Chapter 2: Equations

Equation 2.1:

$$x_1 + x_2$$

Equation 2.2:

$$\sum_{i=1}^{2} x_i = x_1 + x_2$$

Equation 2.3:

$$\sum_{i=1}^{n} x_i = x_1 + x_2 + x_3 + \cdots + x_n$$

Equation 2.4:

$$a + a + a + \cdots + a$$

Equation 2.5:

$$\sum_{i=1}^{n} a = na$$

Equation 2.6:

$$\sum_{i=1}^{n} ax_i = ax_1 + ax_2 + ax_3 + \cdots + ax_n$$

Equation 2.7:

$$\sum_{i=1}^{n} a x_i = a \sum_{i=1}^{n} x_i$$

Equation 2.8:

$$\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Equation 2.9:

$$\overline{x}_w = \frac{\sum_{i=1}^{n} a_i x_i}{n}$$

Equation 2.10:

$$\sum_{i=1}^{n} a_i = n$$

Equation 2.11:

$$\left(x_1 + y_1\right) + \left(x_2 + y_2\right) + \left(x_3 + y_3\right) + \cdots + \left(x_n + y_n\right)$$

Equation 2.12:

$$\left(x_1 + y_1\right) + \left(x_2 + y_2\right) + \left(x_3 + y_3\right) + \cdots + \left(x_n + y_n\right) = \sum_{i=1}^{n} \left(x_i + y_i\right)$$

Equation 2.13:

$$\begin{aligned}&(x_1+y_1)+(x_2+y_2)+(x_3+y_3)+\cdots+(x_n+y_n)\\&=(x_1+x_2+x_3+\cdots+x_n)+(y_1+y_2+y_3+\cdots+y_n)\\&=\sum_{i=1}^{n}x_i+\sum_{i=1}^{n}y_i\end{aligned}$$

Equation 2.14:

$$\sum_{i=1}^{n}(x_i+y_i)=\sum_{i=1}^{n}x_i+\sum_{i=1}^{n}y_i$$

Equation 2.15:

$$\sum_{i=1}^{n}(x_i-\overline{x})$$

Equation 2.16:

$$\sum_{i=1}^{n}(x_i-\overline{x})=\sum_{i=1}^{n}x_i-\sum_{i=1}^{n}\overline{x}$$

Equation 2.17:

$$\sum_{i=1}^{n}\overline{x}=n\overline{x}$$

Equation 2.18:

$$\sum_{i=1}^{n}x_i=\frac{n}{n}\sum_{i=1}^{n}x_i=n\frac{\sum_{i=1}^{n}x_i}{n}=n\overline{x}$$

Equation 2.19:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)=n\overline{x}-n\overline{x}=0$$

Equation 2.20;

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)\overline{x}$$

Equation 2.21:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)\overline{x}=\overline{x}\sum_{i=1}^{n}\left(x_i-\overline{x}\right)=\overline{x}\left(0\right)=0$$

Equation 2.22:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)x_i$$

Equation 2.23:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)x_i=\sum_{i=1}^{n}\left(x_i-\overline{x}\right)x_i-\sum_{i=1}^{n}\left(x_i-\overline{x}\right)\overline{x}$$

Equation 2.24:

$$\sum_{i=1}^{n}x_i+\sum_{i=1}^{n}y_i=\sum_{i=1}^{n}\left(x_i+y_i\right)$$

Equation 2.25:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)x_i-\sum_{i=1}^{n}\left(x_i-\overline{x}\right)\overline{x}=\sum_{i=1}^{n}\left(\left(x_i-\overline{x}\right)x_i-\left(x_i-\overline{x}\right)\overline{x}\right)$$

Equation 2.26:

$$\sum_{i=1}^{n}\left(\left(x_i-\overline{x}\right)x_i-\left(x_i-\overline{x}\right)\overline{x}\right)=\sum_{i=1}^{n}\left(\left(x_i-\overline{x}\right)\left(x_i-\overline{x}\right)\right)$$

Equation 2.27:

$$\sum_{i=1}^{n}\left(\left(x_i-\overline{x}\right)\left(x_i-\overline{x}\right)\right)=\sum_{i=1}^{n}\left(x_i-\overline{x}\right)^2\geq 0$$

Equation 2.28:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)x_i=\sum_{i=1}^{n}\left(x_i-\overline{x}\right)^2$$

Equation 2.29:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)\overline{y}=0$$

Equation 2.30:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)y_i$$

Equation 2.31:

$$\sum_{i=1}^{n}(x_i-\overline{x})\,y_i=\sum_{i=1}^{n}(x_i-\overline{x})\,y_i-\sum_{i=1}^{n}(x_i-\overline{x})\,\overline{y}$$

Equation 2.32:

$$\sum_{i=1}^{n}(x_i-\overline{x})\,y_i=\sum_{i=1}^{n}(x_i-\overline{x})\,y_i-\sum_{i=1}^{n}(x_i-\overline{x})\,\overline{y}=\sum_{i=1}^{n}\left((x_i-\overline{x})\,y_i-(x_i-\overline{x})\,\overline{y}\right)$$

Equation 2.33:

$$\sum_{i=1}^{n}(x_i-\overline{x})\,y_i=\sum_{i=1}^{n}\left((x_i-\overline{x})\,y_i-(x_i-\overline{x})\,\overline{y}\right)=\sum_{i=1}^{n}(x_i-\overline{x})(y_i-\overline{y})$$

Equation 2.34:

$$\sum_{i=1}^{n}(x_i-\overline{x})(y_i-\overline{y})=\sum_{i=1}^{n}\left((y_i-\overline{y})\,x_i-(y_i-\overline{y})\,\overline{x}\right)$$

Equation 2.35:

$$\sum_{i=1}^{n}(x_i-\overline{x})(y_i-\overline{y})=\sum_{i=1}^{n}\left((y_i-\overline{y})\,x_i-(y_i-\overline{y})\,\overline{x}\right)=\sum_{i=1}^{n}(y_i-\overline{y})\,x_i-\sum_{i=1}^{n}(y_i-\overline{y})\,\overline{x}$$

Equation 2.36:

$$\sum_{i=1}^{n}(x_i-\overline{x})(y_i-\overline{y})=\sum_{i=1}^{n}(y_i-\overline{y})x_i$$

Equation 2.37:

$$\sum_{i=1}^{n}\left(x_i-\overline{x}\right)y_i=\sum_{i=1}^{n}\left(x_i-\overline{x}\right)\left(y_i-\overline{y}\right)=\sum_{i=1}^{n}\left(y_i-\overline{y}\right)x_i$$

Equation 2.38:

$$\left(x_1+y_1\right)z_1+\left(x_2+y_2\right)z_2+\left(x_3+y_3\right)z_3+\cdots+\left(x_n+y_n\right)z_n=\sum_{i=1}^{n}\left(x_i+y_i\right)z_i$$

Equation 2.39:

$$\begin{aligned}&\left(x_1z_1+x_2z_2+x_3z_3+\cdots+x_nz_n\right)+\left(y_1z_1+y_2z_2+y_3z_3+\cdots+y_nz_n\right)\\&=\sum_{i=1}^{n}x_iz_i+\sum_{i=1}^{n}y_iz_i\end{aligned}$$

Equation 2.40:

$$\sum_{i=1}^{n}\left(x_i+y_i\right)z_i=\sum_{i=1}^{n}x_iz_i+\sum_{i=1}^{n}y_iz_i$$