Index Numbers

EXERCISE 5.1 [PAGES 77 - 78]

Exercise 5.1 | Q 1.01 | Page 77

Find the Price Index Number using Simple Aggregate Method in the following example.

Use 1995 as base year in the following problem.

Commodity	P	Q	R	S	T
Price (in ₹) in 1995	15	20	24	22	28
Price (in ₹) in 2000	27	38	32	40	45

Solution:

Commodity	**Price in 1995 (Base year) p_0**	**Price in 2000 (Current year)p_1**
P	15	27
Q	20	38
R	24	32
S	22	40
T	28	45
Total	109	180

From the table, $\sum p_0 = 109$, $\sum p_1 = 182$

$$\text{Price Index Number } (P_{01}) = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{182}{109} \times 100$$

$$= 166.97$$

Exercise 5.1 | Q 1.02 | Page 77

Find the Price Index Number using Simple Aggregate Method in the following example.

Use 1995 as base year in the following problem.

Commodity	A	B	C	D	E

Price (in ₹) in 1995	42	30	54	70	120
Price (in ₹) in 2005	60	55	74	110	140

Solution:

Commodity	Price in 1995 (Base year) p_0	Price in 2005 (Current year)p_1
A	42	60
B	30	55
C	54	74
D	70	110
E	120	140
Total	316	439

From the table, $\sum p_0 = 316$, $\sum p_1 = 439$

$$\text{Price Index Number } (P_{01}) = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{439}{316} \times 100$$

$$= 138.92$$

Exercise 5.1 | Q 1.03 | Page 77

Find the Price Index Number using Simple Aggregate Method in the following example.

Commodity	Unit	Base Year Price (in ₹)	Current Year Price (in ₹)
Wheat	kg	28	36
Rice	kg	40	56
Milk	litre	35	45
Clothing	meter	82	104
Fuel	litre	58	72

Solution:

Commodity	Unit	Base Year Price (in ₹)	Current Year Price (in ₹)
Wheat	kg	28	36
Rice	kg	40	56

Milk	litre	35	45
Clothing	meter	82	104
Fuel	litre	58	72
Total		243	313

From the table, $\sum p_0 = 243$, $\sum p_1 = 313$

$$\text{Price Index Number } (P_{01}) = \frac{\sum P_1}{\sum P_0} \times 100$$

$$= \frac{313}{243} \times 100$$

$$= 128.81$$

Exercise 5.1 | Q 1.04 | Page 77

Find the Price Index Number using the Simple Aggregate Method in the following example.

Use 2000 as base year in the following problem.

Commodity	Price (in ₹) for year 2000	Price (in ₹) for year 2006
Watch	900	1475
Shoes	1760	2300
Sunglasses	600	1040
Mobile	4500	8500

Solution:

Commodity	Price (in ₹) for year 2000	Price (in ₹) for year 2006
Watch	900	1475
Shoes	1760	2300
Sunglasses	600	1040
Mobile	4500	8500
Total	7760	13315

From the table, $\sum p_0 = 7760$, $\sum p_1 = 13315$

$$\text{Price Index Number } (P_{01}) = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{13,315}{7,760} \times 100$$

$$= 171.59$$

Exercise 5.1 | Q 1.05 | Page 77

Find the Price Index Number using the Simple Aggregate Method in the following example.

Use 1990 as base year in the following problem.

Commodity	Unit	Price (in ₹) for year 2000	Price (in ₹) for year 2006
Butter	kg	27	33
Cheese	kg	30	36
Milk	litre	25	29
Bread	loaf	10	14
Eggs	doz	24	36
Ghee	tin	250	320

Solution:

Commodity	Unit	Price (in ₹) for year 2000	Price (in ₹) for year 2006
Butter	kg	27	33
Cheese	kg	30	36
Milk	litre	25	29
Bread	loaf	10	14
Eggs	doz	24	36
Ghee	tin	250	320
Total		366	468

From the table, $\sum p_0 = 366$, $\sum p_1 = 468$

$$\text{Price Index Number } (P_{01}) = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{468}{366} \times 100$$

$$= 127.87$$

Exercise 5.1 | Q 1.06 | Page 78

Find the Price Index Number using the Simple Aggregate Method in the following example.

Assume 2000 to be base year in the following problem.

Fruit	Unit	Price (in ₹) in 2000	Price (in ₹) for 2007
Mango	doz	250	300
Banana	doz	12	24
Apple	kg	80	110
Peach	kg	75	90
Orange	doz	36	65
Sweet Lime	doz	30	45

Solution:

Fruit	Unit	Price in 2000 (Base year) p_0	Price in 2007 (current year) p_1
Mango	doz	250	300
Banana	doz	12	24
Apple	kg	80	110
Peach	kg	75	90
Orange	doz	36	65
Sweet Lime	doz	30	45
Total		483	634

From the table, $\sum p_0 = 483$, $\sum p_1 = 634$

$$\text{Price Index Number } (P_{01}) = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{634}{483} \times 100$$

$$= 131.26$$

Exercise 5.1 | Q 1.07 | Page 78

Find the Price Index Number using the Simple Aggregate Method in the following example.

Use 2005 as base year in the following problem.

Vegetable	Unit	Price (in ₹) in 2005	Price (in ₹) for 2012
Ladies Finger	kg	32	38
Capsicum	kg	30	36
Brinjal	kg	40	60
Tomato	kg	40	62
Potato	kg	16	28

Solution:

Vegetable	Unit	Price in 2005 (Base year) p_0	Price in 2012 (Current year) p_1
Ladies Finger	kg	32	38
Capsicum	kg	30	36
Brinjal	kg	40	60
Tomato	kg	40	62
Potato	kg	16	28
Total		158	224

From the table, $\sum p_0 = 158$, $\sum p_1 = 224$

$$\text{Price Index Number } (P_{01}) = \frac{\sum p_1}{\sum p_0} \times 100$$

$$= \frac{224}{158} \times 100$$

$$= 141.77$$

Exercise 5.1 | Q 1.08 | Page 78

Find the Quantity Index Number using the Simple Aggregate Method in the following example.

Commodity	I	II	III	IV	V
Base Year Quantities	140	120	100	200	225

Current Year Quantities	100	80	70	150	185

Solution:

Commodity	Base Year Quantities q_0	Current Year Quantities q_1
I	140	100
II	120	80
III	100	70
IV	200	150
V	225	185
Total	785	585

From the table, $\sum q_0 = 785$, $\sum q_1 = 585$

$$\text{Price Index Number } (Q_{01}) = \frac{\sum q_1}{\sum q_0} \times 100$$

$$= \frac{585}{785} \times 100$$

$$= 74.52$$

Exercise 5.1 | Q 1.09 | Page 78

Find the Quantity Index Number using the Simple Aggregate Method in the following example.

Commodity	A	B	C	D	E
Base Year Quantities	360	280	340	160	260
Current Year Quantities	440	320	470	210	300

Solution:

Commodity	Base Year Quantities q_0	Current Year Quantities q_1
A	360	440
B	280	320
C	340	470
D	160	210

E	260	300
Total	1400	1740

From the table, $\sum q_0 = 1400$, $\sum q_1 = 1740$

$$\text{Price Index Number } (Q_{01}) = \frac{\sum q_1}{\sum q_0} \times 100$$

$$= \frac{1740}{1400} \times 100$$

$$= 124.29$$

Exercise 5.1 | Q 1.1 | Page 78

Find the Value Index Number using Simple Aggregate Method in the following example.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	30	22	40	18
B	40	16	60	12
C	10	38	15	24
D	50	12	60	16
E	20	28	25	36

Solution:

Commodity	**Base year**		**Current year**		p_0q_0	p_1q_1
	p_0	q_0	p_1	q_1		
A	30	22	40	18	660	720
B	40	16	60	12	640	720
C	10	38	15	24	380	360
D	50	12	60	16	600	960
E	20	28	25	36	560	900

Total	-	-	-	-	2840	3660

From the table, $\sum p_0q_0 = 2840, \sum p_1q_1 = 3660$

Value Index Number $(V_{01}) = \frac{\sum p_1q_1}{\sum p_0q_0} \times 100$

$= \frac{3660}{2840} \times 100$

$= 128.87$

Exercise 5.1 | Q 1.11 | Page 78

Find the Value Index Number using Simple Aggregate Method in the following example.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	50	22	70	14
B	70	16	90	22
C	60	18	105	14
D	120	12	140	15
E	100	22	155	28

Solution:

Commodity	**Base year**		**Current year**		p_0q_0	p_1q_1
	p_0	q_0	p_1	q_1		
A	50	22	70	14	1100	980
B	70	16	90	22	1120	1980
C	60	18	105	14	1080	1470
D	120	12	140	15	1440	2100
E	100	22	155	28	2200	4340
Total	-	-	-	-	6940	10870

From the table, $\sum p_0q_0 = 6940, \sum p_1q_1 = 10870$

Value Index Number $(V_{01}) = \frac{\sum p_1q_1}{\sum p_0q_0} \times 100$

$= \frac{10870}{6940} \times 100$

$= 156.63$

Exercise 5.1 | Q 1.12 | Page 78

Find x if the Price Index Number by Simple Aggregate Method is 125.

