

Name..... **MARKING SCHEME**.....
School.....
Candidate's Signature

Adm No
Date.....

121/1
MATHEMATICS
FORM 1
July 2021
Time: 2¹/₂ Hours

ZERAKI ACHIEVERS EXAM

Kenya Certificate of Secondary Education

INSTRUCTIONS TO CANDIDATES

- a) Write your name and admission number in the spaces provided above.
- b) This paper consists of **TWO** sections. **Section A** and **Section B**
- c) Answer **ALL** the questions in **section A** and only **FIVE** questions from **Section B**
- d) All answers and working must be written on the question paper in the spaces provided below each question.
- e) **Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.**
- f) Marks may be given for correct working even if the answer is wrong
- g) Non-programmable silent calculators and **KNEC** mathematical tables may be used except where stated otherwise.
- h) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
- i) Write the answers in English.

FOR EXAMINERS USE ONLY

SECTION 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL

SECTION 11

17	18	19	20	21	22	23	TOTAL

GRAND TOTAL

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This paper consists of 15 printed pages. Candidates should check carefully to ascertain that all the pages are printed as indicated and no questions are missing.

SECTION A (50 MARKS)

1. Simplify without using a calculator, giving your answer as a fraction in its simplest form.

$$\frac{2 \frac{1}{3} - 1 \frac{2}{3} \div \frac{5}{9}}{\frac{4}{7} \text{ of } 2 \frac{1}{3} - 2 \frac{2}{7}} \quad (3 \text{ marks})$$

$$\frac{\frac{7}{3} - \left(\frac{5}{3} \times \frac{9}{5}\right)}{\left(\frac{4}{7} \times \frac{7}{3}\right) - \frac{16}{7}}$$

$$\frac{\frac{7}{3} - \frac{3}{1}}{\frac{4}{3} - \frac{16}{7}}$$

$$\frac{-\frac{2}{3}}{28 - 48}$$

$$-\frac{2}{3} \div -\frac{20}{21}$$

$$+\frac{2}{3} \times \frac{21}{+20}$$

$$= \frac{7}{10}$$

2. Evaluate without tables or calculator.

$$\frac{-12 \div (-3) \times 4 - (-20)}{-6 \times 6 \div 3 + -6} \quad (3 \text{ marks})$$

$$\frac{4 \times 4 + 20}{-6 \times 2 - 6}$$

$$\frac{16 + 20}{-12 - 6}$$

$$\frac{36}{-18}$$

$$= -\underline{\underline{2}}$$

3. An airbus left town N at 1945hrs and arrived in town L at 0320hrs. It stayed for $1\frac{1}{2}$ hours for rest

and refreshment of passengers and crew. It then headed for town W and took $1\frac{1}{2}$ hours.

- (a) How long did the journey from town N to town L take in hours and minutes? (2 marks)

$$0320 \text{ hrs} - 1945 \text{ hrs}$$

$$\begin{array}{r} 2720 \\ - 1945 \\ \hline 0735 \end{array}$$

$\Rightarrow \underline{\underline{7 \text{ hours } 35 \text{ minutes}}}$

- (b) At what time did it arrive in town W? (1 mark)

$$\text{Arrival time in W} = 0320 \text{ hrs} + 1\frac{1}{2} \text{ hours} + 1\frac{1}{2} \text{ hours}$$

$$= 0320 \text{ hrs} + 3 \text{ hours}$$

$$= \underline{\underline{0620 \text{ hrs}}}$$

4. Mzee is three times as old as his son now. If ten years ago the sum of their ages was 44, how old was Mzee when his son was born? (3 marks)

Let the age of the son be x

$$(3x - 10) + (x - 10) = 44$$

$$3x - 10 + x - 10 = 44$$

$$4x - 20 = 44$$

$$4x = 64$$

$$\underline{x = 16}$$

$$\begin{aligned} \text{Mzee's present age} &= 3x + 16 \\ &= \underline{\underline{48 \text{ years}}} \end{aligned}$$

$$48 - 16 = \underline{\underline{32 \text{ years}}}$$

5. Given that $\frac{2x+3y}{3x+4y} = 5$, find the ratio $y : x$. (3 marks)

$$2x + 3y = 15x + 20y$$

$$3y - 20y = 15x - 2x$$

$$-17y = 13x$$

$$y = -\frac{13}{17}x$$

$$\underline{\underline{y : x = -13 : 17}}$$

6. Express 2.83 as improper fraction. (3 marks)

$$\begin{array}{r} y = 2.8383\dots \\ 100y = 283.8383\dots \end{array}$$

$$99y = 281$$

$$\begin{array}{r} y = \frac{281}{99} \\ \hline \end{array}$$

7. An Italian tourist, on arrival in Kenya, converted 6000 Euros into Kenya shillings. During her three day's stay in the country, she spent Kshs 260,000. She converted the remaining amount into US dollars. Using the exchange rates table below calculate how many US dollars she got?

