THE UNINTED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

FORM TWO SECONDARY EDUCATION EXAMINATION, 2007

0041 **BASIC MATHEMATICS**

Time: 2:30 Hours **ANSWERS**

Instructions:

1. this paper consists of section A and B
2. Answer all questions
3. Each question carries Four marks.

1. Which is greater 5/6 or 5/7?
Solution:
To compare 5/6 and 5/7, find their common denominators:
For 5/6: (5 × 7) / (6 × 7) = 35/42.
For 5/7: (5 × 6) / (7 × 6) = 30/42.
Since 35/42 > 30/42, 5/6 > 5/7.

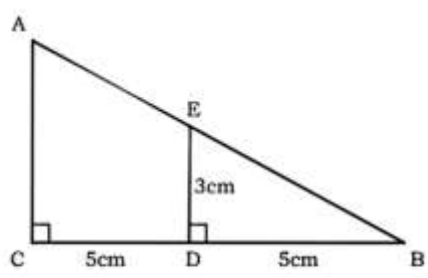
Answer: 5/6.

2. The average of scores in three subjects is 33. If the average of scores in two subjects is 16, find the score of the third subject.
Solution:
The sum of scores of three subjects = 33 × 3 = 99.
The sum of scores of two subjects = 16 × 2 = 32.
The score of the third subject = 99 - 32 = 67.

Answer: 67.

3. Estimate 521 to the nearest hundreds and 29 to the nearest tens. Hence find the product of the estimations.
Solution:
521 rounded to the nearest hundreds = 500.
29 rounded to the nearest tens = 30.
The product = 500 × 30 = 15000.

Answer: 15000.
4. Find the length of AC in the figure below if BD = 5 cm, DC = 5 cm, and DE = 3 cm.



Solution:
Using the Pythagorean theorem:
$AC^2 = AD^2 + DE^2$.
AD = BD + DC = 5 + 5 = 10 cm.
$AC^2 = 10^2 + 3^2 = 100 + 9 = 109$.
AC = √109 cm.
Answer: √109 cm.

5. Without using mathematical tables, evaluate 2 log 5 + 4 log 2 - 1/3 log 64.
Solution:
Using logarithmic properties:
2 log 5 + 4 log 2 - 1/3 log 64 = log 5^2 + log 2^4 - log 64^(1/3).
= log 25 + log 16 - log 4.
= log (25 × 16) - log 4.
= log 400 - log 4.
= log (400 / 4).
= log 100 = 2.

6. A rope of 18 m and 80 cm is to be divided into four equal parts. How long will each part be? (Give your answer in metres and centimetres.)

Solution:
Convert 18 m 80 cm to centimetres:
18 m = 1800 cm, so 18 m 80 cm = 1880 cm.
Divide by 4:
1880 ÷ 4 = 470 cm.
Convert back to metres:
470 cm = 4 m 70 cm.

Answer: 4 m 70 cm.

7. Simplify (144 + 20) × 48 + 4 ÷ 2.

Solution:
Simplify step by step: apply BODMAS
144 + 20 = 164. .... Bracket open
164 × 48 = 7872. ....multiplication to open the brackets
4 ÷ 2 = 2. ....division
7872 + 2 = 7874. .... addition

Answer: 7874.

8. The area of a trapezium is 4000 cm^2. If one of the parallel sides is 80 cm and the height of the trapezium is 40 cm, find the length of the other parallel side.

Solution:
The area of a trapezium is given by:
Area = 1/2 × (a + b) × h, where a and b are the parallel sides and h is the height.
4000 = 1/2 × (80 + b) × 40.

4000 = 20 × (80 + b).
4000 ÷ 20 = 80 + b.
200 = 80 + b.
b = 200 - 80 = 120.
Answer: 120 cm.

9. Express 0.125 as a percentage.
Solution:
To convert a decimal to a percentage, multiply by 100:
0.125 × 100 = 12.5%.

Answer: 12.5%.

10. An equilateral triangle of sides a, b, and c has a perimeter of 105 m. Find the length of side c.
Solution:
For an equilateral triangle, all sides are equal, so a = b = c.
Perimeter = a + b + c = 105.
3c = 105.
c = 105 ÷ 3 = 35.
11. If a:b = 4:9 and b:c = 3:7, evaluate a:c.
Solution:
We are given two ratios:
a : b = 4 : 9 and b : c = 3 : 7.

Step 1: Adjust both ratios so that the value of b is the same.
The least common multiple (LCM) of 9 and 3 is 9.
For b : c = 3 : 7, multiply both terms by 3:
b : c = 9 : 21.

Step 2: Combine a : b = 4 : 9 with b : c = 9 : 21.
a : b : c = 4 : 9 : 21.
Step 3: Extract the ratio of a : c from a : b : c.
a : c = 4 : 21.
Answer: a : c = 4 : 21.

