Unit 1 Progress Check: MCQ Part B

1. If f is the function defined by $f(x) = \frac{\frac{1}{x}-1}{x-1}$, then $\lim\limits_{x \to 1} f(x)$ is equivalent to which of the following?

(A) $\lim\limits_{x \to 1} \left(-\frac{1}{x}\right)$ ✔

(B) $\lim\limits_{x \to 1} \left(\frac{1}{x^2} - 1\right)$

(C) $\lim\limits_{x \to 1} \left(\frac{x-1}{x-1}\right)$

(D) $\frac{\lim\limits_{x \to 1} \left(\frac{1}{x}-1\right)}{\lim\limits_{x \to 1} (x-1)}$

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2. Let f and g be functions such that $\lim\limits_{x \to 4} g(x) = 2$ and $\lim\limits_{x \to 4} \frac{f(x)}{g(x)} = \pi$. What is $\lim\limits_{x \to 4} f(x)$?

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

(B) $2 + \pi$

(C) 2π ✔

(D) The limit cannot be determined from the information given.

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3. $$f(x) = \begin{cases} \frac{x}{|x|} & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$$

If f is the function defined above, then $\lim\limits_{x \to 0} f(x)$ is

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(A) -1

(B) 0

(C) 1

(D) nonexistent ✔

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4. The function f is defined for all x in the interval $4 < x < 6$. Which of the following statements, if true, implies that $\lim_{x \to 5} f(x) = 17$?

(A) There exists a function g with $f(x) \le g(x)$ for $4 < x < 6$, and $\lim_{x \to 5} g(x) = 17$.

(B) There exists a function g with $g(x) \le f(x)$ for $4 < x < 6$, and $\lim_{x \to 5} g(x) = 17$.

(C) There exist functions g and h with $f(x) \le g(x) \le h(x)$ for $4 < x < 6$, and $\lim_{x \to 5} g(x) = \lim_{x \to 5} h(x) = 17$.

(D) There exist functions g and h with $g(x) \le f(x) \le h(x)$ for $4 < x < 6$, and $\lim_{x \to 5} g(x) = \lim_{x \to 5} h(x) = 17$. ✔

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5. The function g is given by $g(x) = \frac{7x-26}{x-5}$. The function h is given by $h(x) = \frac{3x+14}{2x+1}$. If f is a function that satisfies $g(x) \le f(x) \le h(x)$ for $0 < x < 5$, what is $\lim_{x \to 2} f(x)$?

(A) $\frac{3}{2}$

(B) 4 ✔

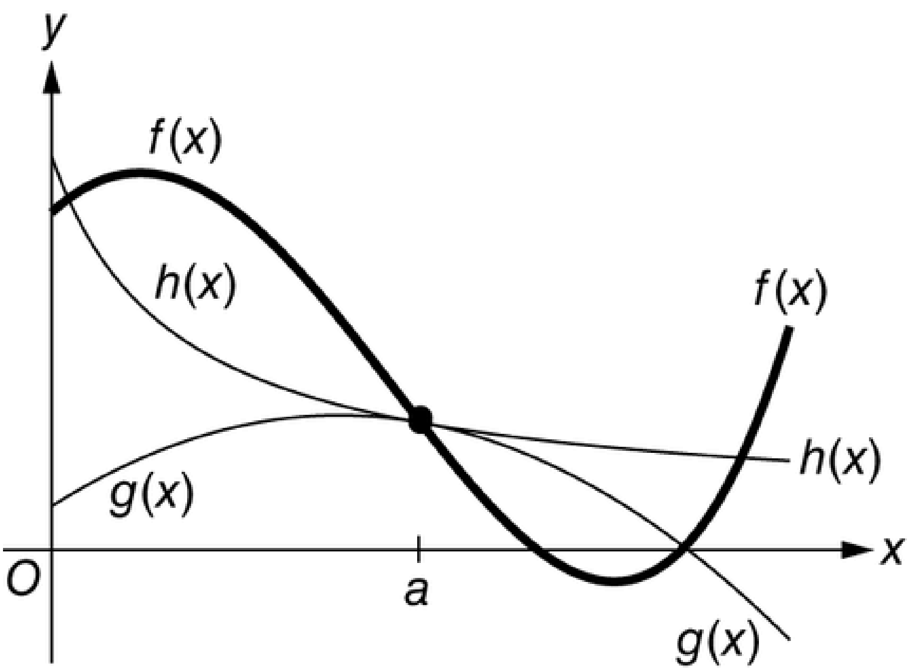
(C) 7

(D) The limit cannot be determined from the information given.

---

6. Let f be a function of x. The value of $\lim_{x \to a} f(x)$ can be found using the squeeze theorem with the functions g and h. Which of the following could be graphs of f, g, and h ?

