
III. Using the TI30 X II Calculator

Turning the Caculator on and off

Use the **ON** key to turn the calculator on. To turn the calculator off, you need to use two key strokes. Above the key labeled **ON** you will find the word **OFF** in another color. If you look in the upper left hand corner of the keypad you will find a key labeled **2ND** in the same color as the word **OFF**. The second key works like a shift key on a computer keyboard: press the **2ND** key *then* press the **ON** key and the result will be the **OFF** key, i.e., the calculator will shut off.

Use the numeric keypad and the arithmetic operator keys (**+**, **-**, **×** and **÷**) to perform routine arithmetic operations. The equal sign key **=** displays the final answer of the calculation and also serves as an **ENTER** key. You can use the up arrow key in the upper left corner of the keypad to scroll through and correct previous calculations.



Using the Calculator to find means and standard deviations.

Place the calculator in STATISTICS mode. To do this you need to activate the STAT function, which is above the **DATA** key. Thus you strike the **2ND** and **DATA** keys in succession. When you do this, the display gives you a choice of several different STAT modes. Press **ENTER** to accept the first one displayed (1-var), one variable mode. We will only use one-variable mode in this class.

Note that if you have previously used the calculator in STAT mode there will still be data stored from the previous problem. The data will even be retained if you have turned the calculator off since the prior use. To clear the data from a prior problem, press **2ND** and **DATA** to activate the STAT menu. Use the right arrow key **→** to scroll to the CLRDATA choice – this choice will not initially appear on the display, you will need to scroll using **→** to see it. Once CLRDATA is selected on the display, press **ENTER** to accept it. The data from prior problems is now erased from the calculator's memory.



Step 2. Now you are ready to start entering data. Press the **DATA** key. The display will show $X_1 =$, asking for the first data point. Use the keypad to enter the data. Then press either the down-arrow \downarrow in the upper right corner of the keypad. The display changes to $FRQ=$ and is asking for the *frequency* with which this data point appears. The default value for the frequency is one. If the data point appears more than once, you can change this to the appropriate frequency, otherwise just press the down-arrow key \downarrow . If you have a number that appears more than once, this saves you from having to enter the number several times.



Once the frequency is correct, press the down-arrow key \downarrow . The display will change to $X_2 =$ and you are ready to enter the second data point. Enter the rest of the data points by repeating these steps.

For example, if your data consists of 8, 8, 8, 9, 10, you would enter the 8 in response to the X_1 prompt on the display, press the down-arrow key, then change the frequency to 3 with the numeric keypad, then press the down-arrow key \downarrow again. Then you would enter the 9 in response to the X_2 prompt, then press the down-arrow key once to see the frequency, then a second time to accept the default frequency of 1 for the data point 9. Finally, you would enter the 10 in response to the X_3 prompt and press the down-arrow key twice (once for the frequency and once to complete the entry of the 10). You have then entered three distinct numbers (8, 9 and 10) and five data points.

Note that you must press the down-arrow key *twice* after displaying the *last* data point in order to store it in memory. The first \downarrow confirms the value of the data point and the second \downarrow confirms the frequency of the value.

After all the data points are entered you can find the mean, population standard deviation, population variance, sample standard deviation and sample variance with a few simple key strokes. Once the data is entered, it stays in memory until you leave **STAT** mode; thus you can do the following steps in any order. You can even intersperse other calculations – as long as they do not take you out of **STAT** mode –

in between finding the mean and standard deviation.

Step 3. Finding the mean and standard deviation.

To find the mean, press the **STATVAR** key. The first line of the display changes to

$$\underline{n} \quad \bar{x} \quad S_X \quad \sigma_X \quad \rightarrow$$

with the first entry, n , selected (underlined) on the display. The second line of the display shows the number of data points that you have entered. Use \rightarrow to move the selection one to the right to select \bar{x} . The second line of the display shows the mean.

To find the *sample standard deviation* press the right-arrow key \rightarrow until the S_X is selected on the first line of the display. The second line of the display will show the sample standard deviation. (You must have entered more than one data point otherwise you will get an error message.)



