**First Mid Term Exam 201 Math Math. Department. First term ( 1434-1435 ) Duration : 2 Hours \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 **Question One [ 6 marks ]**

**1. Determine whether the following sequence is increasing, decreasing, or not monotonic.**

**Is the sequence bounded?** $a\_{n}=n+ \frac{1}{n}$ **.**

**2. Determine whether the following sequence converges or diverges. If it converges, find the limit.** $\left\{\frac{ln n}{ln 2n}\right\}\_{n=1}^{\infty }$

**3. Find a formula for the general term** $a\_{n}$ **of the following sequence, assuming that the pattern of the first few terms continues.** $\left\{1 ,-\frac{2}{3}, \frac{4}{9}, -\frac{8}{27}, …\right\}$

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**Question Two [ 6 marks ]**

**1. Find the radius of convergence and interval of convergence of the following series.**

$\sum\_{n=1}^{\infty }\left(-1\right)^{n} \frac{\left(x+2\right)^{n}}{n 2^{n}}$

**2. Find the power series representation for the function** $f\left(x\right)=ln (3+x)$ **and the radius of convergence.**

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**Question Three [ 8 marks ]**

**a) Test the following series for convergence or divergence**

**1.** $\sum\_{n=1}^{\infty }( \sqrt[n]{2} -1 )$ **“ by using the Limit Comparison test”**

**2.** $\sum\_{n=1}^{\infty }( \frac{n}{n+1} )^{n^{2}}$ **“ by using the** $n^{th}$ **Root test”**

**3.** $\sum\_{n=1}^{\infty }\frac{sin (\frac{1}{n} )}{\sqrt{n}}$ **“ by using the Limit Comparison test”**

**b) Use the integral test to determine whether the series is convergent or divergent.**

$\sum\_{n= 2}^{\infty }\frac{1}{n^{2}-4n + 5}$

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