

Name _____

Differential Equations, Slope Fields, and mixed practice (no calculator)

Solve the differential equation. (no calculator)

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

2. $\frac{dy}{dt} = k(800 - y)$

3. $\frac{dy}{dx} = \frac{4x}{y}$ given $y(0) = 5$

4. $y' = x(1 + y)$ given $y(0) = 1$

5. Find the equation of the tangent to the curve $y = ex$ that is parallel to the line $x - 4y = 1$.

Integrate the function (no calculator)

6. $\int \frac{4x-1}{4x^2-2x} dx$

7. $\int \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$

Evaluate each

8. $\int (4 - \sqrt[3]{t^2}) dt$

9. $\int (4\theta^2 - \cos \theta) d\theta$

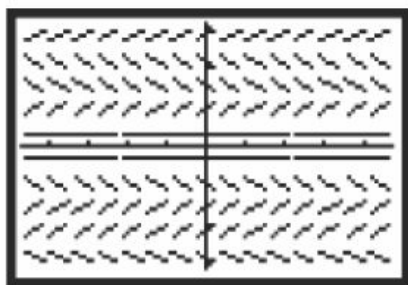
10. Solve the differential equation. (find $f(x)$)

$f''(x) = 6x - 8$; $f'(1) = -3$; $f(2) = 4$

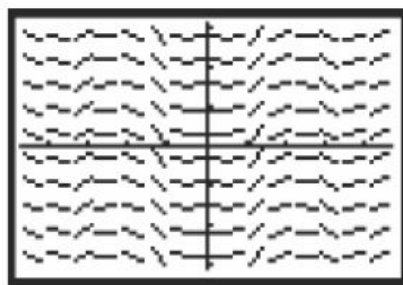
11. Find the function $f(x)$ satisfying the given conditions.

$f''(x) = 5x$, $f'(0) = -4$, $f(0) = -9$

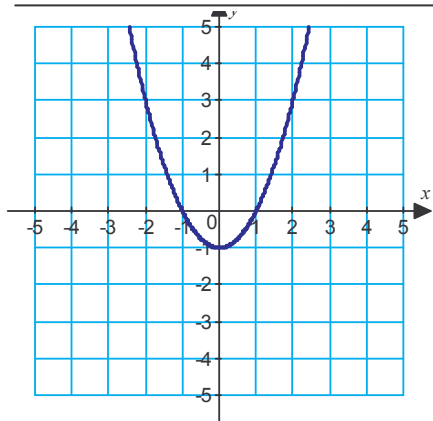
12. One of the following slope fields is for the differential equation $dy/dx = \sin(x^3)$, and the other is for the differential equation $dy/dx = \sin(y^3)$.



A



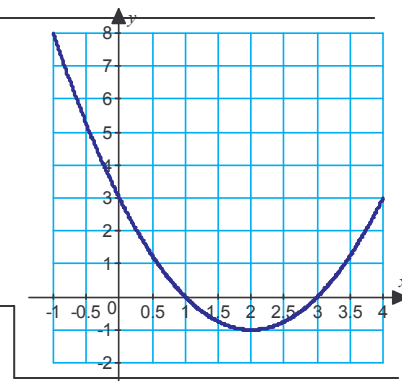
B



13. Sketch a graph of a function $f(x)$ corresponding to the given graph of $y = f'(x)$.

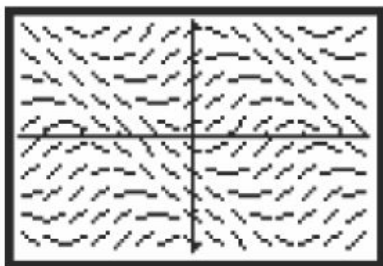
14. Given $\int_2^6 f(x)dx = -1$ and $\int_6^{10} f(x) = 5$; find each value
- a. $\int_2^{10} f(x)dx$ b. $\int_2^2 f(x)dx$ c. $\int_2^{10} 2f(x)dx$

15. Use the graph to the right to list $\int_0^1 f(x) dx$, $\int_0^2 f(x) dx$ and $\int_0^3 f(x) dx$ in order, from smallest to largest.

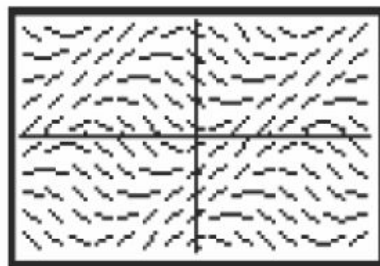


16. Which slope file goes with which equation in the picture below?

One of the following slope fields is for the differential equation $dy/dx = \sin(x + y)$, and the other is for the differential equation $dy/dx = \sin(x - y)$.



