TI-83/84 Plus Graphing Calculator Worksheet #2

The graphing calculator is set in the following WINDOW, MODE, and Y=, settings. Resetting your calculator brings it back to these original settings.

**Resetting Calculator to Factory Setting**

- when the user have used the calculator in various ways and it is difficult to go back to the original setting.
- when the user lend the calculator to others and they have messed up the original setting.
- this should be done before a test or after you lend the calculator to a friend

**Adjusting WINDOW of a graph:**

Sometimes, a graph needs to be set with a customize WINDOW. This is similar to setting the intervals and the ranges for both x- and y- axis.

**Example 1:** Graph \( y = -2x^2 + 5x + 15 \).

- To enter negative sign, press \( - \)
- To enter \( x \), press \( X,T,\theta,n \)

Note: We use the subtraction button \( - \) between terms. Otherwise, we use \( (-) \) for negative signs.

The ZoomFit option does not give a neat WINDOW setting, but it allows us to see the whole graph.

Press to deselect ENTER

Scroll down with \( \downarrow \) and press ENTER or Select Option 0
To quickly reset the original WINDOW setting without resetting the entire calculator:

Now, we try using a customize WINDOW setting to 

\[ x : [-10, 10, 1] \text{ and } y : [-20, 20, 1]. \]

Example 2: Using the graph \( y = -2x^2 + 5x + 15 \) from the previous example,

a. Create a table of values starting at \( x = -3 \) with an increasing interval of 0.5.

b. Trace the graph and find the value of \( y \) when \( x = 5 \) from the graph.

c. What is the \( y \)-intercept of this graph?

d. Determine the \( x \)-intercepts.

e. Give the coordinates of where the maximum value of this graph occurs.

f. Solve \(-2x^2 + 5x + 15 > 0\) and then solve \(-2x^2 + 5x + 15 \leq 0\).

a. **To create and customize a Table of Values:**

b. **To Trace along a Graph and find a Y-value from an X-value:**

The equation is displayed on top.

Note the blinking cursor and the valued of the current \( x \) and \( y \).

\( y \)-value of \(-10\) is shown.
c. To find \( y \)-intercept, let \( x = 0 \)

![Graph showing the \( y \)-intercept at \(-15\).]

To find the \( y \)-intercept of a quadratic equation is its constant value after we manipulate it to \( ax^2 + bx + c = 0 \).

![TRACE]

To find \( x \)-intercept, let \( y = 0 \): This means using the ZERO function.

d. To find \( x \)-intercept, let \( y = 0 \): This means using the ZERO function.

![2nd TRACE CALC Select Option 2 Enter to input \( x \)-value ENTER y-value of \(-15\) is shown]

Select Option 2

Use and take the cursor to the left of the first \( x \)-intercept.

Use and take the cursor to the right of the first \( x \)-intercept.

Press again.

Do the same steps for the second \( x \)-intercept.

Zero = \( x \)-intercept = Solution = Root

Note the two little triangles that appear. They indicate the calculator will find the \( x \)-intercept within that range.

Because the original quadratic equation, \( y = -2x^2 + 5x + 15 \), is not factorable, these solutions are the decimal equivalents of the roots found from the quadratic formula. However, we prefer the exact values from the quadratic formula to their decimal equivalents.

e. To find the coordinates of the Maximum (or the Minimum) of a Graph:

![2nd TRACE CALC Select Option 3 for Minimum Select Option 4 for Maximum Enter]

Select Option 3 for Minimum

Select Option 4 for Maximum

Use and take the cursor to the left of the Maximum point.

Use and take the cursor to the right of the Maximum point.

Press again.
f. **Solve Inequalities from Graphing:** \((-2x^2 + 5x + 15 > 0\) and \((-2x^2 + 5x + 15 \leq 0)\)

\[
x \text{-intercepts } = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(5) \pm \sqrt{(5)^2 - 4(-2)(15)}}{2(-2)} = \frac{-5 \pm \sqrt{145}}{-4} = \frac{5 \pm \sqrt{145}}{4}
\]

\[
x = \frac{5 - \sqrt{145}}{4} \approx -1.760399 \quad \text{Exact Solution: } \frac{5 - \sqrt{145}}{4} < x < \frac{5 + \sqrt{145}}{4}
\]

\[
x = \frac{5 + \sqrt{145}}{4} \approx 4.2603986 \quad \text{Exact Solution: } x \leq \frac{5 - \sqrt{145}}{4} \text{ or } x \geq \frac{5 + \sqrt{145}}{4}
\]

For \(-2x^2 + 5x + 15 > 0\), it is the same as when \(y > 0\).  
Approx Solution: \(-1.760399 < x < 4.2603986\)

For \(-2x^2 + 5x + 15 \leq 0\), it is the same as when \(y \leq 0\).  
Approx Solution: \(x \leq -1.760399\) or \(x \geq 4.2603986\)

