



## The applications

The NumWorks calculator is app-based, just like a phone. That means you will open different applications based on the task you are completing. Let's dive into some of the apps to see what they do!

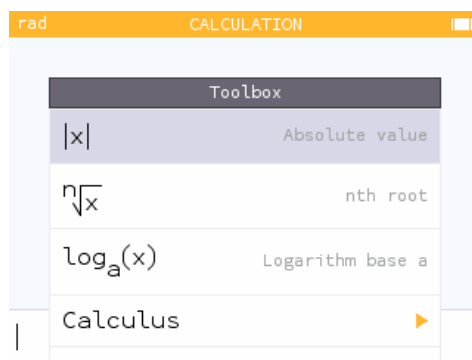
### Calculation




The **Calculation** application is where you will do all of your... calculations!

Navigate to the Calculation application and open it by pressing .

1. Let's add some fractions! By hand, add  $\frac{1}{6} + \frac{1}{2}$ .
2. Check your work by using the calculator. What do you notice about your answer?
3. Use your calculator to subtract  $\frac{9}{5} - \frac{4}{10}$ .
4. How do the results of the last two calculations differ?
5. Navigate up into the *calculation history* and click on the three dots on the right side of the screen to view the *additional results*. What additional results are provided for this calculation?
6. Return to the editing bar and open the **Toolbox**. Navigate through the Toolbox and list any functions that you know.



7. How many ways are there to select four plants out of the six that are available? Within the **Toolbox** , open the **Probability** section and select **Combination**. Input  $\binom{6}{4}$ .

## Grapher



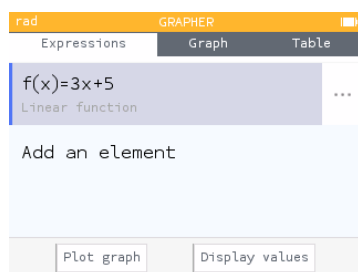
Graphing relations and functions is simple within the **Grapher** application.

Our goal will be to graph the linear function  $f(x) = 3x + 5$ , look at its features and view the table.

Notice that there are three tabs at the top of the screen: **Expressions**, **Graph** and **Table**.

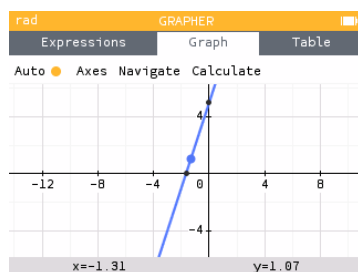
The **Expressions** tab is where you will enter your function.

1. Press  $\odot$  to **Add an element**. There are some templates you can use when entering expressions. For this example, select the  $f(x) = x$  template.
2. Input the function  $f(x) = 3x + 5$ .



The **Graph** tab will plot the graphs of your functions and provide tools for exploring key characteristics.

1. View the graph. The **auto** zoom generally provides a window that you will find useful.



2. Press the  $\oplus$  and  $\ominus$  keys to zoom in and out.
3. Navigate to  $x = -2$ . What is the value of  $f(x)$ ?
4. What is the value of  $f(x)$  when  $x = 4$ ?
5. Open the **Calculate** menu. Then open the **Find** menu. This menu provides tools for finding key characteristics of our graph. Use the **Inverse image** option to determine the value of  $x$  when  $f(x) = 10$ .

The **Table** tab provides a table of points for your function.

1. Open the **Table** tab.
2. The table displays the  $x$  and  $f(x)$  values for  $x = 0$  through  $x = 10$ . Copy down the values of  $f(x)$  in the table below.

$x$	0	1	2	3	4	5	6	7	8	9	10
$f(x)$											

3. What is the value of  $f(x)$  when  $x = 100$ ?

## Statistics



The **Statistics** application is great for studying graphical representations of data sets and viewing summary statistics.


Open the Statistics app and notice the three tabs at the top of the screen: **Data**, **Graph** and **Stats**.

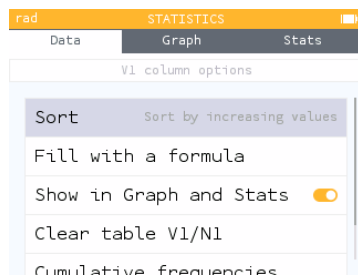
The **Data** tab is where you will enter your data.

The table below shows the number of text messages sent in the past 24 hours by the students in a class.

