SOLVING EQUATIONS RELATED TO QUADRATIC FUNCTIONS

QUADRATIC FUNCTIONS

- Quadratic functions relate a set of input values (domain of the independent variable) to a set of output values (range of the dependent variable) using a relationship with a varying rate of change. Within the domain and range of a quadratic function, each input value generates only one output value so that the input value and its corresponding output value are paired numbers.

QUADRATIC FUNCTIONS

- Quadratic functions can be solved in one of 3 ways:

  - Graphically
  - Tabularly
  - Symbolically

QUADRATIC FUNCTIONS

- Graphically:
- Locate the point on the graph of f(x) that has a y-coordinate equal to the given function value. The x-coordinate of this point is the x-value paired with that function value. This x-value is the solution to the equation. For a Quadratic function, there will only be one point for which this is true.

QUADRATIC FUNCTIONS

- Tabularly:
- Locate the function value in the dependent variable column or row. The value in the independent variable column or row associated with this function value is the solution to the equation.

QUADRATIC FUNCTIONS

- Symbolically:
- Substitute the given function value for the dependent variable in the symbolic representation of f(x). Use a method such as inverse operations, factoring and applying the zero-product property, or the quadratic formula to solve for x.

EXAMPLES

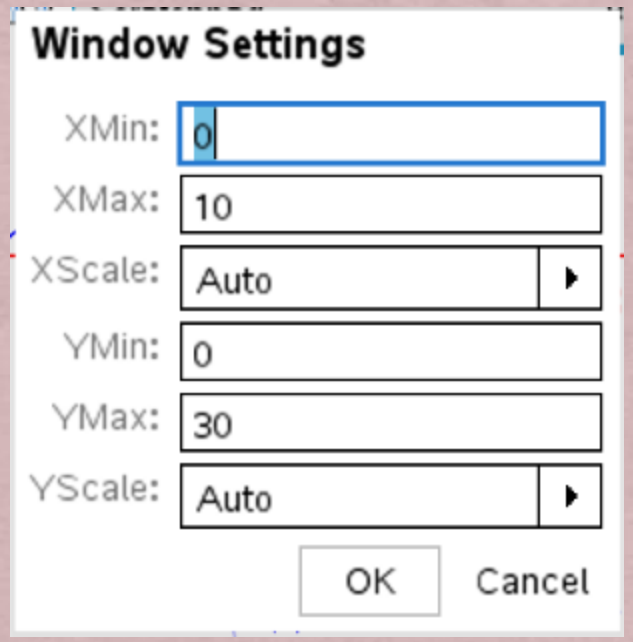
- Several high schools in the area are having a model rocket launch. A special camera will be fixed on the top of a 20-meter tall pole to capture pictures during the rocket flights. A quadratic function can be used to represent the height above the ground, $h(t)$, in terms of the number of seconds, t, into the flight. The Science Club has calculated the function for their rocket as $h(t) = -4.9t2 + 20t + 1.5$ when the launch pad is 1.5 meters above the ground. A related equation, $y = 20$, represents the height of the camera's aim. Graph the function and equation, then determine when the camera will capture a picture of their rocket.

