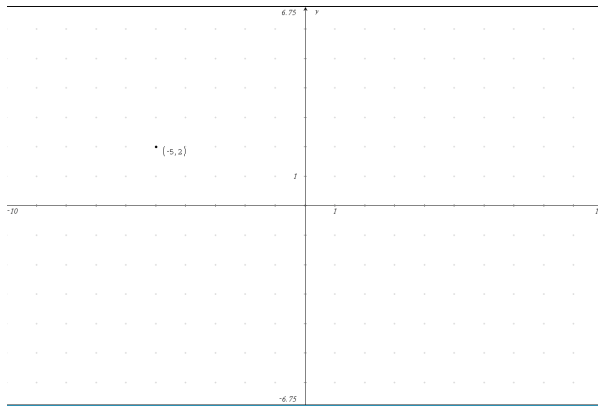


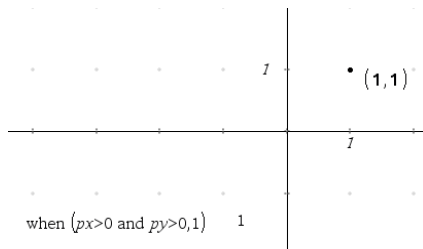
## Advanced Authoring



1. Graphs page, hide input line and chevron
2. Show grid, Point On grid, right click to show coordinates  
NOTE: I prefer to work in Document View: computer to "compose".

when ( $px > 0$  and  $py > 0, 1$ )

4. Text box: when(... as above This means when the x-coord and y-coord are both positive, display a 1, otherwise undef is displayed.



when ( $px > 0$  and  $py > 0, 1$ ) undef

What I learned from Bryson Perry and Jeff McCalla  
Thank you!!!

• (-5,  $py := 2$ )

3. Store the x-coord into px (point x) and y-coord into py by right clicking on the number in the ordered pair and choosing store. Notice that the coords are now **bold**.

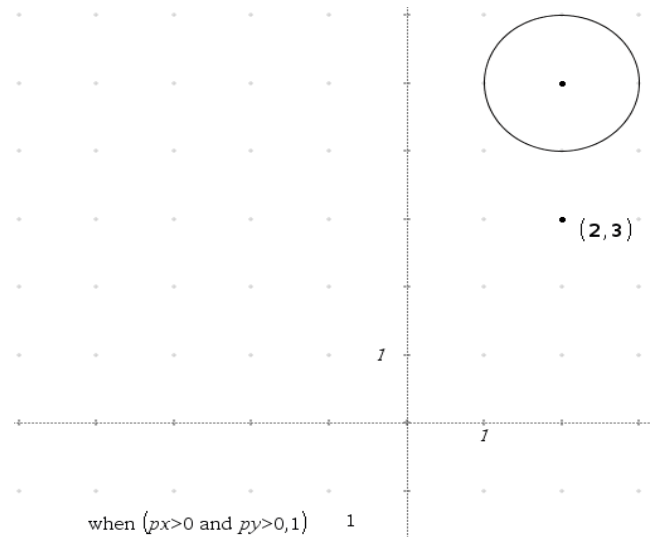
when ( $px > 0$  and  $py > 0, 1$ ) undef

5. Right click, choose calculate, prompted to type L for px (L for Link), then prompted L for py. Since False, undef is displayed b/c point is in Quad 2.

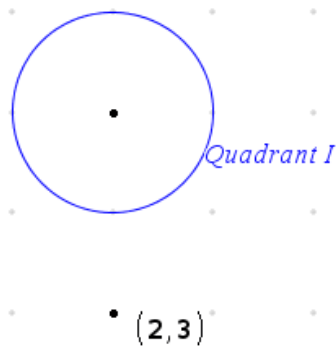
when ( $px > 0$  and  $py > 0, 1$ ) undef

• (-2, -2)

