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

(a) Express $\sqrt{5}\cos\theta - 2\sin\theta$ in the form $R\cos(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$

State the value of R and give the value of α to 4 significant figures.

(3)

(b) Solve, for $-\pi < \theta < \pi$,

$$\sqrt{5}\cos\theta - 2\sin\theta = 0.5$$

giving your answers to 3 significant figures.

(4)

$$f(x) = A\left(\sqrt{5}\cos\theta - 2\sin\theta\right) + B \qquad \theta \in \mathbb{R}$$

where A and B are constants.

Given that the range of f is

$$-15 \leqslant f(x) \leqslant 33$$

(c) find the value of B and the possible values of A.

(4)

(Total for Question 7 is 11 marks)

8. Given that a is a positive constant,

(a) on **separate** diagrams, sketch the graph with equation

(i) $y = a - |x|$

(ii) $y = |3x - 2a|$

Show on each sketch the coordinates, in terms of a, of each point at which the graph crosses or meets the axes.

(4)

(b) Find, in terms of a, the values of x for which

$$a - |x| = |3x - 2a|$$

(4)

(Total for Question 8 is 8 marks)

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9. (a) Given that $-\frac{\pi}{2} < \mathrm{g}(x) < \frac{\pi}{2}$, sketch the graph of $y = \mathrm{g}(x)$ where

$$\mathrm{g}(x) = \arctan x \qquad x \in \mathbb{R}$$

(2)

(b) Find the exact value of x for which

$$3\mathrm{g}(x + 1) - \pi = 0$$

(2)

The equation $\arctan x - 4 + \frac{1}{2}x = 0$ has a positive root at $x = \alpha$ radians.

(c) Show that $5 < \alpha < 6$

(2)

The iteration formula

$$x_{n+1} = 8 - 2\arctan x_n$$

can be used to find an approximation for α

(d) Taking $x_0 = 5$, use this formula to find x_1 and α, giving each answer to 4 decimal places.

(3)

(Total for Question 9 is 9 marks)

TOTAL FOR PAPER IS 75 MARKS