

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BED SCIENCE,
BSC CHEMISTRY, BSC BIOLOGY.

MATH 101: FOUNDATION MATHEMATICS

STREAMS: AS ABOVE

TIME: 2 HOURS

DAY/DATE: MONDAY 14/12/2020

2.30 P.M - 4.30 P.M.

INSTRUCTIONS:

- ❖ Answer question **ONE(COMPULSORY)** and **TWO** other questions.
- ❖ Sketch maps and diagrams may be used whenever they help to illustrate your answer.
- ❖ **Do not** write on the question paper.
- ❖ This is a **closed book exam**, No reference materials are allowed in the examination room.
- ❖ There will be **No** use of mobile phones or any other unauthorized materials.
- ❖ Write your answers legibly and use your time wisely.

QUESTION ONE: (30 MARKS)

(a) Solve the following equation $\frac{1}{3}(3m - 6) + \frac{1}{4}(5m + 4) + \frac{1}{5}(2m - 9) = -3$ (2 marks)

(b) Simplify : $\frac{9x^2-1}{3x^2+2x-1}$ (2 marks)

(c) Find the standard deviation of the following data (3 marks)
15, 11,8,12,10,8,11,15

(d) Find $\frac{dy}{dx}$ for $y = \sqrt{x} + \frac{2}{x^2}$ (2 marks)

(e) Divide $6x^2 - 26x + 12$ by $x - 4$. (3 marks)

(f) Express $\log\left(\frac{x^3y^2}{\sqrt{z^3}}\right)$ in terms of m , n and p given that $\log x = m$, $\log y = n$ and $\log z = p$. (2 marks)

(g) Evaluate $\frac{\sqrt{14}}{\sqrt{7}-\sqrt{2}} - \frac{\sqrt{14}}{\sqrt{7}+\sqrt{2}}$ by rationalizing the denominator (3 marks)

(h) Work out $\int \left(\frac{2x^3-3x}{4x}\right)dx$ (3 marks)

(i) Combine $3 \ln s + \frac{1}{2} \ln t - 4 \ln(t^2 + 1)$ into a single logarithm (2 marks)

(j) Determine the 19th term of an AP given that the 6th term is 17 and the 13th term is 38. (3 marks)

(k) Work out ${}^4P_2 (5 + 3x) \binom{5}{2} = 1140$ (2 marks)

(l) Determine the coordinates of the centre and the radius of the circle given by the equation $x^2 + y^2 + 8x - 2y + 8 = 0$ (3 marks)

QUESTION TWO: (20 MARKS)

(a) Using the first principle, differentiate $y = x^2 + 5$ (4 marks)

(b) The expression $x^3 + kx^2 - 2x - 4$, is divisible by $(x + 1)$

(i) Find the value of k (3 marks)

(ii) Use the long division method to confirm this result. Hence, solve the equation

$$x^3 + kx^2 - 2x - 4 = 0 \text{ (with the value of } k \text{ in (i) above).} \quad (5 \text{ marks})$$

(c) A line Q passes through point (3, 1) and is perpendicular to the line $2y = 4x + 5$. Determine the equation of the line Q. (2 marks)

(d) Solve $2x^2 + 5x = 3$ by completing the square method. (3 marks)

(e) Given the polynomial, $P(x) = 2x^3 - 3x^2 - 7x - 6$. Find (3 marks)

- (i) $P(-1)$
- (ii) $P(3)$
- (iii) $P(1)$

QUESTION THREE: (20 MARKS)

(a) Evaluate $\int_{-2}^3 (4 - x^2) dx$ (3 marks)

(b) Work out the derivative of $y = \frac{2}{5}x^3 - \frac{4}{x^3} + \sqrt[4]{x^5} + 7$ (3 marks)

(c) (i) Find the equation of the tangent and normal to the curve $y = \frac{4}{x}$ at $x = 1$. (5 marks)

(iii) Find and classify the turning points of the curve represented by $y = x^3 + 3x^2 - 9x - 4$ (6 marks)

(iv) Hence sketch the curve $y = x^3 + 3x^2 - 9x - 4$ (3 marks)

QUESTION FOUR: (20 MARKS)

(a) The data below represent masses to the nearest kilogram of fish caught in a day.

Masses	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29
No. of fish	5	20	10	10	5

Determine:

- (i) Mode (1 mark)
- (ii) Mean (3 marks)
- (iii) Median (3 marks)
- (iv) Standard deviation (3 marks)
- (v) 80th Percentile (3 marks)
- (vi) Semi – interquartile range (3 marks)

(b) A batch of 40 components contains 5 which are defective. If a component is drawn at random from the batch and tested and then a second is drawn at random, calculate the probability of having one defective component, both:

(i) With replacement (2 marks)

(ii) Without replacement (2 marks)

QUESTION FIVE: (20 MARKS)

(a) Solve the following equation $\log_2(x + 3) - 3 = \log_2(x - 5)$ (2 marks)

(b) The angle of depression of a ship viewed at a particular instant from the top of a 75m vertical cliff is 30° . Find the distance of the ship from instant and after 1 minute if its angle of depression of its new position is 20° . (3 marks)

(c) Differentiate the following using the indicated technique $y = (4x - 1)^3$ (chain rule) (3 marks)

(d) Find the gradient of the curve $y = \frac{x^2+2}{x-5}$, at the point $x = 1$ (3 marks)

(e) Simplify $(a^3)(\sqrt{b})(\sqrt{c^5})(\sqrt{a^3})(\sqrt{b^2})(c^3)$ and hence evaluate where $a = \frac{1}{4}$, $b = 6$ and $c = 1$ (3 marks)

(f) Factorize the expression $3x^2 + 5x + 0.75$ (3 marks)

(g) If $f(x) = ax + \frac{b}{x}$ and if $f(2) = 9$ and $f(3) = 16$, evaluate a, b and find the value of x which $f(x) = 0$ (3 mks)

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