	Buying	Selling
1 US dollar \$	96.20	96.90
1 Euro C	112.32	112.83

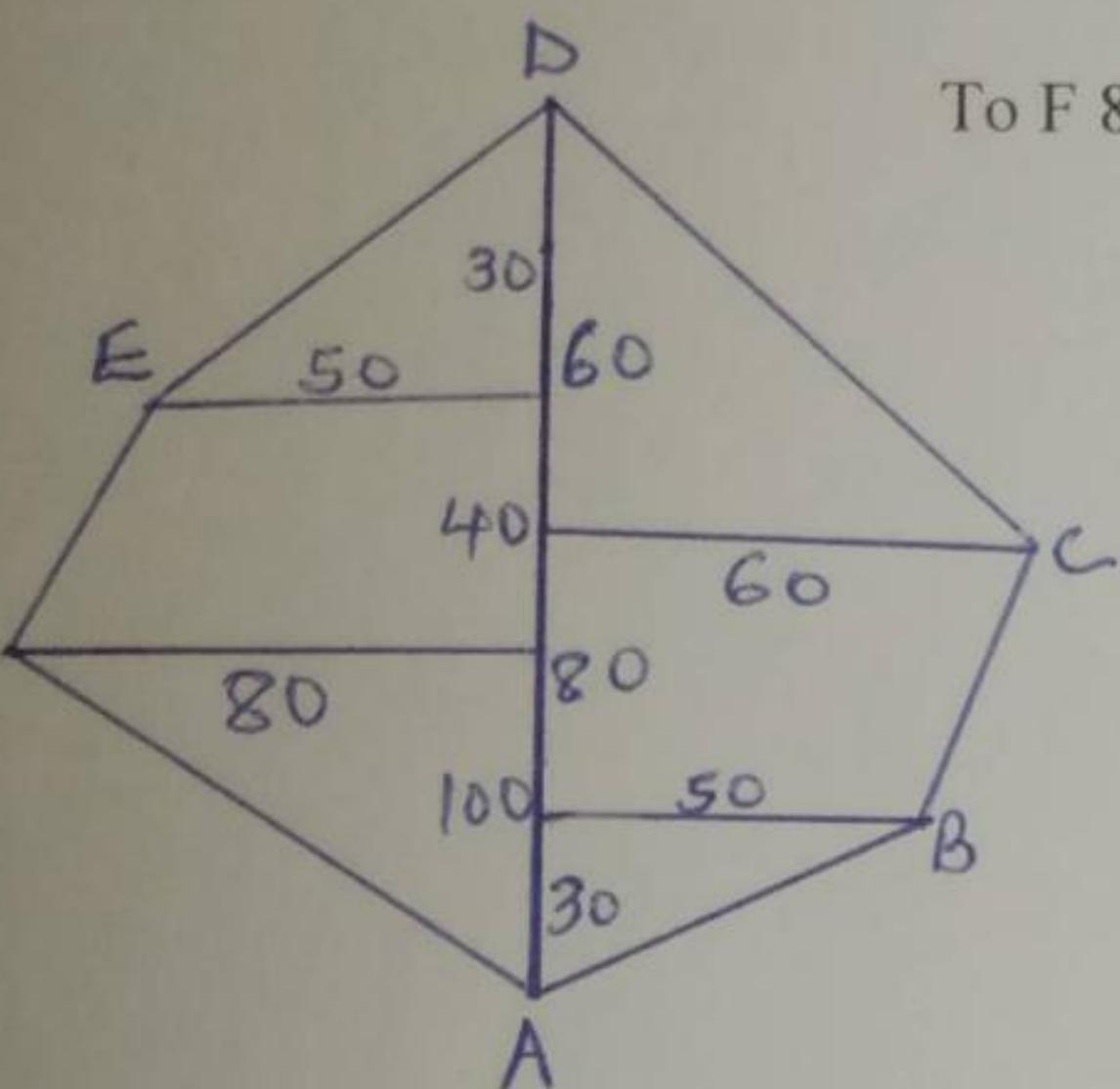
(3 marks)

$$6000 \times 112.32 = \text{Kshs } 673,920$$

$$\begin{aligned} \text{Balance in Ksh} &= \text{Ksh } 673,920 - 260,000 \\ &= \underline{\underline{\text{Kshs } 413,920}} \end{aligned}$$

$$\begin{aligned} \text{Balance in US dollars} &= \frac{413,920}{96.90} \\ &= \underline{\underline{4271.62 \text{ US dollars}}} \end{aligned}$$

8. Find the area in hectares of a field book measurement is recorded in metres as follows.



D	
170	
140	
110	60 to C
100	
30	50 to B
A	

(3 marks)

Total Area

$$\begin{aligned}
 &= \frac{1}{2} \times 30 \times 50 + \frac{1}{2} (60+50) 80 + \frac{1}{2} \times 60 \times 60 + \frac{1}{2} \times 50 \times 30 \\
 &\quad + \frac{1}{2} (50+80) 40 + \frac{1}{2} \times 80 \times 100 \\
 &= 750 + 4400 + 1800 + 750 + 2600 + 4000 = 14,300 \text{ m}^2
 \end{aligned}$$

$$\text{Area in ha} = \frac{14,300}{10,000} = 1.43 \text{ ha}$$

Find

9. The perimeter of a triangular field is 120 m. Two of the sides are 21m and 40m. Calculate the largest angle of the field, and find the area of the field. (4 marks)

$$120 \text{ m} = 21 + 40 + y$$

$$y = 59 \text{ m}$$

Let 1cm rep 10m

Largest angle

$$= 148^\circ \pm 1^\circ$$

10. A paint dealer mixes three types of paint A, B and C in the ratios A: B = 3:4 and B:C = 1:2. The mixture is to contain 168 litres of C.

- a) Find the ratio A: B:C

(2 marks)

$$A : B$$

$$3 : 4$$

$$B : C$$

$$1 : 2$$

$$A : B : C = \underline{\underline{3 : 4 : 8}}$$

- b) Find the required number of litres of B. (1 marks)

If 8 → 168 litres

$$\therefore 4 \rightarrow \frac{4 \times 168}{8}$$

$$= \underline{\underline{84 \text{ litres}}}$$

11. Annette has some money in two denominations only. Fifty shillings notes and twenty shilling coins. She has three times as many fifty shilling notes as twenty shilling coins. If altogether she has sh. 3,400, find the number of fifty shilling notes and 20-shilling coin. (3 marks)

Let the number of 20 shilling coins be y

$$\text{fifty shilling notes} = 3y$$

$$3y(50) + y(20) = 3400$$

$$150y + 20y = 3400$$

$$170y = 3400$$

$$\underline{\underline{y = 20}}$$

$$\text{fifty shillings notes}$$

$$= 20 \times 3$$

$$= \underline{\underline{60}}$$

12. The mean of five numbers is 20. The mean of the first three numbers is 16. The fifth number is greater than the fourth by 8. Find the fifth number. (3 marks)

$$\text{sum of the 5 numbers} = 20 \times 5$$

$$= \underline{\underline{100}}$$

$$\text{sum of the first 3 numbers} = 16 \times 3$$

$$= \underline{\underline{48}}$$

$$\text{sum of the fourth \& fifth numbers} = 100 - 48$$

$$= \underline{\underline{52}}$$

Let the 4th be a

$$a + a + 8 = 52$$

$$2a = 44$$

$$a = 22$$

the 5th number

$$= 22 + 8$$

$$= \underline{\underline{30}}$$

13. A farmer has a piece of land measuring 840m by 396m. He divides it into square plots of equal size. Find the maximum area of one plot. (3 marks)

