Ministry of Education, Culture & Higher Education

National Examinations and Certifications Office

Form Four National Examinations.

JUNE, 2024

SUBJECT: Math

TIME: 2 HOURS

INSTRUCTIONS: Answer all questions in the ANSWER BOOKLET

PART ONE: MULTIPLE CHOICE QUESTIONS **(20 × 2 = 40 MARKS).**

1. The algebraic expression for half of x is

   a) $x+2$ b) $x-2$ c) $2x$ d) $\frac{x}{2}$

2. $\cot x \cdot \sin 2x \cdot \sec^2 x =$

   a) 0 b) 1 c) 2 d) 4

3. The value of $\hat{C}$ in the figure below (figure 1) is

   a) 50° b) 40° c) 60° d) 70°

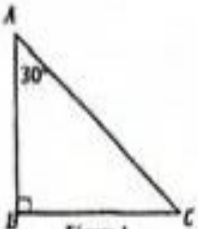

Figure 1

4. The expression $\sqrt[3]{16} \times \sqrt[3]{4}$ is equal

   a) 16 b) 4 c) 3 d) 12

5. The number 20.003 has ______ significant digits

   a) 2 b) 3 c) 4 d) 5

6. A group of 250 students took a test. If 76% of them passed the test. How many students passed the exam?

   a) 100 b) 190 c) 200 d) 60

7. If $A = \begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$, then $\det(A) =$

   a) 1 b) 9 c) -1 d) 8

Teacher :- Mohamed Muhudin Nor M M Nor +252610910170

8. Find the area of the rectangle Below (Fig. 2)

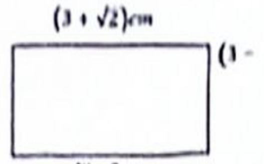

Fig. 2

(a) $9\ cm^2$

(b) $2\ cm^2$

(c) $7\ cm^2$

(d) $5\ cm^2$

9. The factorization of $a^3 - 8$ is:

(a) $(a+2)(a^2-2a+4)$ (a + 2)(a² + 4a + 4) → $(a+2)(a^2+4a+4)$

(b) $(a-2)(a^2-2a+4)$ $\underline{(a-2)(a^2+2a+4)}$

10. The mean of four numbers is 7, three of the numbers are 4,6 and 10. The fourth number is:

a) 10 b) 4 c) 6 d) 8

11. $\int \frac{2}{x} dx =$

a) $\ln x + c$ b) $2\ln x + c$ c) $\ln 2x + c$ d) $\ln\frac{2}{x} + c$

12. If $z = 3 + 4i$ then the magnitude of z, $|z| =$

a) 3 b) 4 c) 5 d) 7

13. The $\lim_{x \to -1} x^3 + x^2 + x + 1 =$

a) 0 b) 1 c) 2 d) 3

14. The derivative of $y = x\cos x$ is

a) $y = \cos x - x\sin x$ b) $y = x\cos x$

c) $y = x\sin x$ d) $y = \cos x + x\sin x$

15. The 6th term of a geometric series is 486 and the 7th term is 1458. Find the common ratio.

a) 1 b) 2 c) 3 d) 4

16. The value of $\sin(\pi - x)$ is:

a) $\cos x$ b) $\sin x$ c) $\sec x$ d) $\tan x$

17. $\lim_{h \to 0} \frac{f(x+h)-f(x)}{h} =$

a) $f(x)$ b) $f'(x)$ c) $f(a)$ d) $f'(a)$

18. From a class of 25 students 4 are selected to work on a special assignment. In how many different ways Can the 4 students be selected?

a) 6375600 b) 12650 c) 13800 d) 303600

19. If $P(A) = 0.53$, $P(B) = 0.36$, and $P(A \cup B) = 0.74$, then $P(A \cap B) =$

a) 0.47 b) 0.64 c) 0.15 d) 0.26

20. The value of $\frac{1}{i^3}$ is equal to

a) i b) $-i$ c) 1 d) -1

Part Two: Match Column A with the appropriate mathematical expression in column B (10 Marks)

COLUMN A	ANSWER	COLUMN B
1. If $f(s) = s^2 + 3s - 2$, then $f(-2) =$	6	3
2. The integral of constant k with respect to x is	3	-2
3. $2(i)^{58} =$	10	4
4. $P(A')$ can not be higher than	1	-4
5. $6\cos\left(\frac{\pi}{2} - x\right)\sec\left(\frac{\pi}{2} - x\right) =$	4	1
6. The number of rows of $\begin{pmatrix} 1 & 2 & 0 & 0 \\ 1 & 1 & 3 & 0 \\ 0 & 2 & 1 & 4 \end{pmatrix}$ is	9	15
7. There are 16 students in a class. If the ratio of boys to girls is 3:5. Then the number of girls in the class is	8	0
8. $\lim_{x \to 0} \frac{1-\cos x}{x}$	2	$kx + c$
9. The magnitude of the vector $\begin{pmatrix} 9 \\ 12 \end{pmatrix}$ is	5	6
10. The distance between $(-1,3)$ and $(3,3)$ is	7	10

