1.7 Homework #1, 3, 5, 7, 9, 11, 33

#1. $\frac{dy}{dx} = xy^2$

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

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

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

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

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

$y = \frac{2}{-x^2 + C_2}$

#3. $\frac{xy^2 y'}{x} = \frac{x+1}{x}$

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

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

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

$y^3 = 3x\,3\ln x + 3C =$

$y = \sqrt[3]{3x + \ln|x| + k}$

#5. $(y + \sin y)\,y' = x + x^3$

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

#7. $\frac{dp}{dt} = t^2 p - p + t^2 - 1$

$+p$

$p(t^2-1) + 1(t^2-1)$

$\frac{dp}{dt} = (p+1)(t^2-1)$

$\int \frac{dp}{(p+1)} = \int (t^2-1)\,dt$

$\ln|p+1| = \frac{1}{3}t^3 - t + C$

$p + 1 = e^{\frac{1}{3}t^3 - t + C}$

7.7

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#9. $\frac{dy}{dx} = \frac{x}{y}$ $y(0) = -3$

$y\,dy = x\,dx$

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

$\frac{1}{2}(-3)^2 = \frac{1}{2}(0) + C$

$C = \frac{9}{2}$

$\boxed{\frac{1}{2}y^2 = \frac{1}{2}x^2 + \frac{9}{2}}$

#11. $\frac{dv}{dt} = \frac{2t + \sec^2 t}{2v}$, $v(0) = -5$

$\int 2v\,dv = \int (2t + \sec^2 t)\,dt$

$v^2 = t^2 + \tan t + C$

$-5^2 = 0 + 0 + C$

$25 = C$

$v^2 = t^2 + \tan t + 25$

$\boxed{v = \sqrt{t^2 + \tan t + 25}}$

#33.

$\frac{dP}{dt} = k(M - P)$

a) it is always positive.

and P is always increasing.

b) $\frac{dP}{dt} = k(M - P) = \frac{dP}{(M - P)} = k\,dt$

$\ln|M - P| = \frac{k}{2}^2 + C$

$M - P = e^{-k + C}$

$P - M = Ae^{-kt}$ $[A = \pm e^C$

$P = M + Ae^{-kt}$

$P0 = 0$ $M + A = 0$

$\boxed{P(t) = M - M \cdot 0 = M}$