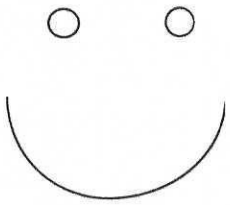
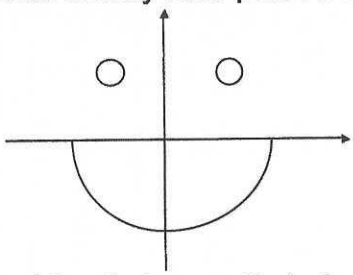
TI 83/84: Calculator Pictures: The Smiley Face Equations

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:

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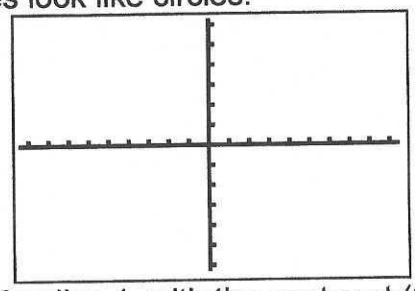


Right Eye: Hmmmm..... How about a circle of radius 1, with the center at (3,4)?

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! .....)

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

$-(x-3)^2 \qquad -(x-3)^2$

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

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

$+4 \qquad +4$

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

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

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!

$(x-h)^2 + (y-k)^2 = r^2$

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

$-(x+3)^2 \qquad -(x+3)^2$

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

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

$+4 \qquad +4$

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

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!

$(x-h)^2 + (y-k)^2 = r^2$ (h, k) center = (0,0)

$(x-0)^2 + (y-0)^2 = 5^2$ r = 5

$x^2 + y^2 = 25$

$-x^2 \qquad -x^2$

$\sqrt{y^2} = \pm\sqrt{25-x^2}$

$y = \pm\sqrt{25-x^2}$

BUT, we only want the bottom half of the circle, so...

$$y = -\sqrt{25-x^2}$$

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 $y_1 = (x+1)/(x<2)$ aka $y = \frac{(x+1)}{(x<2)}$

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.

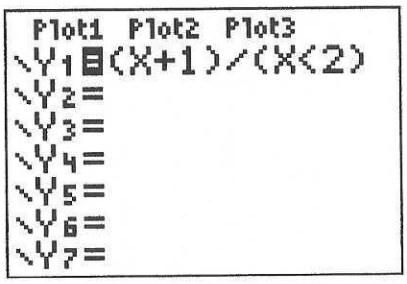
So, when x is less than 2, the equation works out to:

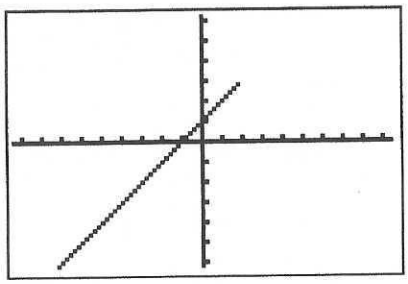
$y_1 = (x+1)/(x<2)$
$y_1 = (x+1)/(1)$
$y_1 = (x+1)$

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.

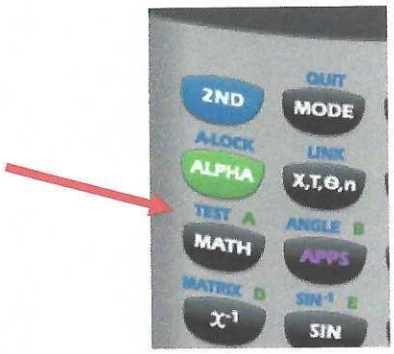
$y_1 = (x+1)/(x<2)$
$y_1 = (x+1)/(0)$
$y_1 = \text{undefined!}$

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 2nd, then TEST, which is above the MATH key:



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

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

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

For example:
$y = (x+1)/((x>2)(x<5))$
graphs the line $y = x+1$, but only between $x = 2$ and $x = 5$.