

# MT

2018 \_\_\_\_ 1100

Seat No.

--	--	--	--	--	--	--	--

## MT - MATHEMATICS (71) Algebra - SEMI PRELIM - I - PAPER - IV

Time : 2 Hours

(Answer Paper)

Max. Marks : 40

<b>A.1.</b>	<b>(A) Solve the following : (Any 4)</b>																
1.	Let $a = 2$ , $b = 4$ and $c = 8$ $b^2 = 4^2 = 16$ $ac = 2 \times 8 = 16$ $\therefore b^2 = ac$ If $b^2 = ac$ then $a, b, c$ are in continued proportion. $\therefore 2, 4, 8$ are in continued proportion.	1															
2.	Here, maximum frequency is 09 which is for 35 and 37 $\therefore$ mode = 35 marks and 37 marks. $\therefore$ Mode of marks is 35 and 37	1															
3.	<table border="1"><thead><tr><th>Sr. No.</th><th>Individuals</th><th>Age</th><th>Taxable income (₹)</th><th>Will have to pay income tax or not</th></tr></thead><tbody><tr><td>1.</td><td>Miss. Nikita</td><td>27</td><td>₹ 2,34,000</td><td>NO</td></tr><tr><td>2.</td><td>Mr. Desilva</td><td>81</td><td>₹ 4,50,000</td><td>NO</td></tr></tbody></table>	Sr. No.	Individuals	Age	Taxable income (₹)	Will have to pay income tax or not	1.	Miss. Nikita	27	₹ 2,34,000	NO	2.	Mr. Desilva	81	₹ 4,50,000	NO	1
Sr. No.	Individuals	Age	Taxable income (₹)	Will have to pay income tax or not													
1.	Miss. Nikita	27	₹ 2,34,000	NO													
2.	Mr. Desilva	81	₹ 4,50,000	NO													
4.	Annual income of an individual = ₹ 5,50,000 Deduction under section 80C = ₹ 1,80,000. But deduction to be considered under section 80C = ₹ 1,50,000. Taxable Income = ₹ 5,50,000 – ₹ 1,50,000 = ₹ 4,00,000. <b><math>\therefore</math> Amount of taxable income is ₹ 4,00,000</b>	1															
5.	20 is the lower class limit and 25 is the upper class limit.	1															

6.	<p>Amount of income tax = ₹ 4000            Education cess = 2% of Income tax  <math display="block">= \frac{2}{100} \times 4000 = ₹ 80</math>           Secondary and higher education cess = 1% of Income tax  <math display="block">= \frac{1}{100} \times 4000 = ₹ 40</math> <math display="block">\therefore \text{Total tax} = 4000 + 80 + 40</math> <math display="block">= \mathbf{4120}</math></p>	1
<b>A.1.</b>	<b>(B) Solve the following : (Any 2)</b>	
1.	<p><math>\sqrt{7} \times \sqrt{5} = \sqrt{35}</math> and  <math>3 \times 3 = 9 = \sqrt{81}</math>            Now, <math>\sqrt{35} &lt; \sqrt{81}</math>  <math>\therefore \sqrt{7} \times \sqrt{5} &lt; 3 \times 3</math>  <math>\therefore \frac{\sqrt{5}}{3} &lt; \frac{3}{\sqrt{7}}</math></p>	1
2.	<p>Data in ascending order :            59, 68, 70, 74, 75, 75, 80            Here <math>n = 7</math> (odd number)  <math>\therefore \text{Median} = \frac{n+1}{2}</math> th term  <math>= \left(\frac{7+1}{2}\right)</math> term = <math>\left(\frac{8}{2}\right)</math> 4th term = 4th term  <math>\therefore</math> 4th term is 74.  <math>\therefore</math> Median = 74</p>	1
3.	<p>Let the total amount received by Alka each month be ₹ x.            Alka's expenditure = 90% of the total amount  <math>\therefore</math> Alka's saving  <math>= (100 - 90)\%</math>  <math>= 10\%</math> of the total amount            But she saves ₹120 per month ..... [Given]  <math>\therefore 10\%</math> of x = 120</p>	1