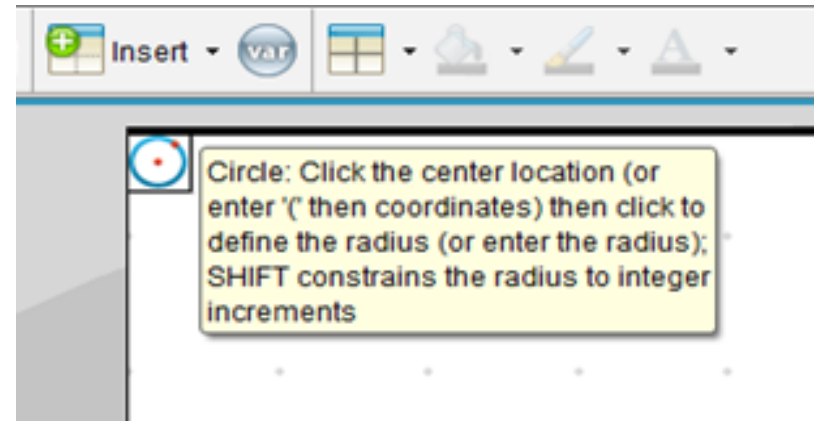
6. Grab the point and move about the screen. 1 is displayed if the point is in Quad 1, undef is displayed otherwise.



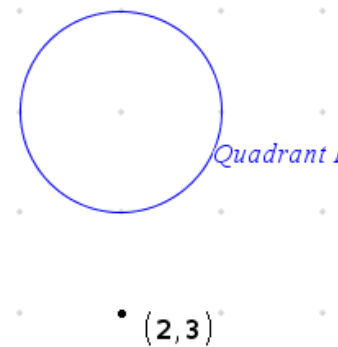
7. Menu > Shapes > Circle Then click on the 1 (for the radius. Then somewhere in Quad 1, click on a point for the center. A circle of radius 1 is drawn.



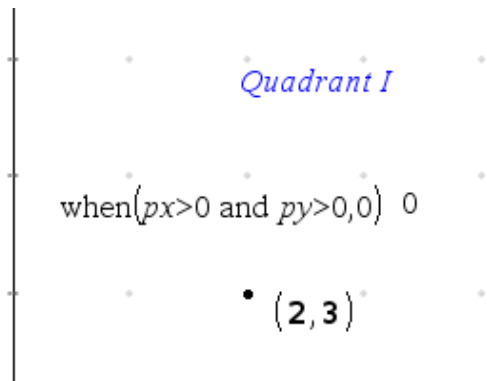
9. Right click on the circle, select Label. Type "Quadrant I". To change the color of the words in the label, you need to change the color of the circle. Right click on the circle, select Color, Line Color, and then the color (here Blue).



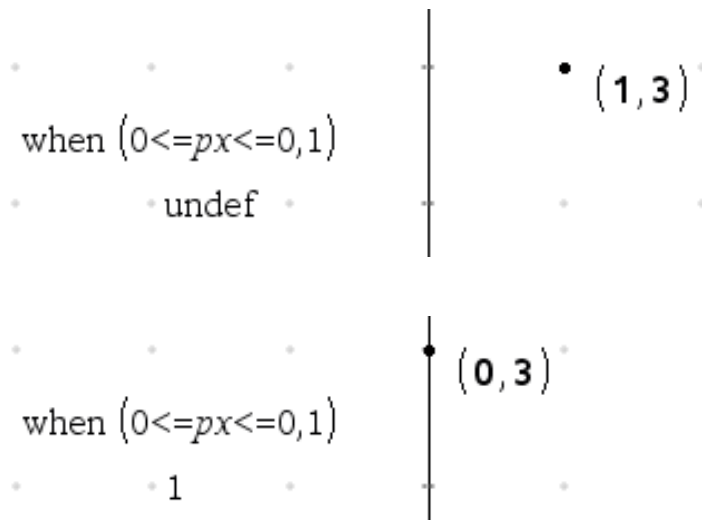
8. NOTE: if you hover over the icon in the upper left corner of the screen, you get some good hints.



