THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
FORM TWO NATIONAL ASSESSMENT

042   **ADDITIONAL MATHEMATICS**

Time: 2:30 Hours   **SOLUTIONS**   **Year: 2024**

Instructions

1. This paper consists of two sections of **ten (10) Compulsory** questions.

2. Answer **all** questions.

3. All writing must be in **blue** or **black** ink **except** drawing which must be in pencil.

4. Cellular phones and any unauthorized materials are **not** allowed in the assessment room.

5. Write your **Assessment Number** at the top right-hand corner of every page.

1. (a) One among the Form Two students at a certain school had a birthday party. During the occasion, some drinks were distributed among the six tables in the following manner:

Wine = 7, 8, 11, 13, 20, 23

Juice = 4, 8, 12, 20, 32, 52

Water = 1, 2, 4, 5, 6, 7.

Use the information stipulated to identify the distribution that follows the Fibonacci sequence.

Solution:

The Fibonacci sequence is a series where each term is the sum of the two preceding terms: 1, 1, 2, 3, 5, 8, 13, 21, 34, …

- Wine: 7, 8, 11, 13, 20, 23 → 8, 13, 21… don't follow Fibonacci.
- Juice: 4, 8, 12, 20, 32, 52 → does follow Fibonacci.
- Water: 1, 2, 4, 5, 6, 7 → 1, 2, 3, 5, 8… don't follow Fibonacci.

Answer: Juice sequence is the Fibonacci.

(b) The tailoring mart association distributed sewing machines to four villages. Each village has the following number of people who belong to the association:

Village A = 69388, B = 125362, C = 164369, D = 378978. To be beneficiary of a sewing machine, it requires a group of 19 members of the same village. Use divisibility rule to identify how many villages can acquire the sewing machines.

Solution:

- Check divisibility by 19:

  $69388 \div 19 = 3652 \rightarrow$ divisible

  $125362 \div 19 = 6598 \rightarrow$ divisible

164369 ÷ 19 = 8656.26 → divisible

378978 ÷ 19 = 19946.21 → not divisible

Answer: Villages A, B and C can acquire sewing machines.

2. (a) Find the solution set of the inequality: -18 < 6x + 6 ≤ 36

Solution:

Subtract 6: -24 < 6x ≤ 30

Divide by 6: -4 < x ≤ 5

Solution set: x ∈ (-4, 5]

Number line: A line from -4 (open circle) to 5 (closed circle).

(b) Given that $K^2 = (T^2g) / (T + g)$, calculate the value of g if K = 12 and T = 6.

Solution:

$K^2 = (T^2g) / (T + g)$

$12^2 = (6^2 \times g) / (6 + g)$

144 = (36g) / (6 + g)

144(6 + g) = 36g
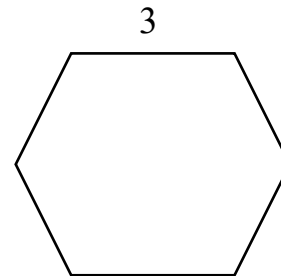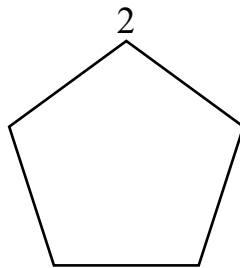
864 + 144g = 36g

144g - 36g = -864 (bring 36g to left)

108g = -864 → g = -8
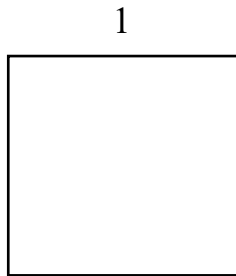
Answer: g = -8

Formula for sum of interior angles of polygon with n sides:

Sum = (n - 2) × 180°

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3. Study the regular polygons 1, 2, and 3 and answer the questions that follow.

1   2   3

(a) Complete the following table by writing the number of triangles and sum of interior angles for each polygon.

Polygon	Number of triangles	Sum of all interior angles
1	2	360^0
2	3	540^0
3	4	760°

(b) Write down the formula for calculating the sum of all interior angles of a polygon with n sides.

$$S = (n-2)180^0$$

4. (a) Calculate the value of k when two lines given by equations $5x + 6y = 5$ and $kx - 3y = 10$ are:

(i) parallel $\rightarrow$ slopes equal

$5x + 6y = 5 \rightarrow y = (-5/6)x + 5/6 \rightarrow$ slope m1 = -5/6

$kx - 3y = 10 \rightarrow y = (k/3)x - 10/3 \rightarrow$ slope m2 = k/3

Parallel $\rightarrow$ m1 = m2 $\rightarrow$ -5/6 = k/3 $\rightarrow$ k = -5/2

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(ii) perpendicular → m1 × m2 = -1

(-5/6) × (k/3) = -1 → -5k / 18 = -1 → 5k = 18 → **k = 18/5**

(b) Show whether the following points are collinear:

(i) (-1,-4), (1,2), (3,8) → check slope between pairs:

Slope AB = (2 + 4)/(1 + 1) = 6/2 = 3

Slope BC = (8 - 2)/(3 - 1) = 6/2 = 3

Same slopes → collinear

(ii) (0,1), (1,3), (2,5) → slope between pairs:

Slope AB = (3 - 1)/(1 - 0) = 2

Slope BC = (5 - 3)/(2 - 1) = 2

Same slopes → collinear

5. (a) A cow tied to a pole at B moves such that rope is always equidistant from B. Describe the locus.

