1973 BC 7

If $y = \ln\left(x^2 + y^2\right)$, then the value of $\frac{dy}{dx}$ at the point $(1,0)$ is

(A) 0 (B) $\frac{1}{2}$ (C) 1 (D) 2 (E) undefined

1985 AB 13

If $x^2 + xy + y^3 = 0$, then, in terms of x and y, $\frac{dy}{dx} =$

(A) $-\frac{2x+y}{x+3y^2}$ (B) $-\frac{x+3y^2}{2x+y}$ (C) $\frac{-2x}{1+3y^2}$ (D) $\frac{-2x}{x+3y^2}$ (E) $-\frac{2x+y}{x+3y^2-1}$

1993 AB 25

$\frac{d}{dx}\left(2^x\right) =$

(A) 2^{x-1} (B) $(2^{x-1})x$ (C) $(2^x)\ln 2$ (D) $(2^{x-1})\ln 2$ (E) $\frac{2x}{\ln 2}$

1969 AB 6

What is $\lim_{h \to 0} \frac{8\left(\frac{1}{2}+h\right)^8 - 8\left(\frac{1}{2}\right)^8}{h}$?

(A) 0 (B) $\frac{1}{2}$ (C) 1 (D) The limit does not exist.

(E) It cannot be determined from the information given.

1988 AB 29

The $\lim_{h \to 0} \frac{\tan 3(x+h) - \tan 3x}{h}$ is

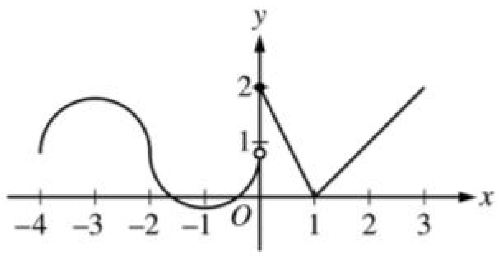
(A) 0 (B) $3\sec^2(3x)$ (C) $\sec^2(3x)$ (D) $3\cot(3x)$ (E) nonexistent

1973 AB 36

If $y = e^{nx}$, then $\dfrac{d^n y}{dx^n} =$

(A) $n^n e^{nx}$ (B) $n! e^{nx}$ (C) $n e^{nx}$ (D) $n^n e^x$ (E) $n! e^x$

2008 BC 3



Graph of f

The graph of the piecewise-defined function f is shown in the figure above. The graph has a vertical tangent line at $x = -2$ and horizontal tangent lines at $x = -3$ and $x = -1$. What are all values of x, $-4 < x < 3$. at which f is continuous but not differentiable?

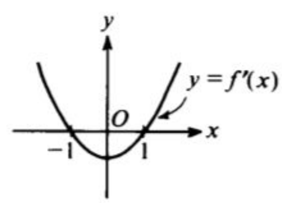
(A) $x = 1$

(B) $x = -2$ and $x = 0$

(C) $x = -2$ and $x = 1$

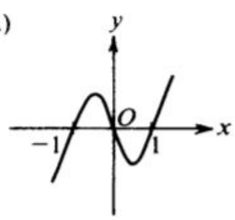
(D) $x = 0$ and $x = 1$

1985 AB 3

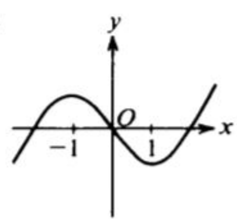


The graph of the derivative of f is shown in the figure above. Which of the following could be the graph of f?

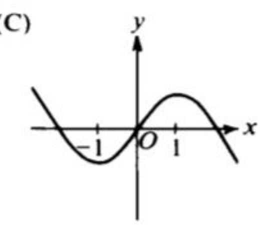
(A)



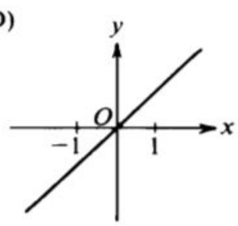
(B)



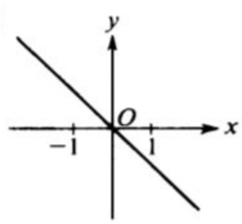
(C)



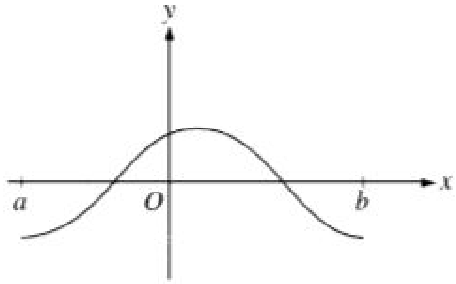
(D)



(E)

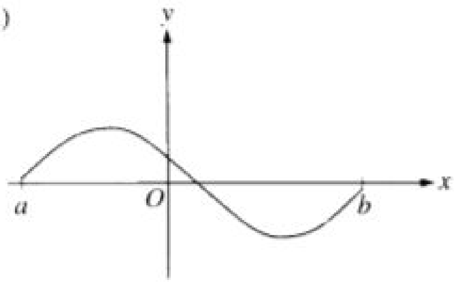


1998 AB 23

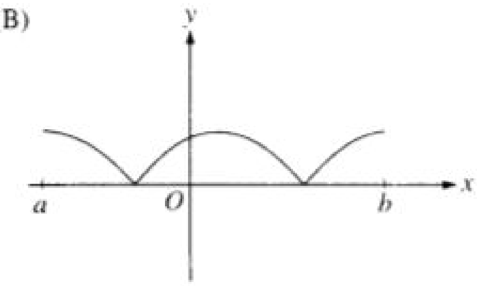


. The graph of f is shown in the figure above. Which of the following could be the graph of the derivative of f?

