Answers

Exercise 1.1

1. (1) Fixed base index numbers : 100, 103.27, 105.09, 106.55, 108, 113.82, 119.27, 125.45

(2) Chain base index numbers : 100, 103.27, 101.76, 101.38, 101.37, 105.39, 104.79, 105.18

(3) Index numbers using average wage : 91.36, 94.35, 96.01, 97.34, 98.67, 103.99, 108.97, 114.62

2. (1) Fixed base index numbers : 100, 101.79, 105.36, 107.14, 110.71, 114.29,121.43, 128.57

(2) Chain base index numbers : 100, 101.79, 103.51, 101.69, 103.33, 103.23, 106.25, 105.88

(3) Index numbers using average price : 96.55, 98.28, 101.72, 103.45, 106.90, 110.34, 117.24, 124.14

3. (1) Fixed base index numbers : 100, 108.70, 112.78, 115.19, 119.44

(2) Chain base general price index numbers : 100, 108.70, 103.65,102.26, 103.71

4. General index number of n items : 126.45; Overall increase in the price of fuel items is 26.45 %

Exercise 1.2

1. Fixed base index numbers : 100, 110, 104.5, 112.86, 135.43, 143.56, 157.92

2. Chain base index numbers : 117.4, 100.51, 102.80, 103.13, 102.64, 102.49, 102.28

3. Chain base index numbers : 100, 99.63, 99.26, 100, 103.73, 101.80, 100, 103.53, 100, 102.05

4. Fixed base index numbers : 110, 123.2, 134.29, 145.03, 152.28, 169.03

Exercise 1.3

1. $I = 307$, prices have increased by 207 %.

2. $I = 123.80$, prices have increased by 23.80 %.

3. $I_L = 126.72$, $I_P = 126.85$, $I_F = 126.78$

4. $I_L = 141.13$, $I_P = 140.15$, $I_F = 140.64$ **5.** $I_F = 142.57$ **6.** $I_P = 115.2$, $I_F = 115.14$

Exercise 1.4

1. Index number by family budget method = 135.64 and total expenditure has increased by 35.64 %. Average monthly disposable income = ₹ 20,346.

2. Index number $I = 128.53$ and rise in total expenditure is 28.53 %.

3. Index number $I = 132.51$ and rise in total expenditure is 32.51 %.

4. Index number $I = 213.20$ and rise in total expenditure is 113.20 %.

5. Index number by family budget method = 129.64 and by total expenditure method $I = 129.64$ Thus, both index numbers are same.

Exercise 1

Section A

1. (c) **2.** (a) **3.** (d) **4.** (c) **5.** (d)

6. (d) **7.** (c) **8.** (c) **9.** (c) **10.** (c)

11. (a) **12.** (c)

Section B

12. The statement is false. Price index number of oil is 500.

Section C

7. Real wage ₹ 16,392.85 and loss to worker ₹ 1642.85 (Decrease in purchasing power)

8. Real wages ₹ 29166.67, 26666.67, 32307.69, 31250

9. Rate of inflation for year 2015 : 2.03 %

10. 449.55

11. Average monthly disposable income = ₹ 30,000

12. Index number of income = 125 **13.** Index number of production = 280 **14.** $I_p = 222.5$

Section D

7. 161.87

8. Fixed base index numbers = 100, 111.11, 133.33, 144.44, 166.67, 222.22, 263.89

9. Chain base index numbers = 100, 104, 100.96, 102.86, 100.93, 116.51

10. Fixed base index numbers = 120, 108, 151.20, 189

11. Chain base index numbers = 100, 112.5, 106.67, 114.58, 109.09, 116.67

12. Index number = 226.6 **13.** $I_L = 166.67$, $I_p = 150$, $I_F = 158.12$ **14.** $I_p = 167.71$

Section E

1. General index number = 122.32 **2.** Index number by total expenditure method = 149.41

3. Index number by total expenditure method = 115.69

4. Fixed base index numbers = 100, 118.75, 125, 131.25, 140.63, 187.5, 203.13;

Index numbers using average price = 91.43, 108.57, 114.29, 120, 128.57, 171.43, 185.71

5. Index number of industrial production I = 379.19

6. Index number I = 126.79 and rise in price is 26.79 %.

7. Real wages = 12,500, 10,000, 9268.29, 9090.91, 9361.7, 9615.38 Purchasing power of money = ₹ 0.38

Section F

1. $I_L = 113.65$, $I_P = 113.94$, $I_F = 113.79$ and rise in price is 13.79 %.

2. $I_P = 191.53$, $I_F = 211.52$

3. $I_F = 84.84$

4. $I_L = 109.52$, $I_P = 110.29$, $I_F = 109.90$

5. Index number by family budget method = 118.58 and index number by total expenditure method = 118.58. Thus, both index numbers are same.

6. Index number for year 2014 $I_1 = 239.41$ and index number for year 2015 $I_2 = 253.44$. The rise in cost of living in the current year is 14.03 %. The percentage rise in the price index number is 5.86 % and rise in wage is 5 %. Hence, wage rise is 0.86 % less.

7. Index number $I = 231.44$ Income should be ₹ 13,886.40 to maintain earlier standard of living.

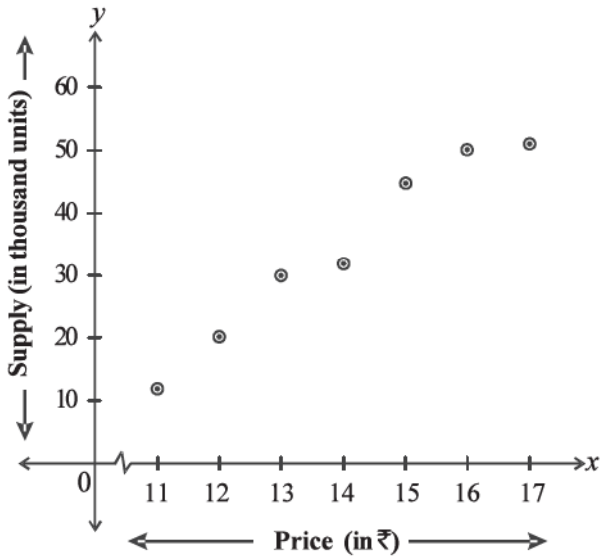
8. Index number of industrial production $= 100.10$, which indicates a rise of 0.10 % with respect to the base year.

