Section D $= \left[\frac{(27+13)}{(27+13+15+76)} \times 100\right]\% = \left(\frac{40}{131} \times 100\right)\% = 30.53\%$

Clearly, the failure rate is minimum for Section D.

14. Total number of students passed in annual exams in a section

= [(Number of students failed in half-yearly but passed in annual exams) + (Number of students passed in both exams)] in that section

∴ Success rate in annual examination in **Section A**

$$= \left[\frac{\text{Number of students of Section A passed in annual exams}}{\text{Total number of students in Section A}} \times 100\right]\%$$

$$= \left[\frac{(14+64)}{(28+14+6+64)} \times 100\right]\% = \left(\frac{78}{112} \times 100\right)\% = 69.64\%$$

Similarly, success rate in annual examinations in :

Section B $= \left[\frac{(12+55)}{(23+12+17+55)} \times 100\right]\% = \left(\frac{67}{107} \times 100\right)\% = 62.62\%$

Section C $= \left[\frac{(8+46)}{(17+8+9+46)} \times 100\right]\% = \left(\frac{54}{80} \times 100\right)\% = 67.5\%$

Section D $= \left[\frac{(13+76)}{(27+13+15+76)} \times 100\right]\% = \left(\frac{89}{131} \times 100\right)\% = 67.94\%$

Clearly, the success rate in annual examination is maximum for Section A.

15. Pass percentages in at least one of the two examinations for different sections are :

For **Section A** $= \left[\frac{(14+6+64)}{(28+14+6+64)} \times 100\right]\% = \left(\frac{84}{112} \times 100\right)\% = 75\%$

For **Section B** $= \left[\frac{(12+17+55)}{(23+12+17+55)} \times 100\right]\% = \left(\frac{84}{107} \times 100\right)\% = 78.5\%$

For **Section C** $= \left[\frac{(8+9+46)}{(17+8+9+46)} \times 100\right]\% = \left(\frac{63}{80} \times 100\right)\% = 78.75\%$

For **Section D** $= \left[\frac{(13+15+76)}{(27+13+15+76)} \times 100\right]\% = \left(\frac{104}{131} \times 100\right)\% = 79.39\%$

Clearly, the pass percentage is maximum for Section D.

16. Number of students who passed half-yearly exams in the school

= (Number of students passed in half-yearly but failed in annual exams) + (Number of students passed in both exams) = (6 + 17 + 9 + 15) + (64 + 55 + 46 + 76) = 288

Also, Number of students who passed annual exams in the school

= (Number of students failed in half-yearly but passed in annual exams) + (Number of students passed in both exams) = (14 + 12 + 8 + 13) + (64 + 55 + 46 + 76) = 288

Since, the number of students passed in half-yearly = the number of students passed in annual exams, therefore, it can be inferred that both the examinations had almost the same difficulty level.

Thus, Statements (*a*), (*b*) and (*d*) are false and Statement (*c*) is true.

Also, number of students from Sections A and B who passed the annual exams

= (14 + 12) + (64 + 55) = 145

And, number of students from Sections A and B who passed the half-yearly exams

= (6 + 17) + (64 + 55) = 142.

Since the number of students of Sections A and B who passed the annual exams is greater than those who passed the half-yearly exams it implies that for students of Sections A and B, the half-yearly exams were more difficult as compared to annual exams.

Hence, Statement (*e*) is false.

17. Total number of Operators who left the Company during 1995-2000

$$= (104 + 120 + 100 + 112 + 144) = 580.$$

Total number of Operators who joined the Company during 1995-2000

$$= (880 + 256 + 240 + 208 + 192 + 248) = 2024.$$

$\therefore$ Required Percentage $= \left(\frac{580}{2024} \times 100\right)\% = 28.66\% \approx 29\%.$

18. Number of Managers working in the Company :

In **1995** = 760.

In **2000** = (760 + 280 + 179 + 148 + 160 + 193) − (120 + 92 + 88 + 72 + 96) = 1252.

$\therefore$ Percentage increase in the number of Managers

$$= \left[\frac{(1252 - 760)}{760} \times 100\right]\% = 64.74\%.$$

Number of Technicians working in the Company :

In **1995** = 1200.

In **2000** = (1200 + 272 + 240 + 236 + 256 + 288) − (120 + 128 + 96 + 100 + 112)
= 1936.

$\therefore$ Percentage increase in the number of Technicians

$$= \left[\frac{(1936 - 1200)}{1200} \times 100\right]\% = 61.33\%.$$

Number of Operators working in the Company :

In **1995** = 880.

In **2000** = (880 + 256 + 240 + 208 + 192 + 248) − (104 + 120 + 100 + 112 + 144)
= 1444.

$\therefore$ Percentage increase in the number of Operators

$$= \left[\frac{(1444 - 880)}{880} \times 100\right]\% = 64.09\%$$

Number of Accountants working in the Company :

In **1995** = 1160.

In **2000** = (1160 + 200 + 224 + 248 + 272 + 260) − (100 + 104 + 96 + 88 + 92)
= 1884.

$\therefore$ Percentage increase in the number of Accountants

$$= \left[\frac{(1884 - 1160)}{1160} \times 100\right]\% = 62.41\%$$

Number of Peons working in the Company :

In **1995** = 820.

In **2000** = (820 + 184 + 152 + 196 + 224 + 200) − (96 + 88 + 80 + 120 + 104)
= 1288.

$\therefore$ Percentage increase in the number of Peons

$$= \left[\frac{(1288 - 820)}{820} \times 100\right]\% = 57.07\%$$

Clearly, the percentage increase is maximum in case of Managers.

19. Required difference = (272 + 240 + 236 + 256 + 288)
− (200 + 224 + 248 + 272 + 260) = 88.

20. Total number of Peons working in the Company in 1999
= (820 + 184 + 152 + 196 + 224) − (96 + 88 + 80 + 120) = 1192.

21. Total number of employees of various categories working in the Company in 1997 are :

Managers = (760 + 280 + 179) − (120 + 92) = 1007
Technicians = (1200 + 272 + 240) − (120 + 128) = 1464
Operators = (880 + 256 + 240) − (104 + 120) = 1152
Accountants = (1160 + 200 + 224) − (100 + 104) = 1380
Peons = (820 + 184 + 152) − (96 + 88) = 972

∴ Pooled average of all the five categories of employees working in the Company in 1997 = $\frac{1}{5} \times (1007 + 1464 + 1152 + 1380 + 972) = \frac{1}{5} \times 5975 = 1195.$

22. Total population of State S = 7 million.

∴ Population above poverty line = [(100 − 19)% of 7] million
= (81% of 7) million = 5.67 million.

And so, the number of females above poverty line in State S = $\left(\frac{3}{7} \times 5.67\right)$ million
= 2.43 million.

23. Let the total population of State R be x million.

Then, population of State R above poverty line = [(100 − 24)% of x] million
$= \left(\frac{76}{100} \times x\right)$ million.

And so, male population of State R above poverty line = $\left[\frac{2}{5} \times \left(\frac{76}{100} \times x\right)\right]$ million

But, it is given that male population of State R above poverty line = 1.9 million

∴ $\frac{2}{5} \times \left(\frac{76}{100} \times x\right) = 1.9 \Rightarrow x = \frac{5 \times 100 \times 1.9}{76 \times 2} = 6.25.$

∴ Total population of State R = 6.25 million.

24. Female population below poverty line for State P = 2.1 million.

Let the male population below poverty line for State P be x million.

Then, $5 : 6 = x : 2.1 \Rightarrow x = \frac{2.1 \times 5}{6} = 1.75$

∴ Population below poverty line for State P = (2.1 + 1.75) million = 3.85 million.

Let the population above poverty line for State P be y million.

Since, 35% of the total population of State P is below poverty line, therefore, 65% of the total population of State P is above poverty line *i.e.*, the ratio of population below poverty line to that above poverty line for State P is 35 : 65.

∴ $35 : 65 = 3.85 : y \Rightarrow y = \frac{65 \times 3.85}{35} = 7.15$

i.e., population above poverty line for State P = 7.15 million and so, male population above poverty line for State P = $\left(\frac{6}{13} \times 7.15\right)$ million = 3.3 million.

25. For State Q :

Male population below poverty line = 2.4 million.

Let the female population below poverty line be x million.

Then, $3 : 5 = 2.4 : x \Rightarrow x = \frac{5 \times 2.4}{3} = 4$

$\therefore$ Total population below poverty line = (2.4 + 4) = 6.4 million.

If N_q be the total population of State Q, then,

25% of N_q = 6.4 million $\Rightarrow N_q = \left(\frac{6.4 \times 100}{25}\right)$ million = 25.6 million.

For State T :

Male population below poverty line = 6 million.

Let the female population below poverty line be y million.

Then, $5 : 3 = 6 : y \Rightarrow y = \frac{3 \times 6}{5} = 3.6$

$\therefore$ Total population below poverty line = (6 + 3.6) = 9.6 million.

If N_t be the total population of State T, then

15% of N_t = 9.6 million $\Rightarrow N_t = \left(\frac{9.6 \times 100}{15}\right)$ million = 64 million.

Thus, required ratio $= \frac{N_q}{N_t} = \frac{25.6}{64} = 0.4 = \frac{2}{5}$.

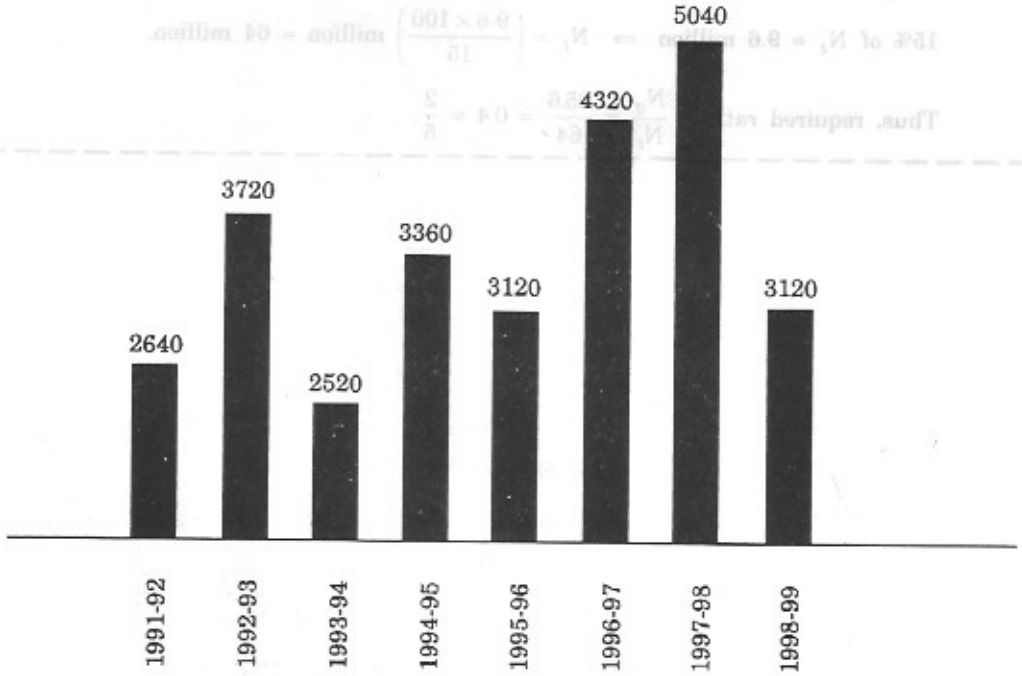
37. BAR GRAPHS

This section comprises of questions in which the data collected in a particular discipline are represented in the form of vertical or horizontal bars drawn by selecting a particular scale. One of the parameters is plotted on the horizontal axis and the other on the vertical axis. The candidate is required to understand the given information and thereafter answer the given questions on the basis of data analysis.

Ex. 1. ***The bar graph given below shows the foreign exchange reserves of a country (in million US $) from 1991-92 to 1998-99. Answer the questions based on this graph.*** **(Bank P.O. 2001)**

FOREIGN EXCHANGE RESERVES OF A COUNTRY

(in million US $)



1. The foreign exchange reserves in 1997-98 was how many times that in 1994-95 ?
   (*a*) 0.7 (*b*) 1.2 (*c*) 1.4 (*d*) 1.5 (*e*) 1.8
2. What was the percentage increase in the foreign exchange reserves in 1997-98 over 1993-94 ?
   (*a*) 100 (*b*) 150 (*c*) 200 (*d*) 620 (*e*) 2520
3. For which year, the percent increase of foreign exchange reserves over the previous year, is the highest ?
   (*a*) 1992-93 (*b*) 1993-94 (*c*) 1994-95 (*d*) 1996-97 (*e*) 1997-98

4. The foreign exchange reserves in 1996-97 were approximately what percent of the average foreign exchange reserves over the period under review ?

(*a*) 95% (*b*) 110% (*c*) 115% (*d*) 125% (*e*) 140%

5. The ratio of the number of years, in which the foreign exchange reserves are above the average reserves, to those in which the reserves are below the average reserves, is :

(*a*) 2 : 6 (*b*) 3 : 4 (*c*) 3 : 5 (*d*) 4 : 4 (*e*) 5 : 3

Sol. 1. (*d*) : Required ratio $= \frac{5040}{3360} = 1.5$.

2. (*a*) : Foreign exchange reserves in 1997-98 = 5040 million US \$

Foreign exchange reserves in 1993-94 = 2520 million US \$.

$\therefore$ Increase = (5040 – 2520) = 2520 million US \$.

$\therefore$ Percentage increase $= \left(\frac{2520}{2520} \times 100\right)\% = 100\%$.

3. (*a*) : There is an increase in foreign exchange reserves during the years 1992-93, 1994-95, 1996-97 and 1997-98 as compared to previous year (as shown by bar-graph).

The percentage increase in reserves during these years compared to previous year are :

(*i*) For **1992-93** $= \left[\frac{(3720 - 2640)}{2640} \times 100\right]\% = 40.91\%$

(*ii*) For **1994-95** $= \left[\frac{(3360 - 2520)}{2520} \times 100\right]\% = 33.33\%$

(*iii*) For **1996-97** $= \left[\frac{(4320 - 3120)}{3120} \times 100\right]\% = 38.46\%$

(*iv*) For **1997-98** $= \left[\frac{(5040 - 4320)}{4320} \times 100\right]\% = 16.67\%$

Clearly, the percentage increase over previous year is highest for 1992-93.

4. (*d*) : Average foreign exchange reserves over the given period

$= \left[\frac{1}{8} \times (2640 + 3720 + 2520 + 3360 + 3120 + 4320 + 5040 + 3120)\right]$ million US \$

= 3480 million US \$.

Foreign exchange reserves in 1996-97 = 4320 million US \$.

$\therefore$ Required Percentage $= \left(\frac{4320}{3480} \times 100\right)\% = 124.14\% \approx 125\%$.

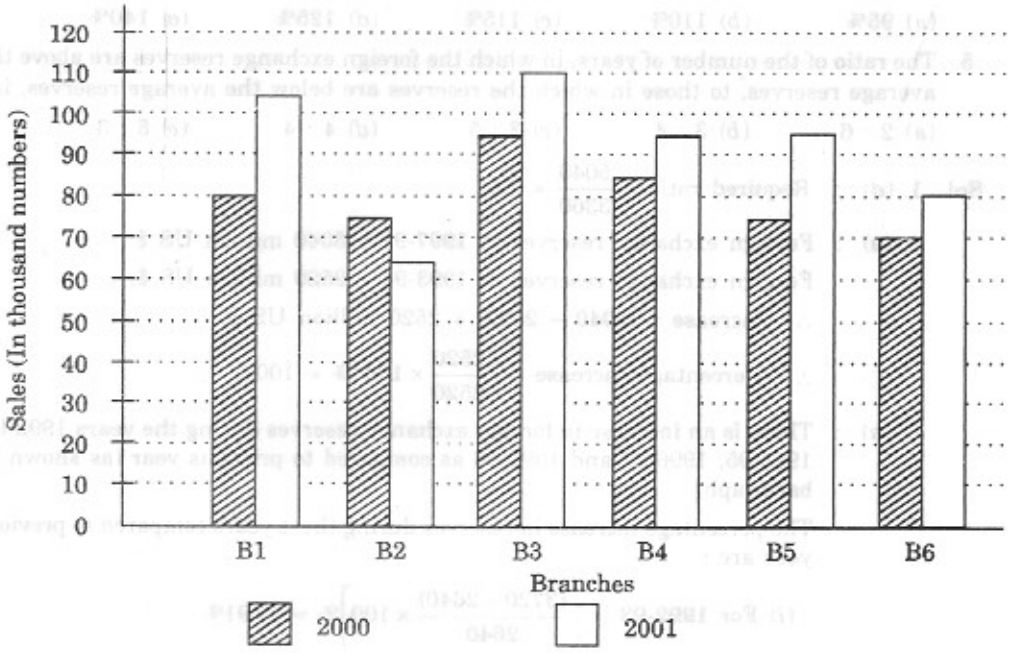
5. (*c*) : Average foreign exchange reserves over the given period = 3480 million US \$.

The country had reserves above 3480 million US \$ during the years 1992-93, 1996-97 and 1997-98 *i.e.*, for 3 years and below 3480 million US \$ during the years 1991-92, 1993-94, 1994-95, 1995-96 and 1998-99 *i.e.*, for 5 years.

Hence, required ratio = 3 : 5.

Ex. 2. ***The bar-graph provided on next page gives the sales of books (in thousand numbers) from six branches of a publishing company during two consecutive years 2000 and 2001. Answer the questions based on this bar-graph.*** **(Bank P.O. 2003)**

Sales of Books (in thousand numbers) from Six Branches — B1, B2, B3, B4, B5 and B6 of a Publishing Company in 2000 and 2001



1. Total sales of branches B1, B3 and B5 together for both the years (in thousand numbers) is :

   (*a*) 250 (*b*) 310 (*c*) 435 (*d*) 560 (*e*) 585

2. Total sales of branch B6 for both the years is what percent of the total sales of branch B3 for both the years ?

   (*a*) 68.54% (*b*) 71.11% (*c*) 73.17% (*d*) 75.55% (*e*) 77.26%

3. What is the average sale of all the branches (in thousand numbers) for the year 2000 ?

   (*a*) 73 (*b*) 80 (*c*) 83 (*d*) 88 (*e*) 96

4. What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years ?

   (*a*) 2 : 3 (*b*) 3 : 5 (*c*) 4 : 5 (*d*) 5 : 7 (*e*) 7 : 9

5. What percent of the average sales of branches B1, B2 and B3 in 2001 is the average sales of branches B1, B3 and B6 in 2000 ?

   (*a*) 75% (*b*) 77.5% (*c*) 82.5% (*d*) 85% (*e*) 87.5%

Sol. 1. (*d*) : Total sales of branches B1, B3 and B5 for both the years (in thousand numbers) = (80 + 105) + (95 + 110) + (75 + 95) = 560.

2. (*c*) : Required Percentage $= \left[\frac{(70+80)}{(95+110)} \times 100\right]\% = \left(\frac{150}{205} \times 100\right)\% = 73.17\%.$

3. (*b*) : Average sales of all the six branches (in thousand numbers) for the year 2000 $= \frac{1}{6} \times [80 + 75 + 95 + 85 + 75 + 70] = 80.$

4. (*e*) : Required ratio $= \frac{(75+65)}{(85+95)} = \frac{140}{180} = \frac{7}{9}.$

5. (e) : Average sales (in thousand numbers) of branches B1, B3 and B6 in 2000

$$= \frac{1}{3} \times (80 + 95 + 70) = \left(\frac{245}{3}\right).$$

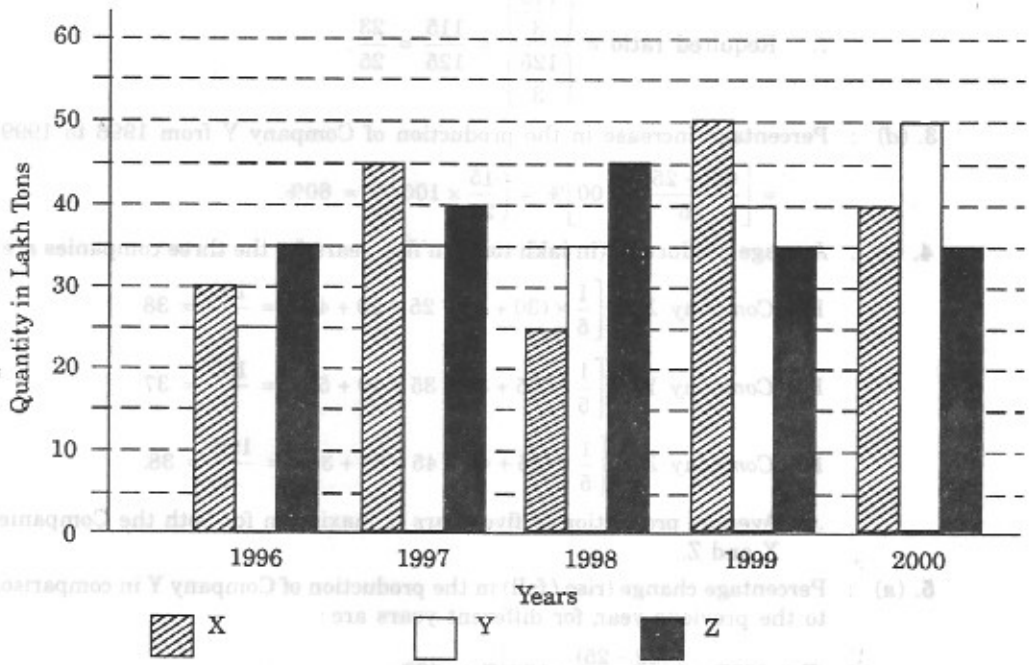
Average sales (in thousand numbers) of branches B1, B2 and B3 in 2001

$$= \frac{1}{3} \times (105 + 65 + 110) = \left(\frac{280}{3}\right).$$

$$\therefore \quad \text{Required Percentage} = \left[\frac{\left(\frac{245}{3}\right)}{\left(\frac{280}{3}\right)} \times 100\right]\% = \left(\frac{245}{280} \times 100\right)\% = 87.5\%.$$

Ex. 3. ***The bar graph provided below gives the data of the production of paper (in lakh tonnes) by three different companies X, Y and Z over the years. Study the graph and answer the questions that follow.*** **(Bank P.O. 2001)**

Production of Paper (in lakh tonnes) by Three Companies X, Y and Z over the Years



1. What is the difference between the production of Company Z in 1998 and Company Y in 1996 ?
   (a) 2,00,000 tons (b) 20,00,000 tons (c) 20,000 tons
   (d) 2,00,00,000 tons (e) None of these
2. What is the ratio of the average production of Company X in the period 1998-2000 to the average production of Company Y in the same period ?
   (a) 1 : 1 (b) 15 : 17 (c) 23 : 25 (d) 27 : 29 (e) None of these
3. What is the percentage increase in the production of Company Y from 1996 to 1999 ?
   (a) 30% (b) 45% (c) 50% (d) 60% (e) 75%
4. The average production for five years was maximum for which Company ?
   (a) X (b) Y (c) Z (d) X and Y both (e) X and Z both

5. For which of the following years, the percentage rise / fall in production from the previous year is the maximum for Company Y ?