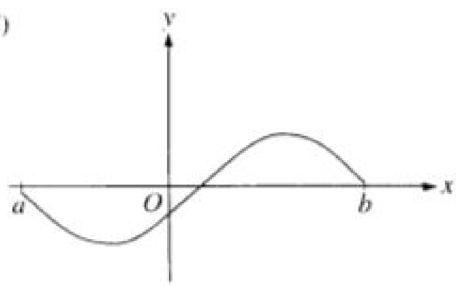
(A)



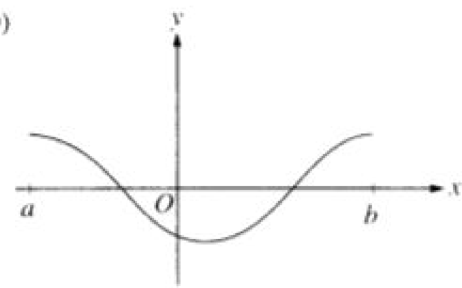
(B)



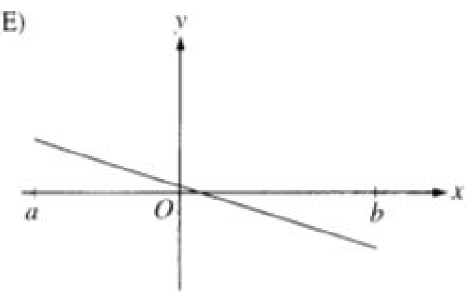
(C)



(D)



(E)



2008 AB/BC 6

$$f(x)=\begin{cases}\dfrac{x^2-4}{x-2} & \text{if } x\neq 2\\ 1 & \text{if } x=2\end{cases}$$

Let f be the function defined above. Which of the following statements about f are true?

I. f has a limit at $x=2$.

II. f is continuous at $x=2$.

III. f is differentiable at $x=2$.

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I, II, and III

1969 BC 20

An equation for a tangent to the graph of $y=\arcsin\frac{x}{2}$ at the origin is

(A) $x-2y=0$ (B) $x-y=0$ (C) $x=0$

(D) $y=0$ (E) $\pi x-2y=0$

1993 AB 16

The slope of the line <u>normal</u> to the graph of $y = 2\ln(\sec x)$ at $x = \frac{\pi}{4}$ is

(A) -2

(B) $-\frac{1}{2}$

(C) $\frac{1}{2}$

(D) 2

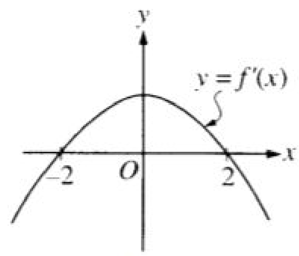
(E) nonexistent

1993 BC 17

The slope of the line tangent to the graph of $\ln(xy) = x$ at the point where $x = 1$ is

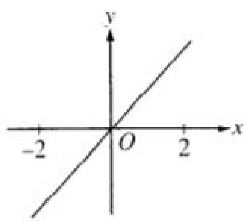
(A) 0 (B) 1 (C) e (D) e^2 (E) $1-e$

1997 AB 11

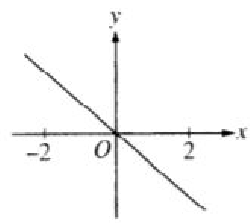


The graph of the derivative of f is shown in the figure above. Which of the following could be the graph of f?

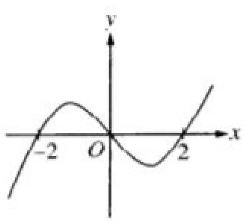
(A)



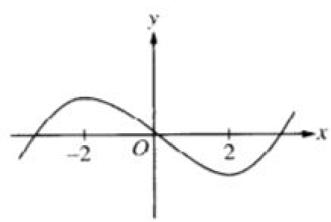
(B)



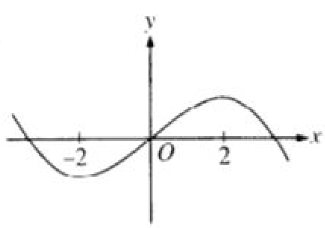
(C)



(D)



(E)

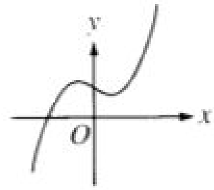


1998 BC 2

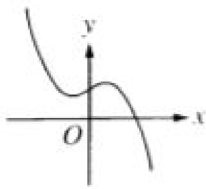
In the xy-plane, the graph of the parametric equations $x = 5t + 2$ and $y = 3t$, for $-3 \le t \le 3$, is a line segment with slope

