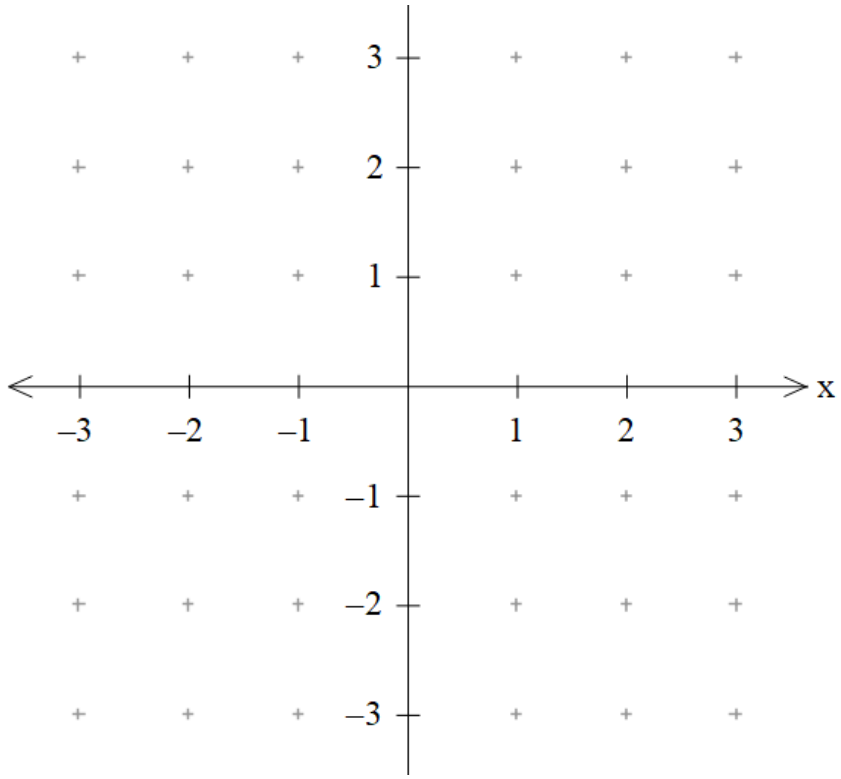
DIRECTION FIELDS

1 Consider the differential equation $\frac{dy}{dx} = y - \frac{x}{2}$.

(a) Find the gradient of a solution curve at the point $(3, -2)$, assuming the curve goes through this point.

(b) Use integer values of x and y from -3 to 3 to construct a direction field for the differential equation $\frac{dy}{dx} = y - \frac{x}{2}$.

	-3	**-2**	**-1**	**0**	**1**	**2**	**3**
3							
2	3.5		2.5	2	1.5	1	0.5
1	2.5		1.5	1	0.5	0	-0.5
0	1.5		0.5	0	-0.5	-1	-1.5
-1	0.5		-0.5	-1	-1.5	-2	-2.5
-2	-0.5		-1.5	-2	-2.5	-3	-3.5
-3	-1.5		-2.5	-3	-3.5	-4	-4.5