2	396	840
2	198	420
3	99	210
	33	70

$$G.C.D = 2 \times 2 \times 3$$

$$= \underline{\underline{12}}$$

$$\text{Maximum } A = l^2$$

$$= 12^2$$

$$= \underline{\underline{144m^2}}$$

14. Each interior angle of a regular polygon is 120° larger than the exterior angle. How many sides have the polygon? (3 marks)

$$n = \frac{360}{\text{Exterior angle}}$$

$$a + a + 120 = 180$$

$$2a = 60$$

$$a = 30$$

$$\text{Exterior angle} = 30^\circ$$

$$n = \frac{360}{30}$$

$$= \underline{\underline{12 \text{ sides}}}$$

15. A photograph is reduced in the ratio 3:5 for a newspaper and further reduced in the ratio 4:5 for a text book. Find the ratio of the photograph size to the text book size. (3 marks)

$$\text{Newspaper} = \frac{3}{5} \text{ photograph}$$

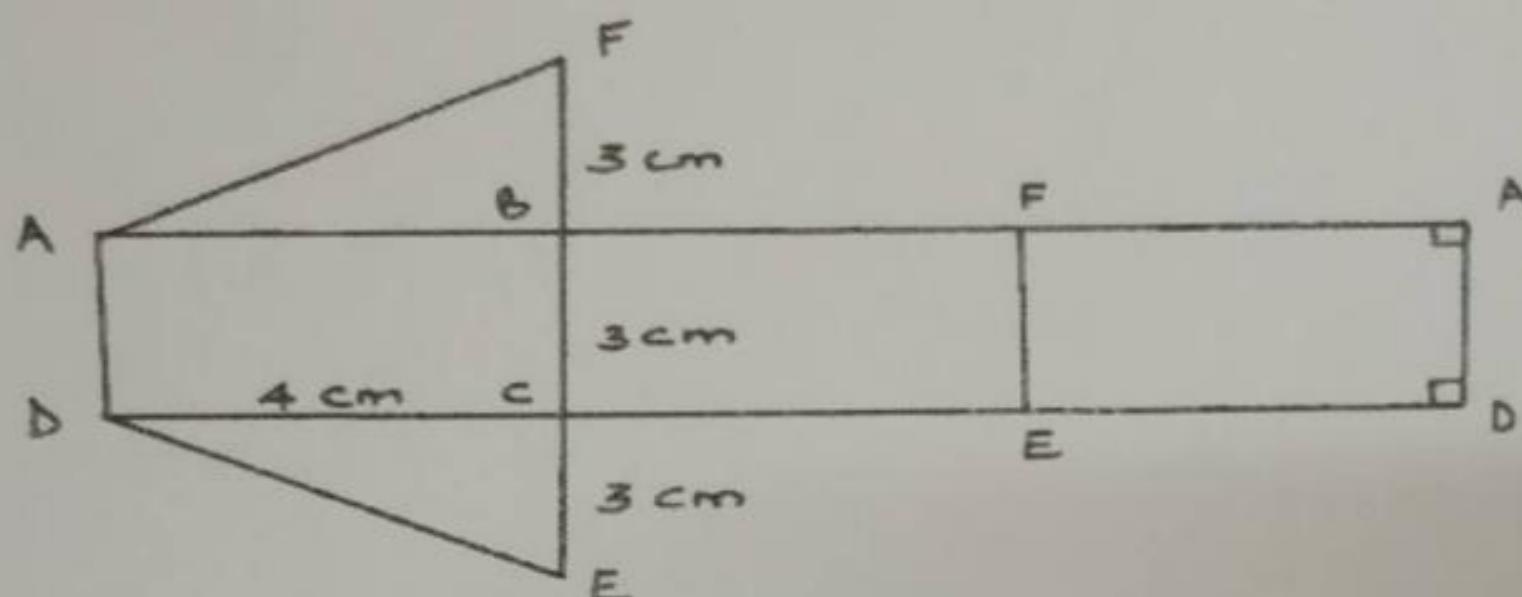
$$\text{Text book} = \frac{4}{5} \text{ newspaper}$$

