

MATHEMATICS II

Date: 24/ 06/2022

Period: 8:30-11:30



END OF TERM III EXAMINATIONS

GRADE COMBINATIONS

SENIOR FOUR

- MATHEMATICS-CHEMISTRY-BIOLOGY (**MCB**)
- MATHEMATICS -COMPUTER SCIENCE-ECONOMICS (**MCE**)
- MATHEMATICS-ECONOMICS-GEOGRAPHY (**MEG**)
- MATHEMATICS -PHYSICS-COMPUTER SCIENCE (**MPC**)
- MATHEMATICS-PHYSICS-GEOGRAPHY (**MPG**)
- PHYSICS-CHEMISTRY-MATHEMATICS (**PCM**)

DURATION:

3HOURS

MARKS:

100

INSTRUCTIONS

1) This paper consists of **one** section

Section A: Attempt **all** questions.

(100marks)

2) You may use mathematical instruments and a calculator **where necessary**.

3) Use a **blue or black ink pen only** to write your answers and a **pencil** to draw diagrams.

4) Show clearly all the working steps. **Marks will not be awarded for the answer without all working steps.**

Section A: Answer all questions (100marks)

1) Without using calculator, calculate:

$$\sin \frac{2\pi}{3} + \cos \frac{\pi}{3} + \sin \frac{4\pi}{3} + \cos\left(-\frac{\pi}{3}\right) + \sin\left(-\frac{\pi}{3}\right) \quad \textbf{(6marks)}$$

2) Find the length of the side BC of triangle ABC in which AB=7cm, AC=9cm and $\angle BAC = 71^\circ$ **(6marks)**

3) Given that: $\log 2 = 0.30$; $\log 3 = 0.48$; $\log 5 = 0.69$

Find:

a. $\log 12$ **(5marks)**

b) $\log 0.8$ **(4marks)**

4) Solve in the set of real numbers $x^4 - 61x^2 + 900 = 0$ **(8marks)**

5) Consider the predicate $p(x, y) : "y = x + 3"$. What are the truth values of the propositions $p(1, 2)$ and $p(0, 3)$ **(6marks)**

$p(1, 2)$ is the proposition " $2 = 1 + 3$ " which is false **(3marks)**

The statement $p(0, 3)$ is the proposition " $3 = 0 + 3$ " which is true. **(3marks)**

6) In a class of 40 students, 26 play football and 20 play volleyball. 17 students play both games. How many students play none of the games at all.

(6marks)

7) Given that $x^3 - 4x^2 + x + 6 = (x - a)(x + b)(x - c)$. Find the values of a, b and c.

(6marks)

8) Factorize completely the polynomial $x^3 + 5x^2 - 4x - 20 = 0$ (6marks)

9) Evaluate the limit below (6 marks)

$$\lim_{x \rightarrow 2} h(x) \text{ if } h(x) = \begin{cases} x^2 - x - 1, & x < 2 \\ 3x - 5, & x \geq 2 \end{cases}$$

10) Write vector column BA of two points $A(1,2)$ and $B(4,3)$ (4marks)

11) Consider two matrices A and B (5marks)

$$A = \begin{pmatrix} 13 & 4 \\ 6 & 10 \end{pmatrix} \text{ and } B = \begin{pmatrix} 7 & 10 \\ 3 & 4 \end{pmatrix}$$

Find $A+3B$

12) Solve the following system of two equations using Cramer's rule:

$$\begin{cases} 3x - 2y = 6 \\ x - y = 1 \end{cases} \quad (8\text{marks})$$

13) Determine an equation of the line that contains the point $(-3, -5)$ and the same slope as $y + 2 = 7(x + 3)$ (6marks)

14) a) Define the statistical terms

i) mean (1mark)

ii) median (1mark)

b) Calculate the mean of marks of 8 students in a Biology Test out of 20

10; 15; 9; 12; 11; 16; 18; 20 (4marks)

15) Given the data below represent the marks obtained by students of S1 in a Mathematics quiz out of 10

Class	Frequency
5-9	3
10-14	6
15-19	5
20-24	5
25-29	4
30-34	2

a) Create the histogram of this distribution (6marks)

b) Determine the mode of this distribution (2marks)

c) How many students did they pass the quiz (4marks)