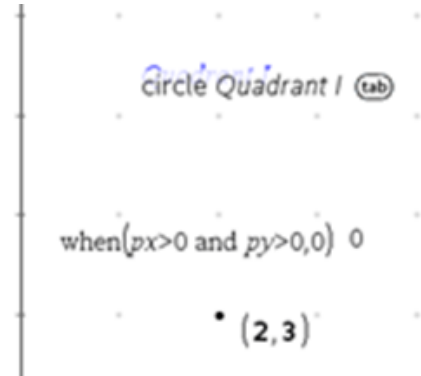
10. Hide the center point by right clicking on it and then selecting Hide. Do NOT hide the circle as it will also hide the label, which is what you want to show. Instead, make the radius of the circle tiny. See next slide to see how to do this.



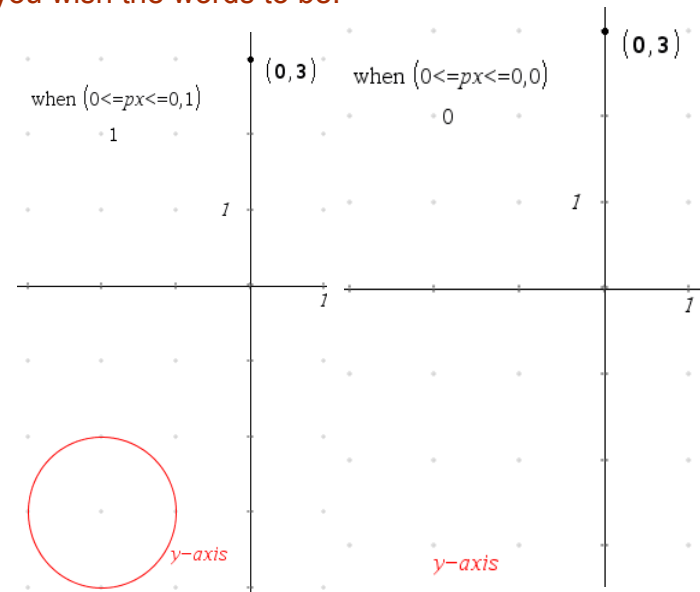
11. Return to the when statement and change the 1 to a 0, that is, the radius of the circle will be 0. The circle disappears but the label doesn't.



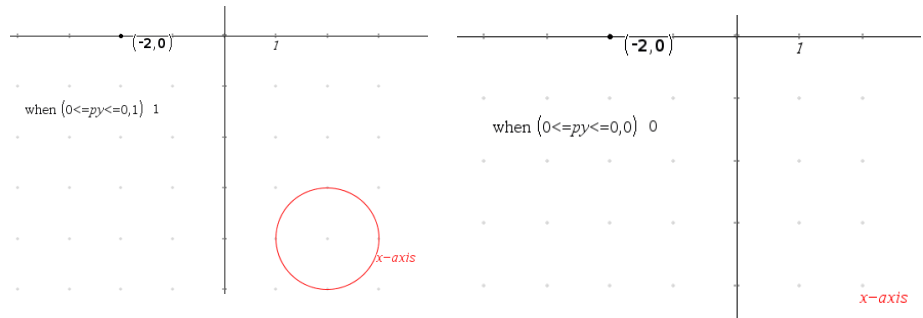
13. To display "y-axis", we will use a when statement. To do so, insert a text box, and type as above.  $0 \leq px \leq 0$  is a way to test if  $px$  is zero. In the graph APP, values may never be EXACTLY zero, so we use this inequality.



