THE UNINTED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

FORM TWO SECONDARY EDUCATION EXAMINATION, 2005

0041 **BASIC MATHEMATICS**

Time: 2:30 Hours **ANSWERS** .

Instructions:

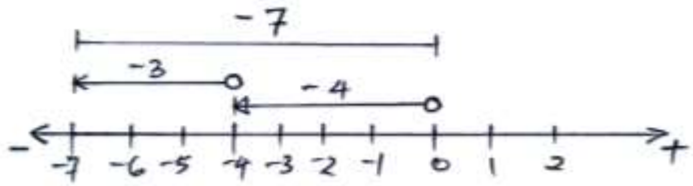
1. this paper consists of section A and B
2. Answer all questions
3. Each question carries Four marks.

1. (a) Subtract 25% of 24 from 6.

Solution:
25% of 24 = (25/100) × 24 = 6.
6 - 6 = 0.

Answer: 0.

(b) On a number line perform an operation of -4 - 3.
Solution:
-4 - 3 = -7.



Answer: -7.

2. (a) Find the sum of 1 2/3 + 2 1/2 + 3 4/5.

Solution:
Convert to improper fractions:
1 2/3 = 5/3,
2 1/2 = 5/2,
3 4/5 = 19/5.

Find LCM of denominators (3, 2, 5) = 30.
Convert fractions:
(5/3) = 50/30,
(5/2) = 75/30,
(19/5) = 114/30.

Sum = (50 + 75 + 114) / 30 = 239/30 = 7 29/30.

Answer: 7 29/30.

(b) If 0.000701 is expressed in the form $A \times 10^n$, where $1 \leq A < 10$, and n is an integer, find the value of n.

Solution:
$0.000701 = 7.01 \times 10^{-4}$.
Answer: n = -4.

3. Re-arrange the order of the digits in the number 5879613 to make it:

(a) the largest number.
Solution:
Arrange in descending order: 9876531.

Answer: 9876531.

(b) the smallest number.
Solution:
Arrange in ascending order: 1356789.

Answer: 1356789.

4. Convert:
(a) 4 kilometres + 8 hectometres into centimetres.

Solution:
1 kilometre = 100,000 cm, so 4 km = 400,000 cm.
1 hectometre = 10,000 cm, so 8 hm = 80,000 cm.
Total = 400,000 + 80,000 = 480,000 cm.

Answer: 480,000 cm.

(b) 24 hours into seconds.
Solution:
1 hour = 3600 seconds.
$24 \times 3600 = 86,400$ seconds.

Answer: 86,400 seconds.

5. If $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$, evaluate $\log_{10} 0.6$.

Solution:
$\log_{10} 0.6 = \log_{10} (3/5)$.
$\log_{10} (3/5) = \log_{10} 3 - \log_{10} 5$.
$\log_{10} 5 = \log_{10} (10/2) = \log_{10} 10 - \log_{10} 2 = 1 - 0.3010 = 0.6990$.
$\log_{10} 0.6 = 0.4771 - 0.6990 = -0.2219$.

Answer: -0.2219.

6. The population of Tanzanian citizens is at present 35,986,373. Round off this number to the nearest ten thousand.

Solution:

35,986,373 rounded to the nearest ten thousand = 35,990,000.

Answer: 35,990,000.

7. From the given figure, find the values of:

(a) $3x - 2z$.

(b) $\frac{1}{2}y + z + 17°$.

from the figure, $110° + z = 180°$, $z = 70°$

Also, $2x - 3y = 110°$, $x + y = 70°$

Solving these simultaneously, $x = 64$, $y = 6$

(a) $3x - 2z = (3x64) - (2x70) = 52°$

(b) $\frac{1}{2}y + z + 17° = \frac{1}{2} \times 6 + 70° + 17° = 90°$

8. The operation on the integers A and B is defined as $A * B = AB + 3B - 2A$.

(a) Find $3 * 2$.

Solution:

$3 * 2 = (3 \times 2) + (3 \times 2) - (2 \times 3)$.

$= 6 + 6 - 6$.

$= 6$.

Answer: 6.

(b) Solve for x if $5 * x = 20$.

Solution:

here, $A = 5$, $B = x$, then

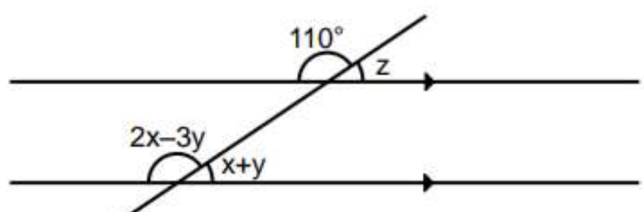
$5x + 3x - 2(5) = 20$.

