CHUKA   **UNIVERSITY**

RESIT/ SPECIAL EXAMINATIONS

**EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF SCIENCE (ECONOMICS AND STATISTICS), BACHELOR OF
SCIENCE (GENERAL) AND BACHELOR OF EDUCATION (ARTS AND SCIENCE)**

MATH 121: CALCULUS I

STREAMS: **TIME: 2 HOURS**

DAY/DATE: MONDYA 23/07/2018   **11.30 AM – 1.30 PM**

INSTRUCTIONS:

- **Answer ALL questions**
- **Adhere to the instructions on the answer booklet.**

QUESTION ONE

a). Determine the domain of the function $f(x) = \sqrt{x^2 - x - 12}$

3mks

b). Evaluate the following limits:

i. $\lim\limits_{x \to 4} \dfrac{x^2 - 2x - 8}{x - 4}$

3mks.

ii. $\lim\limits_{x \to \infty} \dfrac{x^3}{(x + 4)(2x^2 + 1)}$

3mks.

c). Given that $y = f(x) = \dfrac{1}{x^2 + 1}$, find $\dfrac{dy}{dx}$ from first principles.

4mks.

d). Find the equations of lines tangent to the curve $y^2 - 6x^2 + 4y + 1 = 0$.
at the point (2, 1).

5mks

e). Differentiate the curve $y = x^x$ at the point x = 1

4mks.

f). Given that $x = \sin^2 \theta$, and $y = \cos^3 \theta$, evaluate $\dfrac{dy}{dx} + \dfrac{3}{2} y^{\frac{1}{3}}$

5mks

g). Show that the $f(x)=x^3-2x^2+2x-4$ has a zero in the interval $[0,3]$ 3mks

h). Evaluate the derivative of $y=\cot\sqrt{x-1}$ 4mks.

QUESTION TWO

a). Show that the points of intersection of the two graphs $y^2=4x$ and $y^2+2x^2=6$ are orthogonal   5mks

b). Evaluate $\lim\limits_{x\to 0}\dfrac{\sin 2x}{\sin 3x}$ 4mks

c). The finance department in a company that produces an automatic camera established that the profit p(x) is given by p(x) = -5x² + 80x – 156, find the number of cameras that must be sold in order to maximize profits and find the maximum profits.   4mks

d). Differentiate the following functions

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

(ii) $x^2+y^2=1$ 4mks

QUESTION THREE

a). Differentiate the curve $y=2^{3x}$ at the point x = 1   4mks.

b). Given that $y=\sin^{-1}(3x)$, find $\dfrac{dy}{dx}$ 4mks

c). A spherical balloon is being blown up so that its volume increases at the rate of 1.5cm³ per second. Find the rate at which the radius increases when the volume of the balloon is 56cm³

5mks

d). Sketch the graph with the following characteristics

$f(0)=f(2)=0,\quad f(x)<0\ if\ x<1, f'(1)=0,\quad f'(x)>0\ \ if\ \ x>1,\ f''(x)>0$

4mks

e). Using $y=\sqrt{2}$, estimate the value of $\sqrt{101}$ 3mks

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