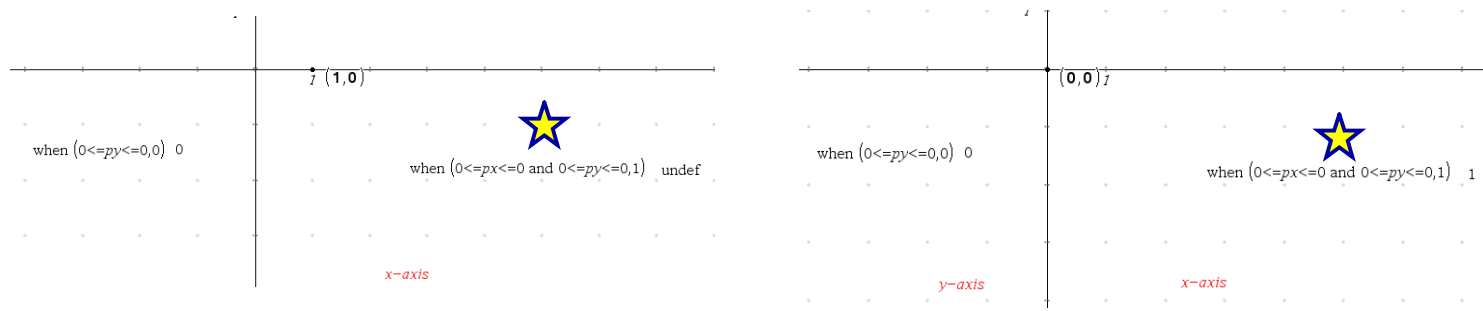
12. To "move" the label "Quadrant I", you need to grab the center of the "invisible" circle. Hover where the center was and "circle Quadrant I tab" is displayed. Grab and drag to where you wish the words to be.



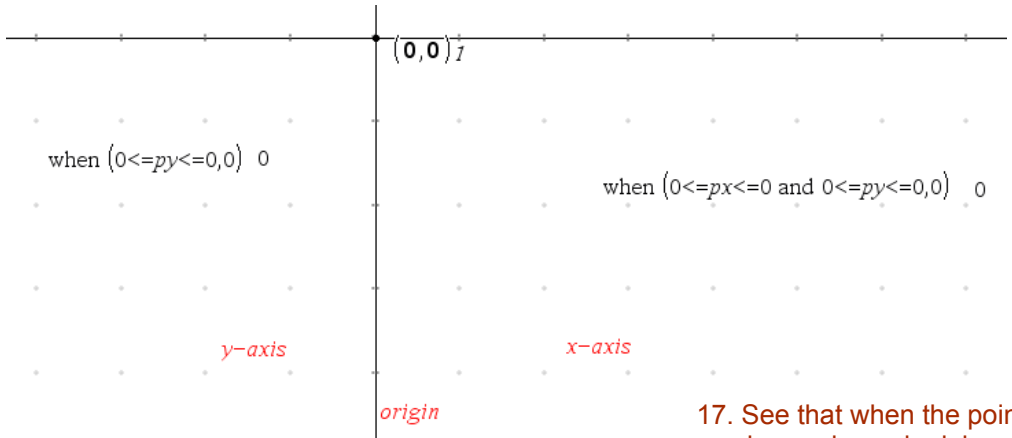
14. Repeat steps 7-10 as appropriate. Then do step 11 and 12 as needed.



15. Repeat steps as needed to show when a point is on the x-axis.



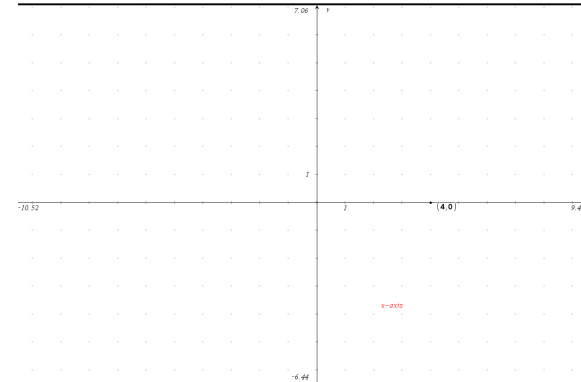
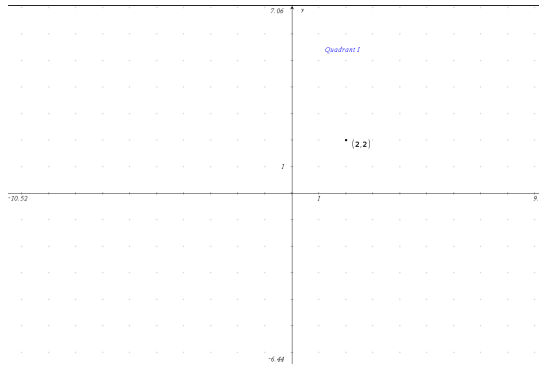
16. To get the origin to display, notice the word "and" in the when statement.



