Name: …………………………............

Class: ……………………………………

ELECTIVE MATHEMATICS 1   MOCK 2023

PARKOSO COMM. SENIOR HIGH SCHOOL, KUMASI
FORM THREE A1, SCI, AGRIC & BUS   *1 HR 30MIN*

*Do **not** open this booklet until you are told to do so. While you are waiting, read and observe the following instructions carefully. Write your **FULL NAME** and **CLASS** in **INK** in the space above.*

*This booklet contains **40** objective test items. Answer **all** questions. Choose the **correct** answer to **each** question and **shade** it on the shading sheet.*

Use the information below to answer Questions 1 and 2.

Two functions are defined on subsets of the real numbers by $f:x\rightarrow\frac{2}{x-1}$ and $g:x\rightarrow\frac{1}{x}$

1. Find $[(f \circ g)](x)$.

A. $1-\frac{1}{x}$

B. $1+\frac{1}{x}$

C. $\frac{2x}{1-x}$

D. $\frac{x}{1+x}$

2. For what value(s) of x is $[(f \circ g)](x)$ not defined?

A. $x = -1$

B. $x = 0$

C. $x > 0$

D. $x = 1$

3. In $\triangle PQR, \overrightarrow{PQ} = 5i - 2j$ and $\overrightarrow{QR} = 4i + 3j$. Find $\overrightarrow{RP}$

A. $-9i + j$

B. $i + 5j$

C. $-9i - j$

D. $-i - 5j$

4. For what values of k is $4x^2 - 12x + k$, a perfect square?

A. 9

B. $\frac{4}{9}$

C. $-\frac{4}{9}$

D. -9

5. Find the inverse of $\begin{pmatrix} 4 & 2 \\ -3 & -2 \end{pmatrix}$

A. $\begin{pmatrix} -2 & -1 \\ 1.5 & 1 \end{pmatrix}$

B. $\begin{pmatrix} -2 & 1 \\ -1.5 & 1 \end{pmatrix}$

C. $\begin{pmatrix} 1 & -1 \\ 1.5 & -2 \end{pmatrix}$

D. $\begin{pmatrix} 1 & 1 \\ -1.5 & -2 \end{pmatrix}$

6. Simplify $\frac{\log\sqrt{27}-\log\sqrt{8}}{\log 3-\log 2}$

A. $-\frac{1}{4}$

B. $-\frac{3}{2}$

C. $\frac{1}{4}$

D. $\frac{3}{2}$

7. Simplify: $\frac{2}{3}\sqrt{162} - \sqrt{50}$

A. $2\sqrt{2}$

B. $-\sqrt{2}$

C. $\sqrt{2}$

D. $3\sqrt{2}$

8. How many subsets do the set $A = \{1, 2, 3\}$?

A. 3

B. 4

C. 9

D. 8

9. The mean of 12 number is 18. If each of the numbers is increased by 5, the new mean.

A. 13

B. 17

C. 18

D. 23

10. In a class of 53 students, 36 passed Biology and 29 passed Chemistry. How many students passed both subjects if 2 students did not write the exams?

A. 11

B. 12

C. 13

D. 14

11. Given that $\frac{3x+4}{(x-2)(x+3)} \equiv \frac{P}{x+3} + \frac{Q}{x-2}$, find the value of Q.

  A. -2

  B. -1

  C. 1

  D. 2

12. Expand and simplify $\left(2 - \sqrt{3}\right)^2$

A. $7 - 4\sqrt{3}$

B. $1 - 4\sqrt{3}$

C. $4 - \sqrt{3}$

D. $4 - 4\sqrt{3}$

13. In how many ways can a committee of 2 women and 3 men be chosen from a group of 7 men and 5 women.

A. 200

B. 210

C. 300

D. 350

14. A binary operation Δ is defined on the set R of real numbers by $x \Delta y = \frac{1}{3}x - 5y$. Find $6 \Delta - 4$