(A)



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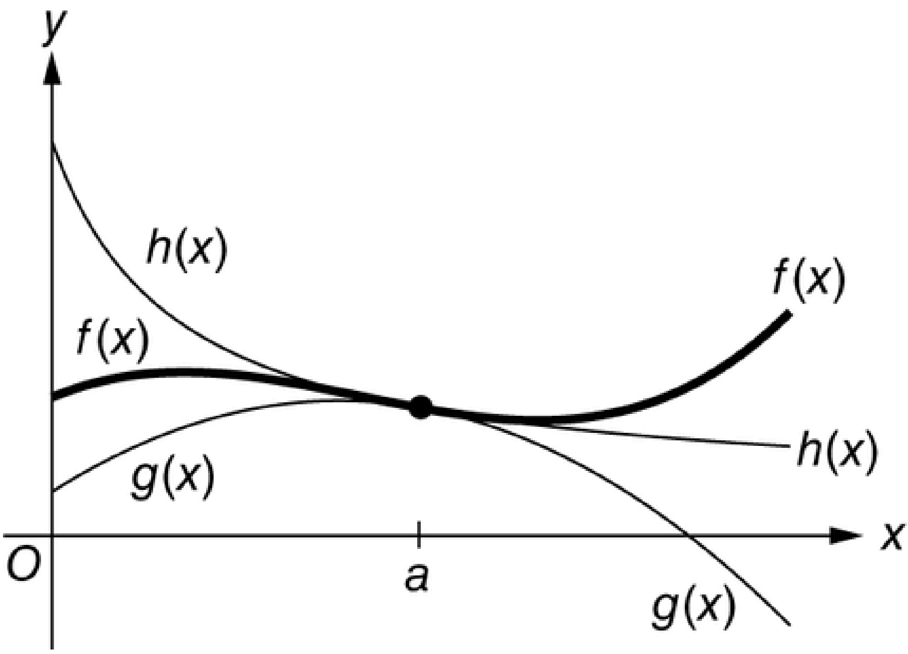
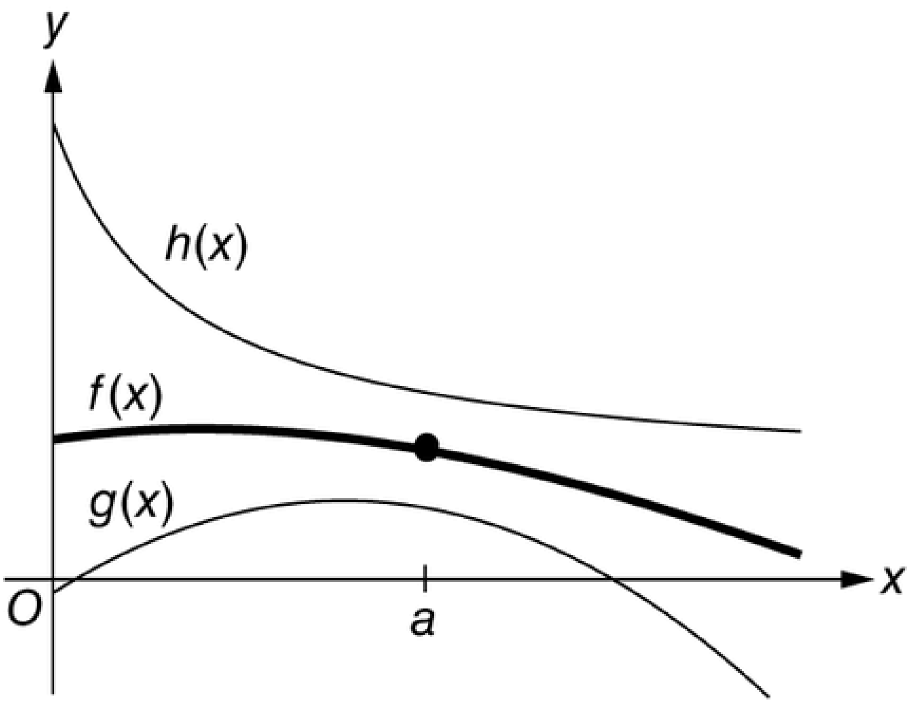


(C)