Commodity	P	Q	R	S	T
Base Year Price (in ₹)	8	12	16	22	18
Current Year Price (in ₹)	12	18	x	28	22

Solution:

Commodity	Base year price	Current year price
	p_0	p_1
P	8	12
Q	12	18
R	16	x
S	22	28
T	18	22
Total	76	x + 80

From the table, $\sum p_0 = 76, \sum p_1 = x + 80$

Given, Price Index Number $(P_{01}) = 125$

Since $P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$

$$125 = \frac{x + 80}{76} \times 100$$

$\therefore 125 \times 76 = (x + 80) \times 100$

$\therefore 9500 = 100(x + 80)$

$\therefore 95 = x + 80$

$\therefore x = 95 - 80$

$\therefore x = 15$

Exercise 5.1 | Q 1.13 | Page 78

Find x if the Price Index Number by Simple Aggregate Method is 120, taking 1995 as base year.

Commodity	A	B	C	D
Price (in ₹) for 1995	95	y	80	35
Price (in ₹) for 2003	116	74	92	42

Solution:

Commodity	Price in 1995 (Base year)	Price in 2003 (Current year)
	p_0	p_1
A	95	116
B	y	74
C	80	92
D	35	42
Total	y + 210	324

From the table, $\sum p_0 = y + 210, \sum p_1 = 324$

Given, Price Index Number (P_{01}) = 120

Since $P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$

$$120 = \frac{324}{y + 210} \times 100$$

$$\therefore y + 210 = \frac{324 \times 100}{120}$$

$\therefore y + 210 = 270$

$\therefore y = 60$

EXERCISE 5.2 [PAGE 82]

Exercise 5.2 | Q 1.01 | Page 82

Calculate Laspeyre's, Paasche's, Dorbish-Bowley's, and MarshallEdgeworth's Price index numbers.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	8	20	11	15
B	7	10	12	10
C	3	30	5	25
D	2	50	4	35

Solution:

Commodity	Base Year		Current Year		p_0q_0	p_1q_0	p_0q_1	p_1q_1
	p_0	q_0	p_1	q_1				
A	8	20	11	15	160	220	120	165

B	7	10	12	10	70	120	70	120
C	3	30	5	25	90	150	75	125
D	2	50	4	35	100	200	70	140
Total	-	-	-	-	420	690	335	550

From the table,

$$\sum p_0q_0 = 420, \sum p_1q_0 = 690$$

$$\sum p_0q_1 = 335, \sum p_1q_1 = 550$$

(i) Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100 = \frac{690}{420} \times 100 = 164.29$$

(ii) Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100 = \frac{550}{335} \times 100 = 164.18$$

(iii) Dorbish-Bowley's Price Index Number:

$$P_{01}(D\text{-}B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$= \frac{164.29 + 164.18}{2}$$

= 164.24

(iv) Marshall-Edgeworth's Price Index Number:

$$P_{01}(M\text{-}E) = \frac{\sum p_1q_0 + \sum p_1q_1}{\sum p_0q_0 + \sum p_0q_1} \times 100$$

$$= \frac{690 + 550}{420 + 335} \times 100$$

$$= \frac{1240}{755} \times 100$$

$$= 164.24$$

Exercise 5.2 | Q 1.02 | Page 82

Calculate Laspeyre's, Paasche's, Dorbish-Bowley's, and Marshall - Edgeworth's Price index numbers.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	10	9	20	8
II	20	5	30	4
III	30	7	50	5
IV	40	8	60	6

Solution:

Commodity	Base Year		Current Year		p_0q_0	p_1q_0	p_0q_1	p_1q_1
	p_0	q_0	p_1	q_1				
I	10	9	20	8	90	180	80	160
II	20	5	30	4	100	150	80	120
III	30	7	50	5	210	350	150	250
IV	40	8	60	6	320	480	240	360
Total	-	-	-	-	720	1160	550	890

From the table,

$$\sum p_0q_0 = 720, \sum p_1q_0 = 1160$$

$$\sum p_0q_1 = 550, \sum p_1q_1 = 890$$

(i) Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{890}{550} \times 100$$

= 161.82

(iii) Dorbish-Bowley's Price Index Number:

$$P_{01}(D - B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$= \frac{161.11 + 161.82}{2}$$

= 161.46

(iv) Marshall-Edgeworth's Price Index Number:

$$P_{01}(M- E) = \frac{\sum p_1q_0 + \sum p_1q_1}{\sum p_0q_0 + \sum p_0q_1} \times 100$$

$$= \frac{1160 + 890}{720 + 550} \times 100$$

= 161.42

Exercise 5.2 | Q 1.03 | Page 82

Calculate Walsh's Price Index Number.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
L	4	16	3	19
M	6	16	8	14
N	8	28	7	32

Solution:

Commodity	Base Year		Current Year		q_0q_1	$\sqrt{q_0q_1}$	$p_0\sqrt{q_0q_1}$	$p_1\sqrt{q_0q_1}$
	p_0	q_0	p_1	q_1				
L	4	16	3	19	304	17.44	69.76	52.32
M	6	16	8	14	224	14.97	89.82	119.76
N	8	28	7	32	896	29.93	239.44	209.51
Total	-	-	-	-		-	399.02	381.59

From the table,

$$\sum p_0\sqrt{q_0q_1} = 399.02, \sum p_1\sqrt{q_0q_1} = 381.59$$

Walsh's Price Index Number:

$$P_{01}(W) = \frac{\sum p_1\sqrt{q_0q_1}}{\sum p_0\sqrt{q_0q_1}} \times 100$$

$$= \frac{381.59}{399.02} \times 100$$

= 95.63

Exercise 5.2 | Q 1.04 | Page 82

Calculate Walsh's Price Index Number.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	10	12	20	9
II	20	4	25	8
III	30	13	40	27
IV	60	29	75	36

Solution:

Commodity	Base Year		Current Year		q_0q_1	$\sqrt{q_0q_1}$	$p_0\sqrt{q_0q_1}$	$p_1\sqrt{q_0q_1}$
	p_0	q_0	p_1	q_1				
I	10	12	20	9	108	10.39	103.9	207.8
II	20	4	25	8	32	5.66	113.2	141.5
III	30	13	40	27	351	18.73	561.9	749.2
IV	60	29	75	36	1044	32.31	1938.6	2423.25
Total	-	-	-	-		-	2717.6	3521.75

From the table,

$$\sum p_0\sqrt{q_0q_1} = 2717.6, \sum p_1\sqrt{q_0q_1} = 3521.75$$

Walsh's Price Index Number:

$$P_{01}(W) = \frac{\sum p_1\sqrt{q_0q_1}}{\sum p_0\sqrt{q_0q_1}} \times 100$$

$$= \frac{3521.75}{2717.6} \times 100$$

= 129.59

Exercise 5.2 | Q 1.05 | Page 82

If $P_{01}(L) = 90$ and $P_{01}(P) = 40$, find $P_{01}(D - B)$ and $P_{01}(F)$.

Solution: Given, $P_{01}(L) = 90$ and $P_{01}(P) = 40$

$$P_{01}(D\text{ - }B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$= \frac{90 + 40}{2} = \frac{130}{2} = 65$$

$$P_{01}(F) = \sqrt{P_{01}(L) \times P_{01}(P)}$$

$$= \sqrt{90 \times 40} = \sqrt{3600} = 60$$

Exercise 5.2 | Q 1.06 | Page 82

If $\sum p_0q_0 = 140$, $\sum p_0q_1 = 200$, $\sum p_1q_0 = 350$, $\sum p_1q_1 = 460$, find Laspeyre's, Paasche's, Dorbish-Bowley's and Marshall-Edgeworth's Price Index Numbers.

Solution: Given, $\sum p_0q_0 = 140$, $\sum p_0q_1 = 200$,

$\sum p_1q_0 = 350$, $\sum p_1q_1 = 460$

- **Laspeyre's Price Index Number:**

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{350}{140} \times 100 = 250$$

- **Paasche's Price Index Number:**

$$P_{01}(P) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$= \frac{460}{200} \times 100 = 230$$

- **Dorbish-Bowley's Price Index Number:**

$$P_{01}(D\text{ - }B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$= \frac{250 + 230}{2} = \frac{480}{2} = 240$$

- **Marshall-Edgeworth's Price Index Number:**

$$P_{01}(M\text{-}E) = \frac{\sum p_1q_0 + \sum p_1q_1}{\sum p_0q_0 + \sum p_0q_1} \times 100$$

$$= \frac{350 + 460}{140 + 200} \times 100$$

$$= \frac{810}{340} \times 100 = 238.24$$

Exercise 5.2 | Q 1.07 | Page 82

Given that Laspeyre's and Dorbish-Bowley's Price Index Numbers are 160.32 and 164.18 respectively, find Paasche's Price Index Number.

