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8. (a) Show that the transformation $v = y - 2x$ transforms the differential equation

$$\frac{dy}{dx} + 2yx(y - 4x) = 2 - 8x^3 \qquad \text{(I)}$$

into the differential equation

$$\frac{dv}{dx} = -2xv^2 \qquad \text{(II)}$$

(4)

(b) Solve the differential equation (II) to determine v as a function of x

(4)

(c) Hence obtain the general solution of the differential equation (I).

(1)

(d) Sketch the solution curve that passes through the point $(-1, -1)$.

On your sketch show clearly the equation of any horizontal or vertical asymptotes.

You do **not** need to find the coordinates of any intercepts with the coordinate axes or the coordinates of any stationary points.

(5)

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(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

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