

Name: \_\_\_\_\_

Math 1B Quiz 4

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You have 20 minutes to complete this quiz. You must show your work. The following fact may be helpful:

1. (3 pts) For what values of  $r$  does  $y = e^{rt}$  satisfy the differential equation  $y'' + y' - 6y = 0$ ?

$$\begin{aligned} y'' &= r^2 e^{rt} \\ y' &= r e^{rt} \\ \text{want! } r^2 e^{rt} + r e^{rt} - 6 e^{rt} &= 0 \\ (r^2 + r - 6) e^{rt} &= 0 \\ (r + 3)(r - 2) &= 0 \quad r = -3 \text{ or } r = 2 \end{aligned}$$

2. (3 pts) Mr Wilson's 1000 gallon swimming pool initially has only water in it, but then Dennis starts dumping mud into the pool at a rate of  $2 \text{ kg/min}$ . The pool filter can remove the mud from 100 gallons of water per minute, returning the clean water to the pool. Find an initial value problem whose solution would give the amount of mud (in kg) in the pool after  $t$  minutes.

$$M' = 2 - 100 \cdot \frac{M}{1000} = 2 - \frac{M}{10}$$

$$M' = \frac{20 - M}{10}$$
$$M(0) = 0$$

(over)

3. (2 pts) Which direction field corresponds with each of the following differential equations?

a)  $y' = y^2 - 1$  I

b)  $y' = x^2 - y^2$  IV

c)  $y' = xy$  II

d)  $y' = x + y$  III

4. (2 pts) Using direction field I below, sketch the graph of the solutions passing through

a) (0, 2) and b) (0, 0)

