

3. A curve C has equation

$$y = x^2e^x.$$

(a) Find $\frac{dy}{dx}$, using the product rule for differentiation. (3)

(b) Hence find the coordinates of the turning points of C . (3)

(c) Find $\frac{d^2y}{dx^2}$. (2)

(d) Determine the nature of each turning point of the curve C . (2)



8. The amount of a certain type of drug in the bloodstream t hours after it has been taken is given by the formula

$$x = De^{-\frac{1}{8}t},$$

where x is the amount of the drug in the bloodstream in milligrams and D is the dose given in milligrams.

A dose of 10 mg of the drug is given.

- (a) Find the amount of the drug in the bloodstream 5 hours after the dose is given. Give your answer in mg to 3 decimal places. **(2)**

A second dose of 10 mg is given after 5 hours.

- (b) Show that the amount of the drug in the bloodstream 1 hour after the second dose is 13.549 mg to 3 decimal places. **(2)**

No more doses of the drug are given. At time T hours after the second dose is given, the amount of the drug in the bloodstream is 3 mg.

- (c) Find the value of T . **(3)**



