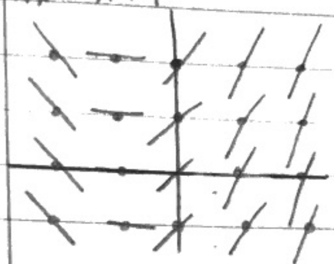
A. 1. $\frac{dy}{dx} = x+1$



2. A. $3y = \frac{dy}{dx}$

$3dx = \frac{1}{y}dy$

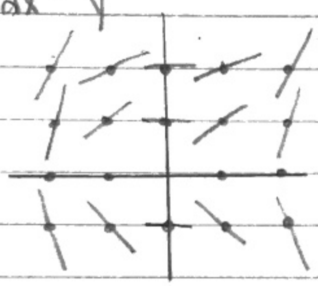
$\int \frac{1}{y}dy = \int 3dx$

$\ln|y| = 3x + C$

$y = e^{3x+C}$

$\boxed{y = Ce^{3x}}$

2. $\frac{dy}{dx} = \frac{x^2}{y}$



B. $(3+x)dy = 5y\,dx$

$\frac{1}{y}dy = \frac{5}{x+3}dx$

$\ln|y| = 5\ln|x+3| + C$

$y = e^{5\ln|x+3|+C}$

$y = Ce^{\ln(x+3)^5}$

$\boxed{y = C(x+3)^5}$

B. 1. $y' = x+y \quad y(0) = 2$

$n=2 \quad h=0.1$

$x_0 = 0 \qquad y_0 = 2$

$x_1 = 0.1 \qquad y_1 = 2 + 0.1(0+2) = 2.2$

$x_2 = 0.2 \qquad y_2 = 2.2 + 0.1(0.1+2.2) = \boxed{2.43}$

C. $\frac{dy}{dx} = \frac{4x}{e^{3y}} \qquad \int e^{3y}dy = \int 4x\,dx$

$u = 3y \quad du = 3dy$

$\frac{1}{3}\int 3e^{3y}dy = 4\int x\,dx$

$\frac{1}{3}e^{3y} = \frac{4x^2}{2} + C$

$\frac{1}{3}e^{3y} = 2x^2 + C$

$e^{3y} = 6x^2 + C$

$3y = \ln(6x^2 + C)$

$y = \frac{1}{3}\ln(6x^2+C)$

$\boxed{y = \ln\sqrt[3]{4x^2+C}}$

2. $y' = 0.5x(3-y) \quad y(0) = 1$

$n = 3 \quad h = 0.4$

$x_0 = 0 \qquad y_0 = 1$

$x_1 = 0.4 \qquad y_1 = 1 + 0.4(0.5 \cdot (0)(3-1)) = 1$

$x_2 = 0.8 \qquad y_2 = 1 + 0.4(0.5 \cdot 0.4(3-1)) = 1.16$

$x_3 = 1.2 \qquad y_3 = 1.16 + 0.4(0.5 \cdot 0.8(3-1.16)) = \boxed{1.4544}$

C. 1. $\frac{dP}{dh} = kP \qquad P = 30e^{kh} \qquad 15 = 30e^{k(18000)} \qquad P = 30e^{\frac{1}{18000}\ln(\frac{1}{2})h}$

$P = Ce^{kh} \qquad \frac{1}{2} = e^{18000k} \qquad P = 30e^{\frac{1}{18000}\ln(1/2)(35000)}$

