Derivatives and Differentiation Practice

Choose one answer per question. Circle A, B, C, or D.

1. Water depth H(t) is measured in centimeters and time t in minutes. If $H'(6) = -0.8$, what does that tell you?
   A. At minute 6, the depth is falling at 0.8 cm per minute.
   B. In the first six minutes, the depth falls by exactly 0.8 cm.
   C. At minute 6, the depth is rising at 0.8 cm per minute.
   D. The depth at minute 6 is 0.8 cm.

2. For $x \neq 0$, what is the derivative of $f(x) = 5/x$?
   A. $-5/x$
   B. $5/x^2$
   C. $-5/x^2$
   D. 5

3. For x measured in radians, what is the derivative of $2\cos(x) - 3\sin(x)$?
   A. $2\sin(x) - 3\cos(x)$
   B. $-2\sin(x) - 3\cos(x)$
   C. $-2\sin(x) + 3\cos(x)$
   D. $-2\cos(x) - 3\sin(x)$

4. If $f(x) = 7e^x + 6$, what is $f'(x)$?
   A. $7e^x + 6$
   B. $7xe^x$
   C. e^x
   D. $7e^x$

5. A function equals $x + 3$ for $x < 2$ and $4x - 3$ for $x \geq 2$. What is its derivative at $x = 2$?
   A. 1
   B. It does not exist
   C. 4
   D. 5

6. At $x = 3$, $a(3) = 4$, $a'(3) = -2$, $b(3) = 5$, and $b'(3) = 7$. If $f(x) = a(x)b(x)$, what is $f'(3)$?
   A. 18
   B. −14
   C. 28
   D. −10

7. For $x \neq -2$, what is the derivative of $(4x - 1)/(x + 2)$?

A. $9/(x + 2)$
B. $-9/(x + 2)^2$
C. 4
D. $9/(x + 2)^2$

8. For $x < 4$, what is the derivative of $\sqrt{(8 - 2x)}$?

A. $1/[2\sqrt{(8 - 2x)}]$
B. $1/\sqrt{(8 - 2x)}$
C. $-1/\sqrt{(8 - 2x)}$
D. $-2/\sqrt{(8 - 2x)}$

9. If $h(t) = 5t^4 - 14t^2 + 8$, what is $h''(1)$?

A. 32
B. -8
C. 46
D. 60

10. A differentiable, one-to-one function g satisfies $g(2) = 7$ and $g'(2) = -4$. What is the derivative of its inverse function at input 7?

A. $-1/7$
B. $1/4$
C. -4
D. $-1/4$

11. A function equals $x^2 + ax$ when $x \leq 1$ and $8x + b$ when $x > 1$. Which pair (a, b) makes the function differentiable at $x = 1$?

A. (8, 1)
B. (6, 1)
C. (6, −1)
D. (4, −3)

12. A curve satisfies $x^2 + xy + 2y^2 = 28$. What is dy/dx at the point (2, 3)?

A. $1/2$
B. $-1/2$
C. -2
D. $-7/12$

13. A rectangle's area is increasing at 5 m²/min. At one instant its length is 9 m and its width is 6 m, shrinking at 1/3 m/min. How fast is its length changing at that instant?

A. Increasing at 8/9 m/min
B. Increasing at 1/3 m/min
C. Increasing at 5/6 m/min
D. Increasing at 4/3 m/min

14. Let f(x) = x² ln(1 + 5x) for x > −1/5. What is f′(1)?

A. 2 ln(6) + 5/6
B. 2 ln(6) + 1/6
C. 2 ln(6)
D. 5/6

15. Let F(x) = (x + 4)^(3x) for x > −4. Which expression equals F′(x) throughout that domain?

A. 3(x + 4)^(3x) ln(x + 4)
B. (x + 4)^(3x) [3 ln(x + 4) + 3/(x + 4)]
C. (x + 4)^(3x) [3 ln(x + 4) + 3x/(x + 4)]
D. 3x(x + 4)^(3x − 1)