



**AKENTEN APPIAH-MENKA UNIVERSITY OF SKILLS TRAINING
AND ENTREPRENEURIAL DEVELOPMENT
INSTITUTE FOR TEACHER PROFESSIONAL DEVELOPMENT AND
LIFELONG LEARNING (ITPDLL)**

END OF FIRST SEMESTER EXAMINATION 2023/2024

COURSE CODE	ECM114/PBMa111/JBM 114
COURSE TITLE	LEARNING, TEACHING AND APPLYING NUMBER AND ALGEBRA
DURATION	TWO HOURS
INSTRUCTIONS	THIS PAPER CONSIST OF SECTIONS A, B, C & D. ANSWER ALL QUESTIONS IN SECTIONS A, B, C AND ONE (1) QUESTION IN SECTION D INTO THE ANSWER BOOKLET PROVIDED.
INDEX NUMBER	

SECTION A [20 Marks]

INSTRUCTION: For questions 1-20, choose the most appropriate answer from the options lettered A, B, C and D provided.

- What value of k makes the expression, $p^2 - 8p + k$, a perfect square?
 - 100
 - 81
 - 64
 - 16
- Factorize completely: $6ax - 12by - 9ay + 8bx$.
 - $(2a - 3b)(4x + 3y)$
 - $(3a + 4b)(2a - 3y)$
 - $(3a - 4b)(2x + 3y)$
 - $(2a + 3b)(4x - 3y)$
- The period of oscillation of a pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$. If $g = 10\text{ms}^{-2}$, $T = 60\text{ms}^{-1}$ and $\pi = \frac{22}{7}$. Find l , approximate to the nearest whole number.
 - 100m
 - 800m
 - 900m
 - 912m

4. If $\frac{1}{2}x + y = 4$ and $3x - \frac{1}{3}y = \frac{1}{2}$. Find the values of x and y .

A. $x = 2, y = -1$

B. $x = 2, y = 3$

C. $x = \frac{1}{2}, y = 3$

D. $x = \frac{1}{2}, y = \frac{1}{3}$

5. Express the sum of 2002.2 and 4.27×10^3 in standard form.

A. 6.272×10^3

B. 6.2702×10^2

C. 6.2702×10^{-2}

D. 6.2702×10^{-3}

6. Arrange the following fractions in descending order of magnitude $\frac{5}{6}, \frac{5}{2}, \frac{8}{3}, \frac{9}{4}$.

A. $\frac{8}{3}, \frac{5}{2}, \frac{5}{6}, \frac{9}{4}$

B. $\frac{5}{6}, \frac{9}{4}, \frac{8}{3}, \frac{5}{2}$

C. $\frac{9}{4}, \frac{5}{2}, \frac{8}{3}, \frac{5}{6}$

D. $\frac{8}{3}, \frac{5}{2}, \frac{9}{4}, \frac{5}{6}$

$$\frac{10+70+33+27}{12} = \frac{99}{12}$$

$$\frac{10}{12}, \frac{70}{12}, \frac{33}{12}, \frac{27}{12}$$

$$\frac{8}{3}, \frac{5}{2}, \frac{9}{4}, \frac{5}{6}$$

7. Which of the following is **not** an irrational number?

A. $\sqrt{3}$

B. $\sqrt{9}$

C. $\sqrt{13}$

D. $\sqrt{15}$

8. Simplify $\left(\frac{4}{5} \times 2\frac{1}{4}\right) + \left(2\frac{1}{2} \div \frac{5}{6}\right)$ leaving your answer correct to the nearest whole number.

A. 0

B. 3

C. 5

D. 6

9. Which property of real numbers is illustrated in the equation $3(7 - 5) = (3 \times 7) - (3 \times 5)$?

- A. Commutative property of subtraction of integers.
- B. Associative property of multiplication over subtraction on integers.
- C. Distributive property of multiplication over subtraction on integers.
- D. Distributive property of subtraction over multiplication on integers.

10. The operation $*$ is defined on the set $S = \{a, b, c\}$ by the table.

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

The inverse element of a under the operation $*$ is

- A. c .
- B. b .
- C. a .
- D. none of the above.

11. A survey of 64 informed students revealed the following information: 45 believe that Mathematics is difficult, 49 believe that Science is difficult and 42 believe both science and mathematics are difficult. How many believe neither of these subjects is difficult?

- A. 3
- B. 12
- C. 22
- D. 30

12. If the universal set $U = \{-3, 0, 2, 3, 4, 5, 6, \dots, 10\}$ is defined on the set of integers. The sets A and B are subsets of U such that $A = \{-3, 0, 3, 5\}$, and $B = \{2, 3, 5, 6\}$, find $(A \cup B)'$

- A. $\{4, 7, 8, 9, 10\}$
- B. $\{2, 4, 7, 8, 10\}$
- C. $\{3, 4, 7, 9, 10\}$
- D. $\{4, 5, 7, 8, 9, 10\}$

13. The total age of two sisters is 108 years. One is 18 years older than the other. Find the ratio of the age of the older to that of the younger.
- A. 2:1
 - B. 7:5
 - C. 7:6
 - D. 9:7
14. Solve for y in the following ratio, $4y:32 = 36:72$
- A. 6
 - B. 9
 - C. 4
 - D. 3
15. Express 243_5 as a base ten numeral
- A. 1024
 - B. 663
 - C. 663
 - D. 366
16. If $23 + 14 = a \pmod{5}$, find the value of a .
- A. 0
 - B. 1
 - C. 2
 - D. 3
17. A function f is defined by $f: x \rightarrow 3 - 2x$. Find the image of $f(-3)$.
- A. 10
 - B. 9
 - C. 8
 - D. 6
18. State the domain of the function $f(x) = \frac{2x-1}{x-4}$
- A. $\{x: x \in R, x \neq -4\}$
 - B. $\{x: x \in R, x \neq \frac{1}{4}\}$
 - C. $\{x: x \in R, x \neq 4\}$
 - D. $\{x: x \in R\}$

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19. Which one of the following Roman Numerals represents the number 1,709?

