Put $x=\frac{\pi}{2}-h,$

When $x\to\frac{\pi}{2}$, then $h\to 0$

$$\lim_{x\to\left(\frac{\pi}{2}\right)^-} f(x)=\lim_{h\to 0}\frac{k\cos\left(\frac{\pi}{2}-h\right)}{\pi-2\left(\frac{\pi}{2}-h\right)}$$

$$=\lim_{h\to 0}\frac{k\sin h}{\pi-\pi+2h}=\lim_{h\to 0}\frac{k}{2}\times\left(\frac{\sin h}{h}\right)$$

$$=\frac{k}{2}\times 1=\frac{k}{2}$$

Given that $f\left(\frac{\pi}{2}\right)=3$

The given function is continuous,

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

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

$k=6.$ Ans.

Q. 6. Find the value of k, if function

$$f(x)=\begin{cases} kx+1, & \text{if } x\le\pi \\ \cos x, & \text{if } x>\pi \end{cases}$$

is continuous at $x=\pi$. (NCERT)

Sol. Put $x=\pi+h,$

When $x\to\pi$, then $h\to 0$

$$\lim_{x\to\pi^+} f(x)=\lim_{h\to 0}\cos(\pi+h)$$

$$=\cos(\pi+0)$$

$$=-1.$$

Put $x=\pi-h,$

When $x\to\pi$, then $h\to 0$

$$\lim_{x\to\pi^-} f(x)=\lim_{h\to 0}k(\pi-h)+1$$

$$=k(\pi-0)+1$$

$$=\pi k+1$$

$$f(\pi)=k\pi+1$$