(*a*) 1997 (*b*) 1998 (*c*) 1999 (*d*) 2000 (*e*) 1997 and 2000

6. In which year was the percentage of production of Company Z to the production of Company Y the maximum ?

(*a*) 1996 (*b*) 1997 (*c*) 1998 (*d*) 1999 (*e*) 2000

Sol. 1. (*b*) : Required difference = [(45 – 25) × 1,00,000] tons = 20,00,000 tons.

2. (*c*) : Average production of Company X in the period 1998-2000

$$= \left[\frac{1}{3} \times (25 + 50 + 40)\right] = \left(\frac{115}{3}\right) \text{ lakh tons.}$$

Average production of Company Y in the period 1998-2000

$$= \left[\frac{1}{3} \times (35 + 40 + 50)\right] = \left(\frac{125}{3}\right) \text{ lakh tons.}$$

$$\therefore \quad \text{Required ratio} = \frac{\left(\frac{115}{3}\right)}{\left(\frac{125}{3}\right)} = \frac{115}{125} = \frac{23}{25}.$$

3. (*d*) : Percentage increase in the production of Company Y from 1996 to 1999

$$= \left[\frac{(40-25)}{25} \times 100\right]\% = \left(\frac{15}{25} \times 100\right)\% = 60\%.$$

4. (*e*) : Average production (in lakh tons) in five years for the three companies are :

$$\text{For } \textit{Company X} = \left[\frac{1}{5} \times (30 + 45 + 25 + 50 + 40)\right] = \frac{190}{5} = 38$$

$$\text{For } \textit{Company Y} = \left[\frac{1}{5} \times (25 + 35 + 35 + 40 + 50)\right] = \frac{185}{5} = 37$$

$$\text{For } \textit{Company Z} = \left[\frac{1}{5} \times (35 + 40 + 45 + 35 + 35)\right] = \frac{190}{5} = 38.$$

∴ Average production of five years is maximum for both the Companies X and Z.

5. (*a*) : Percentage change (rise / fall) in the production of Company Y in comparison to the previous year, for different years are :

$$\textit{For 1997} = \left[\frac{(32-25)}{25} \times 100\right]\% = 40\%$$

$$\textit{For 1998} = \left[\frac{(35-35)}{25} \times 100\right]\% = 0\%$$

$$\textit{For 1999} = \left[\frac{(40-35)}{35} \times 100\right]\% = 14.29\%$$

$$\textit{For 2000} = \left[\frac{(50-40)}{40} \times 100\right]\% = 25\%$$

Hence, the maximum percentage rise / fall in the production of Company Y is for 1997.

6. (*a*) : The percentages of production of Company Z to the production of Company Z for various years are :

$$For\ 1996 = \left(\frac{35}{25} \times 100\right)\% = 140\%;\ For\ 1997 = \left(\frac{40}{35} \times 100\right)\% = 114.29\%;$$

$$For\ 1998 = \left(\frac{45}{35} \times 100\right)\% = 128.57\%;\ For\ 1999 = \left(\frac{35}{40} \times 100\right)\% = 87.5\%;$$

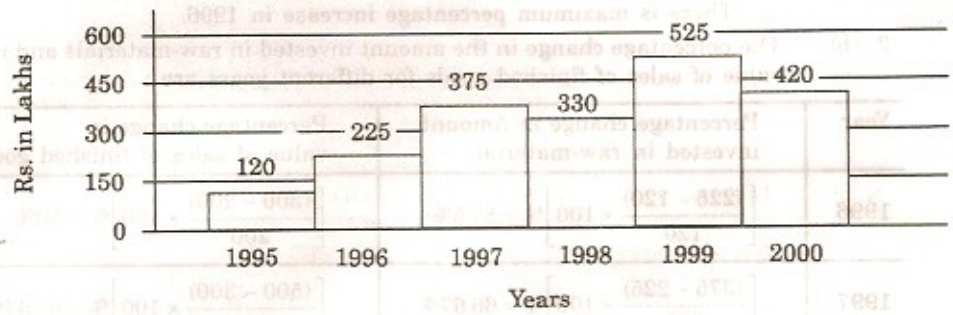
$$For\ 2000 = \left(\frac{35}{50} \times 100\right)\% = 70\%.$$

Clearly, this percentage is highest for 1996.

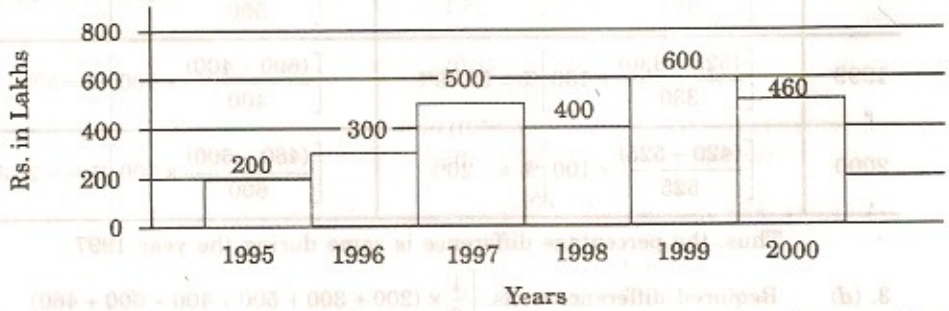
Ex. 4. ***Out of the two bar graphs provided below, one shows the amounts (in Lakh Rs.) invested by a Company in purchasing raw materials over the years and the other shows the values (in Lakh Rs.) of finished goods sold by the Company over the years. Study the two bar graphs and answer the questions based on them.***

Amount Invested in Raw Materials and the Value of Sales of Finished Goods for a Company over the Years

Amount Invested in Raw Materials (Rs. in Lakhs)



Value of Sales of Finished Goods (Rs. in Lakhs)



1. In which year, there has been a maximum percentage increase in the amount invested in Raw Materials as compared to the previous year ?
   (*a*) 1996 (*b*) 1997 (*c*) 1998 (*d*) 1999 (*e*) 2000
2. In which year, the percentage change (compared to the previous year) in the investment on Raw Materials is the same as that in the value of sales of finished goods ?
   (*a*) 1996 (*b*) 1997 (*c*) 1998 (*d*) 1999 (*e*) 2000
3. What was the difference between the average amount invested in Raw Materials during the given period and the average value of sales of finished goods during this period ?
   (*a*) Rs. 62.5 lakhs (*b*) Rs. 68.5 lakhs (*c*) Rs. 71.5 lakhs
   (*d*) Rs. 77.5 lakhs (*e*) Rs. 83.5 lakhs

4. The value of sales of finished goods in 1999 was approximately what percent of the average amount invested in Raw Materials in the years 1997, 1998 and 1999 ?

(*a*) 33% (*b*) 37% (*c*) 45% (*d*) 49% (*e*) 53%

5. The maximum difference between the amount invested in Raw Materials and the value of sales of finished goods was during the year :

(*a*) 1995 (*b*) 1996 (*c*) 1997 (*d*) 1998 (*e*) 1999

Sol. 1. (*a*) : The percentage increase in the amount invested in raw-materials as compared to the previous year, for different years are :

$$\textit{For 1996} = \left[\frac{(225-120)}{120}\times 100\right]\% = 87.5\%$$

$$\textit{For 1997} = \left[\frac{(375-225)}{225}\times 100\right]\% = 66.67\%$$

For 1998 there is a decrease.

$$\textit{For 1999} = \left[\frac{(525-330)}{330}\times 100\right]\% = 59.09\%$$

For 2000 there is a decrease.

∴ There is maximum percentage increase in 1996.

2. (*b*) : The percentage change in the amount invested in raw-materials and in the value of sales of finished goods for different years are :

Year	Percentage change in Amount invested in raw-material	Percentage change in value of sales of finished goods
1996	$\left[\frac{(225-120)}{120}\times 100\right]\% = 87.5\%$	$\left[\frac{(300-200)}{200}\times 100\right]\% = 50\%$
1997	$\left[\frac{(375-225)}{225}\times 100\right]\% = 66.67\%$	$\left[\frac{(500-300)}{300}\times 100\right]\% = 66.67\%$
1998	$\left[\frac{(330-375)}{375}\times 100\right]\% = -12\%$	$\left[\frac{(400-500)}{500}\times 100\right]\% = -20\%$
1999	$\left[\frac{(525-330)}{330}\times 100\right]\% = 59.09\%$	$\left[\frac{(600-400)}{400}\times 100\right]\% = 50\%$
2000	$\left[\frac{(420-525)}{525}\times 100\right]\% = -20\%$	$\left[\frac{(460-600)}{600}\times 100\right]\% = -23.33\%.$

Thus, the percentage difference is same during the year 1997.

3. (*d*) : Required difference = Rs. $\left[\frac{1}{6}\times(200+300+500+400+600+460) - \frac{1}{6}\times(120+225+375+330+525+420)\right]$ lakhs

$$= \text{Rs.}\left[\left(\frac{2460}{6}\right)-\left(\frac{1995}{6}\right)\right] \text{ lakhs} = \text{Rs. } (410-332.5) \text{ lakhs} = \text{Rs. } 77.5 \text{ lakhs.}$$

4. (*d*) : Required percentage $= \left[\frac{600}{(375+330+525)}\times 100\right]\% = 48.78\% \approx 49\%.$

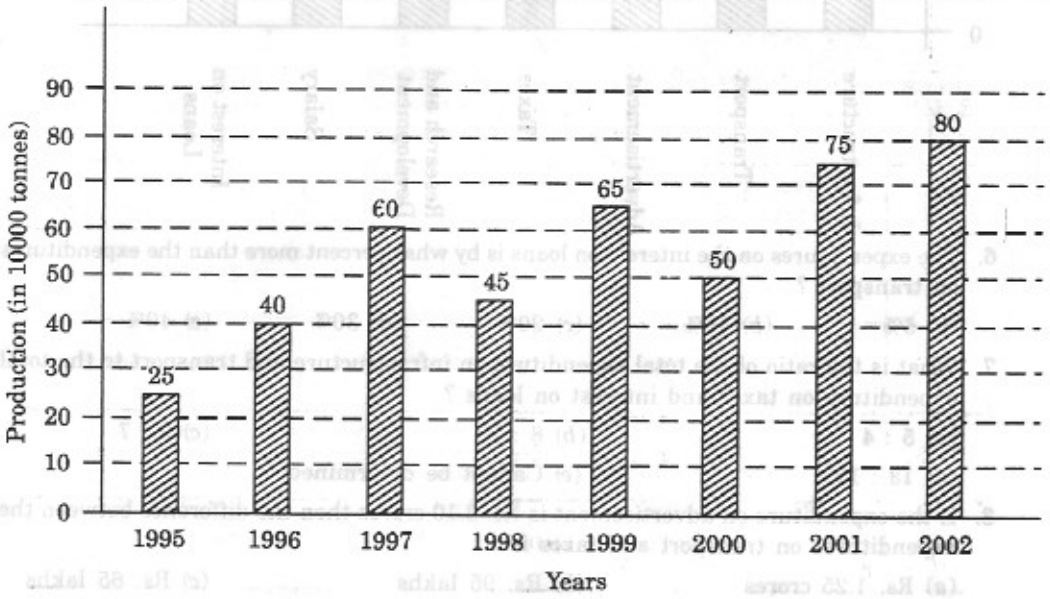
5. (*c*) : The differences between the amount invested in raw material and the value of sales of finished goods for various years are :

For 1995 = Rs. (200 – 120) lakhs = Rs. 80 lakhs.
For 1996 = Rs. (300 – 225) lakhs = Rs. 75 lakhs.
For 1997 = Rs. (500 – 375) lakhs = Rs. 125 lakhs.
For 1998 = Rs. (400 – 330) lakhs = Rs. 70 lakhs.
For 1999 = Rs. (600 – 525) lakhs = Rs. 75 lakhs.
For 2000 = Rs. (460 – 420) lakhs = Rs. 40 lakhs.
Clearly, maximum difference was during 1997.

EXERCISE 37

Directions (Questions 1 to 5) : ***Study the following bar-graph and answer the questions given below.*** **(Bank P.O. 2002)**

Production of Fertilizers by a Company (in 10000 tonnes) over the Years



1. In how many of the given years was the production of fertilizers more than the average production of the given years ?
(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4 (*e*) 5

2. The average production of 1996 and 1997 was exactly equal to the average production of which of the following pairs of years ?
(*a*) 2000 and 2001 (*b*) 1999 and 2000 (*c*) 1998 and 2000
(*d*) 1995 and 1999 (*e*) 1995 and 2001

3. What was the percentage decline in the production of fertilizers from 1997 to 1998 ?
(*a*) $33\frac{1}{3}\%$ (*b*) 30% (*c*) 25% (*d*) 21% (*e*) 20%

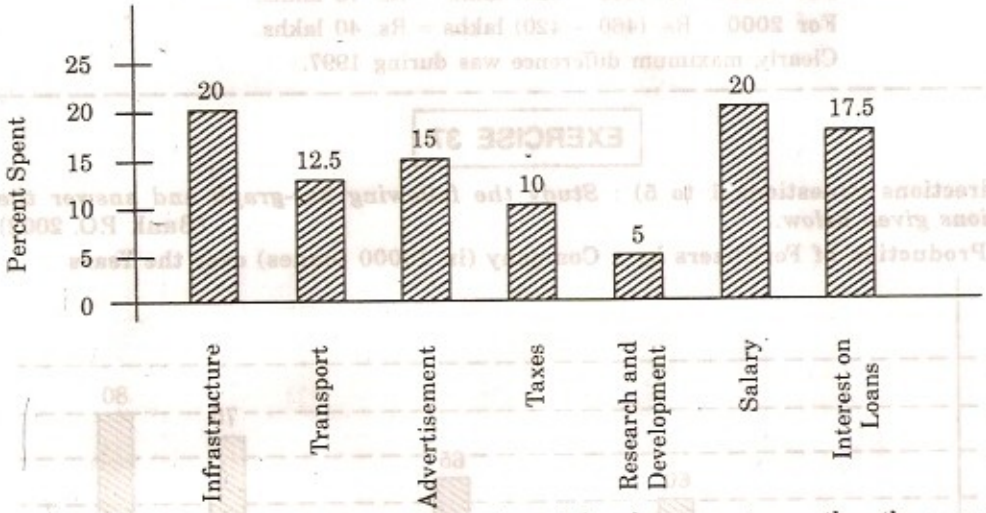
4. In which year was the percentage increase in production as compared to the previous year the maximum ?
(*a*) 2002 (*b*) 2001 (*c*) 1999 (*d*) 1997 (*e*) 1996

5. What was the percentage increase in production of fertilizers in 2002 compared to that in 1995 ?

(a) 320% (b) 300% (c) 220% (d) 200% (e) 150%

Directions (Questions 6 to 10) : ***The bar-graph given below shows the percentage distribution of total expenditures of a Company under various expense heads during 2003. Study the graph and answer the questions that follow :***

Percentage Distribution of Total Expenditures of a Company



6. The expenditures on the interest on loans is by what percent more than the expenditures on transport ?

(a) 5% (b) 10% (c) 20% (d) 30% (e) 40%

7. What is the ratio of the total expenditure on infrastructure and transport to the total expenditure on taxes and interest on loans ?

(a) 5 : 4 (b) 8 : 7 (c) 9 : 7
(d) 13 : 11 (e) Cannot be determined

8. If the expenditure on advertisement is Rs. 2.10 crores then the difference between the expenditures on transport and taxes is :

(a) Rs. 1.25 crores (b) Rs. 95 lakhs (c) Rs. 65 lakhs
(d) Rs. 35 lakhs (e) Rs. 25 lakhs

9. The total amount of expenditures of the Company is how many times the expenditure on research and development ?

(a) 27 (b) 20 (c) 18 (d) 8 (e) 5

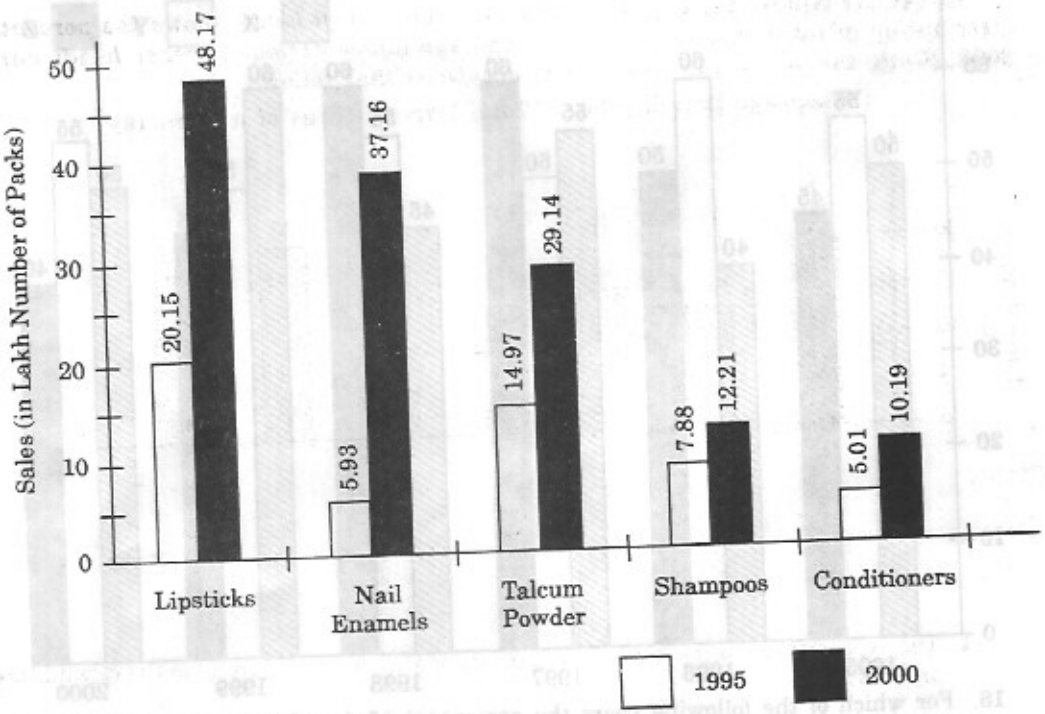
10. If the interest on loans amounted to Rs. 2.45 crores then the total amount of expenditure on advertisement, taxes and research and development is :

(a) Rs. 7 crores (b) Rs. 5.4 crores (c) Rs. 4.2 crores
(d) Rs. 3 crores (e) Rs. 2.4 crores

Directions (Questions 11 to 15) : ***A cosmetic company produces five different products. The sales of these five products (in lakh number of packs) during 1995 and 2000 are shown in the following bar-graph. The questions given below are based on this graph.***

(Bank P.O. 2001)

Sales (in lakh number of packs) of five different products of a Cosmetic Company during 1995 and 2000



11. The sales have increased by nearly 55% from 1995 to 2000 in the case of :

(*a*) Lipsticks (*b*) Nail enamels (*c*) Talcum powders
(*d*) Shampoos (*e*) Conditioners