END

CASS MATH CORE SENIOR FOUR ,2022 MARKING SCHEME

ANSWER 16marks

$$\begin{aligned} & \sin \frac{2\pi}{3} + \cos \frac{\pi}{3} + \sin \frac{4\pi}{3} + \cos\left(-\frac{\pi}{3}\right) + \sin\left(-\frac{\pi}{3}\right) \\ &= \frac{\sqrt{3}}{2} + \frac{1}{2} - \frac{\sqrt{3}}{2} + \frac{1}{2} - 1 \\ &= \frac{1}{2} - \frac{1}{2} \\ &= 0 \end{aligned}$$

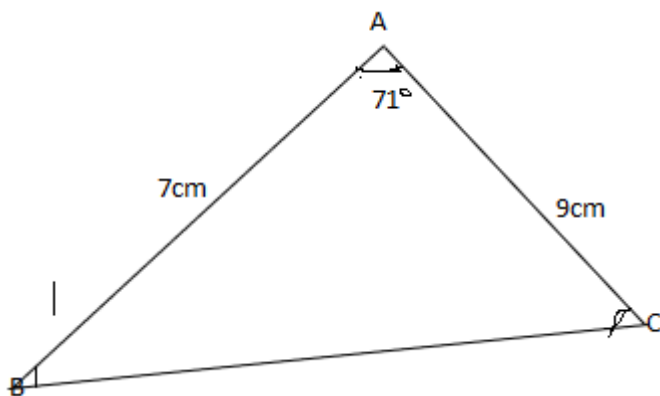
Answer 2

a) By using cosine law**2 mark**

$$a^2 = c^2 + b^2 - 2bc \cos A$$

$$a = \sqrt{49 + 81 - (2 \cdot 7 \cdot 9) \cos 71^\circ} \quad \text{.....**3 mark**}$$

$$BC = 9.43 \text{ cm} \quad \text{.....**1 mark**}$$



ANSWER 4

$$\text{Let } x^2 = t \quad \text{.....**1 marks**}$$

$$t^2 - 61t + 900 = 0 \quad \text{.....**2 marks**}$$

$$(t - 25)(t - 36) = 0 \quad \text{.....**2 marks**}$$

$$t = 25 \text{ or } t = 36 \quad \text{..... **1 mark**}$$

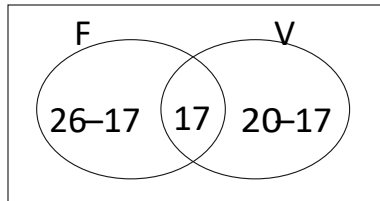
For $t=25$

$$x = \pm 5 \quad \text{.....1 mark}$$

For $t=36$

$$x = \pm 6 \quad \text{.....1 mark}$$

Answer 6.....(.6marks)



$$40 - (26 - 17) - 17 - (20 - 17) =$$
$$40 - 9 - 17 - 3 = 11$$

Factorize: $x^3 - 4x^2 + x + 6$.

We obtain

$$x^3 - x^2 + x + 6 = (x - 3)(x + 1)(x - 2)$$

$$(x - 3)(x + 1)(x - 2) = (x - a)(x - c)(x + b)$$

$$a = 3, b = 1, c = 2 \quad / \quad \text{6marks}$$

Answer 6 6marks

$$ii) x^3 + 5x^2 - 4x - 20 = (x - 2)(x^2 + 7x + 10)$$

$$x^2 + 7x + 10 = (x + 2)(x + 5).$$

$$x^3 + 5x^2 - 4x - 20 = (x - 2)(x + 2)(x + 5)$$

Answer 9

$$\lim_{x \rightarrow 2^-} (x^2 - x - 1) = 2^2 - 2 - 1 = 1 \text{...../2 marks}$$

$$\lim_{x \rightarrow 2^+} (3x - 5) = (3 \cdot 2 - 5) = 1 \text{...../2 marks}$$

Hence $\lim_{x \rightarrow 2} h(x) = 1$ /2 marks

Answer 10

$$\overrightarrow{BA} = \overrightarrow{OA} - \overrightarrow{OB} \quad \text{/2marks}$$

$$= \begin{pmatrix} 1 \\ 2 \end{pmatrix} - \begin{pmatrix} 4 \\ 3 \end{pmatrix} = \begin{pmatrix} -3 \\ -1 \end{pmatrix} \quad \text{/2marks}$$

