Exercises for Derivatives

Use the limit definition $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ to find $f(x)'$:

(1) $f(x) = (x+1)^2$ Solution

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(2) $f(x) = (x+2)^3$ Solution

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(3) $f(x) = (x+3)^4$ Solution

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(4) $f(x) = \sqrt{x+1}$ Solution

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(5) $f(x) = \dfrac{1}{x+1}$ Solution

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(6) $f(x) = \dfrac{1}{\sqrt{x+5}}$ Solution

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(7) $f(x) = \dfrac{x}{x+1}$ Solution

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(8) $f(x) = x\sqrt{x+1}$ Solution

Solutions

(1)

$f(x) = (x+1)^2$

Back to Questions

$f'(x) =$

Solutions

(1)

$f(x) = (x+1)^2$

Back to Questions

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} =$$

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(1)

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$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h} =$$

$$\lim_{h \to 0} \frac{(x+h+1)^2 - (x+1)^2}{h} = \text{(factoring)}$$

Solutions

(1)

$f(x) = (x+1)^2$

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$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h} =$$

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$$\lim_{h\to 0} \frac{[(x+h+1) + (x+1)][(x+h+1) - (x+1)]}{h} =$$

Solutions

(1)

$f(x) = (x+1)^2$

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$$\lim_{h\to 0} \frac{(2x+2+h)h}{h} =$$

Solutions

(1)

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$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h} =$$

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$$\lim_{h\to 0} 2x + 2 + h =$$

Solutions

(1)

$f(x) = (x+1)^2$

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$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h} =$$

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$$2x + 2 + 0 =$$

Solutions

(1)

$f(x) = (x+1)^2$

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$2x + 2$

(2)

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$f'(x) =$

Back to Questions

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$3(x+2)^2$

(3)

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Back to Questions

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$4(x+3)^3$

(4)

$f(x) = \sqrt{x+1}$. We must assume that $x + 1 \geq 0$, so we will always have $\left(\sqrt{x+1}\right)^2 = |x+1| = x + 1$.

Back to Questions

$f'(x) =$

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$$\lim_{h \to 0} \frac{\sqrt{x+h+1} - \sqrt{x+1}}{h} \frac{\sqrt{x+h+1} + \sqrt{x+1}}{\sqrt{x+h+1} + \sqrt{x+1}} =$$

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$$\lim_{h\to 0} \frac{h}{h\left(\sqrt{x+h+1} + \sqrt{x+1}\right)} =$$

$$\lim_{h\to 0} \frac{1}{\sqrt{x+h+1} + \sqrt{x+1}} = \left(\text{and now we must have } x+1 > 0\right)$$

(4)

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$$\lim_{h \to 0} \frac{\sqrt{x+h+1} - \sqrt{x+1}}{h} \frac{\sqrt{x+h+1} + \sqrt{x+1}}{\sqrt{x+h+1} + \sqrt{x+1}} =$$

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$$\lim_{h \to 0} \frac{1}{\sqrt{x+h+1} + \sqrt{x+1}} = \left(\text{and now we must have } x+1 > 0\right)$$

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$$\frac{1}{2\sqrt{x+1}}$$

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$f(x) = \dfrac{x}{x+1}$. We must assume $x + 1 \neq 0$.

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