$(0, 30) \qquad \ln(\frac{1}{2}) = 18000k \qquad \boxed{P = 7.794\text{ m}}$

$(18000, 15) \qquad k = \frac{1}{18000}\ln(\frac{1}{2})$

D. $\frac{dy}{dx} = 2y - 1$

$\frac{1}{2y-1}\,dy = dx$

$\frac{1}{2}\int \frac{2}{2y-1}\,dy = \int dx$

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

$\ln|2y-1| = 2x + C$

$2y - 1 = e^{2x+c}$

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

$2y = Ce^{2x} + 1$

$\boxed{y = \frac{1}{2}(Ce^{2x} + 1)}$

B. $xy' - 3y = 0$

$x\frac{dy}{dx} = 3y$

$\int \frac{1}{y}\,dy = 3\int \frac{1}{x}\,dx$

$\ln|y| = 3\ln|x| + C$

$\ln|y| = \ln(x^3) + C$

$\ln|y| = \ln(x^3) + c$

$y = e^{\ln(x^3) + C}$

$y = Cx^3$

$(2,-3)\quad -3 = C(2)^3$

$\frac{-3}{8} = C \qquad y = -\frac{3x^3}{8}$

E. $y' - 2xy = 0$

$\frac{dy}{dx} = 2xy$

$\int \frac{1}{y}\,dy = \int 2x\,dx$

$\ln|y| = x^2 + C$

$y = e^{x^2 + c}$

$\boxed{y = Ce^{x^2}}$

C. $2x\frac{dy}{dx} - \ln x^2 = 0$

$2x\frac{dy}{dx} = \ln x^2$

$2x\,dy = \ln x^2\,dx$

$2x\,dy = 2\ln x\,dx$

$\int dy = \int \frac{\ln x}{x}\,dx \quad u = \ln x \quad du = \frac{1}{x}dx$

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

$y = \frac{1}{2}(\ln x)^2 + C \quad (1,2)$

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

$2 = 0 + C$

$2 = C$

$\boxed{y = \frac{1}{2}(\ln x)^2 + 2}$

F. $\frac{dy}{dx} - e^y \sin x = 0$

$\frac{dy}{dx} = e^y \sin x$

$e^{-y}\,dy = \sin x\,dx$

$\int -e^{-y}\,dy = \int \sin x\,dx$

$-e^{-y} = -\cos x + C$

$e^{-y} = \cos x + C$

$-y = \ln(\cos x + C)$

$\boxed{y = -\ln(\cos x + C)}$

3A. $\frac{dy}{dx} = 5y \qquad \frac{1}{y}dy = 5dx$

$\ln|y| = 5x + C$

$y = Ce^{5x} \quad (0,12)$

$\boxed{y = 12e^{5x}}$

D. $xe^{x^2} + y\frac{dy}{dx} = 0$

$\int y\frac{dy}{dx} = -\int xe^{x^2}$

$\frac{y^2}{2} = -\frac{1}{2}\int 2xe^{x^2}dx$

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

$\boxed{y^2 = -e^{x^2} + C}$

4. $\frac{dy}{dx} = \frac{2x}{y}$ $y(0) = 2$

A. $\int y\,dy = \int 2x\,dx$

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

$y^2 = 2x^2 + C$

$2^2 = 2(0)^2 + C$

$4 = 0$

$\boxed{y^2 = 2x^2 + 4}$

B. $y = \sqrt{2x^2+4}$

$y(1) = \sqrt{2\cdot1^2+4}$

$y(1) = \boxed{\sqrt{6}}$

C. $h = 0.5$

$x_0 = 0$ $y_0 = 2$

$x_1 = 0.5$ $y_1 = 2 + 0.5\left(\frac{2\cdot0}{2}\right) = 2$

$x_2 = 1$ $y_2 = 2 + 0.5\left(\frac{2\cdot0.5}{2}\right) = \boxed{2.25}$

D. My answer in part C is an underestimation

5. $\frac{dy}{dt} = y\left(1 - \frac{P}{100}\right)$ $(0,4)$

$y = \frac{100}{1 + ce^{-1t}}$

$4 = \frac{100}{1 + C}$ $C + 1 = \frac{100}{4}$

$C + 1 = 25$ $C = 24$

$\boxed{y = \frac{100}{1 + 24e^{t}}}$

6. $(0,40)$ $(5,104)$ $\frac{dP}{dt} = kP\left(1 - \frac{P}{4000}\right)$

A. $P = \frac{4000}{1 + Ce^{-kt}}$ $40 = \frac{4000}{1 + ce^{-k(0)}}$ $40 = \frac{4000}{1 + C}$

$1 + C = 100$

$C = 99$

$P = \frac{4000}{1 + 99e^{-kt}}$

$104 = \frac{4000}{1 + 99e^{-k(5)}}$

$k \approx 0.19436102$

$\boxed{P = \frac{4000}{1 + 99e^{-0.19436k}}}$

B. $P = \frac{4000}{1 + 99e^{-0.19436(15)}} = \boxed{628.530 \text{ elk}}$

:) $\boxed{628 \text{ elk}}$

C. $\lim_{t\to\infty} P = \boxed{4000}$

7. (0,25)

