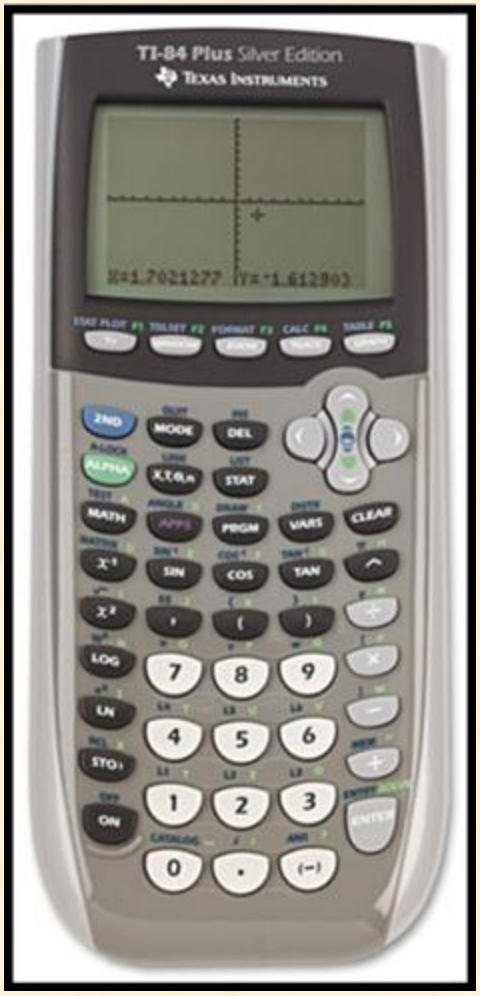

Guide to Using Your Calculator on the ACT

Tips & Strategies to Help You Maximize Your Score

By Art Cockerham

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What Calculator Should You Use?

The calculator you use on test day should be the one that you're most familiar with. It would be helpful if it was a calculator with graphing capability such as the Texas Instruments TI-84. It's also important that you don't attempt to use a calculator that is not permitted by the ACT. At the time this book was written, the following types of calculators were *not* allowed:

- Calculators with built-in computer algebra systems, including the TI-89 and TI-92
- Tablets or laptops
- The calculator on your cell phone

For a complete list and the most up-to-date information, visit the ACT Calculator Policy page at http://www.actstudent.org/faq/calculator.html

Doing Calculations Carefully

While I encourage students to use their calculators for even routine calculations on the ACT, it's important that you use it carefully. In particular, on many problems order or operations is a very important factor in getting the problem correct. If you don't enter the calculation carefully into your calculator, paying attention to when you need to use parentheses, there's a good chance your calculator will spit out the wrong answer.

To see what I mean, let's look at a problem.

Given the function defined by $f(x) = \frac{x^2+8}{x+4}$, what is $f(-2)$?

A. -2
B. 0
C. 2
D. 4
E. 6

When entering this into your calculator, if you want to do it in one calculation you need *three* sets of parentheses. It should look like this:

$$((-2)^2 + 8)/(-2 + 4)$$

If you've entered that carefully, your calculator should tell you that $f(-2) = 6$, so the correct answer is Choice E.

Here's a second example. Suppose you wanted to find the answer to the following question by testing the answer choices.

What is the value of x in the following equation?

$$2^x \cdot 4^{x+1} = 2048$$

A. 1/2
B. 1
C. 3/2
D. 2
E. 3

The correct answer to this question is Choice E. To check that on your calculator, you would enter it like this:

2^3 * 4^(3 + 1)

So when do you need parentheses in a calculation?

- Around the entire numerator of a fraction
- Around the entire denominator of a fraction
- When you raise a negative number to a power (negative number *inside* the parentheses and the exponent *outside* the parentheses)
- When you raise a fraction to a power (fraction *inside* the parentheses and the exponent *outside* the parentheses)
- When an exponent is an expression instead of just a number
- When there are parentheses in the expression you are trying to evaluate

Solving Equations

Virtually any equation you encounter on the ACT can be solved by graphing on your calculator. You'll enter one side of the equation into Y_1 and the other into Y_2. Then graph and find the point of intersection. The solution to the equation is the *x*-coordinate of the point of intersection.

Let's look at an example:

Which of the following is/are the solution(s) to the equation $| x - 3 | = 5$?

