

### 1.3 MATHEMATICS (121 and 122)

#### 1.3.1 Mathematics Alt. A Paper 1 (121/1)

#### SECTION 1 (50 marks)

*Answer all the questions in this section in the spaces provided.*

- 1 Without using a calculator, evaluate;

$$\frac{2\frac{1}{5} + \frac{2}{3} \text{ of } 3\frac{3}{4} - 4\frac{1}{6}}{1\frac{1}{4} - 2\frac{2}{5} \div 1\frac{1}{3} + 3\frac{3}{4}}$$

(3 marks)

- 2 The diagonal of a rectangular garden measures  $11\frac{1}{4}$  m while its width measures  $6\frac{3}{4}$  m. Calculate the perimeter of the garden.

(2 marks)

- 3 A motorist took 2 hours to travel from one town to another town and 1 hour 40 minutes to travel back. Calculate the percentage change in the speed of the motorist.

(3 marks)

- 4 A square room is covered by a number of whole rectangular slabs of sides 60 cm by 42 cm. Calculate the least possible area of the room in square metres.

(3 marks)

- 5 Given that  $\sin (x + 60)^\circ = \cos (2x)^\circ$ , find  $\tan (x + 60)^\circ$ .

(3 marks)

- 6 Simplify the expression:

$$\frac{4x - 9x^3}{3x^2 - 4x - 4}$$

(3 marks)

- 7 The external length, width and height of an open rectangular container are 41 cm, 21 cm and 15.5 cm respectively. The thickness of the material making the container is 5 mm. If the container has 8 litres of water, calculate the internal height above the water level.

(4 marks)

- 8 Factorise  $2x^2y^2 - 5xy - 12$

(2 marks)

- 9 Using a ruler and a pair of compasses only:

- (a) construct a parallelogram PQRS in which  $PQ = 6$  cm,  $QR = 4$  cm and angle  $SPQ = 75^\circ$ ;

(3 marks)

- (b) determine the perpendicular distance between PQ and SR.

(1 mark)

- 10 The masses of people during a clinic session were recorded as shown in the table below.

Mass (kg)	40-44	45-49	50-54	55-59	60-64	65-69	70-74
No. of people	1	2	12	10	2	2	1

Calculate the mean mass.

(3 marks)

- 11 A customer paid Ksh 5 880 for a suit after she was allowed a discount of 2% on the selling price. If the discount had not been allowed, the shopkeeper would have made a profit of 20% on the sale of the suit. Calculate the price at which the shopkeeper bought the suit. (3 marks)
- Three vertices of a parallelogram PQRS are P(-1, 2), Q(8, -5) and R (5,0).
- (a) On the grid provided below draw the parallelogram PQRS. (1 mark)
- (b) Determine the length of the diagonal QS. (2 marks)
- 13 In January, Mambo donated  $\frac{1}{6}$ th of his salary to a children's home while Simba donated  $\frac{1}{5}$ th of his salary to the same children's home. Their total donation for January was Ksh 14 820. In February, Mambo donated  $\frac{1}{8}$ th of his salary to the children's home while Simba donated  $\frac{1}{12}$ th of his salary to the children's home. Their total donation for February was Ksh 8 675. Calculate Mambo's monthly salary. (4 marks)
- 14 (a) Express 10500 in terms of its prime factors. (1 mark)
- (b) Determine the smallest positive number P such that 10500P is a perfect cube. (2 marks)
- 15 Three police posts X, Y and Z are such that Y is 50 km on a bearing of  $060^\circ$  from X while Z is 70 km from Y and on a bearing of  $300^\circ$  from X.
- (a) Using a suitable scale, draw a diagram to represent the above situation. (3 marks)
- (b) Determine the distance, in km, of Z from X. (1 mark)
- 16 A small cone of height 8 cm is cut off from a bigger cone to leave a frustum of height 16 cm. If the volume of the smaller cone is  $160 \text{ cm}^3$ , find the volume of the frustum. (3 marks)

## SECTION II (50 marks)

*Answer any five questions in this section in the spaces provided.*

- 17 A solid consists of a cone and a hemisphere. The common diameter of the cone and the hemisphere is 12 cm and the slanting height of the cone is 10 cm.
- (a) Calculate correct to two decimal places:
- (i) the surface area of the solid; (3 marks)
- (ii) the volume of the solid. (4 marks)
- (b) If the density of the material used to make the solid is  $1.3 \text{ g/cm}^3$ , calculate its mass in kilograms. (3 marks)

