

15. Composition and Resolution of Concurrent Forces (composition-and-resolution-of-concurrent-forces/solution/grade-12/mathematics/190/solutions)
16. Parallel Forces, Moments and Couples (parallel-forces-moments-and-couples/solution/grade-12/mathematics/193/solutions)
17. Kinetics : The Geometry of Motion (kinetics:-the-geometry-of-motion/solution/grade-12/mathematics/196/solutions)
18. Newton's Law of Motion (newtons-law-of-motion/solution/grade-12/mathematics/199/solutions)
19. Projectiles (projectiles/solution/grade-12/mathematics/202/solutions)
20. Work, Energy and Power (work-energy-and-power/solution/grade-12/mathematics/203/solutions)
21. Linear Programming (linear-programming/solution/grade-12/mathematics/206/solutions)
22. Computational Methods (computational-methods/solution/grade-12/mathematics/211/solutions)
23. System of Linear Equations (system-of-linear-equations/solution/grade-12/mathematics/209/solutions)
24. Numerical Integration (numerical-integration/solution/grade-12/mathematics/208/solutions)

[Previous \(statistics/solution/grade-12/mathematics/186/solutions\)](#)
[Next \(probability/solution/grade-12/mathematics/188/solutions\)](#)

## **Statistics**

[13.1 \(statistics-13-1/solution/grade-12/mathematics/185/solutions\)](#)
[13.2 \(statistics-13-2/solution/grade-12/mathematics/186/solutions\)](#)
[13.3 \(statistics-13-3/solution/grade-12/mathematics/187/solutions\)](#)

### **13.3**

1.

a.

Soln:

We have,

$$\text{Correlation coefficient } (r) = \frac{\text{Cov.}(X,Y)}{\sqrt{\text{Var.}(X)} \cdot \sqrt{\text{Var.}(Y)}}$$

$$= \frac{18}{\sqrt{16} \cdot \sqrt{81}} = \frac{18}{4 \cdot 9} = \frac{1}{2} = 0.5$$

b.

Soln:



Go Top

$$r = \frac{\text{Cov.}(X,Y)}{\sqrt{\text{Var.}(X)} \cdot \sqrt{\text{Var.}(Y)}} = \frac{-16.5}{\sqrt{2.89} \cdot \sqrt{100}} = -\frac{16.5}{17} = -0.97.$$

c.

Soln:

$$r = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{\sqrt{(\sum X - \bar{X})^2} \cdot \sqrt{(\sum Y - \bar{Y})^2}} = \frac{35}{\sqrt{40} \cdot \sqrt{63}} = \frac{35}{50.2} = 0.70.$$

d.

Soln:

$$\text{Since, } \sigma_x = \sqrt{\frac{(\sum x - \bar{x})^2}{n}} \text{ then } 3.2 = \sqrt{\frac{(\sum x - \bar{x})^2}{15}}.$$

$$\text{Or, } (\sum x - \bar{x})^2 = 15 * (3.2)^2 = 15 * 10.24 = 153.6$$

$$\text{Similarly, } (\sum y - \bar{y})^2 = 15 * (3.4)^2 = 15 * 11.56 = 173.4$$

$$\text{We have } r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{(\sum x - \bar{x})^2} \cdot \sqrt{(\sum y - \bar{y})^2}}$$

$$= \frac{122}{\sqrt{153.6} \cdot \sqrt{173.4}} = \frac{122}{163.2} = 0.75.$$

e.

$$r = \frac{n \sum xy - \sum^X \cdot \sum^Y}{\sqrt{n \sum x^2 - (\sum^X)^2} \sqrt{n \sum y^2 - (\sum^Y)^2}}$$

$$= \frac{10 * 415 - 60 * 60}{\sqrt{10 * 400 - 60^2} \cdot \sqrt{10 * 580 - 60^2}} = \frac{4150 - 3600}{20 * 46.9} = \frac{550}{938} = 0.589.$$

f.

Soln:

$$\text{Or, } \bar{x} = \frac{\sum x}{n} = \frac{50}{10} = 5.$$

$$\text{Or, } \bar{y} = \frac{\sum y}{n} = \frac{30}{10} = 3.$$

We have,

$$r = \frac{n \sum xy - \sum^X \cdot \sum^Y}{\sqrt{n \sum x^2 - (\sum^X)^2} \sqrt{n \sum y^2 - (\sum^Y)^2}}$$

$$= \frac{10 * 115 - 50 * 30}{\sqrt{10 * 290 - 50^2} \sqrt{10 * 300 - (30)^2}}$$

$$= \frac{1150 - 1500}{\sqrt{2900 - 2500} \sqrt{3000 - 900}}$$

$$= -\frac{350}{20 * 45.8} = -\frac{350}{916} = -0.382$$

2.

a.

Soln:

Calculation of correlation Co – efficient.

