6. Relative to a fixed origin O,

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

The line l passes through A and B.

(a) Write down a vector equation for l

(2)

Given also that

- the point C has position vector $3\mathbf{i} + \alpha\mathbf{j} + 5\mathbf{k}$ where α is a constant
- the points A, B and C form the triangle ABC
- angle BAC is 45°

(b) find the exact possible values of α

(6)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 8 marks)

7. (a) Show that the substitution $u = \tan x$ transforms

$$\int \frac{\tan x + \tan^3 x}{(4 + \sec^2 x)^3} \, \mathrm{d}x$$

to

$$\int \frac{u}{(k + u^2)^n} \, \mathrm{d}u$$

where k and n are integers to be found.

(4)

(b) Hence find

$$\int \frac{\tan x + \tan^3 x}{(4 + \sec^2 x)^3} \, \mathrm{d}x$$

(2)

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