	$\therefore \frac{10}{100} \times x = 120$ $\therefore x = \frac{120 \times 100}{10}$ $\therefore x = 1200$ <p><math>\therefore</math> Amount received by Alka each month is ₹1200.</p>	1
<b>A.2. (A) Solve the following :</b>		
1.	(C) 25	1
2.	(B) ₹ 5	1
3.	(A) 114°	1
4.	(B) Median	1
<b>A.2. (B) Solve the following : (Any 2)</b>		
1.	<p>Here <math>t_1 = a = \frac{1}{4}</math>,</p> $t_2 = \frac{3}{4}, \quad t_3 = \frac{5}{4}, \quad t_4 = \frac{7}{4}$ <p>For an A. P. <math>d = t_{n+1} - t_n</math></p> $d = t_2 - t_1 = \frac{3}{4} - \frac{1}{4} = \frac{3-1}{4} = \frac{2}{4} = \frac{1}{2}$ $d = t_3 - t_2 = \frac{5}{4} - \frac{3}{4} = \frac{5-3}{4} = \frac{2}{4} = \frac{1}{2}$	1
	$\therefore \text{First term (a) is } \frac{1}{4} \text{ and Common difference (d) is } \frac{1}{2}.$	1
2.	<p>FV of share = ₹ 5, Premium = ₹ 20</p> $\therefore \text{MV} = \text{FV} + \text{Premium}$ $= 5 + 20 = ₹ 25$ <p>Total investment = ₹ 20,000</p> $\therefore \text{Number of shares} = \frac{\text{Total Investment}}{\text{MV}}$ $= \frac{20000}{25}$ $= 800$	1

∴ Mrs. Deshpande will get 800 shares.

1

3. (i) Total no. of students = 1000  
 Central angle for cricket =  $81^\circ$   
 ∴ No. of students interested in cricket  

$$= \frac{\text{Central angle}}{360} \times \text{Total no. of students}$$

$$= \frac{81}{360} \times 1000 = 225$$

∴ No. of students interested in cricket = 225

1

- (ii) Central angle for Football =  $63^\circ$   
 ∴ No. of students interested in football  

$$= \frac{\text{Central angle}}{360} \times \text{Total no. of students}$$

$$= \frac{63}{360} \times 1000 = 175$$

∴ No. of students interested in football = 175

1

**A.3. (A) Solve the following activity : (Any 2)**

1.

Different Items	% of Expenditure	Measure of Central angle
Food	40	$\frac{40}{100} \times 360 = 144^\circ$
Clothing	20	$\frac{20}{100} \times \frac{360}{360} = 72^\circ$
House rent	15	$\frac{15}{100} \times \quad = 54^\circ$
Education	20	$\frac{20}{100} \times 360 = 72^\circ$
Expenditure	05	$\frac{05}{100} \times 360 = 72^\circ$
<b>Total</b>	<b>100</b>	<b><math>360^\circ</math></b>

2

2.	<table border="1" data-bbox="300 342 930 600"> <thead> <tr> <th>Sr. No.</th> <th>Face Value</th> <th>Share is at</th> <th>Market Value</th> </tr> </thead> <tbody> <tr> <td>(i)</td> <td>₹ 100</td> <td>par</td> <td>₹ 100</td> </tr> <tr> <td>(ii)</td> <td>₹ 75</td> <td>Premium ₹ 500</td> <td>₹ 575</td> </tr> <tr> <td>(iii)</td> <td>₹ 10</td> <td>Discount ₹ 5</td> <td>₹ 5</td> </tr> </tbody> </table>	Sr. No.	Face Value	Share is at	Market Value	(i)	₹ 100	par	₹ 100	(ii)	₹ 75	Premium ₹ 500	₹ 575	(iii)	₹ 10	Discount ₹ 5	₹ 5	2
Sr. No.	Face Value	Share is at	Market Value															
(i)	₹ 100	par	₹ 100															
(ii)	₹ 75	Premium ₹ 500	₹ 575															
(iii)	₹ 10	Discount ₹ 5	₹ 5															
3.	<p>Here, <math>a = 1</math>, <math>t_1 = 1</math>, <math>t_2 = 8</math>, <math>t_3 = 15</math>, ...</p> <p><math>t_2 - t_1 = 8 - 1 = 7</math></p> <p><math>t_3 - t_2 = 15 - 8 = 7</math></p> <p><math>\therefore d = 7</math></p>	1																
3.	<p>Here, <math>a = 1</math>, <math>t_1 = 1</math>, <math>t_2 = 8</math>, <math>t_3 = 15</math>, ...</p> <p><math>t_2 - t_1 = 8 - 1 = 7</math></p> <p><math>t_3 - t_2 = 15 - 8 = 7</math></p> <p><math>\therefore d = 7</math></p>	1																
<b>A.3.</b>	<b>(B) Solve the following activity : (Any 2)</b>																	
1.	<p><b>Method - I</b></p> <p>For the reverse A.P. 49, ..., -5, -8, -11</p> <p><math>a = 49</math>, <math>d = -8 - (-5) = -8 + 5 = -3</math></p> <p><math>\therefore</math> Fourth term from the end of given A.P. is <math>t_4</math> in the reverse A.P.</p> <p>We know,</p> $t_n = a + (n - 1) d$ <p><math>\therefore t_4 = 49 + (4 - 1) (-3)</math></p> <p><math>\therefore t_4 = 49 + 3(-3)</math></p> <p><math>\therefore t_4 = 49 - 9</math></p> <p><math>\therefore t_4 = 40</math></p> <p><math>\therefore</math> <b>Fourth term from the end of given A.P. is 40</b></p> <p><b>Method - II</b></p> <p>For an A.P., First term is <math>a</math> and Common difference is <math>d</math>. Let <math>l</math> be the last term of this A.P. Then <math>n</math>th term from the end = <math>l - (n - 1)d</math></p> <p>The given A.P. is -11, -8, -5, ..... 49.</p> <p>Here <math>a = -11</math>, <math>d = -8 - (-11) = -8 + 11 = 3</math> and last term (<math>l</math>) = 49</p> <p><math>\therefore</math> 4th term from the end</p> $= l - (n - 1)d$ $= 49 - (4 - 1)3$ $= 49 - 3 \times 3$ $= 49 - 9$ $= 40$ <p><math>\therefore</math> <b>Fourth term from the end of given A.P. is 40</b></p>	1																
		1																
		1																