Height(X)	Weight(Y)	$x = X - \bar{X}$	$y = Y - \bar{Y}$	$x^2$	$y^2$	xy
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160	63	-2	1	4	1	-2
162	62	0	0	0	0	0
165	64	3	2	9	4	6
161	60	-1	-2	1	4	2
162	61	0	-1	0	1	0
$\sum X = 810$	$\sum Y = 310$			$\sum x^2 = 14$	$\sum y^2 = 10$	$\sum xy = 0$

$$\text{Or, } \bar{X} = \frac{\sum X}{n} = \frac{810}{5} = 162,$$

$$\text{Or, } \bar{Y} = \frac{\sum Y}{n} = \frac{310}{5} = 62,$$

$$\text{Now, } r = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}} = \frac{6}{\sqrt{14} \cdot \sqrt{10}} = \frac{6}{11.82} = 0.51$$

b.

Soln:

Calculation of correlation Co – efficient.

X	Y	$x = X - \bar{X}$	$y = Y - \bar{Y}$	$x^2$	$y^2$	xy
5	2	1	-2	1	4	-2
7	3	3	-1	9	1	-3
1	4	-3	0	9	0	0
3	5	-1	1	1	1	-1
4	6	0	2	0	4	0
$\sum X = 20$	$\sum Y = 20$			$\sum x^2 = 20$	$\sum y^2 = 10$	$\sum xy = -6$

$$\text{Or, } \bar{X} = \frac{\sum X}{n} = \frac{20}{5} = 4,$$

$$\text{Or, } \bar{Y} = \frac{\sum Y}{n} = \frac{20}{5} = 4,$$

$$\text{Now, } r = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}} = \frac{-6}{\sqrt{20} \cdot \sqrt{10}} = \frac{-6}{14.14} = -0.42$$

c.

Soln:

Calculation of correlation Co – efficient.

Husband(X)	Wife(Y)	$x = X - \bar{X}$	$y = Y - \bar{Y}$	$x^2$	$y^2$	xy
23	29	-1.17	-0.33	1.3689	0.1089	0.3861
22	18	-2.17	-2.33	4.7089	5.4289	5.0561
24	20	-0.17	-0.33	0.0289	0.1089	0.0561
23	21	-1.17	0.67	1.3689	0.4489	-0.7839
26	21	-1.83	0.67	3.3489	0.4489	1.2261
27	22	2.83	1.67	2.7889	2.7889	4.7261

$\sum X = 145$	$\sum Y = 122$			$\sum x^2 = 13.61$	$\sum y^2 = .33$	$\sum xy = -10.67$
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$$\text{Or, } \bar{X} = \frac{\sum X}{n} = \frac{145}{6} = 24.17,$$

$$\text{Or, } \bar{Y} = \frac{\sum Y}{n} = \frac{122}{6} = 20.33,$$

$$\text{Now, } r = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}} = \frac{10.67}{\sqrt{13.61} \cdot \sqrt{9.33}} = \frac{10.67}{11.27} = 0.94.$$

3.

Soln:

Let the missed number of Y series be a then,

$$\text{Or, } \bar{Y} = \frac{9+11+a+8+7}{5}$$

$$\text{Or, } 8 * 5 = 15 + a.$$

So, a

$$= 5$$

Calculation of correlation Co – efficient.

X	Y	$x = X - \bar{X}$	$y = Y - \bar{Y}$	$x^2$	$y^2$	xy
6	9	0	1	10	1	0
2	11	-4	3	16	9	-12
10	5	4	-3	16	9	-12
4	8	-2	0	4	0	0
8	7	2	-1	4	1	-2
				$\sum x^2 = 40$	$\sum y^2 = 20$	$\sum xy = -26$

$$\text{Now, } r = \frac{\sum xy}{\sqrt{\sum x^2} \sqrt{\sum y^2}} = -\frac{26}{\sqrt{40} \sqrt{20}} = -\frac{26}{28.28} = -0.92.$$

4.

Soln:

$$n = 12.$$

$$\text{Corrected } \left( \sum X \right) = 30 - 11 + 10 = 29,$$

$$\text{Corrected } \left( \sum Y \right) = 5 - 4 + 14 = 15,$$

$$\text{Corrected } \left( \sum x^2 \right) = 670 - (11)^2 + (10)^2 = 649.$$

$$\text{Corrected } \left( \sum y^2 \right) = 288 - (4)^2 + (14)^2 = 468.$$

$$\text{Corrected } \left( \sum xy \right) = 334 - 11 * 4 + 10 * 14 = 430.$$

$$\text{Now, corrected } (r) = \frac{n \sum xy - \sum X \cdot \sum Y}{\sqrt{n \sum x^2 - (\sum X)^2} \sqrt{n \sum y^2 - (\sum Y)^2}} = \frac{12 * 430 - 29 * 15}{\sqrt{12 * 649 - (29)^2} \cdot \sqrt{12 * 468 - (15)^2}} = \frac{5160 - 435}{\sqrt{7788 - 841} \cdot \sqrt{5616 - 225}} = \frac{4725}{83.34 * 72.42} = 0.775.$$