Mathematics 242 Homework.

Problem 1. For the differential equation

$$\frac{dy}{dx} = 1 + 2x + 3y$$

(a) If $y(0) = 5$ find $y'(0)$.
(b) If $y(-2) = 4$ find $y'(-2)$. □

Problem 2. For the differential equation

$$y' = .15y(20 - y)$$

(a) Find the constant solutions.
(b) Make graph of the constant solutions along with the solutions that satisfy $y(0) = 10$, and $y(0) = 25$.
(c) If $y(0) = 21$ estimate $y(200)$. □

Recall from calculus that if $y(x)$ is a differentiable function of y and h is close to zero they for any x_0 we have the approximation

$$y(x_0 + h) \approx y(x_0) + y'(x_0)h.$$

For example if $y(2) = 3$ and $y'(3) = -4$ then we have the approximation

$$y(2 + h) \approx y(2) + y'(2)h = 3 - 4h.$$

Therefore (letting $h = .1$) we have

$$y(3.1) \approx 3 - 4(.1) = 2.6$$

and (letting $h = -0.5$)

$$y(1.95) = y(2 + (-.05)) = 3 - 4(-.05) = 3.2$$

Problem 3. For the differential equation

$$y'(x) = 5 - 2y$$

(a) If $y(1) = 3$ find $y'(1)$.
(b) Use your answer to part (a) to find an approximation to $y(1.05)$.