

2024 SHS2 END OF SEMESTER EXAMS – MATHEMATICS [ELECTIVE] 1
MATHEMATICS [ELECTIVE]
PAPER 1
OBJECTIVE TEST

*Answer **all** questions*

[40 marks]

Think carefully before you shade the answer space; erase completely any answers you wish to change.

Do all rough work on this question paper.

Answer the following questions:

- 1.** A binary operation $*$ is defined on the set of positive real numbers by $a * b = b - 2ab$. If $2 * y = 9$, find the value of y .

A. -2 B. 3 C. 2 D. -3

- 2.** A function f is defined on the set R , of real numbers by $f: x \rightarrow \frac{x}{3} - 1$. Find $f(-3)$

A. 2 B. 3 C. -1 D. -2

- 3.** If a polynomial $f(x)$ is divided by $x + 2$, the quotient is $x^2 + x - 1$ and the remainder is 3 , find $f(x)$.

A. $x^3 + 3x^2 + 3x - 1$ B. $2x^3 + 3x^2 + x - 1$
C. $2x^3 + 3x^2 + x - 1$ D. $x^3 + 3x^2 + x + 1$

- 4.** If $3x^2 - 4x + m = 0$ has equal roots, find the value of m .

A. $\frac{16}{9}$ B. $\frac{4}{3}$ C. 9 D. 16

- 5.** Find the coefficient of x^2 in the expansion of $\left(1 + \frac{x}{4}\right)^6$

A. $\frac{15}{2}$ B. $\frac{15}{4}$ C. $\frac{15}{16}$ D. $\frac{15}{8}$

- 6.** Find the gradient of the line passing through the point $M(6, 7)$ and $N(9, 8)$.

A. -1 B. $\frac{1}{2}$ C. $-\frac{1}{2}$ D. 1

- 7.** If $f(x) = \frac{1}{x(x+2)}$ where $x \in R$, determine the domain of the function $f(x)$.

A. $\{x: x \in R, x \neq -2\}$ B. $\{x: x \in R, x \neq 0\}$
C. $\{x: x \in R, x \neq -2, x \neq 0\}$ D. $\{x: x \in R, x > -2, x \neq 0\}$

8. Determine the coefficient of x^6 in the expansion of $(x + 1)^8$.

- A. 28 B. $28y^2$ C. $56y^2$ D. 56

9. $P(-2, 1)$ and $Q(-6, 2)$ are points in a plane. Find $|PQ|$.

- A. $\sqrt{15}$ B. $\sqrt{16}$ C. $\sqrt{17}$ D. $\sqrt{18}$

10. Find the roots of the equation $2x^2 - 3x = 2$.

- A. 2 and -1 B. 1 and -2 C. 1 and 2 D. -1 and -2

11. Simplify $\frac{1}{\sqrt{3}} - \frac{1}{\sqrt{27}}$

- A. $\frac{2\sqrt{3}}{3}$ B. $\frac{\sqrt{3}}{3}$ C. $\frac{2\sqrt{3}}{9}$ D. $\frac{\sqrt{3}}{9}$

12. Given that $\sqrt{150} - \sqrt{12p} + \sqrt{54} = 0$, find the value of the constant p .

- A. 32 B. 16 C. 8 D. 4

A binary operation $*$ is defined on the set of real numbers by $a * b = 3ab$ where a and $b \in R$.
Use the information to answer question 13 to 15.

13. Find the identity element of $*$.

- A. 2 B. $-\frac{1}{3}$ C. $\frac{1}{3}$ D. -2

14. If the inverse of 3 under $*$

- A. 3 B. $\frac{1}{3}$ C. $\frac{1}{9}$ D. $\frac{1}{27}$

15. Find $2 * -1$.

- A. -6 B. 5 C. 7 D. 6

16. The polynomial $f(x) = 2x^3 - 4x^2 + x - 7$ is divided by $x - 1$. Find the remainder.

- A. 0 B. 14 C. -14 D. -8

17. $\frac{5-\sqrt{3}}{2+\sqrt{3}}$ is expressed in the form $a + b\sqrt{3}$, where a and b are real numbers. Find the value of b .

