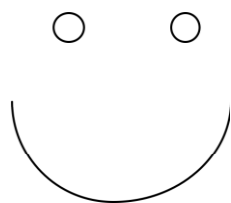
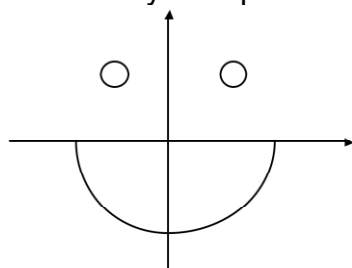


## TI 83/84: Calculator Pictures: The Smiley Face Equations

Suppose we wanted to make a simple Smiley face on our calculators

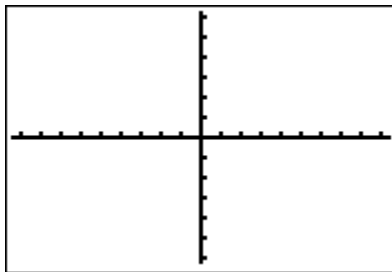


Let's imagine that same Smiley face placed on the x-y coordinate plane:



Set your calculator to this window so that circles look like circles:

```
WINDOW
Xmin=-9.4
Xmax=9.4
Xscl=1
Ymin=-6.2
Ymax=6.2
Yscl=1
Xres=1
```



Right Eye: Hmmmm..... How about a circle of radius 1, with the center at (3,4)?

formula:  $(x - h)^2 + (y - k)^2 = r^2$  gives center (h,k), radius r.

therefore:  $(x - 3)^2 + (y - 4)^2 = 1^2$

**(.....insert a healthy dose of algebra.....fill it in yourself! .....**

$$\text{so: } y = \pm \sqrt{1 - (x - 3)^2} + 4$$

So, to enter it in the calculator, use:  $y_1 = \sqrt{1 - (x - 3)^2} + 4$   
 $y_2 = -\sqrt{1 - (x - 3)^2} + 4$

Left Eye: Should be the same as the right eye, but with the center at (-3,4).

So, to enter it in the calculator, use:  $y_3 = \sqrt{(1 - (x + 3)^2) + 4}$   
 $y_4 = -\sqrt{(1 - (x + 3)^2) + 4}$

**Why? Figure out the details!**

Smile: The negative half of a circle centered at the origin, of radius 5.

So, to enter it in the calculator, use:  $y_5 = -\sqrt{25 - x^2}$

**Why? Figure out the details!**

Now, to make it look extra good:

Use 2nd FORMAT and choose AxesOff.

If you want to graph just PART of an equation for your circles project (optional)

Example: to graph  $y = x + 1$  but only for  $x < 2$  on your calculator, use  $y_1 = (x + 1) / (x < 2)$

Why does this work?

When the calculator does any inequality test, it returns a one (1) if the statement is true, and a zero (0) if the statement is false.

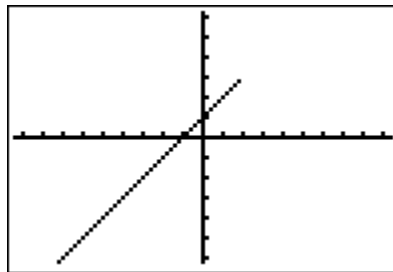
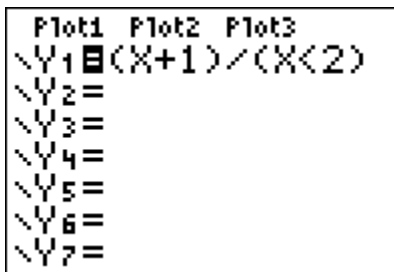
So, when  $x$  is less than 2, the equation works out to:

$$\begin{aligned} y_1 &= (x + 1) / (x < 2) \\ y_1 &= (x + 1) / (1) \\ y_1 &= (x + 1) \end{aligned}$$

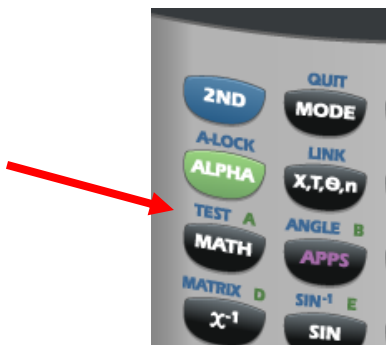
But when  $x$  is NOT less than 2, the equation ends up trying to divide by zero, which is undefined -- so the calculator doesn't graph anything.

$$\begin{aligned} y_1 &= (x + 1) / (x < 2) \\ y_1 &= (x + 1) / (0) \\ y_1 &= \text{undefined!} \end{aligned}$$

So, for  $y_1$  in the above example, when  $x < 2$ , you just get the graph of  $y = x + 1$ . However, when  $x$  is not less than 2 (when  $x \geq 2$ ), the function is undefined, and the calculator graphs nothing.



Where do you find the inequality signs on your calculator? Press  $\boxed{2nd}$ , then TEST, which is above the  $\boxed{MATH}$  key:



What if you want to limit both sides of your graph? Do this:

$$y_1 = (\text{graph eq'n}) / ((x > 2)(x < 5))$$

This would graph your equation, only between  $x = 2$  and  $x = 5$ .