Name _____

1. Solve $\frac{dy}{dt} = e^{2t-3y}$, with y(0) = 0

answer: $y(t) = \frac{1}{3}ln(\frac{3}{2}e^{2t} - \frac{1}{2})$ For problems 2-3, find the general solution.

$$2. \ \frac{dy}{dx} + 2y = 6x^2$$

answer:
$$y(x) = Ce^{-2x} + 3x^2 - 3x + \frac{3}{2}$$

3.
$$\frac{dP}{dt} + 3P = \cos(t)$$

answer: $P(t) = Ce^{-3t} + 0.3cos(t) + 0.1sin(t)$

4. For the differential equation y' = 3xy, y(1) = 10, take one step using Euler's method with h = 0.001, to approximate y(1.001).

answer: 10.03

5. Find all equilibrium points of $y' = 1 + \cos(\pi y)$ and classify each as a source, sink or node. If y(0) = -2, what does y(t) converge to, as $t \to \infty$?

answer: y = ... - 5, -3, -1, 1, 3, 5, ... all are nodes. $y(t) \to -1$.

6. A 200 gallon tank if full to the brim with pure water, and 10 gallons/minute of a brine solution with 0.5 kg/gallon salt flows into it. Since the tank is full, 10 gallons/minute of well-mixed solution flows onto the ground. Find a differential equation with initial condition for S(t) = kg salt in the tank, and solve it for S(t).

answer: $\frac{dS}{dt} = 10(0.5) - 10\frac{S}{200}, S(0) = 0$ $S(t) = 100 - 100e^{-0.05t}$