12. During the period 1995-2000, the minimum rate of increase in sales is in the case of :

(*a*) Lipsticks (*b*) Nail enamels (*c*) Talcum powders
(*d*) Shampoos (*e*) Conditioners

13. The sales of lipsticks in 2000 was by what percent more than the sales of nail enamels in 2000 ? (rounded off to the nearest integer)

(*a*) 33% (*b*) 31% (*c*) 28% (*d*) 22% (*e*) 21%

14. The sales of conditioners in 1995 was by what percent less than the sales of shampoos in 1995 ? (rounded off to the nearest integer)

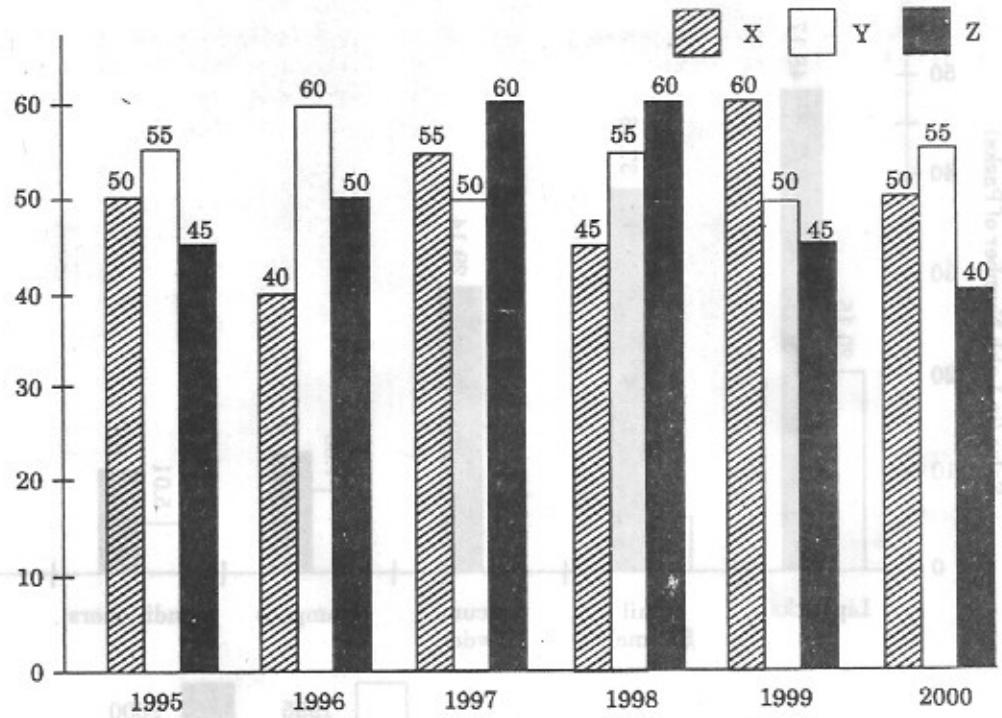
(*a*) 57% (*b*) 36% (*c*) 29% (*d*) 25% (*e*) 19%

15. What is the approximate ratio of the sales of nail enamels in 2000 to the sales of Talcum powders in 1995 ?

(*a*) 7 : 2 (*b*) 5 : 2 (*c*) 4 : 3 (*d*) 2 : 1 (*e*) 5 : 3

Directions (Questions 16 to 20) : ***A soft-drink company prepares drinks of three different flavours — X, Y and Z. The production of the three flavours over a period of six years has been expressed in the bar-graph provided below. Study the graph and answer the questions based on it.*** **(I.B.P.S. 2002)**

Production of three different flavours of soft-drinks X, Y, Z by a Company over the years (in lakh bottles)



16. For which of the following years the percentage of rise / fall in production from the previous year is the maximum for the flavour Y ?

(*a*) 1996 (*b*) 1997 (*c*) 1998 (*d*) 1999 (*e*) 2000

17. For which flavour was the average annual production maximum in the given period ?

(*a*) X only (*b*) Y only (*c*) Z only (*d*) X and Y (*e*) X and Z

18. The total production of flavour Z in 1997 and 1998 is what percentage of the total production of flavour X in 1995 and 1996 ?

(*a*) 96.67% (*b*) 102.25% (*c*) 115.57% (*d*) 120% (*e*) 133.33%

19. What is the difference between the average production of flavour X in 1995, 1996 and 1997 and the average production of flavour Y in 1998, 1999 and 2000 ?

(*a*) 50,000 bottles (*b*) 80,000 bottles (*c*) 2,40,000 bottles
(*d*) 3,30,000 bottles (*e*) 5,00,000 bottles

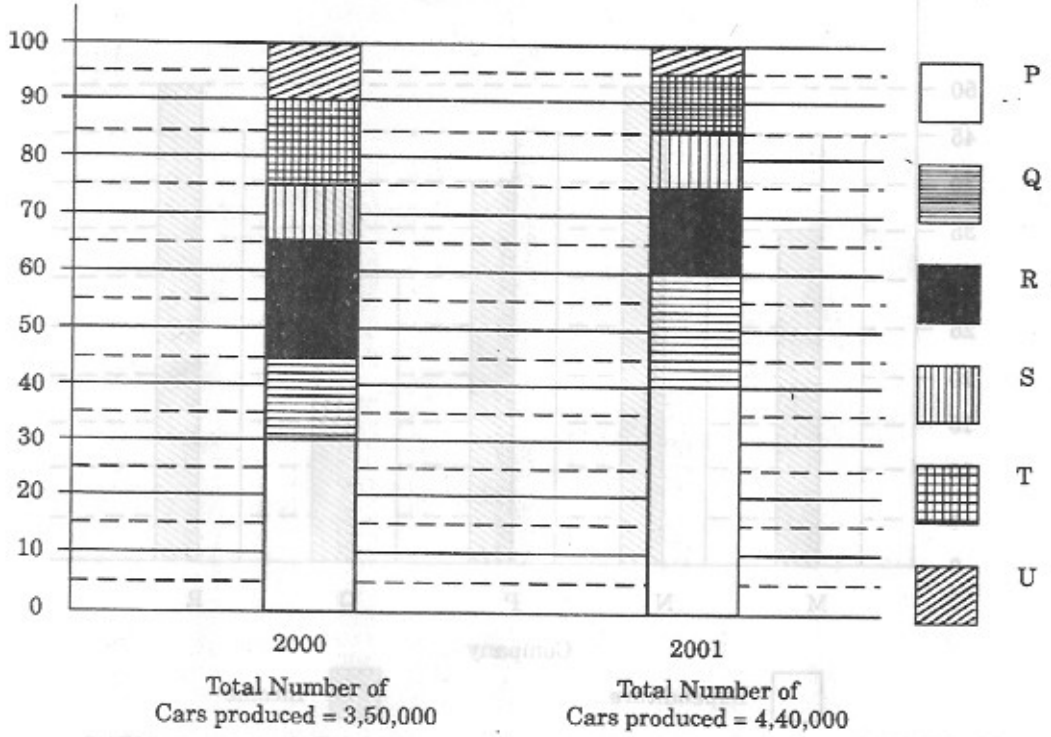
20. What was the approximate decline in the production of flavour Z in 2000 as compared to the production in 1998 ?

(*a*) 50% (*b*) 42% (*c*) 33% (*d*) 25% (*e*) 22.5%

Directions (Questions 21 to 25) : ***The bar-graph given below shows the percentage distribution of the total production of a car manufacturing company into various models over two years. Study the graph carefully and answer the questions that follow.***

(Bank P.O. 2001)

Percentage of Six different types of Cars manufactured by a Company over two years



21. Total number of cars of models P, Q and T manufactured in 2000 is :

(a) 2,45,000 (b) 2,27,500 (c) 2,10,000 (d) 1,92,500 (e) 1,57,500

22. For which model the percentage rise / fall in production from 2000 to 2001 was minimum ?

(a) Q (b) R (c) S (d) T (e) U

23. What was the difference in the number of Q type cars produced in 2000 and that produced in 2001 ?

(a) 35,500 (b) 27,000 (c) 22,500 (d) 17,500 (e) 16,000

24. If the percentage production of P type cars in 2001 was the same as that in 2000, then the number of P type cars produced in 2001 would have been :

(a) 1,40,000 (b) 1,32,000 (c) 1,17,000 (d) 1,05,000 (e) 97,000

25. If 85% of the S type cars produced in each year were sold by the Company, how many S type cars remained unsold ?

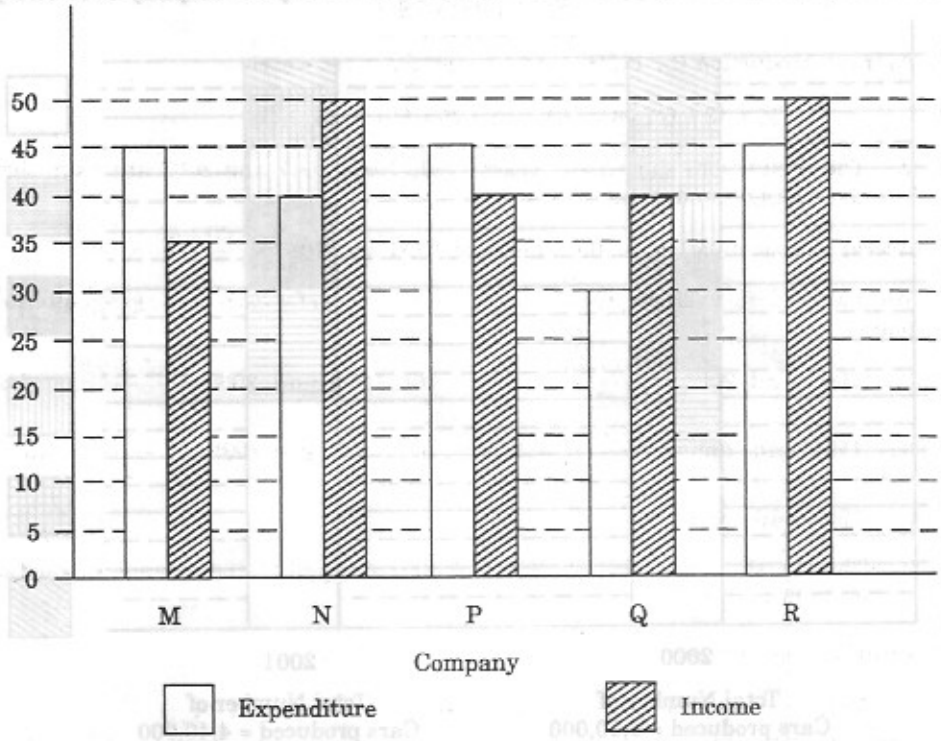
(a) 7650 (b) 9350 (c) 11,850 (d) 12,250 (e) 13,350

Directions (Questions 26 to 30) : ***The following bar-graph shows the Income and Expenditures (in million US $) of five Companies in the year 2001. The percent profit or loss of a Company is given by***

$$(Profit / Loss)\% = \frac{Income - Expenditure}{Expenditure} \times 100.$$

Study the graph and answer the questions that are based on it. (S.B.I.P.O. 2002)

Income and Expenditure (in million US $) of five Companies in the year 2001



26. Which Company earned the maximum percentage profit in the year 2001 ?

(*a*) M (*b*) N (*c*) P (*d*) Q (*e*) R

27. The Companies M and N together had a percentage profit / loss of :

(*a*) 12% loss (*b*) 10% loss (*c*) 10% profit
(*d*) 12% profit (*e*) There was no loss or profit

28. In 2001 what was the approximate percentage of profit / loss of all the five Companies taken together ?

(*a*) 5% profit (*b*) 6.5% profit (*c*) 4% loss (*d*) 7% loss (*e*) 10% profit

29. If the income of Company Q in 2001 was 10% more than its income in 2000 and the Company had earned a profit of 20% in 2000, then its expenditure in 2000 (in million US $) was :

(*a*) 28.28 (*b*) 30.30 (*c*) 32.32 (*d*) 34.34 (*e*) 36.36

30. For Company R, if the expenditure had increased by 20% in year 2001 from year 2000 and the Company had earned a profit of 10% in 2000, what was the Company's income in 2000 (in million US $) ?

(*a*) 35.75 (*b*) 37.25 (*c*) 38.5 (*d*) 41.25 (*e*) 42.75

ANSWERS

1. (*d*)	**2.** (*e*)	**3.** (*c*)	**4.** (*e*)	**5.** (*c*)	**6.** (*e*)	**7.** (*d*)	**8.** (*d*)	**9.** (*b*)
10. (*c*)	**11.** (*d*)	**12.** (*d*)	**13.** (*c*)	**14.** (*b*)	**15.** (*b*)	**16.** (*b*)	**17.** (*b*)	**18.** (*e*)
19. (*e*)	**20.** (*c*)	**21.** (*c*)	**22.** (*b*)	**23.** (*a*)	**24.** (*b*)	**25.** (*c*)	**26.** (*d*)	**27.** (*e*)
28. (*a*)	**29.** (*b*)	**30.** (*d*)						

SOLUTIONS

1. Average production (in 10000 tonnes) over the given years

$$= \frac{1}{8} \times (25 + 40 + 60 + 45 + 65 + 50 + 75 + 80) = 55$$

$\therefore$ The productions during the years 1997, 1999, 2001 and 2002 are more than the average production.

2. Average production (in 10000 tonnes) of 1996 and 1997 $= \frac{40 + 60}{2} = 50.$

We shall find the average production (in 10000 tonnes) for each of the given alternative pairs :

(*a*) **2000 and 2001** $= \frac{50 + 75}{2} = 62.5$ (*b*) **1999 and 2000** $= \frac{65 + 50}{2} = 57.5$

(*c*) **1998 and 2000** $= \frac{45 + 50}{2} = 47.5$ (*d*) **1995 and 1999** $= \frac{25 + 65}{2} = 45$

(*e*) **1995 and 2001** $= \frac{25 + 75}{2} = 50.$

$\therefore$ The average production of 1996 and 1997 is equal to the average production of 1995 and 2001.

3. Required percentage $= \left[\frac{(45 - 60)}{60} \times 100\right]\% = -25\%.$

$\therefore$ There is a decline of 25% in production from 1997 to 1998.

4. The percentage increase in production compared to previous year for different years are :

In **1996** $= \left[\frac{(40 - 25)}{25} \times 100\right]\% = 60\%;$ In **1997** $= \left[\frac{(60 - 40)}{40} \times 100\right]\% = 50\%$

In **1998** there is a decrease in production.

In **1999** $= \left[\frac{(65 - 45)}{45} \times 100\right]\% = 44.44\%$

In **2000** there is a decrease in production.

In **2001** $= \left[\frac{(75 - 50)}{50} \times 100\right]\% = 50\%;$ In **2002** $= \left[\frac{(80 - 75)}{75} \times 100\right]\% = 6.67\%$

Clearly, there is maximum percentage increase in production in 1996.

5. Required percentage $= \left[\frac{(80 - 25)}{25} \times 100\right]\% = 220\%.$

6. Let the total amount of expenditures be Rs. x.

Then, the expenditure on interest on loans = Rs. (17.5% of x) = Rs. $\left(\frac{17.5}{100}x\right)$

and the expenditure on transport = Rs. (12.5% of x) = Rs. $\left(\frac{12.5}{100}x\right)$

$\therefore$ Difference between the two expenditures = Rs. $\left(\frac{17.5}{100}x - \frac{12.5}{100}x\right)$ = Rs. $\left(\frac{5x}{100}\right)$

and so, the required percentage $= \left[\frac{\left(\frac{5x}{100}\right)}{\left(\frac{12.5x}{100}\right)} \times 100\right]\% = 40\%.$

7. Let the total amount of expenditures be Rs. x.
Then, the total expenditure on infrastructure and transport

$$= \text{Rs. } [(20 + 12.5)\% \text{ of } x] = \text{Rs. } (32.5\% \text{ of } x) = \text{Rs. } \left(\frac{32.5x}{100}\right)$$

and total expenditure on taxes and interest on loans

$$= \text{Rs. } [(10 + 17.5)\% \text{ of } x] = \text{Rs. } (27.5\% \text{ of } x) = \text{Rs. } \left(\frac{27.5x}{100}\right)$$

$$\therefore \text{ Required ratio} = \frac{\left(\frac{32.5x}{100}\right)}{\left(\frac{27.5x}{100}\right)} = 13 : 11.$$

8. Let the total expenditure be Rs. x crores.

Then, 15% of $x = 2.10 \Rightarrow x = \left(\frac{2.10 \times 100}{15}\right) = 14.$

$\therefore$ Total expenditure = Rs. 14 crores
and so, the difference between the expenditures on transport and taxes
= Rs. [(12.5 – 10)% of 14] crores = Rs. (2.5% of 14) crores
= Rs. 0.35 crores = Rs. 35 lakhs.

9. Let the total expenditures be Rs. x.

Then, the expenditure on Research and Development = Rs. (5% of x) = Rs. $\left(\frac{x}{20}\right)$.

$\therefore$ Ratio of the total expenditure to the expenditure on Research and Development

$$= \frac{x}{\left(\frac{x}{20}\right)} = \frac{20}{1}.$$

Thus, the total expenditure is 20 times the expenditure on Research and Development.

10. Let the total expenditure be Rs. x crores. Then, 17.5% of $x = 2.45 \Rightarrow x = 14$.
$\therefore$ Total expenditure = Rs. 14 crores
and so, the total expenditure on advertisement, taxes and research and development = Rs. [(15 + 10 + 5)% of 14] crores
= Rs. (30% of 14) crores = Rs. 4.2 crores.

11. The percentage increase from 1995 to 2000 for various products are :

Lipsticks $= \left[\frac{(48.17 - 20.15)}{20.15} \times 100\right]\% = 139.06$

Nail enamels $= \left[\frac{(37.76 - 5.93)}{5.93} \times 100\right]\% = 536.76\%$

Talcum powders $= \left[\frac{(29.14 - 14.97)}{14.97} \times 100\right]\% = 94.66\%$

Shampoos $= \left[\frac{(12.21 - 7.88)}{7.88} \times 100\right]\% = 54.95\% \approx 55\%$

Conditioners $= \left[\frac{(10.19 - 5.01)}{5.01} \times 100\right]\% = 103.39\%.$

12. As calculated in the Solution of Q. 11, the minimum rate of increase in sales from 1995 to 2000 is in the case of Shampoos.

13. Required percentage $= \left[\frac{(48.17 - 37.76)}{37.76} \times 100\right]\% = 27.57\% \approx 28\%.$

14. Required percentage $= \left[\frac{(7.88 - 5.01)}{7.88} \times 100\right]\% = 36.42\% \approx 36\%.$

15. Required ratio $= \frac{37.76}{14.97} \approx 2.5 = \frac{5}{2}.$

16. The percentage rise / fall in production from the previous year for flavour Y during various years are :

In **1996** $= \left[\frac{(60 - 55)}{55} \times 100\right]\% = 9.09\%$ (increase)

In **1997** $= \left[\frac{(60 - 50)}{60} \times 100\right]\% = 16.67\%$ (decrease)

In **1998** $= \left[\frac{(55 - 50)}{55} \times 100\right]\% = 10\%$ (increase)

In **1999** $= \left[\frac{(55 - 50)}{55} \times 100\right] = 9.09\%$ (decrease)

In **2000** $= \left[\frac{(55 - 50)}{50} \times 100\right]\% = 10\%$ (increase)

$\therefore$ Maximum change is decrease of 16.67% during 1997.

17. Average annual productions over the given period for various flavours are :

For *flavour X* $= \left[\frac{1}{6} \times (50 + 40 + 55 + 45 + 60 + 50)\right]$ lakh bottles = 50 lakh bottles.

For *flavour Y* $= \left[\frac{1}{6} \times (55 + 60 + 50 + 55 + 50 + 55)\right]$ lakh bottles

$= 54.17$ lakh bottles.

For *flavour Z* $= \left[\frac{1}{6} \times (45 + 50 + 60 + 60 + 45 + 40)\right]$ lakh bottles = 50 lakh bottles.

$\therefore$ Maximum average production is for flavour Y.

18. Required percentage $= \left[\frac{(60 + 60)}{(50 + 40)} \times 100\right]\% = \left(\frac{120}{90} \times 100\right)\% = 133.33\%.$

19. Average production of flavour X in 1995, 1996 and 1997 $= \left[\frac{1}{3} \times (50 + 40 + 55)\right]$

$= \left(\frac{145}{3}\right)$ lakh bottles.

Average production of flavour Y in 1998, 1999 and 2000 $= \left[\frac{1}{3} \times (55 + 50 + 55)\right]$

$= \left(\frac{160}{3}\right)$ lakh bottles.

$\therefore$ Difference $= \left(\frac{160}{3} - \frac{145}{3}\right) = \frac{15}{3} = 5$ lakh bottles = 5,00,000 bottles.

20. Percentage decline in the production of flavour Z in 2000 as compared to the production in 1998 $= \left[\frac{(60-40)}{60} \times 100\right]\% = \left(\frac{20}{60} \times 100\right)\% = 33.33\% \approx 33\%$.

21. We shall first determine the number of cars of each model produced by the Company during the two years :

In 2000 : Total number of cars produced = 3,50,000.

