

Problem Set

1. $f(1)=2$, $f'(1)=3$, and $f'(2)=4$. Find the value of $(f^{-1})'(2)$.

2. Use logarithmic differentiation to find $\frac{dy}{dx}$. $y = \frac{x(x^2 - 1)^{3/2}}{\sqrt[3]{4x + 1}}$

3 - 10: Find $\frac{dy}{dx}$.

3. $y = \tan^{-1}(x^4)$

4. $y = (\ln x)^5$

5. $y = x^3 e^{\cos x}$

6. $y = \log_2(5x)$

7. $y = \frac{3^x}{x^3}$

8. $y = e^{6\ln(1-x)}$

9. $y = \sin^{-1}\left(\frac{x}{5}\right)$

10. $y = x^{\tan x}$ (Use logarithmic differentiation.)

10. The differentiable function f has the values shown below.

| x | f | f' |
|-----|-----|------|
| 0 | 2 | 1 |
| 1 | 3 | 2 |
| 2 | 5 | 3 |
| 3 | 10 | 4 |

$S(x) = f^{-1}(x)$. Find $S'(3)$.

AP Calculus

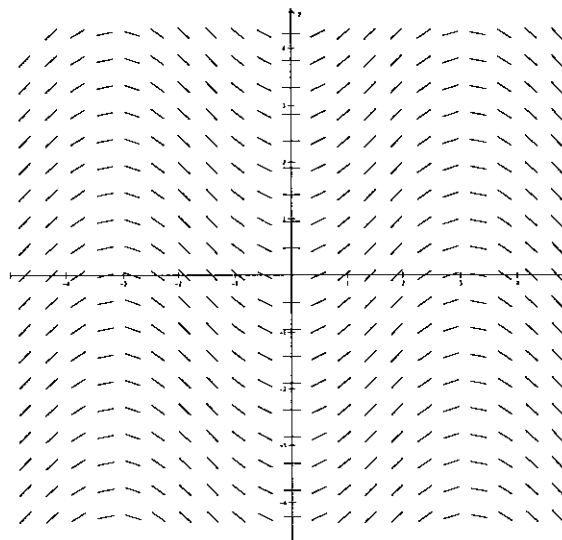
AP Style Questions

Differential Equations and Slope Fields

1-8 No Calculators

9-10 With Calculators

1. The slope field for a differential equation is given in the figure. The slope field corresponds to which of the following differential equations?



- A) $\frac{dy}{dx} = \tan x \sec x$
- B) $\frac{dy}{dx} = \sin x$
- C) $\frac{dy}{dx} = \cos x$
- D) $\frac{dy}{dx} = -\sin x$
- E) $\frac{dy}{dx} = -\cos x$
2. The point (1,4) lies on the graph of an equation $y = f(x)$ for which $\frac{dy}{dx} = 3\sqrt{xy}$ where $x \geq 0$ and $y \geq 0$. When $x = 0$, the value of y is
- A) 0
- B) 1
- C) 2
- D) 3
- E) 4

3. At $t = 0$, a particle starts at the origin with a velocity of 6 feet per second and moves along the x -axis in such a way that at time t its acceleration is $12t^2$ feet per second per second. Through how many feet does the particle move during the first two seconds?

A) 16 ft

B) 20 ft

C) 24 ft

D) 28 ft

E) 32 ft

4. The number of bacteria in a culture is growing at a rate of $1500e^{3t/4}$ per unit of time t . At $t = 0$, the number of bacteria present was 2000. Find the number present at $t = 4$.

A) $2000e^3$

B) $6000e^3$

C) $2000e^6$

D) $1500e^6$

E) $1500e^3 + 500$

5. 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) $4 + 2e^{x^2}$

6. The slope field for a differential equation is given in the figure. The slope field corresponds to which of the following differential equations?

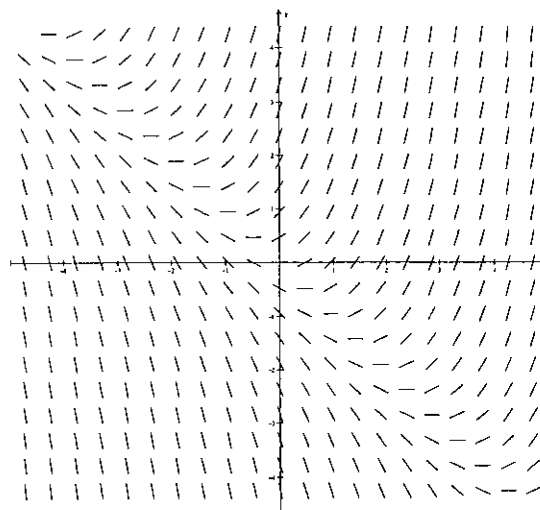
A) $\frac{dy}{dx} = x + y$

B) $\frac{dy}{dx} = -y$

C) $\frac{dy}{dx} = y - \frac{1}{2}y^2$

D) $\frac{dy}{dx} = x^2 + y^2$

E) $\frac{dy}{dx} = y^2$



7. $\int \frac{e^{x^2} - 2x}{e^{x^2}} dx =$

A) $x - e^{x^2} + C$

B) $x - e^{-x^2} + C$

C) $x + e^{-x^2} + C$

D) $-e^{x^2} + C$

E) $e^{x^2} + C$

8. The acceleration of a particle at time t moving along the x -axis is given by $a = 4e^{2t}$. At the instant when $t = 0$, the particle is at the point $x = 2$ moving with velocity $v = -2$. The position of the particle at $t = \frac{1}{2}$ is

A) $e - 3$

B) $e - 2$

C) $e - 1$

D) e

E) $e + 1$

9. The change in N , the number of bacteria in a culture dish at time t , is given by $\frac{dN}{dt} = 2N$. If $N = 3$ when $t = 0$, the approximate value of t when $N = 1210$ is

- A) 2
- B) 3
- C) 4
- D) 5
- E) 6

10. Let $y(t)$ be the temperature, in degrees F, of a cup of tea at time t minutes, $t \geq 0$. Room temperature is 70 degrees and the initial temperature of the tea is 180 degrees. The tea's temperature is described by the differential equation

$$\frac{dy}{dt} = -0.1(y - 70), \text{ with the initial condition } y(0) = 180.$$

- A) Use separation of variables to find an expression for y in terms of t , where t is measured in minutes.

B) How hot is the tea after 10 minutes?

C) If the tea is safe to drink when its temperature is less than 120 degrees, at what time is the tea safe to drink?