3. (a) Show that the transformation $y = \frac{1}{z}$ transforms the differential equation

$$x^2 \frac{dy}{dx} + xy = 2y^2 \qquad \text{(I)}$$

into the differential equation

$$\frac{dz}{dx} - \frac{z}{x} = -\frac{2}{x^2} \qquad \text{(II)}$$

(3)

(b) Solve differential equation (II) to determine z in terms of x.

(4)

(c) Hence determine the particular solution of differential equation (I) for which $y = -\frac{3}{8}$ at $x = 3$

Give your answer in the form $y = f(x)$.

(2)

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Question 3 continued

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Question 3 continued

(Total for Question 3 is 9 marks)