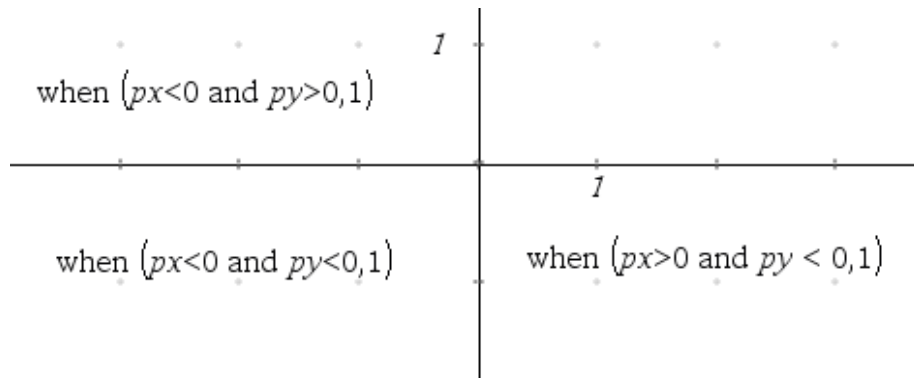
17. See that when the point is at the origin, it displays x-axis, y-axis, and origin.

when( $px > 0$  and  $py > 0, 0$ ) 0

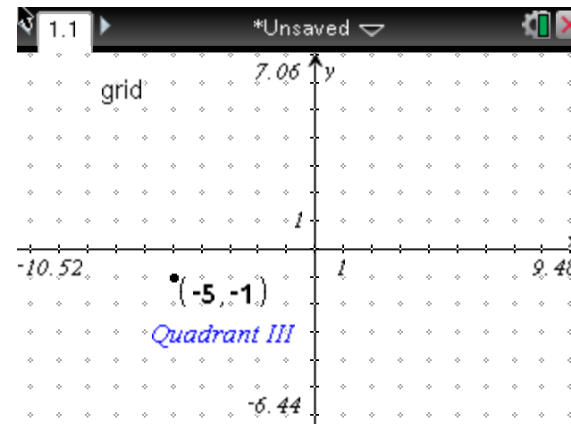
- 1:Recent
- 2:Hide
- 3:Delete
- 4:Calculate
- 5:Convert to geometric
- 6:Pin
- 7:Attach (2,1)
- 8:Detach



18. Hide all the when statements and their outputs. Do not delete these, we need them. Then grab the point and move it about the screen to see that it does, in fact, work so far.

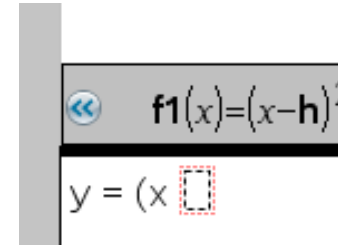
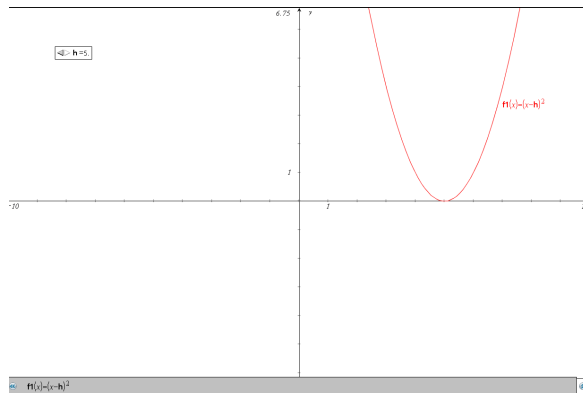
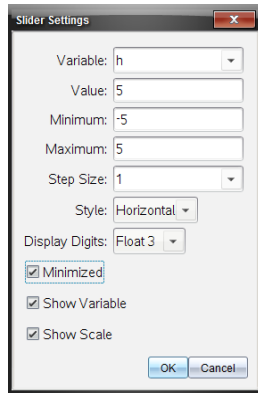


