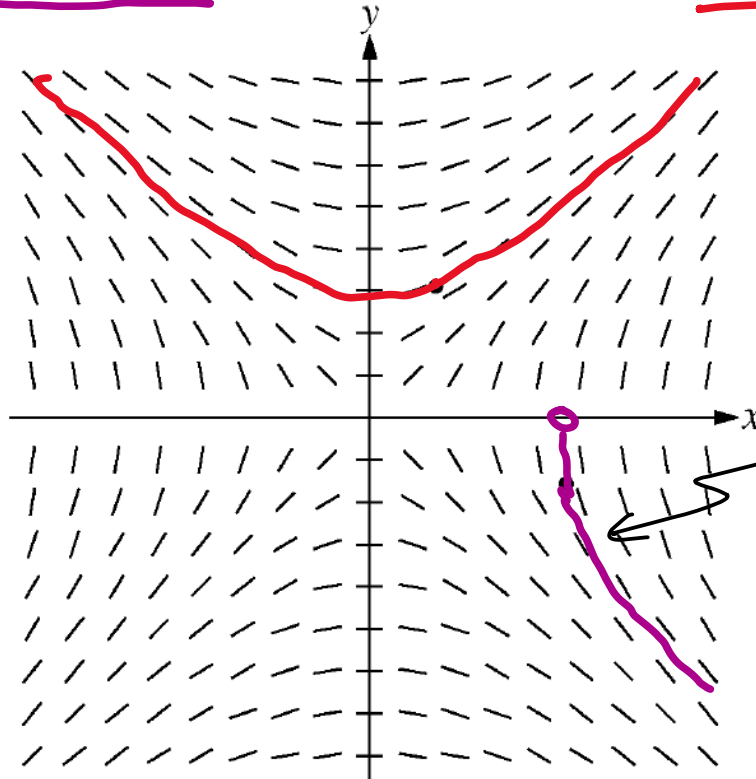


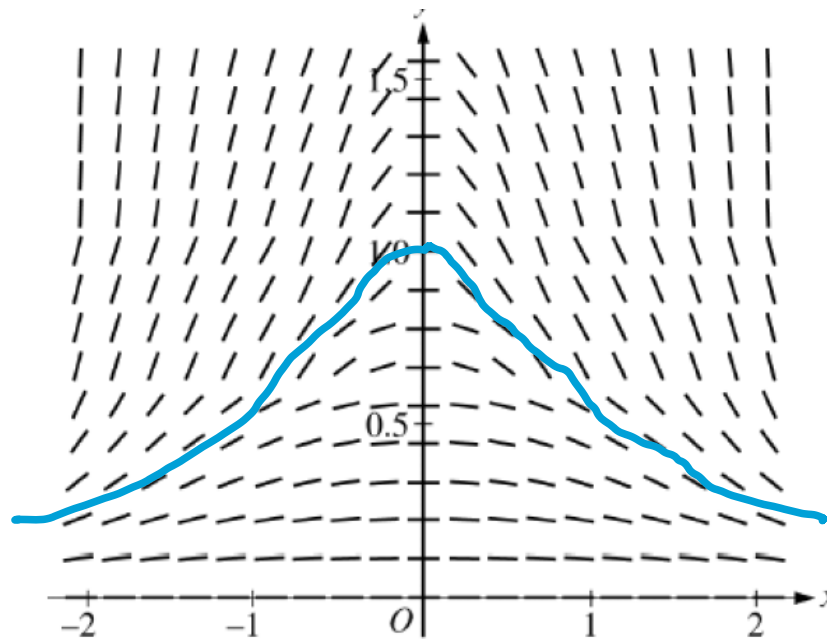
The following problems are a combination of AP® Classroom problems, released exam problems from AP® Central, and adapted from Mark Kiraly's card match problems from 7.3.

1. The slope field for the given differential equation $\frac{dy}{dx} = \frac{x}{y}$, where $y \neq 0$, is shown below. Sketch the solution curve that passes through the point $(3, -1)$ and sketch the solution curve that passes through the point $(1, 2)$.



The solution's domain should be the largest possible continuous interval. So the solution stops at undefined values of dy/dx , in this case, when $y = 0$.

- 2.



