Difference in Means and Standard Deviation

1. Researchers tested to see if people who exercise regularly sleep better than people who don't. They took a random sample of adults and surveyed their exercise routine and sleep duration. Calculate the difference between the two means. (One Tailed Test)

	Exercise:	No Exercise:
Mean ($\bar{X}_1$)	85h	82h ($\bar{X}_2$)
Standard Deviation (s_1)	6	8 (s_2)
Number (N_1)	22	50 (N_2)

2. In order to compare the means of two populations, independent samples were observed. Test the difference in means between the two.

   Sample 1: $N_1 = 21$ $\bar{x}_1 = 27.6$ $s_1^2 = 20.25$

   Sample 2: $N_2 = 11$ $\bar{x}_2 = 21.5$ $s_2^2 = 30.25$

3. Calculate the difference of the means in the samples given.

   Sample 1: $\bar{X} = 30.17$ N= 9   s= 16.09

   Sample 2: $\bar{X} = 53.71$ N= 8   s= 10.36

4. A survey was taken to see if there was a difference between boys and girls and the number of absences they receive. Calculate the difference in means.

Boys: N= 6 $\bar{X}$= 5.83   s= 2.38

Girls: N=6 $\bar{X} = 8.17$ s= 1.32

5. You grow 20 crystals from a solution and measure the length of each crystal. Calculate the sample standard deviation.

6. Four friends were comparing their scores on their exam. Calculate the standard deviation. (Population)

    6, 2, 3, 1

7. Find the standard deviation for the series of numbers:

    2, 3, 6, 8, 11

8. Find the standard deviation of the set of numbers:

    10, 15, 7, 13

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1. Researchers tested to see if people who exercise regularly sleep better than people who don't. They took a random sample of adults and surveyed their exercise routine and sleep duration. Calculate the difference between the two means. (One Tailed Test)

	Exercise:	No Exercise:	
Mean ($\bar{X}_1$)	85h	82h	($\bar{X}_2$)
Standard Deviation (s_1)	6	8	(s_2)
Number (N_1)	22	50	(N_2)

Steps 1 and 2 are provided, so move on to **step 3 find the standard error**

$$s\overline{x_1} - \bar{x}_2 = \left(\frac{N_1 s_1^2 + N_2 s_2^2}{N_1 + N_2 - 2}\right)\left(\frac{N_1 + N_2}{N_1 N_2}\right)$$

$$\left(\frac{(22)(36) + (50)(64)}{22 + 50 - 2}\right)\left(\frac{22 + 50}{(22)(50)}\right)$$

$$\left(\frac{3992}{70}\right)\left(\frac{72}{1100}\right)$$

(57.0285)(0.0654)

$$s\overline{x_1} - \bar{x}_2 = 3.73$$

Step 4 calculate the t value t= $\frac{\overline{x_1} - \overline{x_2}}{s\overline{x_1} - \bar{x}_2}$

$$t = \frac{85 - 82}{3.73}$$

t= 0.80

Step 5 find the critical t value df= $N_1 + N_2 - 2$

22+50-2

= 70

Do you accept or reject the null hypothesis based on the critical t?

2. In order to compare the means of two populations, independent samples were observed. Test the difference of means between the two.

Sample 1: $N_1 = 21$ $\bar{x}_1 = 27.6$ $s_1^2 = 20.25$

Sample 2: $N_2 = 11$ $\bar{x}_2 = 21.5$ $s_2^2 = 30.25$

Step 3 find the standard error

$(\frac{(21)(20.25)+(11)(30.25)}{21+11-2})(\frac{21+11}{(21)(11)})$

$(\frac{758}{30})(\frac{32}{231})$

= 1.807

Step 4 calculate the t value

$\frac{27.6-21.5}{1.807}$

= 3.375

Step 5 find the critical t value

21+11-2

= 30

Do you accept or reject based on the critical t?

3. Calculate the difference of the means in the samples given.

Sample 1: $\bar{X} = 30.17$ N= 9   s= 16.09

Sample 2: $\bar{X} = 53.71$ N= 8   s= 10.36

Step 3

$(\frac{(9)(258.8881)+(8)(107.3296)}{9+8-2})(\frac{9+8}{(9)(8)})$

(155.33286)(0.2361)

$\sqrt{36.6758}$

=6.665

Step 4

$\frac{30.17-53.71}{6.665}$

= -3.53

Step 5

9+8-2= 15

Do you accept or reject based on critical t?

4. A survey was taken to see if there was a difference between boys and girls and the number of absences they receive. Calculate the difference of means.

Boys: N= 6 $\bar{X}$= 5.83   s= 2.38

Girls: N=6 $\bar{X} = 8.17$ s= 1.32

Step 3

$(\frac{(6)(5.6644)+(6)(1.7424)}{6+6-2})(\frac{6+6}{(6)(6)})$

$(\frac{44.4408}{10})(\frac{12}{36})$

=1.48

Step 4

$\frac{5.83-8.17}{1.48}$

= -1.58

Step 5

6+6-2= 10

Do you accept or reject based on critical t?

5. You grow 20 crystals from a solution and measure the length of each crystal. Calculate the sample standard deviation.

     9, 2, 5, 4, 12, 7, 8, 11, 9, 3, 7, 4, 12, 5, 4, 10, 9, 6, 9, 4

     Step 1 find the mean

     140/20

     = 7

     Step 2 find the square of the distance from the mean for each value (x-μ)

     $(9 - 7)^2 = (2)^2 = 4$
     $(2 - 7)^2 = (-5)^2 = 25$
     $(5 - 7)^2 = (-2)^2 = 4$
     $(4 - 7)^2 = (-3)^2 = 9$

     And so on.

     Step 3 find the mean of those values

     $$\frac{178}{20-1}$$

     = 9.368

     Step 4 take the square root of the sum

     $\sqrt{9.368}$

     = 3.0607

     The standard deviation of the sample is 3.0607

6. Four friends were comparing their scores on their exam. Calculate the standard deviation. (Population)

     6, 2, 3, 1

     Step 1 find the mean

     $$\frac{6+2+3+1}{4}$$

     = 3

Step 2 (x-μ)

(6-3) = (3^2) = 9

(2-3) = $(-1)^2$ = 1

(3-3) = $(0)^2$ = 0

(1-3) = (-2^2)= 4

Step 3 find the mean

$\frac{9+1+0+4}{4}$

$\frac{14}{4}$

= 3.5

Step 4 take the square root of the sum

$\sqrt{3.5}$

= 1.87

The standard deviation is 1.87

7. Find the standard deviation for the series of numbers: 2, 3, 6, 8, 11

   Step 1

   $\frac{2+3+6+8+11}{5}$

   = 6

   Step 2

   (2-6) = -4^2= -16

   (3-6) = -3^2= -9

   (6-6) = $0^2 = 0$

   (8-6) = 2^2=4

   (11-6) = $5^2 = 25$

   Step 3

$$\frac{-16+ -9+0+4+25}{5-1}$$

= 1

Step 4

$$\sqrt{1}$$

= 1

The standard deviation is 1

8. Find the standard deviation of the set of numbers: 10, 15, 7, 13

Step 1

$$\frac{10+15+7+13}{4}$$

= 11.25

Step 2

(10-11.25) = $-1.25^2 = -1.5625$

(15-11.25) = $3.75^2 = 10.725$

(7-11.25) = $-4.25^2 = -18.0625$

(13-11.25) = $1.75^2 = 3.0625$

Step 3

$$\frac{36.74}{4}$$

= 9.19

Step 4

$$\sqrt{9.19}$$

= 3.03

The standard deviation is 3.03