6. Relative to a fixed origin O,

- the point A has position vector $\mathbf{i} - 4\mathbf{j} + 3\mathbf{k}$
- the point B has position vector $5\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$
- the point C has position vector $3\mathbf{i} + p\mathbf{j} - \mathbf{k}$

where p is a constant.

The line l passes through A and B.

(a) Find a vector equation for the line l

(3)

Given that $\overrightarrow{AC}$ is perpendicular to l

(b) find the value of p

(3)

(c) Hence find the area of triangle ABC, giving your answer as a surd in simplest form.

(3)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 9 marks)

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

Solutions relying entirely on calculator technology are not acceptable.

The curve C has parametric equations

$$x = \sin t - 3\cos^2 t \qquad y = 3\sin t + 2\cos t \qquad 0 \leqslant t \leqslant 5$$

(a) Show that $\dfrac{dy}{dx} = 3$ where $t = \pi$

(4)

The point P lies on C where $t = \pi$

(b) Find the equation of the tangent to the curve at P in the form $y = mx + c$ where m and c are constants to be found.

(3)

Given that the tangent to the curve at P cuts C at the point Q

(c) show that the value of t at point Q satisfies the equation

$$9\cos^2 t + 2\cos t - 7 = 0$$

(2)

(d) Hence find the exact value of the y coordinate of Q

(3)

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