Math 3280: DE+LA. Test 1 partial answers. Prof. Bruce Peckham

- 1. (a) Neither
  - (b) linear but not separable
- 2. k > 0 so  $\dot{T} < 0$  when T > 70 and  $\dot{T} > 0$  when T < 70.
- 3. (a)  $y(x) = 2e^{-4x}$ 
  - (b) y(x) = gx + 3
  - (c)  $y(t) = \frac{1}{2}e^t + Ce^{-3t}$
  - (d)  $\frac{y^4}{4} = x^3 + x + 4$  (implicit solution)
- 4. (a)  $v' = av \frac{b}{A}v^2$ (b) A = b or A = b/a
- 5. Sketch not provided. The solution should start at y(0) = 1 with a slope of -1, have a horizontal tangent at x = 1, and go back up from there. A rough estimate of y(2) is about 1 (same height it started.)

6. 
$$\phi(2) \approx \frac{15}{32}$$
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- 7. r = 1 or 2 OR A = 0.
- 8. Sketch not provided. Phase line should include dots at equilibria: P = 0, 1, and arrows in between equilibria. The arrow should be to the right for P > 1, and to the left for P < 1, except for the equilibrium point at P = 0. If P(0) = 10, the population increases (doomsday).
- 9.  $\dot{D}(t) = k_1 D(t)(10000 D(t)) k_2 D(t)$ , where  $k_1$  and  $k_2$  are both positive constants. D(0) = 50.