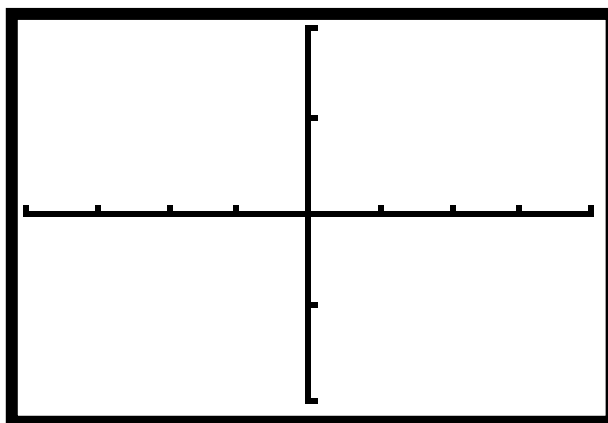


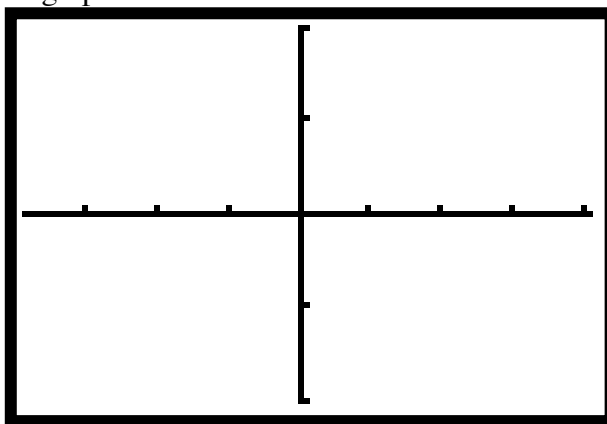
So you thought your calculator knew how to graph?

1. In the space below, carefully *write out* your prediction for what the graph of $y=\sin(45x)$ should look like. You may use comparisons to the graph of $y=\sin(x)$, but be sure to also use words like amplitude, period, x -intercepts and y -intercepts in your descriptions.
2. Compare your descriptions with those of the other members of your group. Combining all of your contributions, write out a careful *group* description of the graph of $y=\sin(45x)$.
3. Use a TI-73, 82, or 83 to graph $y=\sin(45x)$ on the window Xmin=-360, Xmax=360, Xscl=90, Ymin=-2, Ymax=2, Yscl=1 below (be sure that you're in Degrees mode). In the space below, sketch what you see



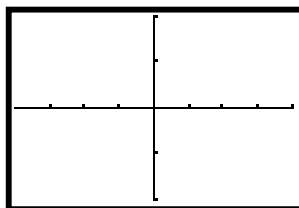
4. What do you notice about the graph of our function? Is it what you expected? What are some of the aspects of the graph that you didn't expect? It might help to jot down a "description" (how would you describe the sketch over the phone if you didn't have access to the function's "formula"?). In particular, what's the y -intercept and slope of the graph at the intercept? Describe in detail how your prediction compares to the calculator's "answer"

5. Now, sketch the calculator's graph of the same function with $X_{\min}=-350$ and $X_{\max}=370$.

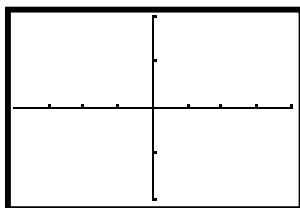


Should the y -intercept have changed? **What's going on?!** Should the graph change dramatically if we shift the window slightly? Try graphing the function on some other windows, being sure that $X_{\max} - X_{\min} = 720$. Hit the **TRACE** key and move along the graph using the arrow keys. Check to be sure that the points on the curve given by the calculator are "correct" (using another calculator, perhaps). Write down what you think might be going on after consulting with the other members of your group.

