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Course | ENG 281
Dept | Mechatronic Eng
Level | 200

ki $\lim_{x \to \frac{\pi}{2}} \left[\frac{\left[x^2 - \frac{\pi}{4}\right] \sin(\cos x)}{x - \pi/2} \right]$

$= \left[\frac{(2x - 0) \cos(-\sin x)}{1 - 0} \right]$

$= \left[\frac{2 \times \pi/2 \cos(\sin \pi/2)}{1} \right]$

$= \frac{\cancel{2 \times 90}}{} = 3.142$

Using product rule

$\frac{dy}{dx} = \frac{dy}{du} * \frac{dy}{dx}$

where $u = \cos x$

$\frac{u}{v}$ we are looking for $\frac{u'}{v'}$

$u = x^2 \sin(\cos x) - \pi/4 [\cos x]$

Let $w = \cos x$

$\frac{dw}{dx} = -\sin x$

Let $y = \sin w$

$\frac{dy}{dw} = \cos w$

$\frac{dy}{dx} = \frac{dy}{dw} \times \frac{dw}{dx} = \cos w \times -\sin x$

where $w = \cos x$

$= \cos(\cos x)(-\sin x)$

2a

Recall

Product rule : $\frac{dab}{} = a\,db + b\,da$

$a = x^2$

$b = \sin(\cos x)$ $\qquad \frac{dy}{dx} = x^2 \cos x (\cos x)(-\sin x)$

$$\frac{dy}{dx} = x^2 \cos(\cos x)(\sin x) + \sin(\cos x)\, 2x$$

b $\lim_{x \to \frac{\pi}{2}} \ln\left(\exp\frac{(3x^2 + 2x - 1)}{x+1}\right)$

Recall $\exp = \log e = 1$

$\lim \exp\left[\frac{3x^2 + 2x - 1}{x+1}\right] = \frac{3x^2 + 2x - 1}{x+1}$

$\therefore \lim_{x \to \frac{\pi}{2}} = \left[\frac{3x^2 + 2x - 1}{x+1}\right] = \frac{3(\frac{\pi}{2})^2 + 2(\frac{\pi}{2}) - 1}{\frac{\pi}{2} + 1}$

$= 3.712$

c $\lim_{x \to 2+\sqrt{3}} \cos\left[\sin^{-1}\frac{(x-2)}{(x-\sqrt{3})}\right]$

$= \cos\left(\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)$

$= \cos\left(\frac{\pi}{3}\right)$

$= 0.5$

d $\lim_{x \to 4}\left[\frac{x^2 - 8x + 16}{x^2 - 5x + 4}\right]$

$= \frac{4^2 - 8(4) + 16}{4^2 - 5(4) + 4}$

$= \frac{16 - 32 + 16}{16 - 20 + 4} = \frac{0}{0}$ undefined

2. $\frac{2}{2\times3} + \frac{2}{3\times4} + \frac{2}{4\times5} + \frac{2}{5\times6} + \cdots$

$u_n = \frac{x^n}{(n+1)(n)}$ $\quad u_{n+1} \quad \frac{x^{n+1}}{(n+2)(n+1)}$

$\left|\frac{u_{n+1}}{u_n}\right| = \left|\frac{nx}{n+2}\right| = \left|\frac{2}{}\right.$

b $\frac{2}{1^2} + \frac{3}{2^2} + \frac{2}{3^2} + \frac{2}{4^2} + \cdots$

$u_n = \frac{2}{n^2} \quad = 0$

$\frac{2}{(n+1)^2} \cdot n^2 = \frac{2}{1 + \frac{2}{n} + \frac{1}{n^2}} \quad \Rightarrow 1$

$\left(\frac{2}{n^2}\right) < \left(\frac{2}{2^n}\right), \quad n > 2$

$\Rightarrow$ DAT

$\sum_{n=1}^{\infty} \frac{2n}{n+2} \qquad \frac{2}{1+\frac{2}{n}} \cdots 1$

$n=1$

$\sum_{n=1}^{\infty} \frac{2n}{n^2+1} \qquad \frac{(n+1)}{(n+1)^2+1} \qquad \frac{n^2+1}{n}$

$\frac{n^2}{n^3} \cdot \quad = \frac{1}{n}$

c $U_n = \frac{1+2n^2}{1+n^2}$

b $U_n = \frac{1}{n!}$

Prove ~~that~~ $\frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}}$

4. $\lim_{x \to 0} \left[\frac{\sin x - \cos x}{x^3} \right]$

$= \frac{\sin(0) - \cos(0)}{0^3}$

$= \frac{0 - 1}{0^3} = \frac{-1}{0} =$ undefined