142

B.Sc. Engg. SWE 1st Semester 13 March 2018 (Afternoon)

# ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
## ORGANISATION OF ISLAMIC COOPERATION (OIC)
## Department of Computer Science and Engineering (CSE)

**MID SEMESTER EXAMINATION** **WINTER SEMESTER, 2017-2018**

**DURATION: 1 Hour 30 Minutes** **FULL MARKS: 100**

## Math 4141: Geometry and Differential Calculus

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Find the domain and range of the following functions 12

i. $f(x)=\sqrt{x^2-11x+30}$ ii. $g(x)=\sec x$ iii. $F(x)=\dfrac{x-3}{|x-3|}$ iv. $h(x)=\sin^{-1}x$

b) Express the function $f(x)=x+|x+1|$ in piecewise form and graph the function. 8

c) Graph the function $f(x)=3\sin\dfrac{\pi}{2}x+1$ using period and amplitude and write their domain and range. 7

d) Find the inverse of the function $f(x)=\ln(x-3)+1$ and graph the $f$ and $f^{-1}$ in the same plane. 6.33

2. a) Write down the precise definition of limit. Using formal definition of limit prove that $\lim_{x\to 2}\sqrt{9x-2}=4$. 8

b) Find the Limit of the following functions: 16

i. $\lim_{x\to 2^+}\dfrac{1}{|2-x|}$ ii. $\lim_{x\to 0}\dfrac{\tan 3x^2+\sin^2 5x}{x^2}$

iii. $\lim_{t\to+\infty}\dfrac{6-t^3}{7t^4+3}$ iv. $\lim_{x\to-\infty}\dfrac{1-e^x}{1+e^x}$

c) Discuss the Limit and Continuity of the following function at, $x=3$ 9.33

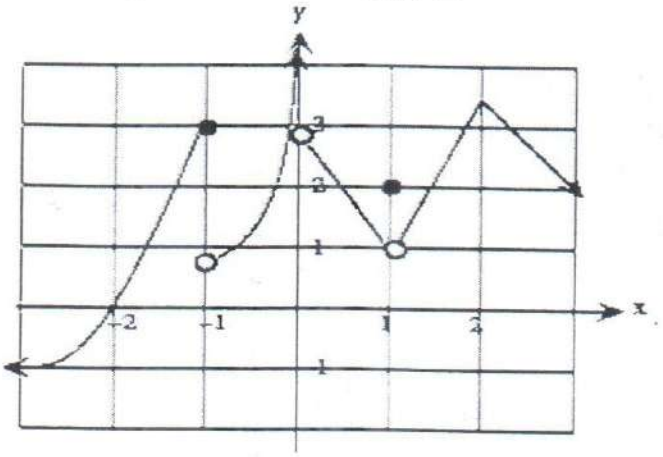
$$f(x)=\begin{cases}4-x^2 & x<3\\ 6 & x=3\\ x-8 & x>3\end{cases}$$

and draw the graph.

3. a) State Sandwich theorem and using this theorem show that 13.33

i. $\lim_{x\to 0}\frac{\sin x}{x}=1$ ii. $\lim_{x\to 0} x^2\sin\frac{1}{x}=0$

b) Whether the following function $f$ graphed is continuous on [-3, 3] or not. If not where does it fail to be continuous and why? What is the $\lim_{x\to 1} f(x)$? 8




c) Use Limit to determine for all horizontal and oblique asymptotes from following equations: 12

i. $F(x)=\frac{x^3-2}{|x|^3+1}$ ii. $h(x)=\frac{x^2-4}{x-1}$

4. a) Find the tangent line to the curve $f(x)=\sqrt{x-1}+2$ at $x=3$. 8

b) At what points do the graph of the function $g(x)=x^2-7x+12$ have horizontal tangent line and show in your graph. 10

c) The power P, in Watts, supplied to a circuit by a battery is given by the formula $P=6I-0.5I^2$ where I is the current in amperes. 10

i. What is the average rate of change of power when current is 1 to 4 amperes?

ii. What is the approximate instantaneous rate of change of power when current is 4 amperes?

d) Show that $f(x)=|2x+1|$ continuous everywhere. 5.33