13. (a) Using integration by parts, find

$$\int x \sin 3x \, \mathrm{d}x$$

(3)

(b) Find the particular solution of the differential equation

$$\frac{\mathrm{d}y}{\mathrm{d}x} = xy^3 \sin 3x \qquad 0 < x < 2\pi$$

for which $y = \frac{1}{2}$ at $x = \frac{\pi}{6}$

Give your answer in the form $y^2 = \mathrm{f}(x)$

(4)