To find the *population standard deviation* press the right-arrow key \rightarrow until the σ_X is selected on the first line of the display. The second line of the display will show the population standard deviation. (You must have entered more than one data point otherwise you will get an error message.)

To find the population variance, display the population standard deviation as above. Then strike the x^2 . The display will show σ_X^2 . Press **ENTER** to do the calculation. The display will then show the answer.

Example.

Find the mean and sample standard deviation for the following data points:

8 8 8 9 10

Solution.

Step 1. If you are not already in STAT mode, press **2ND** nad **DATA** to

activate the STAT menu, then press **ENTER** to select 1-VAR mode. Then erase any data from previous problems. To do this, press **2ND**, **DATA** and **→** to select CLRDATA. Press **ENTER** to clear the data.

Step 2. Next enter the data. Press **DATA**. The display shows $X_1 =$. Enter the first 8. Press **↓** and change the FRQ to 3 since the number 8 appears three times in the data list. Press the **↓** key again to move to the $X_2 =$ prompt. Enter the 9, press **↓** twice (once to accept the data value, once to accept the frequency of one). Finally, enter the 10 in response to the $X_3 =$ prompt and again press **↓** twice. The display will show $X_4 =$ indicating that the prior entries have been accepted and the calculator is ready for another entry.

Step 3. Find the mean and sample standard deviation. To do this, press **STATVAR**. The first line of the display changes to

$$\underline{n} \quad \bar{x} \quad S_X \quad \sigma_X \quad \rightarrow$$

The n is underlined and the second line of the display shows 5, indicating that five data points have been entered. Use **→** to select \bar{X} in the first line of the display. The second line of the display changes to 8.6 to show the mean. Use **→** to select S_X on the first line of the display. The second line of the display changes to 0.894427191, the sample standard deviation.

If you wanted the *population standard deviation* you would use **→** one more time to move the selection in the first line of the display to σ_X and the second line of the display would show 0.8, the population standard deviation.

Correcting Errors

The arrow keys in the upper right of the keypad let you scroll left and right through the first line of the display and up and down through prior entries.

For example, if are trying to find

$$54 \div 271$$

and you have incorrectly entered 55 instead of 54

$$55 \div 271$$

the display will show

$$55/271$$

You can use **←** to backspace and correct the 55 to 54 by just over-typing the error.

If you have already pressed **ENTER**, the first line of the display shows the incorrect entry

$$55/271$$

and the second line shows the incorrect answer 0.202. You can use **↑** to move back to the first line of the display, then use the arrow keys to move to the second 5 in 55 and over-type it to correct it to read

$$54/271$$

Now pressing enter gives the correct answer of 0.199.

To correct statistical data points, press **DATA** and use the up or down arrow keys to scroll through the data. You can correct either the value of one of the entries or the frequency with which it occurs by just overtyping.

Sample calculations.

Example. Simplify the following expression:

$$1.28 \frac{3.2}{\sqrt{33}}$$

Solution. Recall that if two expressions are written next to each other with no operation in between, then there is an implicit multiplication sign present. Thus this is the same as

$$1.28 \times \frac{3.2}{\sqrt{33}}$$

Further, this is the same as

$$\frac{1.28}{1} \times \frac{3.2}{\sqrt{33}} \quad \text{or} \quad \frac{1.28 \times 3.2}{\sqrt{33}}$$

consolidating the terms in the numerator.

The calculator makes this easy to do, just reading from left to right in the expression.

For example, start with the first expression:

$$1.28 \times \frac{3.2}{\sqrt{33}}$$

Use the keypad to enter the 1.28. Then strike the \times key, then use the keypad to enter 3.2. Next we are supposed to divide the result by $\sqrt{33}$, so strike the \div key to begin the division.

