

Calculus Worksheet: Limits of Functions(1)

Find if possible

1.

$$\lim_{x \rightarrow 0} \frac{2}{1+e^{\frac{1}{x}}}$$

a) As  $x \rightarrow 0^+$ ,  $\frac{1}{x} \rightarrow +\infty$  and  $e^{\frac{1}{x}} \rightarrow +\infty$

$$\Rightarrow \frac{2}{1+e^{\frac{1}{x}}} \rightarrow 0.$$

b) As  $x \rightarrow 0^-$ ,  $\frac{1}{x} \rightarrow -\infty$  and  $e^{\frac{1}{x}} \rightarrow 0$

$$\Rightarrow \frac{2}{1+e^{\frac{1}{x}}} \rightarrow 2.$$

The two sided limits are not equal  $\Rightarrow \lim_{x \rightarrow 0} \frac{2}{1+e^{\frac{1}{x}}}$   
does not exist

2.

$$\lim_{x \rightarrow 0} \sqrt{2 + \arctan\left(\frac{1}{x}\right)}$$

a) As  $x \rightarrow 0^+$ ,  $\frac{1}{x} \rightarrow +\infty$ ,  $\arctan \frac{1}{x} \rightarrow \frac{\pi}{2}$

$$\Rightarrow \lim_{x \rightarrow 0^+} \sqrt{2 + \arctan \frac{1}{x}} = \sqrt{2 + \frac{\pi}{2}}$$

b) As  $x \rightarrow 0^-$ ,  $\frac{1}{x} \rightarrow -\infty$ ,  $\arctan \frac{1}{x} \rightarrow -\frac{\pi}{2}$

$$\Rightarrow \lim_{x \rightarrow 0^-} \sqrt{2 + \arctan \frac{1}{x}} = \sqrt{2 - \frac{\pi}{2}}$$

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The two limits are not equal.

$$\Rightarrow \lim_{x \rightarrow 0} \sqrt{2 + \arctan \frac{1}{x}} \text{ does not exist.}$$