9. Index number $I = 128.75$.

10. Cost of living index number $= 196.35$ and the rise is $(196.35 - 100) = 96.35$ % as compared to the base year.

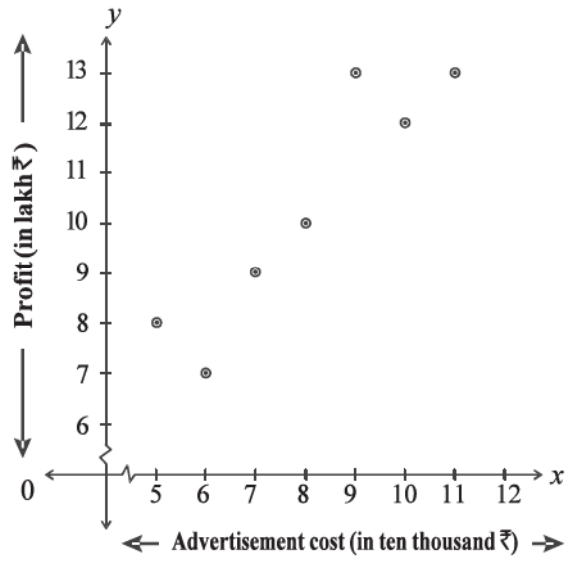
Exercise 2.1

1.



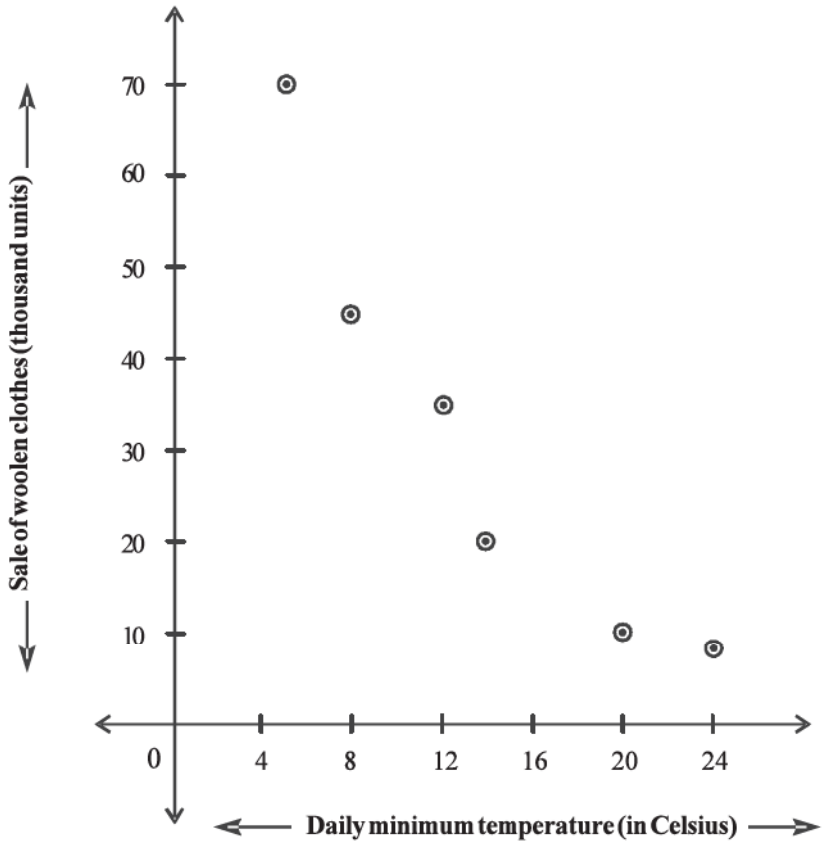
There is partial positive corelation between price and supply

2.



There is partial positive correlation between advertisement cost and profit

3.



There is partial negative correlation between daily minimum temperature and sale of woolen clothes

Exercise 2.2

1. $r = 0.81$ **2.** $r = -0.90$ **3.** $r = 0.90$ **4.** $r = 0.24$ **5.** $r = 0.82$

6. $r = -0.96$ **7.** $r = 0.67$ **8.** $r = -0.92$ **9.** $r = 0.99$ **10.** $r = 0.80$

11. $r = 0.84$ **12.** $r = 0.5$ **13.** $r = 0.8$ **14.** (1) $r = 0.94$ (2) $r = 0.96$

15. $r = -0.55$

Exercise 2.3

1. $r = 0.49$ **2.** $r = 0.78$ **3.** $r = 0.7$ **4.** $r = 0.82$ **5.** $r = 0.91$

6. $r = 0.90$ **7.** $r = -0.30$ **8.** Corrected $\Sigma d^2 = 122.5, r = 0.26$

Exercise 2

Section A

1. (c) **2.** (a) **3.** (d) **4.** (b) **5.** (c)

6. (d) **7.** (b) **8.** (b) **9.** (b) **10.** (c)

11. (a) **12.** (b) **13.** (c) **14.** (c) **15.** (a)

16. (b) **17.** (b) **18.** (a)

Section B

3. Positive **4.** Positive **5.** Negative **6.** Negative **7.** Nonsense correlation

8. r remain unchanged due to change of origion, so $r = 0.4$ **10.** $r = 0$ **11.** Negative

Section C

11. $r = 0.67$ **12.** $r = -0.54$ **13.** $r = 0.27$

Section D

10. $r = 0.75$ **11.** $r = 0$ **12.** $r = -0.5$ **13.** $r = 0.2$

Section E

1. $r = -0.81$ **2.** $r = 0.43$ **3.** $r = 0.79$ **4.** $r = 0.77$ **5.** $r = 0.54$