Answer 11

$$A + 3B = \begin{pmatrix} 13 & 4 \\ 6 & 10 \end{pmatrix} + 3 \begin{pmatrix} 7 & 10 \\ 3 & 4 \end{pmatrix} \quad \text{/3 marks}$$

$$= \begin{pmatrix} 13 & 4 \\ 6 & 10 \end{pmatrix} + \begin{pmatrix} 21 & 30 \\ 6 & 12 \end{pmatrix} = \begin{pmatrix} 34 & 34 \\ 15 & 22 \end{pmatrix} \quad \text{/2 marks}$$

Answer 12 8marks

$$\Delta = \begin{vmatrix} 3 & -2 \\ 1 & -1 \end{vmatrix} = -3 + 2 = -1$$

$$\Delta_x = \begin{vmatrix} 6 & -2 \\ 1 & -1 \end{vmatrix} = -6 + 2 = -4$$

$$\Delta_y = \begin{vmatrix} 3 & 6 \\ 1 & 1 \end{vmatrix} = 3 - 6 = -3$$

$$x = \frac{\Delta_x}{\Delta} = \frac{-4}{-1} = 4$$

$$y = \frac{\Delta_y}{\Delta} = \frac{-3}{-1} = 3$$

Answer 13 6marks

Knowing that, $m = 7$ and

$$y - y_0 = m(x - x_0)$$

$$y + 5 = 7(x + 3)$$

$$y = 7x + 21 - 5$$

$$y = 7x + 16$$

Answer 14

i) **Mean:** is the sum of data values divided by the number of values in the data

1mark

ii) **Median:** is the middle value when the data is arranged in order of magnitude

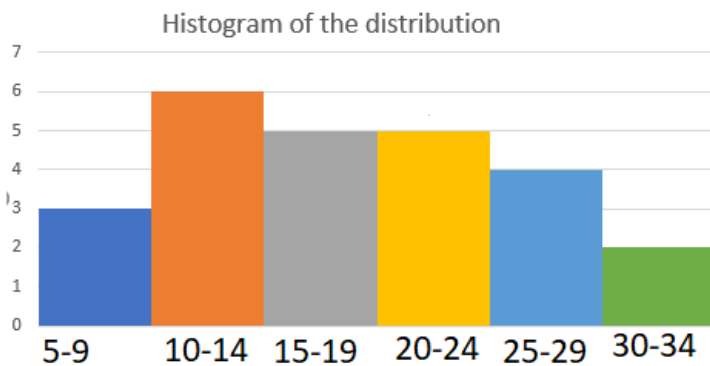
1mark

b) 10;15; 9;12;11;16;18;20

4marks

$$\text{Mean} = (10+15+9+12+11+16+18+20) : 8 = 93.5$$

a)



/6marks

b) The mode is 6 according to observation on histogram.

(2marks)

c) How many students did they pass the quiz
passed the quiz

$$: 3+6+5+5+4+2=25 \text{ students}$$

(4marks)

END

CASS MATH SUBSIDIARY SENIOR 4 ,MARKING SCHEME 2022

ANSWER 1 2marks

$${}^5P_2 = \frac{5!}{(5-2)!}$$

$${}^5P_2 = \frac{5!}{(5-2)!} = \frac{5!}{3!} = 20$$

Answer 2 1

Probability is the chance that something will happen 1

answer 3 3marks

By using sine law $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$.../ **0.5 mark**

