

① Mathematics I BSCIT Sem 3  
Assignment 1 & 2

① Find the domain and range of the following functions:

a)  $y = \sqrt{16 - y^2}$     b)  $f(x) = \sqrt{x-5}$     c)  $g(x) = \frac{2x+1}{x-3}$

② If  $f$  and  $g$  are even functions, prove that  $f+g$  is also even function.

③ A mobile phone plan has a basic charge of \$40 a month. This plan has 300 free minutes and charges 15 cents for additional minutes if the call time is more than 300 free minutes. Write the monthly cost  $C$  as a function of number of minutes used as  $m$ . Find the monthly costs for 200 and 500 minutes call time.

④ A function defined by

$$f(x) = \begin{cases} 2-x & \text{if } x \leq -2 \\ x^2 & \text{if } x > -2 \end{cases}$$

Evaluate  $f(-2)$ ,  $f(-1)$ ,  $f(3)$ ,  $f(4)$  and sketch the graph.

⑤ In New York state, the maximum speed permitted on freeways is 85 km/h and the minimum speed is 50 km/h. The fine for violating this limit is \$25 for every km/h above the maximum and below the minimum speeds. Write the amount of the fine  $F$  as a function of driving speed  $S$ . Also, find the fine amount if driven at 100 km/h.

⑥ The number of death due to high concentration of sulfur dioxide is 97 per week when the  $SO_2$  concentration is 100  $mg/m^3$  and 110 death when the concentration is 200  $mg/m^3$ .

a) Write a linear model between number of death and  $SO_2$  concentration.

b) Find the death number per week when  $SO_2$  is 300  $mg/m^3$ .

c) Interpret the slope coefficient of the model.

⑦ Functions are defined as  $f(x) = \sqrt{x}$  and  $g(x) = \sqrt{2-x}$ . Find the functions  $(f+g)$ ,  $(f-g)$ ,  $(f \cdot g)$  and  $\frac{f}{g}$ . Also find their domain.

⑧ Find  $f \circ g$ ,  $g \circ f$ ,  $f \circ f$  and  $g \circ g$  and state their domain.

a)  $f(x) = \sqrt{x}$ ;  $g(x) = \sqrt{1-x}$     b)  $f(x) = x + \frac{1}{x}$ ;  $g(x) = \frac{x+1}{x+2}$

c)  $f(x) = \sqrt{x+1}$ ;  $g(x) = \frac{1}{x}$     d)  $f(x) = x^2$ ;  $g(x) = 1 - \sqrt{x}$

ch 2

① Show that  $\lim_{x \rightarrow 0} \frac{x!}{x}$  does not exist. (Imp)

② Show that  $\lim_{x \rightarrow 0} x \sin\left(\frac{1}{x}\right)$  exists. (Imp)

③ Prove that  $\lim_{x \rightarrow 2} \frac{k-2}{x-2}$  does not exist.

- (1) find  $\delta$  such that  $|x-9| < \delta$  implies  $|f(x)-3| < 0.4$ .
- (5) Find the limit, if it exists
- (a)  $\lim_{x \rightarrow 6} \frac{2x+12}{|x+6|}$  (b)  $\lim_{x \rightarrow -2} \frac{2+|x|}{2+x}$
- (c)  $\lim_{x \rightarrow \infty} \left( \frac{x^2+x}{3-x} \right)$  (d)  $\lim_{x \rightarrow -\infty} \frac{1-x-x^2}{2x^2-7}$
- (6) Prove the following statements using  $\epsilon$ - $\delta$  definition of limit
- (a)  $\lim_{x \rightarrow 2} \frac{x^2+x-6}{x-2} = 5$  (b)  $\lim_{x \rightarrow 2} (x^2-1) = 3$  (c)  $\lim_{x \rightarrow 2} x^3 = 8$
- (7) For the limit  $\lim_{x \rightarrow 2} (x^3-3x+4) = 6$ , illustrate the precise definition of limit by finding the values of  $\delta$  that correspond to  $\epsilon = 0.2$  and  $\epsilon = 0.1$ .
- (8) Prove that  $f(x) = \begin{cases} x^2+3x & \text{for } x < 0 \\ 5x+1 & \text{for } x \geq 0 \end{cases}$  has jump discontinuity at  $x=0$ .
- (9) Show that  $f(x) = \frac{\ln x + \tan^{-1} x}{x^2-1}$  is continuous in some interval.
- (10) Evaluate the function  $\lim_{x \rightarrow 1} \arcsin\left(\frac{1-\sqrt{x}}{1-x}\right)$  using properties of continuous function.
- (11) Show that (a)  $f(x) = \sqrt{4-x^2}$  is continuous on  $[-2, 2]$   
(b)  $f(x) = 5 - \sqrt{9-x^2}$  is continuous on  $[-3, 3]$ .
- (12) Find the horizontal and vertical asymptotes, (if exists).
- (a)  $y = \frac{2x+1}{x-2}$  (b)  $y = \frac{1+x^7}{x^2-x^4}$  (c)  $y = \frac{1}{x+2}$
- (13) Show that  $x = \frac{\pi}{2}$  is a vertical asymptote of the curve  $f(x) = \tan x$ .