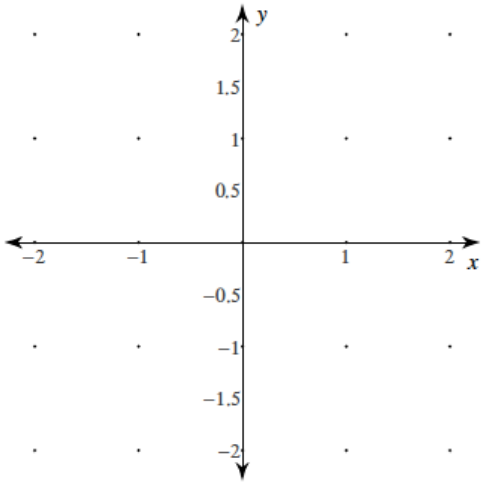
Honors Calculus
Chapter 6 Review

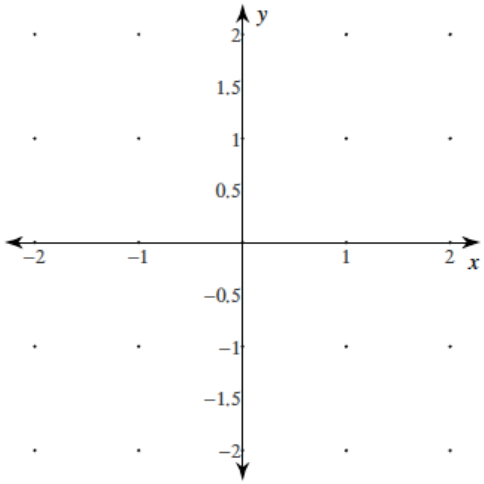
Part I

Sketch the slope field for each differential equation.

1) $\dfrac{dy}{dx} = x$

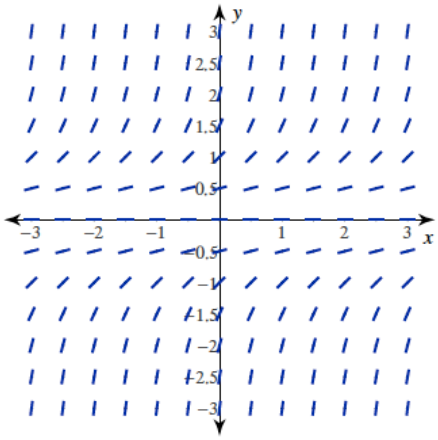


2) $\dfrac{dy}{dx} = -\dfrac{x}{y}$



For each problem, find a differential equation that could be represented with the given slope field.

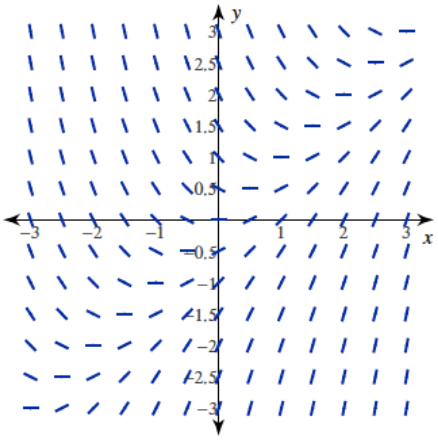
3)



A) $\dfrac{dy}{dx} = -\dfrac{1}{x}$ B) $\dfrac{dy}{dx} = -\dfrac{1}{y}$

C) $\dfrac{dy}{dx} = 1$ D) $\dfrac{dy}{dx} = y^2$

4)



A) $\dfrac{dy}{dx} = x + y$ B) $\dfrac{dy}{dx} = x - y$

C) $\dfrac{dy}{dx} = xy$ D) $\dfrac{dy}{dx} = -xy$

Write and solve the differential equation that models the verbal statement.

5. The rate of change of W with respect to t is proportional to t.
6. The rate of change of y with respect to x is inversely proportional to x.
7. The rate of change of P with respect to x is proportional to e^{2x}.
8. The rate of change of M with respect to t is proportional to M.

Find the exponential function that passes through the two points.

9. (0, 1/2), (3, 32)

10. (2, 3), (4, 3/4)

Part II

In problems 1 – 8 find the general solution to the differential equation.

