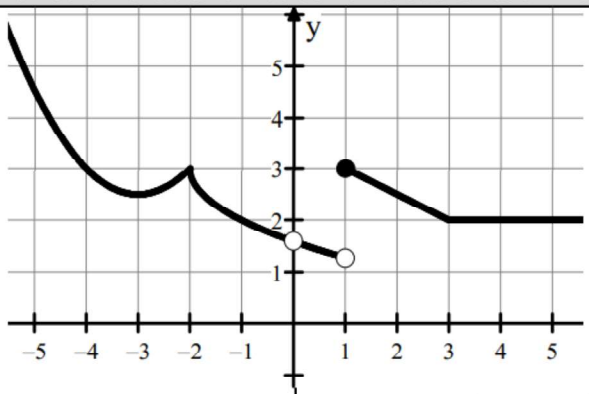
Unit 2.4 Determining When Derivatives Do and Do Not Exist

Identify any x-values of the function that are not continuous and/or not differentiable.

1.



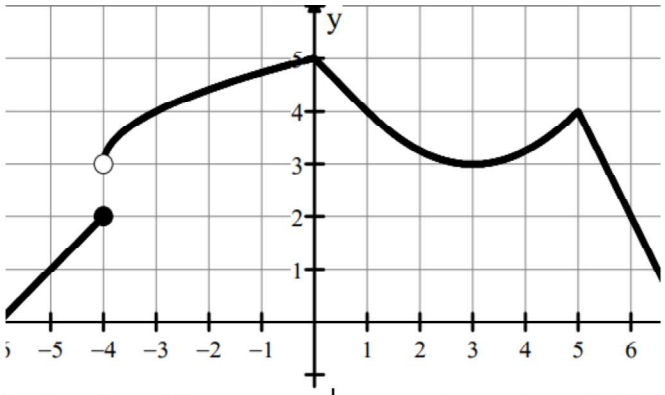
x-values where the function is not continuous.

$x=0, x=1$

x-values where the function is continuous, but not differentiable.

$x=-2, x=3$

2.



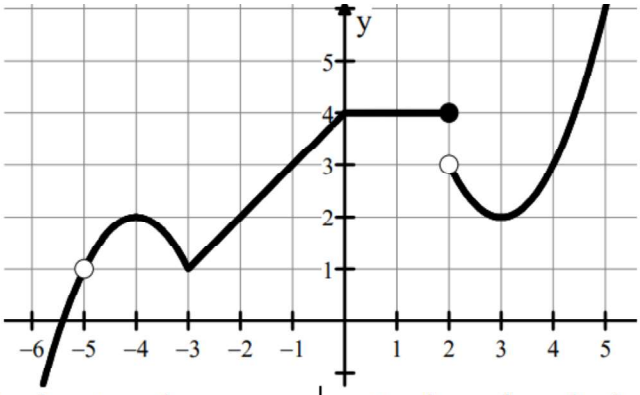
x-values where the function is not continuous.

$x=-4$

x-values where the function is continuous, but not differentiable.

$x=0, x=5$

3.



x-values where the function is not continuous.

$x=-5, x=2$

x-values where the function is continuous, but not differentiable.

$x=-3, x=0$

4. f is continuous for $a \le x \le b$ but not differentiable for some c such that $a < c < b$. Which of the following could be true?

not Cont.

(A) $x = c$ is a vertical asymptote of the graph of f.

not Cont.

(B) $\lim_{x \to c} f(x) \neq f(c)$

Cont, not diff

(C) The graph of f has a cusp at $x = c$.

not Cont.

(D) $f(c)$ is undefined.

(E) None of the above

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5. If g is differentiable at $x = c$, which of the following must be true?

Part of def'n of continuity

I. g is continuous at $x = c$. ✓

II. $\lim_{x \to c} g(x)$ exists. ✓

def'n of derivative

III. $\lim_{x \to c} \frac{g(x)-g(c)}{x-c}$ exists. ✓

(A) I only (B) II only (C) III only

(D) I and II only (E) I, II, and III

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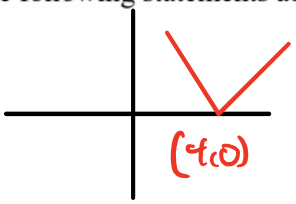
6. Let h be the function given by $h(x) = |x - 4|$. Which of the following statements about h are true?

I. h is continuous at $x = 4$. ✓

II. h is differentiable at $x = 4$. ✗

III. h has an absolute minimum at $x = 4$. ✓



(A) I only (B) II only (C) III only

(D) I and III only (E) II and III only

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7. If f is a differentiable function such that $f(2) = 5$ and $f'(2) = 7$, which of the following statements could be false?

∴ continuous POT SOT

Part of def'n of continuity

(A) $\lim_{x \to 2} f(x) = 5$

def'n of derivative

(D) $\lim_{h \to 0} \frac{f(2+h)-5}{h} = 7$

Part of def'n of continuity

(B) $\lim_{x \to 2^-} f(x) = \lim_{x \to 2^+} f(x)$

(E) $\lim_{h \to 0} f'(x) = 7$

This is the derivative of the derivative, aka. $f''(x)$

def'n of derivative

(C) $\lim_{x \to 2} \frac{f(x)-5}{x-2} = 7$