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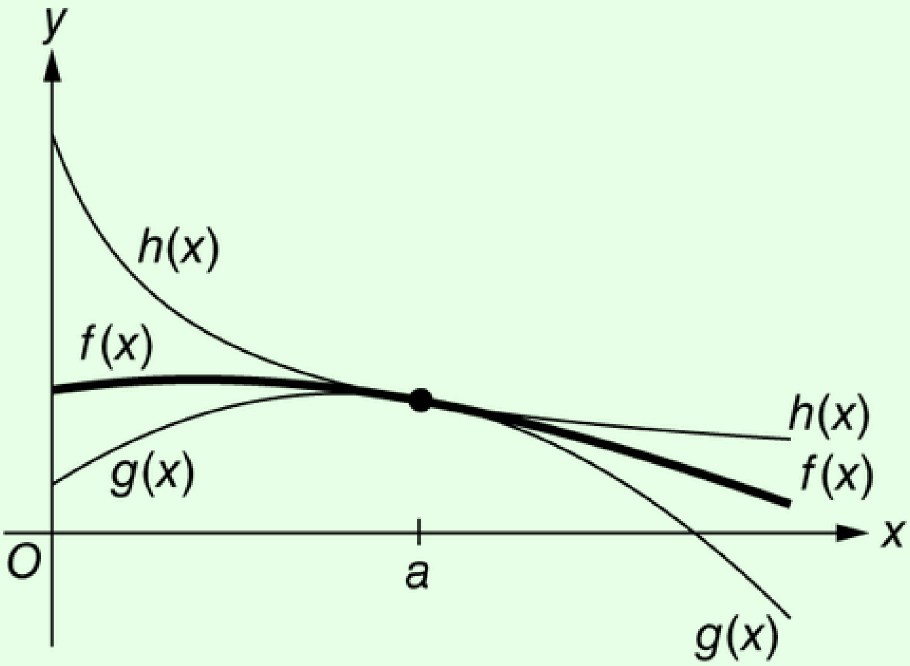
(D)



7.

x	1.9	1.95	1.99	1.999	2.001	2.01	2.05	2.1
$f(x)$	4.204	3.671	3.147	3.015	2.985	2.847	2.160	1.113

The table above gives selected values for a function f. Based on the data in the table, which of the following could not be the graph of f on the interval $1.9 \leq x \leq 2.1$?

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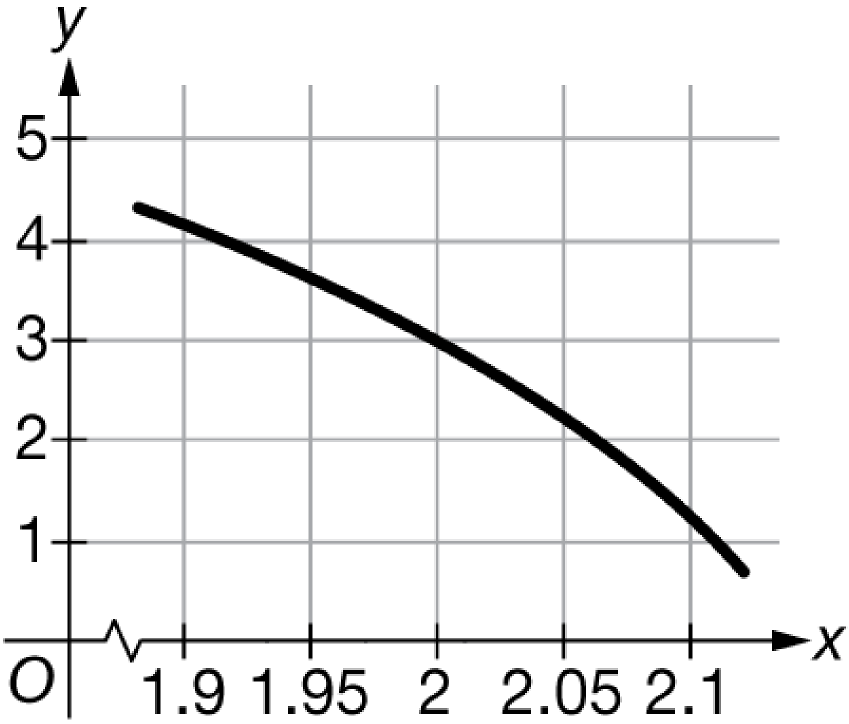
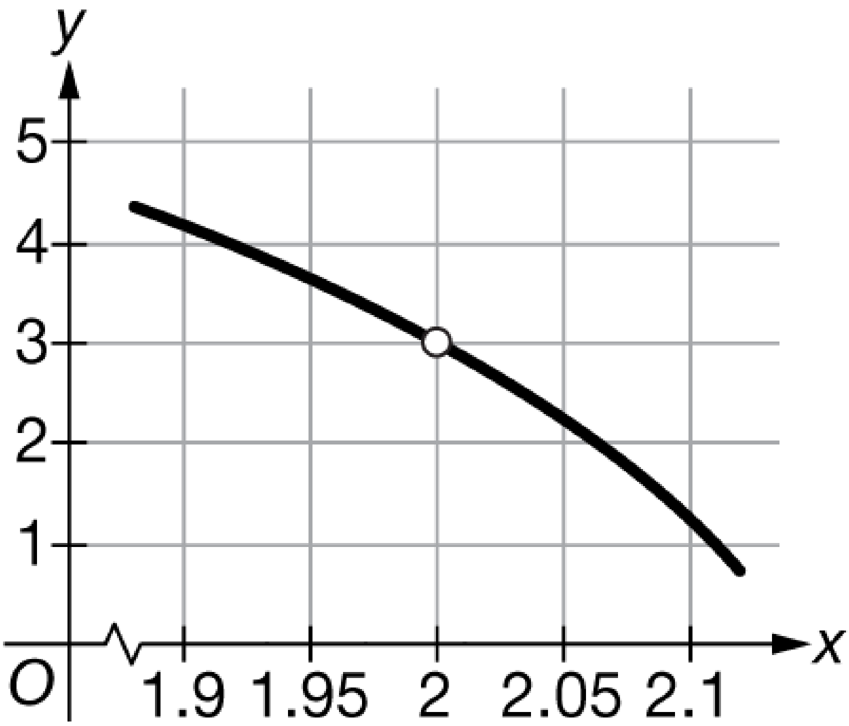
(A)