6. $r = 0.13$

Section F

1. $r = 0.99$ **2.** $r = -0.96$ **3.** $r = 0.88$ **4.** $r = 0.81$ **5.** $r = 0.38$

6. $r = 0.79$ **7.** $r = 0$ **8.** $r = 0.6$ **9.** $r = 0.3$ **10.** $r = 0.79$

11. Corrected $\Sigma d^2 = 78$; $r = 0.53$ **12.** $r = 0.73$

●

Exercise 3.1

1. $\hat{y} = 31.44 - 1.34\,x$ and for price x = 20 ₹, estimate of demand $\hat{y} = 4.64$ (hundred units)

2. $\hat{y} = 3.35 + 1.93\,x$ and for usage time of car x = 5 year, Estimate of annual maintenance cost $\hat{y} = 13$ (thousand ₹)

$\therefore$ Error $e = y - \hat{y} = 13 - 13 = 0$ (Here for x = 5, the observed value of y given in the table is 13)

3. $\hat{y} = 64.27 + 0.83\,x$ and for average rain x = 35 cm, estimate of yield of crop $\hat{y} = 93.32$ (ton)

4. $\hat{y} = 69.7 + 1.13\,x$ and for experience of worker, x = 7 year, estimate of performance index $\hat{y} = 77.61$

Exercise 3.2

1. $\hat{y} = 54.84 + 2.52\,x$ and for 300 kg usage of fertilizer [$\therefore$ x = 30 (ten kg.)], estimate of crop of cotton $\hat{y} = 130.44$ (Quintal per Hectare)

2. $\hat{y} = 52.84 + 0.68\,x$ and for a father's height x = 170 cm, estimate of height of the son $\hat{y} = 168.44$ cm

3. $\hat{y} = 20.72 - 0.71\,x$ and for altitude x = 7 thousand feat, estimate of effective Oxygen $\hat{y} = 15.75$ %

4. $\hat{y} = -3495.7 + 327.73\,x$ and for carpet area x = 110 sq. meter estimated monthly rent $\hat{y} = 32554.6$ ₹

5. $\hat{y} = 0.53 + 0.02\,x$ and for x = 80 customers, estimated sales $\hat{y} = 2.13$ (thousand ₹)

6. $\hat{y} = 7.6 + 0.29\,x$; x = Profit (lakh ₹) and y = Administrative cost (lakh ₹)

7. $\hat{y} = 53.72 + 1.54\,x$ and for rainfall x = 60 cm, estimate of yield of corn $\hat{y} = 146.12$ Quintal

8. $\hat{y} = 8.74 + 1.02\,x$ and for price x = 16 ₹, estimated supply $\hat{y} = 25.06$ (hundred units)

9. $\hat{y} = -4.8 + 0.15\,x$ and for maximum daily temperature x = 42 celcius, estimate of sale of icecream $\hat{y} = 1.5$ (lakh ₹)

Exercise 3

Section A

1. (b) **2.** (a) **3.** (c) **4.** (d) **5.** (a)

6. (a) **7.** (c) **8.** (c) **9.** (d) **10.** (b)

11. (c) **12.** (c) **13.** (c) **14.** (c) **15.** (b)

Section B

8. Error = 0

9. Both variables are multiplied by 2 there fore $c_x = \frac{1}{2}$ and $c_y = \frac{1}{2}$. $\therefore$ Regression coefficient will not change

10. $b_{yx} = 0.5 \times \frac{4}{2} = 1$ **11.** $\hat{y} = 50$ **12.** $r = 1$ **13.** $r = -1$

Section C

2. Error $e = 1$ **3.** $a = 2$ and $\hat{y} = 2 + 0.6\,x$

4. $b_{yx} = 5$ So, it can be said that because of increase of 1 unit in x, there is appropriate 5 units of increase in y.

5. $s_y = 3$ **6.** $R^2 = 1$ **7.** $s_x = 5$ **8.** 5 Units

9. $b_{yx} = 1.2$ and $a = 13$ **10.** $b_{vu} = b_{yx} \times \frac{c_x}{c_y} = 0.75 \times \frac{\frac{1}{6}}{\frac{1}{2}} = 0.25$

Section D

8. $\hat{y} = 4 + 0.75\,x$ **9.** $\hat{y} = -10 + 2\,x$

10. $R^2 = 0.81$; 81 % variation of the total variation in y, can be explained by the regression model.

11. $b_{yx} = 2.52$ so it can be said that because of increase of 1 unit in x, there is approximate 2.52 units of increase in y.

12. (i) $b_{vu} = 0.8$ (ii) $b_{vu} = 1.6$ (iii) $b_{vu} = 0.08$ **13.** $\hat{y} = 12 + 0.88\,x$

Section E

1. $\hat{y} = 2 + 0.75\,x$ **2.** $\hat{y} = 38.8 + 0.67\,x$ **3.** $\hat{y} = 58 + 3.2\,x$

4. $\hat{y} = 764.8 + 11.4\,x$ and for $x = 20$ cm, estimate of yield of crop is $\hat{y} = 992.8$ kg.

5. $\hat{y} = 18 + 0.8\,x$ and for $x =$ ₹ 45 lakh, estimate of market price is $\hat{y} = 54$ (lakh ₹)

Section F

1. $\hat{y} = 73.29 - 1.59\,x$ and for price x = 40 ₹, estimate of demand $\hat{y} = 9.69$ (hundred units)

2. $\hat{y} = 73.43 + 0.9\,x$ and for Experience x = 17 years, the estimate of performance rating $\hat{y} = 88.73$

3. $\hat{y} = 34.8 + 0.74\,x$ and for daily income x = 500 ₹, estimate of expenditure $\hat{y} = 404.8$ ₹

4. $\hat{y} = 3.73 + 0.13\,x$ and for advertisement cost $x = 50$ (ten thousand ₹), estimate of sales $\hat{y} = 10.23$ crore ₹

5. $\hat{y} = -122.94 + 91.67\,x$ and $R^2 = 0.97$ $\therefore$ Regression model is reliable.