$$= \frac{4}{5} \times \frac{3}{5} \text{ photograph}$$

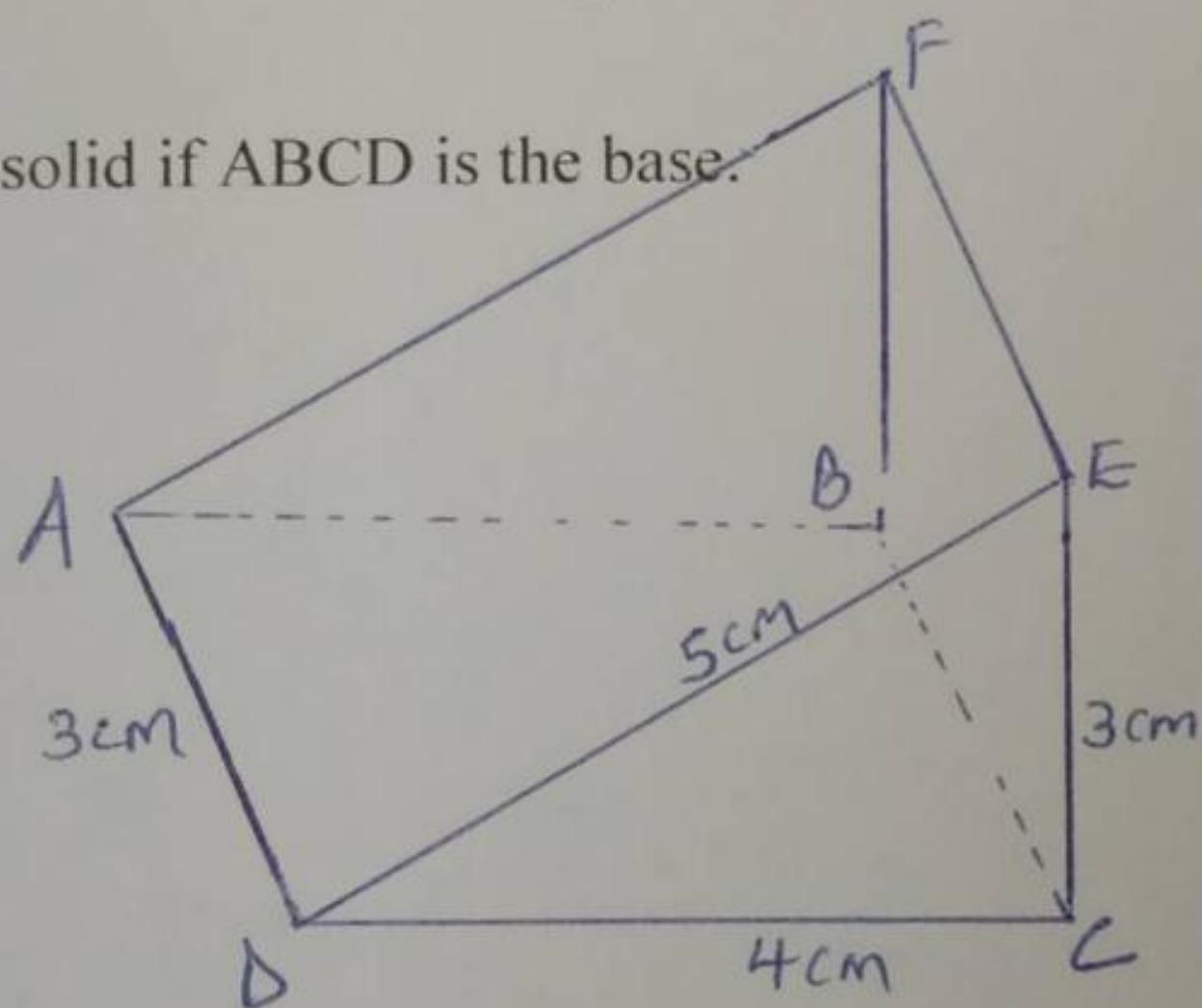
$$\text{Text book} = \frac{12}{25} \text{ photograph}$$

$$\text{photograph : Text book} = \underline{\underline{25:12}}$$

16. The net of a solid is as shown below.



(a) Sketch the solid if ABCD is the base. (2 marks)



(b) Calculate the volume of the solid sketched in (a). (2 marks)

$$\begin{aligned}\text{Volume} &= \frac{1}{2} b h \times l \\ &= \frac{1}{2} \times 4 \times 3 \times 3 \\ &= \underline{\underline{18 \text{ cm}^3}}\end{aligned}$$

SECTION B (50 MARKS)

Attempt **ONLY FIVE** questions in this section.

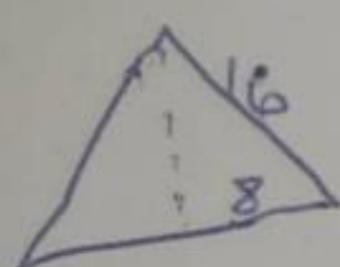
17. Milk in a cooling factory is stored in a rectangular tank whose internal dimensions are 1.7m by 1.4m by 2.2m one day the tank was 75% full of milk.

- a) Calculate the volume of milk in the tank in litres. (3 marks)

$$\begin{aligned} \text{Volume of milk} &= (1.7 \times 1.4 \times 2.2 \times \frac{75}{100}) \text{ m}^3 \\ &= \underline{\underline{3.927 \text{ m}^3}} \\ 1 \text{ m}^3 &= 1000 \text{ litres} \\ \therefore 3.927 \text{ m}^3 &= 3.927 \times 1000 \\ &= \underline{\underline{3927 \text{ litres}}} \end{aligned}$$

- b) The milk is packed in small packets which are in the shape of a right pyramid on an equilateral triangle base of side 16cm. The height of each packet is 13.6cm. Each packet is sold at Sh.30. Calculate

- i. The volume of milk in milliliters, contained in each packet to 2 significant figures. (4 marks)

