2023 END OF FIRST SEMESTER EXAMINATION

ELECTIVE MATHEMATICS

FORM 2

ANSWER ALL QUESTIONS

1hour:20minutes

1. If $5x + 3y = 3$, then find $32^x \cdot 8^y$.
   A. 4
   B. 8
   C. 16
   D. 32
2. The expression $\frac{1}{3}x^2 - 2$ can be rewritten as $\frac{1}{3}(x-k)(x+k)$, where k is a positive constant.
   What is the value of k?
   A. 2
   B. 6
   C. $\sqrt{2}$
   D. $\sqrt{6}$
3. If the polynomial $f(x)$ is divided by $x + 2$, the quotient is $x^2 + x - 1$ and the remainder is 3, find $f(x)$.
   A. $f(x) = x^3 + 3x^2 + 3x + 1$
   B. $f(x) = x^3 + 3x^2 + x - 1$
   C. $f(x) = x^3 + 3x^2 + x - 5$
   D. $f(x) = x^3 + 3x^2 + x + 1$
4. If $\sin A - \cos A = 0$, then the value of $sin^4 A + cos^4 A$ is

*	a	b	c
a	c	a	b
b	a	b	c
c	b	c	a

   A. 2
   B. 1
   C. $^3/_4$
   D. $^1/_2$

5. A binary operation $*$ is defined on the set A = $\{a, b, c\}$ by the following table:
   Find the inverse of the element c under $*$
   A. c
   B. a
   C. b
   D. 0

6. If $\alpha \; and \; \beta$ are the roots of $2x^2 - 5x + 6 = 0$, find the equation whose roots are ($\alpha + 1$) and ($\beta + 1$)
   A. $2x^2 - 9x - 15 = 0$
   B. $2x^2 - 9x - 13 = 0$
   C. $2x^2 - 9x + 13 = 0$
   D. $2x^2 - 9x + 15 = 0$
7. If $\frac{x-2}{(x+3)(2x-1)} \equiv \frac{V}{x+3} + \frac{W}{2x-1}$, find the value of V.
   A. $\frac{5}{7}$
   B. $\frac{3}{7}$
   C. $-\frac{3}{7}$
   D. $-\frac{5}{7}$
8. Express $\log\left(\frac{a\sqrt{b}}{c^{\frac{1}{3}}}\right)$ in terms of $\log a, \quad \log b, \quad and \; \log c$.
   A. $\frac{1}{3}\log c - \log a + \frac{1}{2}\log b$
   B. $3\log c - \log a - \frac{1}{2}\log b$
   C. $\log a - \frac{1}{2}\log b + \log c$
   D. $\log a + \frac{1}{2}\log b - \frac{1}{3}\log c$
9. Find the coefficient of x^6 in the binomial expansion of $(2 + x)^{10}$.
   A. 210
   B. 3360
   C. 16
   D. 64
10. For what range of values of x is $x^2 - 2x - 3 \leq 0$?
   A. $1 \leq x \leq 3$
   B. $-3 \leq x \leq -1$
   C. $-3 \leq x \leq 1$
   D. $-1 \leq x \leq 3$
11. The perpendicular bisector of the line joining points (6, 2) and (4, 2) passes through which of the following points?
   A. (5, 2)
   B. (1, 1)
   C. (1, 0)
   D. (0, 0)

12. The first term of an arithmetic progression (A.P) is 4 and the sum of the first three terms is 18. Find the product of the first three terms.
    A. 172
    B. 192
    C. 272
    D. 292
13. Express $\frac{5\pi}{6}$ radians in degrees.
    A. 210°
    B. 170°
    C. 150°
    D. 105°
14. If $y = 2(x^2 + 3x)^3$, find $\frac{dy}{dx}$
    A. $2(2x + 3)(x^2 + 3x)^2$
    B. $4(2x + 3)(x^2 + 3x)^2$
    C. $6(2x + 3)(x^2 + 3x)^2$
    D. $6(x^2 + 3x)^2$
15. If $\frac{8-3\sqrt{6}}{2\sqrt{3}+3\sqrt{2}} = p\sqrt{3} + q\sqrt{2}$, evaluate $(p + q)$
    A. $-\frac{10}{3}$
    B. $-\frac{4}{3}$
    C. $\frac{4}{3}$
    D. $\frac{10}{3}$
16. A binary operation $*$ is defined on the set, R, by $p * q = \frac{p}{q} + \frac{q}{p} + 1, where\ p, q \in R$, P$\neq 0\ and\ q \neq 0$. Simplify
    $(y + 2) * 3 = 8$
    A. $y^2 - 17y - 27 = 0$
    B. $y^2 + 17y + 29 = 0$
    C. $y^2 - 17y - 29 = 0$
    D. $y^2 + 17y - 27 = 0$
17. Find $\lim_{x \to -3} \left(\frac{2x^2+x-21}{x-3}\right)$
    A. 0
    B. 1
    C. 7
    D. 13
    E.

