INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

HIGHER EDUCATION CERTIFICATE

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: HEC
YEAR/SEM: YEAR 1/SEMESTER 2
COURSE CODE: FDN 1201
NAME: FONDATION MATHEMATICS TWO

DATE:
TIME:

INSTRUCTIONS TO CANDIDATES:

SECTION A

Attempt ALL Questions (Each question carries 4 marks)

Question 1:

If $y = x^2$ find $\frac{dy}{dx}$ using the first principal method

Question 2:

A bag contains 3 red balls and 4 blue balls. You draw a ball without looking, and then you draw a second ball without replacing the first. What is the probability of drawing a red ball then a blue ball?

Question 3:

Mr. Mohammed has a coin that has two side i.e a head(H) and a tail(T). What is the probability of flipping his fair coin twice and get heads?

Question 4:

Given two independent events A and B. P(A)= ½ and P(B)=1/4) find P(AUB)

Question 5:

Show that the gradient of the function $y = \sin^2\theta + \cos^2\theta$ equals to zero for all the points lying on it.

Question 6:

Using the product rule find the derivative of $y = (4x^2 + 2)(3x + 9)$

Question 7:

Work out $\int \frac{x^2+8x+15}{x+3} dx$

Question 8:

Find the simple aggregative index number for the year 2000 with 1980 as base year

Commodity	Price in 1980	Price in 2000
A	200	250
B	110	150
C	20	30
D	210	250
E	25	25

Question 9:

The following data represent the marks of 20 students.

80	76	90	85	80
70	60	62	70	85
65	60	63	74	75
76	70	70	80	85

Use the marks above to construct a frequency distribution table for the ungrouped data

Question 10:

a) The given data set shows marks of 10 students in a Math test marked out of 20.

15, 14, 14, 15, 15, 14,15, 16, 13, 18

Use the data above to compute the

i) Mean

ii) Median

Question 11:

For five entries, the following values were calculated between two variables x and y

$$\sum x = 14 \quad \sum x^2 = 22 \sum y = 942 \quad \sum y^2 = 170552 \sum xy = 1565$$

Calculate to two decimal points the Pearson's coefficient of correlation

Question 12:

A 30 m long ladder is placed against a vertical wall of a building. The foot of the ladder is 9m from base of the building. If the top of the ladder slips 3m, then the foot of the Ladder will slide by how much distance.

Question 13:

If $y = x + \sqrt{x^2 + 1}$, prove that $\frac{dy}{dx} = \frac{y}{y-x}$

Question 14:

Use the product rule to find the gradient of the curve

$y = (1 + x^3)(1 + \cos x)$

Question 15:

A shopper is standing on level ground 800m from the base of a 250 m foot tall department store. The shopper looks up and sees a flag on the store's roof. To the *nearest degree* what is the angle of elevation to the top of the building from the point on the ground where the shopper is standing?

Question 16:

(Integrate the following

$$\int (10x^8 + 15x^7 + 14x^6 - x^5 - \tfrac{1}{4}x^4 + 3x^3 + x - 2)dx$$

Question 17:

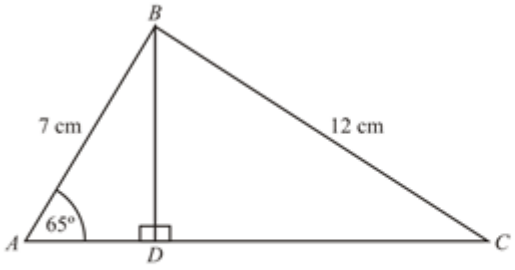
If $y = \cot x$, show that $\frac{dy}{dx} = -(\operatorname{cosec} x)^2$

Question 18:

Find the value of the following

$$\int_2^3 (2x+1)dx$$

Question 19:



In the figure above, calculate length AC

Question 20:

Find the value $\int_2^3 \frac{x^3 + 2x^2 - x}{x} dx$

SECTION B

Attempt any three (Each question carries 20 marks)

Question 1:

a) Determine the following integrals

i) $\int 4\sec^2 x \; dx$

ii) $\int \frac{3x^2-5x}{x}\, dx$ (2 marks)

iii) $\int \frac{4}{3x^2}\, dx$ (2 marks)

b) Evaluate the following definite integrals

i) $\int_1^3 (x^2 - 4x + 3)dx$ (3 marks)

ii) $\int_{-1}^{1} \frac{-3}{4} t^2 dt$ (3 marks)

iii) $\int_0^2 x^2\sqrt{x^3+1}\;\; dx$ (3 marks)

c) Find the value of a such that $\int_0^a \frac{x^3+x^2+9x+9}{x^2+9}\, .dx = 4$ (5 marks)

Question 2:

a) If $y = tanx$, show that $\frac{d(tanx)}{dx} = \sec^2 x$

b) Use the quotient rule to find ;

i) $y = \frac{2x^2}{3x^3-4}$

ii) $y = \frac{5x-1}{3x+2}$

c) Use the product rule to find $\frac{dy}{dx}$

i) $y = (x^2 - 1)(3x + 2)^3$

ii) $y = (x^3 + cosx)(3x + \sin x)$

d) Find the gradients of the following curves at different points;

i) $y = 3x^2 - 2x + 1$ at $x = 2$

ii) $y = x^3 - 1 \; at \; x = -1$

Question 3:

a) During a beauty contest Judges X and Y awarded different points for 8 rounds. Find the correlation between X and Y Using the spearman's rank correlation coefficient;