Solution: Given, P_{01} (L) = 160.32, P_{01} (D-B) = 164.18

$$P_{01}(D\text{-}B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$\therefore 164.18 = \frac{160.32 + P_{01}(P)}{2}$$

$$\therefore 328.36 = 160.32 + P_{01}(P)$$

$$\therefore P_{01}(P) = 328.36 - 160.32$$

$$\therefore P_{01}(P) = 168.04$$

Exercise 5.2 | Q 1.08 | Page 82

Given that $\sum p_0q_0 = 220$, $\sum p_0q_1 = 380$, $\sum p_1q_1 = 350$ and MarshallEdgeworth's Price Index Number is 150, find Laspeyre's Price Index Number.

Solution: Given, $\sum p_0q_0 = 220$, $\sum p_0q_1 = 380$,

$\sum p_1q_1 = 350$ and P_{01} (M - E) = 150

$$P_{01}(M - E) = \frac{\sum p_1q_0 + \sum p_1q_1}{\sum p_0q_0 + \sum p_0q_1} \times 100$$

$$\therefore 150 = \frac{\sum p_1q_0 + 350}{220 + 380} \times 100$$

$$\therefore 150 = \frac{\sum p_1q_0 + 350}{600} \times 100$$

$$\therefore \frac{150 \times 600}{100} = \sum p_1q_0 + 350$$

$\therefore 900 = \sum p_1q_0 + 350$

$\therefore \sum p_1q_0 = 900 - 350 = 550$

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{550}{220} \times 100 = 250$$

Exercise 5.2 | Q 1.09 | Page 82

Find x in the following table if Laspeyre's and Paasche's Price Index Numbers are equal.

Commodity	Base Year		Current year	
	Price	Quantity	Price	Quantity
A	2	10	2	5
B	2	5	x	2

Solution:

Commodity	Base Year		Current year		p_0q_0	p_1q_0	p_0q_1	p_1q_1
	p_0	q_0	p_1	q_1				
A	2	10	2	5	20	20	10	10

B	2	5	x	2	10	5x	4	2x
Total	-	-	-	-	30	20+5x	14	10+2x

From the table,

$\sum p_0q_0 = 30$, $\sum p_1q_0 = 20 + 5x$

$\sum p_0q_1 = 14$, $\sum p_1q_1 = 10 + 2x$

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$\therefore P_{01}(L) = \frac{20 + 5x}{30} \times 100 \quad ...(i)$$

$$P_{01}(P) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$\therefore P_{01}(P) = \frac{10 + 2x}{14} \times 100 \quad ....(ii)$$

Since $P_{01}(L) = P_{01}(P)$,

$$\frac{20 + 5x}{30} \times 100 = \frac{10 + 2x}{14} \times 100 \quad ....[From (i) and (ii)]$$

$\therefore 14(20 + 5x) = 30(10 + 2x)$

$\therefore 280 + 70x = 300 + 60x$

$\therefore 70x - 60x = 300 - 280$

$\therefore 10x = 20$

$$\therefore x = \frac{20}{10} = 2$$

Exercise 5.2 | Q 1.1 | Page 82

If Laspeyre's Price Index Number is four times Paasche's Price Index Number, then find the relation between Dorbish-Bowley's and Fisher's Price Index Numbers.

Solution: Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

It is given that

$P_{01}(L) = 4 \times P_{01}(P)$

$$\therefore \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = 4 \times \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$\therefore \frac{\sum p_1 q_0}{\sum p_0 q_0} = 4 \times \frac{\sum p_1 q_1}{\sum p_0 q_1}$$

If we denote $\frac{\sum p_1 q_0}{\sum p_0 q_0} = A$, $\frac{\sum p_1 q_1}{\sum p_0 q_1} = B$,

then A = 4B

Dorbish-Bowley's Price Index Number:

$$P_{01}(D - B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$P_{01}(D - B) = \frac{\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}}{2} \times 100$$

$$= \frac{A + B}{2} \times 100$$

$$= \frac{4B + B}{2} \times 100 \quad \text{....[} \because A = 4B\text{]}$$

$$= \frac{5B}{2} \times 100$$

$= 250\ B$

$\therefore P_{01}(D\text{-}B) = 250\ B \quad ....(i)$

Fisher's Price Index Number:

$$P_{01}(F) = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$$

$$= \sqrt{A \times B} \times 100$$

$$= \sqrt{4B \times B} \times 100$$

$$= \sqrt{4B^2} \times 100$$

$= 2B \times 100$

$\therefore P_{01}\ (F) = 200\ B \quad ...(ii)$

Dividing (i) by (ii), we get

$$\frac{P_{01}(D - B)}{P_{01}(F)} = \frac{250B}{200B}$$

$$\therefore \frac{P_{01}(D - B)}{P_{01}(F)} = \frac{5}{4}$$

$$\therefore P_{01}(D - B) = \frac{5}{4} \times P_{01}(F)$$

Exercise 5.2 | Q 1.11 | Page 82

If Dorbish-Bowley's and Fisher's Price Index Numbers are 5 and 4, respectively, then find Laspeyre's and Paasche's Price Index Numbers.

Solution: Let Laspeyre's Price Index Number $P_{01}(L) = x$

and Paasche's Price Index Number $P_{01}(P) = y$

Dorbish-Bowley's Price Index Number P_{01}(D-B) = 5 Fisher's Price Index Number P_{01}(F) = 4

$$\frac{P_{01}(L)\,P_{01}(P)}{2} = P_{01}(D–B)$$

$$\therefore \frac{x+y}{2} = 5$$

$$\therefore x + y = 10 \qquad ...(i)$$

$$\sqrt{P_{01}(L) \times P_{01}(P)} = P_{01}(F)$$

$$\therefore \sqrt{xy} = 4$$

$$\therefore xy = 16$$

$$\therefore y = \frac{16}{y}$$

$$\therefore x + \frac{16}{x} = 10 \qquad ...[From (i)]$$

$$\therefore x^2 + 16 = 10x$$

$$\therefore x^2 – 10x + 16 = 0$$

$$\therefore x – 8x – 2x + 16 = 0$$

$\therefore x(x – 8) –2(x – 8) = 0$

$\therefore (x – 2)\,(x – 8)$

$\therefore x = 2$ or $x = 8$

If $x = 2$, then from equation (i), $y = 8$

If $x = 8$, then from equation (i), $y = 2$

$\therefore P_{01}(L) = 8$ and $P_{01}(P) = 2$

or $P_{01}(P) = 8$ and $P_{01}(L) = 2$

EXERCISE 5.3 [PAGE 87]

Exercise 5.3 | Q 1 | Page 87

Calculate the cost of living index in problem

Group	Base Year		Current Year
	Price	Quantity	Price
Food	120	15	170
Clothing	150	20	190
Fuel & Lighting	130	30	220
House Rent	160	10	180
Miscellaneous	200	12	200

Solution:

Group	Base Year		Current Year	p_1q_0	p_0q_0
	p_0	q_0	P_1		
Food	120	15	170	2550	1800
Clothing	150	20	190	3800	3000
Fuel & Lighting	130	30	220	6600	3900
House Rent	160	10	180	1800	1600
Miscellaneous	200	12	200	2400	2400
Total	–	–	–	17150	12700

From the table,

From the table,

$$\sum p_1q_0 = 17,150, \sum p_0q_0 = 12,700$$

Now, by Aggregate Expenditure Method,

$$CLI = \frac{\sum P_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{17150}{12700} \times 100$$

$$= 135.04$$

Exercise 5.3 | Q 2 | Page 87

Calculate the cost of living index in problem

Group	Base Year		Current Year
	Price	Quantity	Price
Food	40	15	45
Clothing	30	10	35
Fuel & Lighting	20	17	25
House Rent	60	22	70
Miscellaneous	70	25	80

Solution:

Group	Base Year		Current Year	p_1q_0	p_0q_0
	p_0	q_0	p_1		
Food	40	15	45	675	600
Clothing	30	10	35	350	300
Fuel & Lighting	20	17	25	425	340
House Rent	60	22	70	1540	1320
Miscellaneous	70	25	80	2000	1750
Total	–	–	–	4990	4310

From the table

$$\sum p_1q_0 = 4,990, \sum p_0q_0 = 4,310$$

Now, by Aggregate Expenditure Method,

$$CLI = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{4990}{4310} \times 100$$

$$= 115.78$$

Exercise 5.3 | Q 3 | Page 87

Calculate the cost of living index in problem

Group	Base Year		Current Year
	Price	Quantity	Price
Food	132	10	170
Clothing	154	12	160
Fuel & Lighting	164	20	180
House Rent	175	18	195
Miscellaneous	128	5	120

Solution:

Group	Base Year		Current Year	p_1q_0	p_0q_0
	p_0	q_0	p_1		
Food	132	10	170	1700	1320
Clothing	154	12	160	1920	1848
Fuel & Lighting	164	20	180	3600	3280
House Rent	175	18	195	3510	3150

Miscellaneous	18	5	120	600	640
Total	–	–	–	11330	10238

From the table,

$$\sum p_1q_0 = 11,330, \sum p_0q_0 = 10,238$$

Now, by Aggregate Expenditure Method,

$$\text{CLI} = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{11330}{10238} \times 100$$

$$= 110.67$$

Exercise 5.3 | Q 4 | Page 87

Base year weights (W) and current year price relatives (I) are given in Problem.

