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Course code - MC1020

Assignment 4

2021/E/084

01) $N = 0$

a) $x_{n+1} = 0 - \sqrt{0 - x_n} = -\sqrt{-x_n}$

$n = 1$

$x_2 = -\sqrt{-x_1}$

$x_2 = -\sqrt{-(0)^2}$

$= 0$

$n = 2$

$x_3 = -\sqrt{-x_2}$

$x_3 = 0$

02) a) $-1 \le \cos n \le 1$

$-1 \times -1 \le \cos n \times -1 \le 1 \times -1$

$2+1 \ge 2-\cos n \ge 2-1$

$\frac{1}{n+3} \le \frac{2-\cos n}{n+3} \le \frac{3}{n+3}$

$\lim_{n\to\infty} \frac{1}{n+3} \le \lim_{n\to\infty} \frac{2-\cos n}{n+3} \le \lim_{n\to 0} \frac{3}{n+3}$

$0 \le \lim_{n\to\infty} \frac{2-6\cos n}{n+3} \le 0$

$\therefore \lim_{n\to\infty} \frac{2-\cos n}{n+3} = 0$

b) $-2 \le \sin n + \cos^3 n \le 2$

$\frac{-2n^2}{(n^2+1)(n-3)} \le \frac{n^2(\sin n+\cos^3 n)}{(n^2+1)(n-3)} \le \frac{2n^2}{(n^2+1)(n-3)}$

$\lim_{n\to\infty} \frac{-2n^2}{(n^2+1)(n-3)} \le \lim_{n\to-\infty} \frac{n^2(\sin n+\cos^3 n)}{(n^2+1)(n-3)} \le \lim_{n\to 0} \frac{2n^2}{(n^2+1)(n-3)}$

$\lim_{n\to-\infty} \frac{-\frac{2}{n}}{(1+\frac{1}{n})(1-\frac{3}{n^2})} \le \lim_{n\to-\infty} \frac{n^2(\sin n+\cos^3 n)}{(n^2+1)(n-3)} \le \lim_{n\to 0} \frac{\frac{2}{n}}{(1+\frac{1}{n^2})(1-\frac{3}{n})}$

$0 \le \lim_{n\to-\infty} \frac{n^2(\sin n+\cos^3 n)}{(n^2+1)(n-3)} \le 0$

$\therefore \lim_{n\to-\infty} \frac{n^2(\sin n+\cos^3 n)}{(n^2+1)(n-3)} = 0$