SMZ

ZANZIBAR EXAMINATIONS COUNCIL

FORM THREE ENTRANCE EXAMINATION

0041 MATHEMATICS

Time: 2:30 Hours **ANSWERS** **Year: 2018**

Instructions:

1. this paper consists of section A and B
2. Answer all questions in Section A and Four questions in section B
3. Use a blue or black pen.

1. a) Convert $0.3\dot{6}$ to a fraction in its simplest form.
Solution:
Let x = 0.363636...
Multiply both sides by 100 to shift the repeating decimal:
100x = 36.363636...
Subtract the original equation from this equation:
100x - x = 36.363636... - 0.363636...
99x = 36
Divide by 99:
x = 36/99
Simplify by dividing both numerator and denominator by 9:
x = 4/11

b) Without using a mathematical table, evaluate the value of:
(9.5 × 8.2) / (10.3 + 9.7)
Solution:
First, calculate the numerator:
9.5 × 8.2 = (9 + 0.5) × (8 + 0.2)
Using the distributive property:
(9 × 8) + (9 × 0.2) + (0.5 × 8) + (0.5 × 0.2)
= 72 + 1.8 + 4 + 0.1
= 77.9
Now, calculate the denominator:
10.3 + 9.7 = 20

Now, divide:
77.9 / 20 = 3.895

2. a) Evaluate
√[(35 - (-17))/2 - (15 - (-2)) × (-6)/3]

Solution:

First, simplify the terms in the numerator and denominator:

(35 - (-17)) = 35 + 17 = 52
(15 - (-2)) = 15 + 2 = 17

Substitute these values into the expression:

√[(52/2) - (17 × (-6)/3)]

Simplify each term:

52/2 = 26
17 × (-6) = -102
-102/3 = -34

Now substitute back:

$\sqrt{[26 - (-34)]}$

Simplify further:

$\sqrt{[26 + 34]} = \sqrt{60}$

Simplify the square root:

$\sqrt{60} = \sqrt{(4 \times 15)} = 2\sqrt{15}$

$2\sqrt{15}$

b) Simplify $(\sqrt{5} - \sqrt{3})^2$

Solution:

Use the formula $(a - b)^2 = a^2 - 2ab + b^2$

$(\sqrt{5} - \sqrt{3})^2 = (\sqrt{5})^2 - 2(\sqrt{5})(\sqrt{3}) + (\sqrt{3})^2$

$(\sqrt{5})^2 = 5$
$(\sqrt{3})^2 = 3$
$2(\sqrt{5})(\sqrt{3}) = 2\sqrt{15}$

Substitute these values:

$5 - 2\sqrt{15} + 3$

Simplify:

$8 - 2\sqrt{15}$

$8 - 2\sqrt{15}$

3. a) Two pairs of jeans and three T-shirts cost 1750. Five such pairs of jeans and two T-shirts cost 3000. Find the unit price of a pair of jeans and a T-shirt.

Solution:
Let the cost of a pair of jeans be x and the cost of a T-shirt be y.
From the first condition:
$2x + 3y = 1750$

From the second condition:
$5x + 2y = 3000$
We now solve these simultaneous equations:
Multiply the first equation by 2 and the second by 3 to eliminate y:

$4x + 6y = 3500$
$15x + 6y = 9000$

Subtract the first equation from the second:

$11x = 5500$
$x = 500$

Substitute $x = 500$ into the first equation:

$2(500) + 3y = 1750$
$1000 + 3y = 1750$
$3y = 750$
$y = 250$
The cost of a pair of jeans is 500, and the cost of a T-shirt is 250.

b) Every morning Ali walks 70 km to and from school. How far does he walk in 130 days?
Solution:
Total distance walked in a day = 70 km
For 130 days:
$70 \times 130 = 9100$
9100 km

4. a) Remove brackets and simplify:
$(2x - y + 4z) - (2x + 5y - 4z)$
Solution:
Distribute the negative sign to the terms inside the second bracket:
$2x - y + 4z - 2x - 5y + 4z$
Combine like terms:
$2x - 2x = 0$
$-y - 5y = -6y$
$4z + 4z = 8z$

Simplified expression:
$-6y + 8z$

b) Find the value of:
$((2/7) + (3/14)) \div (3/8)$
Solution:
First, find the sum in the numerator:
$2/7 = 4/14$ (convert to have the same denominator)
$(4/14) + (3/14) = 7/14 = 1/2$
Now divide by 3/8:
$(1/2) \div (3/8)$
$(1/2) \times (8/3) = 8/6 = 4/3$
4/3

5. a) i) Write all prime numbers between 40 and 50
Prime numbers between 40 and 50 are: 41, 43, and 47
ii) Write three factors of 12
Three factors of 12 are: 1, 2, and 3
iii) Write three multiples of 9
Three multiples of 9 are: 9, 18, and 27

b) A block of copper has a volume of 160 cm^3. On heating this amount increases by 6%. What is its volume after heating?

