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10/ENGG02/032

Computer Engineering

ENG 281

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(1) Evaluate $\lim_{x \rightarrow \pi/2} \left\{ (x^2 - \pi/4) (\sin(\cos x)) \right\}$.

Solution

Applying the product rule for the numerator
 $u \frac{dv}{dx} + v \frac{du}{dx}$

$$u = x^2 - \pi/4 \quad , \quad v = \sin(\cos x)$$

$$a = \cos x \implies v = \sin a$$

$$\frac{da}{dx} = -\sin x \quad ; \quad \frac{dv}{da} = \cos a = \cos(\cos x)$$

$$\frac{dv}{dx} \times \frac{da}{dx} = \frac{dv}{da} = -\sin x \cdot \cos(\cos x)$$

$$\frac{dv}{dx} = -\sin x \cdot \cos(\cos x)$$

$$\therefore \lim_{x \rightarrow \pi/2} \left\{ (x^2 - \pi/4) (-\sin x \cdot \cos(\cos x)) + \sin(\cos x) (2x) \right\}$$

$$= \left(\frac{\pi}{2} \right)^2 - \frac{\pi}{4} \times -\sin 90 \cos(\cos 90) + \sin(\cos 90) \times 2 \left(\frac{\pi}{2} \right)$$

$$= \left\{ \left(\frac{\pi^2}{4} - \frac{\pi}{4} \right) \times -1 \right\} + \left\{ 0 \times \pi \right\}$$

$$= -\frac{\pi^2}{4} + \frac{\pi}{4}$$

$$= \frac{-\pi(\pi-1)}{4}$$

Q) Evaluate $\lim_{x \rightarrow \pi/2} \ln \left\{ \frac{\exp(3x^2 + 2x - 1)}{x+1} \right\}$.

Solution

\therefore factorizing $3x^2 + 2x - 1$
 $= (3x-1)(x+1)$.

$$\frac{\exp(3x^2 + 2x - 1)}{(x+1)} = \frac{\exp(3x-1)(x+1)}{(x+1)}$$

$$= \exp(3x-1)$$

$$\rightarrow \lim_{x \rightarrow \pi/2} \ln \left\{ \exp(3x-1) \right\}$$

$$\lim_{x \rightarrow \pi/2} \ln \left\{ \exp(3(\pi/2) - 1) \right\}$$

$$= \ln(40.9515) = 3.7124$$