X	85	98	105	80	70	90	91	60
Y	130	144	160	125	120	150	152	110

(10 marks)

b) Find the Pearsonian correlation coefficient between sales (in million units) and expenses (in thousand shillings) of the following 10 firms:

Firm	A	B	C	D	E	F	G	H	I	J

Sales (X)	60	60	65	70	75	75	75	70	70	60
Expenses(Y)	13	15	16	18	18	17	17	16	15	15

Question 4:

a) Given two events A and B are mutually exclusive P(A)=1/3 and P(B)=1/4, Find P(AUB)

(4 marks)

b) A black die and white die are thrown at the same time. Display all the possible outcomes . Find the probability of obtaining

i) A total of 5

ii) A total of 11

iii) A total of at least 8

C) A bag contains 6 red balls and 4 green balls. Two balls are selected one at a time without the replacement. Find the probability of selecting at random

I. Both red

II. Both green

III. One green and one red

Question 5:

a) The table below shows the marks obtained out of 50 by semester two students at IUEA in a mathematics contest

Marks	Number of students

1-10	9
11-20	10
21-30	11
31-40	8
41-50	7

Use the above frequency table to find;

i) Mean

ii) Mode

iii) Median

(15 marks)

b) Construct by simple average of price relative method the price index of 2024, taking 2023 as base year from the following data:

Commodities	Price in 2023	Price in 2024
A	60	80
B	50	60
C	60	72
D	50	75
E	25	37.5

(5 marks)

Question 6:

The function f is defined by $f(x) = \frac{8x+5}{2x+3}$ $for\ x > \frac{-3}{2}$

a) Find $f^{-1}(\frac{3}{2})$ (4 marks)

b) Show that $f(x) = A + \frac{B}{2x+3}$ where A and B are constants to be found

The function g is defined by $g(x) = 16 - x^2 \quad 0 \leq x \leq 4$

c) State the range of $g^{-1}(x)$

d) Find the domain of $fog^{-1}(x)$

Question 7:

(a) use the first principle method to derive the following

(i) the product rule formula used in differentiation

(ii) The quotient rule formula used in differentiation

(b) a) Find the integrals of the following

i)

$$\int \sqrt{x}\,(5x+9)\,dx$$

ii)

$$\int \frac{x^3-3x^2-x+3}{x^2-4x+3}\,dx$$

Question 8:

a) The table below shows the initial salaries in (UGX 000) of employees in a certain company

Annual salary	Number of graduates
1000	3
2000	6
3000	12
4000	9
5000	3

6000	2

Use the table to calculate;

i) mean

ii) median

iii) variance

iv) standard deviation

v) coefficient of variance

Question 9:

The table shows the inputs (X) and harvests (Y) made by a farmer during a certain harvest season.

X	4.3	6.9	0.0	10.4	5.2	1.8	8.0	9.2	2.1
Y	224	208	123	419	230	184	362	351	196

a) Use the Pearson's coefficient of correlation to determine if there is a connection between X and Y

b) Calculate the regression equation line of y on x

c) Calculate the harvests that were corresponding with the following inputs

i) 8.0

ii) 6.9

iii) 0.0

Question 10:

a) Find the simple aggregative index number for the year 2000 with 1980 as base year

Commodity	A	B	C	D	E
Price in 1980	200	110	20	210	25

Price in 2000	210	150	30	230	27

b) Using Simple Average of Relatives Method, find price index for each of the following :

i) For 2004, taking 2000 as base year

Commodity	A	B	C	D	E
Price in 2000	15	16	60	40	20
Price in 2004	20	22	80	50	30

c) Given are the following price-quantity data, with price quoted in 1000s shs and production in qtls.

	2020		2021	
Item	Price	Production	Price	Production
Sugar	6	400	8	450
Oil	8	450	7	550
Wheat	7	500	10	600

From the data find:

i) Laspeyre's Price Index for 2021, using 2020 as the base

ii) Paasche's Price Index for 2021, using 2020 as the base

iii) Fischers ideal index

Question 11:

Required formulas	
Mean for a frequency distribution	$\bar{x} = \frac{\Sigma fx}{\Sigma f}$
Variance	$var(\sigma^2) = \frac{\Sigma fd^2}{\Sigma f}$ where $d = x - \bar{x}$
Standard deviation	$\sigma = \sqrt{var}$
Coefficient of variation	$Cov = \frac{\sigma}{\mu} \times 100$
Mean deviation	$\frac{\Sigma \lvert d \rvert}{n}$
Simple price index	$\boldsymbol{P_{0i} = \frac{p_i}{p_0} \times 100}$
Simple aggregate price index	$\boldsymbol{P_{0i} = \frac{\Sigma p_i}{\Sigma p_0} \times 100}$
Simple average of price relatives	$\boldsymbol{P_{0i} = \frac{\Sigma \frac{p_i}{p_0}}{n} \times 100}$
Peasonian coefficient of correlation	$\boldsymbol{r_{xy} = \frac{\Sigma d_x d_y}{\sqrt{\Sigma d_x^2 \Sigma d_y^2}}}$
	$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$
Least squares method	$y = a + bx$ where: $b = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2}$ and $a = \bar{y} - b\bar{x}$ ($\bar{y}, \bar{x}$: are the means of y and x, respectively)