# Quiz 7

February 10, 2016

1. Irene owns a sports supply store with room for 50 badminton rackets. She currently has 40 rackets in inventory and determines that they are selling at a daily rate equal to 14% of the available capacity. Use $y(t)$ for the number of rackets in inventory after $t$ days.

(a) Set up a differential equation which describes the situation above.

$$\frac{dy}{dt} = -.14(50-y)$$

(b) Find the particular solution of the differential equation in part (a).

$$\frac{dy}{dt} - .14y = -7$$
$$u(t) = e^{\int -.14dt} = e^{-.14t}$$
$$e^{-.14t} y = \int e^{-.14t}(-7)dt$$
$$= \frac{7}{-.14}e^{-.14t} + C$$
$$y = 50 + Ce^{.14t}$$
$$40 = 50 + Ce^{.14(0)} \rightarrow C = -10$$
$$\boxed{y = 50 - 10e^{.14t}}$$

$$\int \frac{dy}{50-y} = \int -.14dt$$
$$-\ln|50-y| = -.14t + C$$
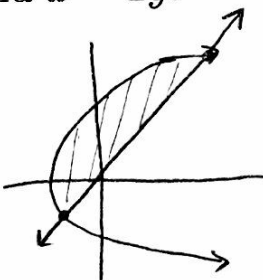$$|50-y| = e^{.14t}e^{-C}$$
$$50-y = Ae^{.14t}$$
$$y = 50 - Ae^{.14t}$$
$$40 = 50 - Ae^{.14(0)} \rightarrow A = 10$$
$$\boxed{y = 50 - 10e^{.14t}}$$

2. Set up the integral which gives the area between the curves $x = y^2 - 3$ and $x = 2y$.



intersection:
$$y^2 - 3 = 2y$$
$$y^2 - 2y - 3 = 0$$
$$(y-3)(y+1) = 0$$
$$y = -1 \text{ OR } 3$$

$$\boxed{\int_{-1}^{3} 2y - (y^2-3)\,dy}$$