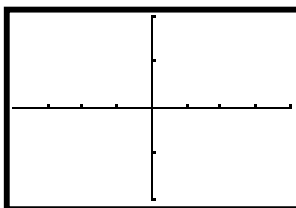
6. Now, go back to the original window ($X_{\min}=-360$ and $X_{\max}=360$). For another "head scratcher", press the **TRACE** key and type **135** then **ENTER** (this *should* place the cursor at the point corresponding to $x=135$ on our graph, but the "point" isn't even *close to* the curve!).
7. Now, graph the function $y=\sin(46x)$, which shouldn't look *too* different from the above graph, right? Wrong (according to the calculator)! There's something funny going on here, isn't there? What do you think is "going on"? How could you check to see if your guess is correct?
8. While pondering this dilemma, consider $y=\sin(47x)$, graphed on the original window. Before you decide the function wasn't graphed, **TRACE** first. then change the window being sure its width is always 720 degrees. Some suggested windows, all very close to the original, are given below in interval form as $[X_{\min},X_{\max}]$:



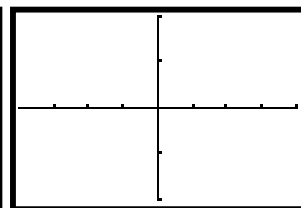
$[-359,361]$



$[-359.2,360.8]$



$[-359.5,360.5]$



$[-359.8,360.2]$

9. Finally, graph $y=\sin(23.5x)$ on a variety of windows of width 720. For the maximum effect, change your plot style (in the **MODE** menu) from **Dot** to **Connected** and try to guess how the calculator would “connect the dots”. Does this help you see what might be causing these “mistakes”?

Which powers of 5 are even?

1. Consider the sequence $5^0=1$, $5^1=5$, $5^2=25$, Use your calculator to help you fill in as many terms of the following table as possible. Note that at some point, your calculator will have to resort to scientific notation in order to express the result. At this point, the calculator is approximating the value of the number in question. Most calculators are only able to provide exact answers for 5^n where n is somewhere between 12 and 17 (on TI-73, 81, 82, and 83 calculators, 14 is the highest power that “works”, while 17 is the highest power that works for the TI-85 and 86).

| | | | | | | | | |
|-------------------------|----------|----------|-----------|------------|----------|----------|----------|----------|
| n | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5^n | 1 | 5 | 25 | 125 | | | | |

| | | | | | |
|-------------------------|----------|----------|-----------|-----------|-----------|
| n | 8 | 9 | 10 | 11 | 12 |
| 5^n | | | | | |

| | | | | | |
|-------------------------|-----------|-----------|-----------|-----------|-----------|
| n | 13 | 14 | 15 | 16 | 17 |
| 5^n | | | | | |

| | | | | | |
|-------------------------|-----------|-----------|-----------|-----------|-----------|
| n | 18 | 19 | 20 | 21 | 22 |
| 5^n | | | | | |

2. Have your calculator compute the largest power of 5 it can compute exactly. For instance, if 5^{14} is given exactly and 5^{15} is expressed using scientific notation, use 5^{14} . Record the result below in the form $5^7=78125$.
3. With the answer still displayed on your calculator, divide the answer by 4 and record your answer. Does the result surprise you? Would you have guessed that any powers of 5 were divisible by 4? I should hope not, but your calculator might disagree!
4. Just to be careful, being sure the result of dividing your power of 5 by 4 is still displayed on your calculator, multiply that number by 4 and see that you get the power of 5 you started with. When was the last time you started with an integer having either a 1 or 6 in the one’s place, multiplied it by 4 and got a number with a 5 in the one’s place? **Hint:** Your answer *should* be NEVER.
5. Now, to show you that you don’t really have to go out and buy a new calculator (it wouldn’t help, since just about every calculator makes this “mistake”), go back to your suspect power of 5 and divide it by 4, as in Step 2. Now, very carefully subtract that number from itself by pressing the subtract key, then carefully typing the number you just calculated. Finally, take a few minutes to write your best guess for what the calculator is doing and why it’s making this mistake.

I hope you keep these activities in mind every time you use your calculator. Calculators are wonderful timesaving tools which can help us learn and understand mathematics. But remember, calculators don't do mathematics, *people* do mathematics. And the more mathematics you know, the less likely you'll be fooled the next time your calculator "lies" to you.