Calculate the cost of living index in:

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	70	90	100	60	80
W	5	3	2	4	6

Solution:

Group	I	W	IW
Food	70	5	350
Clothing	90	3	270
Fuel and Lighting	100	2	200
House Rent	60	4	240
Miscellaneous	80	6	480
Total	–	20	1540

From the table,

$$\sum W = 20, \sum IW = 1540$$

Now, by Family Budget Method,

$$\text{CLI} = \frac{\sum IW}{\sum W} = \frac{1540}{20} = 77.$$

Exercise 5.3 | Q 5 | Page 87

Base year weights (W) and current year price relatives (I) are given in Problem.

Calculate the cost of living index in:

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	400	300	150	120	100
W	3	3	4	5	2

Solution:

Group	I	W	IW
Food	400	3	1200
Clothing	300	3	900
Fuel and Lighting	150	4	600
House Rent	120	5	600
Miscellaneous	100	2	200
Total	–	**17**	**3500**

From the table,

$$\sum W = 17, \sum IW = 3500$$

Now, by Family Budget Method,

$$CLI = \frac{\sum IW}{\sum W} = \frac{3500}{17} = 205.88.$$

Exercise 5.3 | Q 6 | Page 87

Base year weights (W) and current year price relatives (I) are given in Problem.

Calculate the cost of living index in:

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	200	150	120	180	160
W	30	20	10	40	50

Solution:

Group	I	W	IW
Food	200	30	6000
Clothing	150	20	3000
Fuel and Lighting	120	10	1200
House Rent	180	40	7200
Miscellaneous	160	50	8000
Total	**–**	**150**	**25400**

From the table,

$$\sum W = 150, \sum W = 25400$$

Now, by Family Budget Method,

$$CLI = \frac{\sum IW}{\sum W} = \frac{25400}{150} = 169.33$$

Exercise 5.3 | Q 7 | Page 87

Base year weights (W) and current year price relatives (I) are given in Problem.

Calculate the cost of living index in:

Find x if the cost of living index is 150.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	180	120	300	100	160
W	4	5	6	x	3

Solution:

Group	I	W	IW
Food	180	4	720
Clothing	120	5	600
Fuel and Lighting	300	6	1800
House Rent	100	x	100x
Miscellaneous	160	3	480
Total	–	**x + 18**	**100x +3600**

From the table,

$$\sum W = x + 18, \sum IW = 100x + 3600$$

Now, by Family Budget Method,

$$CLI = \frac{\sum IW}{\sum W}$$

$$\therefore 150 = \frac{100x + 3600}{x + 18} \quad ...[\because CLI = 150]$$

$$\therefore 150x + 2700 = 100x + 3600$$

$$\therefore 150 - 100x = 3600 - 2700$$

$$\therefore 50x = 900$$

$$\therefore x = \frac{900}{50} = 18.$$

Exercise 5.3 | Q 8 | Page 87

Base year weights (W) and current year price relatives (I) are given in Problem.

Calculate the cost of living index in:

Find y if the cost of living index is 200.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	180	120	160	300	200
W	4	5	3	y	2

Solution:

Group	I	W	IW
Food	180	4	720
Clothing	120	5	600
Fuel & Lighting	160	33	480
House Rent	300	y	300y
Miscellaneous	200	2	400

Total	–	y + 14	300y + 2200

From the table,

$$\sum W = y + 14, \sum IW = 300y + 2200$$

Now, by Family Budget Method,

$$CLI = \frac{\sum IW}{\sum W}$$

$$\therefore 200 = \frac{300y + 2200}{y + 14} \quad ...[\because CLI = 150]$$

$\therefore 200y + 2800 = 300 + 2200$

$\therefore 300y - 200y = 2800 - 2200$

$\therefore 100y = 600$

$$\therefore y = \frac{600}{100}$$

$\therefore y = 6.$

Exercise 5.3 | Q 9 | Page 87

The Cost of Living Index Number for years 1995 and 1999 are 140 and 200 respectively. A person earns ₹ 11,200 per month in the year 1995. What should be his monthly earnings in the year 1999 in order to maintain his standard of living as in the year 1995?

Solution: For the year 1995,

$CLI = 140$ and income = ₹ 11200

$$\text{Now, Real income} = \frac{\text{Income}}{CLI} \times 100$$

$$= \frac{11200}{140} \times 100$$

$\therefore$ Real income = 8000

For the year 1999, CLI = 200

$$\therefore \text{Real income} = \frac{\text{Income}}{\text{CLI}} \times 100$$

$$\therefore 8000 = \frac{\text{Income}}{200} \times 100$$

$$\therefore \text{Income} = \frac{8000 \times 200}{100}$$

= 16000

In order to maintain the same standard of living as in 1995, income in 1999 should be ₹ 16,000.

MISCELLANEOUS EXERCISE 5 [PAGES 89 - 94]

Miscellaneous Exercise 5 | Q 1.01 | Page 89

Choose the correct alternative :

Price Index Number by Simple Aggregate Method is given by

$\sum \frac{p_1}{p_0} \times 100$

$\sum \frac{p_0}{p_1} \times 100$

$\frac{\sum p_1}{\sum p_0} \times 100$

$\frac{\sum p_0}{\sum p_1} \times 100$

Solution:

Price Index Number by Simple Aggregate Method is given by

$\sum \frac{p_1}{p_0} \times 100.$

Miscellaneous Exercise 5 | Q 1.02 | Page 89

Choose the correct alternative :

Quantity Index Number by Simple Aggregate Method is given by

Options

$\sum \frac{q_1}{q_0} \times 100$

$\sum \frac{q_0}{q_1} \times 100$

$\frac{\sum q_1}{\sum q_0} \times 100$

$\frac{\sum q_1}{\sum q_0} \times 100$

Solution:

Quantity Index Number by Simple Aggregate Method is given by $\frac{\sum q_1}{\sum q_0} \times 100.$

Miscellaneous Exercise 5 | Q 1.03 | Page 90

Choose the correct alternative :

Value Index Number by Simple Aggregate Method is given by

Options

$\sum \frac{p_1 q_0}{p_0 q_1} \times 100$

$\sum \frac{p_0 q_1}{p_0 q_0} \times 100$

$\frac{\sum p_1 q_1}{\sum p_1 q_0} \times 100$

$\frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$

Solution:

Value Index Number by Simple Aggregate Method is given by

$$\frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100.$$

Miscellaneous Exercise 5 | Q 1.04 | Page 89

Choose the correct alternative :

Price Index Number by Weighted Aggregate Method is given by

Options

$$\sum \frac{p_1 w}{p_0 w} \times 100$$

$$\sum \frac{p_0 w}{p_1 w} \times 100$$

$$\frac{\sum p_1 w}{\sum p_0 w} \times 100$$

$$\frac{\sum p_0 w}{\sum p_1 w} \times 100$$

Solution:

Price Index Number by Weighted Aggregate Method is given by

$$\frac{\sum p_1 w}{\sum p_0 w} \times 100.$$

Miscellaneous Exercise 5 | Q 1.05 | Page 89

Choose the correct alternative :

Quantity Index Number by Weighted Aggregate Method is given by

Options

$\sum \frac{q_1 w}{q_0 w} \times 100$

$\sum \frac{q_0 w}{q_1 w} \times 100$

$\frac{\sum q_1 w}{\sum q_0 w} \times 100$

$\frac{\sum q_0 w}{\sum q_1 w} \times 100$

Solution:

Quantity Index Number by Weighted Aggregate Method is given by $\frac{\sum q_1 w}{\sum q_0 w} \times 100$.

