Sep. Diff. eq.

1) Let $\frac{dy}{dx} = x$, Find y

$\int 1\,dy = \int x\,dx$

$y + c_2 = \frac{x^2}{2} + c_1$

$\rightarrow y = \frac{x^2}{2} + C_3$

2) Let $\frac{dy}{dx} = xy$, Find y.

$dy = xy\,dx$

$\int \frac{dy}{y} = \int x\,dx$

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

$e^{\ln|y|} = e^{x^2/2 + C_1}$

$|y| = e^{x^2/2} \cdot e^{C_1}$

$|y| = C_2 e^{x^2/2}$

$y = \pm C_2 e^{x^2/2}$

$y = C e^{x^2/2}$

Let $\frac{dy}{dx} = \frac{x}{y}$, Find y.

$$\int y\,dy = \int x\,dx$$

$$\frac{y^2}{2} = \frac{x^2}{2} + C_1$$

$$y = \pm\sqrt{x^2 + C}$$

$$y^2 = x^2 + C_2$$

21. If $\frac{dy}{dt} = ky$ and k is a nonzero constant, then y could be

(A) $2e^{kty}$ (B) $2e^{kt}$ (C) $e^{kt}+3$ (D) $kty+5$ (E) $\frac{1}{2}ky^2+\frac{1}{2}$

$$\int \frac{dy}{y} = \int k\,dt \qquad \ln|y| = kt + C$$

$$|y| = e^{kt+C} = e^{kt}\cdot e^{C}$$

$$y = Ce^{kt} \leftarrow |y| = Ce^{kt}$$

33. If $\frac{dy}{dx} = 2y^2$ and if $y = -1$ when $x = 1$, then when $x = 2$, $y =$

(A) $-\frac{2}{3}$ (B) $-\frac{1}{3}$ (C) 0 (D) $\frac{1}{3}$ (E) $\frac{2}{3}$

$$\int \frac{dy}{y^2} = \int 2\,dx$$

y^{-2}

$$-\frac{1}{y} = 2x + C$$

$$y = \frac{1}{-2x + 1}\Bigg|_{x=2}$$

$$= \frac{1}{-2(2)+1} = -\frac{1}{3}$$

$$\frac{1}{y} = -2x + C$$

$$y = \frac{1}{-2x + C}$$

$$-1 = \frac{1}{-2(1) + C}$$

$$-1 = \frac{1}{-2 + C} \rightarrow C = 1$$