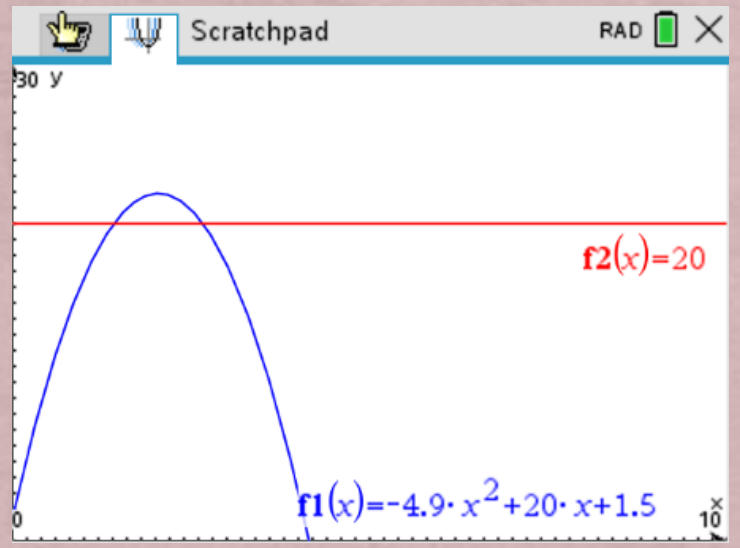
EXAMPLES

+ **STEP 1** Graph the function $h(t) = -4.9t^2 + 20t + 1.5$ and the related equation $y = 20$.

+ In the calculator:
+ Add graph
+ Type in function
+ MENU, 4, 1 → we are going to change the window so that we can see what we want