F3

F3

Trigonometry

1. $\cot x = \tan 65°$ **(4 marks)**

$\cot x = \tan 65°$

$\tan(90° - \theta) = \tan 65°$ (1marks)

$90° - \theta = 65°$ (1mark)

$-\theta = 65° - 90°$ (1mark)

$-\theta = -25°$

$\theta = 25°$ (1mark)

OR

$\cot x = \tan 65°$

Let $\cot x = \frac{1}{\tan x}$ (1mark)

Substitute

$\frac{1}{\tan x} = \tan 65°$ (2marks)

$x = 65°$ (1mark)

2. Show that $cos3x == 4cos^3x - 3cosx$ **(5 marks)**

$cos3x = \quad cos(2x + x)$ **(1 mark)**

$cos(2x + x) = cos2xcosx - sin2xsinx$ **(1 mark)**

$= (2cos^2x - 1)cosx - (2sinxcosx)sinx$

$= 2cos^3x - cosx - (2sin^2xcosx)$ **(1 mark)**

$= 2cos^3x - cosx - (2(1 - cos^2x)cosx)$ **(1 mark)**

$= 2cos^3x - cosx - (2(cosx - cos^3x))$

$= 2cos^3x - cosx - 2cosx + 2cos^3x$ **(1 mark)**

$= 4cos^3x - 3cosx$

Complex Number

1. Use De Moivre's theorem to calculate the value of $\frac{1}{(1-i)^6}$ [4 Marks]

$R = \sqrt{1^2 + (-1)^2} = \sqrt{1+1} = \sqrt{2}$ **(1 mark)**

$\theta = \tan^{-1}(\frac{-1}{1}) = -45°$ *which i lies in Q IV* **(1 mark)**

$\therefore \theta = 0° - 45°$ or $\theta = 360° - 45°$

$\theta = -45°$ $\quad$ $\theta = 315°$

$\frac{1}{(1-i)^6} = (1-i)^{-6}$ $\quad$ or $\frac{1}{(1-i)^6} = (1-i)^{-6}$

$z^n = r^n(cosn\theta + isin(n\theta))$ $\quad$ $z^n = r^n(cosn\theta + isin(n\theta))$

$z^6 = (\sqrt{2})^{-6}(cos - 6(-45°) + isin - 6(-45°))$ **(1 mark)** $\quad = (\sqrt{2}(cos315° + isin315°)^{-6}$ **(1mark)**

$z^{-6} = (\sqrt{2})^{-6}(cos(270) + isin(270))$ $\quad = (\sqrt{2})^{-6}(cos - 6(315°) + isin6(315°))$

$z^{-6} = \frac{1}{(\sqrt{2})^6}(cos(270) + isin(270)))$ $\quad = \frac{1}{(\sqrt{2})^6}(cos(-1890°) + isin(-1890°))$

$= \frac{1}{8}(cos(270) + isin(270)))$ **(1 mark)** $\quad = \frac{1}{8}(0 + i(-1)) = -\frac{1}{8}i$ **(1 mark)**

$= \frac{1}{8}(0 + i(-1)) = -\frac{1}{8}i$

2. Show that [5 Marks]

$$\left[\frac{1+i}{1-i}\right]^4 + \left[\frac{1-i}{1+i}\right]^4 = 2$$

$$\left[\frac{(1+i)}{(1-i)}\frac{(1+i)}{(1+i)}\right]^4 + \left[\frac{(1-i)}{(1+i)} x \ \frac{(1-i)}{(1-i)}\right]^4$$ **(1 mark)**

$$\left[\frac{(1+i+i+i^2)}{(1-i^2)}\right]^4 + \left[\frac{(1-i-i+i^2)}{(1-i^2)}\right]^4$$ **(1 mark)**

$$\left[\frac{(1+2i-1)}{(1+1)}\right]^4 + \left[\frac{(1-2i-1)}{(1+1))}\right]^4$$ **(1 mark)**

$$\left[\frac{2i}{2}\right]^4 + \left[\frac{-2i}{2}\right]^4 = 2$$ **(1 mark)**

$$\left[\frac{16}{16}\right] + \left[\frac{16}{16}\right] = 2$$ **(1 mark)**

$$1 + 1 = 2$$

Teacher :- Mohamed Muhudin Nor M M Nor +252610910170

Statistics and probability

1. Given that the row data 4,6,8,8,18,9,9,18,12,18

Find

a) Mean (3 Marks)

b) Mode (3 Marks)

c) Median (3 Marks)

d) Range (3 Marks)

