

1. Find the derivative using the DEFINITION.

$$f(x) = \sqrt{3 - 5x}$$

$$\begin{aligned} \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} &= \lim_{h \rightarrow 0} \frac{\sqrt{3 - 5(x+h)} - \sqrt{3 - 5x}}{h} = \\ \lim_{h \rightarrow 0} \frac{\sqrt{3 - 5(x+h)} - \sqrt{3 - 5x}}{h} &\cdot \frac{\sqrt{3 - 5x - 5h} + \sqrt{3 - 5x}}{\sqrt{3 - 5x - 5h} + \sqrt{3 - 5x}} = \dots \\ &\frac{-5}{2\sqrt{3 - 5x}} \end{aligned}$$

2. Prove there is a root between 0 and 1 of the following equation. $e^{-x^2} = x$

use the IVT here

3. Evaluate the following limits. No approximations, exact answers or, if that is not possible, explain in words.

(a)

$$\lim_{x \rightarrow \pi^-} \ln(\sin x)$$

$-\infty$

(b)

$$\lim_{x \rightarrow 0^+} \arctan \frac{1}{x}$$

$\frac{\pi}{2}$

(c)

$$\lim_{x \rightarrow 1} \left(\frac{1}{x-1} + \frac{1}{x^2 - 3x + 2} \right)$$

-1

(d)

$$\lim_{h \rightarrow 0} \frac{(h-1)^3 + 1}{h}$$

3

(e)

$$\lim_{v \rightarrow 4^+} \frac{4-v}{|4-v|}$$

-1

(f)

$$\lim_{x \rightarrow 3} \frac{\sqrt{x+6} - x}{x^3 - 3x^2}$$

$-\frac{5}{54}$