Table 1: Number of texts sent in past 24 hours

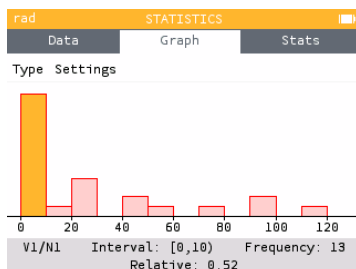
0	7	1	29	25	8	5	1	25	98	9	0	26	8	118	72	0	92	52	14	3	3	44	5	42
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1. On the **Data** tab, enter the values into the **V1** column. What do you think **N1** represents?
2. Once your data is entered, navigate back up to the top of the column and press  to open the V1 column options. Sort your data.



To view graphical representations of your data, you will use the **Graph** tab.

1. Open the **Graph** tab and create a histogram for this data.



2. Navigate through the histogram.
3. The histogram is showing "bins" of size 10. Change the **Bin width** to 20 using the histogram **Settings**. What do you notice about the distribution?
4. You can also view a boxplot of the data on number of texts sent. Change the graph from a histogram to a boxplot using the **Type** menu.
5. Navigate through the boxplot. Record the values shown in the bottom banner.
6. The last value in the boxplot is displayed as a single dot. What does this represent about that data point?

The **Stats** tab provides summary statistics for the dataset.

1. Open the **Stats** tab. What do you notice about the first few entries on this tab?

rad STATISTICS		
Data		Stats
		V1/N1
Number of data points	n	25
Minimum	Min	0
First quartile	Q1	3
Median	Med	9
Third quartile	Q3	43
Maximum	Max	118
Range	R	118
Interquartile range	IQR	40

2. Scroll through the list of summary statistics found on the **Stats** tab. Which of the terms or symbols do you recognize?

## Regression



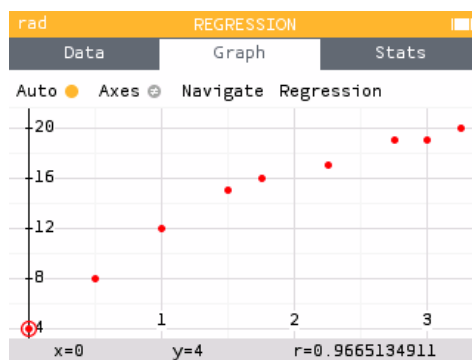
The **Regression** application plots scatterplots and provides the line of best fit.

Open the Regression application. The Regression app also has three tabs at the top of the screen: **Data**, **Graph** and **Stats**.

The table below shows the relationship between quiz scores (out of 20) and study time (in hours) for a few students in a class.

Study time (hours)	1.5	3	2.25	1.75	0.5	3.25	1	0	2.75
Score (out of 20)	15	19	17	16	8	20	12	4	19

1. On the **Data** tab, enter the values of "Study time" into the **X1** column and the values of "Score" into the **Y1** column.
2. Select the **Graph** tab to view the scatterplot.



3. Navigate through the data points. Notice that the values of  $x$  and  $y$  appear in the bottom banner.
4. How would you describe the relationship between Study time and Score?

Let's find the line of best fit.

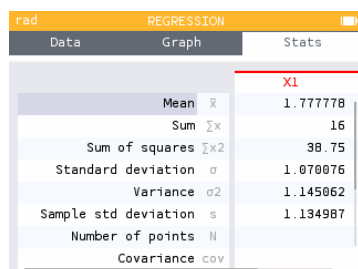
1. While viewing the scatterplot on the **Graph** tab, press  $\odot$  to open the list of regression models.
2. Press  $\odot$  on **Linear**.
3. Navigate through the data points and onto the line of best fit. What is the regression equation (round to the nearest hundredth)?
4. Find the equation of the line of best fit in the **Regression** menu.

We can use the equation of the line to make predictions for scores based on other study times.

1. While in the **Regression** menu, select **Predict Y given X**.
2. Predict the quiz score for a student who studied for 2 hours.
3. Return to the Regression menu and select **Find X given predicted Y**.
4. Determine how many hours of studying a student would need in order to earn a score of 18 on the quiz.

The **Stats** tab provides summary statistics for our dataset.

1. Navigate to the **Stats** tab and find the row **Mean  $\bar{x}$** . This reports the mean or average for X1 and Y1.



	X1
Mean $\bar{x}$	1.777778
Sum $\sum x$	16
Sum of squares $\sum x^2$	38.75
Standard deviation $\sigma$	1.070076
Variance $\sigma^2$	1.145062
Sample std deviation $s$	1.134987
Number of points $N$	
Covariance $cov$	

2. What is the average amount of time these students studied (round to the nearest hundredth)?
3. What is the average quiz score for these students (round to the nearest hundredth)?

Keep exploring!

There's a lot more you can do on the NumWorks calculator! Keep exploring the applications and check out the short tutorials at [num.works/tutorials](https://num.works/tutorials).