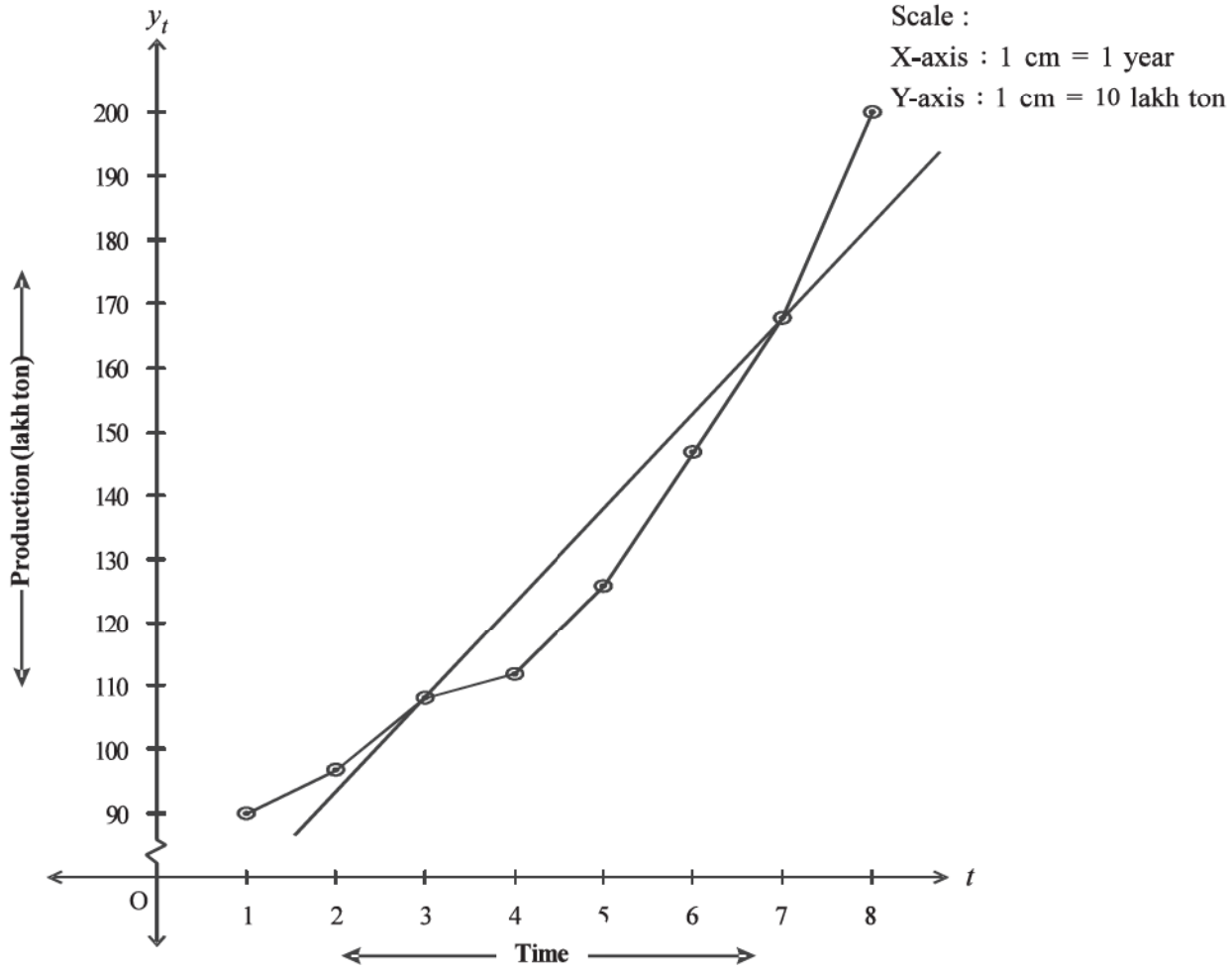
6. $\hat{y} = -10 + 1.6\,x$ and for x = 30 $\hat{y} = 38$

