Name: _____

VIP ID: _____

- Write your name and VIP ID in the space provided above.
- The test has five (5) pages, including this one.
- Enter your answer in the box(es) provided.
- Show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given at the right of each problem number.

Page	**Max**	**Points**
2	40	
3	20	
4	20	
5	20	
Total	100	

Skills tested on this page:

Terminology	**Notation**	**Background Algebra**
Derivatives	**Integration**	**Management of constants**

Problem 1 (40 pts)**.** Consider the following *first-order separable* differential equation:

$$y' = x(y+1)$$

(a) **[10 pts]** Find an *implicit form* of its **general solution**.

(b) **[10 pts]** Find a *particular solution* that solves the following **initial value problem**

$$y' = x(y+1), \quad y(0) = e - 1$$

$y =$

(c) **[10 pts]** Are there any **singular solutions**? Find at least one.

$y =$

(d) **[10 pts]** Find an explicit *particular solution* that solves this other **initial value problem**

$$y' = x(y+1), \quad y(0) = -1$$

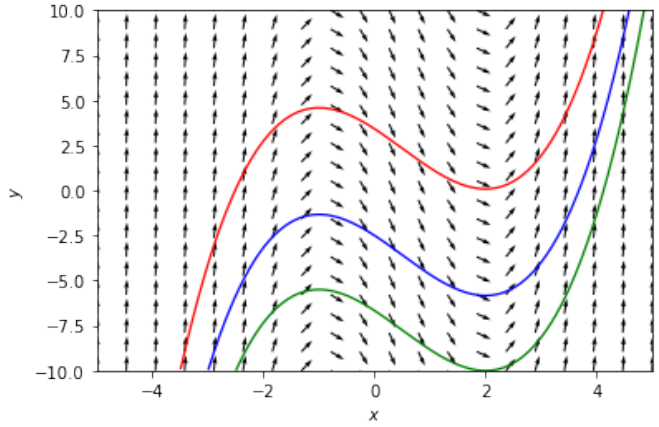
$y =$

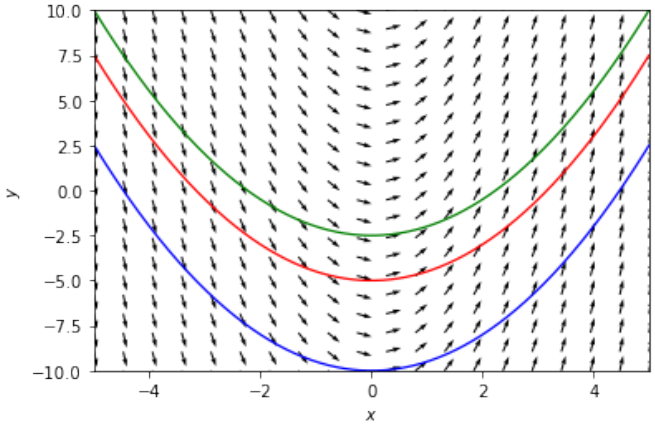
Skills on this page: Slope fields, Euler's Method

Problem 2 (10 pts—all or nothing)**.** Which of the following is the slope field of the following differential equation?

$$y' = x^2 - x - 2$$

(You do not need to show work)





Problem 3 (10 pts)**.** Use Euler's method with a step size $h = 0.5$ to obtain a numerical approximation of the following **initial value problem**

$$y' = x^2 y, \quad y(0) = 1$$

n	x_n	y_n	$f(x_n, y_n)$
0			
1			
2			

Skills on this page: Basic First-order differential equations

Problem 4 (10 pts)**.** Solve the following initial value problem:

$$9y' = \frac{1}{\sqrt{3x+4}} \qquad y(7) = -1$$

Problem 5 (10 pts)**.** Solve the following differential equation:

$$xy' = \sqrt{x^2+y^2} + y$$

Skills on this page: Basic First-order differential equations

Problem 6 (20 pts)**.** Solve the following differential equation:

$$y' + 2\frac{y}{x} = x - 1$$