

AP Calculus

2.13 - Recognizing the derivative from the limit definition of the derivative

$h \rightarrow 0$ form

Limit

Function

Derivative being calculated

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

$$\lim_{h \rightarrow 0} \frac{f(a+h) - f(x)}{h}$$

1. $\lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h}$

2. $\lim_{h \rightarrow 0} \frac{\tan(x+h) - \tan x}{h}$

3. $\lim_{h \rightarrow 0} \frac{(x+h)^4 - x^4}{h}$

4. $\lim_{h \rightarrow 0} \frac{2(x+h)^2 + 3(x+h) - 2x^2 - 3x}{h}$

5. $\lim_{h \rightarrow 0} \frac{\sin 2(x+h) - \sin 2x}{h}$

6. $\lim_{h \rightarrow 0} \frac{\cos(x+h)^2 - \cos x^2}{h}$

7. $\lim_{h \rightarrow 0} \frac{\ln(1+h)}{h}$

8. $\lim_{h \rightarrow 0} \frac{(3+h)^2 - 9}{h}$

9. $\lim_{h \rightarrow 0} \frac{(h-1)^5 + 1}{h}$

10. $\lim_{h \rightarrow 0} \frac{e^{2+h} - e^2}{h}$

$x \rightarrow a$ form

Limit

Function

Derivative being calculated

$$\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$$

1. $\lim_{x \rightarrow 5} \frac{x^2 - 25}{x - 5}$

2. $\lim_{x \rightarrow \frac{\pi}{3}} \frac{\sin x - \sin \frac{\pi}{3}}{x - \frac{\pi}{3}}$

3. $\lim_{x \rightarrow \frac{\pi}{6}} \frac{\sin x - \frac{1}{2}}{x - \frac{\pi}{6}}$

4. $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\cos x - \frac{\sqrt{2}}{2}}{x - \frac{\pi}{4}}$

5. $\lim_{x \rightarrow 0} \frac{\sin x}{x}$

6. $\lim_{x \rightarrow \pi} \frac{\sin x}{x - \pi}$

7. $\lim_{x \rightarrow 4} \frac{\sqrt{x} - 2}{x - 4}$

8. $\lim_{x \rightarrow 1} \frac{\ln x}{x - 1}$

9. $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$

10. $\lim_{x \rightarrow 3} \frac{\sqrt{(x^2 - x)} - \sqrt{6}}{x - 3}$