Miscellaneous Exercise 5 | Q 1.06 | Page 90

Choose the correct alternative :

Value Index Number by Weighted Aggregate Method is given by

Options

$\sum \frac{p_1 q_0 w}{p_0 q_0 w} \times 100$

$\sum \frac{p_0 q_1 w}{p_0 q_0 w} \times 100$

$\frac{\sum p_1 q_1 w}{\sum p_0 q_1 w} \times 100$

$\frac{\sum p_1 q_1 w}{\sum p_0 q_0 w} \times 100$

Solution:

Value Index Number by Weighted Aggregate Method is given by $\frac{\sum p_1 q_1 w}{\sum p_0 q_0 w} \times 100.$

Miscellaneous Exercise 5 | Q 1.07 | Page 90

Choose the correct alternative :

Laspeyre's Price Index Number is given by

Options

$\frac{\sum p_0 q_0}{\sum p_1 q_0} \times 100$

$\frac{\sum p_0 q_1}{\sum p_1 q_1} \times 100$

$\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$

$\frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$

Solution:

Laspeyre's Price Index Number is given by $\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100.$

Miscellaneous Exercise 5 | Q 1.08 | Page 90

Choose the correct alternative :

Paasche's Price Index Number is given by

Options

$\frac{\sum p_0q_0}{\sum p_1q_0} \times 100$

$\frac{\sum p_0q_1}{\sum p_1q_1} \times 100$

$\frac{\sum p_1q_0}{\sum p_0q_0} \times 100$

$\frac{\sum p_1q_1}{\sum p_0q_1} \times 100$

Solution:

Paasche's Price Index Number is given by $\frac{\sum p_1q_1}{\sum p_0q_1} \times 100.$

Miscellaneous Exercise 5 | Q 1.09 | Page 90

Choose the correct alternative :

Dorbish-Bowley's Price Index Number is given by

Options

$\frac{\frac{\sum p_1q_0}{\sum p_0q_1} + \frac{\sum p_0q_1}{\sum p_1q_0}}{2} \times 100$

$\frac{\frac{\sum p_1q_1}{\sum p_0q_0} + \frac{\sum p_0q_0}{\sum p_1q_1}}{2} \times 100$

$\frac{\frac{\sum p_1q_0}{\sum p_0q_0} + \frac{\sum p_1q_1}{\sum p_0q_1}}{2} \times 100$

$\frac{\frac{\sum p_0q_0}{\sum p_1q_0} + \frac{\sum p_0q_1}{\sum p_1q_1}}{2} \times 100$

Solution:

Dorbish-Bowley's Price Index Number is given by

$$\frac{\frac{\sum p_1q_0}{\sum p_0q_0} + \frac{\sum p_1q_1}{\sum p_0q_1}}{2} \times 100.$$

Miscellaneous Exercise 5 | Q 1.1 | Page 90

Choose the correct alternative :

Fisher's Price Number is given by

Options

$$\sqrt{\frac{\sum p_1q_0}{\sum p_0q_0} \times \frac{\sum p_1q_1}{\sum p_0q_1}} \times 100$$

$$\sqrt{\frac{\sum p_0q_0}{\sum p_1q_0} \times \frac{\sum p_0q_1}{\sum p_1q_1}} \times 100$$

$$\sqrt{\frac{\sum p_0q_1}{\sum p_0q_0} \times \frac{\sum p_1q_1}{\sum p_1q_0}} \times 100$$

$$\sqrt{\frac{\sum p_1q_0}{\sum p_1q_1} \times \frac{\sum p_0q_0}{\sum p_0q_1}} \times 100$$

Solution:

Fisher's Price Number is given by $\sqrt{\frac{\sum p_1q_0}{\sum p_0q_0} \times \frac{\sum p_1q_1}{\sum p_0q_1}} \times 100.$

Miscellaneous Exercise 5 | Q 1.11 | Page 90

Choose the correct alternative :

Marshall-Edgeworth's Price Index Number is given by

Options

$\frac{\sum p_1(q_0+q_1)}{\sum p_0(q_0+q_1)} \times 100$

$\frac{\sum p_0(q_0+q_1)}{\sum p_1(q_0+q_1)} \times 100$

$\frac{\sum q_1(p_0+p_1)}{\sum q_1(p_0+p_1)} \times 100$

$\frac{\sum q_0(p_0+p_1)}{\sum q_1(p_0+p_1)} \times 100$

Solution:

Marshall-Edgeworth's Price Index Number is given by

$\frac{\sum p_1(q_0+q_1)}{\sum p_0(q_0+q_1)} \times 100.$

Miscellaneous Exercise 5 | Q 1.12 | Page 90

Choose the correct alternative :

Walsh's Price Index Number is given by

$$\frac{\sum p_1\sqrt{q_0q_1}}{\sum p_0\sqrt{q_0q_1}} \times 100$$

$$\frac{\sum p_0\sqrt{q_0q_1}}{\sum p_1\sqrt{q_0q_1}} \times 100$$

$$\frac{\sum q_1\sqrt{p_0p_1}}{\sum q_0\sqrt{p_0p_1}} \times 100$$

$$\frac{\sum q_0\sqrt{p_0p_1}}{\sum q_1\sqrt{p_0p_1}} \times 100$$

Solution:

Walsh's Price Index Number is given by $\frac{\sum p_1\sqrt{q_0q_1}}{\sum p_0\sqrt{q_0q_1}} \times 100.$

Miscellaneous Exercise 5 | Q 1.13 | Page 91

Choose the correct alternative :

The cost of Living Index Number using Aggregate Expenditure Method is given by

Options

$$\frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$\sum \frac{p_1q_1}{p_0q_1} \times 100$$

$$\frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$\sum \frac{p_1q_0}{p_0q_0} \times 100$$

Solution:

The cost of Living Index Number using Aggregate Expenditure Method is given by $\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$.

Miscellaneous Exercise 5 | Q 1.14 | Page 91

Choose the correct alternative :

The Cost of Living Index Number using Weighted Relative Method is given by

Options

$\frac{\sum IW}{\sum W}$

$\sum \frac{W}{IW}$

$\frac{\sum W}{\sum IW}$

$\sum \frac{IW}{W}$

Solution:

The Cost of Living Index Number using Weighted Relative Method is given by $\frac{\sum IW}{\sum W}$.

Miscellaneous Exercise 5 | Q 2.01 | Page 91

Fill in the blank :

Price Index Number by Simple Aggregate Method is given by _____.

Solution:

Price Index Number by Simple Aggregate Method is given by $\frac{\sum p_1}{\sum p_0} \times 100$.

Miscellaneous Exercise 5 | Q 2.02 | Page 91

Fill in the blank :

Quantity Index Number by Simple Aggregate Method is given by _____.

Solution:

Quantity Index Number by Simple Aggregate Method is given by $\frac{\sum q_1}{\sum q_0} \times 100.$

Miscellaneous Exercise 5 | Q 2.03 | Page 91

Fill in the blank :

Value Index Number by Simple Aggregate Method is given by _____.

Solution:

Value Index Number by Simple Aggregate Method is given by $\frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100.$

Miscellaneous Exercise 5 | Q 2.04 | Page 91

Fill in the blank :

Price Index Number by Weighted Aggregate Method is given by _____.

Solution:

Price Index Number by Weighted Aggregate Method is given by $\frac{\sum p_1 w}{\sum p_0 w} \times 100.$

Miscellaneous Exercise 5 | Q 2.05 | Page 91

Fill in the blank :

Quantity Index Number by Weighted Aggregate Method is given by _____.

Solution:

Quantity Index Number by Weighted Aggregate Method is given by $\frac{\sum q_1 w}{\sum q_0 w} \times 100.$

Miscellaneous Exercise 5 | Q 2.06 | Page 91

Fill in the blank :

Value Index Number by Weighted Aggregate Method is given by _____.

Solution:

Value Index Number by Weighted Aggregate Method is given by

$$\frac{\sum p_1 q_1 w}{\sum p_0 q_0 w} \times 100.$$

Miscellaneous Exercise 5 | Q 2.07 | Page 91

Fill in the blank :

Laspeyre's Price Index Number is given by _____.

Solution:

Laspeyre's Price Index Number is given $\frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100.$

Miscellaneous Exercise 5 | Q 2.08 | Page 91

Fill in the blank :

Paasche's Price Index Number is given by _____.

Solution:

Paasche's Price Index Number is given by $\frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100.$

Miscellaneous Exercise 5 | Q 2.09 | Page 91

Fill in the blank :

Dorbish-Bowley's Price Index Number is given by _____.

Solution:

Dorbish-Bowley's Price Index Number is given by

$$\frac{1}{2}\left[\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}\right] \times 100.$$

Miscellaneous Exercise 5 | Q 2.1 | Page 91

Fill in the blank :

Fisher's Price Index Number is given by _____.

Solution:

Fisher's Price Index Number is given by

$$\sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100.$$

Miscellaneous Exercise 5 | Q 2.11 | Page 91

Fill in the blank :

Marshall-Edgeworth's Price Index Number is given by _____.

Solution:

Marshall-Edgeworth's Price Index Number is given by

$$\frac{\sum p_1 (q_0 + q_1)}{\sum p_0 (q_0 + q_1)} \times 100.$$

Miscellaneous Exercise 5 | Q 2.12 | Page 91

Fill in the blank :

Walsh's Price Index Number is given by _____.

Solution:

Walsh's Price Index Number is given by $\frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100.$

Miscellaneous Exercise 5 | Q 3.01 | Page 91

State whether the following is True or False :

$\frac{\sum p_1}{\sum p_0} \times 100$ is the price Index Number by Simple Aggregate Method.

Options

True

False

Solution:

$\frac{\sum p_1}{\sum p_0} \times 100$ is the price Index Number by Simple Aggregate Method **True**.

Miscellaneous Exercise 5 | Q 3.02 | Page 91

State whether the following is True or False :

$\frac{\sum q_0}{\sum q_1} \times 100$ is the Quantity Index Number by Simple Aggregate Method.

1. True
2. **False**

Solution:

$\frac{\sum q_0}{\sum q_1} \times 100$ is the Quantity Index Number by Simple Aggregate Method **False**.

