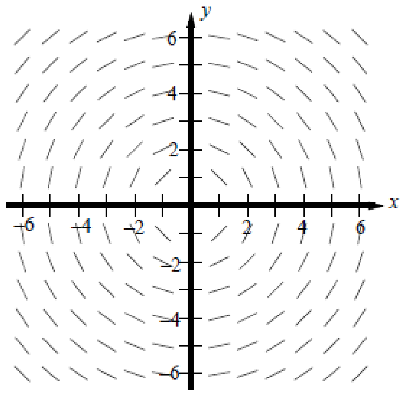
Differentials and Slope Fields Practice

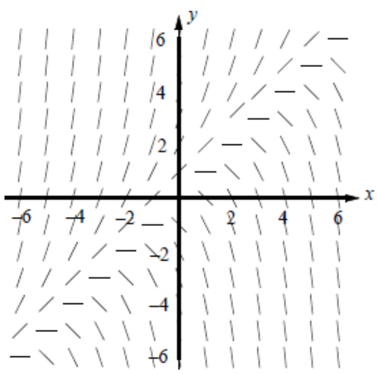
1.



Shown above is a slope field for which of the following differential equations?

(A) $\frac{dy}{dx} = \frac{x}{y}$ (B) $\frac{dy}{dx} = -\frac{x}{y}$ (C) $\frac{dy}{dx} = \frac{x^2}{y}$ (D) $\frac{dy}{dx} = -\frac{x^2}{y}$

2.



Shown above is a slope field for which of the following differential equations?

(A) $\frac{dy}{dx} = x + y$ (B) $\frac{dy}{dx} = x - y$ (C) $\frac{dy}{dx} = -x + y$ (D) $\frac{dy}{dx} = x^2 - y$

3.

The solution to the differential equation $\frac{dy}{dx} = \frac{3x^2}{2y}$, where $y(3) = 4$, is

(A) $y = \sqrt{\frac{x^3}{3} + 1}$ (B) $y = 7 - \sqrt{\frac{x^3}{3}}$ (C) $y = \sqrt{x^3 - 9}$ (D) $y = \sqrt{x^3 - 11}$

4.

If $\frac{dy}{dx} = \frac{x + \sec^2 x}{y}$ and $y(0) = 2$, then $y =$

(A) $\sqrt{x^2 + 2\sec x + 2}$ (C) $\sqrt{x^2 + \sec^2 x + 2}$

(B) $\sqrt{x^2 + 2\tan x + 4}$ (D) $\sqrt{x^2 + \tan^2 x + 4}$

5.

At each point (x, y) on a certain curve, the slope of the curve is xy. If the curve contains the point $(0, -1)$, which of the following is the equation for the curve?

(A) $y = x^2 - 2$ (B) $y = 3x^2 - 4$ (C) $y = -e^{\frac{x^2}{2}}$ (D) $y = -e^{(x^2 - 1)}$

6.

If $\frac{dy}{dx} = (y - 4)\sec^2 x$ and $y(0) = 5$, then $y =$

(A) $e^{\tan x} + 4$ (B) $6e^{\tan x} - 1$ (C) $2e^{\tan x} + 2$ (D) $4\sec x + 1$

7.

Bacteria in a certain culture increase at a rate proportional to the number present. If the number of bacteria doubles every four hours, in how many hours will the number of bacteria triple?

(A) $\ln(\frac{27}{2})$ (B) $\ln(\frac{81}{2})$ (C) $\frac{4\ln 2}{\ln 3}$ (D) $\frac{4\ln 3}{\ln 2}$

8.

The population $P(t)$ of a species satisfies the logistic differential equation $\frac{dP}{dt} = 3P - 0.0006P^2$, where the initial population is $P(0) = 1000$ and t is the time in years. What is $\lim_{t \to \infty} P(t)$?

(A) 1000 (B) 2000 (C) 3000 (D) 5000

9.

A healthy population $P(t)$ of animals satisfies the logistic differential equation $\frac{dP}{dt} = 5P(1 - \frac{P}{240})$, where the initial population is $P(0) = 150$ and t is the time in years. For what value of P is the population growing the fastest?

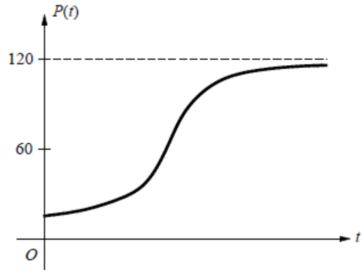
(A) 48 (B) 60 (C) 120 (D) 240

10.

A population is modeled by a function P that satisfies the logistic differential equation $\frac{dP}{dt} = \frac{P}{5}\left(1 - \frac{P}{150}\right)$, where the initial population is $P(0) = 800$ and t is the time in years. What is the slope of the graph of P at the point of inflection?

(A) 5 (B) 7.5 (C) 10 (D) 12.5

11.



Which of the following differential equations for population P could model the logistic growth shown in the figure above

(A) $\frac{dP}{dt} = 0.03P^2 - 0.0005P$

(B) $\frac{dP}{dt} = 0.03P^2 - 0.000125P$

(C) $\frac{dP}{dt} = 0.03P - 0.001P^2$

(D) $\frac{dP}{dt} = 0.03P - 0.00025P^2$

12.

Let $y = f(x)$ be the solution to the differential equation $\frac{dy}{dx} = 1 + 2x - y$ with the initial condition $f(1) = 2$.

What is the approximation for $f(2)$ if Euler's method is used, starting at $x = 1$ with a step size of 0.5?

(A) 2.5 (B) 2.75 (C) 3.25 (D) 3.75

13.

x	-1	-0.6	-0.2	0.2	0.6
$f'(x)$	1	2	-0.5	-1.5	1.2

The table above gives selected values for the derivative of a function f on the interval $-1 \le x \le 0.6$. If $f(-1) = 1.5$ and Euler's method is used to approximate $f(0.6)$ with step size of 0.8, what is the resulting approximation?

(A) 1.9 (B) 2.1 (C) 2.3 (D) 2.5