P = (30 – 0)% of 3,50,000 = 30% of 3,50,000 = 1,05,000

Q = (45 – 30)% of 3,50,000 = 15% of 3,50,000 = 52,500

R = (65 – 45)% of 3,50,000 = 20% of 3,50,000 = 70,000

S = (75 – 65)% of 3,50,000 = 10% of 3,50,000 = 35,000

T = (90 – 75)% of 3,50,000 = 15% of 3,50,000 = 52,500

U = (100 – 90)% of 3,50,000 = 10% of 3,50,000 = 35,000.

In 2001 : Total number of cars produced = 4,40,000.

P = (40 – 0)% of 4,40,000 = 40% of 4,40,000 = 1,76,000

Q = (60 – 40)% of 4,40,000 = 20% of 4,40,000 = 88,000

R = (75 – 60)% of 4,40,000 = 15% of 4,40,000 = 66,000

S = (85 – 75)% of 4,40,000 = 10% of 4,40,000 = 44,000

T = (95 – 85)% of 4,40,000 = 10% of 4,40,000 = 44,000

U = (100 – 95)% of 4,40,000 = 5% of 4,40,000 = 22,000.

Now, we shall solve the questions.

Total number of cars of models P, Q and T manufactured in 2000

= (105000 + 52500 + 52500) = 2,10,000.

22. Using the above calculation, the percentage change (rise / fall) in production from 2000 to 2001 for various models is :

For P $= \left[\frac{(176000-105000)}{105000} \times 100\right]\% = 67.62\%$, rise.

For Q $= \left[\frac{(88000-52500)}{52500} \times 100\right]\% = 67.62\%$, rise.

For R $= \left[\frac{(70000-66000)}{70000} \times 100\right]\% = 5.71\%$, fall.

For S $= \left[\frac{(44000-35000)}{35000} \times 100\right]\% = 25.71\%$, rise.

For T $= \left[\frac{(52500-44000)}{52500} \times 100\right]\% = 16.19\%$, fall.

For U $= \left[\frac{(35000-22000)}{35000} \times 100\right]\% = 37.14\%$, fall.

$\therefore$ Minimum percentage rise / fall in production is in the case of model R.

23. Required difference = 88000 – 52500 = 35500

(Using calculations in the Solution of Q. 21)

24. If the percentage production of P type cars in 2001 = percentage production of P type cars in 2000 = 30%

then, number of P type cars produced in 2001 = 30% of 440000 = 132000.

25. Number of S type cars which remained unsold in 2000 = 15% of 35000

and number of S type cars which remained unsold in 2001 = 15% of 44000

$\therefore$ Total number of S type cars which remained unsold

$= 15\%$ of $(35000 + 44000) = 15\%$ of $79000 = 11850$.

26. The percentage profit / loss in the year 2001 for various companies are :

$$For\ M = \left[\frac{(30-45)}{45} \times 100\right]\% = -33.33\%\ i.e.\ \%\text{Loss} = 33.33\%$$

$$For\ N = \left[\frac{(50-40)}{40} \times 100\right]\% = 25\%\ i.e.\ \%\text{Profit} = 25\%$$

$$For\ P = \left[\frac{(40-45)}{45} \times 100\right]\% = -11.11\%\ i.e.\ \%\text{Loss} = 11.11\%$$

$$For\ Q = \left[\frac{(40-30)}{30} \times 100\right]\% = 33.33\%\ i.e.\ \%\text{Profit} = 33.33\%$$

$$For\ R = \left[\frac{(50-45)}{45} \times 100\right]\% = 11.11\%\ i.e.\ \%\text{Profit} = 11.11\%$$

Clearly, the Company Q earned the maximum profit in 2001.

27. Total income of companies M and N together = (35 + 50) million US \$

= 85 million US \$

Total expenditure of companies M and N together = (45 + 40) million US \$

= 85 million US \$

$\therefore$ Percent Profit / Loss of companies M and N together

$$\%\text{Profit / Loss} = \left(\frac{85-85}{85} \times 100\right) = 0\%.$$

Thus, there was neither loss nor profit for companies M and N together.

28. Total income of all five companies = (35 + 50 + 40 + 40 + 50) = 215 million US \$

Total expenditure of all five companies = (45 + 40 + 45 + 30 + 45)

= 205 million US \$

$$\therefore\ \%\text{Profit} = \left[\frac{(215-205)}{205} \times 100\right]\% = 4.88\% = 5\%.$$

29. Let the income of Company Q in 2000 = x million US \$

Then, income of Company Q in 2001 = $\left(\frac{110}{100}x\right)$ million US \$

$$\therefore\ \frac{110}{100}x = 40 \Rightarrow x = \left(\frac{400}{11}\right).$$

i.e. income of Company Q in 2000 = $\left(\frac{400}{11}\right)$ million US \$.

Let the expenditure of Company Q in 2000 be E million US \$.

$$\text{Then, } 20 = \frac{\left[\left(\frac{400}{11}\right) - E\right]}{E} \times 100 \quad [\because\ \%\text{Profit} = 20\%]$$

$$\Rightarrow\ 20 = \left[\left(\frac{400}{11E}\right) - 1\right] \times 100 \Rightarrow E = \frac{400}{11} \times \frac{100}{120} = 30.30.$$

$\therefore$ Expenditure of Company Q in 2000 = 30.30 million US \$.

30. Let the expenditure of Company R in 2000 be x million US \$.

Then, expenditure of Company R in 2001 = $\left(\frac{120}{100}x\right)$ million US \$.

$\therefore \quad \frac{120}{100}x = 45 \Rightarrow x = 37.5$

i.e. expenditure of Company R in 2000 = 37.5 million US \$.

Let the income of Company R in 2000 be I million US \$.

Then, $10 = \frac{(I - 37.5)}{37.5} \times 100$ [$\because$ % profit in 2000 = 10%]

$\Rightarrow \quad I - 37.5 = 3.75 \Rightarrow I = 41.25$

i.e. Income of Company R in 2000 = 41.25 million US \$.

38. PIE-CHARTS

IMPORTANT FACTS AND FORMULAE

The **pie-chart** or a **pie-graph** is a method of representing a given numerical data in the form of sectors of a circle.

The sectors of the circle are constructed in such a way that the area of each sector is proportional to the corresponding value of the component of the data.

From geometry, we know that the area of the sector of a circle is proportional to the central angle.

So, the central angle of each sector must be proportional to the corresponding value of the component.

Since the sum of all the central angles is 360°, we have

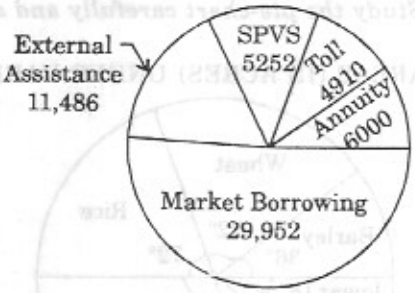
$$\text{Central angle of the component} = \left(\frac{\text{Value of the component}}{\text{Total value}} \times 360\right)^\circ$$

SOLVED EXAMPLES

The procedure of solving problems based on pie-charts will be clear from the following solved examples.

Example 1. ***The following pie-chart shows the sources of funds to be collected by the National Highways Authority of India (NHAI) for its Phase II projects. Study the pie-chart and answer the questions that follow.***

SOURCES OF FUNDS TO BE ARRANGED BY NHAI
FOR PHASE II PROJECTS (IN CRORES RS.)



Total funds to be arranged for Projects (Phase II) = Rs. 57,600 crores.

1. Near about 20% of the funds are to be arranged through :
   (*a*) SPVS (*b*) External Assistance
   (*c*) Annuity (*d*) Market Borrowing
2. The central angle corresponding to Market Borrowing is :
   (*a*) 52° (*b*) 137.8% (*c*) 187.2° (*d*) 192.4°
3. The approximate ratio of the funds to be arranged through Toll and that through Market Borrowing is :
   (*a*) 2 : 9 (*b*) 1 : 6 (*c*) 3 : 11 (*d*) 2 : 5

4. If NHAI could receive a total of Rs. 9695 crores as External Assistance, by what percent (approximately) should it increase the Market Borrowings to arrange for the shortage of funds ?

(*a*) 4.5% (*b*) 7.5% (*c*) 6% (*d*) 8%

5. If the toll is to be collected through an outsourced agency by allowing a maximum 10% commission, how much amount should be permitted to be collected by the outsourced agency, so that the project is supported with Rs. 4910 crores ?

(*a*) Rs. 6213 crores (*b*) Rs. 5827 crores (*c*) Rs. 5401 crores (*d*) Rs. 5216 crores

SOLUTION

1. (*b*) : 20% of the total funds to be arranged = Rs. (20% of 57600) crores
= Rs. 11520 crores = Rs. 11486 crores.

Rs. 11486 crores is the amount of funds to be arranged through External Assistance.

2. (*c*) : Central angle corresponding to Market Borrowing $= \left(\frac{29952}{57600} \times 360°\right) = 187.2°$.

3. (*b*) : Required ratio $= \frac{4910}{29952} = \frac{1}{6.1} \approx \frac{1}{6}$.

4. (*c*) : Shortage of funds arranged through External Assistance
= Rs. (11486 – 9695) crores = Rs. 1791 crores.

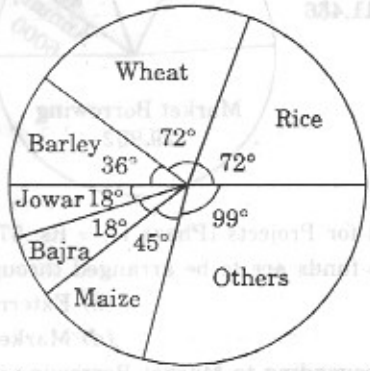
∴ Increase required in Market Borrowings = Rs. 1791 crores.

Percentage increase required $= \left(\frac{1791}{29952} \times 100\right)\% = 5.98\% \approx 6\%$.

5. (*c*) : Amount permitted = (Funds required from Toll for projects of Phase II)
+ (10% of these funds)
= Rs. 4910 crores + Rs. (10% of 4910) crores
= Rs. (4910 + 491) crores = Rs. 5401 crores

Example 2. ***The pie-chart provided below gives the distribution of land (in a village) under various food crops. Study the pie-chart carefully and answer the questions that follow.***

DISTRIBUTION OF AREAS (IN ACRES) UNDER VARIOUS FOOD CROPS



1. Which combination of three crops contribute to 50% of the total area under the food crops ?

(*a*) Wheat, Barley and Jowar (*b*) Rice, Wheat and Jowar
(*c*) Rice Wheat and Barley (*d*) Bajra, Maize and Rice

2. If the total area under jowar was 1.5 million acres, then what was the area (in million acres) under rice ?

(*a*) 6 (*b*) 7.5 (*c*) 9 (*d*) 4.5

3. If the production of wheat is 6 times that of barley, then what is the ratio between the yield per acre of wheat and barley ?

(*a*) 3 : 2 (*b*) 3 : 1 (*c*) 12 : 1 (*d*) 2 : 3

4. If the yield per acre of rice was 50% more than that of barley, then the production of barley is what percent of that of rice ?

(*a*) 30% (*b*) $33\frac{1}{3}\%$ (*c*) 35% (*d*) 36%

5. If the total area goes up by 5%, and the area under wheat production goes up by 12%, then what will be the angle for wheat in the new pie-chart ?

(*a*) 62.4° (*b*) 76.8° (*c*) 80.6° (*d*) 84.2°

SOLUTION

1. (*c*) : The total of the central angles corresponding to the three crops which cover 50% of the total area, should be 180°. Now, the total of the central angles for the given combinations are :

(*i*) Wheat, Barley and Jowar = (72° + 36° + 18°) = 126°
(*ii*) Rice, Wheat and Jowar = (72° + 72° + 18°) = 162°
(*iii*) Rice, Wheat and Barley = (72° + 72° + 36°) = 180°
(*iv*) Bajra, Maize and Rice = (18° + 45° + 72°) = 135°

Clearly, (*iii*) is the required combination.

2. (*a*) : The area under any of the food crops is proportional to the central angle corresponding to that crop.

Let, the area under rice production be x million acres.

Then, $18 : 72 = 1.5 : x \Rightarrow x = \left(\frac{72 \times 1.5}{18}\right) = 6.$

Thus, the area under rice production = 6 million acres.

3. (*b*) : Let the total production of barley be T tonnes and let Z acres of land be put under barley production.

Then, the total production of wheat = (6T) tonnes.

Also, area under wheat production = (2Z) acres.

$$\left[\because \frac{\text{Area under Wheat production}}{\text{Area under Barley production}} = \frac{72^\circ}{36^\circ} = 2 \right.$$
$$\left. \text{and therefore, Area under wheat} = 2 \times \text{Area under barley} = (2Z) \text{ acres}\right]$$

Now, yield per acre for wheat = $\left(\frac{6T}{2Z}\right)$ tonnes/ acre = $\left(\frac{3T}{Z}\right)$ tonnes/ acre

and yield per acre for barley = $\left(\frac{T}{Z}\right)$ tonnes/ acre.

$\therefore$ Required Ratio = $\left(\frac{3T/Z}{T/Z}\right) = 3 : 1.$

4. (*b*) : Let Z acres of land be put under barley production.

Then, $\frac{\text{Area under rice production}}{\text{Area under barley production}} = \frac{72^\circ}{36^\circ} = 2.$

$\therefore$ Area under Rice production = 2 × area under barley production = (2Z) acres.

Now, if p tonnes be the yield per acre of barley then, yield per acre of rice

$$= (p + 50\% \text{ of } p) \text{ tonnes} = \left(\frac{3}{2}p\right) \text{ tonnes.}$$

$\therefore$ Total production of rice = (yield per acre) × (area under production)

$$= \left(\frac{3}{2}p\right) \times 2Z = (3pZ) \text{ tonnes.}$$

And, Total production of barley = (pZ) tonnes.

$\therefore$ Percentage production of barley to that of rice = $\left(\frac{pZ}{3pZ} \times 100\right)\% = 33\frac{1}{3}\%$.

5. (*b*) : Initially, let t acres be the total area under consideration.

Then, area under wheat production initially was = $\left(\frac{72}{360} \times t\right)$ acres = $\left(\frac{t}{5}\right)$ acres.

Now, if the total area under consideration be increased by 5%, then the new value of the total area = $\left(\frac{105}{100}t\right)$ acres.

Also, if the area under wheat production be increased by 12%, then the new value of the area under wheat = $\left[\frac{t}{5} + \left(12\% \text{ of } \frac{t}{5}\right)\right]$ acres = $\left(\frac{112t}{500}\right)$ acres.

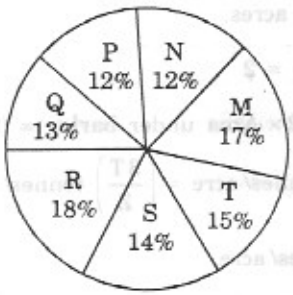
$\therefore$ Central angle corresponding to wheat in the new pie-chart

$$= \left[\frac{\text{Area under wheat (new)}}{\text{Total area (new)}} \times 360\right]^\circ = \left[\frac{\left(\frac{112t}{500}\right)}{\left(\frac{105t}{100}\right)} \times 360\right]^\circ = 76.8^\circ.$$

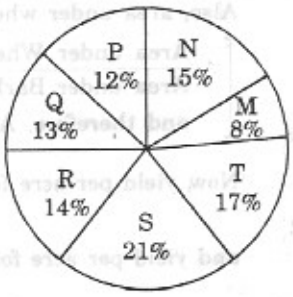
Example 3. ***The following pie-charts show the distribution of students of graduate and post-graduate levels in seven different institutes — M, N, P, Q, R, S and T in a town.*** **(Bank P.O. 2003)**

DISTRIBUTION OF STUDENTS AT GRADUATE AND POST-GRADUATE LEVELS IN SEVEN INSTITUTES — M, N, P, Q, R, S AND T

Total Number of Students of Graduate Level = 27300



Total Number of Students of Post-Graduate Level = 24700



1. How many students of institutes M and S are studying at graduate level ?
   (*a*) 7516 (*b*) 8463 (*c*) 9127 (*d*) 9404
2. Total number of students studying at post-graduate level from institutes N and P is :
   (*a*) 5601 (*b*) 5944 (*c*) 6669 (*d*) 7004
3. What is the total number of graduate and post-graduate level students in institute R ?
   (*a*) 8320 (*b*) 7916 (*c*) 9116 (*d*) 8372
4. What is the ratio between the number of students studying at post-graduate and graduate levels respectively from institute S ?
   (*a*) 14 : 19 (*b*) 19 : 21 (*c*) 17 : 21 (*d*) 19 : 14

5. What is the ratio between the number of students studying at post-graduate level from institute S and the number of students studying at graduate level from institute Q ?

(*a*) 13 : 19 (*b*) 21 : 13 (*c*) 13 : 8 (*d*) 19 : 13

SOLUTION

1. (*b*) : Students of institute M at graduate level = 17% of 27300 = 4641.
Students of institute S at graduate level = 14% of 27300 = 3822.
∴ Total number of students at graduate level in institutes M and S
= 4641 + 3822 = 8463.

2. (*c*) : Required number = (15% of 24700) + (12% of 24700) = 3705 + 2964 = 6669.

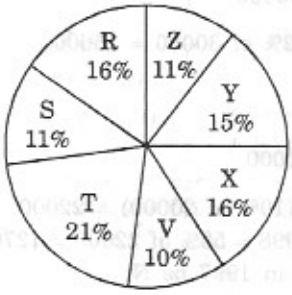
3. (*d*) : Required number = (18% of 27300) + (14% of 24700) = 4914 + 3458 = 8372.

4. (*d*) : Required ratio = $\frac{(21\% \text{ of } 24700)}{(14\% \text{ of } 27300)} = \frac{21 \times 24700}{14 \times 27300} = \frac{19}{14}$.

5. (*d*) : Required ratio = $\frac{(21\% \text{ of } 24700)}{(13\% \text{ of } 27300)} = \frac{21 \times 24700}{13 \times 27300} = \frac{19}{13}$.

Example 4. ***Study the following pie-chart and the table and answer the questions based on them.*** (S.B.I.P.O. 1999)

PROPORTION OF POPULATION OF SEVEN VILLAGES IN 1997



Village	% Population Below Poverty Line
X	38
Y	52
Z	42
R	51
S	49
T	46
V	58

1. Find the population of village S if the population of village X below poverty line in 1997 is 12160.

(*a*) 18500 (*b*) 20500 (*c*) 22000 (*d*) 26000

2. The ratio of population of village T below poverty line to that of village Z below poverty line in 1997 is :

(*a*) 11 : 23 (*b*) 13 : 11 (*c*) 23 : 11 (*d*) 11 : 13

3. If the population of village R in 1997 is 32000, then what will be the population of village Y below poverty line in that year ?

(*a*) 14100 (*b*) 15600 (*c*) 16500 (*d*) 17000

4. If in 1998, the population of villages Y and V increase by 10% each and the percentage of population below poverty line remains unchanged for all the villages, then find the population of village V below poverty line in 1998, given that the population of village Y in 1997 was 30000.

(*a*) 11250 (*b*) 12760 (*c*) 13140 (*d*) 13780

5. If in 1999, the population of village R increases by 10% while that of village Z reduces by 5% compared to that in 1997 and the percentage of population below poverty line remains unchanged for all the villages, then find the approximate ratio of population of village R below poverty line to the ratio of population of village Z below poverty line for the year 1999.

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

SOLUTION

1. (*c*) : Let the population of village X be x.

Then, 38% of $x = 12160 \Rightarrow x = \frac{12160 \times 100}{38} = 32000.$

Now, if s be the population of village S, then

$16 : 11 = 32000 : s \Rightarrow s = \frac{11 \times 32000}{16} = 22000.$

2. (*c*) : Let N be the total population of all the seven villages.

Then, population of village T below poverty line = 46% of (21% of N)

and population of village Z below poverty line = 42% of (11% of N)

$\therefore$ Required ratio $= \frac{46\% \text{ of } (21\% \text{ of N})}{42\% \text{ of } (11\% \text{ of N})} = \frac{46 \times 21}{42 \times 11} = \frac{23}{11}.$

3. (*b*) : Population of village R = 32000 (given).

Let the population of village Y be y.

Then, $16 : 15 = 32000 : y \Rightarrow y = \frac{15 \times 32000}{16} = 30000$

$\therefore$ Population of village Y below poverty line = 52% of 30000 = 15600.

4. (*b*) : Population of village Y in 1997 = 30000 (given).

Let the population of village V in 1997 be v.

Then, $15 : 10 = 30000 : v \Rightarrow v = \frac{30000 \times 10}{15} = 20000.$

Now, population of village V in 1998 = 20000 + (10% of 20000) = 22000.

$\therefore$ Population of village V below poverty line in 1998 = 58% of 22000 = 12760.

5. (*a*) : Let the total population of all the seven villages in 1997 be N.

Then, population of village R in 1997 = 16% of N $= \frac{16}{100}$ N

and population of village Z in 1997 = 11% of N $= \frac{11}{100}$ N.