Solution:
Find 6% of 160:
$6/100 \times 160 = 9.6$
Add this increase to the original volume:
$160 + 9.6 = 169.6$
169.6 cm^3

6. a) In the figure below, line PQ and RS are parallel. Line EJF and EHG are straight. Lines EF and EH are equal. Angle FHJ = 35° and angle HGS = 130°. Find the size of the angle EFH.

Solution:
Using the property that angles on a straight line sum to 180°:
Angle FHG = 180° - 130° = 50°
Since EF = EH, triangle EFH is isosceles. Therefore, angles EFH and EHF are equal.
Let angle EFH = x. Using the angle sum property of a triangle:
$x + x + 50° = 180°$
$2x = 180° - 50°$
$2x = 130°$
$x = 65°$

b) If x^y = 4, find the value of 6x^(4y) + 1.

Solution:
Given x^y = 4, raise both sides to the power of 4:
(x^y)^4 = 4^4
x^(4y) = 256
Substitute x^(4y) = 256 into the expression:
6x^(4y) + 1 = 6(256) + 1
6(256) = 1536
1536 + 1 = 1537

7. a) The equation of the line y = 4x + m passes through the points (1, 2) and (n, 4). Find the values of m and n.
Solution:
Substitute the point (1, 2) into y = 4x + m to find m:
2 = 4(1) + m
2 = 4 + m
m = 2 - 4
m = -2
Now substitute m = -2 and the point (n, 4) into the equation to find n:
4 = 4n - 2
4 + 2 = 4n
6 = 4n
n = 6/4
n = 3/2
b) Juma uses 4 liters of fuel for a trip of 80 km. What is the amount of fuel that can be used in a trip of 320 km? Give your answer in cm^3.

Solution:
First, find the fuel consumption per kilometer:
4 liters / 80 km = 0.05 liters/km

For 320 km, the fuel required is:
320 × 0.05 liters = 16 liters
Convert liters to cm^3:
1 liter = 1000 cm^3
16 liters = 16 × 1000 = 16000 cm^3

8. a) Find the value of x in $\log(x^2 + 5x + 7) = 0$

Solution:
Using the logarithmic property log(a) = 0 implies a = 1:

$x^2 + 5x + 7 = 1$
Simplify the equation:
$x^2 + 5x + 7 - 1 = 0$
$x^2 + 5x + 6 = 0$
Factorize the quadratic equation:
$(x + 3)(x + 2) = 0$
Solve for x:
$x = -3$ or $x = -2$

b) Make x the subject of the formula $z = m / (x^2 y)$

Solution:
Multiply through by $(x - y)$:
$z(x^2 y) = m$
Expand:
$zx^2y = m$
Divide through by z:
$x^2 = m/(zy)$
$x = \sqrt{(m/zy)}$

9. a) Define the following terms on set theory:

i) Set: A set is a well-defined collection of distinct objects, considered as an entity.
ii) Union of two sets: The union of two sets A and B, denoted by $A \cup B$, is the set of all elements that are in A, in B, or in both.
iii) Intersection of two sets: The intersection of two sets A and B, denoted by $A \cap B$, is the set of all elements that are common to both A and B.
iv) Complement of a set: The complement of a set A, denoted by A', is the set of all elements in the universal set that are not in A.
b) In a certain office, every man owns either a car, a lorry, or both. 23 own lorries, 14 own cars, and 5 own both lorries and cars. How many men are there in the office?
Solution:
Using the principle of inclusion and exclusion:
Total = (Men owning lorries) + (Men owning cars) - (Men owning both)
Total = 23 + 14 - 5 Total = 32

10. a) Without using a mathematical table, find the value of
$1/\sin^2 45° + 2/\cos^2 45° + 3/\tan^2 45°$

Solution:
$\sin 45° = \cos 45° = 1/\sqrt{2}$, and $\tan 45° = 1$
$1/\sin^2 45° = 1/(1/\sqrt{2})^2 = 1/(1/2) = 2$
$2/\cos^2 45° = 2/(1/\sqrt{2})^2 = 2/(1/2) = 4$

$3/\tan^2 45° = 3/(1)^2 = 3$
Add the values:
$2 + 4 + 3 = 9$

b) A man on the top of a cliff 8 m high observes that the angle of depression of a boat at sea is 12°. How far is the boat from the cliff?

Solution:
Using the tangent function:
$\tan(12°) = \text{Opposite} / \text{Adjacent}$
$\tan(12°) = 8 / \text{Distance}$
$\text{Distance} = 8 / \tan(12°)$
Using the approximate value of $\tan(12°) \approx 0.2126$:
$\text{Distance} \approx 8 / 0.2126$
$\text{Distance} \approx 37.63$ m

11. a) Juma invested a certain amount of money in a business that paid simple interest at the rate of 15% per annum. At the end of nine months, he withdrew sh 1,125, which was the interest of the money he had earned. How much money had he invested?

