20.

$$f(x) = \begin{cases} x[x], & , if \ \ 0 \le x < 2 \\ (x-1)x, & if \ \ 2 \le x < 3 \end{cases}$$ **at x = 2.**

Solution:

We know that, a function f is differentiable at a point ‘a’ in its domain if

Lf’(c) = Rf’(c)

$$\text{where } Lf'(c) = \lim_{h \to 0} \frac{f(a-h) - f(a)}{-h} \text{ and}$$

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

$$\text{Here, } f(x) = \begin{cases} x[x], \text{ if } 0 \le x < 2 \\ (x-1)x, \text{ if } 2 \le x < 2 \end{cases} \text{ at } x = 2.$$

at $x = 2$

$$Lf'(c) = \lim_{h \to 0} \frac{f(2-h) - f(2)}{-h} = \lim_{h \to 0} \frac{(2-h)[2-h] - (2-1)2}{-h}$$

$$= \lim_{h \to 0} \frac{(2-h).1 - 2}{-h} \qquad [\because [2-h] = 1]$$

$$= \lim_{h \to 0} \frac{2 - h - 2}{-h} = 1$$

$$Rf'(c) = \lim_{h \to 0} \frac{f(2+h) - f(2)}{h}$$

$$= \lim_{h \to 0} \frac{(2+h-1)(2+h) - (2-1).2}{h}$$

$$= \lim_{h \to 0} \frac{(1+h)(2+h) - 2}{h} = \lim_{h \to 0} \frac{2 + h + 2h + h^2 - 2}{h}$$

$$= \lim_{h \to 0} \frac{3h + h^2}{h} = \lim_{h \to 0} \frac{h(3+h)}{h} = 3$$

$$Lf'(2) \neq Rf'(2)$$

Therefore, f(x) is not differentiable at x = 2.