$\therefore$ Population of village R in 1999 $= \left\{\frac{16}{100}\text{N} + \left(10\% \text{ of } \frac{16}{100}\text{N}\right)\right\} = \frac{1760}{10000}\text{N}$

and population of village Z in 1999 $= \left\{\frac{11}{100}\text{N} - \left(5\% \text{ of } \frac{11}{100}\text{N}\right)\right\} = \frac{1045}{10000}\text{N}$

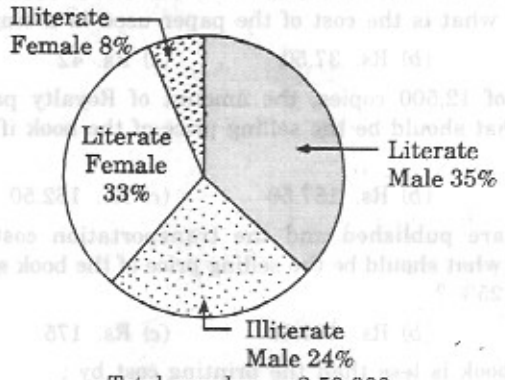
Now, population of village R below poverty line for 1999 = 51% of $\left(\frac{1760}{10000}\text{N}\right)$

and population of village Z below poverty line for 1999 = 42% of $\left(\frac{1045}{10000}\text{N}\right)$.

$\therefore$ Required ratio $= \frac{51\% \text{ of } \left(\frac{1760}{10000}\text{N}\right)}{42\% \text{ of } \left(\frac{1045}{10000}\text{N}\right)} = \frac{51 \times 1760}{42 \times 1045} \approx \frac{2}{1}.$

EXERCISE 38

1. The following pie-chart shows the percentage of Literate and Illiterate — Males and Females in a city. **(Bank P.O. 2003)**



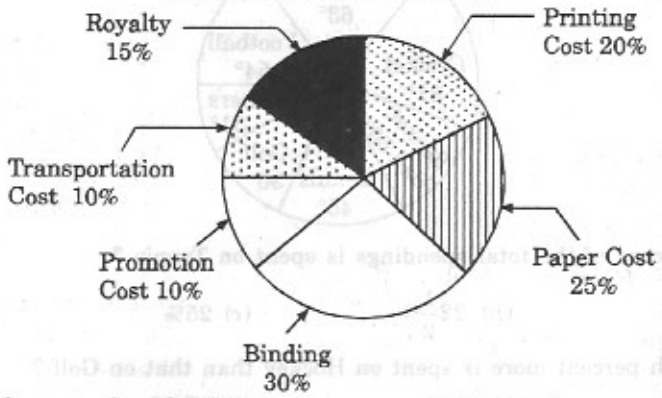
Total number = 2,50,000.

What is the difference between the number of Literate Males and Literate Females ?

(*a*) 75,000 (*b*) 1,500 (*c*) 5,000 (*d*) 500

Directions (Questions 2 to 10) : ***The following pie-chart shows the percentage distribution of the expenditure incurred in publishing a book. Study the pie-chart and answer the questions based on it.*** **(Bank P.O. 2002)**

VARIOUS EXPENDITURES (IN PERCENTAGE) INCURRED IN PUBLISHING A BOOK



2. What is the central angle of the sector corresponding to the expenditure incurred on Royalty ?

(*a*) 15° (*b*) 24° (*c*) 54° (*d*) 48°

3. Which two expenditures together have a central angle of 108° ?

(*a*) Binding Cost and Transportation Cost (*b*) Printing Cost and Paper Cost
(*c*) Royalty and Promotion Cost (*d*) Binding Cost and Paper Cost

4. If the difference between the two expenditures are represented by 18° in the pie-chart, then these expenditures possibly are :

(*a*) Binding Cost and Promotion Cost (*b*) Paper Cost and Royalty
(*c*) Binding Cost and Printing Post (*d*) Paper Cost and Printing Cost

5. If for an edition of the book, the cost of paper is Rs. 56250, then find the promotion cost for this edition.

(*a*) Rs. 20,000 (*b*) Rs. 22,500 (*c*) Rs. 25,500 (*d*) Rs. 28,125

6. If for a certain quantity of books, the publisher has to pay Rs. 30,600 as printing cost, then what will be the amount of royalty to be paid for these books ?

(*a*) Rs. 19,450 (*b*) Rs. 21,200 (*c*) Rs. 22,950 (*d*) Rs. 26,150

7. The price of the book is marked 20% above the C.P. If the marked price of the book is Rs. 180, then what is the cost of the paper used in a single copy of the book ?

(*a*) Rs. 36 (*b*) Rs. 37.50 (*c*) Rs. 42 (*d*) Rs. 44.25

8. For an edition of 12,500 copies, the amount of Royalty paid by the publisher is Rs. 2,81,250. What should be the selling price of the book if the publisher desires a profit of 5% ?

(*a*) Rs. 152.50 (*b*) Rs. 157.50 (*c*) Rs. 162.50 (*d*) Rs. 167.50

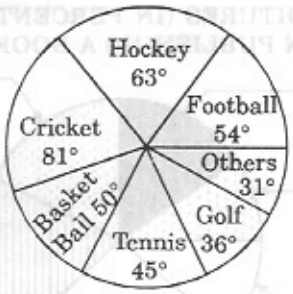
9. If 5500 copies are published and the transportation cost on them amounts to Rs. 82,500, then what should be the selling price of the book so that the publisher can earn a profit of 25% ?

(*a*) Rs. 187.50 (*b*) Rs. 191.50 (*c*) Rs. 175 (*d*) Rs. 180

10. Royalty on the book is less than the printing cost by :

(*a*) 5% (*b*) $33\frac{1}{3}$% (*c*) 20% (*d*) 25%

Directions (Questions 11 to 15) : ***The circle-graph given here shows the spendings of a country on various sports during a particular year. Study the graph carefully and answer the questions given below it.***



11. What percent of the total spendings is spent on Tennis ?

(*a*) $12\frac{1}{2}$% (*b*) $22\frac{1}{2}$% (*c*) 25% (*d*) 45%

12. How much percent more is spent on Hockey than that on Golf ?

(*a*) 27% (*b*) 35% (*c*) 37.5% (*d*) 75%

13. How much percent less is spent on Football than that on Cricket ?

(*a*) $22\frac{2}{9}$% (*b*) 27% (*c*) $33\frac{1}{3}$% (*d*) $37\frac{1}{2}$%

14. If the total amount spent on sports during the year was Rs. 2 crores, the amount spent on Cricket and Hockey together was :

(*a*) Rs. 8,00,000 (*b*) Rs. 80,00,000 (*c*) Rs. 1,20,00,000 (*d*) Rs. 1,60,00,000

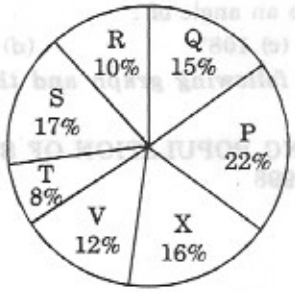
15. If the total amount spent on sports during the year be Rs. 1,80,00,000, the amount spent on Basketball exceeds that on Tennis by :

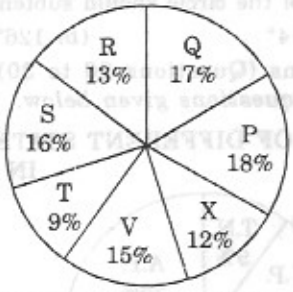
(*a*) Rs. 2,50,000 (*b*) Rs. 3,60,000 (*c*) Rs. 3,75,000 (*d*) Rs. 4,10,000

Directions (Questions 16 to 20) : ***Study the following graph carefully and answer the questions given below :*** **(Bank P.O. 2002)**

DISTRIBUTION OF CANDIDATES WHO WERE ENROLLED FOR MBA ENTRANCE EXAM AND THE CANDIDATES (OUT OF THOSE ENROLLED) WHO PASSED THE EXAM IN DIFFERENT INSTITUTES

Candidates Enrolled = 8550 **Candidates who Passed the Exam = 5700**





16. What percentage of candidates passed the Exam from institute T out of the total number of candidates enrolled from the same institute ?

(*a*) 50% (*b*) 62.5% (*c*) 75% (*d*) 80%

17. What is the ratio of candidates passed to the candidates enrolled from institute P ?

(*a*) 9 : 11 (*b*) 14 : 17 (*c*) 6 : 11 (*d*) 9 : 17

18. What is the percentage of candidates passed to the candidates enrolled for institutes Q and R together ?

(*a*) 68% (*b*) 80% (*c*) 74% (*d*) 65%

19. Which institute has the highest percentage of candidates passed to the candidates enrolled ?

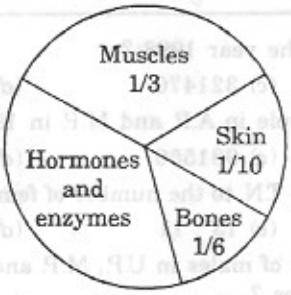
(*a*) Q (*b*) R (*c*) V (*d*) T

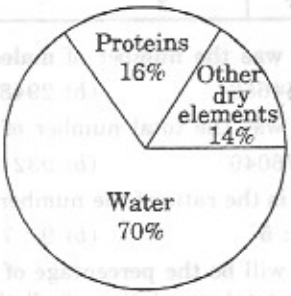
20. The number of candidates passed from institutes S and P together exceeds the number of candidates enrolled from institutes T and R together by :

(*a*) 228 (*b*) 279 (*c*) 399 (*d*) 407

Directions (Questions 21 to 25) : ***Study the following pie-diagrams carefully and answer the questions given below it.***

PERCENTAGE COMPOSITION OF HUMAN BODY





21. In the human body, what part is made of neither bones nor skin ?

(*a*) $\frac{1}{40}$ (*b*) $\frac{3}{80}$ (*c*) $\frac{2}{5}$ (*d*) None of these

22. What is the ratio of the distribution of proteins in the muscles to that of the distribution of proteins in the bones ?

(*a*) 1 : 18 (*b*) 1 : 2 (*c*) 2 : 1 (*d*) 18 : 1

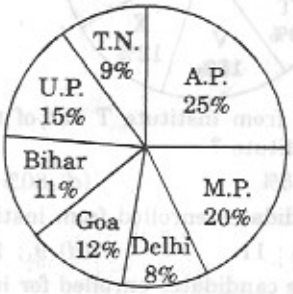
23. What will be the quantity of water in the body of a person weighing 50 kg ?
(a) 20 kg (b) 35 kg (c) 41 kg (d) 42.5 kg

24. What percent of the total weight of human body is equivalent to the weight of the proteins in skin in human body ?
(a) 0.016 (b) 1.6 (c) 0.16 (d) Data inadequate

25. To show the distribution of proteins and other dry elements in the human body, the arc of the circle should subtend at the centre an angle of :
(a) 54° (b) 126° (c) 108° (d) 252°

Directions (Questions 26 to 30) : ***Study the following graph and the table and answer the questions given below.***

DATA OF DIFFERENT STATES REGARDING POPULATION OF STATES IN THE YEAR 1998



Total Population of the given States = 3276000

States	Sex and Literacy wise Population Ratio					
	Sex			Literacy		
	M	—	F	Literate	—	Illiterate
A.P.	5	:	3	2	:	7
M.P.	3	:	1	1	:	4
Delhi	2	:	3	2	:	1
Goa	3	:	5	3	:	2
Bihar	3	:	4	5	:	1
U.P.	3	:	2	7	:	2
T.N.	3	:	4	9	:	4

26. What was the number of males in U.P. in the year 1998 ?
(a) 254650 (b) 294840 (c) 321470 (d) 341200

27. What was the total number of illiterate people in A.P. and M.P. in 1998 ?
(a) 876040 (b) 932170 (c) 981550 (d) 1161160

28. What is the ratio of the number of females in T.N. to the number of females in Delhi ?
(a) 7 : 5 (b) 9 : 7 (c) 13 : 11 (d) 15 : 14

29. What will be the percentage of total number of males in U.P., M.P. and Goa together to the total population of all the given states ?
(a) 25% (b) 27.5% (c) 28.5% (d) 31.5%

30. If in the year 1998, there was an increase of 10% in the population of U.P. and 12% in the population of M.P. compared to the previous year, then what was the ratio of populations of U.P. and M.P. in 1997 ?
(a) 42 : 55 (b) 48 : 55 (c) 7 : 11 (d) 4 : 5

ANSWERS

1. (*c*)	2. (*c*)	3. (*a*)	4. (*d*)	5. (*b*)	6. (*c*)	7. (*b*)	8. (*b*)	9. (*a*)
10. (*d*)	11. (*a*)	12. (*d*)	13. (*c*)	14. (*b*)	15. (*a*)	16. (*c*)	17. (*c*)	18. (*b*)
19. (*b*)	20. (*c*)	21. (*d*)	22. (*c*)	23. (*b*)	24. (*b*)	25. (*c*)	26. (*b*)	27. (*d*)
28. (*d*)	29. (*c*)	30. (*a*)						

SOLUTIONS

1. Difference = (35% of 2,50,000) – (33% of 2,50,000)
   = (35% – 33%) of 2,50,000 = 2% of 2,50,000 = 5000.
2. Central angle corresponding to Royalty = (15% of 360)° = 54°.
3. Central angle of 108° = $\left(\frac{108}{360} \times 100\right)$% of the total expenditure
   = 30% of the total expenditure.

   From the pie-chart it is clear that :
   Binding Cost + Transportation Cost = (20% + 10%) of the total expenditure
   = 30% of the total expenditure.

   ∴ Binding Cost and Transportation Cost together have a central angle of 108°.
4. Central angle of 18° = $\left(\frac{18}{360} \times 100\right)$% of the total expenditure
   = 5% of the total expenditure.

   From the pie-chart it is clear that :
   Out of the given combinations, only in combination (*d*) the difference is 5% *i.e.*
   Paper Cost – Printing Cost = (25% – 20%) of total expenditure
   = 5% of total expenditure.
5. Let the Promotion Cost for this edition be Rs. p.

   Then, 25 : 10 = 56250 : p ⇒ p = Rs. $\left(\frac{56250 \times 10}{25}\right)$ = Rs. 22500.
6. Let the amount of Royalty to be paid for these books be Rs. r.

   Then, 20 : 15 = 30600 : r ⇒ r = Rs. $\left(\frac{30600 \times 15}{20}\right)$ = Rs. 22950.
7. Clearly, marked price of the book = 120% of C.P.
   Also, cost of paper = 25% of C.P.
   Let the cost of paper for a single book be Rs. n.

   Then, 120 : 25 = 180 : n ⇒ n = Rs. $\left(\frac{25 \times 180}{120}\right)$ = Rs. 37.50.
8. Clearly, S.P. of the book = 105% of C.P.
   Let the selling price of this edition (of 12500 books) be Rs. x.

   Then, 15 : 105 = 281250 : x ⇒ x = Rs. $\left(\frac{105 \times 281250}{15}\right)$ = Rs. 1968750.

   ∴ S.P. of one book = Rs. $\left(\frac{1968750}{12500}\right)$ = Rs. 157.50.

9. For the publisher to earn a profit of 25%, S.P. = 125% of C.P.
Also Transportation Cost = 10% of C.P.
Let the S.P. of 5500 books be Rs. x.

Then, $10 : 125 = 82500 : x \Rightarrow x = \text{Rs.}\left(\frac{125 \times 82500}{10}\right) = \text{Rs. } 1031250.$

$\therefore$ S.P. of one book $= \text{Rs.}\left(\frac{1031250}{5500}\right) = \text{Rs. } 187.50.$

10. Printing Cost of book = 20% of C.P.
Royalty on book = 15% of C.P.
Difference = (20% of C.P.) – (15% of C.P.) = 5% of C.P.

$\therefore$ Percentage difference $= \left(\frac{\text{Difference}}{\text{Printing Cost}} \times 100\right)\%$

$= \left(\frac{5\% \text{ of C.P.}}{20\% \text{ of C.P.}} \times 100\right)\% = 25\%.$

Thus, Royalty on the book is 25% less than the Printing Cost.

11. Percentage of money spent on Tennis $= \left(\frac{45}{360} \times 100\right)\% = 12\frac{1}{2}\%.$

12. Let the total spendings on sports be Rs. x. Then,

Amount spent on Golf $= \text{Rs.}\left(\frac{36}{360} \times x\right) = \text{Rs. } \frac{x}{10}.$

Amount spent on Hockey $= \text{Rs.}\left(\frac{63}{360} \times x\right) = \text{Rs. } \frac{7}{40}x.$

Difference $= \text{Rs.}\left(\frac{7}{40}x - \frac{x}{10}\right) = \text{Rs. } \frac{3x}{40}.$

$\therefore$ Required Percentage $= \left[\left(\frac{3x/40}{x/10}\right) \times 100\right]\% = 75\%.$

13. Let the total spendings on sports be Rs. x. Then,

Amount spent on Cricket $= \text{Rs.}\left(\frac{81}{360} \times x\right) = \text{Rs.}\left(\frac{9}{40}x\right).$

Amount spent on Football $= \text{Rs.}\left(\frac{54}{360} \times x\right) = \text{Rs.}\left(\frac{3}{20}x\right).$

Difference $= \text{Rs.}\left(\frac{9}{40}x - \frac{3}{20}x\right) = \text{Rs. } \frac{3}{40}x.$

$\therefore$ Required Percentage $= \left[\left(\frac{3x/40}{9x/40}\right) \times 100\right]\% = 33\frac{1}{3}\%.$

14. Amount spent on Cricket and Hockey together

$= \text{Rs.}\left[\frac{(81+63)}{360} \times 2\right] \text{crores} = \text{Rs. } 0.8 \text{ crores} = \text{Rs. } 8000000.$

15. Amount spent on Basketball exceeds that on Tennis by :

$\text{Rs.}\left[\frac{(50-45)}{360} \times 18000000\right] = \text{Rs. } 250000.$

16. Required percentage $= \left(\frac{9\% \text{ of } 5700}{8\% \text{ of } 8550} \times 100\right)\% = \left(\frac{9 \times 5700}{8 \times 8550} \times 100\right)\% = 75\%.$

17. Required ratio $= \left(\frac{18\% \text{ of } 5700}{22\% \text{ of } 8550}\right) = \left(\frac{18 \times 5700}{22 \times 8550}\right) = \frac{6}{11}$.

18. Candidates passed from institutes Q and R together

$= [(13\% + 17\%) \text{ of } 5700] = 30\% \text{ of } 5700.$

Candidates enrolled from institutes Q and R together

$= [(15\% + 10\%) \text{ of } 8550] = 25\% \text{ of } 8550.$

$\therefore$ Required Percentage $= \left(\frac{30\% \text{ of } 5700}{25\% \text{ of } 8550} \times 100\right)\% = \left(\frac{30 \times 5700}{25 \times 8550} \times 100\right)\% = 80\%.$

19. The percentage of candidates passed to candidates enrolled can be determined for each institute as under :

(*i*) $P = \left[\left(\frac{18\% \text{ of } 5700}{22\% \text{ of } 8550}\right) \times 100\right]\% = \left[\frac{18 \times 5700}{22 \times 8550} \times 100\right]\% = \left[\frac{18 \times 2}{22 \times 3} \times 100\right]\% = 54.55\%.$

(*ii*) $Q = \left[\left(\frac{17\% \text{ of } 5700}{15\% \text{ of } 8550}\right) \times 100\right]\% = 75.56\%.$

(*iii*) $R = \left[\left(\frac{13\% \text{ of } 5700}{10\% \text{ of } 8550}\right) \times 100\right]\% = 86.67\%.$

(*iv*) $S = \left[\left(\frac{16\% \text{ of } 5700}{17\% \text{ of } 8550}\right) \times 100\right]\% = 62.75\%.$

(*v*) $T = \left[\left(\frac{9\% \text{ of } 5700}{8\% \text{ of } 8550}\right) \times 100\right]\% = 75\%.$

(*vi*) $V = \left[\left(\frac{15\% \text{ of } 5700}{12\% \text{ of } 8550}\right) \times 100\right]\% = 83.33\%.$

(*vii*) $X = \left[\left(\frac{12\% \text{ of } 5700}{16\% \text{ of } 8550}\right) \times 100\right]\% = 50\%.$

Highest of these is 86.67% corresponding to institute R.

