Time: 2:30 Hours   **ANSWERS**   **Year: 2020**

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) Find the value of 4 3/4 ÷ 5 1/8.

Solution:
Convert the mixed fractions to improper fractions:
4 3/4 = 19/4
5 1/8 = 41/8
Divide the fractions:
19/4 ÷ 41/8 = 19/4 × 8/41
Simplify:
(19 × 8) / (4 × 41) = 152 / 164 = 38 / 41

b) Work out 2235 + 2126.
Solution:
2235 + 2126 = 4361

2. Rationalize the denominator of 2 / (2√3 + √2).
Solution:
Multiply numerator and denominator by the conjugate of the denominator:
(2 / (2√3 + √2)) × ((2√3 - √2) / (2√3 - √2))
Numerator:
2(2√3 - √2) = 4√3 - 2√2
Denominator:
$(2√3)^2 - (√2)^2 = 12 - 2 = 10$
(4√3 - 2√2) / 10

Simplify further:
(4√3 / 10) - (2√2 / 10) = (2√3 / 5) - (√2 / 5)

= (2√3 / 5) - (√2 / 5)

3. In the figure below, find the values of x, y, and z.
Solution:
The sum of angles in a triangle is 180°:
x + 80 + 40 = 180
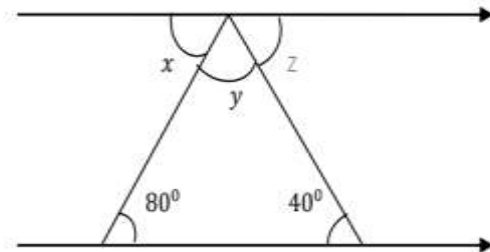x = 180 - 120
x = 60°

For the vertically opposite angle:
y = 60°
The sum of angles on a straight line is 180°:
z + 60 = 180
z = 120°
x = 60°, y = 60°, z = 120°

4. a) Write 0.0745 in standard form.
Solution:
$0.0745 = 7.45 \times 10^{-2}$
7.45×10^{-2}

b) Express 0.12 as a percentage.
Solution:
$0.12 \times 100 = 12\%$
12%

5. a) Simplify the expression $(3a^3b^2)^{-3}$.

Solution:
Apply the exponent rule $xy^n = x^n y^n$:
$(3a^3b^2)^{-3} = 3^{-3}(a^3)^{-3}(b^2)^{-3}$

Simplify each term:
$3^{-3} = 1/3^3 = 1/27$
$(a^3)^{-3} = a^{-9} = 1/a^9$
$(b^2)^{-3} = b^{-6} = 1/b^6$
Combine:
$(3a^3b^2)^{-3} = (1/27)(1/a^9)(1/b^6)$

$= 1 / (27a^9b^6)$

b) Make Y the subject of the formula, given that $X = (Y + YM^2) / KZ$.

Solution:
Multiply through by KZ to eliminate the denominator:
$XKZ = Y + YM^2$
Factorize Y on the right-hand side:
$XKZ = Y(1 + M^2)$
Solve for Y:
$Y = XKZ / (1 + M^2)$

6. a) Simplify the expression $x(2y + 3) + y(3x + 4)$.

Solution:
Distribute x and y across the brackets:
$x(2y) + x(3) + y(3x) + y(4)$
Simplify each term:

2xy + 3x + 3xy + 4y
Combine like terms:
(2xy + 3xy) + 3x + 4y
5xy + 3x + 4y
b) Find the exterior angle of a regular nonagon.

Solution:
The formula for the exterior angle of a regular polygon is:
Exterior angle = 360° / n
For a nonagon (n = 9):
Exterior angle = 360° / 9
Exterior angle = 40°

7. The sum of the two numbers a and b is 30, and a is twice b. Find the value of a and b.
Solution:
a + b = 30
a = 2b
Substitute a = 2b into a + b = 30:
2b + b = 30
3b = 30
b = 10
a = 2b = 2 × 10 = 20
a = 20, b = 10

8. a) Write in the box the correct mathematical sign <, >, = from the pair of numbers below:
i) 36% and 0.36
36% = 36/100 = 0.36
36% = 0.36

ii) 1 4/5 and 1.65
1 4/5 = 1 + 4/5 = 1 + 0.8 = 1.8
1.8 > 1.65

iii) 1.065 and 1 13/20
1 13/20 = 1 + 13/20 = 1 + 0.65 = 1.65
1.065 < 1.65

b) The total mass of 20 similar iron bars is 50kg 420g. What is the mass of each bar?