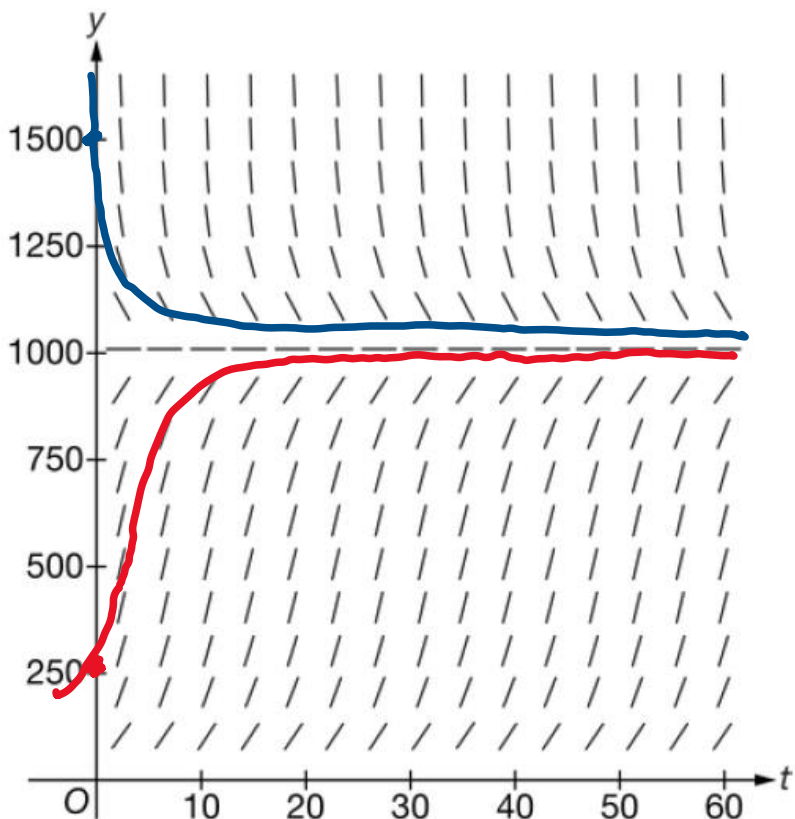
$\lim_{x \rightarrow \pm\infty} \frac{1}{1+x^2} = 0$
Asymptote!

The slope field for a certain differential equation is shown above. Which of the following could be a solution to the differential equation with the initial condition $y(0) = 1$?

- (A) $y = \cos x$ (B) $y = 1 - x^2$ (C) $y = e^x$ (D) $y = \sqrt{1 - x^2}$ (E) $y = \frac{1}{1+x^2}$

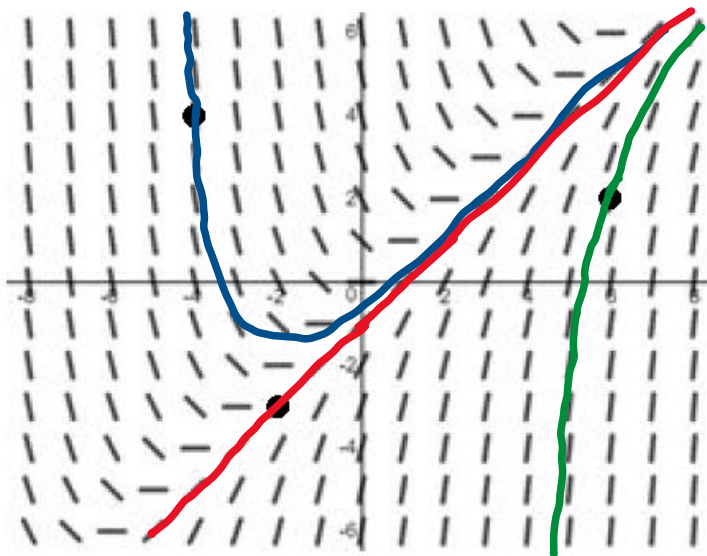
3. The number of frogs living in a pond at time t , measured in weeks, is modeled by the function $y = F(t)$ that satisfies the differential equation $\frac{dy}{dt} = \frac{1}{2500}y(1010 - y)$. The number of frogs in the pond at time $t = 0$ is $F(0) = b$ where b is a positive constant.

A slope field for the given differential equation is shown in the figure below. Sketch the solution curve that passes through the point $(0, 250)$ and sketch the solution curve that passes through the point $(0, 1500)$.



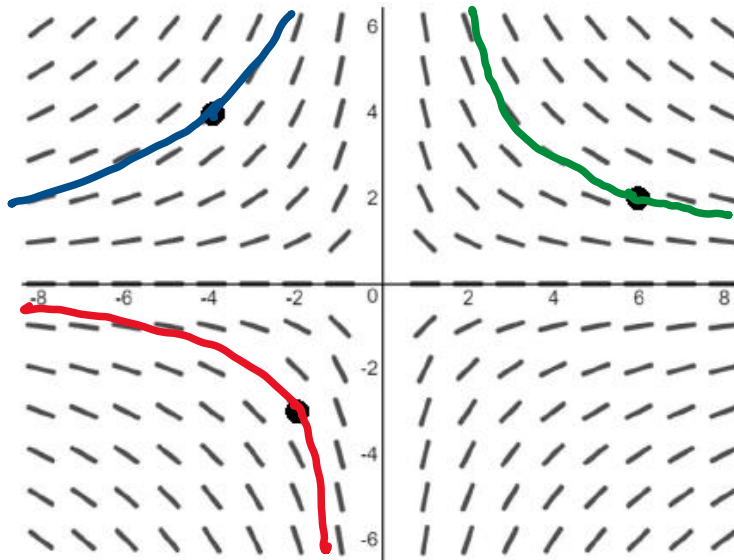
4. For the given differential equation, sketch the solution curve that passes through the point $(-4, 4)$, sketch the solution curve that passes through the point $(6, 2)$, and sketch the solution curve that passes through the point $(-2, -3)$.