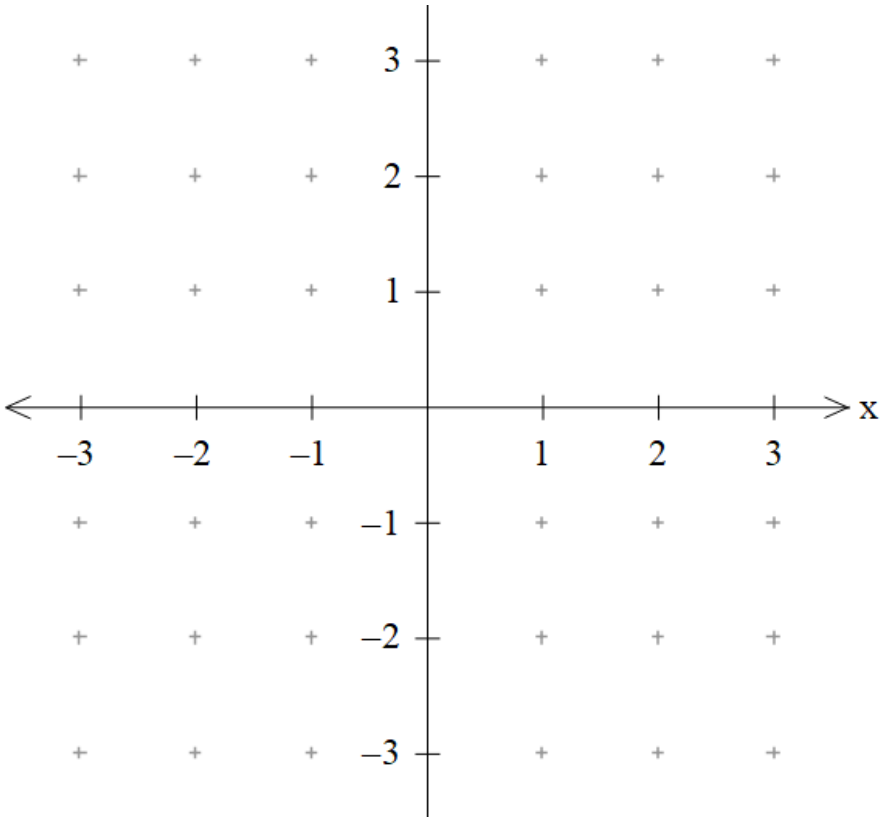


DIRECTION FIELDS

2 Construct direction fields for the following differential equations for $-3 \le x \le 3$ and $-3 \le y \le 3$. Use integer values of x and y.

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

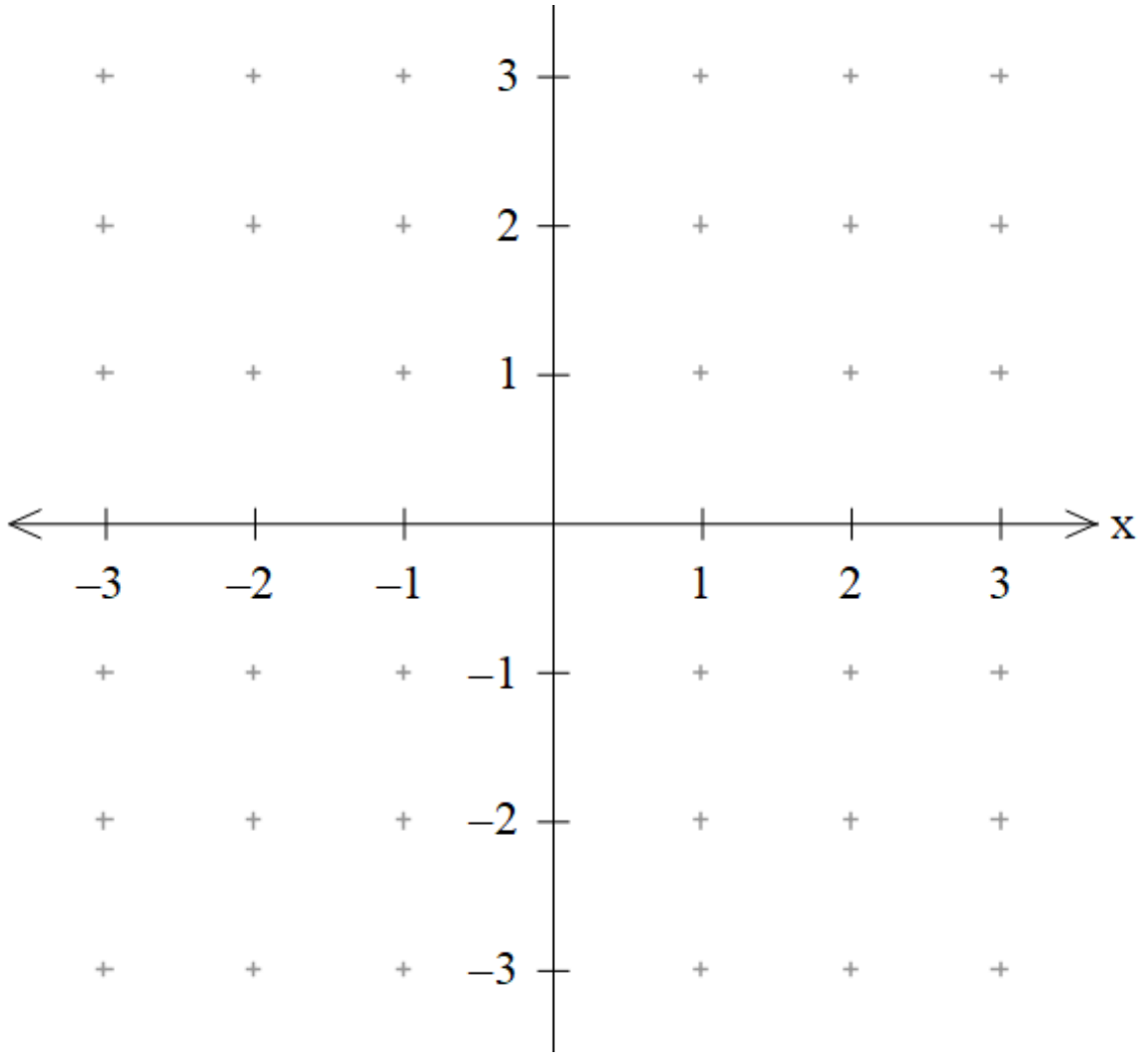
	-3	-2	-1	0	1	2	3
3							
2							
1							
0							
-1							
-2							
-3							



