1. (a) separable, linear
   (b) separable but not linear
2. (a) $y(x) = \frac{3}{4}x^2 + \frac{5}{4}$
   (b) $P(s) = 4e^{\frac{3}{2}s}$
   (c) $x(t) = te^{-t^3} + Ce^{-t^3}$
   (d) $-y^{-1} = \frac{x^4}{4} + \frac{x^2}{2} + x + C = \frac{x^3}{3}$ (implicit solution)
3. (a) $\dot{W} = -2W$
   (b) i. $W(t) = Ce^{-2t}$
   ii. $T(t) = 70 - \frac{C}{2}e^{-2t}$ ($\frac{C}{2}$ could be replaced with just C.)
4. Sketch not provided. (All solutions should approach the line $y = \frac{x}{4} - \frac{1}{2}$ as time increases.)
5. $\phi(1.1) = -0.8, \phi(1.2) = -0.599$
6. $m = -\frac{1}{3}$ OR $A = 0$.
7. Sketch not provided. $P($0 must be greater than 1 in order for the population to survive.
8. Let $M(t)$ be the number of mathematicians alive at time t.

$$\dot{M} = k_1 M - k_2 M^3 - 100$$

k_1 and k_2 are both positive constants.