

1. Calculate the derivative (slope of the tangent line) using the definition.

Distribute/FOIL: $f'(3) = \lim_{h \rightarrow 0} \frac{9 + 6h + h^2 + 15 + 5h - 24}{h}$	Step: ____
Collect like terms: $f'(3) = \lim_{h \rightarrow 0} \frac{h^2 + 11h}{h}$	Step: ____
Evaluate the limit: $f'(3) = 11$	Step: ____
Definition of the derivative at $x = 3$: $f'(3) = \lim_{h \rightarrow 0} \frac{f(3 + h) - f(3)}{h}$	Step: ____
Factor: $f'(3) = \lim_{h \rightarrow 0} \frac{h(h + 11)}{h}$	Step: ____
Begin Simplifying: $f'(3) = \lim_{h \rightarrow 0} \frac{(3 + h)(3 + h) + 5(3 + h) - 24}{h}$	Step: ____
Cancel: $f'(3) = \lim_{h \rightarrow 0} h + 11$	Step: ____
Use $f(x) = x^2 + 5x$ $f'(3) = \lim_{h \rightarrow 0} \frac{(3 + h)^2 + 5(3 + h) - 24}{h}$	Step: ____

2. $f(x) = 3x^2 - x$. Find $f'(-2)$ by circling the correct next step from each row. In the third column, explain why this is the correct step and what caused the error in the incorrect step.

Step 1.	$\lim_{h \rightarrow 0} \frac{f(-2+h) - f(-2)}{h}$	$\lim_{h \rightarrow -2} \frac{f(-2+h) - f(-2)}{h}$	
Step 2.	$\lim_{h \rightarrow 0} \frac{3(-2+h)^2 + 2 + h + 14}{h}$	$\lim_{h \rightarrow 0} \frac{3(-2+h)^2 + 2 - h - 14}{h}$	
Step 3.	$\lim_{h \rightarrow 0} \frac{3(4 - 4h + h^2) + 2 - h - 14}{h}$	$\lim_{h \rightarrow 0} \frac{3(4 + h^2) - 2 - h - 14}{h}$	
Step 4.	$\lim_{h \rightarrow 0} \frac{12 - 4h + h^2 + 2 - h - 14}{h}$	$\lim_{h \rightarrow 0} \frac{12 - 12h + 3h^2 + 2 - h - 14}{h}$	
Step 5.	$\lim_{h \rightarrow 0} \frac{-12h + 3h^2 - h}{h}$	$\lim_{h \rightarrow 0} \frac{3h^2 - 13h + 12}{h}$	
Step 6.	$\lim_{h \rightarrow 0} \frac{-12\cancel{h} + 3h^2 - h}{\cancel{h}}$	$\lim_{h \rightarrow 0} \frac{3h^2 - 13h}{h}$	
Step 7.	$\frac{3h^2 - 13h}{h}$	$\lim_{h \rightarrow 0} \frac{h(3h - 13)}{h}$	
Step 8.	$\lim_{h \rightarrow 0} 3h - 13$	$3h - 13h$	
Step 9.	$-10h$	-13	

3. $f(x) = \sqrt{x}$. Find $f'(4)$ by filling in the boxes with the correct mathematical expressions.

$$f'(4) = \lim_{h \rightarrow 0} \frac{f(\boxed{}) - f(\boxed{})}{h}$$

$$= \lim_{h \rightarrow 0}$$

$$= \lim_{h \rightarrow 0} \frac{\sqrt{4+h} - 2}{h} \cdot \frac{\sqrt{4+h} + 2}{\sqrt{4+h} + 2}$$

$$= \lim_{h \rightarrow 0}$$

$$= \lim_{h \rightarrow 0} \frac{4 + h + \boxed{}}{h (\sqrt{4 + h} + 2)}$$

$$= \lim_{h \rightarrow 0} \frac{\square}{h(\sqrt{4+h}+2)}$$

$$= \lim_{h \rightarrow 0} \frac{1}{\sqrt{4+h}+2}$$

$$= \frac{1}{\sqrt{4 + \boxed{} + 2}}$$

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4. Now you're on your own! Use the definition of the derivative to calculate the following derivatives.

(a) $f(x) = 7x^2 + 5x$. Find $f'(2)$.

(b) $f(x) = \frac{1}{x}$. Find $f'(3)$.

(c) $f(x) = \frac{2}{\sqrt{x}}$. Find $f'(4)$.