

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 10 m while its width measures 6 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:

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

(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°;

(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 $\frac{1}{3}$ th of his salary to a children's home while Simba donated $\frac{1}{4}$ th of his salary to the same children's home. Their total donation for January was Ksh 14 820. In February, Mambo donated $\frac{1}{2}$ th of his salary to the children's home while Simba donated $\frac{1}{3}$ 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° from X while Z is 70 km from Y and on a bearing of 300° 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 cm³, 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 g/cm³, calculate its mass in kilograms. (3 marks)

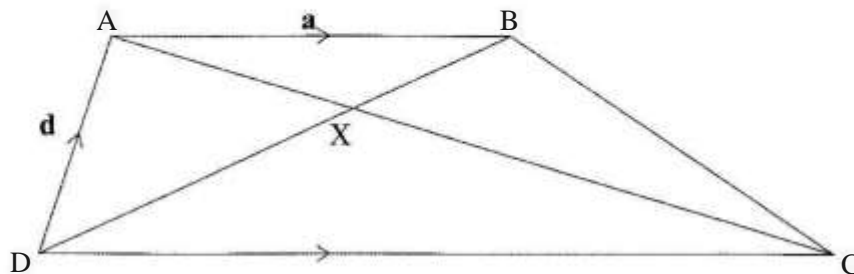
- 18 Makau made a journey of 700 km partly by train and partly by bus. He started his journey at 8.00 a.m. by train which travelled at 50 km/h. After alighting from the train, he took a lunch break of 30 minutes. He then continued his journey by bus which travelled at 75 km/h. The whole journey took $11\frac{1}{2}$ 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,
 $s = 2t^2 - 5t + 41$.

Determine:

- (a) the velocity of the particle when $t = 3$ seconds; (3 marks)
 (b) the value of t when the particle is momentarily at rest; (3 marks)
 (c) the displacement when the particle is momentarily at rest; (2 marks)
 (d) 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 $DC = 2AB$. $\mathbf{AB} = \mathbf{a}$, $\mathbf{DA} = \mathbf{d}$, $\mathbf{AX} = k \mathbf{AC}$ and $\mathbf{DX} = h \mathbf{DB}$, where h and k are constants.



- (a) Find in terms of \mathbf{a} and \mathbf{d} :
- (i) \mathbf{BC} ; (2 marks)
 (ii) \mathbf{AX} ; (2 marks)
 (iii) \mathbf{DX} . (1 mark)
- (b) 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

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