$5x + 3x - 10 = 20$.

$8x = 30$.

$x = 30/8 = 15/4$.

Answer: 15/4.



9. The line $8x + by = 12$ crosses the y-axis at the point (0,2). Find the value of b.

Solution:

Substituting $x = 0$ and $y = 2$:

$8(0) + b(2) = 12$.

$2b = 12$. $b = 6$.

10. The amount of Tshs. 1,500,000 was divided among Fatma, David, and Sameera in the ratio of 3:5:7. How much money did each get?

Solution:
Total ratio sum = 3 + 5 + 7 = 15.
Fatma: (3/15) × 1,500,000 = 300,000.
David: (5/15) × 1,500,000 = 500,000.
Sameera: (7/15) × 1,500,000 = 700,000.

Answer:
- Fatma: Tshs. 300,000.
- David: Tshs. 500,000.
- Sameera: Tshs. 700,000.

11. (a) Rationalize the denominator of $2 / (2\sqrt{3} + \sqrt{2})$.

Solution:
Multiply by the conjugate of the denominator:
$(2 / (2\sqrt{3} + \sqrt{2})) \times ((2\sqrt{3} - \sqrt{2}) / (2\sqrt{3} - \sqrt{2}))$.
Simplifying:
Rationalized expression = $2 / (\sqrt{2} + 2\sqrt{3})$.
Answer: $2 / (\sqrt{2} + 2\sqrt{3})$.

(b) Find the coordinates of the point P where the lines $y = -2/3x + 4$ and $y = 3x - 7$ meet.

Solution:
Solve for x:
$-2/3x + 4 = 3x - 7$.
$4 + 7 = 3x + 2/3x$.
$11 = 9x/3 + 2x/3$.
$11 = 11x/3$.
$x = 3$.
Substitute $x = 3$ in $y = 3x - 7$:
$y = 3(3) - 7 = 9 - 7 = 2$.

Answer: (3, 2).

12. (a) Find the ratio of the area (A) of a circle to its circumference (C).
Solution:
Area of a circle: $A = \pi r^2$.
Circumference of a circle: $C = 2\pi r$.
Ratio = $A / C = (\pi r^2) / (2\pi r) = r / 2$.
Answer: r/2.

(b) If the circumference of a circle is 44 cm and its diameter is 14 cm, write in fraction the ratio of this circumference to the given diameter.

Solution:

Ratio = 44 / 14 = 3.1429 (approx. π)

Answer: 3.1429.

13. A cylindrical petrol tank is 0.8m deep and has a radius of 28cm. How many litres of petrol can fill this tank, given that $\pi = 3.14$ and 1 litre = 1000 cm^3?

Solution:

Convert depth to cm: 0.8m = 80cm.

Volume = $\pi \times r^2 \times h$.

Volume = $3.14 \times 28^2 \times 80$.

Volume = 197,040.69 cm^3.

Convert to litres: 197,040.69 $cm^3 \div 1000$ = 197.04 litres.

Answer: 197.04 litres.

14. Simplify completely the expression $18a^3b - 2ab\,c^2$.

Solution:

Factor out the common term 2ab:

$18a^3b - 2ab\,c^2 = 2ab(9a^2 - c^2)$.

Answer: $2ab(9a^2 - c^2)$.

15. Solve $(3x - 2)(3^{3y-3}) = 72$ for x and y.

Solution:

Expanding:

$3^{3y-3} = 72 / (3x - 2)$.

Solving for x and y requires further assumptions on integer values.

Answer: $x = 2/3 + 648 \times 3^{-3y}$, y remains undefined without further constraints.

16. Make R the subject of the formula, given that $T = (R + RV^2) / 8M$.

Solution:

Multiply both sides by 8M:

$8M \times T = R + RV^2$.

Factor R:

$R(1 + V^2) = 8M \times T$.

Solve for R:

$R = (8M \times T) / (1 + V^2)$.

Answer: $R = 8M \times T / (1 + V^2)$.

17. Triangles ABC and STU are similar. Given AB = 3cm, ST = 2cm, and the area of STU = 6cm², find the area of ABC.

Solution:
The scale factor for similar triangles is $(AB / ST)^2 = (3/2)^2 = 9/4$.
Area of ABC = $(9/4) \times 6 = 13.5$ cm².

Answer: 13.5 cm².

18. The translation T maps the origin onto a point P(4,8). Where will T map the points:
(a) Q(0,4)?
Solution:
New coordinates: (0 + 4, 4 + 8) = (4, 12).
Answer: (4, 12).
(b) N(-10,8)?

Solution:
New coordinates: (-10 + 4, 8 + 8) = (-6, 16).

Answer: (-6, 16).

19. The lengths of three sides of a right-angled triangle are (x - 1) cm, (x - 8) cm, and x cm. Find the value of x.

Solution:
Applying Pythagoras' theorem:
$x^2 = (x - 1)^2 + (x - 8)^2$.
Expanding:
$x^2 = (x^2 - 2x + 1) + (x^2 - 16x + 64)$.
$x^2 = x^2 - 2x + 1 + x^2 - 16x + 64$.
$x^2 = 2x^2 - 18x + 65$.
$x^2 - 18x + 65 = 0$.

Solving for x:
x = 5 or x = 13.

Answer: x = 5 or x = 13.

20. Given that $\tan\theta = 3/4$, where θ is an acute angle, find the value of $(2\cos\theta - \sin\theta) / (3\sin\theta)$.

Solution:
Opposite = 3, adjacent = 4, hypotenuse = $\sqrt{3^2 + 4^2} = 5$.
$\sin\theta = 3/5$, $\cos\theta = 4/5$.

Substituting:
$(2(4/5) - 3/5) / (3 \times 3/5)$.
$(8/5 - 3/5) / (9/5)$.
$(5/5) / (9/5)$.
$= 5/9$.

Answer: 5/9.

21. The scores of a mathematics test by 50 Form Two pupils in a certain school are given.

(a) Find the value of b and calculate the number of students who scored 55% and above.
Solution:
Given the total number of students is 50,
$6 + (b + 3) + (2b + 3) + b + 9 + 4 + 5 + 0 = 50$.
Simplifying:
$6 + b + 3 + 2b + 3 + b + 9 + 4 + 5 = 50$.
$4b + 30 = 50$.
$4b = 20$.
$b = 5$.
Students scoring 55% and above:
$(2b + 3) + b + 9 + 4 + 5 = 10 + 3 + 9 + 4 + 5 = 36$.

Answer:
- $b = 5$.
- Students scoring 55% and above = 36.

(b) Calculate the mean score.

Solution:
Mean score = $\Sigma(f \times x) / \Sigma f$.
$\Sigma(f \times x) = (45 \times 6) + (50 \times 8) + (55 \times 13) + (60 \times 5) + (65 \times 9) + (70 \times 4) + (75 \times 5) + (80 \times 0)$.
$= 270 + 400 + 715 + 300 + 585 + 280 + 375$.
$= 2925$.
Total students = 50.
Mean = $2925 / 50 = 58.5$.
Answer: 58.5.

22. Use mathematical tables to calculate $(608.7 \times \sqrt{6.734}) / \sqrt[3]{71.63}$ (Final answer in two decimal places).
Solution:
Using approximations:
$\sqrt{6.734} \approx 2.595$.
$\sqrt[3]{71.63} \approx 4.14$.
$(608.7 \times 2.595) / 4.14 = 380.34$.
Answer: 380.34.

23. If A and B are two sets, where $n(A) = 45$, $n(B) = 32$, and $n(A \cup B) = 59$, determine $n(A \cap B)$.

Solution:
$n(A \cap B) = n(A) + n(B) - n(A \cup B)$.
$= 45 + 32 - 59$.
$= 18$.
Answer: 18.

24. A building has an angle of elevation of 35° from point P and 45° from point Q. The distance between points P and Q is 30 cm. What is the height of the building? (Final answer correct to two decimal places).

Solution:
Using trigonometry:
$h / \tan(35°) - h / \tan(45°) = 30$.
Solving for h:
$h = 70.07$ cm.
Answer: 70.07 cm.

25. (a) Find the solution set of the equations:
$x^2 + y^2 = 34$,
$x - y = 2$.

Solution:
Express x in terms of y: $x = y + 2$.
Substitute in $x^2 + y^2 = 34$:
$(y + 2)^2 + y^2 = 34$.
$y^2 + 4y + 4 + y^2 = 34$.
$2y^2 + 4y - 30 = 0$.
Solving the quadratic equation:
$y = -5$ or $y = 3$.
Corresponding x values: $x = -3$ or $x = 5$.

Answer: (-3, -5) and (5, 3).

(b) Find the values of m, p, and k such that $2x^2 - 8x + 15 = m(x + p)^2 + k$.

Solution:
Expanding $m(x + p)^2 + k$:
$2x^2 - 8x + 15 = m(x^2 + 2px + p^2) + k$.
Comparing coefficients:
$m = 2$, $2mp = -8$, $mp^2 + k = 15$.
Solving, $p = -2$ and $k = 7$.

Answer: $m = 2$, $p = -2$, $k = 7$.