20. Required difference $= [(16\% + 18\%) \text{ of } 5700] - [(8\% + 10\%) \text{ of } 8550]$

$= [(34\% \text{ of } 5700) - (18\% \text{ of } 8550)] = (1938 - 1539) = 399.$

21. Part of the body made of neither bones nor skin $= 1 - \left(\frac{1}{6} + \frac{1}{10}\right) = \frac{11}{15}$.

22. Required ratio $= \frac{16\% \text{ of } \frac{1}{3}}{16\% \text{ of } \frac{1}{6}} = \frac{6}{3} = \frac{2}{1}$.

23. Quantity of water in the body of a person weighing 50 kg = (70% of 50) kg = 35 kg.

24. Let the body weight be x kg.

Then, weight of skin protein in the body $= \left[16\% \text{ of } \left(\frac{1}{10} \text{ of } x\right)\right] \text{ kg} = \left(\frac{16}{1000} x\right) \text{ kg}$

$\therefore$ Required percentage $= \left[\frac{\left(\frac{16}{1000} x\right)}{x} \times 100\right]\% = 1.6\%.$

25. Percentage of proteins and other dry elements in the body = (16% + 14%) = 30%

$\therefore$ Central angle corresponding to proteins and other dry elements together

$= 30\% \text{ of } 360° = 108°.$

26. Number of males in U.P. $= \left[\frac{3}{5} \text{ of } (15\% \text{ of } 3276000)\right] = \frac{3}{5} \times \frac{15}{100} \times 3276000 = \mathbf{294840}.$

27. No. of illiterate people in A.P. $= \left[\frac{7}{9} \text{ of } (25\% \text{ of } 3276000)\right] = 637000.$

No. of illiterate people in M.P. $= \left[\frac{4}{5} \text{ of } (20\% \text{ of } 3276000)\right] = 524160.$

Total number $= (637000 + 524160) = 1161160.$

28. Required ratio $= \dfrac{\frac{4}{7} \text{ of } (9\% \text{ of } 3276000)}{\frac{3}{5} \text{ of } (8\% \text{ of } 3276000)} = \dfrac{\left(\frac{4}{7} \times 9\right)}{\left(\frac{3}{5} \times 8\right)} = \left(\frac{4}{7} \times 9 \times \frac{5}{3} \times \frac{1}{8}\right) = \frac{15}{14}.$

29. Number of males in U.P. $= \left[\frac{3}{5} \text{ of } (15\% \text{ of N})\right] = \frac{3}{5} \times \frac{15}{100} \times N = 9 \times \frac{N}{100}$

where N = 3276000.

Number of males in M.P. $= \left[\frac{3}{4} \text{ of } (20\% \text{ of N})\right] = \frac{3}{4} \times \frac{20}{100} \times N = 15 \times \frac{N}{100}.$

Number of males in Goa $= \left[\frac{3}{8} \text{ of } (12\% \text{ of N})\right] = \frac{3}{8} \times \frac{12}{100} \times N = 4.5 \times \frac{N}{100}.$

$\therefore$ Total number of males in these three states $= (9 + 15 + 4.5) \times \frac{N}{100} = \left(28.5 \times \frac{N}{100}\right).$

$\therefore$ Required Percentage $= \left[\dfrac{\left(28.5 \times \frac{N}{100}\right)}{N} \times 100\right]\% = 28.5\%.$

30. Let x be the population of U.P. in 1997. Then,

Population of U.P. in 1998 $= 110\%$ of $x = \frac{110}{100} \times x.$

Also, let y be the population of M.P. in 1997. Then,

Population of M.P. in 1998 $= 112\%$ of $y = \frac{112}{100} \times y.$

Ratio of populations of U.P. and M.P. in 1998 $= \dfrac{\left(\frac{110}{100} \times x\right)}{\left(\frac{112}{100} \times y\right)} = \frac{110x}{112y}.$

From the pie-chart, this ratio is $\frac{15}{20}$.

$\therefore \quad \frac{110x}{112y} = \frac{15}{20} \Rightarrow \frac{x}{y} = \frac{15}{20} \times \frac{112}{110} = \frac{42}{55}.$

Thus, ratio of populations of U.P. and M.P. in 1997 $= x : y = 42 : 55.$

39. LINE-GRAPHS

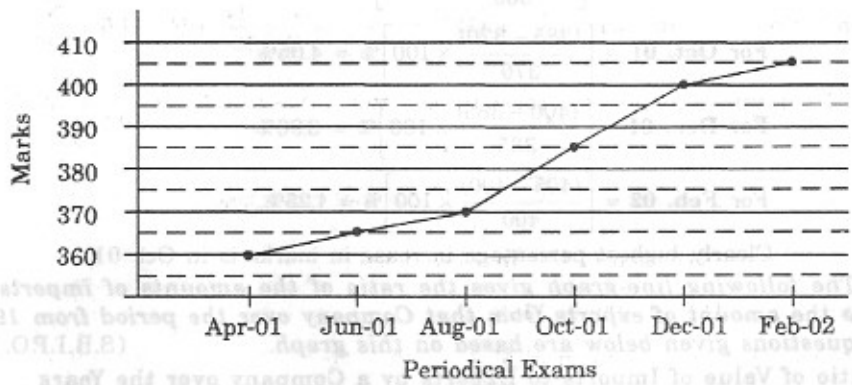
This section comprises of questions in which the data collected in a particular discipline are represented by specific points joined together by straight lines. The points are plotted on a two-dimensional plane taking one parameter on the horizontal axis and the other on the vertical axis. The candidate is required to analyse the given information and thereafter answer the given questions on the basis of the analysis of data.

SOLVED EXAMPLES

Ex. 1. ***In a school the periodical examinations are held every second month. In a session during Apr. 2001 – Mar. 2002, a student of Class IX appeared for each of the periodical exams. The aggregate marks obtained by him in each periodical exam are represented in the line-graph given below. Study the graph and answer the questions based on it.*** (S.B.I.P.O. 2003)

MARKS OBTAINED BY A STUDENT IN SIX PERIODICAL EXAMS HELD IN EVERY TWO MONTHS DURING THE YEAR IN THE SESSION 2001-02

Maximum Total Marks in each Periodical Exam = 500



1. The total number of marks obtained in Feb. 02 is what percent of the total marks obtained in Apr. 01 ?
   (*a*) 110% (*b*) 112.5% (*c*) 115% (*d*) 116.5% (*e*) 117.5%
2. What are the average marks obtained by the student in all the periodical exams during the session ?
   (*a*) 373 (*b*) 379 (*c*) 381 (*d*) 385 (*e*) 389
3. What is the percentage of marks obtained by the student in the periodical exams of Aug. 01 and Oct. 01 taken together ?
   (*a*) 73.25% (*b*) 75.5% (*c*) 77% (*d*) 78.75% (*e*) 79.5%
4. In which periodical exams there is a fall in percentage of marks as compared to the previous periodical exams ?
   (*a*) None (*b*) Jun. 01 (*c*) Oct. 01 (*e*) Feb. 02 (*e*) None of these
5. In which periodical exams did the student obtain the highest percentage increase in marks over the previous periodical exams ?
   (*a*) Jun. 01 (*b*) Aug. 01 (*c*) Oct. 01 (*d*) Dec. 01 (*e*) Feb. 02

Sol. Here it is clear from the graph that the student obtained 360, 365, 370, 385, 400 and 405 marks in periodical exams held in Apr. 01, Jun. 01, Aug. 01, Oct. 01, Dec. 01 and Feb. 02 respectively.

1. (*b*) : Required percentage $= \left(\frac{405}{360} \times 100\right)\% = 112.5\%.$

2. (*c*) : Average marks obtained in all the periodical exams

$= \frac{1}{6} \times [360 + 365 + 370 + 385 + 400 + 405] = 380.83 \approx 381.$

3. (*b*) : Required percentage $= \left[\frac{(370 + 385)}{(500 + 500)} \times 100\right]\% = \left(\frac{755}{1000} \times 100\right)\% = 75.5\%.$

4. (*a*) : As is clear from the graph, the total marks obtained in periodical exams, go on increasing. Since, the maximum marks for all the periodical exams are same, it implies that the percentage of marks also goes on increasing. Thus, in none of the periodical exams, there is a fall in percentage of marks compared to the previous exam.

5. (*c*) : Percentage increase in marks in various periodical exams compared to the previous exams are :

For **Jun. 01** $= \left[\frac{(365 - 360)}{360} \times 100\right]\% = 1.39\%$

For **Aug. 01** $= \left[\frac{(370 - 365)}{365} \times 100\right]\% = 1.37\%$

For **Oct. 01** $= \left[\frac{(385 - 370)}{370} \times 100\right]\% = 4.05\%$

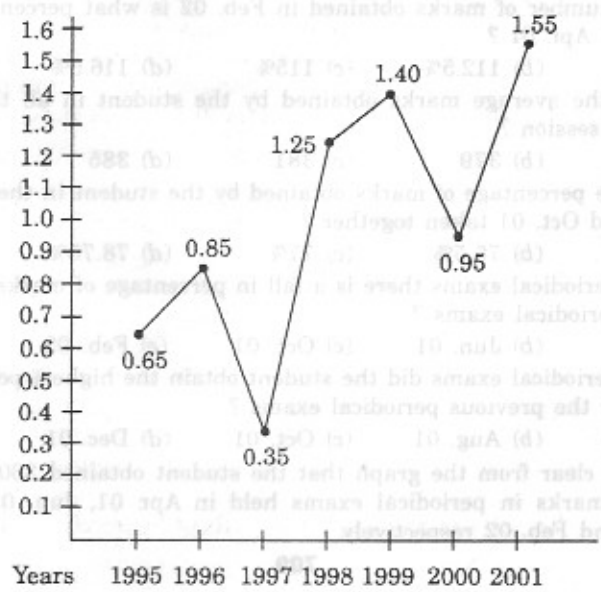
For **Dec. 01** $= \left[\frac{(400 - 385)}{385} \times 100\right]\% = 3.90\%$

For **Feb. 02** $= \left[\frac{(405 - 400)}{400} \times 100\right]\% = 1.25\%.$

Clearly, highest percentage increase in marks is in Oct. 01.

Ex. 2. ***The following line-graph gives the ratio of the amounts of imports by a Company to the amount of exports from that Company over the period from 1995 to 2001. The questions given below are based on this graph.*** **(S.B.I.P.O. 2001)**

Ratio of Value of Imports to Exports by a Company over the Years



1. In how many of the given years were the exports more than the imports ?
(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4 (*e*) None of these

2. The imports were minimum proportionate to the exports of the Company in the year :
(*a*) 1995 (*b*) 1996 (*c*) 1997 (*d*) 2000 (*e*) 2001

3. If the imports of the Company in 1996 was Rs. 272 crores, the exports from the Company in 1996 was :
(*a*) Rs. 370 crores (*b*) Rs. 320 crores (*c*) Rs. 280 crores
(*d*) Rs. 275 crores (*e*) Rs. 264 crores

4. What was the percentage increase in imports from 1997 to 1998 ?
(*a*) 72 (*b*) 56 (*c*) 28 (*d*) None of these (*e*) Data inadequate

5. If the imports in 1998 was Rs. 250 crores and the total exports in the years 1998 and 1999 together was Rs. 500 crores, then the imports in 1999 was :
(*a*) Rs. 250 crores (*b*) Rs. 300 crores (*c*) Rs. 357 crores
(*d*) Rs. 420 crores (*e*) None of these

Sol. 1. (*d*) : The exports are more than the imports implies that the ratio of value of imports to exports is less than 1.

Now, this ratio is less than 1 in the years 1995, 1996, 1997 and 2000.

Thus, there are four such years.

2. (*c*) : The imports are minimum proportionate to the exports implies that the ratio of the value of imports to exports has the minimum value.

Now, this ratio has a minimum value of 0.35 in 1997, *i.e.*, the imports are minimum proportionate to the exports in 1997.

3. (*b*) : Ratio of imports to exports in the year 1996 = 0.85.

Let the exports in 1996 = Rs. x crores.

Then, $\frac{272}{x} = 0.85 \Rightarrow x = \frac{272}{0.85} = 320.$

$\therefore$ Exports in 1996 = Rs. 320 crores.

4. (*e*) : The graph gives only the ratio of imports to exports for different years. To find the percentage increase in imports from 1997 to 1998, we require more details such as the value of imports or exports during these years. Hence, the data is inadequate to answer this question.

5. (*d*) : The ratio of imports to exports for the years 1998 and 1999 are 1.25 and 1.40 respectively.

Let the exports in the year 1998 = Rs. x crores.

Then, the exports in the year 1999 = Rs. $(500 - x)$ crores.

$\therefore \quad 1.25 = \frac{250}{x} \Rightarrow x = \frac{250}{1.25} = 200$ [Using ratio for 1998]

Thus, the exports in the year 1999 = Rs. (500 – 200) crores = Rs. 300 crores.

Let the imports in the year 1999 = Rs. y crores.

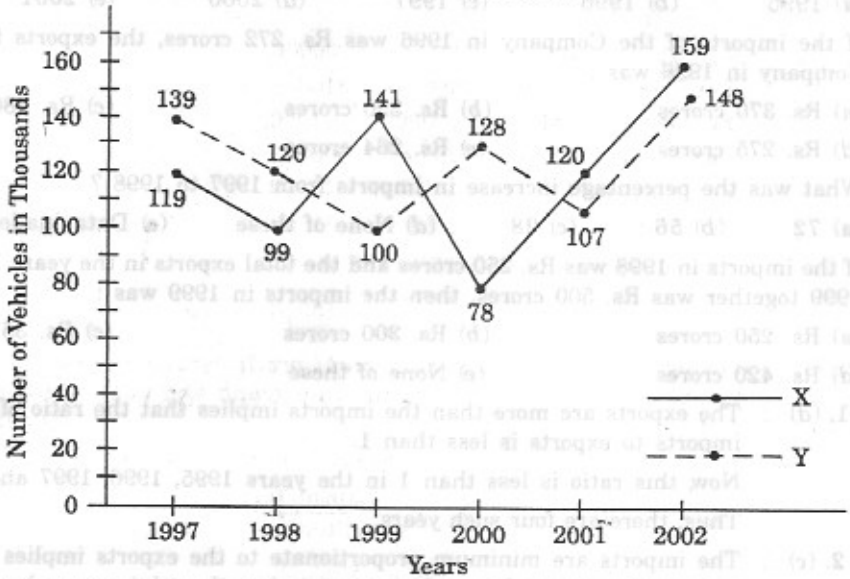
Then, $1.40 = \frac{y}{300} \Rightarrow y = (300 \times 1.40) = 420.$

$\therefore$ Imports in the year 1999 = Rs. 420 crores.

Ex. 3. ***Study the following line-graph and answer the questions based on it.***

(R.B.I. 2003)

Number of Vehicles Manufactured by Two Companies over the Years
(Number in Thousands)



1. What is the difference between the total productions of the two Companies in the given years ?

   (*a*) 19000 (*b*) 22000 (*c*) 26000 (*d*) 28000 (*e*) 29000

2. What is the difference between the numbers of vehicles manufactured by Company Y in 2000 and 2001 ?

   (*a*) 50000 (*b*) 42000 (*c*) 33000 (*d*) 21000 (*e*) 13000

3. What is the average number of vehicles manufactured by Company X over the given period ? (rounded off to the nearest integer)

   (*a*) 119333 (*b*) 113666 (*c*) 112778 (*d*) 111223 (*e*) None of these

4. In which of the following years, the difference between the productions of Companies X and Y was the maximum among the given years ?

   (*a*) 1997 (*b*) 1998 (*c*) 1999 (*d*) 2000 (*e*) 2001

5. The production of Company Y in 2000 was approximately what percent of the production of Company X in the same year ?

   (*a*) 173 (*b*) 164 (*c*) 132 (*d*) 97 (*e*) 61

Sol. From the line-graph it is clear that the productions of Company X in the years 1997, 1998, 1999, 2000, 2001 and 2002 are 119000, 99000, 141000, 78000, 120000 and 159000 respectively and those of Company Y are 139000, 120000, 100000, 128000, 107000 and 148000 respectively.

1. (*c*) : Total production of Company X from 1997 to 2002

   = 119000 + 99000 + 141000 + 78000 + 120000 + 159000 = 716000.

   and total production of Company Y from 1997 to 2002

   = 139000 + 120000 + 100000 + 128000 + 107000 + 148000 = 742000.

   Difference = 742000 − 716000 = 26000.

2. (*d*) : Required difference = 128000 − 107000 = 21000.

3. (*a*) : Average number of vehicles manufactured by Company X

$$= \frac{1}{6} \times (119000 + 99000 + 141000 + 78000 + 120000 + 159000) = 119333.$$

4. (*d*) : The difference between the productions of Companies X and Y in various years are :

For 1997 = (139000 – 119000) = 20000;
For 1998 = (120000 – 99000) = 21000;
For 1999 = (141000 – 100000) = 41000;
For 2000 = (128000 – 78000) = 50000;
For 2001 = (120000 – 107000) = 13000;
For 2002 = (159000 – 148000) = 11000.

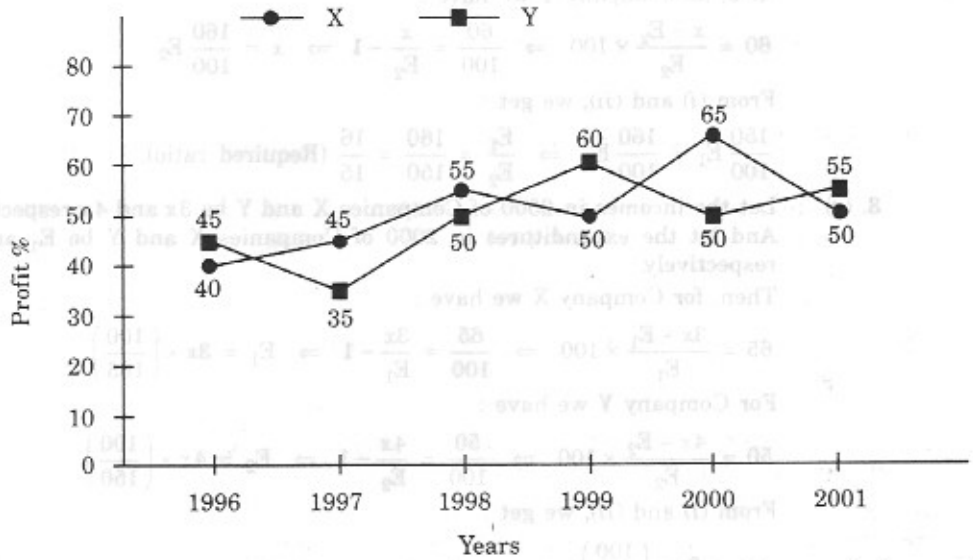
Clearly, maximum difference was in 2000.

5. (*b*) : Required percentage $= \left(\frac{128000}{78000} \times 100\right)\% \approx 164\%.$

Ex. 4. ***The following line-graph gives the percent profit earned by two Companies X and Y during the period 1996 – 2001. Study the line-graph and answer the questions that are based on it.*** **(NABARD, 2002)**

Percentage Profit Earned by Two Companies X and Y over the Given Years

$$\%\text{Profit / Loss} = \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$



1. If the expenditure of Company Y in 1997 was Rs. 220 crores, what was its income in 1997 ?
   (*a*) Rs. 312 crores (*b*) Rs. 297 crores (*c*) Rs. 283 crores
   (*d*) Rs. 275 crores (*e*) Rs. 261 crores
2. If the incomes of the two Companies were equal in 1999, then what was the ratio of expenditure of Company X to that of Company Y in 1999 ?
   (*a*) 6 : 5 (*b*) 5 : 6 (*c*) 11 : 6 (*d*) 16 : 15 (*e*) 15 : 16
3. The incomes of the Companies X and Y in 2000 were in the ratio of 3 : 4 respectively. What was the respective ratio of their expenditures in 2000 ?
   (*a*) 7 : 22 (*b*) 14 : 19 (*c*) 15 : 22 (*d*) 27 : 35 (*e*) 33 : 40

4. If the expenditures of Companies X and Y in 1996 were equal and the total income of the two Companies in 1996 was Rs. 342 crores, what was the total profit of the two Companies together in 1996 ? (Profit = Income – Expenditure)

(*a*) Rs. 240 crores (*b*) Rs. 171 crores (*c*) Rs. 120 crores
(*d*) Rs. 102 crores (*e*) None of these

5. The expenditure of Company X in the year 1998 was Rs. 200 crores and the income of Company X in 1998 was the same as its expenditure in 2001. The income of Company X in 2001 was :

(*a*) Rs. 465 crores (*b*) Rs. 385 crores (*c*) Rs. 335 crores
(*d*) Rs. 295 crores (*e*) Rs. 255 crores

Sol. 1. (*b*) : Profit percent of Company Y in 1997 = 35.

Let the income of Company Y in 1997 be Rs. x crores.

Then, $35 = \frac{x-220}{220} \times 100 \Rightarrow x = 297.$

$\therefore$ Income of Company Y in 1997 = Rs. 297 crores.

2. (*d*) : Let the incomes of each of the two Companies X and Y in 1999 be Rs. x. And let the expenditures of Companies X and Y in 1999 be E_1 and E_2 respectively.

Then, for Company X we have :

$$50 = \frac{x - E_1}{E_1} \times 100 \Rightarrow \frac{50}{100} = \frac{x}{E_1} - 1 \Rightarrow x = \frac{150}{100} E_1 \quad ...(i)$$

Also, for Company Y we have :

$$60 = \frac{x - E_2}{E_2} \times 100 \Rightarrow \frac{60}{100} = \frac{x}{E_2} - 1 \Rightarrow x = \frac{160}{100} E_2 \quad ...(ii)$$

From (*i*) and (*ii*), we get :

$$\frac{150}{100} E_1 = \frac{160}{100} E_2 \Rightarrow \frac{E_1}{E_2} = \frac{160}{150} = \frac{16}{15} \text{ (Required ratio).}$$

3. (*c*) : Let the incomes in 2000 of Companies X and Y be $3x$ and $4x$ respectively. And let the expenditures in 2000 of Companies X and Y be E_1 and E_2 respectively.

