The Management University of Africa

Sponsored by the Kenya Institute of Management

UNDERGRADUATE UNIVERSITY EXAMINATIONS

SCHOOL OF MANAGEMENT AND LEADERSHIP

DEGREE OF BACHELOR OF EDUCATION ARTS

MTH 424: ORDINARY DIFFERENTIAL EQUATION

DATE: 31ST MARCH 2026

DURATION: 2 HOURS

MAXIMUM MARKS: 70

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **THREE** questions.
6. Question **ONE** carries **25 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided.**

QUESTION ONE

a) Use integrating factor method to solve the differential equation y′ = - 2xy + 5x

(4 marks)

b) Solve the equation $\frac{dy}{dx} = \frac{x^2}{y^2}$, given y (1) = 2 **(7 marks)**

c) Solve the second order differential equation y″ - 9y′ + 20y = 0 **(6 marks)**

d) Determine if $y_1(x)$ = Sin x and y_2 (x) = Sin x – Cos x are linearly independent solutions of y″+ y = 0 **(8 marks)**

QUESTION TWO

a) If h(t) = $2t^4 + 3t^{\frac{5}{3}} - \frac{4}{t}$ find h″(t) and h‴(t) **(7 marks)**

b) If Z= f(x,y) = $(x^2 + y^3)^{10}$ + ln x, then find the first and second order partial derivatives of function Z **(8 marks)**

QUESTION THREE

a) Show that the differential equation y′ = xy – 21 + 3y – 7x is separable

(6 marks)

b) Solve y′ + 2xy = 1 **(4 marks)**

c) Solve y′= xy given y(0) = 5 **(5 marks)**

QUESTION FOUR

a) Show that y(x) = $3e^{2x} + e^{-2x}$ – 3x is the unique solution of the unique solution of the initial value problem y″- 4y = 12x , when y (0) = 4, y′ (0) = 1 **(8 marks)**

b) Find the solution of the initial value problem y″ - y′ + 0.25y = 0, y (0) = 2, y′ (0) = $\frac{1}{3}$ **(7 marks)**

QUESTION FIVE

a) Find a particular solution of $y'' - 3y' - 4y = 3e^{2t}$ **(7 marks)**

b) Show that the sets of functions: $x^2 - x + 1$, $x^2 - 1$ and $3x^2 - x - 1$ are linearly independent **(8 marks)**

QUESTION SIX

a) Solve $y^4 - 7y''' + 15y'' - 13y' + 4y = 0$ **(7 marks)**

b) Find the solution of the initial value problem $16y'' - 8y' + 145y = 0$, $y(0) = -2$, $y'(0) = 1$ **(8 marks)**

MTH 424

Tables and Formulae

1) f′(x) = $\frac{f(x+h)-f(x)}{h}$
2) If f(x) = x^n, then f′(x) = nx^{n-1}
3) If f(x) = x^n, then f′(x) = nx^{n-1}
4) If f(x) = $\frac{h(x)}{g(x)}$, then f′(x) = $\frac{h'(x)g(x)-g'(x)h(x)}{(g(x))^2}$
5) If f(x) = h(x)g(x), then f′(x) = h(x)g′(x) + h′(x)g(x)
6) If y ′ + $py=q$, then integrating factor = $e^{\int P(x)dx}$
7) r(x) = $e^{\int \frac{1}{x} dx}$ = $e^{\log x}$ = x
8) $\int u\frac{dv}{dx}dx = uv - \int v\frac{du}{dx}dx$
9) $x = \frac{-b \pm \sqrt{x^2-4ac}}{2a}$
10) LIATE = Log, Inverse, Trigonometry, Algebraic, Trigonometric function, Exponential
11) Wronskian determinant = $|¿)¿y2(¿)¿y'1(¿)¿y'2(¿)¿|$ = $y1(¿)\ \ y'2(¿)$ - $y'1(\text{to})\,y2(¿)$
12) Linearly independent functions = K1f1(t) + K2f2(t) + K3f3(t) +……+Knfn(t) = 0

Nature of roots	Roots	Complementary functions
Real and distinct roots	M_1, M_2, M_3	$C_1\ e^{M1x} + C_2e^{M2x} + C_3e^{M3x}$
Repeated roots	$M_1 = M_2$	$(C_1 + C_2x)\ e^{M1x}$
	$M_1 = M_2 = M_3$	$(C_1 + C_2x + C_3x^2)\ e^{M1x}$
Complex roots	$M_1 = \alpha + i\beta$ $M_2 = \alpha - i\ \beta$	$e^{\alpha x}\ [(C_1\cos\beta x + C_2\sin\beta x]$
Repeated complex roots	$M_1 = M_2 = \alpha + i\beta$	$e^{\alpha x}\ [(C_1 + C_2x)\cos\beta x + (C_3 + C4\sin\beta x]$