DIRECTION FIELDS

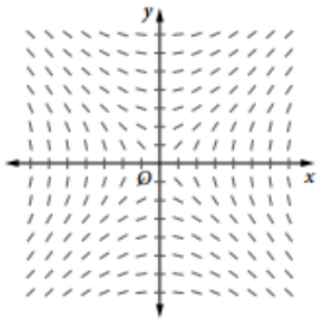
2 Construct direction fields for the following differential equations for $-3 \le x \le 3$ and $-3 \le y \le 3$. Use integer values of x and y.

(g) $\frac{dy}{dx} = \sqrt{3-y}$



DIRECTION FIELDS

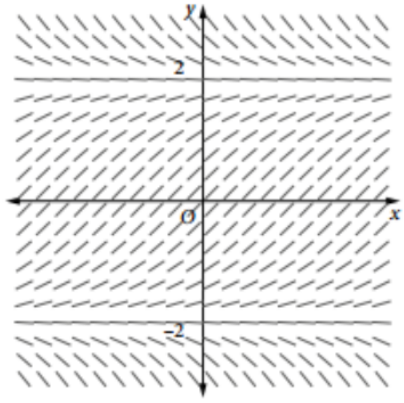
4 The graph shown is the slope field of a first-order differential equation.
This differential equation could be:



A $y' = \frac{y}{x}$ **B** $y' = \frac{x}{y}$

C $y' = -\frac{y}{x}$ **D** $y' = -\frac{x}{y}$

5 The slope field of $\frac{dy}{dx} = f(y)$ is shown.

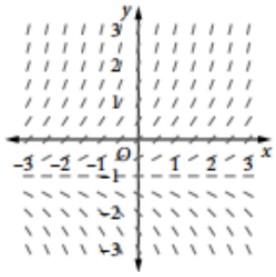


For each of the following, sketch a possible curve which is a solution to this differential equation, containing a point for which:

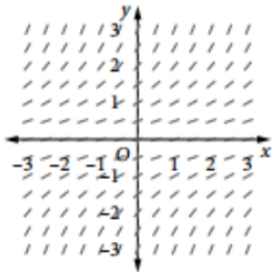
(a) $y > 2$
(b) $-2 < y < 2$
(c) $y < -2$