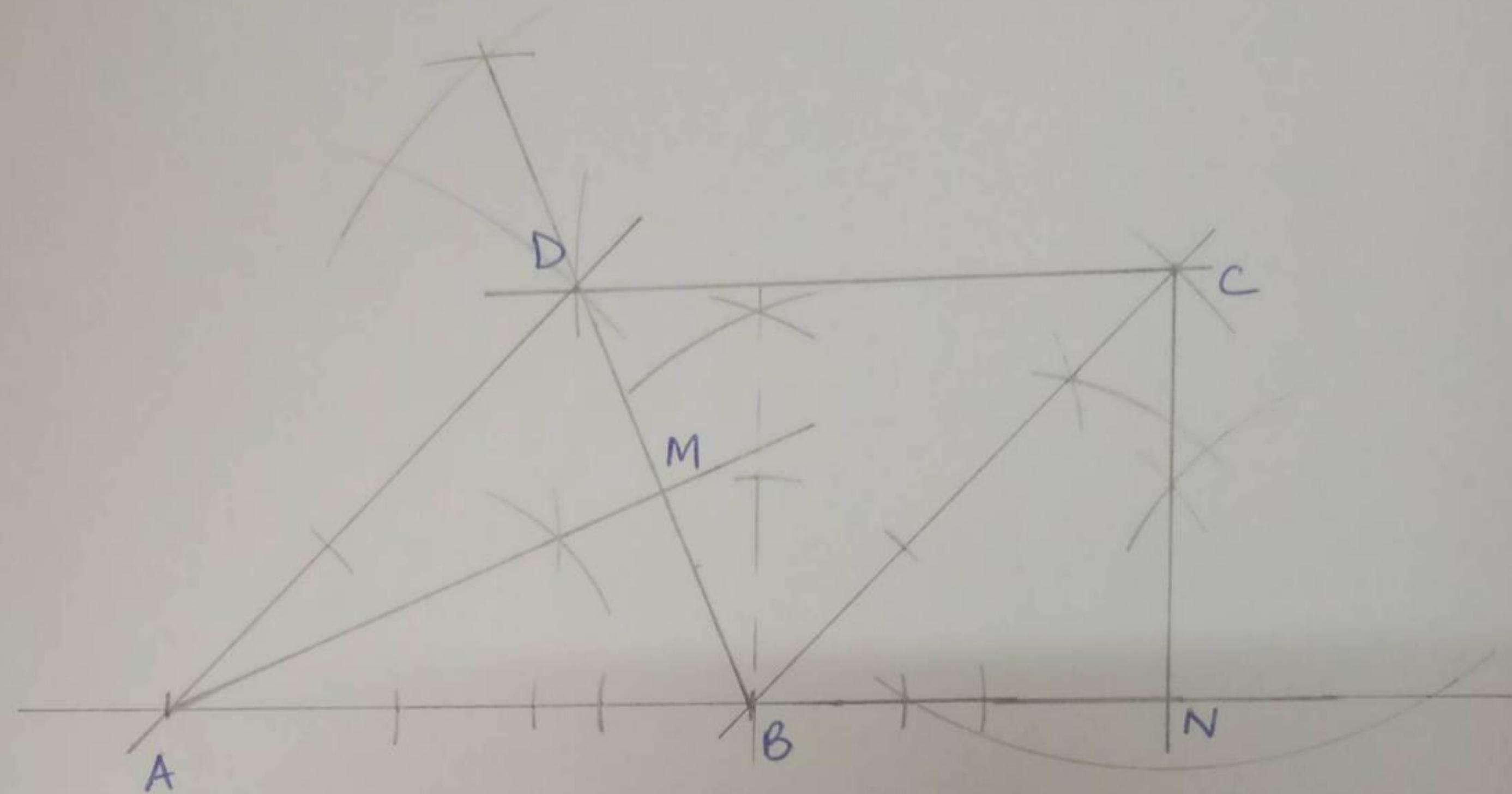


$$\begin{array}{l|l} \begin{aligned} V &= \frac{1}{3} \text{Base Area} \times \text{Height} \\ &= \frac{1}{3} \times \cancel{\left(\frac{1}{2} \times 16 \times 16 \times 8 \right)} \\ \text{Base Area} &= \frac{1}{2} b h \\ h &= \sqrt{16^2 - 8^2} \\ &= 13.86 \text{ cm} \end{aligned} & \begin{aligned} 1 \text{ cm}^3 &= 1 \text{ ml} \\ \therefore 502.66 \text{ cm}^3 &= \frac{502.66 \text{ cm}^3 \times 1 \text{ ml}}{1 \text{ cm}^3} \\ &= \underline{\underline{502.66 \text{ ml}}} \\ &\approx \underline{\underline{500 \text{ ml}}} \text{ (2sf)} \end{aligned} \end{array}$$

- ii. The exact amount of money that was realized from the sale of all the packets of milk. (3 marks)

$$\begin{aligned} \text{Total Cost} &= \frac{3927 \text{ l}}{0.5 \text{ L}} \times 30 \\ &= \underline{\underline{\text{Sh. } 235,620}} \end{aligned}$$

18. a) Using a ruler and a pair of compasses only construct a rhombus A B C D such that AB = 6cm and $\angle ABC = 135^\circ$. (4 marks)



$$BN = 4.2 \text{ cm}$$

$$CN = 54.3 \text{ cm}$$

- b) Drop a perpendicular from C to AB extended to meet AB at N. Measure BN and CN. (3 marks)
- c) Bisect $\angle ABC$ and $\angle DAB$, let the two bisectors meet at M. Measure MA. (1 mark)
- d) Determine the area of triangle ABM. (2 marks)

$$AB = 6 \text{ cm}$$

$$BM = 2.4 \text{ cm}$$

$$\angle ABM = 67.5^\circ$$

$$\text{Area of } \triangle ABM = \frac{1}{2} \times 6 \times 2.4 \sin 67.5$$

$$= \underline{\underline{6.652 \text{ cm}^2}}$$

19. a) A manufacturer sells goods to a shopkeeper at a profit of 15%. The shopkeeper sells them so as to make a profit of 25%. During a sale, the shopkeeper reduced his prices by 10%. Find, to the nearest shilling, the factory price of an article which was marked at sh. 450 during the sale. (3 marks)

The price before reduction by 10%

$$= \frac{450 \times 100\%}{90\%}$$

$$= \underline{\underline{500}}/$$

$$125\% \equiv 500/$$

$$\therefore 100\% \equiv ? \frac{100\% \times 500}{125\%}$$

$$= \underline{\underline{\text{sh} 400}}$$

$$115\% \equiv 400/$$

$$\therefore 100\% \equiv ? \frac{100\% \times 400}{115\%}$$

$$= \underline{\underline{\text{sh} 347.83}}$$

$$= \underline{\underline{\text{sh. 348}}}$$

b) Mrs. Kinuthia bought a car in USA for sterling pounds 10,000. She paid transportation charges from USA to Kenya amounting to 500 US dollars. On arrival to Kenya she paid import duty of 20% of the buying price and clearance tax of 0.5% of its total value in Kenya. If the exchange rate were as follows:

$$1 \text{ Sterling pound} = 1.50 \text{ US dollars}$$

$$1 \text{ Sterling pound} = 120.00 \text{ Kenya shillings}$$

$$1 \text{ US dollars} = 80.00 \text{ Kenya shillings}$$

- i) Calculate the total amount paid for the car by Mrs. Kinuthia in Kshs. (5 marks)

$$\text{Buying price} = 10,000 \times 120$$

$$= \underline{\underline{\text{Kshs. 120,000}}}$$

$$\text{Transportation charges} = 500 \times 80$$

$$= \underline{\underline{\text{Ksh 40,000}}}$$

$$\text{Import duty} = \frac{20}{100} \times 1,200,000$$

$$= \underline{\underline{\text{Kshs 240,000}}}$$

$$\text{Clearance tax} = \frac{0.5}{100} \times (1,200,000 + 40,000 + 240,000)$$

$$= \underline{\underline{\text{sh 1,480,000} \times \frac{0.5}{100}}}$$

$$= \underline{\underline{\text{sh 7,400}}}$$

$$\text{Total amount paid} = \text{sh}(1,480,000 + 7,400)$$

$$= \underline{\underline{\text{Kshs. 1,487,400}}}$$

- ii) If Kinuthia later on sold the lorry at a profit of 10% find how much profit he was paid. (2 marks)

