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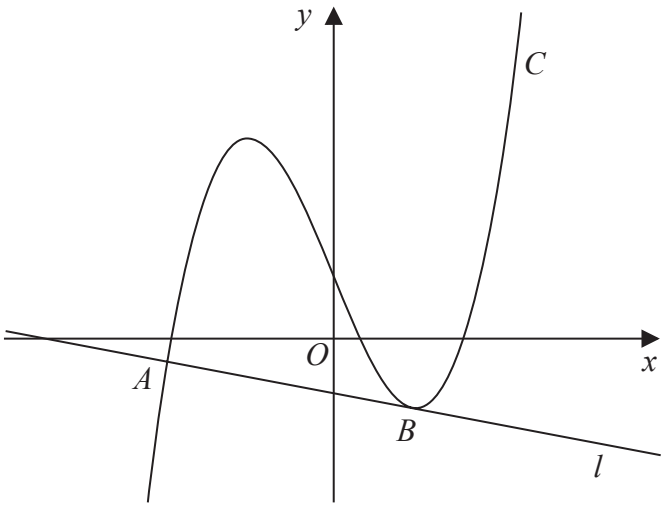



**Figure 5**

Figure 5 shows a sketch of the curve $C$ with equation

$$y = \frac{2}{7}x^3 + \frac{1}{7}x^2 - \frac{5}{2}x + k$$

where $k$ is a constant.

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

**(2)**

The line $l$, shown in Figure 5, is the normal to $C$ at the point $A$ with $x$ coordinate $-\dfrac{7}{2}$

Given that $l$ is also a tangent to $C$ at the point $B$,

(b) show that the $x$ coordinate of the point $B$ is a solution of the equation

$$12x^2 + 4x - 33 = 0$$

**(4)**

(c) Hence find the $x$ coordinate of $B$, justifying your answer.

**(2)**

Given that the $y$ intercept of $l$ is $-1$

(d) find the value of $k$.

**(4)**

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**TOTAL FOR PAPER IS 75 MARKS**

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