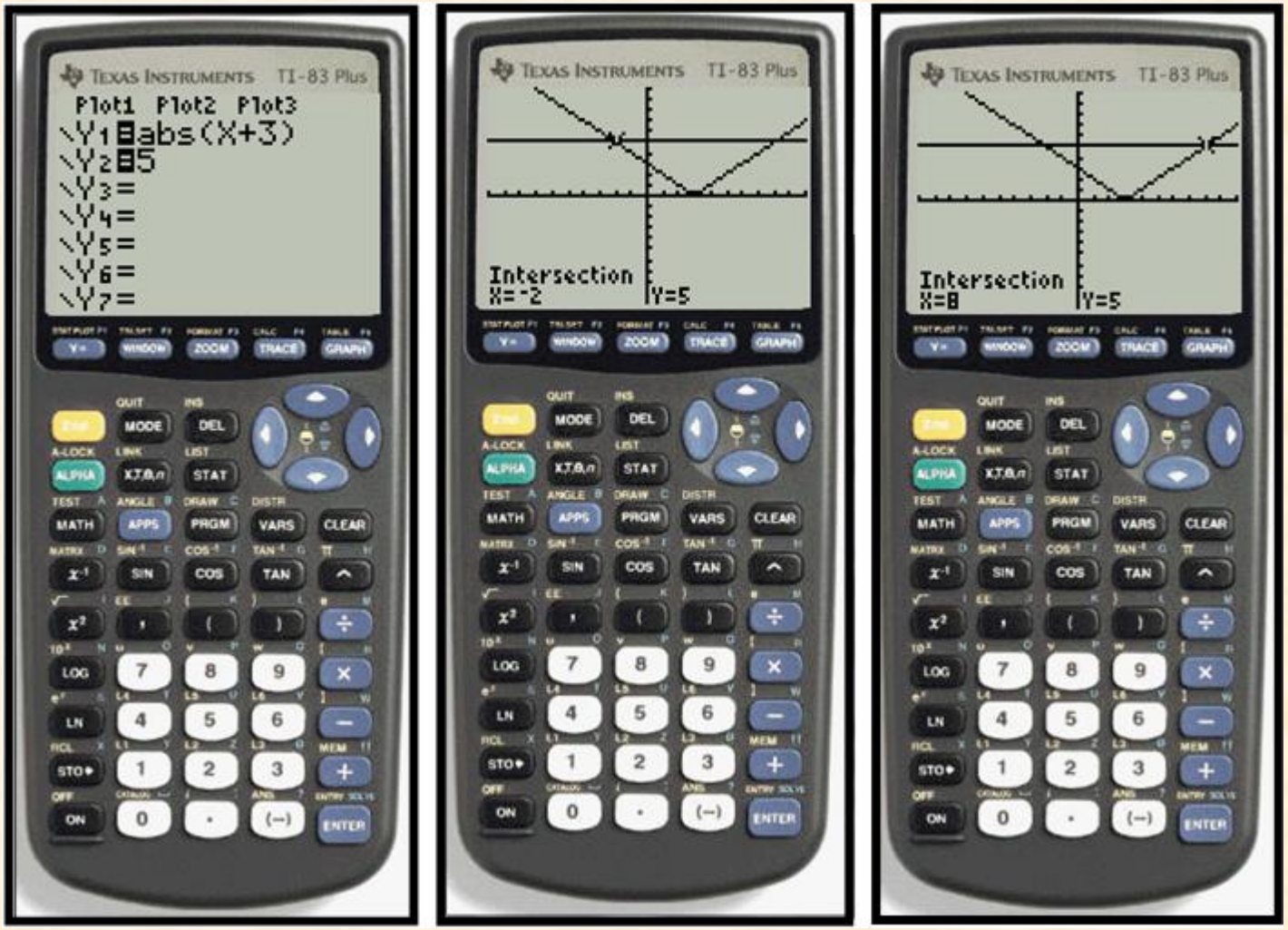
A. 8 only
B. -8 and 8
C. 2 and 8
D. -2 and 8
E. 3 and 5

To solve this by graphing, do the following:

1. Enter $| x - 3 |$ in Y_1 (Note: absolute value can found by choosing MATH and then using the right arrow to go over to the NUM menu.)
2. Enter 5 in Y_2
3. Graph
4. Choose 2^{nd} and then CALC
5. Choose 5: intersect
6. Move your cursor near the first point of intersection
7. Hit Enter 3 times
8. Repeat Steps 4 – 7 to find the second solution

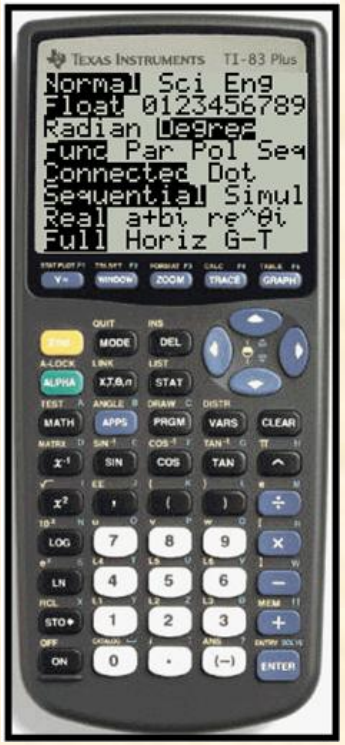
The *x*-coordinates of the points of intersection are -2 and 8, so Choice D is the correct answer.

To see what this problem would look like on your calculator, take a look at the screenshots on the next page.