Next we need to find the square root of 33. The square root function is above the squaring function x^2 on the calculator, so to activate it you must strike **2ND** and **x^2** . The display at this point shows

$$1.28 * 3.2 / \sqrt{($$

Now you can enter the 33, resulting in the display showing

$$1.28 * 3.2 / \sqrt{(33$$

To close the operation, strike the right-parentheses key **)** so the display shows

$$1.28 * 3.2 / \sqrt{(33)}$$

This is exactly what we want to compute, so press **ENTER** to get the result, 0.713, displayed on the second line of the display.



If you made a mistake entering one of the numbers, you can use **↑** to return to the first line of the display and edit the entry.

Example. Simplify the expression

$$1.96 \sqrt{\frac{0.67(1 - 0.67)}{512}}$$

Solution. Again, this is the same as

$$1.96 \times \sqrt{\frac{0.67 \times (1 - 0.67)}{512}}$$

To do this, enter the 1.96 followed by the \times . Next activate the square root function with **2ND** and **x^2** . The display now shows

$$1.96 * \sqrt{($$

Now enter 0.67 and \times so the display shows

$$1.96 * \sqrt{(0.67*$$

Next repeat the punctuation from the formula (the left parenthesis) with (on the calculator's keypad, so the display shows

$$1.96 * \sqrt{(0.67 * ($$

Now enter the $1 - 0.67$) using the keypad, then close the parentheses. The display then shows

$$1.96 * \sqrt{(0.67 * (1 - 0.67)$$

Finally, we are supposed to divide by 512, so enter \div and 512. The display then shows

$$1.96 * \sqrt{(0.67 * (1 - 0.67)/512$$

The parentheses are mis-matched at this point – there are two left-parentheses and only one right parenthesis. You need to close the first left-parenthesis (the one right after the $\sqrt{}$) by entering a second left-parenthesis at this point. The display now shows

$$1.96 * \sqrt{(0.67 * (1 - 0.67)/512)$$

In more conventional notation, this is the same as

$$1.96 \times \sqrt{\left(\frac{(0.67 * (1 - 0.67))}{512}\right)}$$

Pressing ENTER now results in 0.0407 appearing on the second line of the display.

The parentheses are punctuation marks that indicate which operations are to be done first. The calculations inside the inner-most parentheses are done first, then those in the next layer, and so on. Thus the position of the parentheses is important. For example, suppose you had misplaced the second right parenthesis and entered

$$1.96 * \sqrt{(0.67 * (1 - 0.67))/512$$

The left-most open-parenthesis – the “(” – is matched with the right-most close-parenthesis – the “).” These two together mark the scope of the square root operator. By mis-placing the second close-parenthesis, the square root operator never gets applied to the 512 since it is outside the scope of the operator. The incorrect calculator display

$$1.96 * \sqrt{(0.67 * (1 - 0.67))/512$$

is equivalent to

$$\frac{1.96 \times \sqrt{((0.67 * (1 - 0.67))}}{512}$$

With the parenthesis in the wrong place, we don't find the square root of 512 in the calculation and get the wrong answer!

Which calculations should I do first?

✓ Do all operations in parentheses first. Parentheses are punctuation marks in mathematics; they are telling you "do me first."

✓ Do all calculations in the numerator and denominator before doing the division implied by the fraction. This means that you regard expressions written like

$$\frac{\textit{numerator}}{\textit{denominator}}$$

as though parentheses were present around the entire numerator and the entire denominator:

$$\frac{(\textit{numerator})}{(\textit{denominator})}.$$

Then the parentheses rule will cause you to simplify the numerator and denominator separately before proceeding with other operations.

✓ After priority rules for parentheses are followed, do powers (exponents) and roots (square roots) before other operations.

✓ Do multiplications and divisions before additions and subtractions.

Symbolically, these rules can be summarized as:

$$(\) \frac{(\textit{numerator})}{(\textit{denominator})}$$

$$x^n \quad \sqrt{x}$$

$$\times \quad \div$$

$$+ \quad -$$

Rounding. If you are careful using your calculator, it should not be necessary to round. However, if you find that you must round, try to keep at least three non-zero digits to the right of the decimal place (since the tables are generally accurate to two or three places). For example, round 38.9673 to 38.967 and round 0.002365 to 0.00237.