Solution:
The formula for simple interest is:
$I = P \times R \times T$

Where:
I = Interest = 1125
P = Principal (amount invested)
R = Rate = 15% = 0.15
T = Time = 9 months = 9/12 = 3/4 years
Substitute the known values into the formula:
$1125 = P \times 0.15 \times 3/4$
$1125 = P \times 0.1125$
$P = 1125 / 0.1125$
$P = 10000$

b) A trader made a profit of 25% after selling a car for 6,500,000. Find the buying price.
Solution:
Selling Price (SP) = Cost Price (CP) + Profit
Profit = 25% of CP = $0.25 \times CP$
$SP = CP + 0.25 \times CP$
$SP = 1.25 \times CP$

Substitute SP = 6,500,000:
6,500,000 = 1.25 × CP

Solve for CP:
CP = 6,500,000 / 1.25
CP = 5,200,000

12. a) Factorize

i) 7a + 14 + ax + 2x
Solution:
Group the terms:
(7a + 14) + (ax + 2x)
Factorize each group:
7(a + 2) + x(a + 2)
Factor out (a + 2):
= (7 + x)(a + 2)

ii) $16x^2 - 4p^2$
Solution:
This is a difference of squares:
$16x^2 - 4p^2 = (4x)^2 - (2p)^2$
Apply the difference of squares formula:
(4x - 2p)(4x + 2p)
b) Solve for x by completing the square:

$x^2 + 3x - 10 = 0$

Solution:
Step 1: Move the constant to the right-hand side:
$x^2 + 3x = 10$

Step 2: Complete the square by adding $(b/2a)^2$ to both sides:
a=1, b = 3, $(b/2)^2 = (3/2)^2 = 9/4$

$x^2 + 3x + 9/4 = 10 + 9/4$
$x^2 + 3x + 9/4 = 40/4 + 9/4$
$x^2 + 3x + 9/4 = 49/4$
Step 3: Write the left-hand side as a perfect square:
$(x + 3/2)^2 = 49/4$
$x + 3/2 = \pm\sqrt{(49/4)}$

$x + 3/2 = \pm 7/2$
$x = -3/2 \pm 7/2$
$x = (-3 - 7)/2 = -10/2 = -5$
$x = 2$ or $x = -5$

13. The total of 60 people were surveyed and asked for their favorite holiday destination. The results are shown in the pie chart.

a) How many people went to Rwanda?
Solution:
The angle for Rwanda is 90°. The total angle in a pie chart is 360°.
The fraction of people who went to Rwanda is:
$90/360 = 1/4$
The number of people who went to Rwanda is:
$1/4 \times 60 = 15$
15 people

b) How many people went to Uganda on holiday?
Solution:
The angle for Uganda is 120°.
The fraction of people who went to Uganda is:
$120/360 = 1/3$
The number of people who went to Uganda is:
$1/3 \times 60 = 20$
20 people

c) How many more people went to Kenya than Rwanda?
Solution:
The angle for Kenya is 150°.
The fraction of people who went to Kenya is:
$150/360 = 5/12$
The number of people who went to Kenya is:
$5/12 \times 60 = 25$

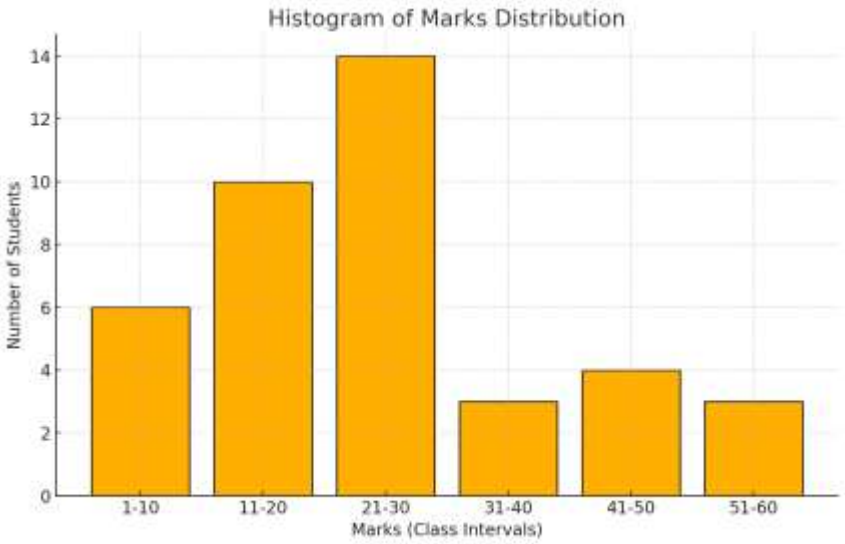
The difference between Kenya and Rwanda is:
$25 - 15 = 10$

= 10 more people

14. a) Define the following terms on statistics:
i) Histogram:
A histogram is a graphical representation of data using rectangular bars to show the frequency of data within specified intervals. The height of each bar corresponds to the frequency of the interval.

ii) Frequency polygon:
A frequency polygon is a graphical representation of data where points, representing the frequency of each interval, are plotted and connected by straight lines.

b) The frequency distribution table below shows the marks of 40 students in a certain test:
Marks in class interval: 1-10, 11-20, 21-30, 31-40, 41-50, 51-60
Number of students: 6, 10 , 14 , 3 , 4 , 3
i) Draw the histogram to represent the data



ii) Draw the frequency polygon