2. FV = ₹ 100 and Premium = ₹ 30

$$\begin{aligned} \therefore MV &= FV + \text{Premium} \\ &= 100 + 30 \\ &= ₹ 130 \end{aligned}$$

Brokerage per share = 0.3% of ₹ 130

$$= \frac{0.3}{100} \times 130$$

$$= ₹ 0.39$$

$$\begin{aligned} \therefore \text{Purchase price per share} &= 130 + 0.39 \\ &= ₹ 130.39 \end{aligned}$$

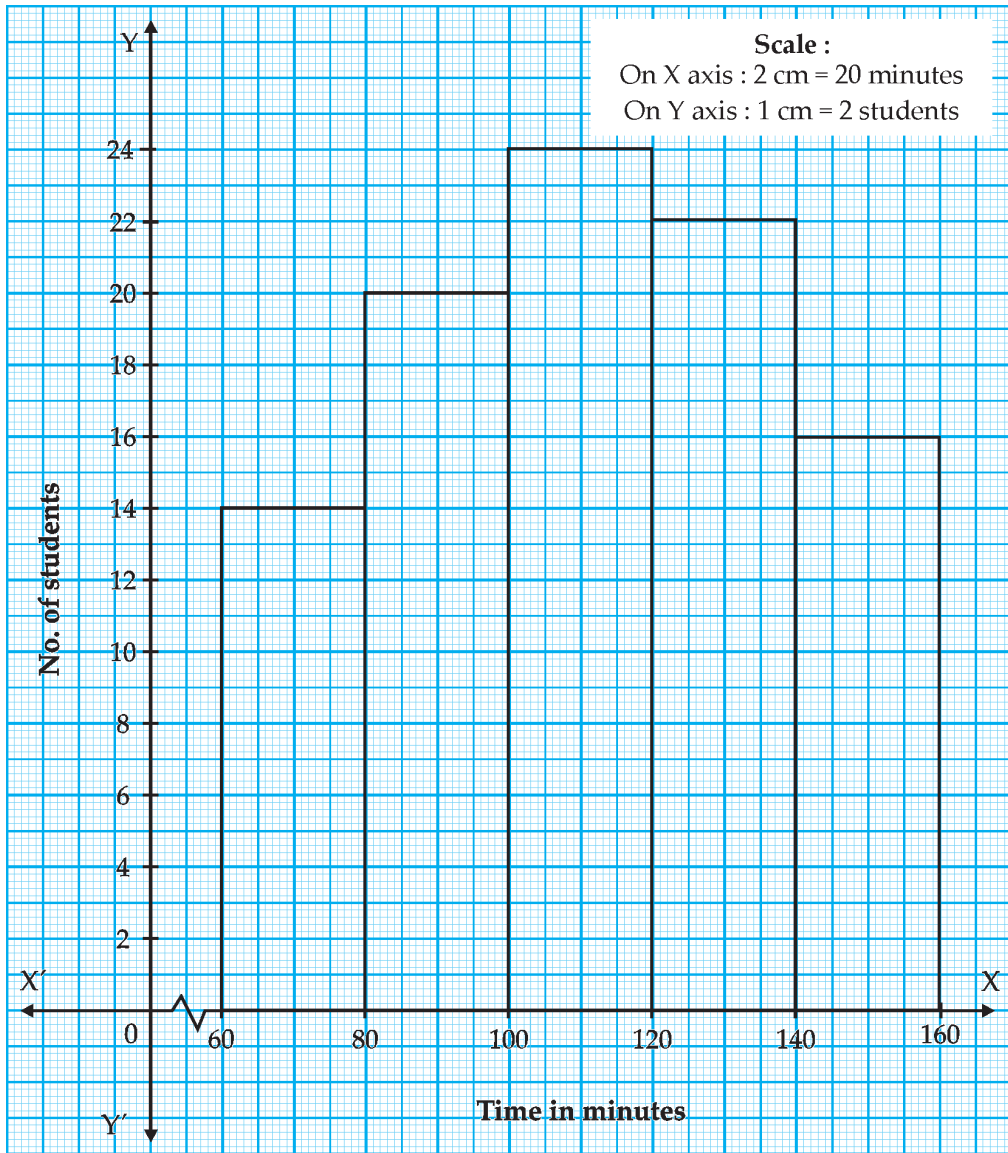
$\therefore$  The purchase price of one share is ₹ 130.39