Miscellaneous Exercise 5 | Q 3.03 | Page 91

State whether the following is True or False :

$\sum \frac{p_0 q_0}{p_1 q_1}$ is Value Index Number by Simple Aggregate Method.

1. True
2. **False**

Solution:

$\sum \frac{p_0 q_0}{p_1 q_1}$ is Value Index Number by Simple Aggregate Method **False**.

Miscellaneous Exercise 5 | Q 3.04 | Page 91

State whether the following is True or False :

$\sum \frac{p_1 q_0}{p_0 q_0} \times 100$ is Paasche's Price Index Number.

1. True
2. **False**

Solution:

$\sum \frac{p_1 q_0}{p_0 q_0} \times 100$ is Paasche's Price Index Number **False**.

Miscellaneous Exercise 5 | Q 3.05 | Page 91

State whether the following is True or False :

$\sum \frac{p_1 q_1}{p_0 q_1}$ is Laspeyre's Price Index Number.

1. True
2. **False**

Solution:

$\sum \frac{p_1 q_1}{p_0 q_1}$ is Laspeyre's Price Index Number **False**.

Miscellaneous Exercise 5 | Q 3.06 | Page 92

State whether the following is True or False :

$\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$ is Dorbish-Bowley's Price Index Number.

1. True
2. **False**

Solution:

$\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$ is Dorbish-Bowley's Price Index Number **False**.

Miscellaneous Exercise 5 | Q 3.07 | Page 92

State whether the following is True or False :

$\frac{1}{2}\left[\sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0}} + \frac{\sqrt{p_1 q_1}}{\sqrt{p_0 q_1}}\right] \times 100$ is Fisher's Price Index Number.

1. True
2. **False**

Solution:

$\frac{1}{2}\left[\sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0}} + \frac{\sqrt{p_1 q_1}}{\sqrt{p_0 q_1}}\right] \times 100$ is Fisher's Price Index Number **False**.

Miscellaneous Exercise 5 | Q 3.08 | Page 92

State whether the following is True or False :

$\frac{\sum p_0 (q_0 + q_1)}{\sum p_1 (q_0 + q_1)} \times 100$ is Marshall-Edgeworth's Price Index Number.

1. True
2. **False**

Solution:

$\frac{\sum p_0(q_0+q_1)}{\sum p_1(q_0+q_1)} \times 100$ is Marshall-Edgeworth's Price Index Number **False**.

Miscellaneous Exercise 5 | Q 3.09 | Page 92

State whether the following is True or False :

$\frac{\sum p_0\sqrt{q_0q_1}}{\sum p_1\sqrt{q_0q_1}} \times 100$ is Walsh's Price Index Number.

1. True
2. **False**

Solution:

$\frac{\sum p_0\sqrt{q_0q_1}}{\sum p_1\sqrt{q_0q_1}} \times 100$ is Walsh's Price Index Number **False**.

Miscellaneous Exercise 5 | Q 3.1 | Page 92

State whether the following is True or False :

$\sqrt{\frac{p_1q_0}{\sum p_0q_0}} \times \sqrt{\frac{\sum p_1q_1}{\sum p_0q_1}} \times 100$ is Fisher's Price Index Number.

1. True
2. **False**

Solution:

$\sqrt{\frac{p_1q_0}{\sum p_0q_0}} \times \sqrt{\frac{\sum p_1q_1}{\sum p_0q_1}} \times 100$ is Fisher's Price Index Number **False**.

Miscellaneous Exercise 5 | Q 4.01 | Page 92

Solve the following problem :

Find the Price Index Number using Simple Aggregate Method. Consider 1980 as base year.

Commodity	Price in 1980 (in ₹)	Price in 1985 (in ₹)
I	22	46
II	38	36
III	20	28

IV	18	44
V	12	16

Solution:

Commodity	Price in 1980 (in ₹) (Base year)	Price in 1985 (in ₹) (Current year)
I	22	46
II	38	36
III	20	28
IV	18	44
V	12	16
Total	**110**	**170**

From the table, $\sum p_0 = 110, \sum p_1 = 170$

Price Index Number $(P_{01}) = \frac{\sum p_1}{\sum p_0} \times 100$

$= \frac{170}{110} \times 100$

$= 154.55$

Miscellaneous Exercise 5 | Q 4.02 | Page 92

Solve the following problem :

Find the Quantity Index Number using Simple Aggregate Method.

Commodity	Base year quantity	Current year quantity
A	100	130
B	170	200
C	210	250
D	90	110
E	50	150

Solution:

Commodity	Base Year Quantity q_0	Current Year Quantity q_1
A	100	130

B	170	200
C	210	250
D	90	110
E	50	150
Total	**620**	**840**

From the table, $\sum q_0 = 620, \sum q_1 = 840$

Quantity Index Number $(Q_{01}) = \frac{\sum q_1}{\sum q_0} \times 100$

$= \frac{840}{620} \times 100$

$= 135.48$

Miscellaneous Exercise 5 | Q 4.03 | Page 92

Solve the following problem :

Find the Value Index Number using Simple Aggregate Method.

Commodity	Base Year		Current Year	
	Price	Quantity	Price	Quantity
I	20	42	22	45
II	35	60	40	58
III	50	22	55	24
IV	60	56	70	62
V	25	40	30	41

Solution:

Commodity	Base Year		Current Year		p_0q_0	p_1q_1
	p_0	q_0	p_1	q_1		
I	20	42	22	45	840	990
II	35	60	40	58	2100	2320

III	50	22	55	24	1100	1320
IV	60	56	70	62	3360	4340
V	25	40	30	41	1000	1230
Total	**–**	**–**	**–**	**–**	**8400**	**10200**

From the table, $\sum p_1q_1 = 8,400, \sum p_1q_1 = 10,200$

Value Index Number $(V_{01}) = \frac{\sum p_1q_1}{\sum p_0q_0} \times 100$

$= \frac{10200}{8400} \times 100$

$= 121.43$

Miscellaneous Exercise 5 | Q 4.04 | Page 92

Solve the following problem :

Find x if the Price Index Number using Simple Aggregate Method is 200.

Commodity	P	Q	R	S	T
Base Year Price	20	12	22	23	13
Current Year Price	30	x	38	51	19

Solution:

Commodity	**Base Year Price p_0**	**Current Year Price p_1**
P	20	30
Q	12	x
R	22	38
S	23	51
T	13	19

Total	90	x + 138

From the table, $\sum p_0 = 90, \sum p_1 = x + 138$

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$$\therefore 200 = \frac{x + 138}{90} \times 100$$

$$\therefore \frac{x + 138}{90} = 2$$

$$\therefore x + 138 = 180$$

$$\therefore x = 180 - 138$$

$$\therefore x = 42.$$

Miscellaneous Exercise 5 | Q 4.05 | Page 92

Solve the following problem :

Calculate Laspeyre's and Paasche's Price Index Number for the following data.

Commodity	Base year		Current year	
	Price p_0	Quantity q_0	price p_1	Quantity q_1
A	20	18	30	15
B	25	8	28	5
C	32	5	40	7
D	12	10	18	10

Solution:

Commodity	Base Year		Current Year		p_0q_0	p_1q_0	p_0q_1	p_1q_1
	p_0	q_0	p_1	q_1				
A	20	18	30	15	360	540	300	450
B	25	8	28	5	200	224	125	140
C	32	5	40	7	160	200	224	280
D	12	10	18	10	120	180	120	180

Total	**–**	**–**	**–**	**–**	**840**	**1144**	**769**	**1050**

From the table,

$$\sum p_0q_0 = 840, \sum p_1q_0 = 1144,$$

$$\sum p_0q_1 = 769, \sum p_1q_1 = 1050$$

Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{1144}{840} \times 100$$

$$= 136.19$$

Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$= \frac{1050}{769} \times 100$$

$$= 136.54$$

Miscellaneous Exercise 5 | Q 4.06 | Page 92

Solve the following problem :

Calculate Dorbish-Bowley's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	30	11	28
II	9	25	12	22
III	10	15	13	11

Solution:

Commodity	Base Year		Current Year		p_0q_0	p_1q_0	p_0q_1	p_1q_1
	p_0	q_0	p_1	q_1				
I	8	30	11	28	240	330	224	308
II	9	25	12	22	225	300	198	264
III	10	15	13	11	150	195	110	143
Total	**–**	**–**	**–**	**–**	**615**	**825**	**532**	**715**

From the table,

$$\sum p_0q_0 = 615, \sum p_1/q_0 = 825,$$

$$\sum p_0q_1 = 532, \sum p_1q_1 = 715$$

Dorbish-Bowley's Price Index Number:

$$P_{01}(D–B) = \frac{\frac{\sum p_1q_0}{\sum p_0q_0} + \frac{\sum p_1q_1}{\sum p_0q_1}}{2} \times 100$$

$$= \frac{\frac{825}{615} + \frac{715}{532}}{2} \times 100$$

$$= 134.27$$

Miscellaneous Exercise 5 | Q 4.07 | Page 92

Solve the following problem :

Calculate Marshall-Edgeworth's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
X	12	35	15	25
Y	29	50	30	70

Solution:

Commodity	Base Year		Current Year		$q_0 + q_1$	$p_0 (q_0 + q_1)$	$p_1 \{q_0 + q_1)$
	p_0	q_0	p_1	q_1			
X	12	35	15	25	60	720	900
Y	29	50	30	70	120	3480	3600
Total	**–**	**–**	**–**	**–**	**–**	**4200**	**4500**

From the table,

$$\sum p_0(q_0 + q_1) = 4,200, \sum p_1(q_0 + q_1) = 4500$$

Marshall-Edgeworth's Price Index Number:

$$P_{01}(M–E) = \frac{\sum p_1(q_0 + q_1)}{\sum p_0(q_0 + q_1)} \times 100$$

$$= \frac{4500}{4200} \times 100$$

$$= 107.14$$

Miscellaneous Exercise 5 | Q 4.08 | Page 93

Solve the following problem :

Calculate Walsh's Price Index Number for the following data.

