Unit 3 Progress Check: MCQ

1. If $g(x) = \ln x$ and f is a differentiable function of x, which of the following is equivalent to the derivative of $f(g(x))$ with respect to x ?

(A) $f'\left(\frac{1}{x}\right)$

(B) $\frac{f'(x)}{x}$

(C) $f'(\ln x)$

(D) $\frac{f'(\ln x)}{x}$ ✓

---

2. For which of the following functions is the chain rule an appropriate method to find the derivative with respect to x ?

1. $y = \sin\left(3x^2\right)$
2. $y = e^x \tan x$
3. $y = \frac{1}{8x^4 - 2x}$

(A) I only

(B) II only

(C) III only

(D) I and III only ✓

---

3. Let f be a differentiable function. If $h(x) = (1 + f(3x))^2$, which of the following gives a correct process for finding $h'(x)$?

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(A) $h'(x) = 2(1 + f(3x))$

(B) $h'(x) = 2(1 + f(3x)) \cdot f'(3x)$

(C) $h'(x) = 2(1 + f(3x)) \cdot f'(x)$

(D) $h'(x) = 2(1 + f(3x)) \cdot f'(3x) \cdot 3$ ✓

---

4. What is the slope of the line tangent to the curve $y^3 - xy^2 + x^3 = 5$ at the point $(1, 2)$?

(A) $\frac{1}{10}$

(B) $\frac{1}{8}$ ✓

(C) $\frac{5}{12}$

(D) $\frac{11}{4}$

---

5. If $\sin(x + y) = 3x - 2y$, then $\frac{dy}{dx} =$

(A) $\frac{3-\cos(x+y)}{2}$

(B) $\frac{1-\cos(x+y)}{\cos(x+y)}$

(C) $\frac{3}{2+\cos(x+y)}$

(D) $\frac{3-\cos(x+y)}{2+\cos(x+y)}$ ✓

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6.

$f(-2)=3$	$f'(-2)=4$	$g(4)=5$	$g'(4)=2$

The point $(-2,4)$ lies on the curve in the xy-plane given by the equation $f(x)g(y)=17-x-y$, where f is a differentiable function of x and g is a differentiable function of y. Selected values of f, f', g, and g' are given in the table above. What is the value of $\frac{dy}{dx}$ at the point $(-2,4)$?

(A) -27

(B) $-\frac{11}{3}$

(C) -3 ✓

(D) $-\frac{4}{7}$

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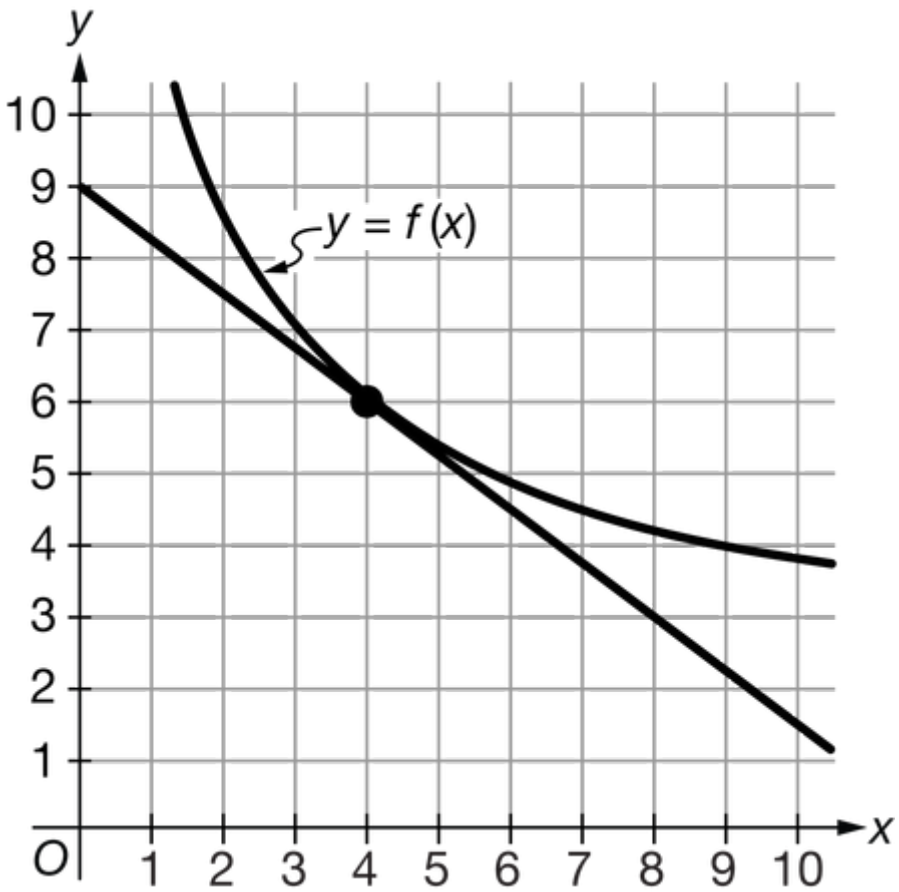
7.