$$\text{Profit} = \frac{10}{100} \times 1,487,400$$

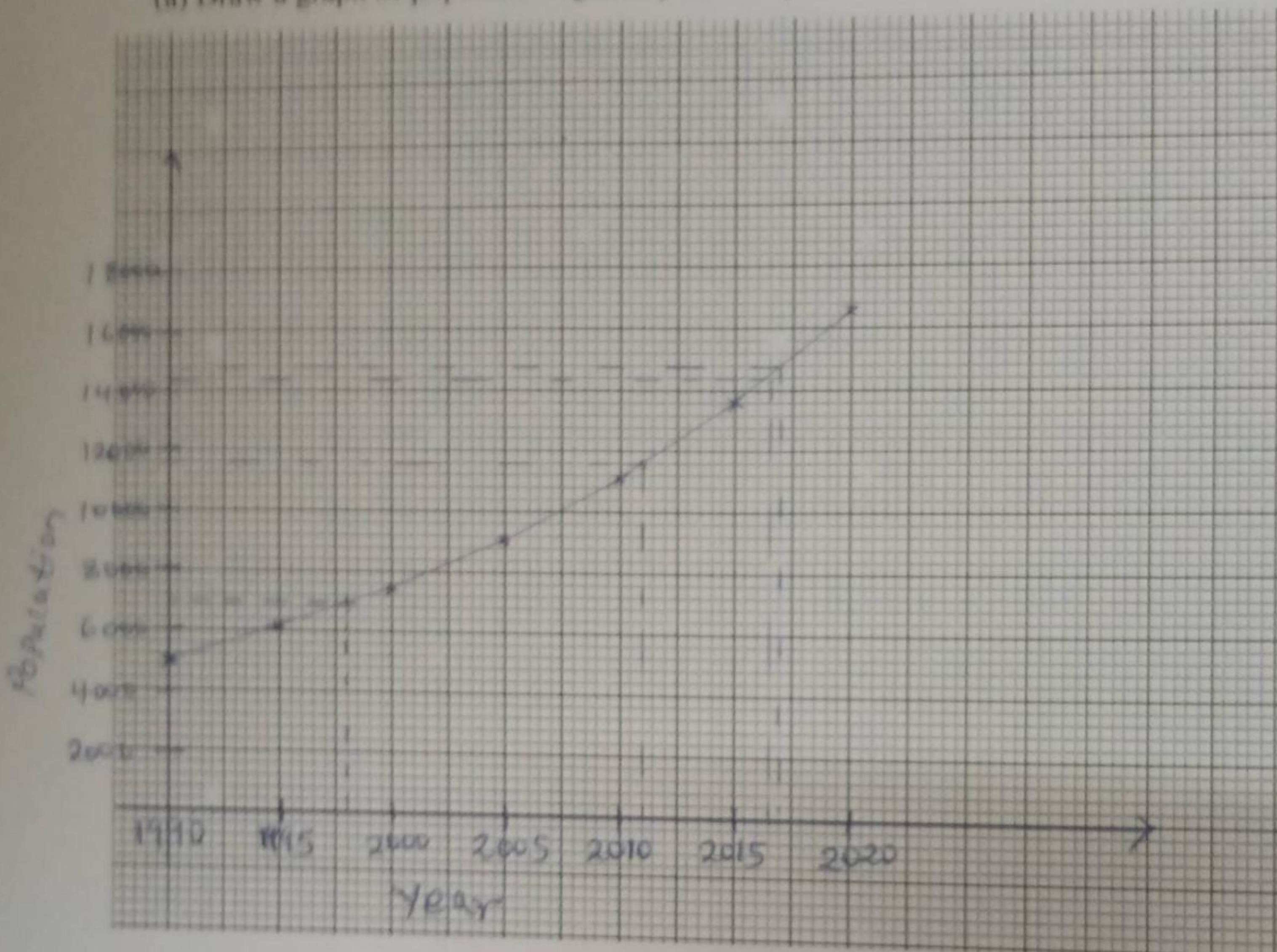
$$= \underline{\underline{\text{Kshs. 148,740}}}$$

20. The following table gives the population of a town at different times.

YEAR	1990	1995	2000	2005	2010	2015	2020
POPULATION	5000	6100	7500	9100	11100	13600	16600

(a) Draw a graph of population against year to represent the information above.

(5 marks)



(b) From the graph estimate the population of the town in:

(i) 1998

7000

(ii) 2014

11600

(iii) 2017

14800

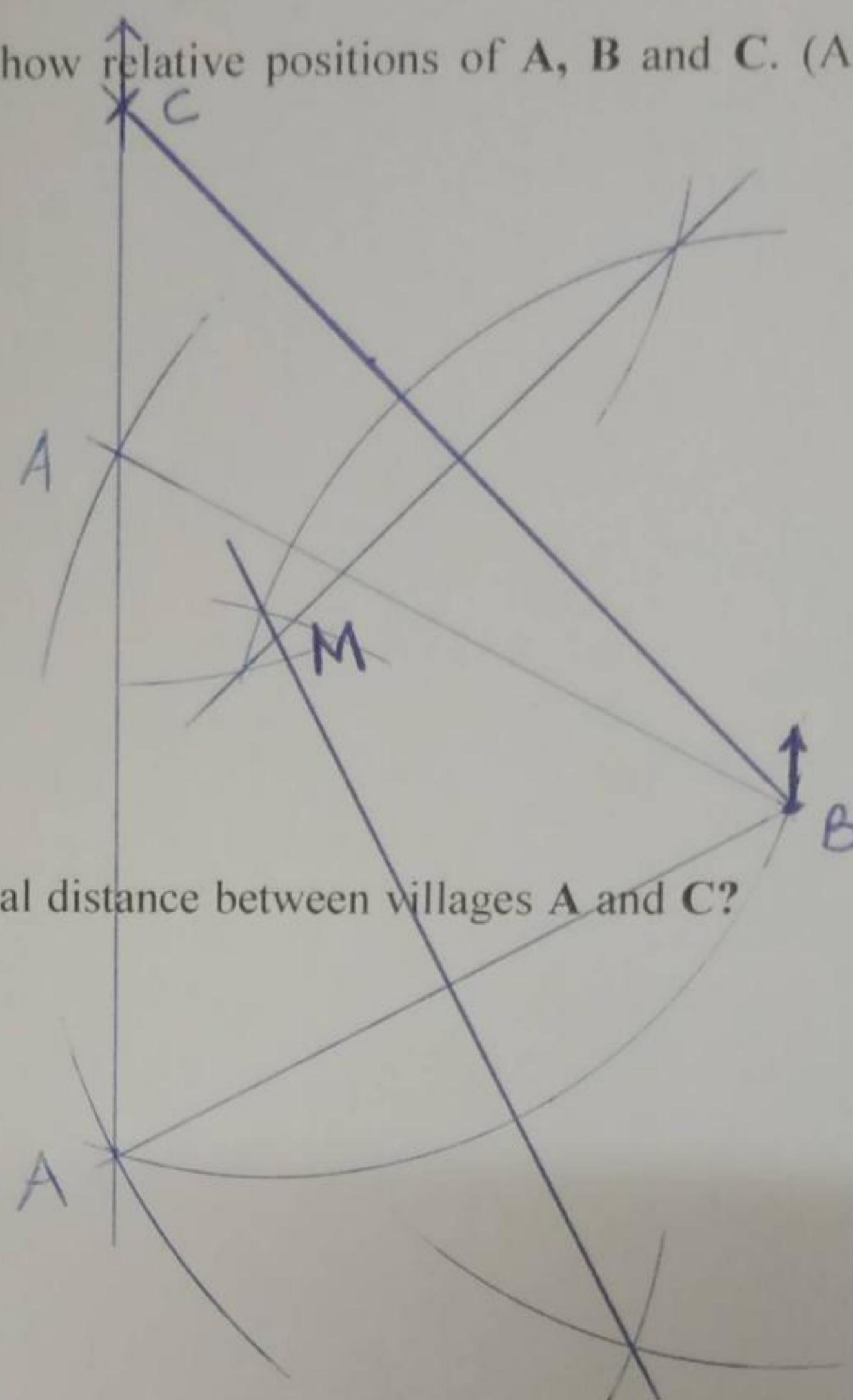
(c) At what time was the population double the figure in 2006?

Population in 1999 = 7200

Double the figure = 7200×2
= 14400

21. Three villages **A**, **B** and **C** drawn on a map of scale 1: 100,000 are such that **B** and **C** are 8km apart while **A** and **B** are 6.3 km apart on the actual ground. **C** is on a bearing of 315^0 from **B** and **A** is due south of **C**,

- (a) Use scale drawing to show relative positions of **A**, **B** and **C**. (Also show two possible positions of **A**).
 (4 marks)



- (b) What is the longest actual distance between villages **A** and **C**? (2 marks)

$$\frac{8.7 \text{ cm} \times 1 \text{ km}}{1 \text{ cm}}$$

$$\underline{\underline{8.7 \text{ km}}}$$

- (c) A market serving the villages is placed in the most central position from each of the three villages. Using the longest position of **A** from **C**, locate the market with centre **M**, hence state the actual distance from **M** to vertex **A**. (4 marks)

$$MA = 4.5 \text{ cm}$$

$$1 \text{ cm rep } 1 \text{ km}$$

$$\therefore \text{Actual distance } MA = \underline{\underline{4.5 \text{ km}}}$$

22. a) Three people Amina, Bundi and Chari formed a business partnership. Amina invested sh.80,000 for 2 years, Bundi sh.50,000 for 3 years and Chari invested his money for 4 years. They agreed that the profits should be shared in proportion to the amount invested and the time for which it was invested. How much did Chari invest if Amina's share of profit of sh.129000 was sh.48000? (5 marks)

Amina	Bundi	Chari	Total
$2 \times 80,000$	$3 \times 50,000$	$4 \times y$	
$160,000$	$150,000$	$4y$	$310,000 + 4y$
$\frac{160,000}{310,000 + 4y} \times 129,000 = 48,000$			
$\frac{160,000}{310,000 + 4y} \times 129,000 = \frac{48,000}{48,000}$			

$10 \times 43,000 = 310,000 + 4y$
 $430,000 - 310,000 = 4y$
 $4y = 120,000$
 $y = \underline{\underline{30,000}}$
 Chari invested sh. $\underline{\underline{30,000}}/$

b) A lady buys a car for sh.40,000⁰⁰⁰, paying sh.16,000⁰⁰⁰, and the remainder in instalments of sh.8000⁰⁰⁰ paid at the end of each of the first three quarters together with a final payment at the end of the fourth quarter to clear the debt. Interest at 3% per quarter, reckoned on the amount owing at the beginning of each quarter is added at the end of each quarter. Calculate the amount of the three quarters and also the final payment to clear the debt. (5 marks)

The initial balance to be paid

$$= \text{sh. } 40,000,000 - \text{sh. } 16,000,000$$

$$= \text{sh. } 24,000,000/$$

The amount of the 3 quarters = sh. $\underline{\underline{24,000,000}}/$

Interest at the beginning of
 the 1st quarter = $\frac{3}{100} \times 24,000,000$
 $= \underline{\underline{720,000}}/$

Interest at the beginning of

$$\begin{aligned} \text{the 2nd quarter} &= \frac{3}{100} \times 16,000,000 \\ &= \underline{\underline{480,000}}/ \end{aligned}$$

Interest at the beginning of
 the 3rd quarter = $\frac{3}{100} \times 8,000,000$
 $= \underline{\underline{240,000}}/$

$$\begin{aligned} \text{The final payment} &= 720,000 + 480,000 + 240,000 \\ &= \text{sh. } \underline{\underline{1,440,000}} \end{aligned}$$

23. A garden measures 10m long and 8m wide. A path of uniform width is made all round the garden. The outer perimeter of the path is 52m.

- a) Find the width and the area of the path.

