1. A detective finds a murder victim at 9 am. The temperature of the body is measured at 90.3°F. One hour later, the temperature of the body is 89.0°F. The temperature of the room has been maintained at a constant 68°F. Newton’s Law of Cooling states that the rate of change of the temperature of an object is proportional to the difference between the object’s temperature and the temperature of the surroundings.

(a) (1 pt) Assuming the temperature, $T$, of the body obeys Newton’s Law of Cooling, write a differential equation for $T$ with initial condition. *Hint: you can assume the proportionality constant is $k$, a positive number. Be careful with the sign of your equation. Your answer should be in terms of $\frac{dT}{dt}$, $k$ and $T$.*

(b) (2 pts) Now using separation of variables, find the formula for $T$. *Hint: your answer should be in terms of $k$ and $t$.*

(c) (1 pt) Use the fact that at $t = 1, T = 89.0$ to find the value $k$. *Hint: You do not need to solve natural logs.*

(d) (1 pt) If the temperature of a live body is 98.6°F, estimate the time the murder occurred. *Hint: you need to interpret the value $t$ you get from solving the equation.*
2. The slope field for $y' = 0.5(1 + y)(2 - y)$ is given in the figure below.

(a) (2 pts) List equilibrium solutions and state whether each is stable or unstable.

(b) (3 pts) Draw solution curves on the slope field through each of the three marked points. *Hint: make sure your curve covers the whole span of $x$."

**Bonus** Is the following statement true or false? Explain your answer.

1. (1 pt) There is a solution curve for the logistic differential equation $dP/dt = P(2 - P)$ that goes through the points $(0, 1)$ and $(1, 3)$.

2. (1 pt) Using Euler’s method with five steps and $\Delta x = 0.2$ to approximate $y(1)$ when $dy/dx = f(x)$ and $y(0) = 0$ gives the same answer as the left Riemann sum approximation to $\int_{0}^{1} f(x)dx$. 