■ 1. Given that $f(x)$ is a continuous and differentiable function for all real numbers, which of the following would give the instantaneous rate of change of $f(x)$ when $x = 4$?

I. $f'(4)$

II. $\lim_{h \to 0} \dfrac{f(4+h) - f(4)}{h}$

III. $\lim_{x \to 4} \dfrac{f(x) - f(4)}{x - 4}$

A I only

B I and II

C II and III

D I, II, and III

■ 2. $\lim_{h \to 0} \dfrac{\cos(\pi + h) + 1}{h}$

A 0

B 1

C -1

D Does not exist

■ 3. Let f be the function defined as $f(x) = x^{x+1}$. Select values of $f(x)$ are given in the table below. If the values in the table are used to approximate $f(2.5)$, what is the difference between the estimate and the actual value?

x	2	3
f(x)	8	81

A 0

B -12.724

C 48.295

D 15.775

■ 4. Which of the following statements cannot be true?

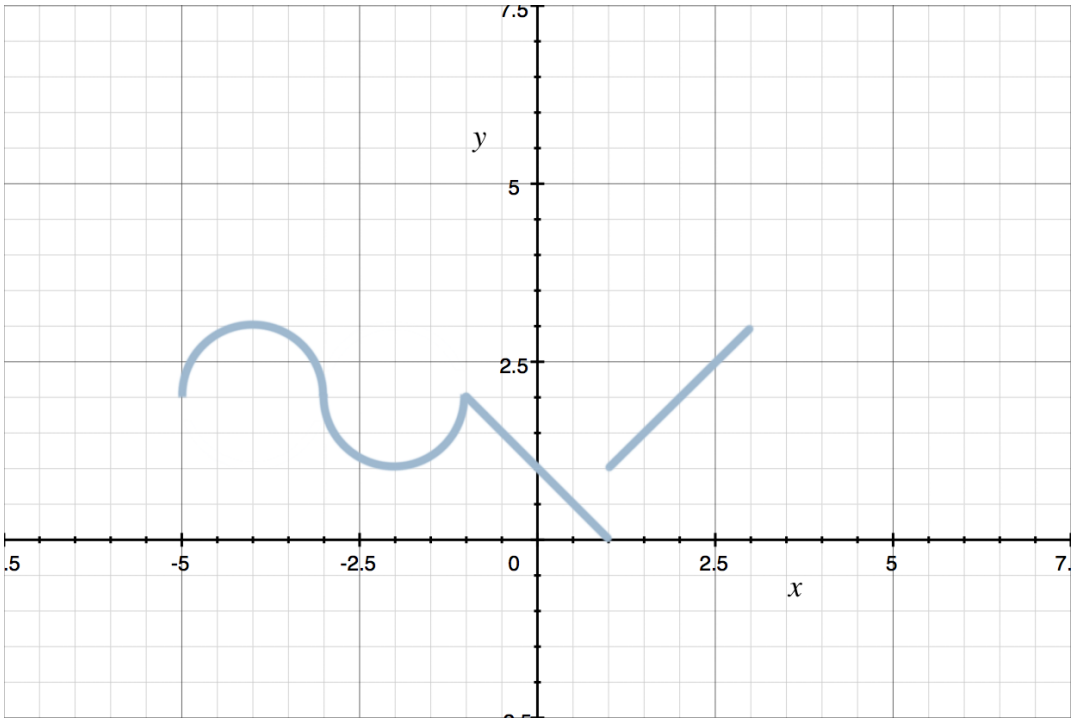
A A function is non-differentiable at $x = c$ and the limit from the left and right at $x = c$ are equal.

B A function is discontinuous and differentiable at a point $x = c$.

C A function is continuous and non-differentiable at a point $x = c$

D A function is continuous and differentiable at a point $x = c$.

■ 5. Given that the graph of f consists of semi-circles and line segments, which of the following statements is false?



A $f(x)$ is not differentiable when $x = -3$ because there is a vertical tangent line.

B $f(x)$ is not differentiable when $x = -4$ and when $x = -2$ because there is a horizontal tangent line.

C $f(x)$ is not differentiable when $x = -1$ because there is a cusp.

D $f(x)$ is not differentiable when $x = 1$ because there is a discontinuity.

■ 6. Find the derivative of $y = 3x^7 - 9x^2 + 21$.