The graph of the decreasing differentiable function f is shown above. Also shown is the line tangent to the graph of f at the point $(4, 6)$. Let g be the inverse of f. Which of the following statements about g' is true?

(A) $g'(4) = -\frac{4}{3}$

(B) $g'(4) = -\frac{3}{4}$

(C) $g'(6) = -\frac{4}{3}$ ✔

(D) $g'(6) = -\frac{3}{4}$

---

8. Let f be the increasing function defined by $f(x) = x^3 + 2x^2 + 4x + 5$, where $f(-1) = 2$. If g is the inverse function of f, which of the following is a correct expression for $g'(2)$?

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(A) $g'(2) = \frac{1}{f'(2)}$

(B) $g'(2) = \frac{1}{f'(-1)}$ ✓

(C) $g'(2) = f'(-1)$

(D) $g'(2) = f'(2)$

9.

x	0	2	4
$f(x)$	8	5	2
$f'(x)$	-1	-2	-5

The table above gives selected values for a differentiable and decreasing function f and its derivative. If $g(x) = f^{-1}(x)$ for all x, which of the following is a correct expression for $g'(2)$?

(A) $g'(2) = f'(2) = -2$

(B) $g'(2) = \frac{1}{f'(2)} = -\frac{1}{2}$

(C) $g'(2) = \frac{1}{f'(4)} = -\frac{1}{5}$ ✓

(D) $g'(2) = -\frac{f'(2)}{(f(2))^2} = \frac{2}{25}$

---

10. $\frac{d}{dx}\left(\sin^{-1}x\right)\Big|_{x=\frac{1}{2}} =$

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(A) $\frac{1}{1+\left(\frac{1}{2}\right)^2}$

(B) $\frac{1}{\sqrt{1-\left(\frac{1}{2}\right)^2}}$ ✓

(C) $\cos^{-1}\left(\frac{1}{2}\right)$

(D) $-\csc\left(\frac{1}{2}\right)\cot\left(\frac{1}{2}\right)$

---

11. $\frac{d}{dx}\left(\cos^{-1}x\right) =$

(A) $-\frac{1}{\sqrt{1-x^2}}$ ✓

(B) $\frac{1}{\sqrt{1-x^2}}$

(C) $-\sin^{-1}x$

(D) $-\cos^{-2}x$

---

12. Which of the following methods can be used to find the derivative of $y = \arcsin x$ with respect to x ?

1. Use the quotient rule to differentiate $\frac{1}{\sin x}$.
2. Use the chain rule to differentiate $\sin(\arcsin x) = x$.
3. Use implicit differentiation to differentiate the function y in the relation $\sin y = x$ with respect to x.