12. The sum of two integers is 6 and their difference is 4. Find the integers.

Solution:
Let the integers be x and y.
From the sum: x + y = 6.
From the difference: x - y = 4.
Solve the system of equations:
Add the equations: (x + y) + (x - y) = 6 + 4.

$2x = 10$.
$x = 10 \div 2 = 5$.
Substitute $x = 5$ into $x + y = 6$:
$5 + y = 6$.
$y = 6 - 5 = 1$.
Answer: The integers are 5 and 1.

13. If $(a - 2b) / (a + 2b) = 2$, calculate the value of a/b.

Solution:
Start with the equation:
$(a - 2b) / (a + 2b) = 2$.
Cross-multiply:
$a - 2b = 2(a + 2b)$.
Expand the right-hand side:
$a - 2b = 2a + 4b$.
Simplify:
$a - 2a = 4b + 2b$.
$-a = 6b$.
Divide both sides by $-b$:
$a/b = -6$.

Answer: $a/b = -6$.

14. Factorize completely $9t^2 - 16r^2$.

Solution:
This is a difference of squares:
$9t^2 - 16r^2 = (3t)^2 - (4r)^2$.
Apply the difference of squares formula:
$a^2 - b^2 = (a - b)(a + b)$.
$9t^2 - 16r^2 = (3t - 4r)(3t + 4r)$.

Answer: $(3t - 4r)(3t + 4r)$.

15. Find the images of B (3, 4) under a reflection in the y-axis and x-axis.

Solution:
Reflection in the y-axis:
The x-coordinate changes sign while the y-coordinate remains the same.
$B(3, 4) \rightarrow B'(-3, 4)$.

Reflection in the x-axis:
The y-coordinate changes sign while the x-coordinate remains the same.
B(3, 4) ----> B''(3, -4).

Answer:
Reflection in the y-axis: B'(-3, 4).
Reflection in the x-axis: B''(3, -4).
16. Find m if $(1 * 3) * m = 18$, given that $a * b = a^2 + b^2$.

Solution:
First, calculate $(1 * 3)$:
$1 * 3 = 1^2 + 3^2 = 1 + 9 = 10$.
Substitute $(1 * 3) = 10$ into the equation:
$10 * m = 18$.
Expand using the definition of $*$:
$10 * m = 10^2 + m^2 = 18$.
$100 + m^2 = 18$.
$m^2 = 18 - 100$.
$m^2 = -82$.
Since m^2 cannot be negative, there is no real solution for m.
Answer: No real solution for m.

17. The sides of a rectangle are $(2 - \sqrt{3})$ cm and $(2 + \sqrt{3})$ cm. Find the length of its diagonal.

Solution:
The diagonal of a rectangle is calculated using the Pythagorean theorem:
$\text{diagonal}^2 = \text{length}^2 + \text{width}^2$.

Length = $2 - \sqrt{3}$, Width = $2 + \sqrt{3}$.
$\text{diagonal}^2 = (2 - \sqrt{3})^2 + (2 + \sqrt{3})^2$.
Expand both terms:
$(2 - \sqrt{3})^2 = 4 - 4\sqrt{3} + 3 = 7 - 4\sqrt{3}$.
$(2 + \sqrt{3})^2 = 4 + 4\sqrt{3} + 3 = 7 + 4\sqrt{3}$.

Add the two results:
$\text{diagonal}^2 = (7 - 4\sqrt{3}) + (7 + 4\sqrt{3}) = 14$.
$\text{diagonal} = \sqrt{14}$.

Answer: $\sqrt{14}$ cm.

18. Simplify by rationalizing the denominator of $\sqrt{5} / (\sqrt{5} + \sqrt{3})$.

Solution:
To rationalize the denominator, multiply numerator and denominator by the conjugate of $(\sqrt{5} + \sqrt{3})$, which is $(\sqrt{5} - \sqrt{3})$:
$(\sqrt{5} / (\sqrt{5} + \sqrt{3})) \times ((\sqrt{5} - \sqrt{3}) / (\sqrt{5} - \sqrt{3}))$
$= (\sqrt{5} \times (\sqrt{5} - \sqrt{3})) / ((\sqrt{5} + \sqrt{3}) \times (\sqrt{5} - \sqrt{3}))$.

Simplify the numerator and denominator:
Numerator = $\sqrt{5} \times \sqrt{5} - \sqrt{5} \times \sqrt{3} = 5 - \sqrt{15}$.
Denominator = $(\sqrt{5})^2 - (\sqrt{3})^2 = 5 - 3 = 2$.

Result = $(5 - \sqrt{15}) / 2$.

Answer: $(5 - \sqrt{15}) / 2$.

19. Given that $\sin A = 3/5$, where A is an acute angle, find the value of $-\cos A + 1$.

Solution:
From $\sin^2 A + \cos^2 A = 1$:
$(3/5)^2 + \cos^2 A = 1$.
$9/25 + \cos^2 A = 1$.
$\cos^2 A = 1 - 9/25 = 16/25$.
$\cos A = \sqrt{(16/25)} = 4/5$ (since A is acute).