19. Finish the exercise for quadrants II, III, and IV.



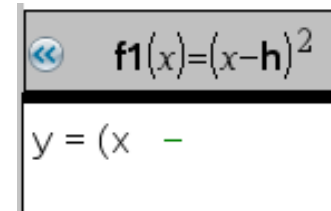
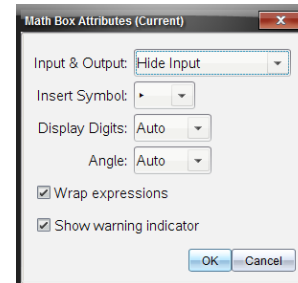
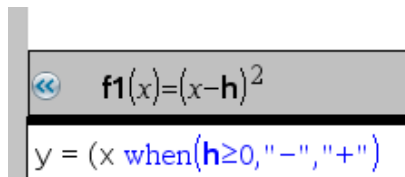
20. Back to handheld view and verifying it works like you want it to work. Do editing as needed.

# Using Interactive Math Boxes



1. New problem, add a graphs page, enter  $f_1(x) = (x - h)^2$ . It doesn't graph b/c  $h$  is not yet defined with values.
2. Actions > Insert Slider. Make the variable  $h$ . Right click to change the settings: -5 to 5 step of 1, minimized, horizontal slider.

3. Split the screen horizontally with the graph on top and Notes on the bottom.
4. Type into Notes:  $y = (x$  then notice that a math box was inserted above. Ctrl m does this.



5. Type  $y = (x$  Then ctrl m to insert a math box. Type as shown above. This means if  $h$  is positive or zero, display a minus sign, otherwise display a plus sign.

6. Then right click on the math box and in Math Box Attributes choose Hide Input. Notice the green minus sign b/c  $h = 3$ , which is positive.

```

f1(x)=(x-h)^2
y = (x when(h>=0,"-","+") - abs(h))^2

```

7. Insert another math box and type in abs(h).

```

f1(x)=(x-h)^2
y = (x - approxrational(|h|))^2

```

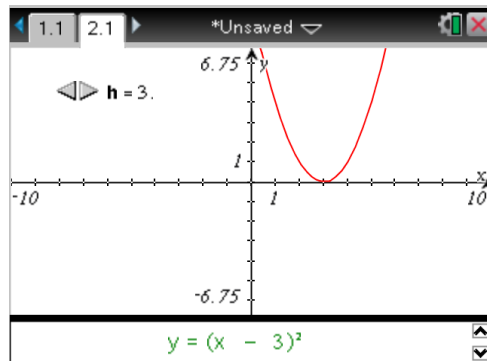
9. To get rid of the decimal point, use the approxrational command.

```

f1(x)=(x-h)^2
y = (x - 3)^2

```

11. Select the items not in green, right click, and change the color.



```

f1(x)=(x-h)^2
y = (x - 3.)^2

```

8. Repeat step 6 to Hide Input.

```

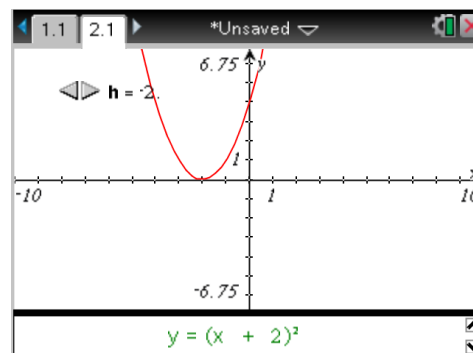
f1(x)=(x-h)^2
y = (x - 3)^2

```

10. It looks like this. But we would like it to be all one color.

12. To change inside the math box, click inside the math box and select what you want to change, then click on the color A at the top of the screen to select the color you desire.

Here we are changing the minus sign to be red.