6 Which of the following slope fields does not represent a differential equation of the form $\frac{dy}{dx} = f(y)$?

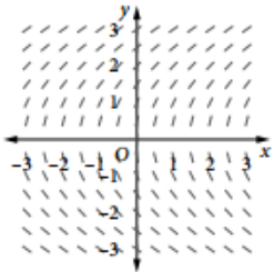
A



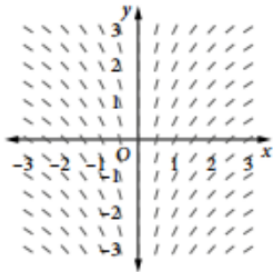
B



C



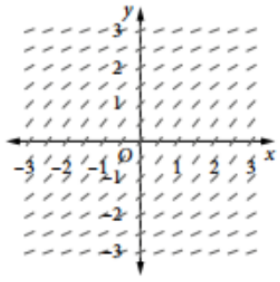
D



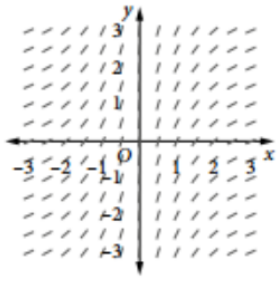
DIRECTION FIELDS

7 Which of the following slope fields represents a differential equation of the form $\frac{dy}{dx} = f(y)$?

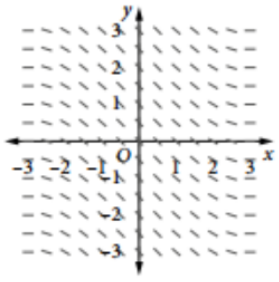
A



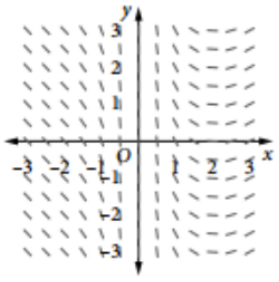
B



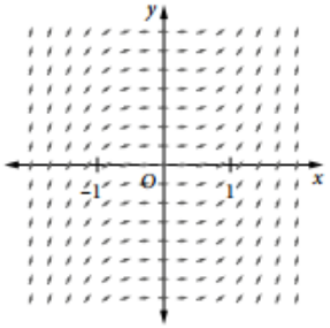
C



D



8 A first-order differential equation has a slope field as shown.



(a) Sketch three possible solutions for this differential equation.

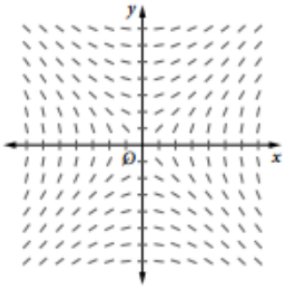
(b) Which of the following first-order differential equations is consistent with the slope field shown?

A $\frac{dy}{dx} = xy$ **B** $\frac{dy}{dx} = x^2$

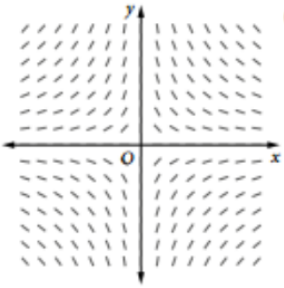
C $\frac{dy}{dx} = x^3$ **D** $\frac{dy}{dx} = x + y$

9 The slope field of $xy' - y = 0$ could be:

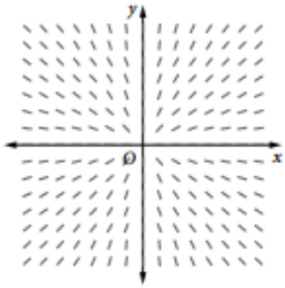
A



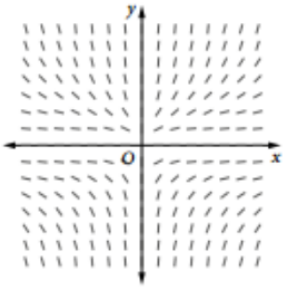
B



C



D



DIRECTION FIELDS

10 (a) Construct the direction field for the differential equation $\frac{dy}{dx} = x + y$, for $-3 \le x \le 3$ and $-3 \le y \le 3$, with x and y increasing in steps of 0.5.

(b) Draw some possible solutions to the differential equation $\frac{dy}{dx} = x + y$, including one that is a straight line, and including one that touches but does not cross the x-axis.

(c) Write the equation of the possible straight line solution.

(d) Verify whether the straight line represents a solution to the differential equation.

	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2	2.5	3
3													
2.5													
2													
1.5													
1													
0.5													
0													
-0.5													
-1													
-1.5													
-2													
-2.5													
-3