Let the width of the path be x

$$2(10+2x) + 2(8+2x) = 52$$

$$36 + 8x = 52$$

$$8x = 16$$

$$\underline{x = 2 \text{ m}}$$

The length is $10 + 2(2\text{m}) = 14\text{m}$

The width is $8 + 2(2) = 12\text{m}$

(4 marks)

$$\begin{aligned} \text{Area of the path} &= 14 \times 12 - 10 \times 8 \\ &= 168 - 80 \\ &= \underline{\underline{88 \text{ m}^2}} \end{aligned}$$

- b) The path is to be covered with square concrete slabs. Each corner of the path is covered with a slab whose side is equal to the width of the path. The rest of the path is covered with slabs of side 50cm. The cost of making each corner slab is sh.600 while the cost of making each smaller slab is sh.50.

Calculate :

- i) the number of the smaller slabs used

(3 marks)

$$\text{Area covered by smaller slabs} = 10 \times 2 + 10 \times 2 + 8 \times 2 + 8 \times 2$$

$$= 20 + 20 + 16 + 16$$

$$= \underline{\underline{72 \text{ m}^2}}$$

$$= \underline{\underline{720,000 \text{ cm}^2}}$$

$$\text{Area of 1 smaller slab} = 50\text{cm} \times 50\text{cm} = \underline{\underline{2500 \text{ cm}^2}}$$

$$\text{No. of smaller slabs} = \frac{720,000}{2500} = \underline{\underline{288 \text{ slabs}}}$$

- ii) the total cost of the slabs used to cover the whole path.

(3 marks)

$$\text{Total cost} = \text{sh}(600 \times 4) + \text{sh}(288 \times 50)$$

$$= \text{sh}(2400 + 14,400)$$

$$= \underline{\underline{\text{sh } 16,800}}$$

24. (a) Complete the table for the following equations

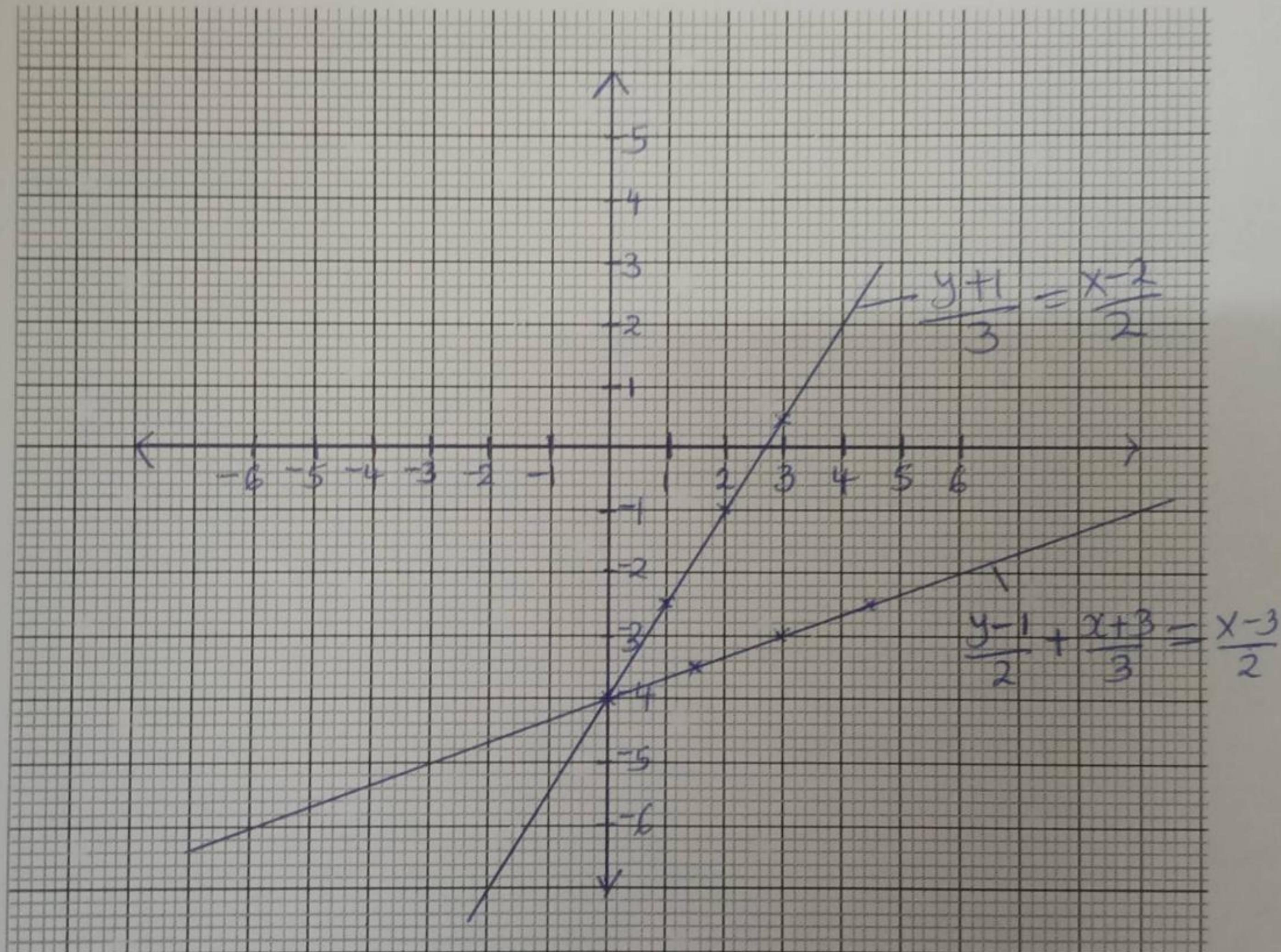
$$(i) \frac{y-1}{2} + \frac{x+3}{3} = \frac{x-3}{2}$$

x	0	1.5	3	4.5
y	-4	-3.5	-3	-2.5

$$(ii) \frac{y+1}{3} = \frac{x-2}{2}$$

x	0	1	2	3
y	-4	-2.5	-1	0.5

(b) On the grid provided draw the graph of the above equations



(c) Use the graphs above solve for the equations (i) and (ii)

$$x = 0$$

$$y = -4$$