13. Final Results

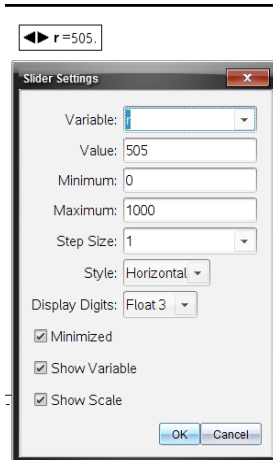
12.

```

f1(x)=(x-h)^2
y = (x when(h>=0,"-","+") - |h|)^2

```

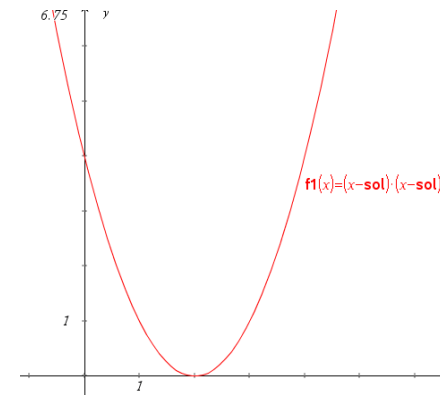
# Randomly Generated Graphs



2.  $\text{randint}(-8,8)+r-r$

3-4.  $\text{randint}(-8,8)+r-r$       **sol=2**

5.  $f1(x)=(x-\text{sol})\cdot(x-\text{sol})$



1. New problem, graphs page, insert slider with settings above.
2. Insert Text Box with  $\text{randint}(-8,8)+r-r$  (as above).
3. Right click on the randint and select Calculate.
4. Right click on the result of the calculation and store into the variable sol (for solution).

5. Into f1(x) type the expression above and enter.

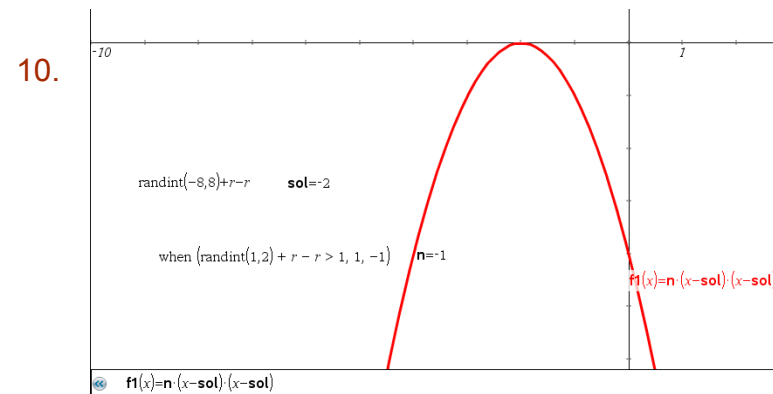
6. when  $\{\text{randint}(1,2) + r - r > 1, 1, -1\}$

7. when  $\{\text{randint}(1,2) + r - r > 1, 1, -1\}$

Select r ? (L for var r)

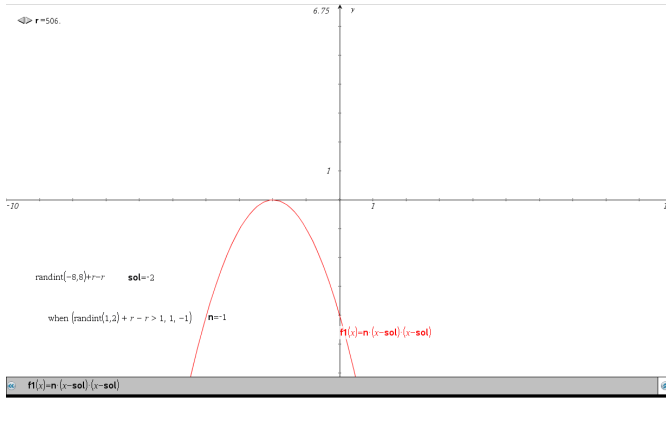
8. when  $\{\text{randint}(1,2) + r - r > 1, 1, -1\}$        $n := 1$

9.  $f1(x)=n\cdot(x-\text{sol})\cdot(x-\text{sol})$



6. Introduce a coefficient of either 1 or -1 into f1(x) and have it randomly generated using the when statement above. Insert a text box to type in the when statement.
7. Right click on the when statement and select Calculate. Press enter to accept L.
8. Right click on the result and Store the result in the variable n.

9. Edit the equation in f1 as shown above.
10. Click the slider a few times and note what is happening.



11. Split the page horizontally so that the graph is the top, and Notes is on the bottom. Resize as shown above. We wish to display the equation in the notes part, with the actual numbers, not the variables.