+ Since we know that we want to see y = 20, lets move the window up

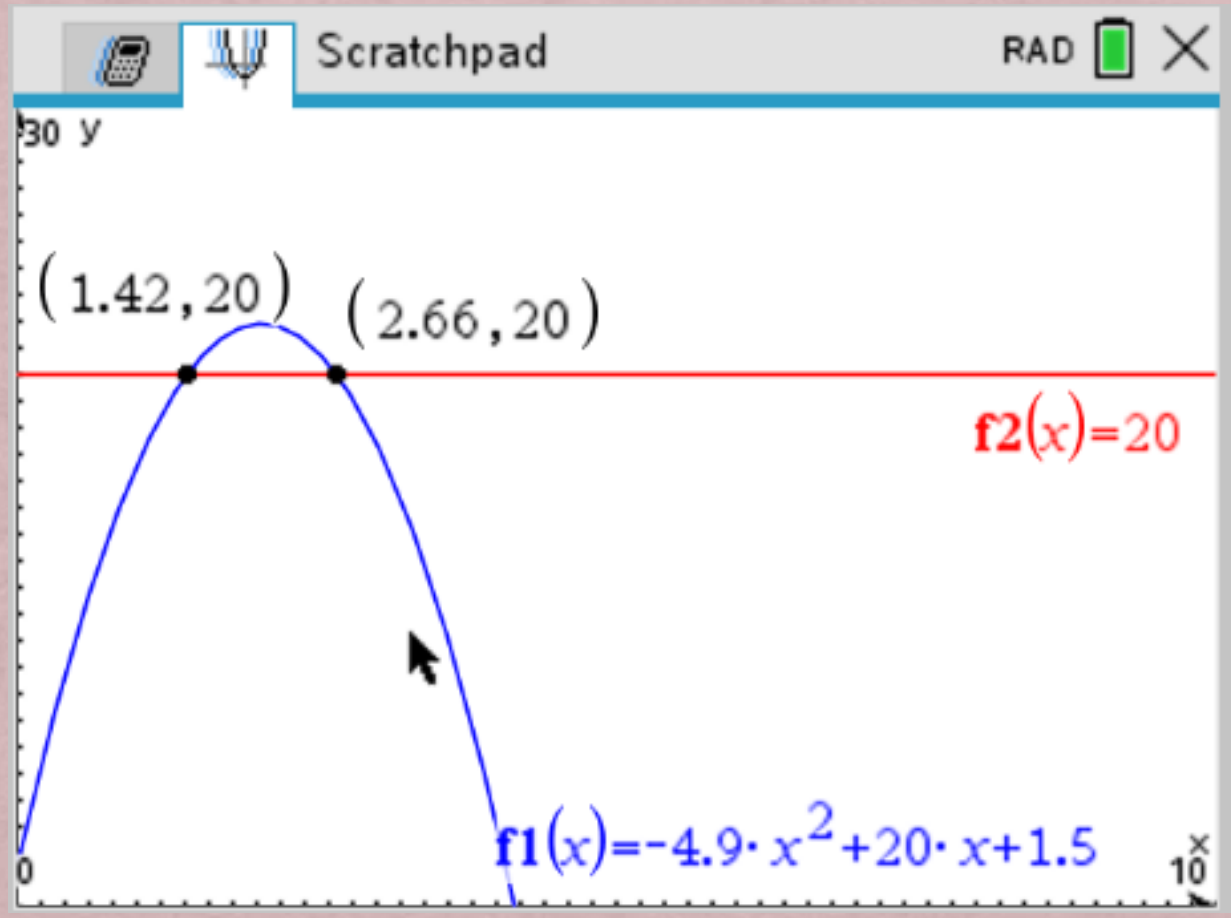




EXAMPLES

- **STEP 2** Determine the points on the graph of $h(t)$ with a y-coordinate or height of 20 meters.

- In the calculator:
- Type Menu, 6, 4
- Lower bound: place cursor to left of intersection
- Upper bound: place cursor to right of intersection
- You will now get the intersection
- Repeat for second intersection



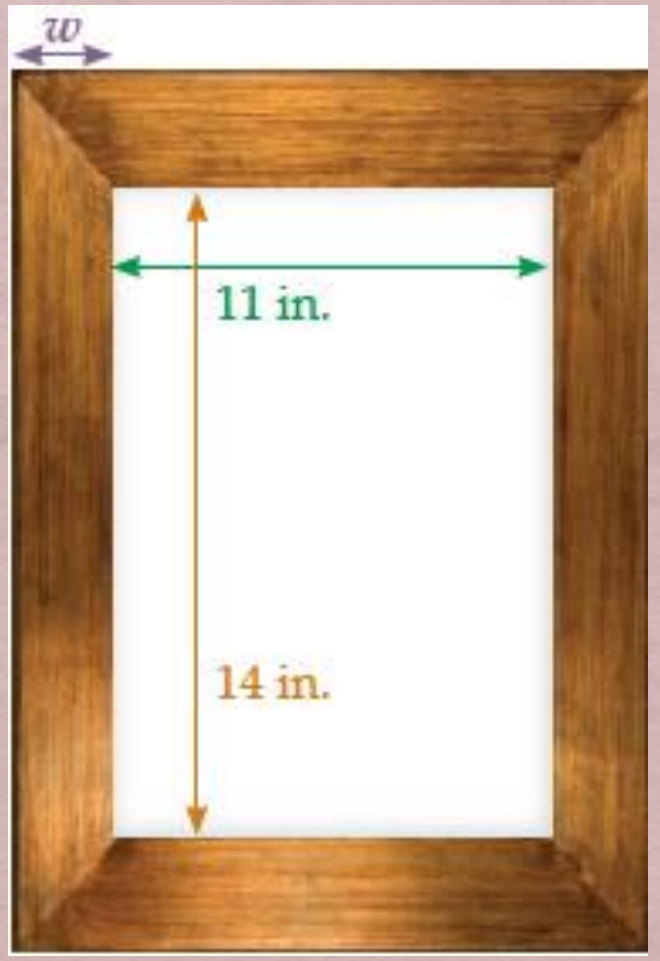
EXAMPLES

- **STEP 3** Interpret the points of intersection of the graphs.

- If all goes as planned, the camera will capture pictures of the Science Club's rocket at 1.42 and 2.66 seconds after the launch.

