# Answere to the Question No- 1

## (a)

$$\lim_{x\to 2} \frac{x^2-4}{x-2}$$

$$= \lim_{x\to 2} \frac{x^2-2^2}{x-2}$$

$$= \lim_{x\to 2} \frac{(x+2)(x-2)}{(x-2)}$$

$$= \lim_{x\to 2} (x+2)$$

$$= 2+2$$

$$= 4 \quad \text{(Ans.)}$$

## (b)

$$\lim_{x\to 0} \frac{1-\cos x}{x^2}$$

$$= \lim_{x\to 0} \frac{2\sin^2 x/2}{x^2}$$

$$= \cancel{\lim_{x\to 0}}\ 2 \cdot \lim_{\frac{x}{2}\to 0} \left(\frac{\sin x/2}{x/2}\right)^2 \cdot \frac{1}{4}$$

$$= 2 \cdot 1^2 \cdot \frac{1}{4}$$

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

(Ans.)

## Answer to the Question. No. 2

$$\lim_{x \to 0} \frac{\sqrt{x+9} - 3}{x} = \frac{1}{a}$$

$$\Rightarrow \lim_{x \to 0} \frac{\left(\sqrt{x+9} - 3\right)\left(\sqrt{x+9} + 3\right)}{x\left(\sqrt{x+9} + 3\right)} = \frac{1}{a}$$

$$\Rightarrow \lim_{x \to 0} \frac{\left(\sqrt{x+9}\right)^2 - 3^2}{x\left(\sqrt{x+9} + 3\right)} = \frac{1}{a}$$

$$\Rightarrow \lim_{x \to 0} \frac{x + 9 - 9}{x\left(\sqrt{x+9} + 3\right)} = \frac{1}{a}$$

$$\Rightarrow \lim_{x \to 0} \frac{x}{x\left(\sqrt{x+9} + 3\right)} = \frac{1}{a}$$

$$\Rightarrow \lim_{x \to 0} \frac{1}{\sqrt{x+9} + 3} = \frac{1}{a}$$

$$\Rightarrow \frac{1}{\sqrt{0+9} + 3} = \frac{1}{a}$$

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

$$\Rightarrow \frac{1}{6} = \frac{1}{a}$$

$\therefore$ $a = 6$ (Ans.)

## Answer to the Question No. 3

$$\lim_{k\to\infty} \frac{(43+k^2)(3+k)(10^{19}-k^2)}{k^5}$$

$$= \lim_{k\to\infty} \frac{(129+3k^2+43k+k^3)(10^{19}-k^2)}{k^5}$$

$$= \lim_{k\to\infty} \frac{129\times10^{19}+3\times10^{19}k^2+43\times10^{19}k+10^{19}k^3-129k^2-3k^4-43k^3-k^5}{k^5}$$

$$= \lim_{k\to\infty} \frac{k^5\left(\frac{129\times10^{19}}{k^5}+\frac{3\times10^{19}}{k^3}+\frac{43\times10^{19}}{k^4}+\frac{10^{19}}{k^2}-\frac{129}{k^3}-\frac{3}{k}-\frac{43}{k^2}-1\right)}{k^5}$$

$$= \lim_{k\to\infty} \left(\frac{129\times10^{19}}{k^5}+\frac{3\times10^{19}}{k^3}+\frac{43\times10^{19}}{k^4}+\frac{10^{19}}{k^2}-\frac{129}{k^3}-\frac{3}{k}-\frac{43}{k^2}-1\right)$$

$$= \frac{129\times 10^{19}}{\infty^5} + \frac{3\times 10^{19}}{\infty^3} + \frac{43\times 10^{19}}{\infty^4} + \frac{10^{19}}{\infty^2}$$

$$- \frac{129}{\infty^3} - \frac{3}{\infty} - \frac{43}{\infty^2} - 1$$

$$= 0 + 0 + 0 + 0 - 0 - 0 - 0 - 1$$

$$= -1$$ (Ans.)

## Answer to the Question No. 4

$$\lim_{x\to -1} \frac{x^3 - x^2 - 5x - 3}{x^3 + 6x^2 + 9x + 4} = -\frac{4}{a}$$

$$\Rightarrow \lim_{x\to -1} \frac{3x^2 - 2x - 5 - 0}{3x^2 + 12x + 9 + 0} = -\frac{4}{a}$$

$$\Rightarrow \lim_{x\to -1} \frac{6x - 2 - 0}{6x + 12 + 0} = -\frac{4}{a}$$

$$\Rightarrow \frac{6(-1)-2}{6(-1)+12} = -\frac{4}{a}$$

$$\Rightarrow \frac{-6-2}{-6+12} = \frac{-4}{a}$$

$$\Rightarrow \frac{-8}{6} = \frac{-4}{a}$$

$$\Rightarrow \frac{4}{3} = \frac{4}{a}$$

$$\Rightarrow \frac{1}{3} = \frac{1}{a}$$

$$\therefore a = 3$$

(Ans.)

## Answere to the Question No. 5

$$\lim_{x \to -\infty} \frac{1+3e^{x}}{1+e^{x}}$$

$$= \frac{1+3e^{-\infty}}{1+e^{-\infty}}$$

$$= \frac{1+\frac{3}{e^{\infty}}}{1+\frac{1}{e^{\infty}}}$$

$$= \frac{1+0}{1+0}$$

$$= 1 \quad \text{(Showed.)}$$

Again,

$$\lim_{x \to \infty} \frac{1+3e^{x}}{1+e^{x}}$$

$$= \cancel{\lim_{x \to \infty}} \frac{1+3e^{\infty}}{1+e^{\infty}}$$

$$= \frac{\frac{1}{e^{\infty}}+\frac{3e^{\infty}}{e^{\infty}}}{\frac{1}{e^{\infty}}+\frac{e^{\infty}}{e^{\infty}}}$$

$$= \frac{\frac{1}{e^{\infty}} + 3}{\frac{1}{e^{\infty}} + 1}$$

$$= 3$$

(Showed.)