*Unit #3:* Differential Equations *Topic:* Separable Differential Equations *Objective: SWBAT find a particular solution to a separable differential equation.* 

## Warm Up #2:

Find the particular solution to the equation  $\frac{dy}{dx} = e^x - 6x^2$  whose graph passes through the point (1,0).

We cannot find a unique or particular solution to a differential equation unless we are given further information. If the general solution to a first-order differential equation is continuous, then all that is needed to write a particular solution is a single point. This given point is called the *initial condition*.

*Example:* 1985 BC #4

Given the differential equation  $\frac{dy}{dx} = \frac{-xy}{\ln y}$ , y > 0.

(a) Find the general solution of the differential equation.

(b) Find the particular solution that satisfies the condition that  $y = e^2$  when x = 0. Express your answer in the form y = f(x).

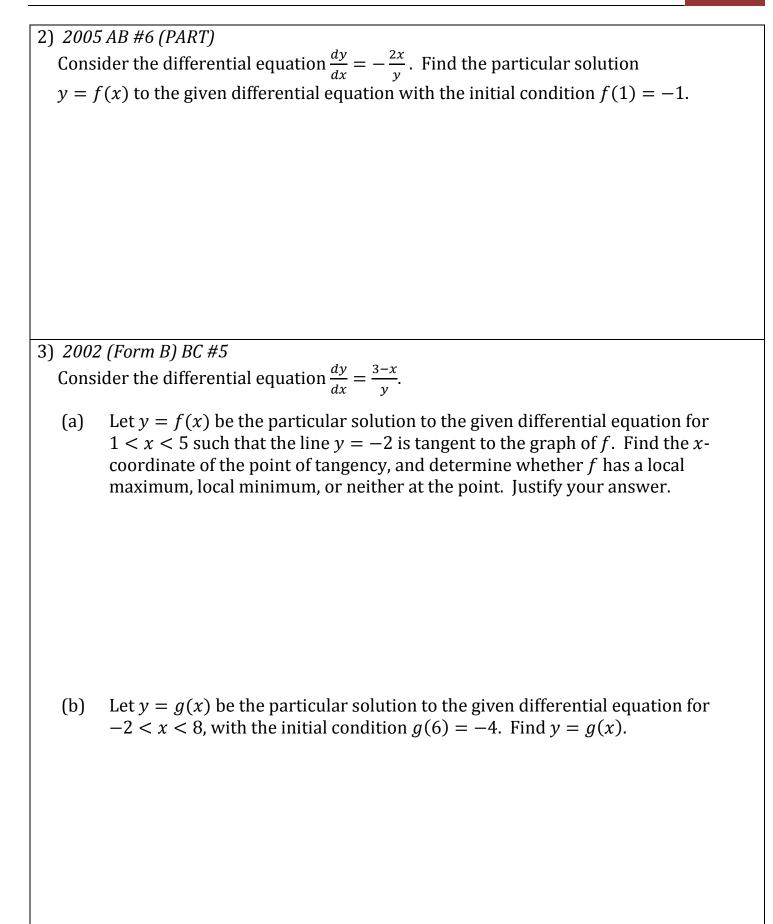
(c) Explain why x = 2 is not in the domain of the solution found in part (b).

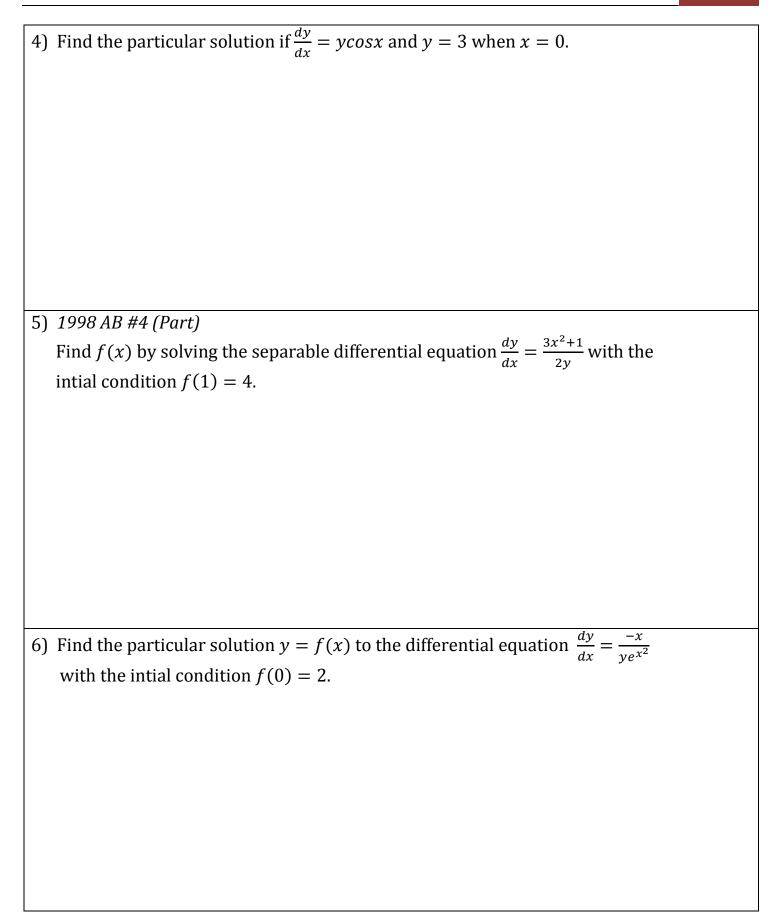
Problem Set #2:

1) 2000 AB 6 Consider the differential equation  $\frac{dy}{dx} = \frac{3x^2}{e^{2y}}$ .

(a) Find a solution y = f(x) to the differential equation satisfying  $f(0) = \frac{1}{2}$ .

(b) Find the domain and range of the function *f* found in part (a).





7) Find the particular solution y = f(t) to the differential equation  $\frac{dy}{dt} = \frac{1}{y^2}$  with the initial condition y(2) = 3.

8) Find f(t) by solving the separable differential equation  $\frac{dy}{dt} = ty$  with the initial condition y(2) = 1.

## Answer Key:

1) a) $y = \frac{1}{2}ln(2x^3 + e)$	b) domain: $x > \left(-\frac{e}{2}\right)^{1/3}$	range: $(-\infty,\infty)$
2) $y = -\sqrt{-2x^2 + 3}$ 3	) a) (3,-2) local max b	) $y = -\sqrt{6x - x^2 + 16}$
4) $y = 3e^{sinx}$ 5) $y = -2$	$\sqrt{x^3 + x + 14} \qquad 6) \ y = \sqrt{x^3 + x + 14}$	$\sqrt{e^{-x^2}+3}$
7) $y = (3t + 21)^{1/3}$ 8)	$y = e^{\frac{1}{2}t^2 - 2}$	