

Limit definition of derivative: $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

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

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

1. What is $\lim_{\Delta x \rightarrow 0} \frac{\sin\left(\frac{\pi}{3} + \Delta x\right) - \sin\left(\frac{\pi}{3}\right)}{\Delta x}$?

(a) $-\frac{1}{2}$

(b) 0

(c) $\frac{1}{2}$

(d) $-\frac{\sqrt{2}}{2}$

(e) does not exist

2. What is $\lim_{h \rightarrow 0} \frac{\csc\left(\frac{\pi}{4} + h\right) - \csc\left(\frac{\pi}{4}\right)}{h}$?

(a) $\sqrt{2}$

(b) $-\sqrt{2}$

(c) 0

(d) $-\frac{\sqrt{2}}{2}$

(e) undefined

Free Response

Directions: Show all your working out for each below.

3. Find: $\lim_{h \rightarrow 0} \frac{\sin\left(\frac{\pi}{2} + h\right) - \sin\left(\frac{\pi}{2}\right)}{h}$

4. Find: $\lim_{h \rightarrow 0} \frac{\cos\left(\frac{\pi}{2} + h\right)}{h}$

5. Find $\lim_{h \rightarrow 0} \frac{\sin\left(\frac{\pi}{6} + h\right) - \frac{1}{2}}{h}$

6. Find $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x - \sin \frac{\pi}{4}}{x - \frac{\pi}{4}}$

7. Find $\lim_{x \rightarrow \pi} \frac{\cos x + 1}{x - \pi}$

8. Find $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\cos x}{x - \frac{\pi}{2}}$

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

10. Find $\lim_{h \rightarrow 0} \frac{\sqrt{9+h} - 3}{h}$

Example 2: $\lim_{h \rightarrow 0} \frac{\tan(x+h) - \tan(x)}{h} = ?$