Answer: The locus is a **circle** with center at point B and radius equal to the length of the rope.

(b) Point T is equidistant from M(5,2) and N(-1,1). Find locus.

Midpoint of MN: ((5 -1)/2, (2 +1)/2) = (2, 1.5)

Slope of MN: (2 -1)/(5 +1) = 1/6 → slope of perpendicular bisector = -6

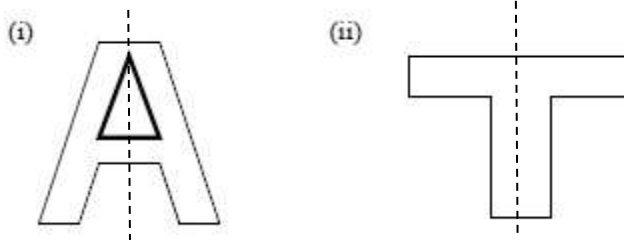Equation of perpendicular bisector: y - 1.5 = -6(x - 2)

y = -6x + 13.5

Answer: Locus is a **straight line**, the perpendicular bisector of MN.

6. (a) Determine the number of lines of symmetry in the following objects:

(i) Ball → infinite

(ii) Pencil → 1 (longitudinal axis)

(b) Use a dotted line(s) to verify the symmetry of the following letters;

(c) Lines of symmetry of polygons:

(i) Square → 4 lines

(ii) Equilateral triangle → 3 lines

(iii) Rhombus → 2 lines

7. (a) Use truth table to show whether ~ (p ∧ q) ∨ (p ∨ q) is a tautology.

Using De Morgan: ~ (p ∧ q) = ~p ∨ ~q

~p ∨ ~q ∨ (p ∨ q) = (~p ∨ p) ∨ (~q ∨ q) = True ∨ True = True

$$\sim(P \wedge q) \vee (P \vee q) \equiv (\sim P \wedge \sim q) \vee (P \vee q)$$

P	q	~p	~q	~(P∧q)	P ∨ q	~(P∧q) ∨ (P∨q)
T	T	F	F	F	T	T
T	F	F	T	F	T	T
F	T	T	F	F	T	T
F	F	T	T	T	F	T

Answer: It is a tautology

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(b) Symbolic form:

(i) Clouds are heavy and it is not raining $= P \wedge \sim Q$

(ii) If it is not true that clouds are heavy, then it is raining $= \sim P \rightarrow Q$

(iii) It rains if and only if clouds are heavy $= Q \leftrightarrow P$

(c) Truth table for $p \rightarrow (\sim q \wedge \sim p)$:

p	q	~q	~p	~q ∧ ~p	p → (~q ∧ ~p)
T	T	F	F	F	F
T	F	T	F	F	F
F	T	F	T	F	T
F	F	T	T	T	T

8. in a certain seminar, the storekeeper was required to buy some stationaries. He decided to purchase 2 pens and notebooks, which cost Tsh. 1400/= from the first shop, and then he bought 6 pens and 8 notebooks from the second shop, which cost Tsh. 3600/=. Suppose 1000 participants are expected to attend the seminar; evaluate the total cost that the storekeeper will incur by using the elimination method.

Storekeeper buys stationeries:

2 pens + 4 notebooks = 1400

6 pens + 8 notebooks = 3600

Let pen = x, notebook = y:

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Equation 1: $2x + 4y = 1400 \rightarrow x + 2y = 700$

Equation 2: $6x + 8y = 3600 \rightarrow 3x + 4y = 1800$

Multiply eq1 by 2: $2x + 4y = 1400$

Subtract from eq2: $3x + 4y - 2x - 4y = 1800 - 1400$

x = 400

Then $y = (700 - 400)/2$

y = 150

$x + y = 400 + 150 = 550$

$550 \times 1000 = 550,000$

The shopkeeper will incur Tsh. 550,000/=

9. (a) $n(K \cup L \cup M) = n(K) + n(L) + n(M) - n(K \cap L) - n(K \cap M) - n(L \cap M) + n(K \cap L \cap M)$

$18 + 22 + 25 - 11 - 15 - 14 + 9 = 34$

n(K ∪ L ∪ M) = 34

(b) Families survey:

Total families = 80

Goats = 49, Cows = 61, Dogs = 50

Goats & Cows = 33, Cows & Dogs = 35, Goats & Dogs = 27, All three = x

Using inclusion-exclusion:

$x = 49 + 61 + 50 - 33 - 35 - 27 + x = 80 \rightarrow x = 15$

(i)   All types of animals = 15

(ii) Goats or cows if dogs only excluded → Goats only + Cows only + Both

Goats & Cows = 49 + 61 - 33 = **77**

(iii) Dogs or cows if goats only excluded → (50) + (61) -35

= **76**

10. (a) a directly proportional to √b. a = 24 when b = 36. Find a when b = 6.25

a / √b = k → k = 24 / √36 = 24 / 6 = 4

Then a = 4 × √6.25 = 4 × 2.5 = 10

Value of a is 10

(b) 16 students cultivate farm in 12 days. How many days for 8 students?

Work = students × days = constant → 16 × 12 = 8 × d → d = 16 ×12 /8

= 24 days

(c) p varies directly as q² and inversely as r. p = 48 when q = 4 and r = 16. Find p

when q = 8 and r = 12

p = k × q² / r → k = p × r / q² = 48 × 16 / 16 = 48

Then p = 48 × 8² / 12 = 48 × 64 / 12 = 3072 /12 = 256

p = 256