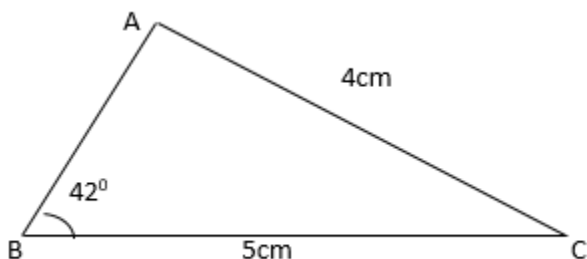
$$\frac{5}{\sin A} = \frac{4}{\sin 42^\circ} \dots\dots\dots \mathbf{0.5 \text{ marks}}$$

$$\sin A = \frac{5 \sin 42^\circ}{4} \dots\dots\dots 0.5 \text{ marks}$$

$$A = \sin^{-1} \left(\frac{5 \sin 42^\circ}{4} \right) = 56.7^\circ \dots\dots\dots \mathbf{0.5 \text{ marks}}$$

$$\angle CAB = 56.7^\circ \dots\dots\dots \mathbf{0.5 \text{ marks}}$$

$$\angle ACB = 180^\circ - 56.7^\circ - 42^\circ = 81.3^\circ \dots\dots \mathbf{0.5 \text{ marks}}$$



Answer 4 (3marks)

$$\begin{cases} 2x + 2y = 18 \\ x + 3y = 17 \end{cases}$$

$$DY = \begin{vmatrix} 2 & 18 \\ 1 & 17 \end{vmatrix}$$

$$D = \begin{vmatrix} 2 & 2 \\ 1 & 3 \end{vmatrix} = 2 \cdot 17 - 1 \cdot 18$$

$$= 2 \cdot 3 - 1 \cdot 2 = 34 - 18 = 0.5$$

$$= 6 - 2 \dots\dots\dots 0.5 = 16$$

$$= 4 \quad / 0.5 \quad X = \frac{DX}{D} = \frac{20}{4} = 5 \quad / 0.5$$

$$DX = \begin{vmatrix} 18 & 2 \\ 17 & 3 \end{vmatrix} \quad Y = \frac{DY}{D} = \frac{16}{4} = 4 \quad / 0.5$$

$$= 18 \cdot 3 - 17 \quad / 0.5$$

$$= 54 - 34 \quad S = \{(5, 4)\}$$

$$= 20$$

Answer 5: 3marks

x is the 1st number

$x+1$ is the 2nd number

$x + x + 1 = 37$ is their sum

Solve for x ; $x + x + 1 = 37$

$$2x + 1 = 37$$

$$2x = 37 - 1$$

$$2x = 36$$

$$x = 18$$

$$x + 1 = 19$$

Therefore, the 1st number is 18 and the 2nd number is 19

$$\text{Answer 6} \quad \lim_{x \rightarrow \infty} \frac{5x + 2}{3x^2 + 1}$$

2marks

$$\lim_{x \rightarrow \infty} \frac{5x + 2}{3x^2 + 1} = \lim_{x \rightarrow \infty} \frac{5x}{3x^2}$$

$$= \lim_{x \rightarrow \infty} \frac{5}{3x} = \frac{5}{\infty} = 0$$

answer 7

$$T = 10 \left(\frac{4t^2 + 16t + 75}{t^2 + 4t + 10} \right)$$

a) At the initial time $t=0$, the food is at

$$T = 10 \left(\frac{4 \times 0 + 16 \times 0 + 75}{0 + 0 + 10} \right) = 75^\circ F \dots\dots / \text{2 marks}$$

b) At $t=3h$,

$$T = 10 \left(\frac{4(3)^2 + 16(3) + 75}{3^2 + 4(3) + 10} \right) = 51.29^\circ F \dots\dots / \text{1 marks}$$

Answer 8 3marks

Hint: $(f \circ g)' = g'(f)f'$

$$f(x) = 2x - 4 \Rightarrow f'(x) = 2 / \text{1 mark}$$

$$g(x) = x + 3 \Rightarrow g'(x) = 1 / \text{1 mark}$$

$$f \circ g'(x) = 1 \times 2 = 2 / \text{1 marks}$$

ANSWER 9 2marks

$$\overrightarrow{BA} = \overrightarrow{OA} - \overrightarrow{OB} \quad \quad \quad / \text{1mark}$$

$$= \begin{pmatrix} 1 \\ 2 \end{pmatrix} - \begin{pmatrix} 4 \\ 3 \end{pmatrix} = \begin{pmatrix} -3 \\ -1 \end{pmatrix} \quad \quad \quad / \text{1mark}$$

Answer 10

Below are marks scored by 7 pupils in religion exam marked out of 10 marks?