A. -18

B. 22

C. -17

D. 23

15. The inverse of a function f is given by $f^{-1}(x) = \frac{2x}{1-x}$, $x \neq 1$. Find the function $f(x)$

A. $\frac{x}{2+x}$, $x \neq -2$

B. $\frac{x}{2-x}$, $x \neq 2$

C. $\frac{2}{1-x}$, $x = 1$

D. $\frac{2}{1+x}$, $x \neq -1$

16. Solve $\left(\frac{1}{9}\right)^{x+2} = 243^{x-2}$

A. $-\frac{6}{7}$

B. $-\frac{7}{6}$

C. $\frac{6}{7}$

D. $\frac{7}{6}$

17. If $\sqrt{5}\cos x + \sqrt{15}\sin x = 0$, for $0° < x < 360$, find the values of x

A. 210° and 330°

B. 150° and 330°

C. 150° and 210°

D. 30° and 150°

18. The gradient of $y = 3x^2 + 11x + 7$ at $P(x, y)$ is -1. Find the coordinates of P

A. $\left(-1, -\frac{5}{2}\right)$

B. $(-2, 3)$

C. $(-2, -3)$

D. $(-3, -2)$

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

A. $\sqrt{\frac{17}{2}}$

B. $\frac{\sqrt{17}}{2}$

C. $\frac{17}{2}$

D. $\frac{17}{4}$

20. Find the equation of the normal to the curve
$y = 2x^2 - 5x + 10$ at $P(1, 7)$

A. $y - x + 3 = 0$
B. $y - x - 6 = 0$
C. $y - x + 6 = 0$
D. $y + x - 3 = 0$

21. What is the minimum value of $g(x) = 2x^2 - 4x + 5$

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

22. $f(x) = 3x^3 + 8x^2 + 6x + k$. Find the value of k if $f(2) = 1$

A. 61

B. -67

C. -61

D. 67

23. If α and β are the roots of the equation $x^2 - x - 3 = 0$, find the value of $\alpha^3 + \beta^3$.

A. 10

B. 5

C. -10

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

24. A binary operation is defined on real numbers by $x \blacksquare y = \frac{2}{3}x + xy$. Find $12 \blacksquare - 3$

A. 44

B. 28

C. 17

D. -28

25. Find the quadratic equation whose roots are $-\frac{1}{2}$ and 3

A. $2x^2 - 5x + 3 = 0$

B. $2x^2 + 5x + 3 = 0$

C. $2x^2 + 5x - 3 = 0$

D. $2x^2 - 5x - 3 = 0$

26. If $\sin x = \frac{12}{13}$ and $\sin y = \frac{4}{5}$ where x and y are both acute angles, find $cos(x + y)$

A. $-\frac{48}{65}$

B. $-\frac{33}{65}$

C. $\frac{13}{65}$

D. $\frac{48}{65}$

27. Find the sum of the **first** 20 terms of the sequence: $-7, -3, 1 ....$
   A. 690
   B. 620
   C. 1240
   D. 660

28. Find the value of $6(\sqrt{4x^2 + 1}) = 13x$, where $x > 0$.
   A. $\frac{24}{25}$
   B. $\frac{5}{6}$
   C. $\frac{6}{5}$
   D. $\frac{25}{24}$

29. Calculate the distance between the points $(-2, -5)$ and $(-1, 3)$.
   A. $\sqrt{17}$ units
   B. $\sqrt{5}$ units
   C. $\sqrt{73}$ units
   D. $\sqrt{65}$ units

30. If $\mathbf{P} = \begin{pmatrix} 2 & 3 \\ -4 & 1 \end{pmatrix}$, $\mathbf{Q} = \begin{pmatrix} 6 \\ 8 \end{pmatrix}$ and $\mathbf{PQ} = k\begin{pmatrix} 45 \\ -20 \end{pmatrix}$, find the value of k.

    A. $\frac{4}{5}$

    B. $-\frac{5}{4}$

    C. $\frac{5}{4}$

    D. $-\frac{4}{5}$

31. The second and fourth terms of an exponential sequence (G.P.) are $\frac{2}{9}$ and $\frac{8}{81}$ respectively. Find the sixth term of the sequence.

    A. $\frac{1}{4}$

    B. $\frac{32}{729}$

    C. $\frac{81}{32}$

    D. $\frac{9}{8}$

32. If the mean of 2, 5, $(x + 1)$, $(x + 2)$, 7 and 9 is 6, find the median.

    A. 5.5
    B. 6.5
    C. 5.0
    D. 6.0

33. Calculate the mean deviation of 5, 8, 2, 9 and 6.

    A. 4
    B. 2
    C. 5
    D. 3

34. Solve, correct to **three** significant figures, $(0.3)^x = (0.5)^8$

    A. 0.461

B. 4.61
C. 0.0130
D. 4.606

35. Find the coordinates of the center of the circle $3x^2 + 3y^2 - 6x + 9y - 5 = 0$

    A. $\left(1, -\frac{3}{2}\right)$

    B. $\left(3, -\frac{9}{2}\right)$

    C. $\left(-3, \frac{9}{2}\right)$

    D. $\left(-1, \frac{3}{2}\right)$

36. Which of the following vectors is perpendicular to $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$?

    A. $\begin{pmatrix} 1 \\ 3 \end{pmatrix}$

    B. $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$

    C. $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$

    D. $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

37. Find, correct to the **nearest** degree, the angle between $\mathbf{p} = 12\mathbf{i} - 5\mathbf{j}$ and $\mathbf{q} = 4\mathbf{i} + 3\mathbf{j}$.

    A. 75°
    B. 59°
    C. 76°
    D. 60°

38. The probabilities that John and Jane will pass an examination are 0.9 and 0.7 respectively. Find the probability that at least one of them will pass the examination.

    A. 0.72
    B. 0.97
    C. 0.28
    D. 0.67

39. Given that X and Y are independent events such that $P(X) = 0.5$, $P(Y) = m$ and $P(X \cup Y) = 0.75$, find the value of m.

    A. 0.4
    B. 0.3
    C. 0.6
    D. 0.5

40. Evaluate: $\lim\limits_{x \to 1} \left(\dfrac{1 - x}{x^2 - 3x + 2} \right)$

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