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. $f(x) = \dfrac{1}{x}$
12. $f(x) = \dfrac{1}{x-1}$
13. $f(x) = 3 - 6x - x^2$
14. $f(x) = (x-2)^2$
15. $f(x) = \sin x$
16. $f(x) = \dfrac{2}{x-1}$
17. $f(x) = \dfrac{4}{x+2}$
18. $f(x) = \cos x$
19. $f(x) = \dfrac{3}{x+1}$

Answers:

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

1. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{[3(x+\Delta x)^2 - 4(x+\Delta x)+5] - [3x^2 - 4x + 5]}{\Delta x}$
$= \cdots = 6x - 4$

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

3. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[2(x+\Delta x)^2+1\right] - \left[2x^2+1\right]}{\Delta x}$
$= \cdots = 4x$

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

5. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[3(x+\Delta x)^2+5(x+\Delta x)+1\right] - \left[3x^2+5x+1\right]}{\Delta x}$
$= \cdots = 6x + 5$

6. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[1+4(x+\Delta x)-2(x+\Delta x)^2\right] - \left[1+4x-2x^2\right]}{\Delta x}$
$= \cdots = 4 - 4x$

7. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[\sqrt{x+\Delta x}\right] - \left[\sqrt{x}\right]}{\Delta x}$
$= \cdots = \frac{1}{2\sqrt{x}}$

8. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[9-(x+\Delta x)^2\right] - \left[9-x^2\right]}{\Delta x}$
$= \cdots = -2x$

9. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[5+3(x+\Delta x)-2(x+\Delta x)^2\right] - \left[5+3x-2x^2\right]}{\Delta x}$
$= \cdots = 3 - 4x$

10. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[\sqrt{5(x+\Delta x)-2}\right] - \left[\sqrt{5x-2}\right]}{\Delta x}$
$= \cdots = \frac{5}{2\sqrt{5x-2}}$

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

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

13. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{\left[3-6(x+\Delta x)-(x+\Delta x)^2\right] - \left[3-6x-x^2\right]}{\Delta x}$
$= \cdots = -6 - 2x$

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

15. $f'(x)$
$= \lim_{\Delta x \to 0} \frac{[\sin(x+\Delta x)] - [\sin x]}{\Delta x}$
$= \cdots = \cos x$

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

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

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

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