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

Use the substitution $x = 4\sin\theta$ to find the exact value of

$$\int_{2}^{2\sqrt{3}} \frac{1}{\left(16-x^2\right)^{\frac{3}{2}}}\,\mathrm{d}x$$

(6)

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Question 7 continued

(Total for Question 7 is 6 marks)

8. Relative to a fixed origin O, the line l has equation

$$\mathbf{r} = \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix} + \lambda \begin{pmatrix} 4 \\ 2 \\ -1 \end{pmatrix}$$

where λ is a scalar parameter.

The point A and the point B lie on line l

Given that

- A has coordinates $(-2, a, 4)$
- B has coordinates $(b, 3, 1)$

(a) find the value of the constant a and the value of the constant b.

(2)

(b) Hence find vector $\overrightarrow{AB}$

(2)

The point C has coordinates $(4, 7, -2)$.

(c) Find the size of angle CAB, giving your answer in degrees to one decimal place.

(4)

The point D lies on the line l so that the area of triangle CAD is twice the area of triangle CAB.

(d) Find the coordinates of the two possible positions of D.

(4)

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