

(c) State the $y$ coordinate of the minimum points on the curve with equation

$$y = 2f(x) - 5 \qquad x > 0$$

**(1)**

(d) State the smallest value of $x$ at which a maximum point occurs for the curve with equation

$$y = -f(2x) \qquad x > 0$$

**(1)**

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**Question 8 continued**

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**Question 8 continued**

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**Question 8 continued**

**Q8**

**(Total 9 marks)**

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**9.** **In this question you must show all stages of your working.**

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

Given that $\cos 2\theta - \sin 3\theta \neq 0$

(a) prove that

$$\frac{\cos^2\theta}{\cos 2\theta - \sin 3\theta} \equiv \frac{1 + \sin\theta}{1 - 2\sin\theta - 4\sin^2\theta}$$

**(4)**

(b) Hence solve, for $0 < \theta \leqslant 360°$

$$\frac{\cos^2\theta}{\cos 2\theta - \sin 3\theta} = 2\operatorname{cosec}\theta$$

Give your answers to one decimal place.

**(5)**

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