4. $\frac{dy}{dx} = x - y$

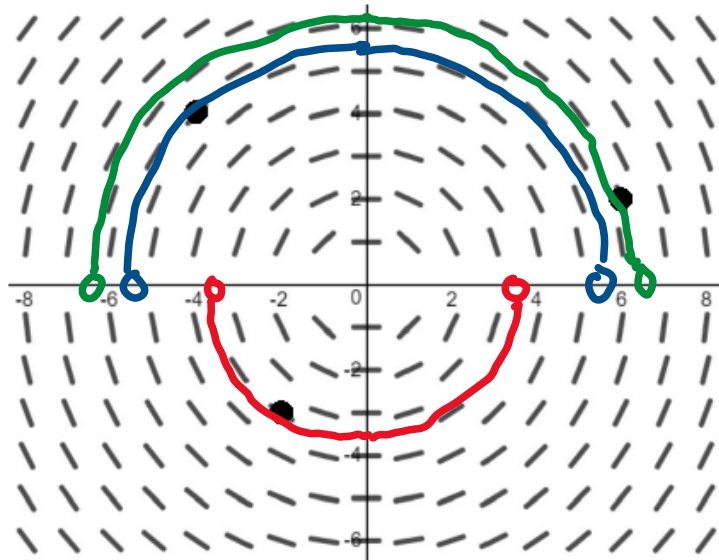


5-7: For each of the given differential equations, sketch the solution curve that passes through the point $(-4, 4)$, sketch the solution curve that passes through the point $(6, 2)$, and sketch the solution curve that passes through the point $(-2, -3)$.

