

KABARAK



UNIVERSITY

**UNIVERSITY EXAMINATIONS
2009/2010 ACADEMIC YEAR
FOR THE CERTIFICATE OF PRE – UNIVERSITY
MATHEMATICS**

COURSE CODE: PMATH 022

COURSE TITLE: BASIC CALCULUS

STREAM: SEMESTER TWO

DAY: THURSDAY

TIME: 9.00 – 11.00 A.M.

DATE: 18/03/2010

INSTRUCTIONS:

Attempt **Question One** and **any other two** questions.

PLEASE TURN OVER

QUESTION ONE - COMPULSORY (30 MARKS)

- a) Given $f(x)=x^2+2x+1$; evaluate f at the input values
- i. 1 (2 mks)
 - ii. $x+1$ (3 mks)
 - iii. $f(1)$ (3 mks)
- b) Let $f(x)=x^3+2x^2-4x$ and $g(x)=x-2$. Find:
- i. $f(x)+g(x)$ (3 mks)
 - ii. $f(x)g(x)$ (2 mks)
 - iii. $\frac{f(x)}{g(x)}$ (3 mks)
- c) Using the first principle method differentiate the following functions:
- i. $y=2x+4$ (3 mks)
 - ii. $y=2x^2+5$ (3 mks)
 - iii. $y=\frac{1}{x^2}$ (3 mks)
 - iv. $y=\sqrt{x-2}$ (3 mks)
- d) Evaluate the following limit: $\lim_{x \rightarrow 0} \frac{x^2 + x}{x}$ (2 mks)

QUESTION TWO (20 MARKS)

- a) Define limit. (2 mks)
- b) Using the definition of limits, verify the following limits:
- i. $\lim_{x \rightarrow 2} 5x - 7 = 3$ (3 mks)
 - ii. $\lim_{x \rightarrow 3} 8 - 2x = 2$ (3 mks)
- c) Evaluate the following limits:
- i. $\lim_{x \rightarrow 2} \frac{x^2 - 7x + 10}{x^2 - 4}$ (3 mks)
 - ii. $\lim_{x \rightarrow 2} \frac{(x-4)^3}{|4-x|}$ (3 mks)
- d) Differentiate the following functions:
- i. $y = \frac{(3x-6)}{(x^2+2)}$ (3 mks)

ii. $f(x) = x^2(2 + 2x^{-4})$ (3 mks)

QUESTION THREE (20 MARKS)

- a) i. Find the equation of the line that passes through the point (5,1) and whose slope is equal to $\frac{1}{2}$. (3 mks)
 ii. Given L being the line $4x+3y=6$. Find the equation of the line L_2 perpendicular to L through Q(2,-3). (3 mks)

b) Integrate $\frac{dy}{dx} = 2x^3 + 3x^5$ (3 mks)

c) Find the equations of the tangent and normal to $y=x^3-2x^2+6$ at (1,4). (4 mks)

d) Differentiate:

i. $y = \frac{(2x^2 + 3x)}{(x+1)^2}$ (4 mks)

ii. $x = \sqrt{y} - 10$ (2 mks)

iii. $y = 2x^{5/2} + x^{3/2} + 4$ (1 mk)

QUESTION FOUR (20 MARKS)

a) An object moves along a line in such a way that its position at time t is:

$$S(t) = t^3 - 6t^2 + 9t + 5$$

- i. Find the velocity and acceleration of the object at time t at t=1 sec. and t=2 seconds. (5 mks)
 ii. When is the object stationary? (3 mks)

b) Integrate the following function:

$$\int_1^2 (2x^3 + x) dx$$
 (3 mks)

c) Given $y=2x^2-6x$

- i. Find the critical points. (2 mks)
 ii. Maximum and minimum values of y. (3 mks)

d) Differentiate and find gradient at the point given:

i. $f(x)=2x^2+4x+6$ at point (1,2) (2 mks)

ii. $f(x)=x^3+2x^2+x+5$ at point (2,4) (2 mks)

QUESTION FIVE (20 MARKS)

a) Differentiate

i. $y = \frac{(2x^2 + 1)^2}{x + 1}$ (3 mks)

ii. $y = \sqrt{x^2 + 2x}$ (3 mks)

iii. $y = (2x^2 + x + 1)(x + 1)^5$ (4 mks)

b) Using the definition of limits, verify the following limit:

$$\lim_{x \rightarrow 0} 3x \sin \frac{1}{x} = 0 \quad (4 \text{ mks})$$

c) Given the function $y = 2x^3 + 2x + 4$, find the gradient of the curve at a point (1,6). (2 mks)

d) Given the curve $y = x^2 - 4$, find the area under the curve bounded by the curve and x-axis.

e) Differentiate

i. $y = \frac{(2x^2 + 1)^2}{x + 1}$ (3 mks)

ii. $x^2 + xy^2 + y^2 + 4 = 0$ (5 mks)