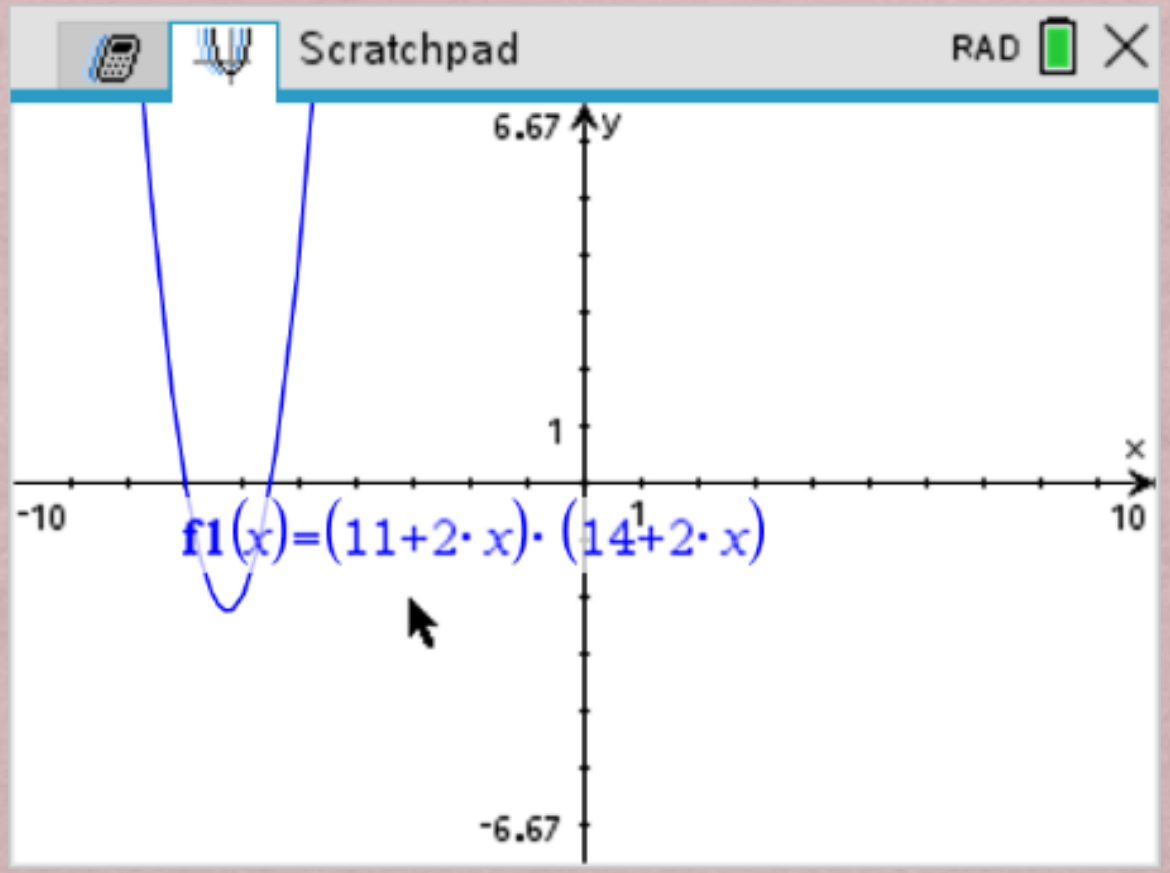
EXAMPLES

- The standard framing for an 11-inch by 14-inch picture with a frame *w* inches wide produces a total area *A*(*w*). The total area, measured in square inches, varies according to the width of the frame. How wide should the frame be for a framed picture with a total area of about 400 square inches?