15.  $b := -2 \cdot n \cdot \text{sol} \triangleright -14$

16.  $ab := |b| \triangleright 14$

17.  $c := n \cdot \text{sol}^2 \triangleright -49$

18.  $ac := |c| \triangleright 49$

$$"y = "&\text{string}(n)&"x^2"&\begin{cases} "+", b \geq 0 \\ "- ", b < 0 \end{cases} &\text{string}(ab)&"x"&\begin{cases} "+", c \geq 0 \\ "- ", c < 0 \end{cases} &\text{string}(ac) \triangleright y = -1x^2 - 14x - 49$$

20. Go back to the first Math Box and edit as shown above.

15. We want to also show the rest of the equation.

Use Math Boxes to:

Calculate b, the linear coefficient, as  $-2 \cdot n \cdot \text{sol}$ .

16. Calculate ab, as the absolute value of b.

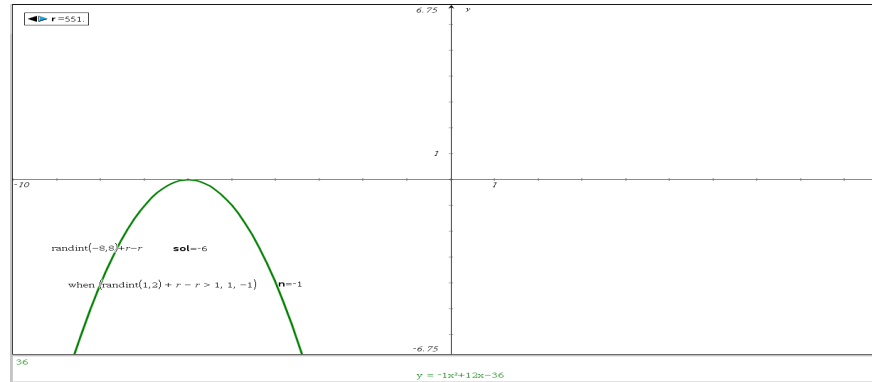
17. Calculate c, the constant term as  $n \cdot \text{sol}^2$ .

18. Calculate ac, as the absolute value of c.

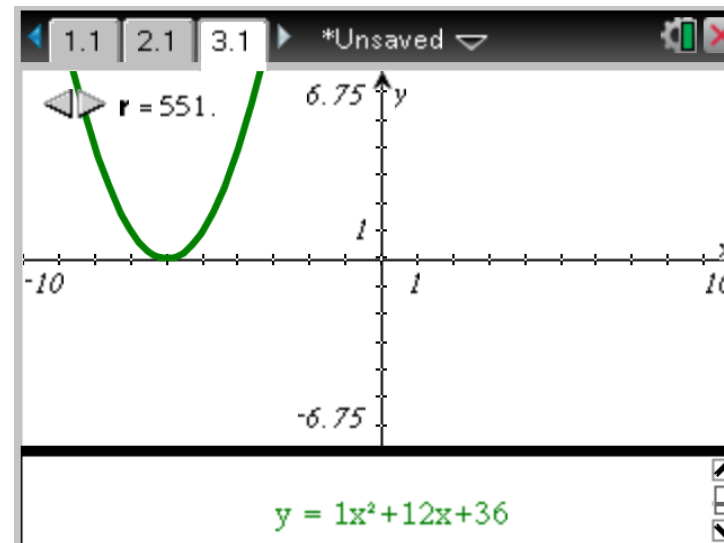
19. Right click and select Math Box Attributes and choose Hide Input.

12-13.  $"y = "&\text{string}(n)&"x^2"$

14.  $"y = "&\text{string}(n)&"x^2" \triangleright y = -1x^2$



21. Right click on the Math Box and Hide Input.
22. Insert spaces before the equation so that it is centered.
23. Resize the top and bottom windows so that more of the graph is shown and less of the Notes page, just the equation.



24. Hide all the appropriate items on the graph screen.
25. Change colors and make graph thicker as desired.
26. Put into handheld view.