

8) Solve the differential equation:  $y' = x(1+y)$

$$\frac{dy}{1+y} = x(1+y) \cdot dx$$

$$\int \frac{dy}{1+y} = \int x dx$$

$$\ln|1+y| = \frac{x^2}{2} + c$$

$$\pm e^{\frac{x^2}{2} + c} = 1+y$$

$$\pm e^c \cdot e^{\frac{x^2}{2}} = 1+y$$

$$y = Ce^{\frac{x^2}{2}} - 1$$

24) The rate of change of N is proportional to N. When  $t=0$ ,  $N=5000$  and when  $t=1$ ,  $N=4750$ . What is the value of N when  $t=5$ ?

$$y = Ce^{rt} \text{ or } A = Pe^{rt} \quad y' = Ky$$

$$(0, 5000) \quad (1, 4750)$$

$$5000 = Ce^{r(0)} \quad 4750 = \frac{5000e^{r(1)}}{5000}$$

$$c = 5000$$

$$y = 5000e^{\left(\frac{5(4750)}{5000}\right)}$$

$$3868.904$$

$$e^r = \frac{4750}{5000}$$

$$\log_e\left(\frac{4750}{5000}\right) = r$$

$$y = 5000e^{\ln\left(\frac{4750}{5000}\right)t}$$

$$y = 5000e^{t \cdot \left(\frac{4750}{5000}\right)}$$

10) Find the general solution:  $y' \sqrt{x^2 - 9} = 5x$

$$\cancel{dx} \frac{dy}{dx} = \frac{5x}{\sqrt{x^2 - 9}} \cdot dx \quad \int dy = \int \frac{5x}{\sqrt{x^2 - 9}} dx$$

$$u = x^2 - 9$$

$$\frac{du}{2} = \frac{2x dx}{2}$$

$$y = \frac{5}{2} \int \frac{du}{\sqrt{u}}$$

$$y = \frac{5}{2} \int u^{-1/2} du$$

$$y = \frac{5}{2} (2u^{1/2}) + C$$

$$y = 5\sqrt{x^2 - 9} + C$$