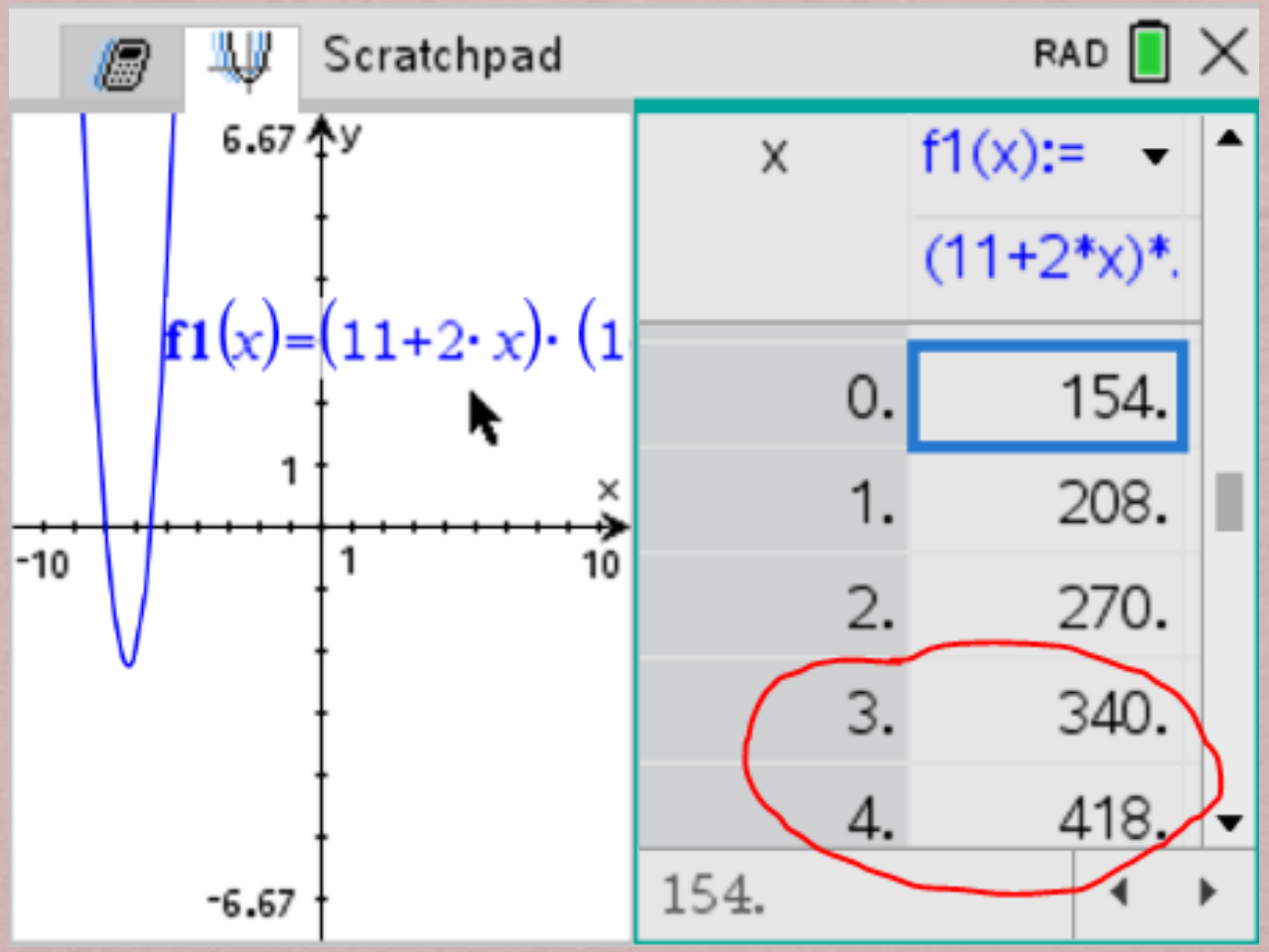
EXAMPLES

- **STEP 1** Write a function for the total area, $A(w)$, in terms of w, the width of the frame.
  - $A(w) = (11 + 2w)(14 + 2w)$
- *The calculator will simplify the equation for you.*
- In the calculator:
- Type in function



EXAMPLES

- **STEP 2** Create a table of function values for the total area.
- In calculator:
- **ctrl T** to get to the table
- Notice that 400 will be in between 3 and 4