3 2 4 5 5 6 3

Arrange in increasing order: 2 3 3 4 5 5 6

i. We compute the mean $\bar{x} = \frac{2+3+3+4+5+5+6}{7} = \frac{28}{7} = 4$ [2Marks]

ii. **Range** - The simplest measure of variability is the range, which is the difference between the highest and the lowest scores **Then**
range = highest value – lowest value = 6 – 2 = 4. [1Marks]

iii.

X	$f(x - \bar{x})^2$
2	4
3	1
3	1
4	0
5	1
5	1
6	4
	$\Sigma(x - \bar{x})^2 = 4 + 1 + 1 + 0 + 1 + 1 + 4 = 12$

X	F	$f(x - \bar{x})^2$
2	1	4
3	2	2
4	1	0
5	2	2
6	1	4
	$\Sigma f = 7$	$\Sigma(x - \bar{x})^2 = 4 + 2 + 0 + 2 + 4 = 12$

$$\sigma^2 = \left(\frac{\Sigma(x - \bar{x})^2}{n} \right) = \frac{12}{7} = 1.71, \text{ then the variance is } 1.71 \quad [3\text{Marks}]$$

As the standard deviation is the positive root of variance, then

$$\sigma = \sqrt{\left(\frac{\Sigma(x - \bar{x})^2}{n} \right)}$$

$$\sigma = \sqrt{\frac{12}{7}} = \sqrt{1.71} [2\text{Marks}]$$

END

SUB-MATHS

Date: 24/ 06/2022

Period: 8:30-11:30



END OF TERM III EXAMINATIONS

GRADE COMBINATIONS

SENIOR FOUR

- BIOLOGY-CHEMISTRY-GEOGRAPHY (**BCG**)
- PHYSICS -CHEMISTRY-BIOLOGY (**PCB**)
- HISTORY -ECONOMICS-GEOGRAPHY (**HEG**)
- LITERATURE -ECONOMICS-GEOGRAPHY (**LEG**)
- HISTORY -ECONOMICS -LITERATURE (**HEL**)
- RELIGIOUS-HISTORY-LITERATURE (**RHL**)
- RELIGIOUS-HISTORY-GEOGRAPHY (**RHG**)

DURATION:

3HOURS

MARKS:

30

INSTRUCTIONS

1)This paper consists of **one** section

Section A: Attempt **all** questions.

(30marks)

2)You may use mathematical instruments and a calculator **where necessary**.

3)Use a **blue or black ink pen only** to write your answers and a **pencil** to draw diagrams.

4)Show clearly all the working steps. **Marks will not be awarded for the answer without all working steps.**

Section A: Answer all questions (30marks)

1. How many permutations are there of 2 letters chosen from letters a, b, c, d, e? (2marks)

2) Define probability (1mark)

3) Find in degrees to 1 decimal place, the size of the angles

$\angle CAB$ and $\angle ACB$ where $AC=4\text{cm}$, $BC=5\text{cm}$ and angle $\angle ABC = 42^\circ$ (3marks)

4) Solve the following system of equation (3marks)

$$\begin{cases} 2x + 2y = 18 \\ x + 3y = 17 \end{cases}$$

5) The sum of two consecutive integers is 37. Find the integers. (3marks)

6) Calculate $\lim_{x \rightarrow \infty} \frac{5x+2}{3x^2+1}$ (2marks)

7) The temperature T (in degrees Fahrenheit) of food placed in a refrigerator is modelled by

$$T = 10 \left(\frac{4t^2 + 16t + 75}{t^2 + 4t + 10} \right)$$

where t is the time (in hours).

a) What is the initial temperature of the food? (2 marks)

b) What is the temperature of the food after 3 hours? (1marks)

8) Given that $f(x) = 2x - 4$ and $g(x) = x + 3$, find the derivative of $f \circ g(x)$

(3marks)

9) Write vector column BA of two point $A(1,2)$ and $B(4,3)$ **(2marks)**

10) The data below are marks scored by 7 pupils in a Religious Test marked out of 10

3 ; 2 ; 4 ; 5 ; 5 ; 6 ; 3

a. Calculate the mean. (2marks)

b. Calculate the range (1mark)

c. Find variance (3marks)

d. Standard deviation (2marks)

END