Then, for Company X we have :

$$65 = \frac{3x - E_1}{E_1} \times 100 \Rightarrow \frac{65}{100} = \frac{3x}{E_1} - 1 \Rightarrow E_1 = 3x \times \left(\frac{100}{165}\right) \quad ...(i)$$

For Company Y we have :

$$50 = \frac{4x - E_2}{E_2} \times 100 \Rightarrow \frac{50}{100} = \frac{4x}{E_2} - 1 \Rightarrow E_2 = 4x \times \left(\frac{100}{150}\right) \quad ...(ii)$$

From (*i*) and (*ii*), we get :

$$\frac{E_1}{E_2} = \frac{3x \times \left(\frac{100}{165}\right)}{4x \times \left(\frac{100}{150}\right)} = \frac{3 \times 150}{4 \times 165} = \frac{15}{22} \text{ (Required ratio).}$$

4. (*d*) : Let the expenditures of each of the Companies X and Y in 1996 be Rs. x crores. And let the income of Company X in 1996 be Rs. z crores so that the income of Company Y in 1996 = Rs. $(342 - z)$ crores.

Then, for Company X we have :

$$40 = \frac{z - x}{x} \times 100 \Rightarrow \frac{40}{100} = \frac{z}{x} - 1 \Rightarrow x = \frac{100z}{140} \quad ...(i)$$

Also, for Company Y we have :

$$45 = \frac{(342 - z) - x}{x} \times 100 \Rightarrow \frac{45}{100} = \frac{(342 - z)}{x} - 1 \Rightarrow x = \frac{(342 - z) \times 100}{145} \quad ...(ii)$$

From (*i*) and (*ii*), we get :

$$\frac{100z}{140} = \frac{(342 - z) \times 100}{145} \Rightarrow z = 168.$$

Substituting $z = 168$ in (*i*), we get : $x = 120$.

∴ Total expenditure of Companies X and Y in 1996 = $2x$ = Rs. 240 crores.

Total income of Companies X and Y in 1996 = Rs. 342 crores.

∴ Total profit = Rs. (342 – 240) crores = Rs. 102 crores.

5. (*a*) : Let the income of Company X in 1998 be Rs. x crores.

Then, $55 = \frac{x - 200}{200} \times 100 \Rightarrow x = 310.$

∴ Expenditure of Company X in 2001

= Income of Company X in 1998 = Rs. 310 crores.

Let the income of Company X in 2001 be Rs. z crores.

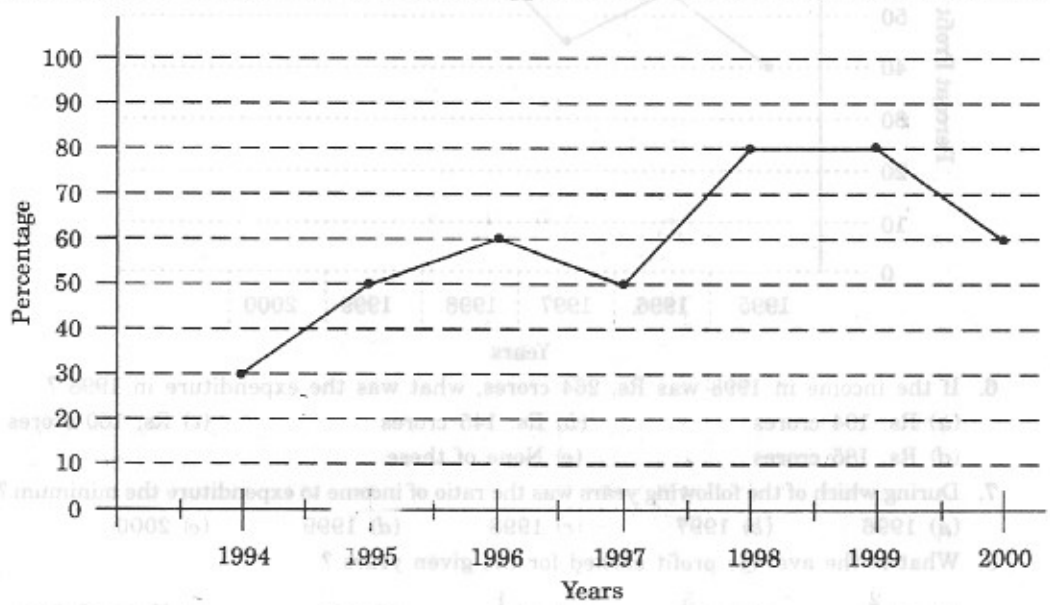
Then, $50 = \frac{z - 310}{310} \times 100 \Rightarrow z = 465.$

∴ Income of Company X in 2001 = Rs. 465 crores.

EXERCISE 39

Directions (Questions 1 to 5) : ***The following line-graph gives the percentage of the number of candidates who qualified an examination out of the total number of candidates who appeared for the examination over a period of seven years from 1994 to 2000. Study the graph and answer the questions based on it.*** **(Bank P.O. 2000)**

Percentage of Candidates Qualified to Appeared in an Examination Over the Years

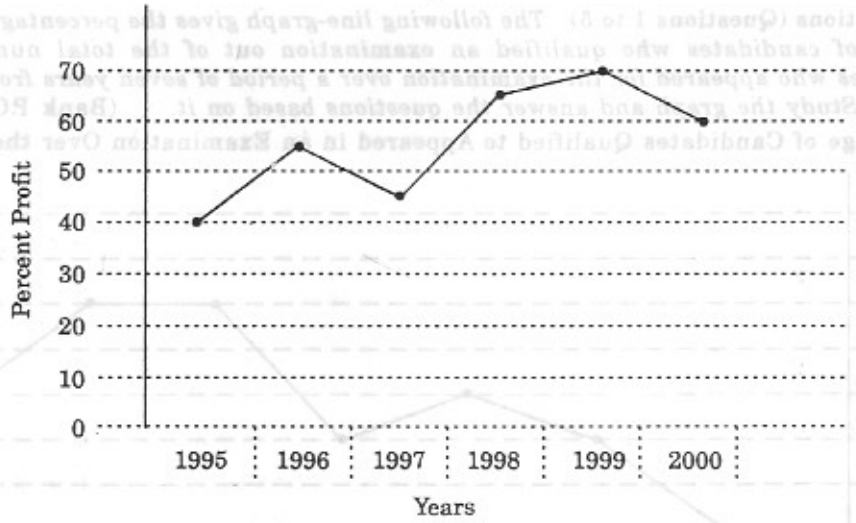


1. The difference between the percentages of candidates qualified to appeared was maximum in which of the following pairs of years ?
   (a) 1994 and 1995 (b) 1997 and 1998 (c) 1998 and 1999
   (d) 1999 and 2000 (e) 1994 and 1997
2. In which pair of years was the number of candidates qualified, the same ?
   (a) 1995 and 1997 (b) 1995 and 2000 (c) 1998 and 1999
   (d) 1996 and 2000 (e) Data inadequate
3. If the number of candidates qualified in 1998 was 21200, what was the number of candidates appeared in 1998 ?
   (a) 32000 (b) 28500 (c) 26500 (d) 25000 (e) 24500
4. If the total number of candidates appeared in 1996 and 1997 together was 47400, then the total number of candidates qualified in these two years together was :
   (a) 34700 (b) 32100 (c) 31500
   (d) None of these (e) Data inadequate
5. The total number of candidates qualified in 1999 and 2000 together was 33500 and the number of candidates appeared in 1999 was 26500. What was the number of candidates appeared in 2000 ?
   (a) 24500 (b) 22000 (c) 20500 (d) 19000 (e) 18500

Directions (Questions 6 to 13) : ***The following line-graph gives the annual percent profit earned by a Company during the period 1995-2000. Study the line-graph and answer the questions that are based on it.*** **(R.B.I. 2003)**

Percent Profit Earned by a Company Over the Years

$$\%\,\text{Profit} = \frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$$



6. If the income in 1998 was Rs. 264 crores, what was the expenditure in 1998 ?
   (a) Rs. 104 crores (b) Rs. 145 crores (c) Rs. 160 crores
   (d) Rs. 185 crores (e) None of these
7. During which of the following years was the ratio of income to expenditure the minimum ?
   (a) 1996 (b) 1997 (c) 1998 (d) 1999 (e) 2000
8. What is the average profit earned for the given years ?
   (a) $50\frac{2}{3}$ (b) $55\frac{5}{6}$ (c) $60\frac{1}{6}$ (d) 335 (e) None of these

9. During which year the ratio of percentage profit earned to that in the previous year is the minimum ?
(*a*) 1996 (*b*) 1997 (*c*) 1998 (*d*) 1999 (*e*) 2000

10. If the expenditures in 1996 and 1999 are equal, then the approximate ratio of the incomes in 1996 and 1999 respectively, is :
(*a*) 1 : 1 (*b*) 2 : 3 (*c*) 9 : 10
(*d*) 13 : 14 (*e*) Cannot be determined

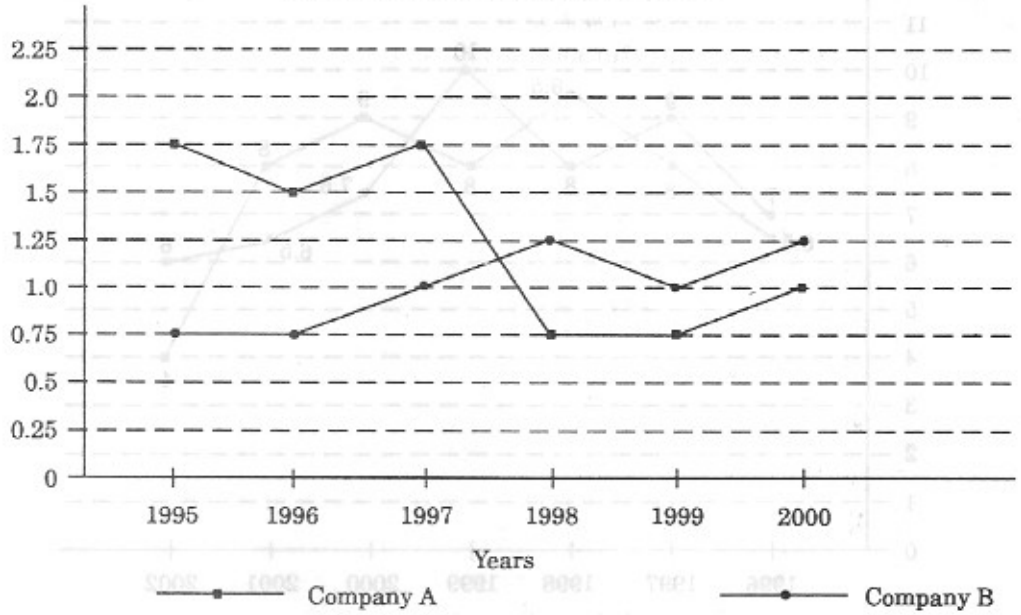
11. If the expenditure in 2000 is 25% more than the expenditure in 1997, then the income in 1997 is what percent less than the income in 2000 ?
(*a*) 22.5% (*b*) 25% (*c*) 27.5% (*d*) 31.25% (*e*) 32.5%

12. If the profit in 1999 was Rs. 4 crores, what was the profit in 2000 ?
(*a*) Rs. 4.2 crores (*b*) Rs. 6.6 crores (*c*) Rs. 6.8 crores
(*d*) Cannot be determined (*e*) None of these

13. In which year is the expenditure minimum ?
(*a*) 2000 (*b*) 1997 (*c*) 1996
(*d*) Cannot be determined (*e*) None of these

Directions (Questions 14 to 18) : *Answer the questions based on the line-graph given below.* **(Bank P.O. 2003)**

Ratio of Exports to Imports (in terms of money in Rs. crores) of Two Companies Over the Years



14. In how many of the given years were the exports more than the imports for Company A ?
(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5 (*e*) 6

15. In which year(s) was the difference between imports and exports of Company B the maximum ?
(*a*) 2000 (*b*) 1996 (*c*) 1998 and 2000
(*d*) Cannot be determined (*e*) None of these

16. If the exports of Company A in 1998 were Rs. 237 crores, what was the amount of imports in that year ?
(*a*) Rs. 189.6 crores (*b*) Rs. 243 crores (*c*) Rs. 281 crores
(*d*) Rs. 316 crores (*e*) None of these

17. If the imports of Company A in 1997 were increased by 40 percent, what would be the ratio of exports to the increased imports ?

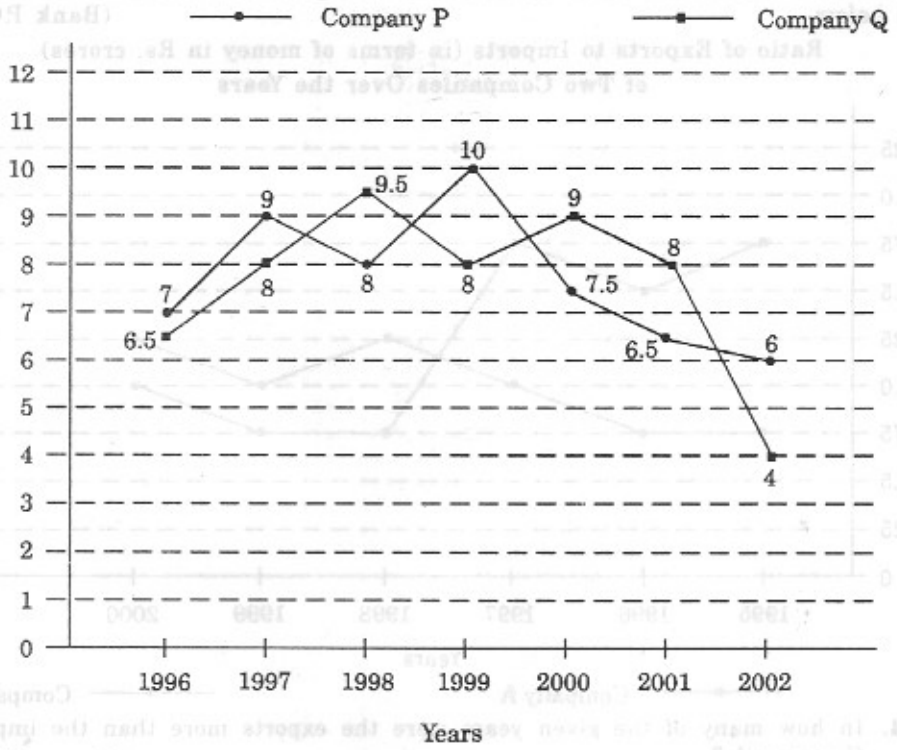
(*a*) 1.20 (*b*) 1.25 (*c*) 1.30
(*d*) None of these (*e*) Cannot be determined

18. In 1995, the export of Company A was double that of Company B. If the imports of Company A during the year was Rs. 180 crores, what was the approximate amount of imports of Company B during that year ?

(*a*) Rs. 190 crores (*b*) Rs. 210 crores (*c*) Rs. 225 crores
(*d*) Cannot be determined (*e*) None of these

Directions (Questions 19 to 23) : ***Two different finance companies declare fixed annual rate of interest on the amounts invested with them by investors. The rate of interest offered by these companies may differ from year to year depending on the variation in the economy of the country and the banks' rate of interest. The annual rate of interest offered by the two Companies P and Q over the years are shown by the line-graph provided below. Answer the questions based on this graph.*** (Bank P.O. 2003)

ANNUAL RATE OF INTEREST OFFERED BY TWO FINANCE COMPANIES OVER THE YEARS



19. If two different amounts in the ratio 8 : 9 are invested in Companies P and Q respectively in 2002, then the amounts received after one year as interests from Companies P and Q are respectively in the ratio :

(*a*) 2 : 3 (*b*) 3 : 4 (*c*) 6 : 7 (*d*) 4 : 3 (*e*) 9 : 8

20. In 2000, a part of Rs. 30 lakhs was invested in Company P and the rest was invested in Company Q for one year. The total interest received was Rs. 2.43 lakhs. What was the amount invested in Company P ?

(*a*) Rs. 9 lakhs (*b*) Rs. 11 lakhs (*c*) Rs. 12 lakhs
(*d*) Rs. 14 lakhs (*e*) Rs. 18 lakhs

21. A sum of Rs. 4.75 lakhs was invested in Company Q in 1999 for one year. How much more interest would have been earned if the sum was invested in Company P ?
(*a*) Rs. 19,000 (*b*) Rs. 14,250 (*c*) Rs. 11,750 (*d*) Rs. 9500 (*e*) Rs. 7500

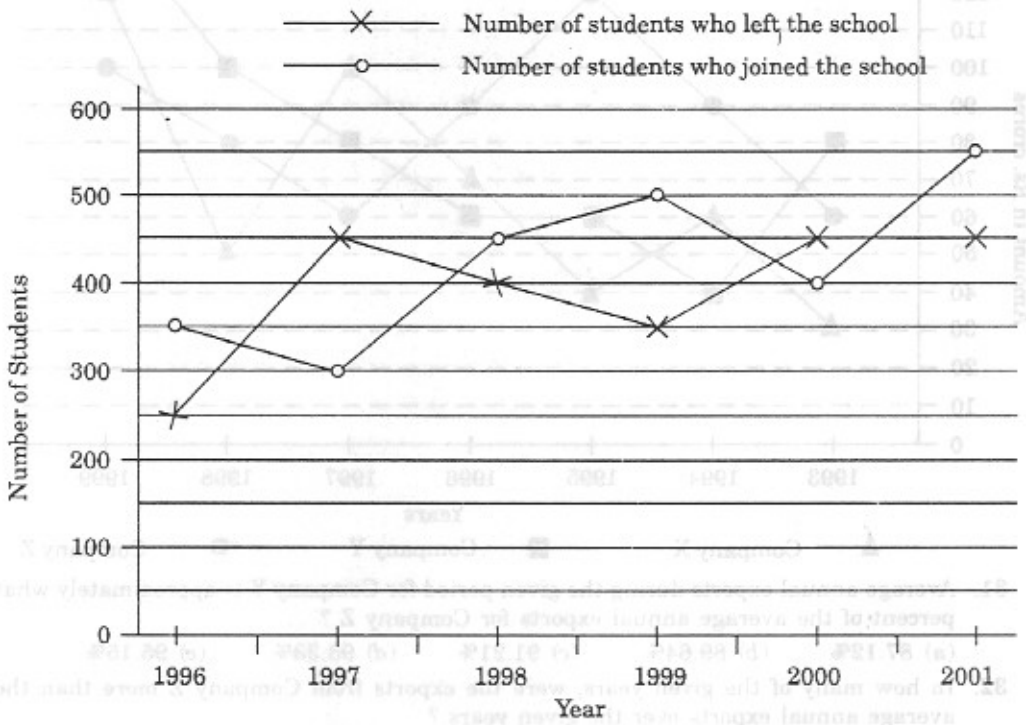
22. An investor invested a sum of Rs. 12 lakhs in Company P in 1998. The total amount received after one year was reinvested in the same Company for one more year. The total appreciation received by the investor on his investment was :
(*a*) Rs. 2,96,200 (*b*) Rs. 2,42,000 (*c*) Rs. 2,25,600
(*d*) Rs. 2,16,000 (*e*) Rs. 2,03,500

23. An investor invested Rs. 5 lakhs in Company Q in 1996. After one year, the entire amount along with the interest was transferred as investment to Company P in 1997 for one year. What amount will be received from Company P, by the investor ?
(*a*) Rs. 5,94,550 (*b*) Rs. 5,80,425 (*c*) Rs. 5,77,800
(*d*) Rs. 5,77,500 (*e*) Rs. 5,75,075

Directions (Questions 24 to 30) : ***Study the following line-graph which gives the number of students who joined and left the school in the beginning of year for six years, from 1996 to 2001.***

Initial strength of the school in 1995 = 3000.

The questions given below the graph are based on this line-graph. (S.B.I.P.O. 2001)



24. The strength of the school increased / decreased from 1997 to 1998 by approximately what percent ?
(*a*) 1.2% (*b*) 1.7% (*c*) 2.1% (*d*) 2.4% (*e*) 2.6%

25. The number of students studying in the school during 1999 was :
(*a*) 2950 (*b*) 3000 (*c*) 3100 (*d*) 3150 (*e*) 3200

26. During which of the following pairs of years, the strength of the school was same ?
(*a*) 1999 and 2001 (*b*) 1998 and 2000 (*c*) 1997 and 1998
(*d*) 1996 and 2000 (*e*) 1999 and 2000

27. The number of students studying in the school in 1998 was what percent of the number of students studying in the school in 2001 ?

(*a*) 92.13% (*b*) 93.75% (*c*) 96.88% (*d*) 97.25% (*e*) 99%

28. Among the given years, the largest number of students joined the school in the year :

(*a*) 1996 (*b*) 1998 (*c*) 1999 (*d*) 2000 (*e*) 2001

29. For which year, the percentage rise / fall in the number of students who left the school compared to the previous year is maximum ?