Commodity	Base year		Current year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
I	8	30	12	25
II	10	42	20	16

Solution:

Commodity	Base Year		Current Year		q_0q_1	$\sqrt{q_0q_1}$	$\frac{p_1}{\sqrt{q_0q_1}}$	$\frac{p_0}{\sqrt{q_0q_1}}$
	p_0	q_0	p_1	q_1				
I	8	30	12	25	750	27.39	328.68	219.12
II	10	42	20	16	672	25.92	518.40	259.20
Total	–	–	–	–	–	–	**847.08**	**478.32**

From the table,

$$\sum p_1\sqrt{q_0q_1} = 847.08, \sum p_0\sqrt{q_0q_1} = 478.32$$

Walsh's Price Index Number:

$$P_{01}(W) = \frac{\sum p_1\sqrt{q_0q_1}}{\sum p_0\sqrt{q_0q_1}} \times 100$$

$$= \frac{847.08}{478.32} \times 100$$

$$= 177.09$$

Miscellaneous Exercise 5 | Q 4.09 | Page 93

Solve the following problem :

Calculate Laspeyre's and Paasche's Price Index Number for the following data.

Commodity	Base Year		Current Year	
	Price P_0	Quantity q_0	Price p_1	Quantity q_1
I	8	30	12	25
II	10	42	20	16

Solution:

Commodity	Base Year	Current Year	p_0q_0	p_0q_1	p_1q_0	p_1q_1

	p_0	q_0	p_1	q_1				
I	8	30	12	25	240	200	360	300
II	10	42	20	16	420	160	840	320
Total	**–**	**–**	**–**	**–**	**660**	**360**	**1200**	**620**

From the table,

$$\sum p_0q_0 = 660, \sum p_0q_1 = 360,$$

$$\sum p_1q_0 = 1200, \sum p_1q_1 = 620$$

Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum p_0q_0}{\sum p_0q_1} \times 100$$

$$= \frac{1200}{600} \times 100$$

$$= 181.82$$

Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$= \frac{620}{360} \times 100$$

$$= 172.22$$

Miscellaneous Exercise 5 | Q 4.1 | Page 93

Solve the following problem :

Find x if Laspeyre's Price Index Number is same as Paasche's Price Index Number for the following data

Commodity	Base Year	Current Year

	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	3	x	2	5
B	4	6	3	5

Solution:

Commodity	Base Year		Current Year		p_0q_0	p_0q_1	p_1q_0	p_1q_1
	p_0	q_0	p_1	q_1				
A	3	x	2	5	3x	15	2x	10
B	4	6	3	5	24	20	18	15
Total	**–**	**–**	**–**	**–**	**3x + 24**	**35**	**2x + 18**	**25**

From the table,

$$\sum p_0q_0 = 3x + 24, \sum p_0q_1 = 35,$$

$$\sum p_1q_0 = 2x + 18, \sum p_1q_1 = 25$$

Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum p_1q_0}{\sum p_1q_0} \times 100 = \frac{2x + 18}{3x + 24} \times 100 \quad \text{...(i)}$$

Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100 = \frac{25}{35} \times 100 = \frac{5}{7} \times 100 \quad \text{...(ii)}$$

Since $P_{01}(L) = P_{01}(P)$,

$$\frac{2x + 18}{3x + 24} \times 100 = \frac{5}{7} \times 100 \quad \text{...[From (i) and (ii)]}$$

$$\therefore \frac{2x+18}{3x+24} = \frac{5}{7}$$

$\therefore$ 14x + 126 = 15x + 120

$\therefore$ 126 – 120 = 15x – ·14x

$\therefore$ x = 6.

Miscellaneous Exercise 5 | Q 4.11 | Page 93

Solve the following problem :

Find x if Walsh's Price Index Number is 150 for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	5	3	10	3
B	x	4	16	9
C	15	5	23	5
D	10	2	26	8

Solution:

Commodity	Base Year		Current Year		q_0q_1	$\sqrt{q_0q_1}$	$\frac{p_1}{\sqrt{q_0q_1}}$	$p_0\sqrt{q_0q_1}$
	p_0	q_0	p_1	q_1				
A	5	3	10	3	9	3	30	15
B	x	4	16	9	36	6	96	6x
C	15	5	23	5	25	5	115	75
D	10	2	26	8	16	4	104	40
Total	–	–	–	–	–	–	**345**	**6x + 130**

From the table,

$$\sum p_1\sqrt{q_0q_1} = 345, \sum p_0\sqrt{q_0q_1} = 6x + 130$$

Walsh's Price Index Number:

$$P_{01}(W) = \frac{\sum p_1\sqrt{q_0q_1}}{\sum p_0\sqrt{q_0q_1}} \times 100$$

$$\therefore 150 = \frac{345}{6x + 130} \times 100 \quad ...[\because P_{01}(W) = 150]$$

$$\therefore 6x + 130 = \frac{345 \times 100}{150}$$

$$\therefore 6x = 130 = 230$$

$$\therefore 6x = 230 - 130$$

$$\therefore 6x = 100$$

$$\therefore x = \frac{100}{6}$$

$$\therefore x = 16.67$$

Miscellaneous Exercise 5 | Q 4.12 | Page 93

Solve the following problem :

Find x if Paasche's Price Index Number is 140 for the following data.

Commodity	Base Year		Current Year	
	Price p_0	Quantity q_0	Price p_1	Quantity q_1
A	20	8	40	7
B	50	10	60	10
C	40	15	60	x
D	12	15	15	15

Solution:

Commodity	Base Year		Current Year		p_0q_1	p_1q_1
	p_0	q_0	p_1	q_1		
A	20	8	40	7	140	280
B	50	10	60	10	500	600
C	40	15	60	x	40x	60x
D	12	15	15	15	180	225
Total	**–**	**–**	**–**	**–**	**40x + 820**	**60x + 1105**

From the table,

$$\sum p_0q_1 = 40x + 820, \sum p_1q_1 = 60x + 1,105$$

Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100$$

$$\therefore 140 = \frac{60x + 1105}{40x + 820} \times 100 \quad ...[P_{01}(P) = 140]$$

$$\therefore \frac{140}{100} = \frac{60x + 1,105}{40x + 820}$$

$$\therefore \frac{7}{5} = \frac{60x + 1,105}{40x + 820}$$

$\therefore 280x + 5,740 = 300x + 5,525$

$\therefore 300x - 280x = 5,740 - 5,525$

$\therefore 20x = 215$

$\therefore x = 10.75$

Miscellaneous Exercise 5 | Q 4.13 | Page 93

Solve the following problem :

Given that Laspeyre's and Paasche's Price Index Numbers are 25 and 16 respectively, find Dorbish-Bowley's and Fisher's Price Index Number.

Solution: Given, $P_{01}(L) = 25$, $P_{01}(P) = 16$

Dorbish-Bowley's Price Index Number:

$$P_{01}(D–B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$= (25 + 16)/(2)$`

$$= \frac{41}{2}$$

$= 20.5$

Fisher's Price Index Number:

$$P_{01}(F) = \sqrt{P_{01}(L) \times P_{01}(P)}$$

$$= \sqrt{25 \times 16}$$

$$= \sqrt{400}$$

$= 20$

Miscellaneous Exercise 5 | Q 4.14 | Page 93

Solve the following problem :

If Laspeyre's and Dorbish's Price Index Numbers are 150.2 and 152.8 respectively, find Paasche's Price Index Number.

Solution: Given, $P_{01}(L) = 150.2$, $P_{01}(D\text{-}B) = 152.8$

Dorbish-Bowley's Price Index Number:

$$P_{01}(D\text{-}B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$\therefore 152.8 = \frac{150.2 + P_{01}(P)}{2}$$

$$\therefore 305.6 = 150.2\ 6 + P_{01}(P)$$

$$\therefore P_{01}(P) = 305.6 - 150.2 = 155.4$$

Miscellaneous Exercise 5 | Q 4.15 | Page 93

Solve the following problem :

If $\sum p\_0q_0 = 120, \sum p_0q_1 = 160, \sum p_1q_1 = 140,$ and $\sum p_1q + 0 = 200,$

find Laspeyre's, Paasche's Dorbish-Bowley's and Marshall Edgeworth's Price Index Number.

