1. *(Inspired by 2004, #5, a 15 minute "No Calculator" question– feel free to use a calculator today)*

    A population is modeled by a function P that satisfies the logistic differential equation

$$\frac{dP}{dt} = \frac{P}{4}\left(1 - \frac{P}{18}\right).$$

(a) (2 points) If $P(0) = 5$, what is $\lim_{t \to \infty} P(t)$?

    If $P(0) = 25$, what is $\lim_{t \to \infty} P(t)$?

(b) (1 point) If $P(0) = 5$, for what value of P is the population growing the fastest?

(c) (5 points) A different population is modeled by a function Y that satisfies the separable differential equation

$$\frac{dY}{dt} = \frac{Y}{4}\left(1 - \frac{t}{18}\right).$$

Find $Y(t)$ is $Y(0) = 5$

(d) (1 point) For the function Y found in part (c), what is the $\lim\limits_{t \to \infty} Y(t)$?

2. (2 points) *(Review)* Consider the curve given by $x^2 + 5y^2 = 9 + 2xy$. Show that $\dfrac{dy}{dx} = \dfrac{x - y}{x - 5y}$