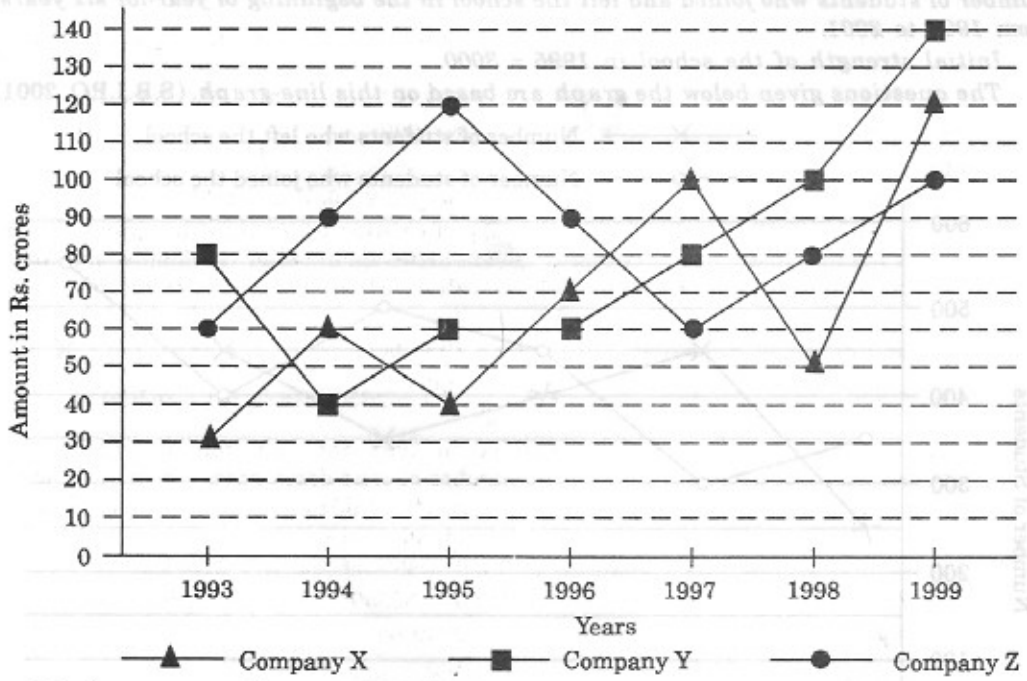
(*a*) 1997 (*b*) 1998 (*c*) 1999 (*d*) 2000 (*e*) 2001

30. The ratio of the least number of students who joined the school to the maximum number of students who left the school in any of the years during the given period is :

(*a*) 7 : 9 (*b*) 4 : 5 (*c*) 3 : 4 (*d*) 9 : 11 (*e*) 2 : 3

Directions (Questions 31 to 35) : ***Study the following graph and answer the questions based on it.*** (S.B.I.P.O. 2000)

Exports from Three Companies Over the Years (in Crore Rs.)



31. Average annual exports during the given period for Company Y is approximately what percent of the average annual exports for Company Z ?

(*a*) 87.12% (*b*) 89.64% (*c*) 91.21% (*d*) 93.33% (*e*) 95.15%

32. In how many of the given years, were the exports from Company Z more than the average annual exports over the given years ?

(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 5 (*e*) 6

33. What was the difference between the average exports of the three Companies in 1993 and the average exports in 1998 ?

(*a*) Rs. 15.33 crores (*b*) Rs. 18.67 crores (*c*) Rs. 20 crores
(*d*) Rs. 22.17 crores (*e*) Rs. 25 crores

34. In which year was the difference between the exports from Companies X and Y the minimum ?

(*a*) 1994 (*b*) 1995 (*c*) 1996 (*d*) 1997 (*e*) None of these

35. For which of the following pairs of years the total exports from the three Companies together are equal ?
(*a*) 1995 and 1998 (*b*) 1996 and 1998 (*c*) 1997 and 1998
(*d*) 1995 and 1996 (*e*) 1993 and 1994

ANSWERS

1. (*b*)	2. (*e*)	3. (*c*)	4. (*e*)	5. (*c*)	6. (*c*)	7. (*b*)	8. (*b*)	9. (*b*)
10. (*a*)	11. (*c*)	12. (*d*)	13. (*d*)	14. (*b*)	15. (*d*)	16. (*d*)	17. (*b*)	18. (*b*)
19. (*d*)	20. (*e*)	21. (*d*)	22. (*c*)	23. (*b*)	24. (*b*)	25. (*d*)	26. (*d*)	27. (*b*)
28. (*e*)	29. (*a*)	30. (*e*)	31. (*d*)	32. (*c*)	33. (*c*)	34. (*c*)	35. (*d*)	

SOLUTIONS

1. The differences between the percentages of candidates qualified to appeared for the given pairs of years are :
For *1994 and 1995* = 50 – 30 = 20; For *1997 and 1998* = 80 – 50 = 30;
For *1998 and 1999* = 80 – 80 = 0; For *1999 and 2000* = 80 – 60 = 20;
For *1994 and 1997* = 50 – 30 = 20.
Thus, the maximum difference is between the years 1997 and 1998.
2. The graph gives the data for the percentage of candidates qualified to appeared and unless the absolute values of number of candidates qualified or candidates appeared is known we cannot compare the absolute values for any two years. Hence, the data is inadequate to solve this question.
3. Let the number of candidates appeared in 1998 be x.
Then, 80% of x = 21200 $\Rightarrow$ $x = \dfrac{21200 \times 100}{80}$ = 26500 (required number).
4. The total number of candidates qualified in 1996 and 1997 together, cannot be determined until we know at least, the number of candidates appeared in any one of the two years 1996 or 1997 or the percentage of candidates qualified to appeared in 1996 and 1997 together. Hence, the data is inadequate.
5. The number of candidates qualified in 1999 = 80% of 26500 = 21200.
$\therefore$ Number of candidates qualified in 2000 = 33500 – 21200 = 12300.
Let the number of candidates appeared in 2000 be x.
Then, 60% of x = 12300 $\Rightarrow$ $x = \dfrac{12300 \times 100}{60}$ = 20500.
6. Let the expenditure in 1998 be Rs. x crores.
Then, $65 = \dfrac{264 - x}{x} \times 100 \Rightarrow \dfrac{65}{100} = \dfrac{264}{x} - 1 \Rightarrow x = \dfrac{264 \times 100}{165} = 160.$
$\therefore$ Expenditure in 1998 = Rs. 160 crores.
7. It is given that : $\%\text{Profit} = \dfrac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$
$\Rightarrow \dfrac{\%\text{Profit}}{100} = \dfrac{\text{Income}}{\text{Expenditure}} - 1 \Rightarrow \dfrac{\text{Income}}{\text{Expenditure}} = \dfrac{\%\text{Profit}}{100} + 1.$
From this it is clear that the ratio of income to expenditure is minimum for the year in which the % profit has the minimum value. Since, out of the given years (*i.e.*, out of 1996, 1997, 1998, 1999 and 2000), the Company has the minimum % profit in the year 1997, so the minimum ratio of income to expenditure is in the year 1997.

8. Average percent profit earned for the given years

$$= \frac{1}{6} \times [40 + 55 + 45 + 65 + 70 + 60] = \frac{335}{6} = 55\frac{5}{6}.$$

9. The ratio of percentage profit earned to that in the previous year, for different years are :

For 1996 $= \frac{55}{40} = 1.38$; **For 1997** $= \frac{45}{55} = 0.82$; **For 1998** $= \frac{65}{45} = 1.44$;

For 1999 $= \frac{70}{65} = 1.08$; **For 2000** $= \frac{60}{70} = 0.86$.

Clearly, this ratio is minimum for 1997.

10. Let the expenditure in 1996 = expenditure in 1999 = x.

Also, let the incomes in 1996 and 1999 be I_1 and I_2 respectively.

Then, for the year 1996, we have :

$$55 = \frac{I_1 - x}{x} \times 100 \Rightarrow \frac{55}{100} = \frac{I_1}{x} - 1 \Rightarrow I_1 = \frac{155x}{100} \quad ...(i)$$

And, for the year 1999, we have :

$$70 = \frac{I_2 - x}{x} \times 100 \Rightarrow \frac{70}{100} = \frac{I_2}{x} - 1 \Rightarrow I_2 = \frac{170x}{100} \quad ...(ii)$$

From (*i*) and (*ii*), we get :

$$\frac{I_1}{I_2} = \frac{\left(\frac{155x}{100}\right)}{\left(\frac{170x}{100}\right)} = \frac{155}{170} = \frac{0.91}{1} \approx 9 : 10.$$

11. Let the expenditure in 1997 be x.

Then, expenditure in 2000 $= x + (25\% \text{ of } x) = \frac{5}{4}x$.

Also, let the incomes in 1997 and 2000 be I_1 and I_2 respectively.

Then, for the year 1997, we have :

$$45 = \frac{I_1 - x}{x} \times 100 \Rightarrow \frac{45}{100} = \frac{I_1}{x} - 1 \Rightarrow I_1 = \frac{145x}{100} = 1.45x.$$

Also, for the year 2000, we have :

$$60 = \frac{\left(I_2 - \frac{5}{4}x\right)}{\left(\frac{5}{4}x\right)} \times 100 \Rightarrow \frac{60}{100} = \frac{4I_2}{5x} - 1 \Rightarrow I_2 = \frac{160}{100} \times \frac{5x}{4} = 2x.$$

Difference between the two incomes $= (2x - 1.45x) = 0.55x$.

$\therefore$ Percentage by which I_1 is less than $I_2 = \left(\frac{0.55x}{2x} \times 100\right)\% = 27.5\%$.

12. From the line-graph we obtain information about the percentage profit only. To find the profit in 2000 we must have the data for the income or expenditure in 2000. Therefore, the profit for 2000 cannot be determined.

13. The line-graph gives the comparison of percent profit for different years but the comparison of the expenditures is not possible without more data. Therefore, the year with minimum expenditure cannot be determined.

14. The exports are more than the imports in those years for which the exports to imports ratio is more than 1. For Company A, such years are 1995, 1996 and 1997. Thus, during these 3 years, the exports are more than the imports for Company A.

15. We shall try to find the difference between the imports and exports of Company B for various years one by one :

For 1995 : We have

$\frac{E}{I} = 0.75$ (where E = amount of exports and I = amount of imports in 1995)

$\Rightarrow$ E = 0.75I $\therefore$ I − E = I − 0.75I = 0.25I.

Thus, the difference between the imports and exports of Company B in 1995 is dependent on the amount of imports of Company B in 1995.

Similarly, the difference for other years can be determined only if the amount of imports for these years are known. Since the imports or exports for various years are not known, the differences between imports and exports for various years cannot be determined.

16. Let the amount of imports of Company A in 1998 be Rs. x crores.

Then, $\frac{237}{x} = 0.75 \Rightarrow x = \frac{237}{0.75} = 316.$

$\therefore$ Amount of imports of Company A in 1998 = Rs. 316 crores.

17. In 1997 for Company A we have :

$\frac{E}{I} = 1.75$ *i.e.*, E = 1.75I ...(*i*)

[where E = amount of exports and I = amount of imports of Company A in 1997]

Now, the required imports I_1 = I + 40% of I = 1.4I.

$\therefore$ Required ratio = $\frac{E}{I_1} = \frac{1.75I}{1.4I} = 1.25.$

18. In 1995 for Company A we have :

$\frac{E_A}{I_A} = 1.75$ ...(*i*) [where E_A = amount of exports and I_A = amount of imports of Company A in 1995]

In 1995 for Company B we have :

$\frac{E_B}{I_B} = 0.75$ ...(*ii*) [where E_B = amount of exports and I_B = amount of imports of Company B in 1995]

Also, we have $E_A = 2E_B$ ...(*iii*)

Substituting I_A = Rs. 180 crores (given) in (*i*), we get

E_A = Rs. (180 × 1.75) crores = Rs. 315 crores.

Using E_A = Rs. 315 crores in (*iii*), we get : $E_B = \frac{E_A}{2}$ = Rs. $\left(\frac{315}{2}\right)$ crores.

Substituting E_B = Rs. $\left(\frac{315}{2}\right)$ crores in (*ii*), we get :

$I_B = \frac{E_B}{0.75}$ = Rs. $\left(\frac{315}{2 \times 0.75}\right)$ crores = Rs. 210 crores.

i.e., amount of imports of Company B in 1995 = Rs. 210 crores.

19. Let the amounts invested in 2002 in Companies P and Q be Rs. $8x$ and Rs. $9x$ respectively.

Then, interest received after one year from Company P

= Rs. (6% of $8x$) = Rs. $\frac{48}{100}x$

and interest received after one year from Company Q

$$= \text{Rs. } (4\% \text{ of } 9x) = \text{Rs. } \frac{36}{100}x.$$

$$\therefore \quad \text{Required ratio} = \frac{\left(\frac{48}{100}x\right)}{\left(\frac{36}{100}x\right)} = \frac{4}{3}.$$

20. Let Rs. x lakhs be invested in Company P in 2000, then amount invested in Company Q in 2000 = Rs. $(30 - x)$ lakhs.

Total interest received from the two Companies after 1 year

$$= \text{Rs. } [(7.5\% \text{ of } x) + \{9\% \text{ of } (30 - x)\}] \text{ lakhs} = \text{Rs. } \left[2.7 - \left(\frac{1.5x}{100}\right)\right] \text{ lakhs.}$$

$$\therefore \quad \left[2.7 - \left(\frac{1.5x}{100}\right)\right] = 2.43 \Rightarrow x = 18.$$

i.e., amount invested in Company P = Rs. 18 lakhs.

21. Difference = Rs. [(10% of 4.75) – (8% of 4.75)] lakhs

= Rs. (2% of 4.75) lakhs = Rs. 0.095 lakhs = Rs. 9500.

22. Amount received from Company P after one year (*i.e.*, in 1999) on investing Rs. 12 lakhs in it = Rs. [12 + (8% of 12)] lakhs = Rs. 12.96 lakhs.

Amount received from Company P after one year on investing Rs. 12.96 lakhs in the year 1999 = Rs. [12.96 + (10% of 12.96)] lakhs = Rs. 14.256 lakhs.

Appreciation received on investment during the period of two years

= Rs. (14.256 – 12) lakhs = Rs. 2.256 lakhs = Rs. 2,25,600.

23. Amount received from Company Q after one year on investment of Rs. 5 lakhs in the year 1996 = Rs. [5 + (6.5% of 5)] lakhs = Rs. 5.325 lakhs.

Amount received from Company P after one year on investment of Rs. 5.325 lakhs in the year 1997 = Rs. [5.325 + (9% of 5.325)] lakhs = Rs. 5.80425 lakhs = Rs. 5,80,425.

Questions 24 to 30 :

Before solving the questions, we shall analyse the graph :

From the graph it is clear that :

In 1996 : Number of students left = 250 and number of students joined = 350.

In 1997 : Number of students left = 450 and number of students joined = 300.

In 1998 : Number of students left = 400 and number of students joined = 450.

In 1999 : Number of students left = 350 and number of students joined = 500.

In 2000 : Number of students left = 450 and number of students joined = 400.

In 2001 : Number of students left = 450 and number of students joined = 550.

Therefore, the numbers of students studying in the school (*i.e.*, strength of the school) in various years :

In 1995 = 3000 (given); **In 1996** = 3000 – 250 + 350 = 3100;

In 1997 = 3100 – 450 + 300 = 2950; **In 1998** = 2950 – 400 + 450 = 3000;

In 1999 = 3000 – 350 + 500 = 3150; **In 2000** = 3150 – 450 + 400 = 3100;

In 2001 = 3100 – 450 + 550 = 3200.

Now, we shall solve the questions.

24. Percentage increase in the strength of the school from 1997 to 1998

$$= \left[\frac{(3000 - 2950)}{2950} \times 100\right]\% = 1.69\% \approx 1.7\%.$$

25. As calculated above, the number of students studying in the school during 1999 = 3150.

26. As calculated above, in the years 1996 and 2000 the strength of the school was same *i.e.*, 3100.

27. Using the calculations above we have :

$$\text{Required percentage} = \left(\frac{3000}{3200} \times 100\right)\% = 93.75\%.$$

28. As calculated above, the largest number of students (*i.e.*, 550) joined the school in the year 2001.

29. The percentage rise / fall in the number of students who left the school (compared to the previous year) during various years are :

$$\textbf{For 1997} = \left[\frac{(450-250)}{250} \times 100\right]\% = 80\% \text{ (rise);}$$

$$\textbf{For 1998} = \left[\frac{(450-400)}{450} \times 100\right]\% = 11.11\% \text{ (fall);}$$

$$\textbf{For 1999} = \left[\frac{(400-350)}{400} \times 100\right]\% = 12.5\% \text{ (fall);}$$

$$\textbf{For 2000} = \left[\frac{(450-350)}{350} \times 100\right]\% = 28.57\% \text{ (rise);}$$

$$\textbf{For 2001} = \left[\frac{(450-450)}{450} \times 100\right]\% = 0\%.$$

Clearly, the maximum percentage rise / fall is for 1997.

30. Using the calculations above we get :

$$\text{Required ratio} = \frac{300}{450} = \frac{2}{3}.$$

Questions 31 to 35 :

Analysis of the graph : From the graph it is clear that

(*i*) The amount of exports of Company X (in crore Rs.) in the years 1993, 1994, 1995, 1996, 1997, 1998 and 1999 are 30, 60, 40, 70, 100, 50 and 120 respectively.

(*ii*) The amount of exports of Company Y (in crore Rs.) in the years 1993, 1994, 1995, 1996, 1997, 1998 and 1999 are 80, 40, 60, 60, 80, 100 and 140 respectively.

(*iii*) The amount of exports of Company Z (in crore Rs.) in the years 1993, 1994, 1995, 1996, 1997, 1998 and 1999 are 60, 90, 120, 90, 60, 80 and 100 respectively.

31. Average annual exports (in Rs. crore) of Company Y during the given period

$$= \frac{1}{7} \times (80 + 40 + 60 + 60 + 80 + 100 + 140) = \frac{560}{7} = 80.$$

Average annual exports (in Rs. crore) of Company Z during the given period

$$= \frac{1}{7} \times (60 + 90 + 120 + 90 + 60 + 80 + 100) = \left(\frac{600}{7}\right).$$

$$\therefore \quad \text{Required percentage} = \left[\frac{80}{\left(\frac{600}{7}\right)} \times 100\right]\% = 93.33\%.$$

32. Average annual exports of Company Z during the given period

$$= \text{Rs.}\left[\frac{1}{7} \times (60 + 90 + 120 + 90 + 60 + 80 + 100)\right] \text{ crores} = \text{Rs.}\left(\frac{600}{7}\right) \text{ crores}$$

$$= \text{Rs. } 85.71 \text{ crores.}$$

From the analysis of graph the exports of Company Z are more than the average annual exports of Company Z (*i.e.*, Rs. 85.71 crores) during the years 1994, 1995, 1996 and 1999, *i.e.*, during 4 of the given years.

33. Average exports of the three Companies X, Y and Z in 1993

$$= \text{Rs.}\left[\frac{1}{3}\times(30+80+60)\right]\text{ crores} = \text{Rs.}\left(\frac{170}{3}\right)\text{ crores.}$$

Average exports of the three Companies X, Y and Z in 1998

$$= \text{Rs.}\left[\frac{1}{3}\times(50+100+80)\right]\text{ crores} = \text{Rs.}\left(\frac{230}{3}\right)\text{ crores.}$$

$$\text{Difference} = \text{Rs.}\left[\left(\frac{230}{3}\right)-\left(\frac{170}{3}\right)\right]\text{ crores} = \text{Rs.}\left(\frac{60}{3}\right)\text{ crores} = \text{Rs. 20 crores.}$$

34. The differences between the exports from the Companies X and Y during various years are :

In **1993** = Rs. (80 – 30) crores = Rs. 50 crores;
In **1994** = Rs. (60 – 40) crores = Rs. 20 crores;
In **1995** = Rs. (60 – 40) crores = Rs. 20 crores;
In **1996** = Rs. (70 – 60) crores = Rs. 10 crores;
In **1997** = Rs. (100 – 80) crores = Rs. 20 crores;
In **1998** = Rs. (100 – 50) crores = Rs. 50 crores;
In **1999** = Rs. (140 – 120) crores = Rs. 20 crores.

Clearly, the difference is minimum in the year 1996.

35. Total exports of the three Companies X, Y and Z together, during various years are :

In **1993** = Rs. (30 + 80 + 60) crores = Rs. 170 crores.
In **1994** = Rs. (60 + 40 + 90) crores = Rs. 190 crores.
In **1995** = Rs. (40 + 60 + 120) crores = Rs. 220 crores.
In **1996** = Rs. (70 + 60 + 90) crores = Rs. 220 crores.
In **1997** = Rs. (100 + 80 + 60) crores = Rs. 240 crores.
In **1998** = Rs. (50 + 100 + 80) crores = Rs. 230 crores.
In **1999** = Rs. (120 + 140 + 100) crores = Rs. 360 crores.

Clearly, the total exports of the three Companies X, Y and Z together are same during the years 1995 and 1996.

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