TEVETA

Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY

LEVEL 6 - YEAR II EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATIONS

SITTING: NOVEMBER DECEMBER 2025

SUBJECT: APPLIED MATHEMATICS AND CALCULUS

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

1. Write your examination number and National Registration Card Number on the answer booklet provided. Ensure you append your signature in the space provided in the answer booklet.
2. Write the answer script serial number on the examination register and on the entry slip.
3. There are EIGHT (8) questions in this paper. Answer Five (5) questions.
4. Diagrams may be used where necessary to clarify your answer.
5. Cell phones and programmable calculators are not allowed in the examination room.

DO NOT TURN THIS PAPER UNTIL YOU ARE TOLD TO DO SO

QUESTION ONE

a) Evaluate: $\lim_{x\to 2}\frac{x^2+x-6}{x-2}$. **[3marks]**

b) Working from the "First Principles", determine $\frac{dy}{dx}$ of $y=\frac{1}{\sqrt{x}}$. **[7marks]**

c) Determine the derivative of the following functions:

i) $y=(2x^3+3)(x^4-2x)$. **[5marks]**

ii) $f(x)=\frac{3x-1}{2x+1}$. **[5marks]**

[Total: 20marks]

QUESTION TWO

a) Given that $z=1+\sqrt{3}\,i$

i) Determine the modulus of z. . **[2marks]**

ii) Express z in the modulus-argument form or polar form. **[3marks]**

b) If $z_1=4(\cos\frac{7\pi}{12}+i\sin\frac{7\pi}{12})$ and $z_2=2(\cos\frac{5\pi}{12}+i\sin\frac{5\pi}{12})$, Compute

i) z_1z_2 . **[5marks]**

ii) $\frac{z_1}{z_2}$. **[5marks]**

leaving your answers in the form $a+bi$.

c). Evaluate $(1+\sqrt{-12})(3-\sqrt{-27})$ and leave the answer in form. **[5marks]**

[Total: 20marks]

QUESTION THREE

a) The equation of a curve is given by $f(x)=x+\frac{1}{x^2}$.

Determine the equation of the **tangent** and **normal** to the curve at the point $A(1,5)$.

[8marks]

b) The gradient of the curve $y=ax^2+bx$ at the point $P(2,4)$ is -8. Calculate the values of a and b. **[6marks]**

c) Determine the coordinates of the stationary points on the curve $y=2x^3-3x^2-12x+18$ and determine the nature of these points. **[6marks]**

[Total: 20marks]

QUESTION FOUR

a) Determine:

i) $\int(1-t)(2+t^2)\,dt.$ **[3marks]**

ii) $\int_{-2}^{-1}\left(4x^3+\frac{2}{x^2}\right)\,dx.$ **[4marks]**

iii) $\int x^2\sqrt{x^3+1}\,dx$. **[5marks]**

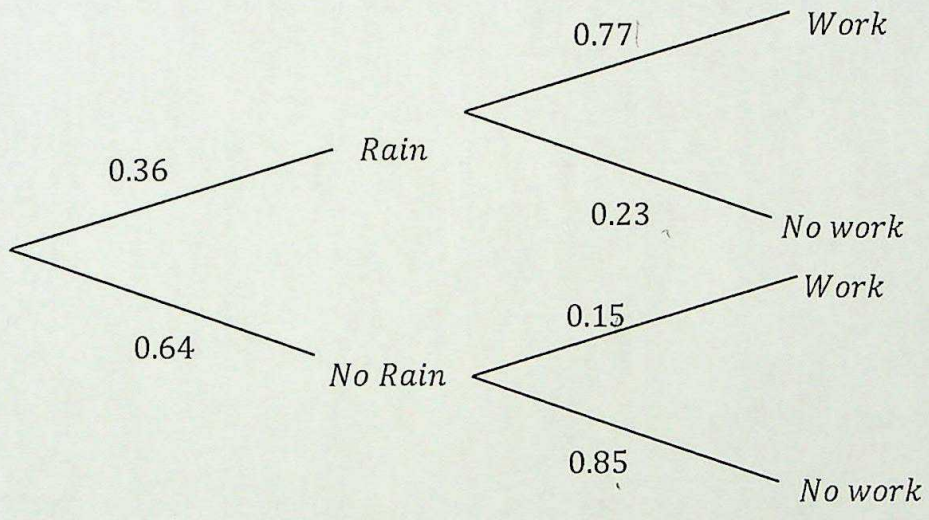
QUESTION SEVEN

a) The probability that a certain vaccine is effective is 0.85. The vaccine is administered to 8 people selected at random.

i) Determine the probability that the vaccine is effective for exactly 6 of these people. **[2marks]**

ii) Determine also, the probability that the vaccine is effective for fewer than 3 of these people. **[4marks]**

b) The tree diagram represents the probability Edna will do her Applied Mathematics homework tonight, depending on whether it rains or not. The probabilities of events are shown on the given diagram below.



i) Write down the probability that it will rain. **[1marks]**

ii) Calculate the probability that Edna will not do the homework. **[3marks]**

iii) Determine the probability that it will not rain and Edna will do homework or that it will rain and she will not do the homework. **[3marks]**

c) The population mean of these numbers listed below is 33.

26 , 31 , 14 , x , 72 , 28 , and 15.

i) Determine the value of x. . **[3marks**

ii) Calculate the standard deviation. **[4marks]**

[Total: 20marks]

b) Sketch the curve $y = 3x(4 - x)$ and determine the area of the region bounded by the curve and the $x -$ axis. **[8marks]**

[Total: 20marks]

QUESTION FIVE

a) Given that $y = ln\ \frac{a-x}{a+x}$, show that $\frac{dy}{dx} = \frac{-2a}{a^2-x^2}$. **[7marks]**

b) Determine the value of a and b for which:

$$\frac{d}{dx}\left(\frac{sinx}{2 + cosx}\right) = \frac{a + b\ cosx}{(2 + cosx)^2}$$ **[7marks]**

c) A car starts from point P at time $t = 0$ seconds and stops at point Q. The distance s, metres, covered by it, in t seconds is given by $s = t^2\left(2 - \frac{t}{3}\right)$.

Determine the time taken by it to reach Q. Also determine the distance between P and Q. **[6marks]**

[Total: 20marks]

QUESTION SIX

a) Given that $y = e^x(cosx - sinx)$, show that $\frac{dy}{dx} = -2e^x sinx$. **[4marks]**

b) Determine the integral of $\int x\ cos5x\ dx$. **[4marks]**

c) A circular cylinder, open at one end, is made of thin sheet of metal whose **area** is $432\pi\ cm^2$. The cylinder has a radius of $r\ cm$ and a height of $h\ cm$.

i) Show that volume, $V\ cm^3$, contained by the cylinder is given by.:

$$V = \frac{\pi}{2}(432r - r^3)$$ **[6marks]**

ii) Given that r can vary, determine the value of r for which V is stationary. **[4marks]**

iii) Evaluate the stationary value of V. **[2marks]**

[Total: 20marks]

QUESTION EIGHT

The table below shows the age distribution of ancillary staff at a named institution in Ndola.

Age (X) in years	20-30	30-40	40-50	50-60	60-70
Number of Ancillary Staff (f)	2	13	20	12	3

a) Show this distribution in the form of:

i) a histogram. **[5marks]**

ii) a frequency polygon. **[5marks]**

b) Draw a cumulative frequency curve (ogive) and use it to determine. **[6marks]**

i) the medium age. **[2marks]**

ii) the upper quartile. **[2marks]**

[Total: 20marks]