

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

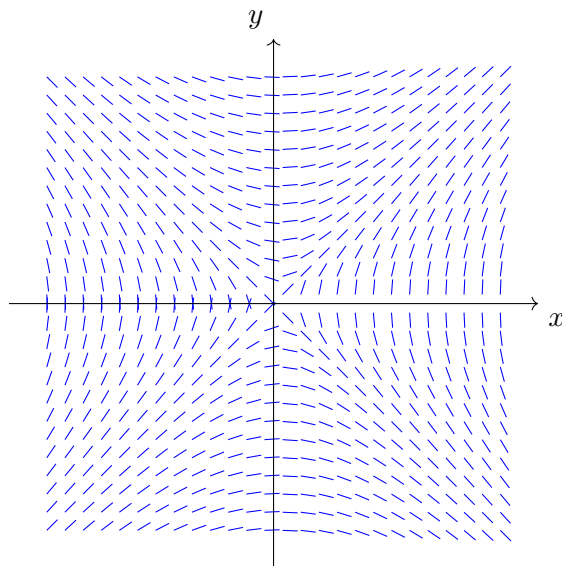
Mark: \_\_\_\_\_

**Mini-math Div 3/4: Monday, January 9, 2023 (20 minutes)**

1. Write a differential equation that describes the following relationships. If necessary, use  $k$  as the constant of proportionality.
  - (a) (2 points) The rate of change of population,  $P$ , with respect to time,  $t$ , is inversely proportional to the square root of time and directly proportional to the area,  $A$ , that the population covers.
  - (b) (2 points) The position of a particle is given by  $s(t)$ , where  $t$  is measured in seconds. Its acceleration is directly proportional to its position. When the particle is at position 4 units, its acceleration is 2 units/ $s^2$ .
2. (4 points) Determine the value of  $k$ , if any, for which  $y = \sin(2x) - k \sin(4x)$  would be a solution to the differential equation  $y'' + 4y = 3 \sin(4x)$ .

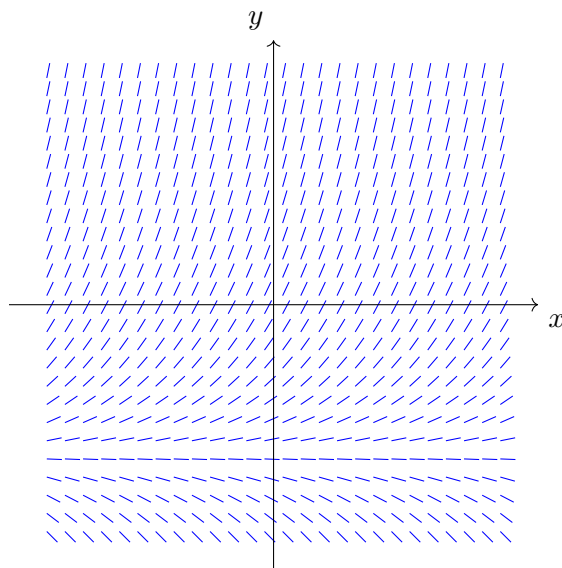
3. (2 points) What differential equation can the slope field to the right represent?

- A.  $\frac{dy}{dx} = 1/x$
- B.  $\frac{dy}{dx} = 1/y$
- C.  $\frac{dy}{dx} = x/y$
- D.  $\frac{dy}{dx} = y/x$



4. (2 points) The slope field for a certain differential equation is shown to the right. Which of the following could be a particular solution to the differential equation?

- A.  $y = x^3$
- B.  $y = \frac{1}{x+2}$
- C.  $y = -2^x - 2$
- D.  $y = e^{-x} - 2$



5. Consider the initial value problem  $\frac{dy}{dx} = 2x + y$  and  $y(1) = 2$ .

(a) (2 points) Find an approximation of  $y(1.2)$  using Euler's Method with two equal steps.

(b) (2 points) Is your estimate in part (a) an overestimate or an underestimate?