A



B

Part 2 AP Questions

1. $\lim_{h \rightarrow 0} \left(\frac{\cos(x+h) - \cos x}{h} \right) =$
- (A) $\sin x$
 (B) $-\sin x$
 (C) $\cos x$
 (D) $-\cos x$
 (E) does not exist
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2. On which of the following intervals, is the graph of the curve $y = x^5 - 5x^4 + 10x + 15$ concave up?
- I. $x < 0$ II. $0 < x < 3$ III. $x > 3$
- (A) I only
 (B) II only
 (C) III only
 (D) I and II only
 (E) II and III only
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3. Let $f(x) = 4x^3 - 3x - 1$. An equation of the line tangent to $y = f(x)$ at $x = 2$ is

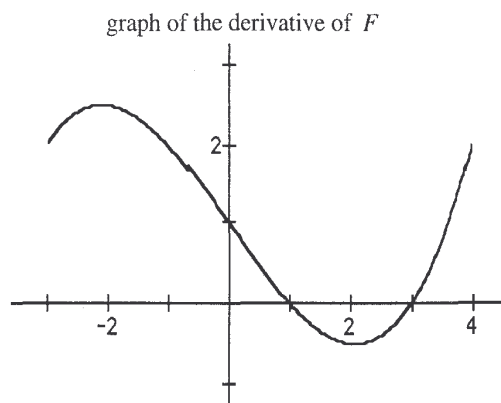
- (A) $y = 25x - 5$
 (B) $y = 45x + 65$
 (C) $y = 45x - 65$
 (D) $y = 65 - 45x$
 (E) $y = 65x - 45$

4. $\int_{\pi/4}^{\pi/3} \frac{\sec^2 x}{\tan x} dx =$

- (A) $\ln \sqrt{3}$ (B) $-\ln \sqrt{3}$ (C) $\ln \sqrt{2}$ (D) $\sqrt{3} - 1$ (E) $\ln \frac{\pi}{3} - \ln \frac{\pi}{4}$
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5. A function F is defined for x on the closed interval $[-3, 4]$. The graph of the *derivative* of F is shown at the right.

- (a) Find the interval(s) for which the graph of F is increasing. Explain briefly.
- (b) Find the possible x -coordinates for the absolute minimum value and the absolute maximum value of F on $[-3, 4]$.
- (c) Find the interval(s) for which the graph of F is concave down. Explain briefly.



A particle starts at time $t = 0$ and moves along a number line so that its position, at time $t \geq 0$, is given by $x(t) = (t - 2)^3(t - 6)$. The particle is moving to the right for

- 6.
- (A) $0 < t < 5$
 - (B) $2 < t < 6$
 - (C) $t > 5$
 - (D) $t \geq 0$
 - (E) never

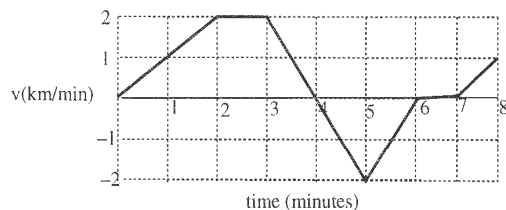
7. What is $\lim_{x \rightarrow \infty} \frac{x^2 - 6}{2 + x - 3x^2}$?
- (A) -3
 - (B) $-\frac{1}{3}$
 - (C) $\frac{1}{3}$
 - (D) 2
 - (E) The limit does not exist.

8. If $g(x) = \frac{x - 2}{x + 2}$, then $g'(2) =$
- (A) 1
 - (B) -1
 - (C) $\frac{1}{4}$
 - (D) $-\frac{1}{4}$
 - (E) 0

9. If $\frac{dy}{dx} = 2xy$ and if $y = 4$ when $x = 0$, then $y =$

- (A) e^{x^2}
- (B) $4e^{x^2}$
- (C) $4 + e^{x^2}$
- (D) $4 + 4e^{x^2}$
- (E) $4 + 2e^{x^2}$

10. A car is moving along a straight road from A to B , starting from A at time $t = 0$. Below is a graph of the car's velocity (positive direction from A to B), plotted against time.



- (a) How many kilometers away from A is the car at time $t = 6$?
- (b) At what time does the car change direction? Explain briefly.
- (c) On the axes provided, sketch a graph of the acceleration of the car.

