

UNEB U.C.E MATHEMATICS (PAPER 1) 2007

SECTION A

1. If $\mathbf{a} * \mathbf{b} = \frac{a}{b} + \frac{b}{a}$, evaluate $\frac{1}{2} * \frac{2}{3}$

2. Make c the subject from the expression: $\mathbf{a} = \mathbf{b} - \sqrt{b^2 + c^2}$

3. The point $\mathbf{R}(10, 7)$ is reflected in the line $y = x$ to give point \mathbf{S} . Given that \mathbf{M} is the mid point of \mathbf{RS} , find the coordinates of \mathbf{M} .

4. Find the area of a triangle whose sides are 13 cm, 24 cm and 13cm.

5. Given the sets:

$\mathbf{A} = \{\text{all natural numbers less than } 30\}$

$\mathbf{B} = \{\text{all prime numbers between } 10 \text{ and } 30\}$

Find:

a) $n(\mathbf{A} \cap \mathbf{B}')$

b) $n(\mathbf{A}' \cap \mathbf{B})$

Where \mathbf{B}' stands for the complement of the set \mathbf{B} .

6. If $\begin{pmatrix} 2 & 4 \\ -3 & 3 \end{pmatrix} + k \begin{pmatrix} 3 & 1 \\ 0 & n \end{pmatrix} = \begin{pmatrix} 8 & 6 \\ -3 & -1 \end{pmatrix}$, find the values of k and n .

7. Use the prime factor method to find the cube root of 3375.

8. In a revenue authority department, the tax earned income is calculated as follows:

The first shs120,000 is tax free and the remaining income is taxed at 25%. Find the tax payable on an earned income of:

a) Shs100,000

b) Shs440,000

SECTION B

Answer any five questions from this section. All questions carry equal marks.

9. a) Given that $\frac{1}{3x-4} + \frac{x}{x+1} = 1$, solve for x .

b) Solve the simultaneous equations $x^2 + 4y^2 = 4$

$y = x - 1$

10. Using a pencil, a ruler and a pair of compasses only, construct a triangle \mathbf{ABC} in which $\overline{AB} = 9.2\text{cm}$, angle $\mathbf{CAB} = 45^\circ$ and angle $\mathbf{ABC} = 75^\circ$.

- a) Measure the length of \overline{BC}
- b) Draw a circumscribing circle through the points **A**, **B** and **C**.
- c) Measure the radius of the circle.

11. a) in the figure below, vectors $\mathbf{OA} = \mathbf{a}$ and $\mathbf{OC} = \mathbf{c}$, $\overline{CD} = \frac{1}{3} \overline{OA}$ and $\overline{AB} = 3 \overline{OC}$

FIGURE

(i) by expressing vectors in terms of \mathbf{a} and \mathbf{c} , find \mathbf{OD} , \mathbf{AB} and \mathbf{OB}

(ii) Show that points **O**, **D** and **B** are collinear.

b) Points **A** and **B** have co-ordinates (0, -1) and (-6, 7) respectively.

Find:

(i) \mathbf{AB} ,

(ii) The magnitude of \mathbf{AB}

12. In a certain school, a sample of 100 students was picked randomly. In this sample, it was found out that 78 students play Netball (**N**), 82 play volleyball (**V**) 53 play tennis (**T**) and 2 do not play any of the three games. All those that play Tennis also play volleyball. 48 play all the three games.

a) Represent the given information on a Venn diagram.

b) How many students play both netball and volleyball but not tennis?

c) If a student is picked at random from sample, what is the probability that the student plays two games only?

13. a) Draw a table showing the values of $\sin 2\theta$ for $0^\circ \leq \theta \leq 90^\circ$, using values of θ at intervals of 15° .

b) use the table in (a) above, a horizontal scale of 2cm for 15° and a vertical scale of 2cm for 0.5 units to draw a graph of $\sin 2\theta$,

c) From the graph, find the values of θ for which $\sin 2\theta = 0.6$.

14. A manager of an industry earns a gross salary of shs2,000,000 per month, which includes an allowances of shs500,000 tax free. The rest of her income is subjected to an income tax which is calculated as follows:

7.5% on the first shs800,000

12.5% on the next shs500,000

20% on the next shs100,000

30% on the next shs60,000

35% on the remainder.

a) Find her taxable income

b) Calculate her monthly income tax

c) Express her monthly tax as a percentage of monthly gross salary.

15. A school constructed an office which required 34 tones of sand the school hired a lorry and a tipper truck with capacities of 7 tones and 5 tones respectively to transport the sand. The cost per trip either by lorry or by tipper truck was shs30, 000. The money available for transportation was shs180, 000. The trips made by the lorry did not exceed those made by the tipper truck.

a) If x and y represent the number of trips made by the lorry and the tipper truck respectively;

- (i) Write down five inequalities to represent the given information.
- (ii) Plot these inequalities on the same axes, shading the unwanted regions.
- b) (i) From your graph in (a)(ii) above, list all the possible numbers of trips, that each vehicle can make so as to maximize the total tonnage of sand transported.
- (ii) Find the number of trips by each vehicle that made the greatest total tonnage.

16. The figure below shows a cuboid **ABCDEFGH** in which **BC = 8cm**, **BF = 6** and **CD = 5cm**. **K** is the mid point of **AB**.

CUBOID

Find the:

- a) (i) length **AG**
- (ii) Angle which **AG** makes with the plane **ABCD**.
- b) Angle between planes **KGH** and **FGHE**.