7. $\hat{y} = -0.44 + 0.7\,x$ and for x = 5, $\hat{y} = 3.06$

●

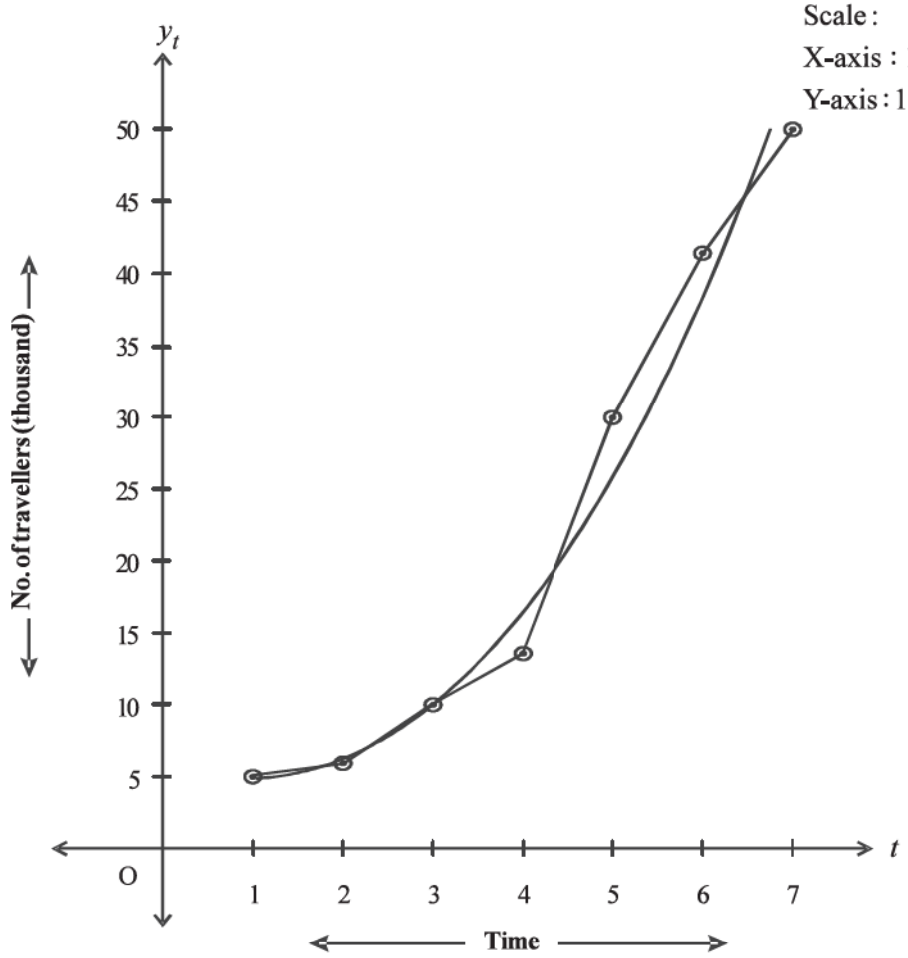
Exercise 4.1

1.



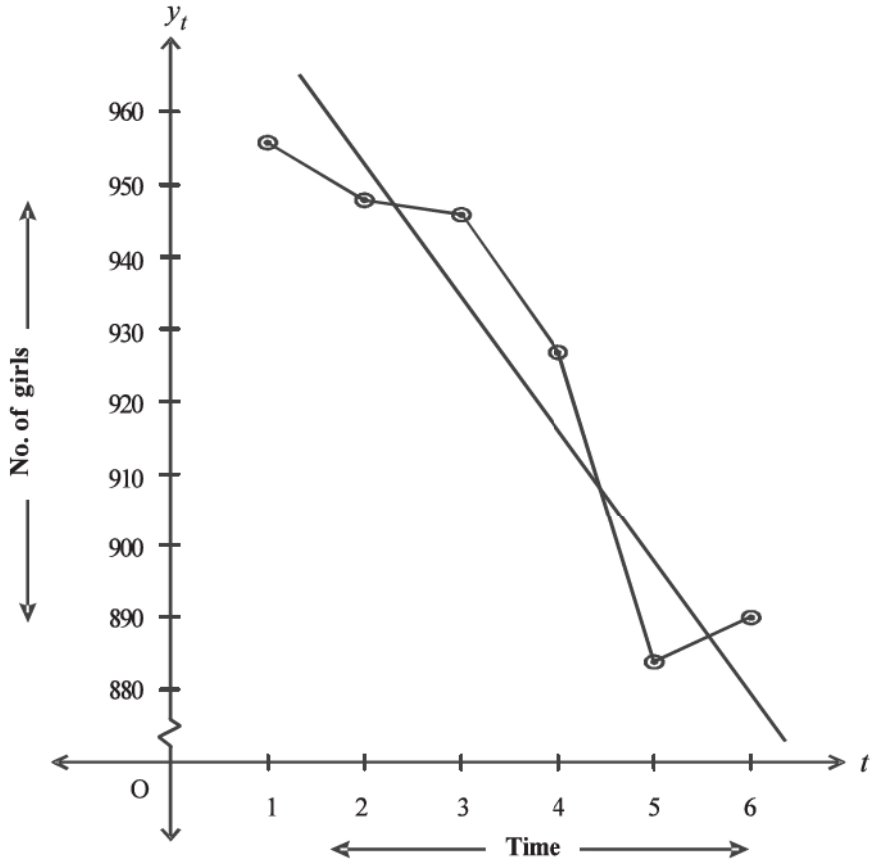
2.