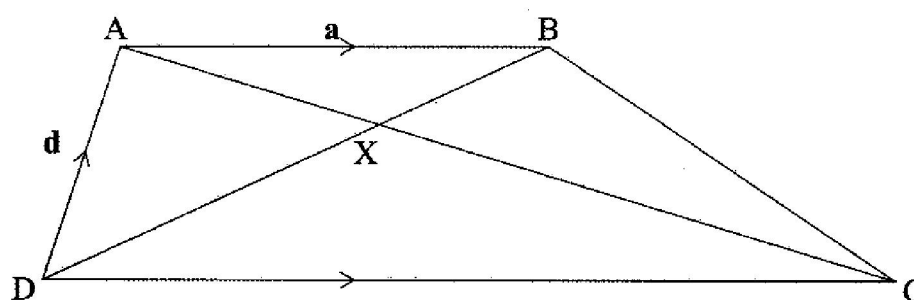
- 18** Makau made a journey of 700 km partly by train and partly by bus. He started his journey at 8.00 a.m. by train which travelled at 50 km/h. After alighting from the train, he took a lunch break of 30 minutes. He then continued his journey by bus which travelled at 75 km/h. The whole journey took  $11\frac{1}{2}$  hours.
- (a) Determine:
- the distance travelled by bus; (4 marks)
  - the time Makau started travelling by bus. (3 marks)
- (b) The bus developed a puncture after travelling  $187\frac{1}{2}$  km. It took 15 minutes to replace the wheel.  
Find the time taken to complete the remaining part of the journey. (3 marks)
- 19** (a) The product of the matrices  $\begin{pmatrix} 0 & 1 \\ 2 & p \end{pmatrix}$  and  $\begin{pmatrix} -1.5 & -0.5 \\ p & p-2 \end{pmatrix}$  is a singular matrix.  
Find the value of  $p$ . (3 marks)
- (b) A saleswoman earned a fixed salary of Ksh  $x$  and a commission of Ksh  $y$  for each item sold. In a certain month she sold 30 items and earned a total of Ksh 50 000. The following month she sold 40 items and earned a total of Ksh 56 000.
- Form two equations in  $x$  and  $y$ . (2 marks)
  - Solve the equations in (i) above using matrix method. (3 marks)
  - In the third month she earned Ksh 68 000. Find the number of items sold. (2 marks)
- 20** In a triangle ABC,  $BC = 8$  cm,  $AC = 12$  cm and angle  $ABC = 120^\circ$ .
- (a) Calculate the length of AB, correct to one decimal place. (4 marks)
- (b) If BC is the base of the triangle, calculate, correct to one decimal place:
- the perpendicular height of the triangle; (2 marks)
  - the area of the triangle; (2 marks)
  - the size of angle ACB. (2 marks)
- 21** (a) Using the trapezium rule with seven ordinates, estimate the area of the region bounded by the curve  $y = -x^2 + 6x + 1$ , the lines  $x = 0$ ,  $y = 0$  and  $x = 6$ . (5 marks)
- (b) Calculate:
- the area of the region in (a) above by integration; (3 marks)
  - the percentage error of the estimated area to the actual area of the region, correct to two decimal places. (2 marks)

- 22 The displacement,  $s$  metres, of a moving particle after  $t$  seconds is given by,  
 $s = 2t^3 - 5t^2 + 4t + 2$ .

Determine:

- the velocity of the particle when  $t = 3$  seconds; (3 marks)
- the value of  $t$  when the particle is momentarily at rest; (3 marks)
- the displacement when the particle is momentarily at rest; (2 marks)
- the acceleration of the particle when  $t = 3$  seconds. (2 marks)

- 23 In the figure below, ABCD is a trapezium. AB is parallel to DC, diagonals AC and DB intersect at X and  $DC = 2AB$ .  $AB = a$ ,  $DA = d$ ,  $AX = kAC$  and  $DX = hDB$ , where  $h$  and  $k$  are constants.



- Find in terms of  $a$  and  $d$ :
    - $BC$ ; (2 marks)
    - $AX$ ; (2 marks)
    - $DX$ . (1 mark)
  - Determine the values of  $h$  and  $k$ . (5 marks)
- 24 The frequency table below shows the daily wages paid to casual workers by a certain company.

Wages in shillings	100-150	150-200	200-300	300-400	400-600
No. of workers	160	120	380	240	100

- Draw a histogram to represent the above information. (5 marks)
- State the class in which the median wage lies. (1 mark)
  - Draw a vertical line, in the histogram, showing where the median wage lies. (1 mark)
- Using the histogram, determine the number of workers who earn sh 450 or less per day. (3 marks)