

1.38 - Standard Deviation

Part 1 - Statistics Cheat Sheet

Sample	Population
n - Sample size	N - Population size
$\bar{x}$ - Mean	$\mu$ - Mean
$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} = \frac{x_1 + x_2 + \dots + x_n}{n}$	$\mu = \frac{\sum_{i=1}^N x_i}{N} = \frac{x_1 + x_2 + \dots + x_N}{N}$
s - Standard deviation	$\sigma$ - Standard deviation
$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$	$\sigma = \sqrt{\frac{\sum_{i=1}^N (x_i - \mu)^2}{N}}$
(Note, TI uses sx for Standard Deviation of a sample of a larger population, using Bessel's Correction)	(Note, TI uses $\sigma x$ for Standard Deviation for the data representing the entire population)
$s^2$ - Variance	$\sigma^2$ - Variance
R - Range	

Part 2 - Calculating the Standard Deviation of an Entire Population

Q1: The ages of 5 children in a family are recorded below. These represent the **entire population** of children in that family.

4, 5, 8, 11, 17

$$\mu = \frac{4+5+8+11+17}{5} = \frac{45}{5} = 9$$

Calculate the **mean** and **standard deviation** of the ages, using the table for assistance.

$x_i$	$\mu$	$x_i - \mu$	$(x_i - \mu)^2$
4	9	4-9 = -5	(-5) <sup>2</sup> = 25
5	9	5-9 = -4	(-4) <sup>2</sup> = 16
8	9	8-9 = -1	(-1) <sup>2</sup> = 1
11	9	11-9 = 2	(2) <sup>2</sup> = 4
17	9	17-9 = 8	(8) <sup>2</sup> = 64

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \mu)^2}{N}}$$

$$\sigma = \sqrt{\frac{25+16+1+4+64}{5}}$$

$$\sigma = \sqrt{\frac{110}{5}}$$

$$\sigma = \sqrt{22}$$

$$\sigma = 4.69$$

So  $\mu = 9, \sigma = 4.69$

Confirm w/ T.I. Calculator

Use the following information to answer questions #2-5. You may use technology (T.I. Calculator) to get your answers.

Students were asked how many times they looked at the clock during a Math 20-2 class. Their responses are recorded below:

0	0	1	2	3
3	3	4	5	8
8	9	11	12	54

Q2: What is the mean of the data?

$$\mu = 8.2$$

Q3: What is the median of the data?

4

Q4: What is the mode of the data?

3

Q5: What is the standard deviation of the data?

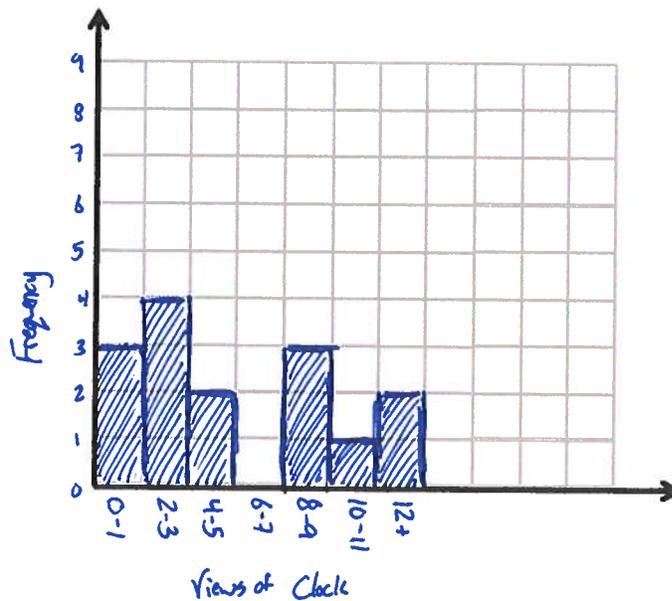
$$\sigma = 12.79$$

Q6: Which datapoint(s) would you consider outliers?

I would consider 54 a possible outlier.

Q7: Build a frequency table using the data, and graph as a Histogram.

Interval	Frequency
0-1	3
2-3	4
4-5	2
6-7	0
8-9	3
10-11	1
12+	2



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**Part 2 – Calculating the Standard Deviation of an Entire Population**

Q8: The heights of a few randomly selected Grade 11 students are given below, in centimeters:

160	162	185	188	165	168	143
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Calculate the **mean** and **standard deviation** of the ages, using the table for assistance.

$x_i$	$\bar{x}$	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
160	167.3	160 - 167.3 = -7.3	(-7.3) <sup>2</sup> = 53.29
162	167.3	162 - 167.3 = -5.3	(-5.3) <sup>2</sup> = 28.09
185	167.3	185 - 167.3 = 17.7	(17.7) <sup>2</sup> = 313.29
188	167.3	188 - 167.3 = 20.7	(20.7) <sup>2</sup> = 428.49
165	167.3	165 - 167.3 = -2.3	(-2.3) <sup>2</sup> = 5.29
168	167.3	168 - 167.3 = 0.7	(0.7) <sup>2</sup> = 0.49
143	167.3	143 - 167.3 = -24.3	(-24.3) <sup>2</sup> = 590.49

$$\bar{x} = \frac{160 + 162 + 185 + 188 + 165 + 168 + 143}{7} = \frac{1171}{7}$$

$$\bar{x} = 167.3$$

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$$

$$s = \sqrt{\frac{53.29 + 28.09 + 313.29 + 428.49 + 5.29 + 0.49 + 590.49}{7 - 1}}$$

$$s = \sqrt{\frac{1419.43}{6}}$$

$$s = \sqrt{236.5716}$$

$$s = 15.38$$

$$\text{So } \boxed{\bar{x} = 167.3, s = 15.4}$$