



Continuity Ex 9.1 Q23

We have given that the function is continuous at $x = 2$

$$\text{LHL} = \text{RHL} = f(2) \dots (1)$$

Now,

$$\text{LHL} = \lim_{x \rightarrow 2^-} f(x) = \lim_{h \rightarrow 0} f(2-h) = \lim_{h \rightarrow 0} a(2-h) + 5 = 2a + 5$$

$$f(2) = 2a + 5$$

$$\text{RHL} = \lim_{x \rightarrow 2^+} f(x) = \lim_{h \rightarrow 0} f(2+h) = \lim_{h \rightarrow 0} 2 + h - 1 = 1$$

\therefore Using (1),

$$2a + 5 = 1 \Rightarrow a = -2$$

Continuity Ex 9.1 Q24

We have, at $x = 0$

$$\text{LHL} = \lim_{x \rightarrow 0^-} f(x) = \lim_{h \rightarrow 0} f(0-h) = \lim_{h \rightarrow 0} \frac{-h}{|-h| + 2(-h)^2} = \lim_{h \rightarrow 0} \frac{-h}{h + 2h^2} = \lim_{h \rightarrow 0} \frac{-1}{1 + 2h} = -1$$

$$f(0) = k$$

$$\text{RHL} = \lim_{x \rightarrow 0^+} f(x) = \lim_{h \rightarrow 0} f(0+h) = \lim_{h \rightarrow 0} \frac{h}{|h| + 2h^2} = \lim_{h \rightarrow 0} \frac{1}{1 + 2h} = 1$$

Since, $\text{LHL} \neq \text{RHL}$, function will remain discontinuous at $x = 0$, regardless the choice of k .

Continuity Ex 9.1 Q25

Since $f(x)$ is continuous at $x = \frac{\pi}{2}$, $\text{L.H.Limit} = \text{R.H.Limit}$.

$$\Rightarrow \lim_{x \rightarrow \frac{\pi}{2}^-} f(x) = \lim_{x \rightarrow \frac{\pi}{2}^+} f(x) = \lim_{x \rightarrow \frac{\pi}{2}} f(x) = f\left(\frac{\pi}{2}\right)$$

$$\Rightarrow \lim_{x \rightarrow \frac{\pi}{2}^-} \frac{k \cos x}{\pi - 2x} = 3$$

$$\Rightarrow k \lim_{x \rightarrow \frac{\pi}{2}} \frac{\sin\left(\frac{\pi}{2} - x\right)}{2\left(\frac{\pi}{2} - x\right)} = 3$$

$$\Rightarrow \frac{k}{2} \lim_{x \rightarrow \frac{\pi}{2}} \frac{\sin\left(\frac{\pi}{2} - x\right)}{\left(\frac{\pi}{2} - x\right)} = 3$$

$$\Rightarrow \frac{k}{2} = 3$$

$$\Rightarrow k = 6$$

Continuity Ex 9.1 Q26

We have given that the function is continuous at $x = 0$

$$\text{LHL} = \text{RHL} = f(0) \dots (1)$$

$$f(0) = c$$

$$\begin{aligned} \text{LHL} = \lim_{x \rightarrow 0^-} f(x) &= \lim_{h \rightarrow 0} f(0-h) = \lim_{h \rightarrow 0} \frac{\sin(a+1)(-h) + \sin(-h)}{-h} = \lim_{h \rightarrow 0} \frac{-\sin(a+1)h - \sin h}{-h} \\ &= \lim_{h \rightarrow 0} \frac{\sin(a+1)h}{h} + \lim_{h \rightarrow 0} \frac{\sin h}{h} \\ &= a+1 + 1 = a+2 \end{aligned}$$

$$\begin{aligned} \text{RHL} = \lim_{x \rightarrow 0^+} f(x) &= \lim_{h \rightarrow 0} f(0+h) = \lim_{h \rightarrow 0} \frac{\sqrt{h+bh^2} - \sqrt{h}}{bh^2} \\ &= \lim_{h \rightarrow 0} \frac{\sqrt{h+bh^2} - \sqrt{h}}{bh^2} \times \frac{\sqrt{h+bh^2} + \sqrt{h}}{\sqrt{h+bh^2} + \sqrt{h}} \\ &= \lim_{h \rightarrow 0} \frac{h+bh^2-h}{bh^2(\sqrt{h+bh^2} + \sqrt{h})} = \lim_{h \rightarrow 0} \frac{bh^2}{bh^2(\sqrt{1+bh} + 1)} = \frac{1}{2} \end{aligned}$$

\therefore from (1),

$$a+2 = \frac{1}{2} \Rightarrow a = \frac{-3}{2}$$

$$c = \frac{1}{2} \quad \text{and}$$

$$b \in \mathbb{R} - \{0\}$$

$$\text{Hence, } a = \frac{-3}{2}, \quad b \in \mathbb{R} - \{0\}, \quad c = \frac{1}{2}$$

***** END *****