Solution: Given,

$$\sum p_0q_0 = 120, \sum p_0q_1 = 160,$$
$$\sum p_1q_1 = 140, \sum p_1q_0 = 200$$

Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum P_1q_0}{\sum p_0q_0} \times 100 = \frac{200}{120} \times 100 = 166.67$$

Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum P_1q_1}{\sum p_0q_1} \times 100 = \frac{140}{160} \times 100 = 87.5$$

Dorbish-Bowley's Price Index Number:

$$P_{01}(D\text{–}B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$= \frac{166.67 + 87.5}{2}$$

$$= \frac{254.17}{2}$$

$$= 127.085$$

Marshall-Edgeworth's Price Index Number:

$$P_{01}(M–E) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

$$= \frac{200 + 140}{120 + 160} \times 100$$

$$= \frac{340}{280} \times 100$$

$$= 121.43$$

Miscellaneous Exercise 5 | Q 4.16 | Page 93

Solve the following problem :

Given that

$$\sum p_0 q_0 = 130, \sum p_1 q_1 = 140, \sum p_0 q_1 = 160, \text{ and } \sum p_1 q_0 = 200,$$

find Laspeyre's, Paasche's, Dorbish-Bowley's, and Marshall-Edgeworth's Price Index Numbers.

Solution: Given,

$$\sum P_0 q_0 = 130, \sum p_0 q_1 = 160,$$
$$\sum p_1 q_1 = 140, \sum p_1 q_0 = 200$$

Laspeyre's Price Index Number:

$$P_{01}(L) = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

$$= \frac{200}{130} \times 100 = 153.85$$

Laspeyre's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$= \frac{140}{160} \times 100 = 87.5$$

Dorbish-Bowley's Price Index Number:

$$P_{01}(D–B) = \frac{P_{01}(L) + P_{01}(P)}{2}$$

$$= \frac{153.85 + 87.5}{2} = 120.68$$

Marshall-Edgeworth's Price Index Number:

$$P_{01}(M–E) = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

$$= \frac{200 + 140}{130 + 160} \times 100$$

= 117.24

Miscellaneous Exercise 5 | Q 4.17 | Page 93

Solve the following problem :

Given that $\sum p_1 q_1 = 300, \sum p_0 q_1 = 320, \sum p_0 q_0$ = 120, and Marshall- Edgeworth's Price Index Number is 120, find $\sum p_1 q_0$ and Paasche's Price Index Number.

Solution: Given, P_{01}(M-E) =

$120, \sum p_1 q_1 = 300, \sum p_0 q_1 = 320, \sum p_0 q_0 = 120$

$$P_{01}(M–E) = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

$$\therefore 120 = \frac{\sum p_1 q_0 + 300}{120 + 320} \times 100$$

$$\therefore 120 = \frac{\sum p_1 q_0 + 300}{440} \times 100$$

$$\therefore \sum p_1 q_0 + 300 = \frac{120 \times 440}{100}$$

$$\therefore \sum p_1 q_0 + 300 = 528$$

$$\therefore \sum p_1 q_0 = 528 - 300$$

$$\therefore \sum p_1 q_0 = 228$$

Paasche's Price Index Number:

$$P_{01}(P) = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

$$= \frac{300}{320} \times 100$$

$$= 93.75$$

Miscellaneous Exercise 5 | Q 4.18 | Page 93

Solve the following problem :

Calculate the cost of living number for the following data.

Group	Base Year		Current Year
	Price p_0	Quantity q_0	Price p_1
Food	150	13	160
Clothing	170	18	150
Fuel and Lighting	175	10	190
House Rent	200	12	210
Miscellaneous	210	15	260

Solution:

Group	Base Year		Current Year	p_0q_0	p_1q_0
	p_0	q_0	p_1		
Food	150	13	160	1950	2080
Clothing	170	18	150	3060	2700
Fuel and Lighting	175	10	190	1750	1900
House Rent	200	12	210	2400	2520
Miscellaneous	210	15	260	3150	3900
Total				**12310**	**13100**

From the table,

$$\sum p_0q_0 = 12310, \sum p_1q_0 = 13,100$$

Now, by Aggregate Expenditure Method,

$$CLI = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100$$

$$= \frac{13,100}{12,310} \times 100$$

$$= 106.42$$

Miscellaneous Exercise 5 | Q 4.19 | Page 94

Solve the following problem :

Find the cost living index number by the Weighted Aggregate Method.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	78	80	110	60	90
W	5	3	4	2	6

Solution:

Group	I	W	IW

Food	78	5	390
Clothing	80	3	240
Fuel and Lighting	110	4	440
House Rent	60	2	120
Miscellaneous	90	6	540
Total	**–**	**20**	**1730**

From the table,

$$\sum W = 20, \sum IW = 1730$$

Now, by family budget method,

$$CLI = \frac{\sum IW}{\sum W}$$

$$= \frac{1730}{20}$$

$$= 86.5$$

Miscellaneous Exercise 5 | Q 4.2 | Page 94

Solve the following problem :

Find the cost of living index number by Family Budget Method for the following data. Also, find the expenditure of a person in the year 2008 if his expenditure in the year 2005 was ₹ 10,000.

Group	Base Year (2005) Price	Current Year (2008) Price	Weight
Food	12	60	25
Clothing	10	45	20
Fuel and Lighting	20	35	15
House Rent	25	20	30
Miscellaneous	16	48	10

Solution:

Group	2005 Base Year	2008 Current Year	$I = \frac{p_1}{p_0} \times 100$	W	IW
	p_0	p_1			
Food	12	60	60/12×100 = 500	25	12500
Clothing	10	45	45/10×100 = 450	20	9000
Fuel and Lighting	20	35	35/20×100 = 175	15	2625
House Rent	25	20	20/25×100 = 80	30	2400
Miscellaneous	16	48	48/16×100 = 300	10	3000
Total	**–**	**–**	**–**	**100**	**29525**

From the table,

$$\sum W = 100, \sum IW = 29525$$

Now, by Family Budget Method,

$$CLI = \frac{\sum IW}{\sum W}$$

$$= \frac{29525}{100}$$

$$= 295.25$$

$$\frac{\text{Expenditure in 2008}}{\text{Expenditure in 2005}} = \frac{\text{CLI of 2008}}{100}$$

$$\therefore \frac{\text{Expenditure in 2008}}{100} = \frac{295.25}{100}$$

$$\therefore \text{Expenditure in 2008} = 10,000 \times \frac{295.25}{100} = 29,525$$

∴ Cost of Living Index = 295.25 and Expenditure in 2008 = ₹ 29,525

Miscellaneous Exercise 5 | Q 4.21 | Page 94

Solve the following problem :

Find x if the cost of living index number is 193 for the following data.

Group	Food	Clothing	Fuel & Lighting	House Rent	Miscellaneous
I	221	198	171	183	161
W	35	14	x	8	20

Solution:

Group	I	W	IW
Food	221	35	7735
Clothing	198	14	2772
Fuel and Lighting	171	x	171x
House Rent	183	8	1464
Miscellaneous	161	20	3220
Total		**x + 77**	**171x + 15191**

From the table,

$$\sum W = x + 77, \sum IW = 171x + 15191$$

Now, by Family Budget Method,

$$CLI = \frac{\sum IW}{\sum W}$$

$$\therefore 193 = \frac{171x + 1591}{x + 77} \quad ...[\because CLI = 193]$$

$$\therefore 193x + 14{,}861 = 171x + 15{,}191$$

$$\therefore 193x - 171x = 15{,}191 - 14{,}861$$

$$\therefore 22x = 330$$

$$\therefore x = \frac{330}{22}$$

$$\therefore x = 15.$$

Miscellaneous Exercise 5 | Q 4.22 | Page 94

Solve the following problem :

The cost of living index number for year 2000 and 2003 are 150 and 210 respectively. A person earns ₹ 13,500 per month in the year 2000. What should be his monthly earning in the year 2003 in order to maintain the same standard of living?

Solution: For the year 2000,

CLI = 150 and income = ₹ 13,500

$$\text{Now, Reall Income} = \frac{\text{Income}}{\text{CLI}} \times 100$$

$$= \frac{13500}{150} \times 100$$

= 90 x 100

= 9,000

Real income = ₹ 9,000

For the year 2003,

CLI = 210

If standard of living is to be maintained, real income in the year 2003 should also be ₹ 9,000.

$$\text{Real income} = \frac{\text{income}}{\text{CLI}} \times 100$$

$$\therefore 9000 = \frac{\text{Income}}{\text{CLI}} \times 100$$

$$\therefore \text{Income} = \frac{9000 \times 210}{100}$$

= 90 xx 210

= 18,900

∴ In order to maintain the same standard of living as in the year 2000, income in 2003 should be ₹ 18,900.