**Example 3:** Solve \(-2x^2 + 5x = -15\) using the INTERSECT function.

**Using the INTERSECT function:**

Enter the two sides of the equation as \(Y_1\) and \(Y_2\):

\[
Y_1 = -2x^2 + 5x
\]

\[
Y_2 = -15
\]

**GRAPH**

1. **2nd TRACE**
2. **CALC**
3. **Select Option 5**
4. **ENTER**
5. **ENTER**
6. **ENTER**

Take cursor close to the first intersecting point

Note that solutions for the equation, \(-2x^2 + 5x = -15\), are the same as the zeros for \(y = -2x^2 + 5x + 15\).
Exercise Questions

1. Graph \( y = x^2 + 6x - 16 \). Adjust the WINDOW to properly fit the graph.
   a. Trace the graph and find the value of \( y \) when \( x = -7 \) from the graph.
   b. What is the \( y \)-intercept of this graph? How is the answer compared to the constant of the equation?
   c. Determine the \( x \)-intercepts. How are they compared to solving the equation by factoring?
   d. Give the coordinates of where the minimum value of this graph occurs.
   e. Solve \( x^2 + 6x - 16 \geq 0 \).
   f. Solve \( x^2 + 6x - 16 < 0 \).

2. Solve all real solutions \( x^3 + 3x^2 - 7x = 15 \) to two decimal place by graphing \( y = x^3 + 3x^2 - 7x - 15 \) and determine its zeros. Adjust WINDOW accordingly.
   a. Why is find the zeros of \( y = x^3 + 3x^2 - 7x - 15 \) the same as solving the equation \( x^3 + 3x^2 - 7x = 15 \)?
   b. Solve the equation, \( x^3 + 3x^2 - 7x = 15 \), again by using the intersect function of the calculator.
   c. Give the coordinates (to the two decimal place) where the minimum value of this graph occurs.
   d. Solve \( x^3 + 3x^2 - 7x - 15 < 0 \).

3. A number people were shipwrecked on an island. The population of the island slowly grew for 20 years until a passing boat rescued the people. The population on the island can be modeled by the formula, \( P = 200(1.1)^t \), where \( P \) is the number of years on the island and \( t \) is the years that they have been shipwrecked.
   a. Why is \( 0 \leq t \leq 20 \) an appropriate \( x \) range for your window?
   b. What is an appropriate \( y \) range? How will ZOOMFit set a good range for you after you have put in the \( x \) range (we used this on the last worksheet)?
   c. How many people were originally shipwrecked? What time is this?
   d. What is the population after 5 years? 18 years?
   e. When is the population 300? When is it 1000?

Answers

1a. When \( x = -7, y = -9 \).
1b. \( y \)-int = -16. The \( y \)-int of the graph is the constant of the equation because all \( x \) terms becomes 0 (as we set \( x = 0 \) to find \( y \)-intercept).
1c. \( x \)-intercepts are -8 and 2. They are the same if we solve the equation by factoring.
1d. Minimum at coordinates (-3, -25)
1e. \( x^2 + 6x - 16 \geq 0 \) when \( x \leq -8 \) or \( x \geq 2 \).
1f. \( x^2 + 6x - 16 < 0 \) when \( -8 < x < 2 \).
2. \( x = -3.80, x = -1.62, x = 2.43 \)
2a. Finding zeros of \( y = x^3 + 3x^2 - 7x - 15 \) is the same as solving the equation \( x^3 + 3x^2 - 7x = 15 \) because we essential let the equation equals to 0 and when \( y = 0 \), we are solving for the \( x \)-intercepts (or zeros of the graph).
2b. Letting \( Y_1 = x^3 + 3x^2 - 7x \) and \( Y_2 = 15 \) will give intersecting points at \( x = -3.80, x = -1.62, x = 2.43 \).
2c. The relative minimum occurs at (0.83, -18.17). As the graph goes infinitely towards negative \( y \), moving towards the left, we can see there is no absolute minimum.
2d. \( x^3 + 3x^2 - 7x - 15 < 0 \) when \( x < -3.80 \) or \( -1.62 < x < 2.43 \)
3a. It is because we cannot have negative time values and it is stated in the question that the population grew for 20 years. Hence, it is appropriate to set time to \( 0 \leq t \leq 20 \).
3b. The ZOOMFit Function uses the range \( y: [200, 1345.49999, 1] \). We can modify WINDOW by customizing the \( y \) range as \( y: [0, 1400, 100] \)
3c. There were originally 200 people shipwrecked. This can be found because when \( t = 0, P = 200 \).
3d. When \( t = 5 \) years, \( P = 322 \) people. When \( t = 18 \) years, \( P = 1111 \) people
3e. \( P = 300 \) people when \( t = 4.26 \) years. \( P = 1000 \) people when \( t = 16.89 \) years