(B)



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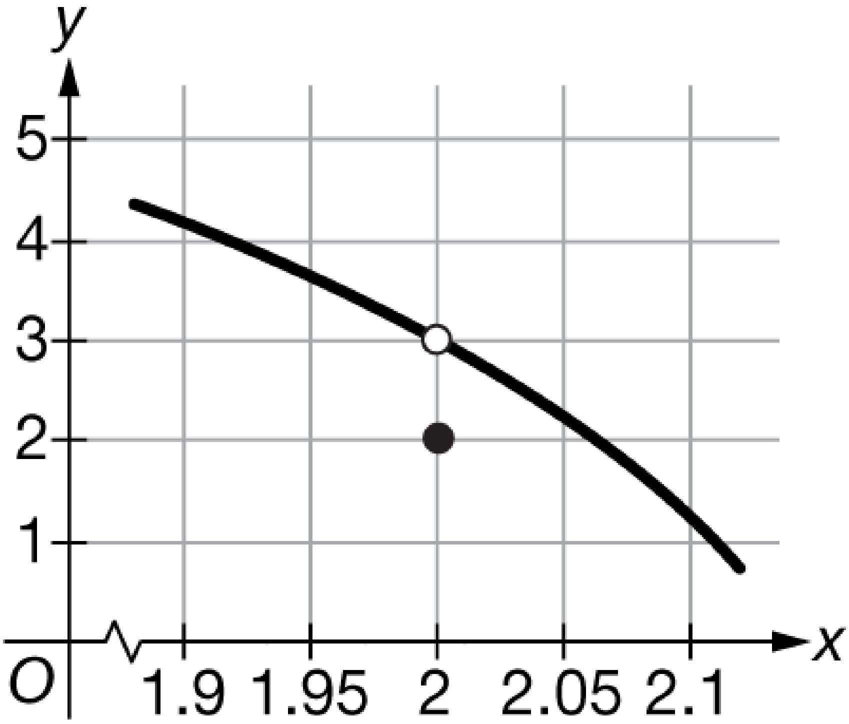
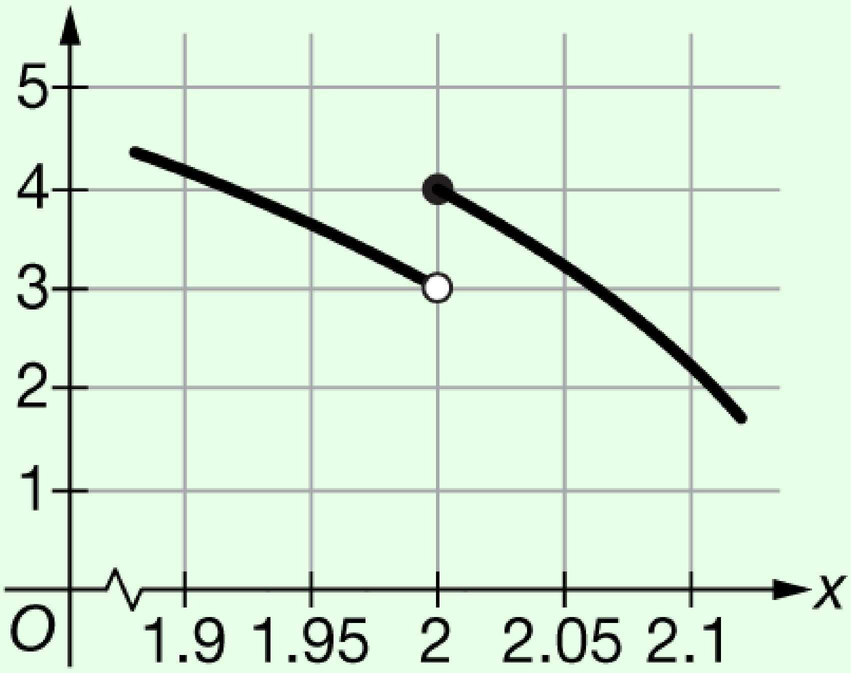
(C)



