

SECTION A [40 MARKS]Attempt **ALL** the Questions in this Section.

(a) Convert:

(i) $(-2, 3)$ to polar (ii) $(3, \frac{5\pi}{3})$ to Cartesian **(4 marks)**

(b) Plot on the same polar grid points:

(i) $(2, -\frac{\pi}{3})$ (ii) $(-3, \frac{5\pi}{3})$ **(4 marks)**

(c) Find equation of a circle in expanded form, with centre $(-2, 3)$ and passing through point $(2, 0)$. **(4 marks)**(d) A parabola has equation $x^2 = -8y$.(i) Find its focus and directrix. (ii) Sketch the parabola. **(4 marks)**

(e) The 2nd term of an arithmetic series is 15 and the 15th term is 21.

(i) Find 1st term and common difference.

(ii) What is the sum of the first 10 terms? **(6 marks)**

(f) Find explicit general solutions of differential equations:

(i) $\frac{dy}{dx} = \frac{y}{x^2}$ (ii) $x \frac{dy}{dx} + y = x^2$ **(6 marks)**

(g) A frequency distribution is given as:

x	102	103	104	105	106
f	10	50	80	40	20

Find:

(i) mean (ii) variance **(6 marks)**(c) (i) $X \sim B(6, 0.45)$. Use cumulative binomial distribution tablesto find $P(x > 4)$.(ii) $X \sim N(30, 16)$. Use normal distribution tables to find $P(x > 25)$.**(6 marks)**

SECTION B [60 MARKS]

Attempt **ONLY THREE** Questions in this Section.

Question 1

(a) Convert:

(i) $2y = x^2$ to polar (ii) $r = 4\cos^2\theta$ to Cartesian **(4 marks)**

(b) A parabola has vertex $(-2, 1)$ and directrix $y = 3$.

(i) Sketch the parabola.

(ii) Find its Cartesian equation in standard form. **(4 marks)**

(c) An ellipse has equation $x^2 - 5y^2 + 4x + 30y - 46 = 0$.

(i) Put the equation in standard form.

(ii) Find its centre and eccentricity. **(6 marks)**

(d) A conic has polar equation $r = \frac{6}{2-3\sin\theta}$

Find its eccentricity, type of conic and directrix. **(6 marks)**

Question 2

(a) A sequence has first term a and common ratio $r < 1$.

Find its n th term a_n and sum to infinity S_∞ . **(4 marks)**

(b) The 3rd term of the sequence is 10 and 6th term is 80.

Find:

(i) its 1st term and common ratio r .

(ii) the sum of the first 10 terms. **(6 marks)**

(c) Given infinite series: $1 + \frac{1}{4} + \frac{1}{9} + \dots$

(i) Write the series in sigma notation.

(ii) Find the 3rd partial term.

(ii) Use divergence test to prove the series converges. **(5 marks)**

(d) If infinite series is:

$$\sum_{n=0}^{\infty} \frac{n!}{2^n}$$

Use ratio test to prove the series diverges. **(5 marks)**

Question 3

(a) Find explicit general solutions of differential equations:

$$(i) \frac{dx}{dt} = x \cos t \quad (ii) \frac{dx}{dt} = \frac{e^t}{\sin x} \quad (6 \text{ marks})$$

(b) Find explicit particular solutions of differential equations:

$$(i) \frac{dy}{dx} = \frac{e^x}{3y^2}; y(0) = -1 \quad (ii) \frac{dy}{dx} = 2xy + y; y(0) = 1 \quad (8 \text{ marks})$$

(c) Find the general solutions of the differential equations:

$$(i) y'' + 6y' + 9y = 0 \quad (ii) y'' + 4y' + 13y = 0 \quad (6 \text{ marks})$$

Question 4

(a) The total marks obtained by 60 students of DEEE in UICT in a semester is given in a frequency distribution below:

Marks	300-390	400-490	500-590	600-690	700-790	800-890
Frequency	4	12	12	18	8	6

Construct:

- (i) a histogram and a frequency polygon on the same axes.
- (ii) a cumulative frequency curve and use it to estimate the median.

(10 marks)

(b) 80% of drivers in Uganda are men. 20 drivers are selected at random.

Calculate the probability that more than 15 drivers are men. **(5 marks)**

(c) The population of 50 African countries is a random variable X that

follows normal distribution with mean 40 million and standard deviation 10 million. Find the percentage of countries with a population between 20 million and 45 million **(5 marks)**

Question 5

- (a) The marks in % obtained by 40 students of DTE in Engineering Maths I test are shown in the table below:

Marks (%)	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90 - 99
Number of students	4	6	2	5	7	8	5	3

Find mean, mode and median of the marks. **(10 marks)**

- (b) A factory produces ball bearings in a given month according to their diameter as shown in the table below:

diameter	91 -93	94 -96	97 - 99	100-102	103-105	106-108	109-111
frequency	4	6	34	40	13	3	5

Calculate mean and standard deviation of ball bearings. **(10 marks)**

END