18. Given that $y = \sqrt{(3x^2 - 1)}$, find $\frac{dy}{dx}$.
    A. $\frac{1}{\sqrt{(3x^2-1)}}$
    B. $\frac{3x}{\sqrt{(3x^2-1)}}$
    C. $\sqrt{(3x^2 - 1)}$
    D. $3x\left(\sqrt{3x^2 - 1}\right)$

A line passes through the origin and the point $(1\frac{1}{4}, 2\frac{1}{2})$. Use this information to answer questions **19** and **20 .**

19. What is the gradient of the line?
    A. 1
    B. 2
    C. 4
    D. 3
20. Find the y coordinate of the line when $x = 4$
    A. 2
    B. 4
    C. 6
    D. 8
21. The equation of a circle is $x^2 + y^2 - 8x - 2y + 1 = 0$. Find its radius.
    A. 3
    B. 4
    C. 7
    D. 9
22. The common ratio of a Geometric Progression is 2. If the 5^{th} term is greater than the first term by 45, find the sum of the first five terms.
    A. 96
    B. 93
    C. 48
    D. 32
23. Express $\frac{5}{1+cos30^\circ}$ as a surd.
    A. $10\sqrt{3}$
    B. $20 - \sqrt{3}$
    C. $20 - 5\sqrt{3}$
    D. $20 - 10\sqrt{3}$

24. If $2sin^2\theta = 1 + cos\theta, 0° \leq \theta \leq 90°$, find the value of θ.
    A. 90°
    B. 60°
    C. 45°
    D. 30°
25. Find the derivative of $y = 3x^2(2x + 1)$ with respect to x at the point x =2
    A. 120
    B. 96
    C. 84
    D. 72
26. Simplify $\left(\frac{1}{\sqrt{3}-1} + \frac{1}{\sqrt{3}+1}\right)^2$
    A. 1
    B. 3
    C. 4
    D. 9
27. An operation $(*)$ is defined on the set **T** = $\{-1, 0, \ldots, 5\}$ by $x(*)y = x + y - xy$. Which of the following operation (s) will give an image which is an element of **T**?
    I. $2(*)5$
    II. $3(*)2$
    III. $3(*)4$
    A. I and III only
    B. II and III only
    C. I only
    D. II only
28. Given that $x: R \to R$ is defined by $x = \frac{y+1}{5-y}$, $y \epsilon R$, find the domain of x.
    A. $\{y: y \in R, y \neq 7\}$
    B. $\{y: y \in R, y \neq 5\}$
    C. $\{y: y \in R, y \neq 1\}$
    D. $\{y: y \in R, y \neq 0\}$
29. Given that $x^2 + 4x + k \equiv (x + r)^2 + 1$, find the values of $k \; and \; r$
    A. $k = 5, r = -1$
    B. $k = 5, r = 2$
    C. $k = 2, r = 5$
    D. $k = -1, r = 5$

30. When $x^3 + kx + 1$ is divided by $(x - 2)$, the remainder is three times as the remainder when it is divided by $(x + 1)$. Find the value of k.

A. $-\frac{3}{7}$

B. $-\frac{9}{7}$

C. $-\frac{3}{5}$

D. $-\frac{9}{5}$

31. If $\frac{6x+k}{2x^2+7x-15} \equiv \frac{4}{x+5} - \frac{2}{2x-3}$, find the value of k.

A. -25

B. -24

C. -22

D. -21

32. If $\log_5\left(\frac{125x^3}{\sqrt[3]{y}}\right)$ is expressed in the form $p\log_5 x + q\log_5 y + k$, find the values of $p, q \text{ and } k$ respectively.

A. 3, $-\frac{1}{3}$,3

B. 3, $\frac{1}{3}$,3

C. $-\frac{1}{3}, 3, 5$

D. 3, $-\frac{1}{3}$, 5

33. Find the first four terms in the binomial expansion of $(1 + 2x)^6$ in ascending powers of x.

A. $1 + 12x + 72x^2 + 144x^3$

B. $1 + 12x + 60x^2 + 160x^3$

C. $1 + 12x + 15x^2 + 20x^3$

D. $1 + 12x + 4x^2 + 8x^3$

34. For what range of values of x is $x^2 - 2x - 3 \leq 0$?

A. $1 \leq x \leq 3$

B. $-3 \leq x \leq -1$

C. $-3 \leq x \leq 1$

D. $-1 \leq x \leq 3$

35. Find the sum to infinity of the sequence $\frac{1}{5}, \frac{2}{15}, \frac{4}{45}$ ....

A. $\frac{1}{15}$

B. $\frac{1}{5}$

C. $\frac{2}{5}$

D. $\frac{3}{5}$

36. If $4sin\theta = 3,\ 0° \leq \theta \leq 180°$, find θ.

A. 48.6°, 131.4°

B. 41.4°, 138.6°

C. 16.2°, 163.8°

D. 13.8°, 166.2°

37. If $y = \frac{1+x}{1-x}$, find $\frac{dy}{dx}$.

A. $\frac{1}{(1-x)^2}$

B. $\frac{2}{(1-x)^2}$

C. $\frac{1+x}{(1-x)^2}$

D. $\frac{x}{(1-x)^2}$

38. The first and twentieth terms of an arithmetic sequence are 3 and 117 respectively. Find 101^{st} term of the sequence.

A. 503

B. 601

C. 603

D. 609

39. Given that $\log_{10} x = a$ and $\log_{10} y = b$, express $\log_{10} \frac{10x^3}{\sqrt{y}}$ in terms of $a\ and\ b$.

A. $3a + \frac{1}{2}b + 1$

B. $3a - \frac{1}{2}b - 1$

C. $3a - \frac{1}{2}b + 1$

D. $3b - \frac{1}{2}a + 1$

40. If P=$\{n^2 + 1 : n = 0,2,3\}$ and Q=$\{n + 1 : n = 2,3,5\}$, find P∩Q.

A. $\{\ \}$

B. $\{1,3\}$

C. $\{4,6\}$

D. $\{5,10\}$