

AP Calculus AB  
Limit and Continuity Test

1. The function  $f$  is differentiable at  $x = b$ . Which of the following statements could be false?

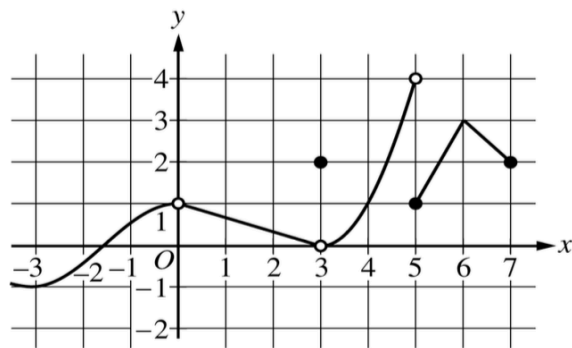
- a)  $\lim_{x \rightarrow b} f(x)$  exists    b)  $\lim_{x \rightarrow b} f(x) = f(b)$     c)  $\lim_{x \rightarrow b^-} f(x) = \lim_{x \rightarrow b^+} f(x)$
- d)  $\lim_{x \rightarrow b^-} f'(x) = \lim_{x \rightarrow b^+} f'(x)$     e) None of these
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2. The function  $f$  is defined for all Reals such that  $f(x) = \begin{cases} x^2 + kx & \text{for } x < 5 \\ 5 \sin \frac{\pi}{2} x & \text{for } x \geq 5 \end{cases}$ .

For which value of  $k$  will the function be continuous throughout its domain?

- a)  $-2$     b)  $-1$     c)  $\frac{2}{3}$     d)  $1$     e) None of these
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3. The graph of the function  $f$  is shown below. At which value of  $x$  is  $f$  continuous, but not differentiable?



Graph of  $f$

- a) 0    b) 2    c) 3    d) 5    e) 6

4. If  $f(x) = \begin{cases} x+2 & \text{for } x \leq 3 \\ 4x-7 & \text{for } x > 3 \end{cases}$ , which of the following statements are true?

I.  $\lim_{x \rightarrow 3} f(x)$  exists    II.  $f$  is continuous at  $x = 3$     III.  $f$  is differentiable at  $x = 3$

- a) None                      b) I only                      c) II only  
 d) I and II only              e) I, II, and III

5. Which of the following functions is differentiable at  $x = 0$ ?

- a)  $f(x) = \sqrt{1+|x|}$     b)  $f(x) = |x|$     c)  $f(x) = \begin{cases} x^2 \sin \frac{1}{x} & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$
- d)  $f(x) = \begin{cases} \frac{1}{x} & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$     e)  $f(x) = \begin{cases} \cos x & \text{for } x < 0 \\ \sin x & \text{for } x \geq 0 \end{cases}$
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6.  $\lim_{h \rightarrow 0} \frac{\sin\left(\frac{\pi}{2} + h\right) - 1}{h} =$

- a)  $\frac{\pi}{2}$     b)  $\frac{\pi}{4}$     c) 0    d)  $-\frac{\pi}{4}$     e) DNE
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7.  $\lim_{x \rightarrow 0} \frac{\int_0^x \sin t^2 dt}{x^3}$

- a) 0    b) 1    c)  $\frac{1}{3}$     d) 3    e) DNE

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8.  $\lim_{x \rightarrow \infty} \frac{4x^5 + 3x^4 + 2x^3 + x^2 + 1}{3x^5 - 9x^4 + 4x^3 + 15} =$

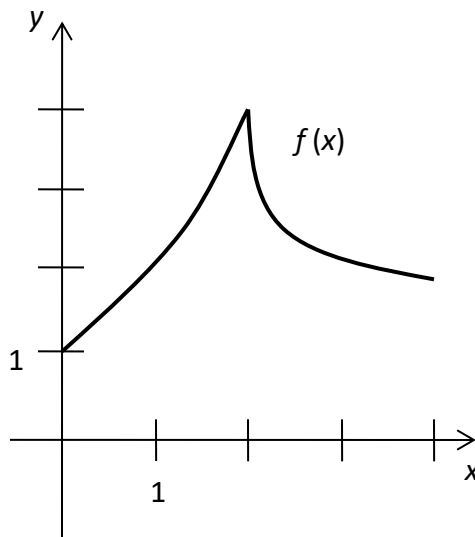
- a) 0    b)  $\frac{3}{4}$     c)  $\frac{4}{3}$     d) 3    e) DNE
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10. The graph of a function  $f$  is given below. Which of the following statements are true?

$$\lim_{x \rightarrow 2} \frac{f(x) - f(2)}{x - 2} \text{ dne}$$

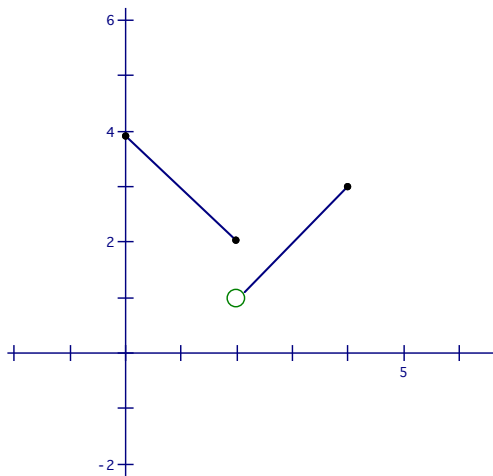
$$\lim_{x \rightarrow 2} f(x) = 4$$

$$\lim_{x \rightarrow 2} f(x) \text{ dne}$$



- a) I only                      b) II only                      c) I and II only
- d) I, II, and III              e) II and III only
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11. The graph of a function is shown below.