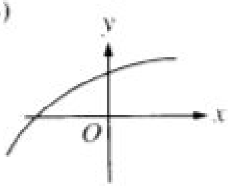
(A) $\frac{3}{5}$ (B) $\frac{5}{3}$ (C) 3 (D) 5 (E) 13

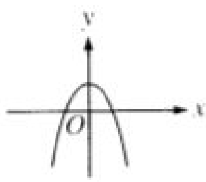
1998 BC 6

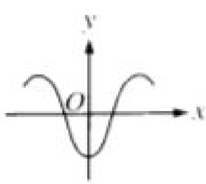


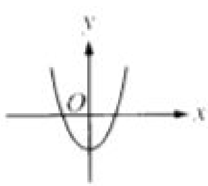
The graph of $y = h(x)$ is shown above. Which of the following could be the graph of $y = h'(x)$?

(A)


(B)


(C)


(D)


(E)


1998 BC 40

Let f and g be functions that are differentiable everywhere. If g is the inverse function of f and if $g(-2) = 5$ and $f'(5) = -\frac{1}{2}$, then $g'(-2) =$

(A) 2 (B) $\frac{1}{2}$ (C) $\frac{1}{5}$ (D) $-\frac{1}{5}$ (E) -2

1985 BC 26

For $0 < x < \frac{\pi}{2}$, if $y = (\sin x)^x$, then $\frac{dy}{dx}$ is

(A) $x \ln(\sin x)$ (B) $(\sin x)^x \cot x$ (C) $x(\sin x)^{x-1}(\cos x)$

(D) $(\sin x)^x (x \cos x + \sin x)$ (E) $(\sin x)^x (x \cot x + \ln(\sin x))$

1. Find the values of a and b that will make $f(x)$ differentiable at $x = -1$.

$$f(x) = \begin{cases} ax^2 + bx - 3, & x < -1 \\ 2x^3 - 5, & x \geq -1 \end{cases}$$

2. Write an equation for the tangent line to $y = x \cos x$ at $x = \frac{\pi}{2}$.

3. Write an equation for the **normal** line at $x = 0$ to $y = 2 + e^{-2x}$.

4. If the line $y = 4x - 18$ is tangent to the curve $y = ax^2 + bx$ at the point $(3, -6)$, then find a and b.

5. Find $y = ax^2 + bx + c$ such that $f(0) = 5,\ f'(0) = 6,\ and\ f''(0) = -3.$

6. The position (in meters) of an object at any time t (in minutes) is given by the function $s(t) = 3t^2 - \cos 2t$.
    a. Find the velocity of the object at time $t = \pi$ using appropriate units.

    b. Find the acceleration of the object at time $t = \pi$ using appropriate units.

7. Use the table of values below representing the position of an object at the given times.

t (sec)	1	2	3	4	5
$s(t)$ (cm)	2.3	5.6	6.2	6.4	4.8

    a. Find the average velocity of the object between times $t = 1$ and $t = 4$. Show your computation.

    b. Find an estimate for the velocity of the object at $t = 3$.

8. Find $\frac{d^2y}{dx^2}$, for the function $y = 2x^4 - 5\sqrt{x}$.

9. Find $\lim_{h\to 0} \frac{\cos(\frac{\pi}{3}+h)-\frac{1}{2}}{h}$

10. Find $\lim_{h\to 0} \frac{3(2+h)^3-24}{h}$

11. Use the table below to find the specified derivatives.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	2	$\frac{1}{3}$	-2	-3
2	3	$\frac{1}{2}$	4	0
3	1	-2	5	-1

a. If $h(x) = f(x) * g(x)$, find $h'(2)$

d. If $h(x) = \frac{2f(x)}{x^3}$, find $h'(2)$

b. If $h(x) = \frac{f(x)}{g(x)}$, find $h'(3)$

e. If $h(x) = g(f(x))$, find $h'(3)$

c. If $h(x) = x^3 * g(x)$, find $h'(1)$

f. If $h(x) = f(x^2)$, find $h'(1)$

g. If $h(x)$ is the inverse of $f(x)$, find $h'(1)$

12. Find the 78^{th} derivative of $f(x) = 3^x$

13. Find the 95^{th} derivative of $f(x) = \sin(3x)$

14. Find the derivative of the function $f(x) = \tan^{-1}(3x^2)$

15. Find the derivative of $f(x) = \sin^{-1}(\cos(3x))$

16. Find the derivative of the inverse of the function $f(x) = 3x^5 - 2x^3 - 4$ at $x = -5$.

17. Find the derivative of the function $y = x^{\cos x}$.

18. Which of the following are asymptotes of $2y + xy - x + 3 = 0$

I. $x = 3$
II. $x = -2$
III. $y = 1$

a. I only
b. III only
c. I and II only
d. II and III only
e. I, II, and III