1

1

3.

Time (in minutes)	No. of students
60 - 80	14
80 - 100	20
100 - 120	24
120 - 140	22
140 - 160	16



**A.4. Solve the following : (Any 3)**

1.

Production (in thousand rupees)	Class Mark ( $x_i$ )	No. of families ( $f_i$ )	$f_i x_i$
20 - 30	25	10	250
30 - 40	35	11	385
40 - 50	45	15	675
50 - 60	55	16	880
60 - 70	65	18	1170
70 - 80	75	14	1050
<b>Total</b>		$N = \sum f_i =$ 84	$\sum f_i x_i =$ 4410

$$\begin{aligned} \text{Mean } (\bar{x}) &= \frac{\sum f_i x_i}{\sum f_i} \\ &= \frac{4410}{84} \\ &= 52.5 \end{aligned}$$

$$\begin{aligned} \text{Mean of production} &= 52.5 \times 1000 \\ &= 52,500 \end{aligned}$$

∴ **Mean of production in rupees is ₹ 52,500.**

2. Here,  $t_1 = a = -5$ ,  $t_n = 45$ ,  $S_n = 120$ ,  $n = ?$ ,  $d = ?$

$$\therefore \text{ Now } S_n = \frac{n}{2} [t_1 + t_n]$$

$$\therefore 120 = \frac{n}{2} [-5 + 45]$$

$$\therefore 240 = n [40]$$

$$\therefore n = \frac{240}{40}$$

$$\therefore n = 6$$

$$t_n = a + (n-1)d$$

$$\therefore 45 = -5 + (6-1)d$$

$$\therefore 45 = -5 + 5d$$

$$\therefore 45 + 5 = 5d$$

$$\therefore 5d = 50$$

$$\therefore d = \frac{50}{5}$$

1

1

1

1

1



	<p><math>\therefore d = 10</math></p> <p><math>\therefore</math> <b>Thus, there are 6 terms in the A.P and the common difference is 10.</b></p>	<b>1</b>
3.	<p>FV of share = ₹ 100</p> <p>Dividend on one share = 7% of ₹ 100</p> $= \frac{7}{100} \times 100$ $= ₹ 7$ <p><math>\therefore</math> Dividend on 150 shares = <math>150 \times 7</math></p> $= ₹ 1050$ <p>MV of share = ₹ 120</p> <p><math>\therefore</math> Total investment = <math>150 \times 120</math></p> $= ₹ 18,000$ <p><math>\therefore</math> Rate of return = <math>\frac{\text{Total dividend received}}{\text{Total investment}} \times 100</math></p> $= \frac{1050}{18000} \times 100$ <p><math>\therefore</math> <b>Rate of return = 5.83%</b></p>	<p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p> <p><b>1</b></p>
4.	<p><math>t_n = a + (n-1)d</math></p> <p><math>\therefore t_{19} = a + (19-1)d</math></p> <p><math>\therefore 52 = a + 18d</math></p> <p><math>\therefore a + 18d = 52</math> ... (i)</p> <p>Also, <math>t_{38} = a + (38-1)d</math></p> <p><math>\therefore 128 = a + 37d</math></p> <p><math>a + 37d = 128</math> ... (ii)</p> <p>Adding equations (i) and (ii) we get,</p> $a + 18d = 52$ $\underline{a + 37d = 128}$ $2a + 55d = 180$ ... (iii) $S_n = \frac{n}{2} [2a + (n-1)d]$ <p><math>\therefore S_{56} = \frac{56}{2} [2a + (56-1)d]</math></p> $= 28 [2a + 55d]$	<b>1</b>
		<b>1</b>