(2,39)

$L = 200$

A. $y = \frac{200}{1+Ce^{-kt}}$ $y = \frac{200}{1+7e^{-kt}}$ $\boxed{y = \frac{200}{1+7e^{-0.26403t}}}$

$25 = \frac{200}{1+Ce^{0}}$ $39 = \frac{200}{1+7e^{-k(2)}}$

$1 + C = 8$ $k \approx 0.26403372$

$C = 7$

B. $y = \frac{200}{1+7e^{-0.26403(5)}}$

$y = 69.6945$ panthers

$\boxed{\text{69 panthers}}$

E. The pop is growing most rapidly when $P = 100$ @ $t = 7.370$ years

C. $100 = \frac{200}{1+7e^{-0.26403}}$

$\boxed{t = 7.370 \text{ years}}$

D. $\frac{dP}{dt} = 0.26403P\left(1 - \frac{P}{200}\right)$

$x_0 = 0$ $y_0 = 25$

$x_1 = 1$ $y_1 = 25 + 1\left(\left.\frac{dP}{dt}\right|_{(0,25)}\right) = 30.77565625$

$x_2 = 2$ $y_2 = 30.77565625 + 1\left(\left.\frac{dP}{dt}\right|_{(1,30.77565625)}\right) = 37.65098456$

$x_3 = 3$ $y_3 = 37.65098456 + 1\left(\left.\frac{dP}{dt}\right|_{(2,37.65098456)}\right) = 45.7205338$

$x_4 = 4$ $y_4 = 45.72053381 + 1\left(\left.\frac{dP}{dt}\right|_{(3,45.7205338)}\right) = 53.03252807$

$x_5 = 5$ $y_5 = 53.03252807 + 1\left(\left.\frac{dP}{dt}\right|_{(4,53.03252807)}\right) = 65.5645877$

$P(5) \approx 65.565$, 65 panthers $\Rightarrow$ this is an underapproximation

$P(5) =$ 69 panthers

8. $\frac{dy}{dx} = \frac{xy}{2}$

A. see bottom of page

B. $(1,1)$

$\left.\frac{dy}{dx}\right|_{(1,1)} = \frac{1 \cdot 1}{2} = \frac{1}{2}$

$y - 1 = m(x-1)$

$\boxed{y - 1 = \frac{1}{2}(x-1)}$

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

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

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

$y(1.2) = \left(\frac{1}{2}\right)\left(\frac{12}{10}\right) + \frac{1}{2}$

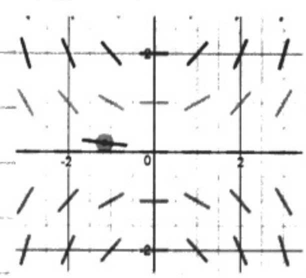
$\frac{6}{10} + \frac{1}{2}$

$\frac{6}{10} + \frac{5}{10} = \frac{11}{10} = 1.1$

$\boxed{y(1.2) \approx 1.1}$

D. My answer in part B is an underestimate. Since y is concave up, the tangent lines are below the curve.

A.



C. $\frac{dy}{dx} = \frac{xy}{2}$

$\frac{1}{y}dy = \frac{1}{2}x\,dx$

$\ln|y| = \frac{1}{4}x^2 + C$

$y = e^{\frac{1}{4}x^2 + C}$

$y = Ce^{x^2/4}$

$y(1) = Ce^{1/4} = 1$

$C = e^{-1/4}$

$y = e^{-1/4} \cdot e^{x^2/4} \Rightarrow -\frac{1}{4} + \frac{x^2}{4} = \frac{-1 + x^2}{4} = \frac{x^2 - 1}{4}$

$y = e^{\frac{x^2-1}{4}}$

$y(1.2) = 1.116$