(D)



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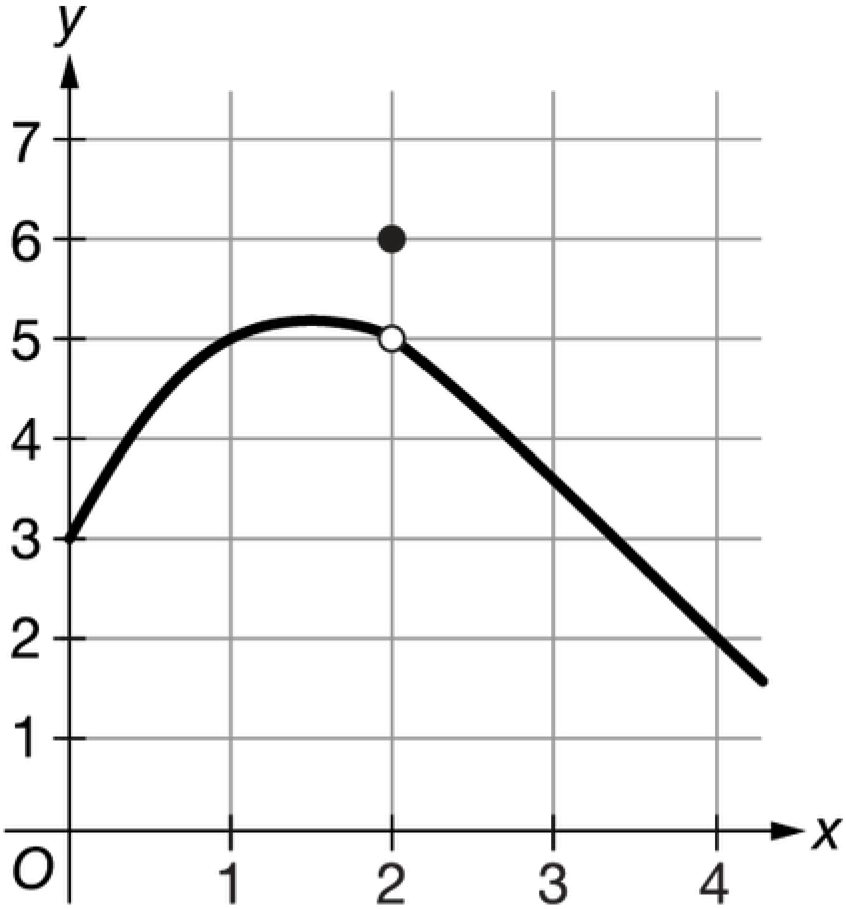
8.

$$f(x) = \begin{cases} -x^2 + 3x + 3 & \text{for} \quad x < 2 \\ 6 & \text{for} \quad x = 2 \\ 8 - \frac{3}{2}x & \text{for} \quad x > 2 \end{cases}$$



Let f be the piecewise function defined above. Also shown is a portion of the graph of f. What is the value of $\lim_{x \to 2} f(f(x))$?

