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Quiz 9

This quiz is graded out of 10 marks. No books, calculators, notes or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

Question 1. *(2 marks)* §8.1 #6 Find a formula for the general term a_n of the sequence, assuming that the pattern of the first few terms continues.

$$\left\{ -\frac{1}{4}, \frac{2}{9}, -\frac{3}{16}, \frac{4}{25}, \dots \right\} \qquad a_n = (-1)^n \frac{n}{(n+1)^2}$$

Question 2. *(4 marks)* §8.1 #26 Determine whether the sequence converges or diverges. If it converges, find the limit.

$$a_n = \frac{(\ln n)^2}{n} \qquad \text{let} \quad f(x) = \frac{(\ln x)^2}{x} \quad \text{where} \quad x \in \mathbb{R}^+$$

$$\lim_{x \to \infty} \frac{(\ln x)^2}{x} \qquad \text{i.f.} \ \frac{\infty}{\infty} \qquad \Rightarrow = \lim_{x \to \infty} \frac{\frac{2}{x}}{1} \ \text{by } \hat{H}$$

$$= \lim_{x \to \infty} \frac{2 \ln x \left(\frac{1}{x}\right)}{1} \ \text{by } \hat{H} \qquad \qquad = 0$$

$$= \lim_{x \to \infty} \frac{2 \ln x}{x} \qquad \text{i.f.} \ \frac{\infty}{\infty}$$

Question 3. *(4 marks)* §8.1 #24 Determine whether the sequence converges or diverges. If it converges, find the limit.

$$a_n = \frac{\sin 2n}{1 + \sqrt{n}}$$

$$b_n = \frac{-1}{\sqrt{n}} \le \frac{-1}{1+\sqrt{n}} \le \frac{\sin 2n}{1+\sqrt{n}} \le \frac{1}{1+\sqrt{n}} \le \frac{1}{\sqrt{n}} = C_n$$

$$\lim_{n \to \infty} b_n = \lim_{n \to \infty} C_n = 0$$

$$\therefore \text{ by squeeze thm. } \lim_{n \to \infty} a_n = 0$$

Question 4. *(5 marks)* Set up the integral to find the volume of the solid obtained from the region in the first quadrant bounded by the graphs of $y = \cos x$, $y = \frac{4x}{\pi\sqrt{2}}$ and $x = 0$ rotated about the line $x = \frac{\pi}{4}$.

see test #2.