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

Water flows at a constant rate into a container.

When the depth of water in the container is h cm, the volume of water in the container, V cm^3, is modelled by the equation

$$V = \frac{1}{3}h^2\sqrt{(h+4)} \qquad 0 \leqslant h \leqslant 21$$

Given that

- the container is initially empty
- water flows into the container at a rate of $30\ \text{cm}^3\text{s}^{-1}$
- the container is full when the depth of the water is 21 cm

find, according to the model,

(a) the time taken to fill the container,

(2)

(b) the exact rate of change of the depth of the water, in cm s^{-1}, when $h = 5$

(5)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 4 continued

(Total for Question 4 is 7 marks)

5.

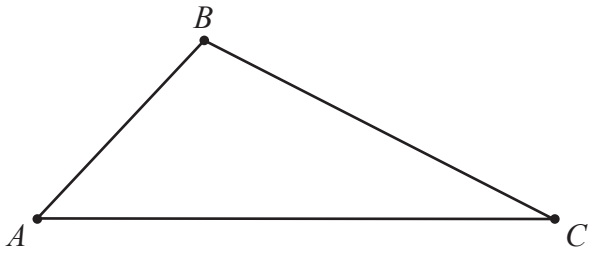

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a sketch of triangle ABC.

Given that

- $\overrightarrow{AB} = 2\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$
- $\overrightarrow{AC} = 6\mathbf{i} - 2\mathbf{j} - 8\mathbf{k}$

(a) find the size of angle BAC, giving the answer, in degrees, to one decimal place.

(3)

(b) Hence find the area of triangle ABC, giving the answer to one decimal place.

(2)

The line AB is extended to a point D such that angle ADC is a right angle.

(c) Find $\overrightarrow{AD}$

(4)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA