THE UNINTED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

FORM TWO SECONDARY EDUCATION EXAMINATION, 2011

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. Add the first three common multiples of 3 and 5.

Answer:

The common multiples of 3 and 5 are found by taking the least common multiple (LCM) of 3 and 5, which is 15.

The first three common multiples of 3 and 5 are 15, 30, and 45.

Adding them together:

15 + 30 + 45 = 90.

Answer: 90.

2. Two numbers are such that the first number plus the second number is 7. The first number minus twice the second number is 1. Find the numbers.

Answer:

Let the two numbers be x and y.

From the first condition: x + y = 7.

From the second condition: x - 2y = 1.

Solve simultaneously:

From x + y = 7, we get x = 7 - y.

Substitute into x - 2y = 1:

(7 - y) - 2y = 1

7 - 3y = 1

3y = 6

y = 2.

Substitute y = 2 into x + y = 7:

x + 2 = 7

x = 5.

Answer: The numbers are 5 and 2.

3. Re-arrange the following fractions starting from the greatest to the smallest: 7/12, 3/4, 5/6, 3/8, 1/2.

Answer:

Convert fractions to decimals for comparison:

7/12 = 0.5833, 3/4 = 0.75, 5/6 = 0.8333, 3/8 = 0.375, 1/2 = 0.5.

From greatest to smallest: 5/6, 3/4, 7/12, 1/2, 3/8.

Answer: 5/6, 3/4, 7/12, 1/2, 3/8.

4. In Mpitimbi village 70% of 1200 cows are black and 22.3% of 18000 goats are white. Find the sum of black cows and white goats.

Answer:

Number of black cows:

70% of 1200 = 0.7 × 1200 = 840.

Number of white goats:

22.3% of 18000 = 0.223 × 18000 = 4014.

Sum of black cows and white goats:
840 + 4014 = 4854.

Answer: 4854.

5. Juma walked a distance of 1 kilometre and 300 metres from his home to a shop. He then walked further 0.85 kilometres to the stadium to greet his friend who was watching football. Calculate the total distance in metres Juma travelled.

Answer:
Convert distances to metres:
1 kilometre = 1000 metres, 300 metres = 300 metres, 0.85 kilometres = 850 metres.

Total distance:
1000 + 300 + 850 = 2150 metres.
Answer: 2150 metres.

6. Express 0.007678 to 3 significant figures.

To 3 significant figures:
0.007678 ≈ 0.00768.
Answer: 0.00768.

7. Find the value of X in the following figure, given that m(BAC) = 50° and m(ABC) = 75°.
Answer:
In triangle ABC, the sum of angles in a triangle is 180°.
m(BAC) + m(ABC) = X .... Opposite exterior angle
50° + 75° = X
X = 180° - 125°.
X = 125°.

8. Simplify 3a - 5b - 7a + 6c + 7a + 8b.
Combine like terms:
(3a - 7a + 7a) + (-5b + 8b) + 6c = 3a + 3b + 6c.

Answer: 3a + 3b + 6c.

9. Expand the expression $(3m + 7n)^2$.

$(3m + 7n)^2 = (3m + 7n)(3m + 7n)$.

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= 9m² + 21mn + 21mn + 49n².
= 9m² + 42mn + 49n².

Answer: 9m² + 42mn + 49n².

10. Find two positive numbers whose difference is 5 and whose product is 266.

Let the two numbers be x and y.
From the conditions:
x - y = 5
x x y = 266

From x - y = 5, we get x = y + 5.
Substitute into x x y = 266:
(y + 5) x y = 266
y² + 5y - 266 = 0
Solve the quadratic equation using the quadratic formula:
y = [-5 ± √(5² - 4 x 1 x -266)] / 2
y = [-5 ± √(25 + 1064)] / 2
y = [-5 ± √1089] / 2
y = [-5 ± 33] / 2

y = (33 - 5) / 2 = 28 / 2 = 14 (taking the positive root).
x = y + 5 = 14 + 5 = 19.

Answer: The numbers are 19 and 14.

11. George and Asha shared 35 mangoes in the ratio 2:3. How many mangoes did each get?

The total ratio is 2 + 3 = 5.
George's share = (2/5) x 35 = 14.
Asha's share = (3/5) x 35 = 21.

Answer: George gets 14 mangoes, and Asha gets 21 mangoes.

12. Find the slope of the line with equation 7x + 2y = 8.
Rearrange into slope-intercept form (y = mx + c):
7x + 2y = 8
2y = -7x + 8
y = (-7/2)x + 4.
The slope (m) is -7/2.

13. A school assembly ground is 30m by 30m. Part of the ground is a concrete rectangle of 25m by 5m, while the rest is grass. Calculate the area of the grass.

Total area of the ground: 30m x 30m = 900m².
Area of the concrete rectangle: 25m x 5m = 125m².

Area of the grass: 900m² - 125m² = 775m².
Answer: The area of the grass is 775m².

14. Rationalize the denominator to the simplest form: $(\sqrt{3} + \sqrt{5}) / (\sqrt{3} - \sqrt{5})$.

Answer:
Multiply numerator and denominator by the conjugate of the denominator $(\sqrt{3} + \sqrt{5})$:
$[(\sqrt{3} + \sqrt{5})(\sqrt{3} + \sqrt{5})] / [(\sqrt{3} - \sqrt{5})(\sqrt{3} + \sqrt{5})]$
$= (3 + 2\sqrt{15} + 5) / (3 - 5)$
$= (8 + 2\sqrt{15}) / (-2)$.

Simplify:
$= -4 - \sqrt{15}$.

15. Simplify $(-4g^5)^2$.
$(-4g^5)^2 = (-4)^2 \times (g^5)^2$
$= 16 \times g^{10}$
$= 16g^{10}$.
Answer: $16g^{10}$.

16. A mother is 4 times older than her child. Five years ago the product of their ages was 175. Find their present ages.

Answer:
Let the child's age be x.
The mother's age $= 4x$.

Five years ago:
Child's age $= x - 5$, Mother's age $= 4x - 5$.
Product of their ages:
$(x - 5)(4x - 5) = 175$.
Expand:
$4x^2 - 5x - 20x + 25 = 175$
$4x^2 - 25x - 150 = 0$.

Solve using the quadratic formula:
$x = [-(-25) \pm \sqrt{((-25)^2 - 4 \times 4 \times -150)}] / (2 \times 4)$
$x = [25 \pm \sqrt{(625 + 2400)}] / 8$
$x = [25 \pm \sqrt{3025}] / 8$

x = [25 ± 55] / 8.

x = (25 + 55) / 8 = 80 / 8 = 10 (taking the positive root).

Mother's age = 4x = 4 x 10 = 40.

Answer: The child is 10 years old, and the mother is 40 years old.

17. Show that $\log_9(MN) = \log_9 M + \log_9 N$.

Answer:
Using the logarithmic property $\log_a(xy) = \log_a x + \log_a y$:
$\log_9(MN) = \log_9 M + \log_9 N$.
Proof:
Let $a = \log_9 M$ and $b = \log_9 N$.
Then $M = 9^a$ and $N = 9^b$.
$MN = 9^a \times 9^b = 9^{a+b}$.

Taking log base 9:
$\log_9(MN) = \log_9(9^{a+b}) = a + b$.
Substitute back:
$\log_9(MN) = \log_9 M + \log_9 N$.

Answer: Shown.

18. Given that m(BAC) = 80°, m(BCA) = 69°, m(YXZ) = 31° and m(YZX) = 80°. Show that the following triangles are similar.

Answer:
Two triangles are similar if their corresponding angles are equal.
For triangle ABC:
m(BAC) = 80°, m(BCA) = 69°, m(ABC) = 180° - (80° + 69°) = 31°.

For triangle XYZ:
m(YXZ) = 31°, m(YZX) = 80°, m(XYZ) = 180° - (31° + 80°) = 69°.

Since m(BAC) = m(YZX), m(BCA) = m(XYZ), and m(ABC) = m(YXZ), the triangles are similar by the Angle-Angle (AA) criterion.

19. The coordinates of the square PQRS are given by P(1, 4), Q(3, 4), R(3, 2), and S(1, 2). Write the coordinates of the image of the square P'Q'R'S' under reflection in the x-axis.

Answer:

Under reflection in the x-axis, the y-coordinate of each point changes sign while the x-coordinate remains the same.

P(1, 4) ------> P'(1, -4)
Q(3, 4) ------> Q'(3, -4)
R(3, 2) ------> R'(3, -2)
S(1, 2) -------> S'(1, -2)

Answer: The coordinates of the image are P'(1, -4), Q'(3, -4), R'(3, -2), S'(1, -2).

20. Which of the following triples fits the Pythagoras theorem?
(a) (33, 55, 65)
(b) (15, 30, 35)

Answer:
The Pythagoras theorem states that in a right-angled triangle, the square of the hypotenuse equals the sum of the squares of the other two sides ($a^2 + b^2 = c^2$).
(a) $33^2 + 55^2 = 1089 + 3025 = 4114$, and $65^2 = 4225$ (not equal).
(b) $15^2 + 30^2 = 225 + 900 = 1125$, and $35^2 = 1225$ (not equal).

Answer: Neither fits the Pythagoras theorem.

21. Given that the universal set ξ = {all counting numbers less than 29}, M and N are the subsets of set ξ where M = {Numbers which are multiples of 4} and N = {Numbers which are perfect squares}. Find (M ∩ N).

Answer:
M = {4, 8, 12, 16, 20, 24, 28}
N = {1, 4, 9, 16, 25}

M ∩ N = {4, 16} (common elements).

Answer: M ∩ N = {4, 16}.

22. An engineer finds that the angle of elevation of the top of a building from a point on the ground is 25°. She walks along a straight line 30 metres closer to the foot of the building and finds that the angle of elevation is 50°. Determine the height of the building.

Answer:
Let the initial distance from the building be x metres and the height of the building be h metres.

From the first point:
$\tan(25°) = h / x$ ------> $h = x \tan(25°)$.

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From the second point:
tan(50°) = h / (x - 30)-------->h = (x - 30) tan(50°).

Equating the two equations for h:
x tan(25°) = (x - 30) tan(50°).
x tan(25°) = x tan(50°) - 30 tan(50°).
x (tan(25°) - tan(50°)) = -30 tan(50°).
x = [30 tan(50°)] / [tan(50°) - tan(25°)].

Substitute the values of tan(25°) ≈ 0.4663 and tan(50°) ≈ 1.1918:
x = [30 x 1.1918] / [1.1918 - 0.4663]
x ≈ 35.87 metres.

Substitute x into h = x tan(25°):
h = 35.87 x 0.4663 ≈ 16.72 metres.

Answer: The height of the building is approximately 16.7 metres.

23. The masses of 40 students from the University of Dar es Salaam were recorded to the nearest kilogram
as follows:

60, 64, 63, 67, 66, 68, 59, 58, 59, 60
64, 66, 65, 60, 73, 70, 63, 69, 70, 60
66, 70, 74, 69, 63, 59, 65, 64, 65
73, 61, 62, 64, 61, 61, 62, 63, 58, 73

Construct a frequency distribution table taking equal class intervals 57-61, 62-66, 67-71, etc., and determine
the class interval with the highest frequency.

Answer:
Class intervals:
57-61, 62-66, 67-71, 72-76

Tally the frequencies:
57-61: 10
62-66: 14
67-71: 10
72-76: 6

Frequency distribution table:

Class Interval	Frequency
57-61	10
62-66	14
67-71	10
72-76	6

The class interval with the highest frequency is 62-66.

Answer: The class interval with the highest frequency is 62-66.

24. Use mathematical tables to compute $17.83 \times 246.9 / (256.2 \times 3.28)$ correct to 3 decimal places.

Answer:
Numerator: $17.83 \times 246.9 = 4401.627$
Denominator: $256.2 \times 3.28 = 839.136$
Divide: $4401.627 / 839.136 = 5.245$

Answer: 5.245

25. Calculate MN and YM in the following figure.

Answer:
From the diagram, triangle XYZ is similar to triangle XMN because they share the same angle ∠X, and both are right triangles.

For MN:
MN / 10 = 3 / 9
MN = (3 / 9) × 10
MN = 3.33 cm

For YM:
YM / 6 = 3 / 9
YM = (3 / 9) × 6
YM = 2.00 cm

Answer: MN = 3.33 cm, YM = 2.00 cm