Scale :
X-axis : 1 cm = 1 year
Y-axis : 1 cm = 5 thousand travellers

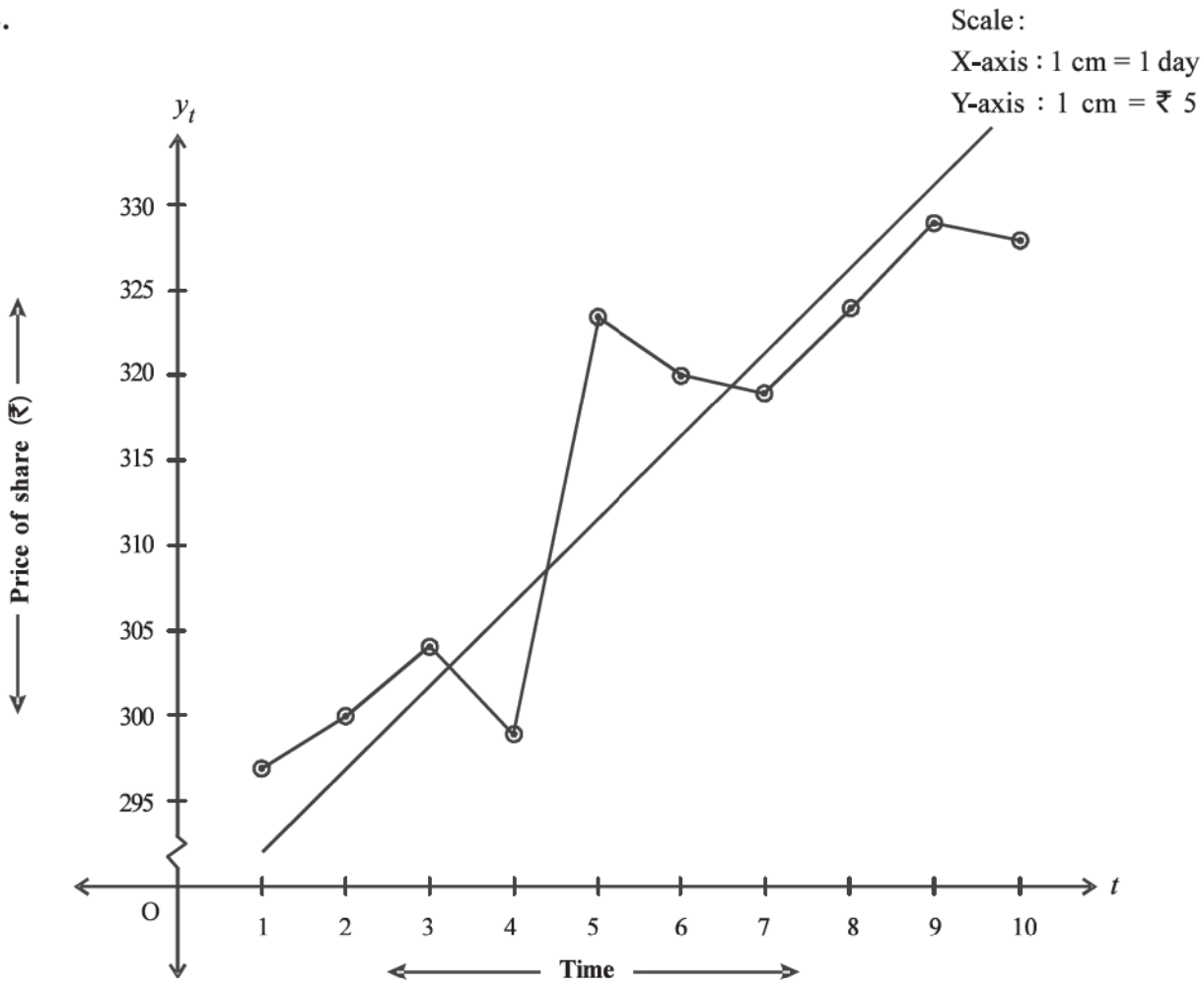


3.

Scale :
X-axis : 1 cm = 10 year
Y-axis : 1 cm = 10 girls



4.



Exercise 4.2

1. $\hat{y} = 7.41 - 0.07\,t$, for year 2017 $\hat{y} = 6.78$

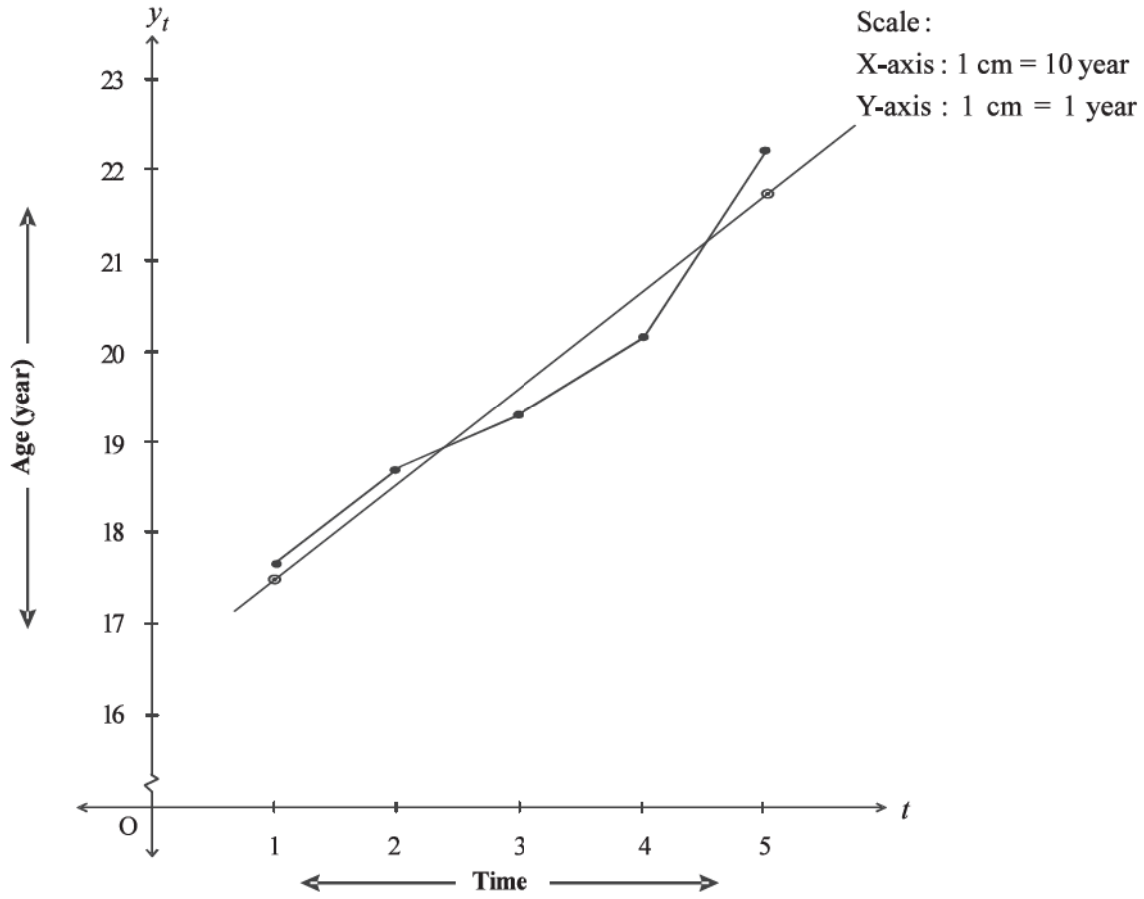
2. $\hat{y} = 447.2 + 69.4\,t$, for year 2015-16 $\hat{y} = 1071.8$

3. $\hat{y} = 57.12 + 9.06\,t$, $\hat{y} = 120.54$ thousand for year 2016

$\hat{y} = 129.6$ thousand for year 2017

Year	2010	2011	2012	2013	2014	2015
Estimated values of trend (thousand vehicles)	66.18	75.24	84.3	93.36	102.42	111.48

4. $\hat{y} = 16.47 + 1.05\,t$, $\hat{y} = 22.77$ years for year 2021



Exercise 4.3

1.

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Three yearly moving average	–	5	6	7	8	9	10	11	12	–

2.