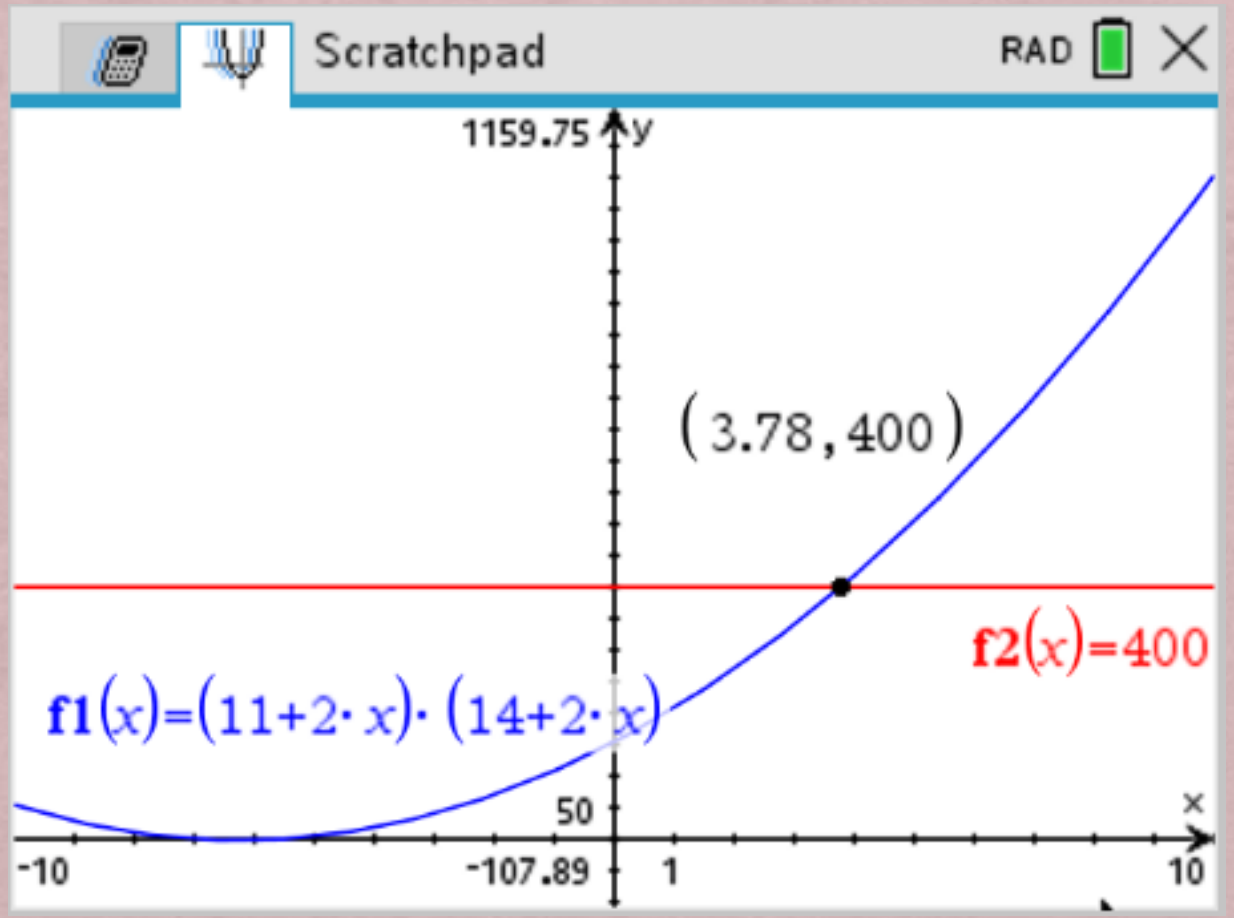


EXAMPLES

- **STEP 3** Use the table to determine the necessary width for this value of A(w).
- The total area of 418 square inches is produced when the frame is 4 inches wide. To find a total area closer to 400 square inches use the graph

EXAMPLES

- In the calculator:
- Ctrl T → get rid of the table
- Press tab to open the function editor; type 400
- MENU, 4, A → fits graph so you can see it
- MENU, 6, 4 → finds the intersection



EXAMPLES

- The x-value, 3.78, tells us the exact width that will give the area of 400 square inches