

University of Guyana  
Faculty of Technology

EMT 121 - PROBLEM SET IV

March 7, 2011

1. A certain ball rebounds to half the height from which it is dropped. Use an infinite geometric series to approximate the total distance the ball travels, after being dropped from 1m above the ground, until it comes to rest.
2. The midpoints of the sides of a square of side 1m are joined to form a new square. The procedure is repeated for each new square.
  - (a) Find the sum of the areas of all the squares.
  - (b) Find the sum of the perimeters of all the squares.
3. A truck radiator holds 5 gal and is filled with water. A gallon of water is removed from the radiator and replaced with a gallon of antifreeze; then, a gallon of the mixture is removed from the radiator and again replaced by a gallon of antifreeze. This process is repeated indefinitely. How much water remains in the tank after this process is repeated 3 times? 5 times?  $n$  times?
4. A certain type of bacteria divides every 5 s. If three of these bacteria are put into a petri dish, how many bacteria are in the dish at the end of 1 min?
5. Use the Binomial Theorem to expand  $(\sqrt{x} - 1)^8$ .
6. Find the term that contains  $x^5$  in the expansion of  $(2x + y)^{20}$ .
7. Find the coefficient of  $x^8$  in the expansion of  $(x^2 + \frac{1}{x})^{10}$ .
8. Determine if  $\sum_{k=1}^{\infty} \frac{1}{(K + 2)(k + 3)}$  converges or diverges. If it converges find the sum.
9. Test for convergence or divergence using any appropriate test. Identify the test used.

(a)  $\sum_{n=1}^{\infty} \frac{2n}{n+1}$

(b)  $\sum_{n=1}^{\infty} \frac{1}{n}$

(c)  $\sum_{n=0}^{\infty} \left(\frac{5}{4}\right)^n$

(d)  $\sum_{n=1}^{\infty} \frac{1}{n\sqrt[3]{n}}$

10. Find the radius of convergence for the given series.

(a)  $\sum_{n=0}^{\infty} \left(\frac{x}{2}\right)^n$

(b)  $\sum_{n=1}^{\infty} \frac{(-1)^n x^n}{3n}$

11. Find the power series for  $f(x) = e^{2x}$  centered at 0.

12. Find the Maclaurin series for  $f(x) = \frac{1}{x+1}$ .

13. Find the power series for  $f(x) = e^{x^3}$

14. Find the Maclaurin expansion for  $\cos x$  .