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(A) I only

(B) III only

(C) II and III only ✓

(D) I, II, and III

---

13. Which of the following expressions can be differentiated using the product rule?

(A) $\cos\left(\sqrt{x}\right)$

(B) $x^2 \tan^{-1} x$ ✓

(C) $x^4 + \arcsin x$

(D) $\left(8x^3 - 5x + 2\right)^{\pi}$

---

14. Which of the following requires the use of implicit differentiation to find $\frac{dy}{dx}$?

(A) $y - x^2 - 3x + 5 = 0$

(B) $y = \ln(3 + x) + x^2$

(C) $y = \ln(y + x) + x^2$ ✓

(D) $y = \frac{x^3 - 4}{3x + 2}$

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15. For which of the following functions would the quotient rule be considered the best method for finding the derivative?

(A) $y = (2x+1)^{-\frac{1}{2}}$

(B) $y = \frac{2x+1}{x}$

(C) $y = \sin^{-1}(2x+1)$

(D) $y = \frac{\sin(2x+1)}{2x+1}$ ✓

---

16. If $y = 2\ln x$, then $\frac{d^4y}{dx^4} =$

(A) $\frac{2}{x}$

(B) $-\frac{12}{x^4}$ ✓

(C) $\frac{16}{x^4}$

(D) $\frac{48}{x^5}$

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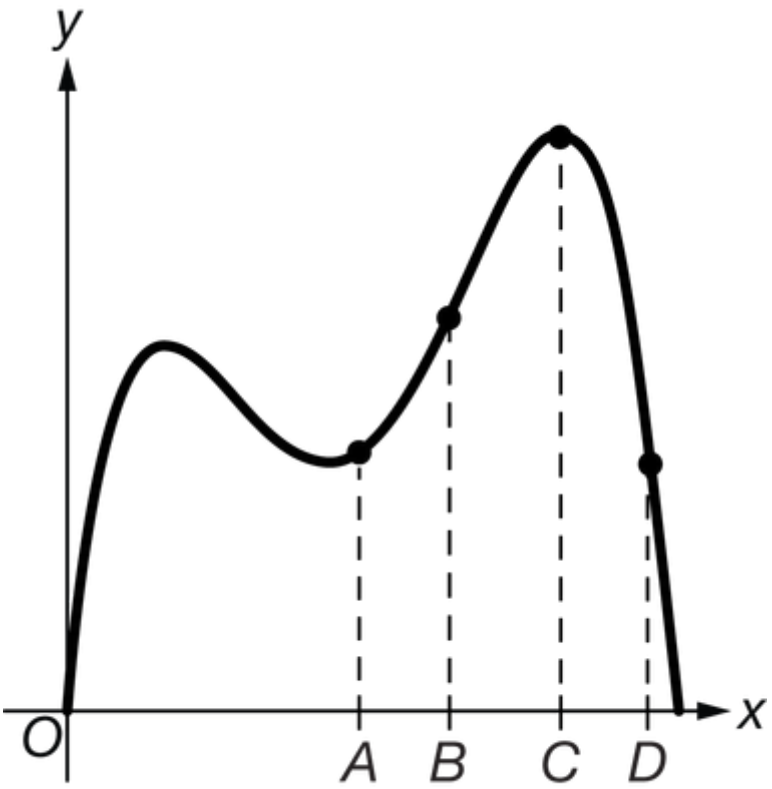
17.



Graph of f'

The figure above shows the graph of f', the derivative of the function f. At which of the four indicated values of x is $f''(x)$ greatest?

(A) A

(B) B ✓

(C) C

(D) D

---

18. Let $y = f(x)$ be a twice-differentiable function such that $f(1) = 3$ and $\frac{dy}{dx} = 4\sqrt{y^2 + 7x^2}$. What is the value of $\frac{d^2y}{dx^2}$ at $x = 1$?

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A 10

B 23

C 55 ✓

D 160