Solution:
50 kg = 50 × 1000 = 50000 g

4

Total mass = 50000 g + 420 g = 50420 g
Mass of each bar = 50420 g / 20 = 2521 g

Convert to kilograms:
2521 g = 2 kg 521 g
Mass of each bar = 2 kg 521 g

9. a) Solve for x if: $(1/2)^x \times (1/8)^{x+1} \times (1/16)^{2x-1} = 1/32$

Solution:
Write each term as a power of 2:
$(1/2)^x = 2^{-x}$
$(1/8)^{x+1} = 2^{-3(x+1)}$
$(1/16)^{2x-1} = 2^{-4(2x-1)}$
$1/32 = 2^{-5}$
Combine the exponents:
$2^{-x} \times 2^{-3(x+1)} \times 2^{-4(2x-1)} = 2^{-5}$
Add the exponents:
$^-x - 3(^x + 1) - 4(2^x - 1) = ^-5$
Simplify:
$^-x - 3^x - 3 - 8^x + 4 = ^-5$
$^-12^x + 1 = ^-5$
$^-12^x = ^-6$
$^x = 1/2$

b) Use logarithm to evaluate the following expression and give your answer to 3 significant figures: 46.22 × 18.33

Solution:
$\log(46.22 \times 18.33) = \log(46.22) + \log(18.33)$
$\log(46.22) \approx 1.665$
$\log(18.33) \approx 1.263$
Add:
$1.665 + 1.263 = 2.928$
Antilog(2.928) ≈ 848.76
= 848.76

10. a) The buying price of the radio is sh. 5000 and the percentage profit is 30%. What is its selling price?

Solution:
Selling Price = Buying Price + Profit
Profit = 30% of Buying Price = $0.3 \times 5000 = 1500$

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Selling Price = 5000 + 1500 = 6500
= 6500

b) Asha borrowed some money at simple interest of 12% per annum. After 2 years, she paid a total interest of sh. 5000. How much money did she pay?

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

Where:
I = Interest = 5000
R = Rate = 12% = 0.12
T = Time = 2 years

Substitute the values:
$5000 = P \times 0.12 \times 2$

Simplify:
$5000 = P \times 0.24$
$P = 5000 / 0.24$
$P = 20833.33$
Asha borrowed sh. 20833.33

11. A wire 17m long attached to the top of tower and the ground. The wire is 15m away from the base of the tower. a) Calculate the height of the tower.

Solution:
Using Pythagoras' theorem:
$c^2 = a^2 + b^2$
Here:
c = 17 m (hypotenuse)
b = 15 m (base)

$a^2 = c^2 - b^2$
$a^2 = 17^2 - 15^2$
$a^2 = 289 - 225$
$a^2 = 64$
$a = \sqrt{64}$
$a = 8$ m
The height of the tower is 8 m

b) Calculate the size of the angle formed between the ground and the wire.
Solution:
Using the trigonometric ratio:
$\cos \theta = $ adjacent / hypotenuse
$\cos \theta = 15 / 17$
$\theta = \cos^{-1}(15 / 17)$
$\theta \approx 28.07°$

12. a) In a class of 40 students, 18 are taking Kiswahili, 12 are taking both Kiswahili and Mathematics. How many students in this class are taking Mathematics, if 6 students are taking neither Kiswahili nor Mathematics?

Solution:
Let the total number of students be 40.
Students taking neither Kiswahili nor Mathematics = 6.
Students taking either Kiswahili or Mathematics or both = 40 - 6 = 34.
Let the number of students taking Mathematics only be M - 12, , where M is the total number of students taking Mathematics.
Students taking Kiswahili = 18.
Students taking both Kiswahili and Mathematics = 12.

Using the formula for the union of two sets:
$n(A) + n(B) - n(A \cap B) = n(A \cup B)$
$18 + M - 12 = 34$
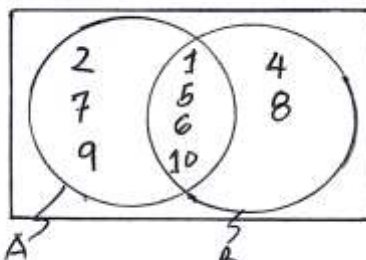$M + 6 = 34$
$M = 28$
Number of students taking Mathematics = 28.

b) Draw a Venn diagram to represent the relationship between the sets
$A = \{1, 2, 5, 6, 7, 9, 10\}$ and $B = \{1, 3, 4, 5, 6, 8, 10\}$.

13. a) If $z = (z_1 z_2) / (z_1 + z_2)$, evaluate z when $z_1 = 50$ and $z_2 = 65$.
Solution:
Substitute $z_1 = 50$ and $z_2 = 65$ into the formula:
$z = (50 \times 65) / (50 + 65)$
$z = 3250 / 115$
$z = 28.26$

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b) Every morning Asha walks 9 km to and from school. How far does she walk in 150 days?

Solution:
Distance walked in a day = 9 km
Total distance in 150 days = $9 \times 150 = 1350$ km

14. x and y are connected by the formula y = 3x + 6. Plot the graph of x against y for the values of x between -4 and 3 inclusive. Use your graph to find:

a) y when x = 2.5
b) y when x = -1.5

Solution:
To plot the graph, first calculate the corresponding y values for x values between -4 and 3 inclusive. Then plot these points and draw the graph.

From the graph of y = 3x + 6

a) When x = 2.5, y = 13.5
b) When x = -1.5, y = 1.5

Graph of y = 3x + 6

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