

1 Definition of Derivative

Use the definition of the derivative to find $f'(x)$.

$$1. f(x) = 3x^2 - 4x + 5$$

$$2. f(x) = 1 - x^2$$

$$3. f(x) = 2x^2 + 1$$

$$4. f(x) = (x - 1)(x + 1)$$

$$5. f(x) = 3x^2 + 5x + 1$$

$$6. f(x) = 1 + 4x - 2x^2$$

$$7. f(x) = \sqrt{x}$$

$$8. f(x) = 9 - x^2$$

$$9. f(x) = 5 + 3x - 2x^2$$

$$10. f(x) = \sqrt{5x - 2}$$

$$11. f(x) = \frac{1}{x}$$

$$12. f(x) = \frac{1}{x - 1}$$

$$13. f(x) = 3 - 6x - x^2$$

$$14. f(x) = (x - 2)^2$$

$$15. f(x) = \sin x$$

$$16. f(x) = \frac{2}{x - 1}$$

$$17. f(x) = \frac{4}{x + 2}$$

$$18. f(x) = \cos x$$

$$19. f(x) = \frac{3}{x + 1}$$

Answers:

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

$$\begin{aligned} 1. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[3(x + \Delta x)^2 - 4(x + \Delta x) + 5] - [3x^2 - 4x + 5]}{\Delta x} \\ &= \dots = 6x - 4 \end{aligned}$$

$$\begin{aligned} 2. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[1 - (x + \Delta x)^2] - [1 - x^2]}{\Delta x} \\ &= \dots = -2x \end{aligned}$$

$$\begin{aligned} 3. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[2(x + \Delta x)^2 + 1] - [2x^2 + 1]}{\Delta x} \\ &= \dots = 4x \end{aligned}$$

$$\begin{aligned} 4. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[(x + \Delta x)^2 - 1] - [x^2 - 1]}{\Delta x} \\ &= \dots = 2x \end{aligned}$$

$$\begin{aligned} 5. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[3(x + \Delta x)^2 + 5(x + \Delta x) + 1] - [3x^2 + 5x + 1]}{\Delta x} \\ &= \dots = 6x + 5 \end{aligned}$$

$$\begin{aligned} 6. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[1 + 4(x + \Delta x) - 2(x + \Delta x)^2] - [1 + 4x - 2x^2]}{\Delta x} \\ &= \dots = 4 - 4x \end{aligned}$$

$$\begin{aligned} 7. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[\sqrt{x + \Delta x}] - [\sqrt{x}]}{\Delta x} \\ &= \dots = \frac{1}{2\sqrt{x}} \end{aligned}$$

$$\begin{aligned} 8. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[9 - (x + \Delta x)^2] - [9 - x^2]}{\Delta x} \\ &= \dots = -2x \end{aligned}$$

$$\begin{aligned} 9. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[5 + 3(x + \Delta x) - 2(x + \Delta x)^2] - [5 + 3x - 2x^2]}{\Delta x} \\ &= \dots = 3 - 4x \end{aligned}$$

$$\begin{aligned} 10. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[\sqrt{5(x + \Delta x) - 2}] - [\sqrt{5x - 2}]}{\Delta x} \\ &= \dots = \frac{5}{2\sqrt{5x - 2}} \end{aligned}$$

$$\begin{aligned} 11. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[\frac{1}{x + \Delta x}] - [\frac{1}{x}]}{\Delta x} \\ &= \dots = -\frac{1}{x^2} \end{aligned}$$

$$\begin{aligned} 12. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[\frac{1}{(x + \Delta x) - 1}] - [\frac{1}{x - 1}]}{\Delta x} \\ &= \dots = -\frac{1}{(x - 1)^2} \end{aligned}$$

$$\begin{aligned} 13. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[3 - 6(x + \Delta x) - (x + \Delta x)^2] - [3 - 6x - x^2]}{\Delta x} \\ &= \dots = -6 - 2x \end{aligned}$$

$$\begin{aligned} 14. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[((x + \Delta x) - 2)^2] - [(x - 2)^2]}{\Delta x} \\ &= \dots = 2x - 4 \end{aligned}$$

$$\begin{aligned} 15. f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{[\sin(x + \Delta x)] - [\sin x]}{\Delta x} \\ &= \dots = \cos x \end{aligned}$$

$$16. f'(x) \\ = \lim_{\Delta x \rightarrow 0} \frac{\left[\frac{2}{(x+\Delta x)-1} \right] - \left[\frac{2}{x-1} \right]}{\Delta x} \\ = \dots = -\frac{2}{(x-1)^2}$$

$$17. f'(x) \\ = \lim_{\Delta x \rightarrow 0} \frac{\left[\frac{4}{(x+\Delta x)+2} \right] - \left[\frac{4}{x+2} \right]}{\Delta x} \\ = \dots = -\frac{4}{(x+2)^2}$$

$$18. f'(x) \\ = \lim_{\Delta x \rightarrow 0} \frac{[\cos(x+\Delta x)] - [\cos x]}{\Delta x} \\ = \dots = -\sin x$$

$$19. f'(x) \\ = \lim_{\Delta x \rightarrow 0} \frac{\left[\frac{3}{(x+\Delta x)+1} \right] - \left[\frac{3}{x+1} \right]}{\Delta x} \\ = \dots = -\frac{3}{(x+1)^2}$$