(A) -15

(B) -7

(C) -1

(D) $\frac{1}{2}$ ✔

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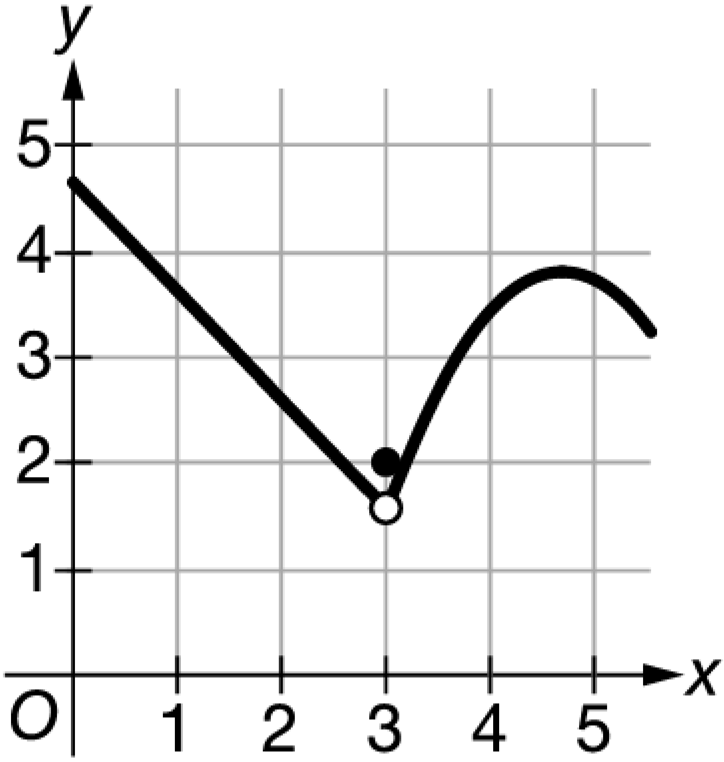
9.

x	2.9	2.95	2.98	2.999	3.001	3.02	3.05	3.1
$f(x)$	1.7	1.65	1.62	1.601	1.603	1.66	1.747	1.89



The table above gives selected values for a function f. Also shown is a portion of the graph of f. The graph consists of a line segment for $x < 3$ and part of a parabola for $x > 3$. What is $\lim_{x \to 3} f(x)$?

(A) 1.6 ✔

(B) 1.602

(C) 2

(D) The limit does not exist.

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10. $f(x) = \begin{cases} \frac{2x^2-3x-2}{x-2} & \text{if } x \neq 2 \\ 7 & \text{if } x = 2 \end{cases}$

The function f is defined above. Which of the following statements is true?

(A) f is continuous at $x = 2$.

(B) f has a removable discontinuity at $x = 2$. ✔

(C) f has a jump discontinuity at $x = 2$.

(D) f has a discontinuity due to a vertical asymptote at $x = 2$.

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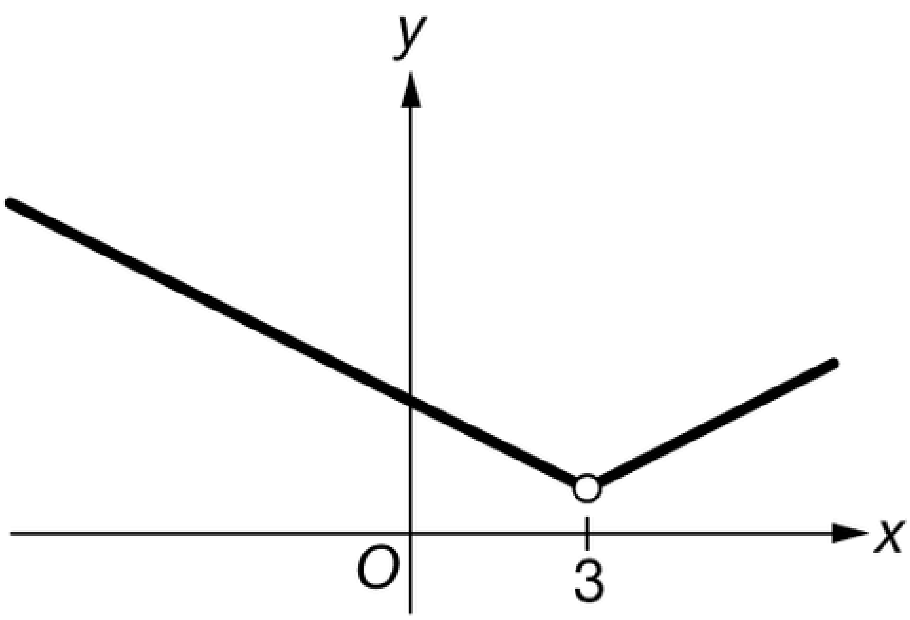
11. The function f has a jump discontinuity at $x = 3$. Which of the following could be the graph of f ?

(A)