	$= 28 \times 180 \quad \dots[\text{From (iii)}]$ $\therefore S_{56} = 5040$	
	$\therefore \text{Hence, the required sum is 5040.}$	<b>1</b>
<b>A.5</b>	<b>Solve the following : (Any 1)</b>	
1.	<p>Share at premium = ₹ 100,            FV = ₹ 50 and dividend = 50%            Dividend per share = 50% of ₹ 50</p> $= \frac{50}{100} \times 50$ $= ₹ 25$ <p>Dividend on 200 share = <math>200 \times 25</math>  <math>= ₹ 5000</math></p> <p>Purchase price per share = FV + Premium  <math>= 50 + 100</math>  <math>= ₹ 150</math></p> <p><math>\therefore</math> Purchase price of 200 shares  <math>= 200 \times 150 + \text{Brokerage}</math>  <math>= 30,000 + 20</math>  <math>= ₹ 30,020</math></p> <p>Now, 100 shares were sold at ₹ 10 discount</p> <p><math>\therefore</math> Selling price per share = FV – discount  <math>= 50 - 10</math>  <math>= ₹ 40</math></p> <p><math>\therefore</math> Selling price of first 100 shares  <math>= 100 \times 40 - \text{Brokerage}</math>  <math>= 4000 - 20 = ₹ 3980</math></p> <p>Now, remaining 100 shares were sold at ₹ 75 premium.</p> <p><math>\therefore</math> Selling price per share = FV + Premium  <math>= 50 + 75</math>  <math>= ₹ 125</math></p> <p><math>\therefore</math> Selling price of 100 shares  <math>= 100 \times ₹ 125 - \text{Brokerage}</math>  <math>= 12,500 - 20 = ₹ 12,480</math></p> <p><math>\therefore</math> Amount received on selling 200 shares  <math>= \text{Dividend} + \text{Selling Price}</math>  <math>= 3,980 + 12,480</math>  <math>= ₹ 16,460</math></p> <p>Net amount received = <math>5000 + 16,460</math></p>	<b>1</b>
		<b>1</b>
		<b>1</b>

