SCORE________________

1. Verify that the indicated function is a solution of the given differential equation.

$$y'' - y' - 2y = 0, \qquad y = e^{2x} - 3e^{-x}$$

[8 points]

2. (a) Give the definition of a differential equation in terms of the dependent and independent variable. (b) Describe a linear differential equation and write out its general form. (c) What is the order of a differential equation?

[10 points]

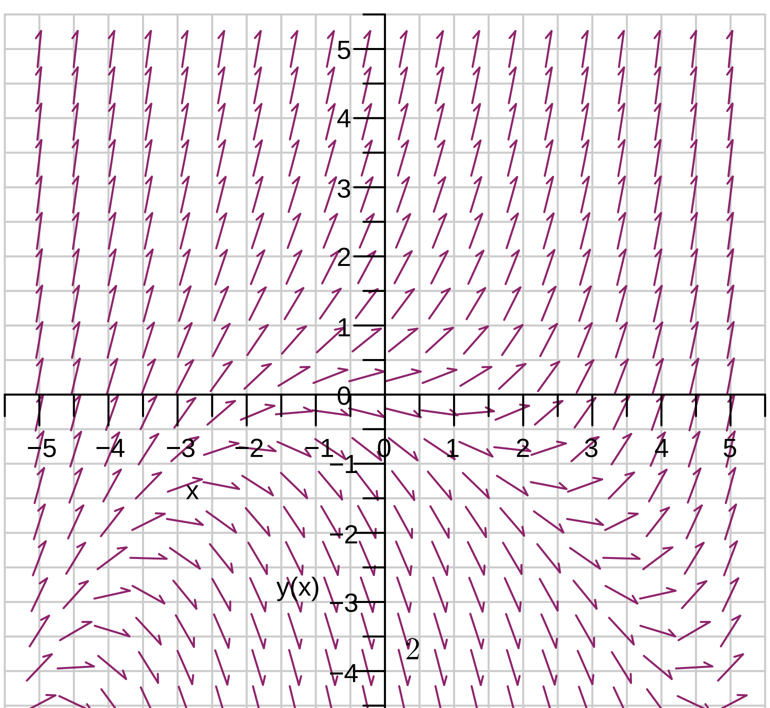
3. (a) State the Existence/ Uniqueness Theorem. (b) Determine whether the given initial value problem has a unique solution using the Existence/ Uniqueness Theorem.

$$\frac{dy}{dx} = \sqrt{y^2 - 9}, \qquad\qquad y(2) = -3$$

[12 points]

4. Use the given direction field to sketch solution curves through the points (2, 1), (4, 0), and (0, 2).

[8 points]



5. Identify the following as separable, linear, exact, homogeneous or Bernoulli. An equation may be more than one kind.

(a) $(2xy + 3)dx + (x^2 - 1)dy = 0$

[5 points]

(b) $\dfrac{dy}{dx} = 2y + y \sin x$

[5 points]

6. Solve the given differential equation by separation of variables.

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

[10 points]

7. Determine if the given equation is exact. If it is exact, solve it.

$$(2xy + 3)\ dx + (x^2 - 1)\ dy = 0$$

[10 points]

8. Solve the given differential equation subject to the indicated initial condition. (Note the $\int \ln u\, du = u \ln u - u + C$).

$$(x+1)\frac{dy}{dx} + y = \ln x, \qquad y(1) = 10$$

[12 points]

9. Solve the given differential equation.

$$\frac{dy}{dx} = (x + y + 2)^2$$

[10 points]

10. Solve the given differential equation.

$$\frac{dy}{dx} - y = e^x y^2$$

[10 points]