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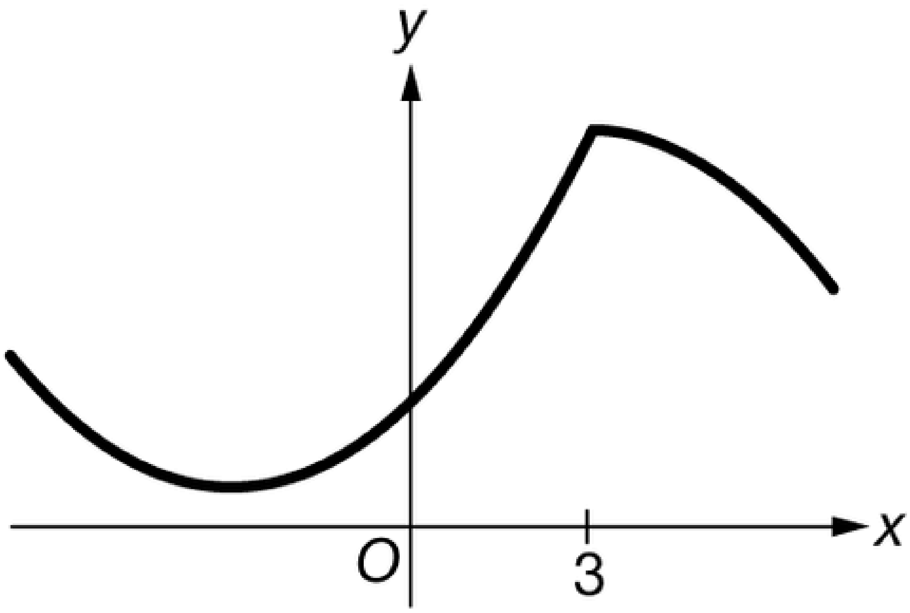
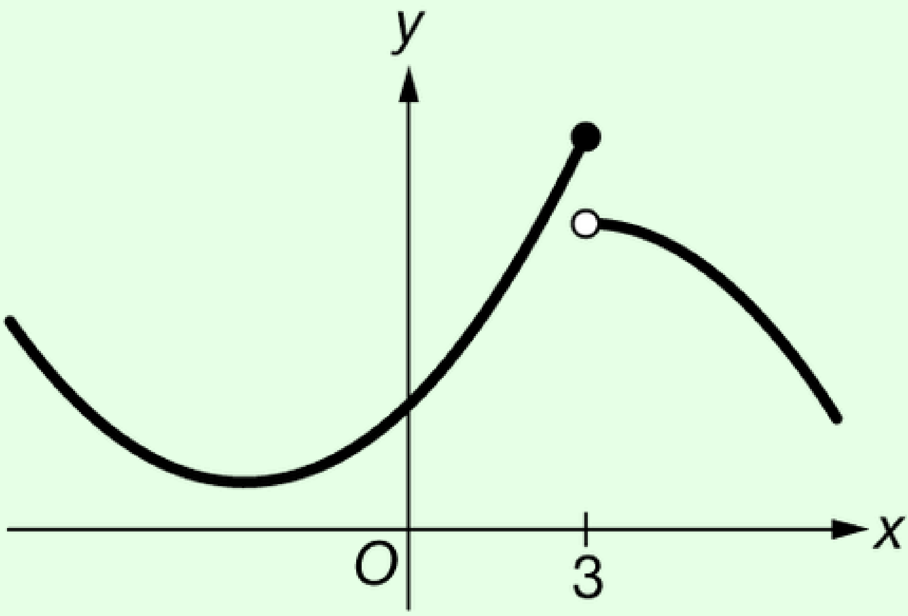
(B)



(C)



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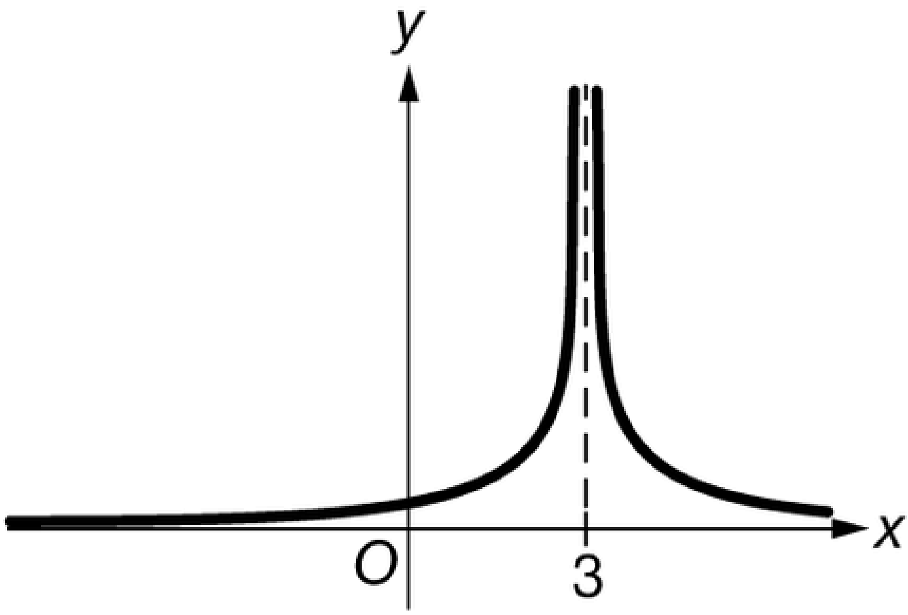
D