$$= ₹ 21,460$$

Here, net amount invested = ₹ 30,020 and net amount received

$$= ₹ 21,460$$

∴ Net amount received < Net amount invested

There is a loss in the transaction

Loss incurred = Net amount invested – Net amount received

$$= 30,020 - 21,460$$

$$= ₹ 8560$$

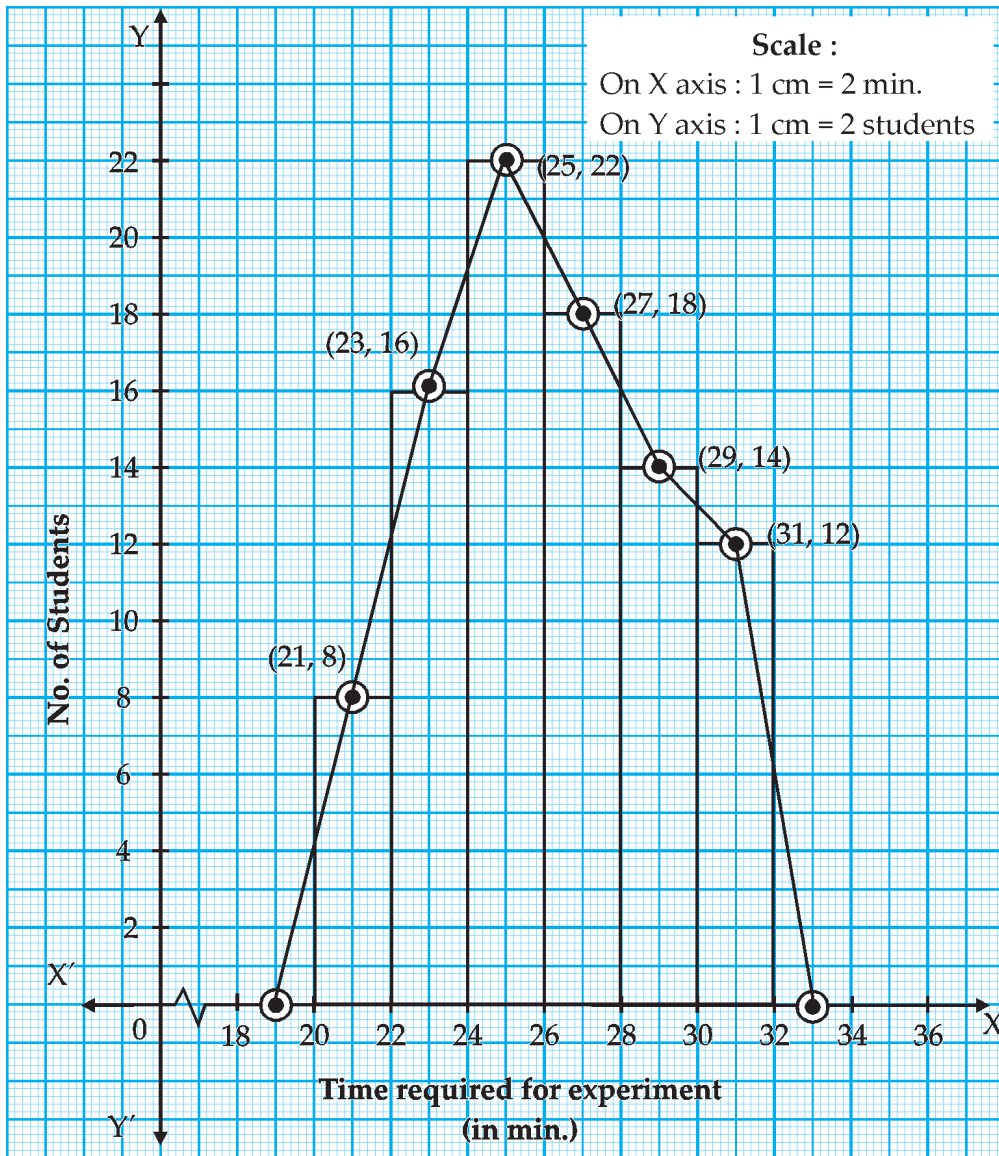
∴ **Mrs. D'Souza made a loss of ₹ 8560 in the whole transaction.**

1

2.

Class	Class mark	Frequency	Coordinate of points
18 - 20	19	0	(19, 0)
20 - 22	21	8	(21, 8)
22 - 24	23	16	(23, 16)
24 - 26	25	22	(25, 22)
26 - 28	27	18	(27, 18)
28 - 30	29	14	(29, 14)
30 - 32	31	12	(31, 12)
32 - 34	33	0	(33, 0)

1



**A.6 Solve the following : (Any 1)**

1.

<b>Class</b> (Distance km)	<b>Frequency</b> (No. of buses)	<b>Cumulative frequency</b> (less than type)
200 - 210	40	40
210 - 220	60	40 + 60 = 100 → c.f.
<b>220 - 230</b>	80 ← <i>f</i>	100 + 80 = 180
230 - 240	50	180 + 50 = 230
240 - 250	20	230 + 20 = 250
<b>Total</b>	<b>250 ← N</b>	

Here, total frequency =  $\sum f_i = N = 250$  and  $h = 10$

$$\therefore \frac{N}{2} = \frac{250}{2} = 125$$

Cumulative frequency (less than type) which is just greater than 125 is 180.

∴ Corresponding class 220 - 230 is the median class.

$$\therefore f = 80, c.f. = 100, L = 220$$

$$\begin{aligned} \text{Median} &= L + \left[ \frac{\frac{N}{2} - c.f.}{f} \right] \times h \\ &= 220 + \left( \frac{125 - 100}{80} \right) \times 10 \\ &= 220 + \left( \frac{25}{80} \right) \times 10 \\ &= 220 + 3.125 \\ &= 223.13 \end{aligned}$$

∴ **Median distance covered is 223.13 km.**

1

1

1