Month	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Four yearly moving average	–	–	274.88	280.38	273.88	263	265.38	269.25	272.63	275.88	–	–

3.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Four yearly moving average	–	–	16.8	18.6	21.2	22.6	23.2	–	–

4.

Year	2013				2014				2015			
Quarter	Q_1	Q_2	Q_3	Q_4	Q_1	Q_2	Q_3	Q_4	Q_1	Q_2	Q_3	Q_4
Four Quarterly moving average	–	–	124.38	134	143	150.88	153.25	148	141.63	136.88	–	–

Exercise 4

Section A

1. (c) **2.** (a) **3.** (b) **4.** (b) **5.** (c)

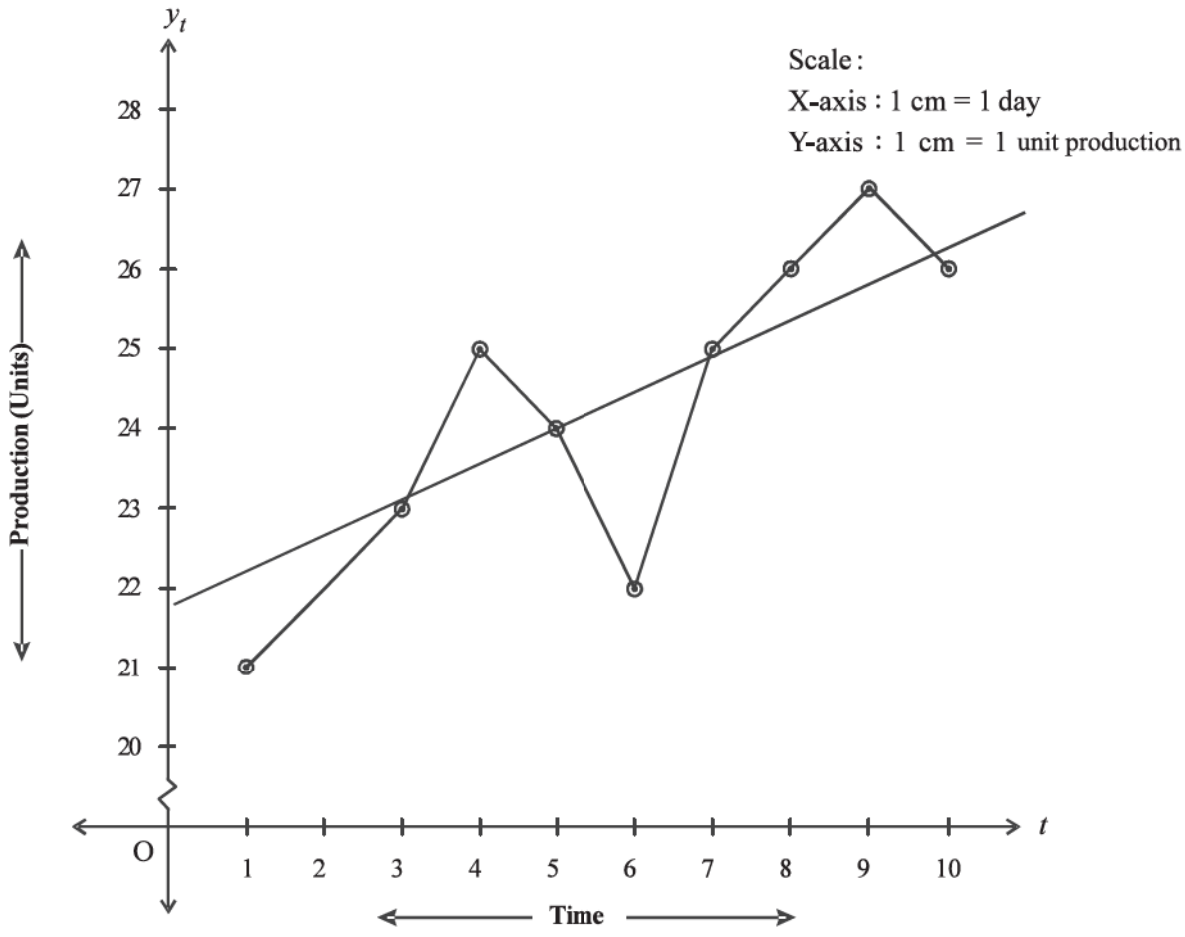
6. (a) **7.** (b) **8.** (c) **9.** (c) **10.** (d)

Section B

10. $\hat{y} = 14.7$ for eighth week

Section D

9.



10. $\hat{y} = 38 + 11.8\,t$

11.

Month	January	February	March	April	May	June	July
Three monthly moving average	–	16.33	17.33	19.67	21.33	22	–