A $y' = 21x^{-6} - 18x$

B $y' = 3x(7x^5 - 6x)$

C $y' = 21x^8 - 18x^2$

D $y' = 21x^6 - 18x$

■ 7. If $f(x) = \sqrt{x} + \dfrac{3}{\sqrt{x}}$, then find $f'(4)$.

A $f'(4) = \dfrac{1}{16}$

B $f'(4) = \dfrac{5}{16}$

C $f'(4) = \dfrac{7}{2}$

D $f'(4) = \dfrac{7}{16}$

■ 8. Evaluate $\dfrac{d}{dx} 3\cos x$.

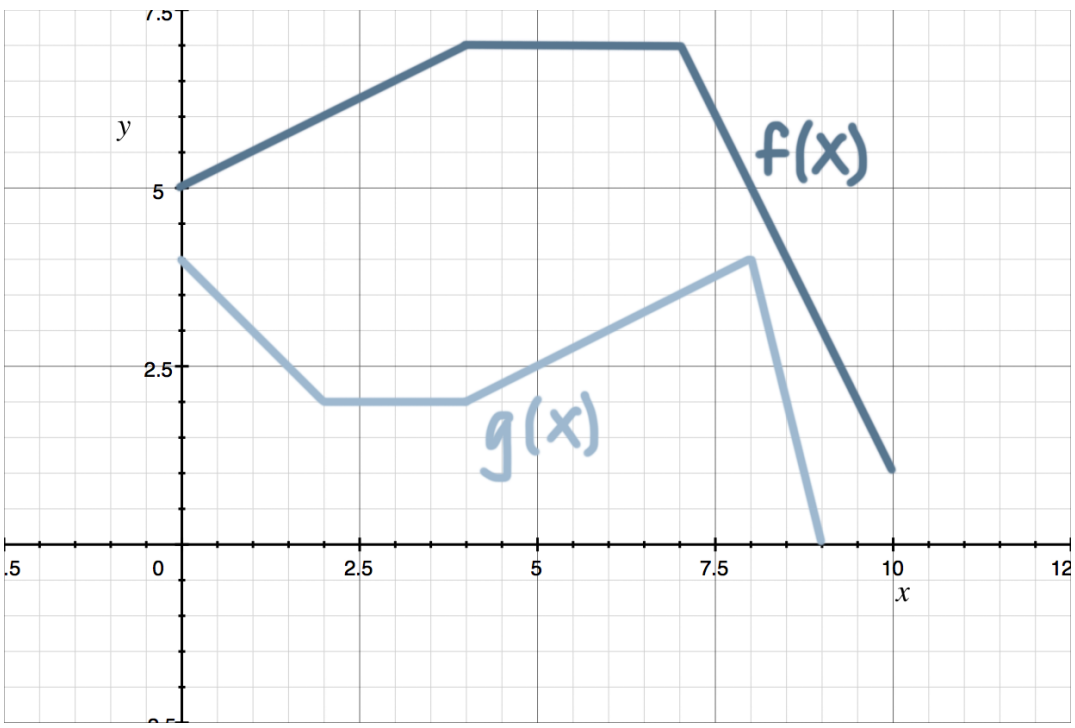
A $3\sin x$

B $-\sin(3x)$

C $\sin(3x)$

D $-3\sin x$

■ 9. The graphs of f and g are shown below and consist only of line segments. Given that $h(x) = f(x)g(x)$, what is the value of $h'(1)$?



A $-\frac{1}{2}$

B -4

C 7

D $\frac{33}{2}$

■ 10. Find the derivative of $y = \frac{x^2 - x + 1}{x^2 + 1}$.

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

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

C $y' = \frac{x^2 - 1}{x^2 + 1}$

D $y' = \frac{x^2}{(x^2 + 1)^2}$

■ 11. Given $y = \tan x$, what is the equation of the tangent line at $x = \frac{\pi}{4}$?

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

B $y = x + 1$

C $y = 2\left(x - \frac{\pi}{4}\right) + 1$

D $y = \frac{1}{2}\left(x - \frac{\pi}{4}\right) + 1$

■ 12. Find the values of a and b that make the function differentiable.

$$f(x) = \begin{cases} 3ax^2 + 4 & x \leq -1 \\ bx - a & x > -1 \end{cases}$$

■ 13. Use the product rule to find the derivative of $h(x) = 8x^3e^x$.

■ 14. Let $f(x) = \frac{x^5 + 4x^3 - 11}{x^2}$. Find $f'(x)$.