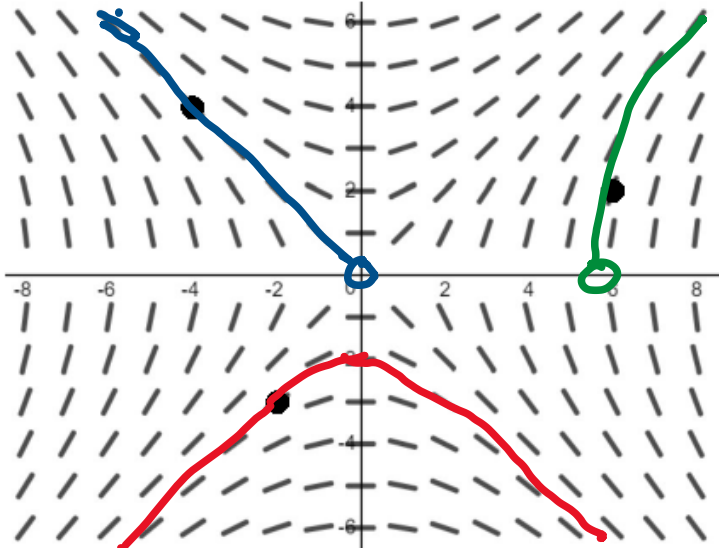
5. $\frac{dy}{dx} = -\frac{y}{x}$



6. $\frac{dy}{dx} = -\frac{x}{y}$

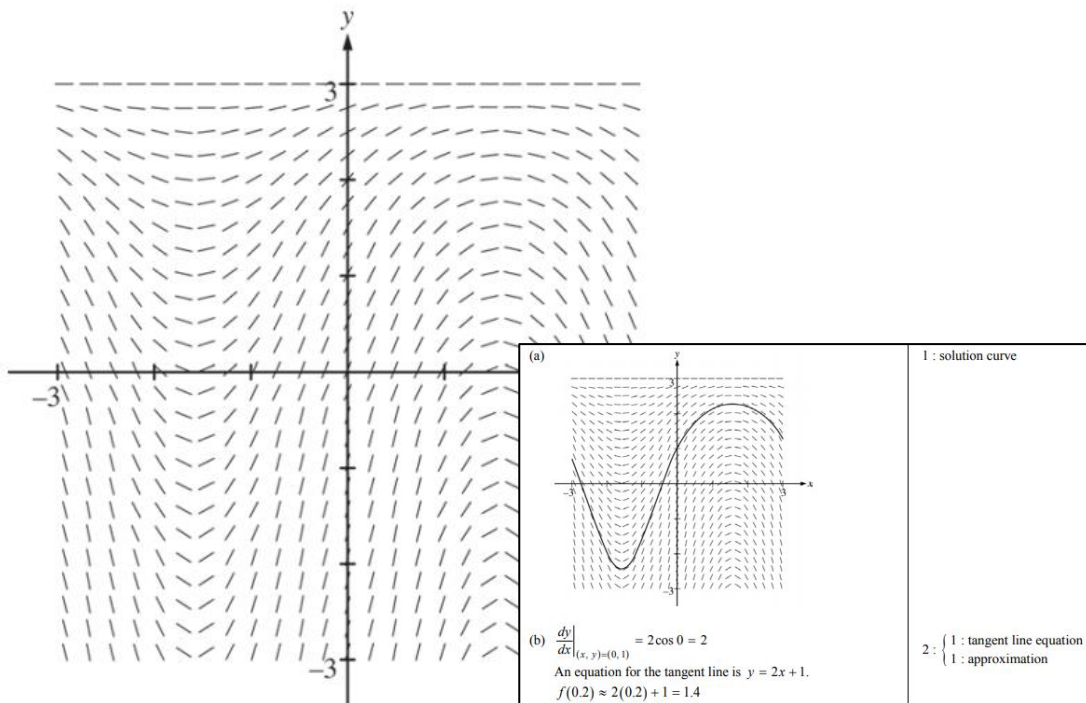


7. $\frac{dy}{dx} = \frac{x}{y}$



2014 AB6 Consider the differential equation $\frac{dy}{dx} = (3 - y)\cos x$. Let $y = f(x)$ be the particular solution to the differential equation with the initial condition $f(0) = 1$. The function f is defined for all real numbers.

- (a) A portion of the slope field of the differential equation is given below. Sketch the solution curve through the point $(0, 1)$.

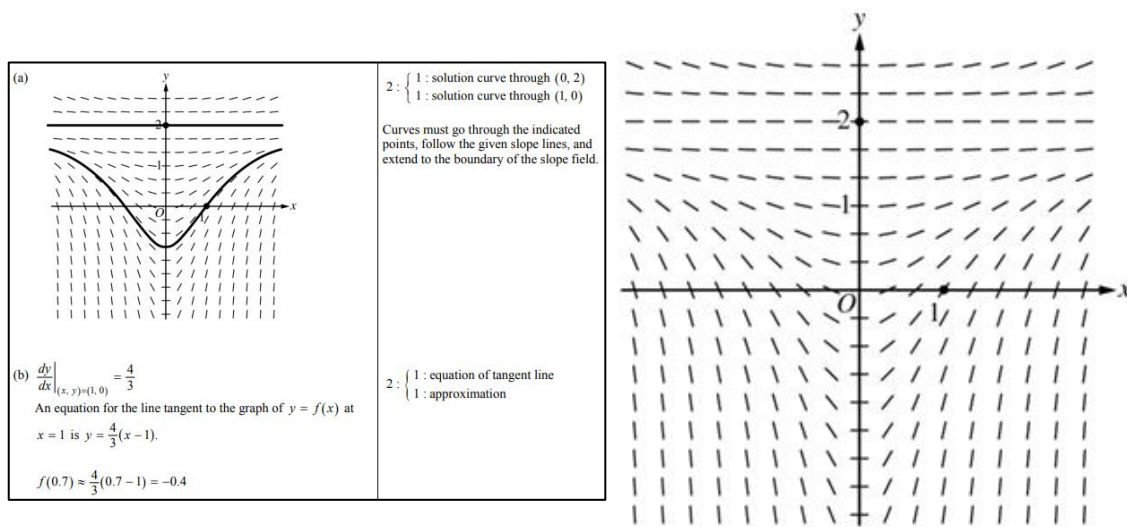


- (b) Write an equation for the line tangent to the solution curve in part (a) at the point $(0, 1)$. Use the equation to approximate $f(0.2)$.

2018 AB 6

Consider the differential equation $\frac{dy}{dx} = \frac{1}{3}x(y - 2)^2$.

- (a) A slope field for the given differential equation is shown below. Sketch the solution curve that passes through the point $(0, 2)$, and sketch the solution curve that passes through the point $(1, 0)$.



- (b) Let $y = f(x)$ be the particular solution to the given differential equation with initial condition $f(1) = 0$. Write an equation for the line tangent to the graph of $y = f(x)$ at $x = 1$. Use your equation to approximate $f(0.7)$.