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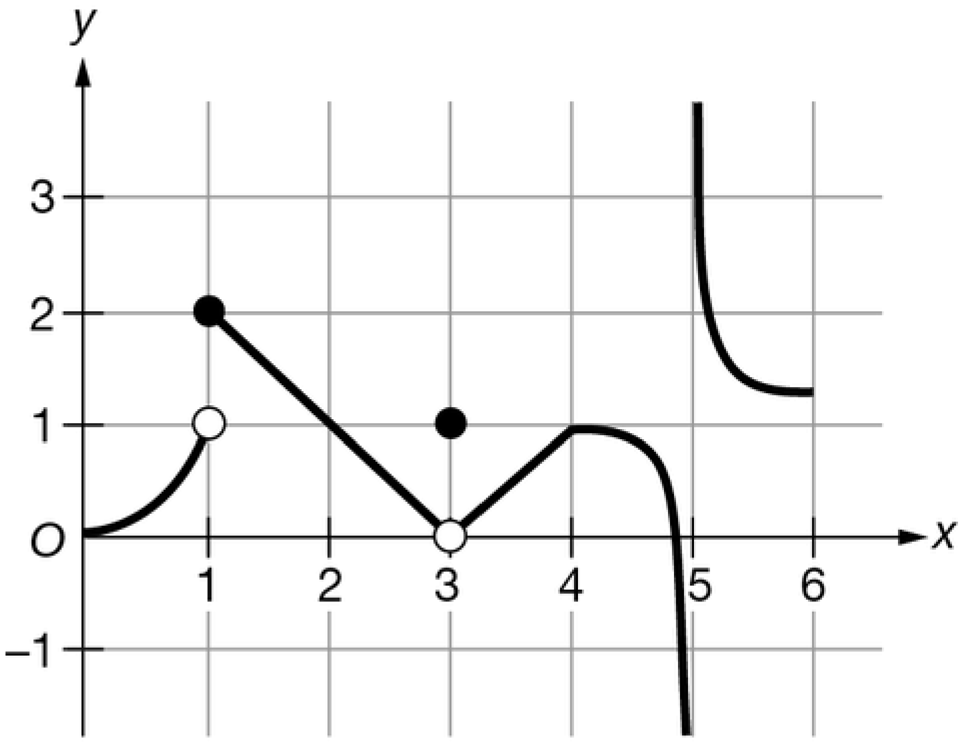
12.



Graph of f

The graph of a function f is shown in the figure above. At what value of x does f have a removable discontinuity?

(A) $x = 1$

(B) $x = 3$ ✔

(C) $x = 4$

(D) $x = 5$

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13. If $\lim_{x \to 6} f(x)$ exists with $\lim_{x \to 6} f(x) < 5$ and $f(6) = 10$, which of the following statements must be false?

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(A) $\lim_{x \to 6^-} f(x) = 0$

(B) $\lim_{x \to 6^+} f(x) < 5$

(C) $\lim_{x \to 6^-} f(x) = \lim_{x \to 6^+} f(x)$

(D) f is continuous at $x = 6$. ✓

---

14. $f(x) = \begin{cases} 2^x & \text{for } 0 < x < 1 \\ \frac{1}{2}x^2 - x + \frac{5}{2} & \text{for } 1 < x < 2 \end{cases}$

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

(A) f is continuous at $x = 1$.

(B) f is not continuous at $x = 1$ because $f(1)$ does not exist. ✓

(C) f is not continuous at $x = 1$ because $\lim_{x \to 1^-} f(x) \neq \lim_{x \to 1^+} f(x)$.

(D) f is not continuous at $x = 1$ because $\lim_{x \to 1} f(x)$ does not exist.

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15. Which of the following functions is continuous at $x = 3$?

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(A) $f(x) = \begin{cases} \frac{x^2+x-12}{x-3} & \text{for} \quad x \neq 3 \\ 8 & \text{for} \quad x = 3 \end{cases}$

(B) $g(x) = \begin{cases} 4x-7 & \text{for } x < 3 \\ \text{undefined} & \text{for } x = 3 \\ x+2 & \text{for } x > 3 \end{cases}$

(C) $h(x) = \begin{cases} -8\sin\left(\frac{\pi}{2}x\right) & \text{for } x < 3 \\ 8 & \text{for } x = 3 \\ -8\cos(\pi x) & \text{for } x > 3 \end{cases}$ ✔

(D) $k(x) = \begin{cases} 8+\ln(4-x) & \text{for} \quad x \leq 3 \\ 8\ln(x-2) & \text{for} \quad x > 3 \end{cases}$