- A. MDCXIX
- B. MDCCIX
- C. MCDXIX
- D. MDCIX

20. Given the inequality $-8 < 9$ write the result when -8 is subtracted from both sides.

- A) $-16 < 1$
- B) $-16 < 17$ $-16 <$
- C) $0 < 17$
- D) $0 < 1$

SECTION B [10Marks]

Indicate whether each of the following statements is TRUE or FALSE in Questions 21 to 30.

21. The following expressions are either undefined or indeterminate $\frac{0}{0}, \frac{100}{0}, \frac{-1}{0}$
22. If b is an even number, then $3b^3 + 3$ is odd.
23. Irrational numbers are fractions whose division process is non-recurrent or non-periodic.
24. $(2 + 3) + (3 + 2)$ describes the associative property of addition.
25. The number of subsets of the set with cardinality 10 is 1024.
26. The function $g(x)$ is said to be one-to-one if $g(a) = g(b)$ implies $a = b$.
27. $A' \cup B' \neq (A \cap B)'$
28. Rational numbers are fractions whose division process are periodic or terminating.
29. There are infinitely many integers between 6.3 and 7.37.
30. A one-to-one function is an onto function.

SECTION C [10 Marks]

From questions 31 to 35, show all short responses in the answer booklet provided.

31. A function $f(x)$ is defined by $f: x \mapsto \frac{2x+3}{5-2x}$. Find the image of -4 .
32. Identify the property being illustrated in the equation. $5(33) = 5(3) + 5(30)$
33. A box can hold sixty pencils when full. How many pencils will be in the box when it is four-tenths full? 24
34. Simplify and combine like terms $6(3x - 1) + 2 - (-3x + 4)$

35. Evaluate the expression below if $x = 2$, $y = -5$, $z = 2$ and $w = -2$

$$xz + yz + \frac{1}{2}$$

SECTION D [20 Marks]

Answer ANY ONE of the following questions in the answer booklet provided.

36. a). Two functions f and g are given by: $f(x) = \frac{2}{3x+1}$ and $g(x) = 3x - 1$

- i. Find the largest possible domain of the functions g and f [2Marks]
- ii. Find the range of the function, f [2Marks]
- iii. Show that the function g is one-to-one [2Marks]
- iv. Find the value of $f \circ g(-3)$ [2Marks]

b). Peter goes for shopping for his mother. He is told to buy 3 pens and 2 pencils which will cost Gh¢68.00 altogether. By mistake he buys 2 pens and 3 pencils for Gh¢62.00. Take x cedis to be cost of one pen and y cedis to be the cost of one pencil.

- i). Write down the two equations in x and y to represent the scenario. [2Marks]
- ii). Solve the equation to find the cost of a pen and a pencil. [3Marks]

c). A set of furniture costing GH¢ 2,400.00 was sold for GH¢ 3,000.00. Find the profit percent. [3Marks]

d). A survey of 64 informed students revealed that 45 believe that mathematics is difficult 49 believe that science is difficult and 42 believe that both subjects are difficult.

- i. How many students believe neither of these subjects is difficult? [2Marks]
- ii. How many students believe Mathematics is difficult but do not believe that Science is difficult? [2Marks]

37. a). Given that the function $f(x) = 7x+3$ and $g(x) = 3x+2$. Find $(g \circ f)(x)$. [3Marks]

b). The operation Δ is given by $a \Delta b = ab + 2 \text{ mod } 5$.

- i) Draw a table for Δ on the set $= \{1, 2, 3, 5\}$ [3Marks]
- ii) Using the table in (i), evaluate $(2 \Delta 3)$ and $(3 \Delta 2)$. [2Marks]

c). The sum of two numbers is sixteen. The difference between four times the smaller number and two is two more than twice the larger number. Find the numbers. [3Marks]

d). Find the prime factors of 81 and 72 and use them to find the highest common factor of 81 and 72. [5Marks]

e). Given the function $f(x) = x^4 + x^3 - 11x^2 - 9x + 18$, evaluate the following,

$$f(0), f(-2), f(-3).$$

[4Marks]

38. a). i). Draw the addition(\oplus) and multiplication(\otimes) tables for arithmetic modulo 6

[3Marks]

ii. Use your tables to evaluate $(2 \otimes 4) \oplus (3 \otimes 4)$ and solve $2 \otimes n = 4$

[3 Marks]

b). Express 2435_{six} to a number in base five

[3Marks]

c). Solve the inequality $8(x + 1) + 1 < 3(2x) + 1$

[3Marks]

d). A group of 40 market women sells at least one of the following foodstuffs: yam, maize and plantain. Of these 22 sell yam, 20 sell maize, 18 sell plantain, 7 sell both yam and maize, 9 sell yam and plantain and no one sells all three items.

i. Draw a Venn diagram to illustrate this information.

[2 Marks]

ii. Find the number of women who sell maize and plantain only.

[2Marks]

iii. How many women sell yam or maize but not plantain?

[2Marks]

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