1. $\frac{dy}{dx} = kx$

2. $\frac{dy}{dx} = ky$

3. $\frac{dy}{dx} = x^2 + k^2$

4. $\frac{dy}{dx} = y^2 + k^2$

5. $\frac{dy}{dx} = y + ky$

6. $\frac{dy}{dx} = y + k$

7. $\frac{dy}{dx} = kx - x$

8. $\frac{dy}{dx} = ky(x-1)$

In problems 9 – 10, solve the initial value problem:

9. $\frac{dy}{dx} = \frac{x(y-2)}{x^2+4}$ $\quad y(1) = 5$

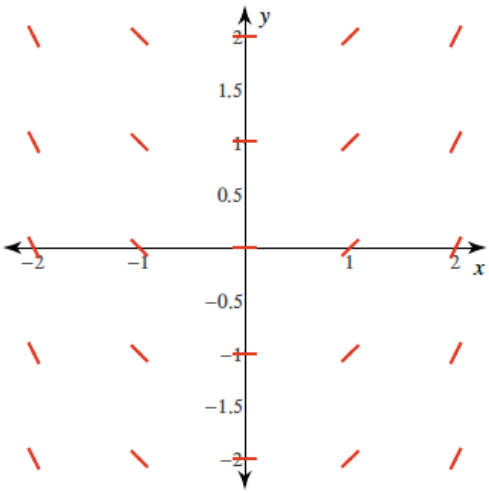
10. $\frac{dy}{dx} = \frac{y}{x}$ $\quad y(2) = 3$

Answers

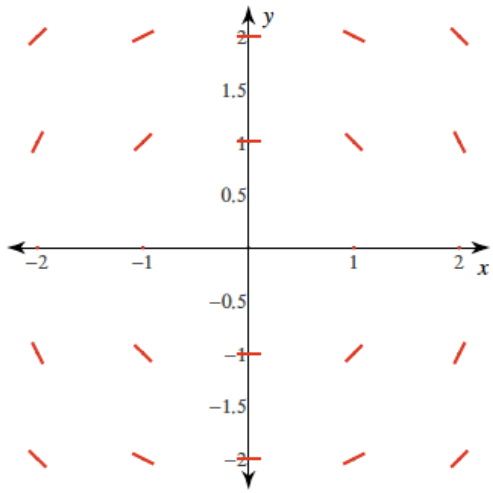
Part I

Sketch the slope field for each differential equation.

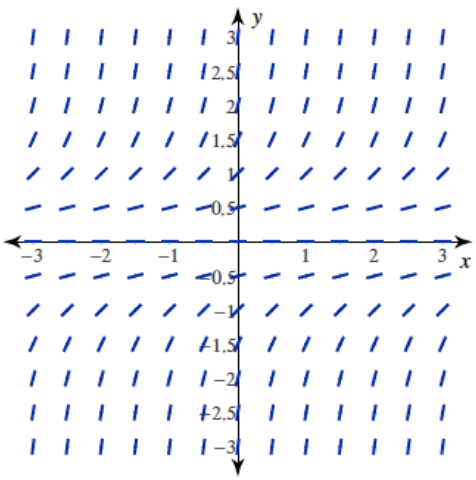
1) $\dfrac{dy}{dx} = x$



2) $\dfrac{dy}{dx} = -\dfrac{x}{y}$



3)



A) $\dfrac{dy}{dx} = -\dfrac{1}{x}$ B) $\dfrac{dy}{dx} = -\dfrac{1}{y}$

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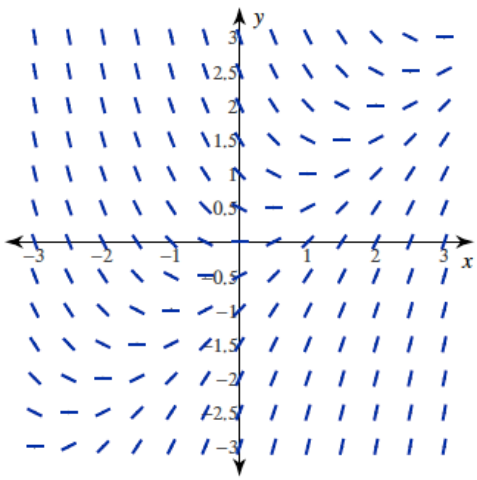

A) $\dfrac{dy}{dx} = x + y$ *B) $\dfrac{dy}{dx} = x - y$

C) $\dfrac{dy}{dx} = xy$ D) $\dfrac{dy}{dx} = -xy$

5. $W = \frac{kt^2}{2} + C = kt^2 + C$

6. $y = k \ln|x| + C$

7. $y = \frac{k}{2}e^{2x} + C = ke^{2x} + C$

8. $M = Ce^{kt}$

9. $y = \frac{1}{2}e^{(\ln 4)t} = \frac{1}{2}(4)^t$

10. $y = 12e^{\ln(1/2)t} = 12\left(\frac{1}{2}\right)^t$

Part II

1. $y = \frac{k}{2}x^2 + c$

2. $y = ce^{kx}$

3. $y = \frac{x^3}{3} + k^2x + c$

4. $y = k\tan(kx + c)$

5. $y = ce^{x+kx}$

6. $y = ce^x - k$

7. $y = \frac{k}{2}x^2 - \frac{x^2}{2} + c$

8. $y = ce^{kx^2+kx}$

9. $y = \frac{3}{\sqrt{5}}\sqrt{x^2+4} + 2$

10. $y = \frac{3}{2}|x|$