Ans :

a) Mean $= \frac{4+6+8+8+9+9+12+18+18+18}{10} = \frac{110}{10} = 11$

b) Mode= 18

c) Median= $\frac{9+9}{2} = 9$

d) Range= $18 - 4 = 14$

2. Find the value of N that satisfies $n_{C_2} = 15$ (5 Marks)

Ans

$n_{C_2} = 15$

$n_{C_2} = \frac{n!}{r!(n-r)!}$

$\frac{n(n-1)(n-2)!}{2!(n-2)!} = 15$ (1 Mark)

$\frac{n(n-1)(n-2)!}{2 \times 1(n-2)!} = 15$

$\frac{n(n-1)}{2} = 15$ (1 Mark)

$n(n-1) = 30$ (1 Mark)

$n^2 - n - 30 = 0$ (2 Marks)

NB by solvining this equation can used one of the 3 methods

1. Factorization
2. Quadratic formula and by completing the square

by factorization

$= (n-6)(n+5)=0$

$\therefore n = 6$ *or* $n = -5$ *so we will take* $+6$

Calculus

1. Find $\lim_{x\to 4}\frac{x^2-16}{x-4}$ (3 Marks)

Ans

$$\lim_{x\to 4}\frac{x^2-16}{x-4}=\lim_{x\to 4}\frac{(x+4)(x-4)}{(x-4)} \quad \text{(1 Mark)}$$

$$=\lim_{x\to 4}(x+4) \quad \text{(1 Mark)}$$

$$=4+4$$

$$=8 \quad \text{(1 Mark)}$$

2. Find the first and second derivative of (2 Marks)
$y=x^5-2x^2+3x-1$

Ans $\frac{dy}{dx}=5x^4-4x+3$ (1 Mark)

$\frac{d^2y}{dx^2}=20x^3-4$ (1 Mark)

3. If $y=sin5x-cos3x$, find $\frac{dy}{dx}$? (2 Marks)

Ans we use chain rule

$\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dx}$

$y=sin5x-cos3x$ let $u=5x$ and $u=3x$

$\frac{dy}{du}=cosu=cos5x$ and $\frac{dy}{du}=-sinu=sin3x$

$\frac{du}{dx}=5$ and $\frac{du}{dx}=3$ (1 Mark)

$\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dx}=5cos5x+3sin3x$ (1 Mark)

Teacher :- Mohamed Muhudin Nor M M Nor +252610910170

4. Find the value $\int_{-1}^{2}(3x^2 + 2x + 1)dx$ (4 Marks)

Ans

$\int_{-1}^{2}(3x^2 + 2x + 1)dx =$

$=(\frac{3x^3}{3} + \frac{2x^2}{2} + x + c)$ (1 Mark)

$=(\frac{3(2)^3}{3} + \frac{2(2)^2}{2} + (2) + c) - (\frac{3(-1)^3}{3} + \frac{2(-1)^2}{2} + (-1) + c)$ (1 Mark)

$=(\frac{3(8)}{3} + \frac{2(4)}{2} + 2 + c) - (-1 + 1 - 1 + c)$

$=(\frac{24}{3} + \frac{8}{2} + 2 + c) - (-1 + c)$ (1 Mark)

$=(8 + 4 + 2 + c) - (-1 + c)$ $=14$

$=(14 + 1)$

$=15$ (1 Mark)

OR

$\int_{-1}^{2}(3x^2 + 2x + 1)dx =$

$=(\frac{3x^3}{3} + \frac{2x^2}{2} + x + c)$ (1 Mark)

$= (x^3 + x^2 + x + c)$

$= ((2)^3 + (2)^2 + 2 + c)) - ((-1)^3 + (-1)^2 + (-1) + c)$ (1 Mark)

$=(8 + 4 + 2 + c) - (-1 + 1 - 1 + c)$ $=14$ (1 Mark

$=(14 + 1)$

$=15$ (1 Mark)

5. Evaluate $\int \frac{1-\cos^2 x}{\cos^2 x}\,dx$ (4 Marks)

$\int \frac{1-\cos^2 x}{\cos^2 x}\,dx = \int \left(\frac{1}{\cos^2 x} - \frac{\cos^2 x}{\cos^2 x}\right)dx$ (1 Mark) or $\int \frac{1-\cos^2 x}{\cos^2 x}\,dx = \int \frac{\sin^2 x}{\cos^2 x}\,dx$

$= \int (\sec^2 x - 1)dx$ (1 Mark) $= \int \tan^2 x\,dx$

$= \int \sec^2 x dx - \int dx$ (1 Mark) $= \int (\sec^2 x - 1)dx$

$= \tan x - x + c$ (1 Mark) $= \tan x - x + c$