Which of the following statement(s) is (are) true?

I.  $\lim_{x \rightarrow 2^-} f(x)$  exists

II.  $\lim_{x \rightarrow 2^+} f(x)$  exists

III.  $\lim_{x \rightarrow 2} f(x)$  exists

a) I only

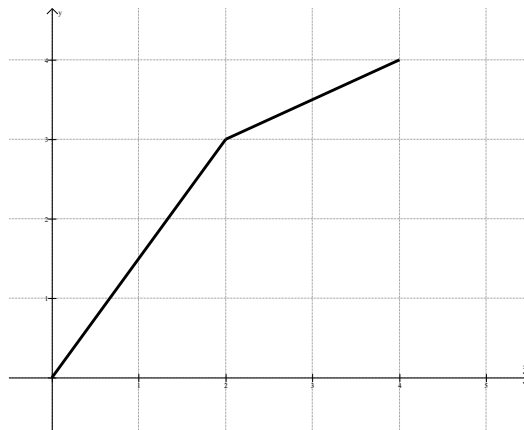
b) II only

c) I and II only

d) I and III only

e) I, II, and I

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12. At which  $x$ -value is  $f$  (graphed above) differentiable but not continuous?

- a) 0    b) 1    c) 2    d) 4    e) nowhere
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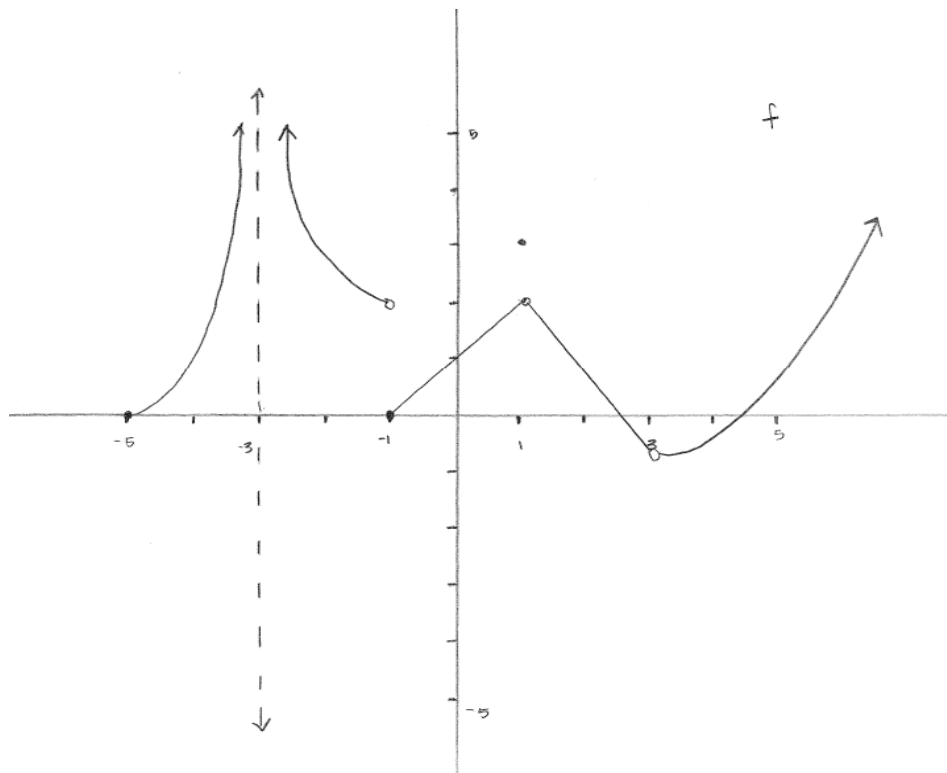
13. 
$$f(x) = \begin{cases} \sin^{-1}[\pi(x-1)], & \text{if } x < 1 \\ 0, & \text{if } x = 1 \\ \ln x^2, & \text{if } x > 1 \end{cases}$$

a) Is  $f(x)$  continuous? Why/Why not?

b) Is  $f(x)$  differentiable? Why/Why not?



15. Given the graph of  $f(x)$  below, find the values of the following:



a.  $\lim_{x \rightarrow -3^-} f(x) =$

b.  $\lim_{x \rightarrow -3^+} f(x) =$

c.  $\lim_{x \rightarrow -3} f(x) =$

d.  $f(-3) =$

e.  $\lim_{x \rightarrow -1^-} f(x) =$

f.  $\lim_{x \rightarrow -1^+} f(x) =$

g.  $\lim_{x \rightarrow -1} f(x) =$

h.  $f(-1) =$

i.  $\lim_{x \rightarrow 1^-} f(x) =$

j.  $\lim_{x \rightarrow 1^+} f(x) =$

k.  $\lim_{x \rightarrow 1} f(x) =$

l.  $f(1) =$

m.  $\lim_{x \rightarrow 3^-} f(x) =$

n.  $\lim_{x \rightarrow 3^+} f(x) =$

o.  $\lim_{x \rightarrow 3} f(x) =$

p.  $f(3) =$