Section E

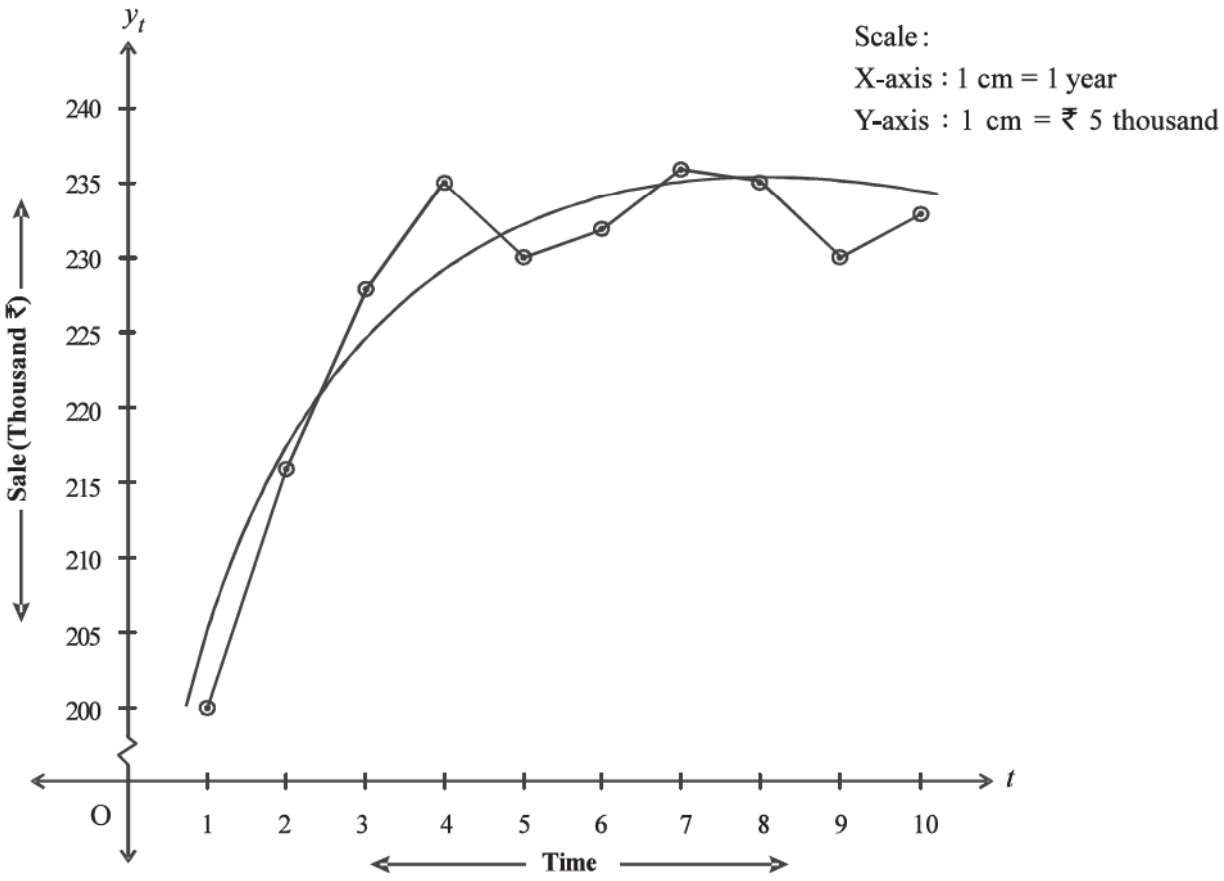
1. $\hat{y} = 23.19 + 0.09\,t$, $\hat{y} =$ 23.91 crore for year 2017

2. $\hat{y} = 49.1 - 2.1\,t$, $\hat{y} =$ 36.5 thousand for year 2016

3.

Month	April 2015	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan. 2016
Three monthly moving average	–	71.33	68.67	66.67	65	63.33	63.33	65	66	–

4.



5.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Five yearly moving average	–	–	118.4	119.2	119	118.8	118	119.4	120.6	–	–

Section F

1. $\hat{y} = 30.26 + 1.19\,t$, $\hat{y} =$ 39.78 crore tons for year 2016-17

$\hat{y} =$ 40.97 crore tons for year 2017-18

2.

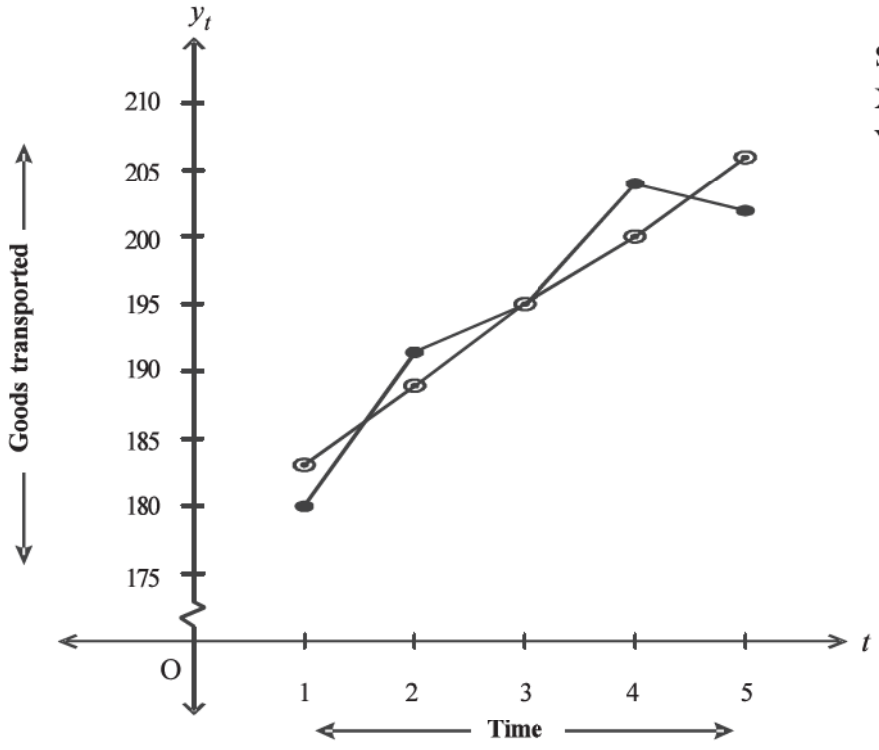
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Four yearly moving average	–	–	358.25	378	395.63	406.63	411.38	415.88	–	–

3. $\hat{y} = 22.55 - 0.39\,t$, $\hat{y} =$ 19.43 for year 2016 $\hat{y} =$ 19.04 for year 2017

4. $\hat{y} = 177.8 + 5.6\,t$, $\hat{y} =$ 211.4 ton for year 2016

Year	2011	2012	2013	2014	2015
Estimated value of trend (tons)	183.4	189	194.6	200.2	205.8

5.



Scale :
X-axis : 1 cm = 1 year
Y-axis : 1 cm = 5 ton

Month	March				April				May			
Week	1	2	3	4	1	2	3	4	1	2	3	4
Four weekly moving average	–	–	38.44	38.7	38.97	39.62	41.29	43.05	44.4	45.72	–	–

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