- A. 10 B. 7 C. -7 D. -10

18. If $p = \frac{x+3}{2x-1}$, express $\frac{2p+1}{3p+1}$ in terms of x .

- A. $\frac{4x-5}{5x-8}$ B. $\frac{4x-5}{5x+8}$ C. $\frac{4x+5}{5x+8}$ D. $\frac{4x+5}{5x-8}$

19. Find the radius of the circle $x^2 + y^2 + 6x - 4y - 12 = 0$

- A. 3 B. 5 C. 6 D. 12

20. If $P(-2, 1)$ and $Q(-6, 2)$ are points in a plane. Find $|PQ|$

- A. $\sqrt{15}$ B. $\sqrt{16}$ C. $\sqrt{17}$ D. $\sqrt{18}$

21. The gradient of a curve is given by $2x - 5$, if the curve passes through the point P(1, 2), find its equation.

- A. $y = x^2 - 5x$ B. $y = x^2 - 5x - 6$
 C. $y = x^2 - 5x + 2$ D. $y = x^2 - 5x + 6$

22. The radius of a circle $3x^2 + 3y^2 - 18x - m = 0$ is **2 units**. Find the value of **m**.

- A. 0 B. -18 C. -15 D. 10

23. Solve $\frac{p}{2} + \frac{k}{3} = 5$ and $2p - k = 6$ simultaneously.

- A. $p = 6, k = 6$ B. $p = -6, k = -6$ C. $p = 6, k = -6$ D. $p = -6, k = 6$

24. If $kx^2 + 2x + k = -kx$ have equal roots, find the values of **k**.

- A. 2 and $-\frac{2}{5}$ B. 3 and 2 C. -2 and $-\frac{2}{3}$ D. $\frac{2+\sqrt{10}}{3}$ and $\frac{2-\sqrt{10}}{3}$

25. Express $\frac{2x-1}{(x-1)(2x+1)}$ in partial fraction

- A. $\frac{1}{x+1} + \frac{1}{2x+1}$ B. $\frac{3}{x+1} + \frac{4}{2x+1}$ C. $\frac{2x}{x+1} + \frac{-1}{2x+1}$ D. $\frac{-3}{x+1} + \frac{4}{2x+1}$

26. Find the equation of a straight line parallel to $5x + 4y = 12$ and passes through the point (3,5)

- A. $4y + 5x + 35 = 0$ B. $4y - 5x + 35 = 0$
 C. $4y - 5x - 35 = 0$ D. $4y + 5x - 35 = 0$

27. If $f(x) = \frac{x+1}{x-3}$, where $x \neq 3$, find the inverse of $f(x)$.

- A. $\frac{3x+1}{x-1}, x \neq 1$ B. $\frac{x-1}{x+1}, x \neq 1$ C. $\frac{x-1}{3x+1}, x \neq -\frac{1}{3}$ D. $\frac{x+1}{x-1}, x \neq -1$

28. Find the midpoint of the line joining the point A(3,0) and B(5,6)

- A. (3,4) B. (4,3) C. (5,6) D. (4,1)

29. Find the gradient of the equation $3x + 2y - 5 = 0$

- A. $\frac{3}{2}$ B. $\frac{4}{2}$ C. $-\frac{3}{2}$ D. $\frac{3}{4}$

30. Simplify $\frac{1-\sqrt{3}}{1+\sqrt{3}}$.

- A. $\frac{1-\sqrt{3}}{1+\sqrt{3}}$ B. $-2+\sqrt{3}$ C. $2+\sqrt{3}$ D. $-2+\sqrt{6}$

31. The equation of the circle is $x^2 + y^2 + 8x - 6y + 5 = 0$. Find its radius

- A. 6 B. 5 C. 4 D. 2

32. Determine the coordinates of the centre from the circle $2x^2 - 6y^2 + 8x - 4y + 2 = 0$

- A. (-4,1) B. (-2,1) C. (2,-1) D. (4,-1)

33. Find the radius of the circle $3x^2 + 3y^2 - 4x + 5y + 3 = 0$

- A. $\frac{1}{2}$ B. $\frac{2}{3}$ C. $1\frac{1}{2}$ D. $\frac{\sqrt{5}}{6}$

34. The polynomial $f(x) = 2x^2 - 4x + x - 7$ is divided by -1 . Find the remainder

- A. -14 B. -8 C. 0 D. 14

35. Find the x and the y-intercept from the equation respectively $x + 2y - 3 = 0$

- A. $\frac{1}{2}, \frac{3}{2}$ B. $\frac{1}{2}, 3$ C. $3, \frac{3}{2}$ D. $-3, \frac{2}{3}$

36. If $g: r \rightarrow 5 - 2r$, r is a real number, find the image of -3

- A. 11. B. -9 C. 13 D. -1

37. Find the sum of the root of the equation $4 - \frac{1}{z} = x$

- A. 4 B. 1 C. -1 D. -4

38. If α and β are the root of the equation $3x^2 - 6x + 4 = 0$, Find the value of $\frac{\alpha^2 + \beta^2}{\alpha\beta}$

- A. $5\frac{1}{3}$ B. $-\frac{2}{3}$ C. 3 D. 1

39. Solve $3^{x+y} = 243$ and $3x + y = 9$

- A. $x=2, y=6$ B. $x=2, y=3$ C. $x=-3, y=-6$ D. $x=-6, y=6$

40. Which of the following is not a rational number?

- A. 0 B. $\sqrt{3}$ C. $\frac{1}{3}$ D. 3

END OF PAPER