

Question 7

Given that

$$\lim_{x \rightarrow 1} f(x) = 4, \quad \lim_{x \rightarrow 1} g(x) = 0, \quad \lim_{x \rightarrow 1} h(x) = -2$$

compute the following limits using limit laws:

(a) $\lim_{x \rightarrow 1} [f(x)^2 + 3h(x)]$

(b) $\lim_{x \rightarrow 1} \left[\frac{f(x) + h(x)}{g(x)^2 + 1} \right]$

Question 7 - Solution

We are given:

$$\lim_{x \rightarrow 1} f(x) = 4, \quad \lim_{x \rightarrow 1} g(x) = 0, \quad \lim_{x \rightarrow 1} h(x) = -2$$

(a) Use the limit laws for powers and linear combinations:

$$\lim_{x \rightarrow 1} [f(x)^2 + 3h(x)] = (\lim_{x \rightarrow 1} f(x))^2 + 3 \cdot \lim_{x \rightarrow 1} h(x) = (4)^2 + 3(-2) = 16 - 6 = \boxed{10}$$

(b) Use limit laws for addition, powers, and quotients (denominator never zero):

$$\lim_{x \rightarrow 1} \left[\frac{f(x) + h(x)}{g(x)^2 + 1} \right] = \frac{\lim_{x \rightarrow 1} (f(x) + h(x))}{\lim_{x \rightarrow 1} (g(x)^2 + 1)} = \frac{4 + (-2)}{0^2 + 1} = \frac{2}{1} = \boxed{2}$$