Substitute cos A into the expression:
$-\cos A + 1 = -(4/5) + 1 = 1 - 4/5 = 1/5$.

Answer: 1/5.

20. Find the solution of the following inequality and locate it on a number line: $|4x - 9| \leq 3$.

Solution:
The inequality $|4x - 9| \leq 3$ implies:
$-3 \leq 4x - 9 \leq 3$.
Solve the left part:
$-3 \leq 4x - 9$.
Add 9 to both sides:
$6 \leq 4x$.
Divide by 4:
$3/2 \leq x$.
Solve the right part:

$4x - 9 \leq 3$.
Add 9 to both sides:
$4x \leq 12$.
Divide by 4:
$x \leq 3$.

Combine the two parts:
$3/2 \leq x \leq 3$.

Answer: $3/2 \leq x \leq 3$.
On a number line, mark the interval [3/2, 3] with solid dots at both endpoints.

21. There are 24 people at a meeting; 12 are farmers, 18 are soldiers, and 8 are both farmers and soldiers.

(i) How many are farmers or soldiers?

Solution:
Use the formula for union of two sets:
$n(F \cup S) = n(F) + n(S) - n(F \cap S)$.
$n(F \cup S) = 12 + 18 - 8 = 22$.

Answer: 22 people are farmers or soldiers.
(ii) How many are neither farmers nor soldiers?

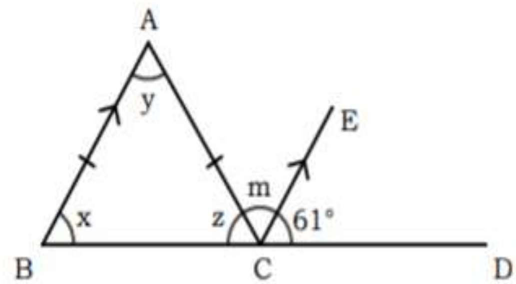
Solution:
The total number of people is 24. Those who are farmers or soldiers = 22.
Those who are neither = 24 - 22 = 2.
Answer: 2 people are neither farmers nor soldiers.

22. Solve the following equation by using the quadratic formula:
$x(x - 4)/3 = -1$.

Solution:
Multiply through by 3 to eliminate the denominator:
$x(x - 4) = -3$.
Expand:
$x^2 - 4x = -3$.
Rearrange into standard form:
$x^2 - 4x + 3 = 0$.
Use the quadratic formula:
$x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$, where $a = 1$, $b = -4$, $c = 3$.
$x = [-(-4) \pm \sqrt{((-4)^2 - 4(1)(3))}] / 2(1)$.

$x = [4 \pm \sqrt{(16 - 12)}] / 2.$
$x = [4 \pm \sqrt{4}] / 2.$
$x = [4 \pm 2] / 2.$
$x = (4 + 2)/2$ or $(4 - 2)/2.$
$x = 6/2$ or $2/2.$
$x = 3$ or $1.$
Answer: $x = 3$ or $x = 1.$

23. In the figure below, find the value of x, y, z, and m.
Solution:
Using the sum of angles in a triangle and supplementary angles, solve step-by-step:
1. $\angle B = \angle D = 61°$ (as indicated).
$x = 61°$.............. Parallel angles
$x=z= 61°$............ Given.
But $x + y + z = 180°$, also $z + m + 61° = 180°$
$61° + y + 61° = 180°$, also $61° + m + 61° = 180°$
therefore, $x = 61°$, $y = 58°$, $z = 61°$, $m= 58°$



24. If the line joining the points A(k, 5 + k) and B(2k, 2) has a gradient of 2, find the coordinates of the given points.
Solution:
Gradient of a line = $(y_2 - y_1) / (x_2 - x_1)$.
Substitute the points A(k, 5 + k) and B(2k, 2):
$2 = (2 - (5 + k)) / (2k - k).$
$2 = (2 - 5 - k) / k.$
$2 = (-3 - k) / k.$
Multiply through by k:
$2k = -3 - k.$
$3k = -3.$
$k = -1.$
Substitute $k = -1$ into the coordinates:
A(k, 5 + k) = A(-1, 5 - 1) = A(-1, 4).
B(2k, 2) = B(2(-1), 2) = B(-2, 2).
Answer: A(-1, 4) and B(-2, 2).

25. The table below shows the masses in kilogrammes of Form one students at Mtakuja Secondary School.

Class Interval	41–45	46–50	51–55	56–60	61–65	66–70
Frequency	3	8	13	11	7	3

(i) The total number of students is 45.

(ii) The frequency polygon and histogram for the given data are plotted on the same axes. The histogram represents the frequency distribution, while the frequency polygon connects the midpoints of the class intervals.