TEXAS INSTRUMENTS TI-83 Plus
Plot1 Plot2 Plot3
\Y1=abs(X+3)
\Y2=5
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
Intersection
X=-2
Y=5
Intersection
X=8
Y=5

Degrees vs. Radians

You got your first introduction to right triangle trigonometry in Geometry when you did your first SOH-CAH-TOA problems. The really rigorous examination of this topic comes later on in Pre-Calculus. There you learn that angles can be measured in radians as well as in degrees. As you work on problems in the ACT Math section, you need to pay attention to whether or not the problem involves angles measured in degrees or radians, and then you should set your calculator to match.



To do that, follow these steps:

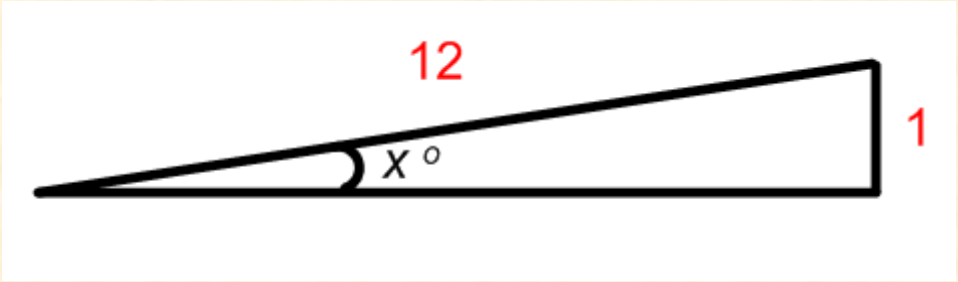
1. Choose MODE
2. Use the arrow keys to move down to the setting for Radians and Degrees
3. Then use the arrows to move your cursor over the one you want and hit ENTER

Let's look at a problem where being in the right MODE might make the difference between getting the question right or getting it wrong.

A federal law requires that any ramp meant to provide access to wheelchairs can rise a maximum of 1 foot for every 12 feet of ramp length. What is the maximum angle, to the nearest tenth of a degree, that the ramp can make with the ground?

A. 3.7
B. 4.2
C. 4.8
D. 5.1
E. 5.6

Because this problem asks for the angle in degrees, the first thing you should do is make sure your calculator is set for degrees. Then make a sketch of the problem and write an equation.



Recall from you work with right triangle trigonometry (SOH-CAH-TOA) problems that the sin of an angle is the ratio of the length of the side opposite the angle to the length of the hypotenuse.

$$\sin x = 1/12$$
$$x = \sin^{-1}(1/12)$$
$$x \approx 4.8$$

Note that to find the angle you need to find the inverse sin of 1/12. To find this value on your calculator, choose 2^{nd} and then SIN and enter 1/12 in the parentheses. If you've set your calculator for degrees, you'll see that the correct answer is Choice C.

Making "Hard" Problems Easier

You can use your calculator for more than just basic calculations on the test. For instance, we've seen that you can solve an equation on your calculator by putting the left side of the equation in Y_1 and the right side of the equation in Y_2. You then hit the graph button and find the point where the two functions intersect. The *x*-coordinate of that point is the solution to the equation.

Beyond that, one of the more interesting things that my students and I have noticed during our practice is that there are occasionally problems near the end of the test that should be rather tricky if you do the math the test makers intend you to do. What we've noticed, however, is that on these problems there's often a calculator approach that makes the problem significantly easier.

Let's look at a problem that illustrates this idea. Similar problems have shown up as one of the last two or three problems on the ACT Math test.

What is the value of tan $\pi/12$ given the formula tan $(1/2\ x)\ = \frac{1-\cos x}{sin\ x}$?

(Note: You may use the following table of values)

θ	sin θ	cos θ
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$

A. $1-\sqrt{3}$

B. $2-\sqrt{3}$

C. $2-\sqrt{2}$

D. 1

E. $\sqrt{2}$

If you've taken Pre-Calculus, you've probably done problems like this before, and if you're comfortable using the formula and doing the math, go for it! This is a problem, however, where you might not need to do all of that fancy math. Go back and look at the question: "What is the value of tan $\pi/12$ … ?" You could simply put this into your calculator (make sure you're in *radians*!) and then compare the decimal you get with the answer choices.

Tan $\pi/12 \approx 0.268$

A. $1 - \sqrt{3} \approx -0.732$
B. $2 - \sqrt{3} \approx 0.268$ *
C. $2 - \sqrt{2} \approx 0.586$
D. 1
E. $\sqrt{2} \approx 1.414$

Here's a second problem that you can try:

What is the value of (sin $7\pi/6$)(sin $5\pi/6$) given the formula for the product of the sins of two angles: $\sin\alpha \cdot \sin\beta = \frac{1}{2}[\cos(\alpha - \beta) - \cos(\alpha + \beta)]$?

θ	$\sin\theta$	$\cos\theta$
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$
$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$
π	0	-1
2π	0	1

A. -1
B. -0.5
C. -0.25
D. 0
E. 1

For this problem, you could simply plug into the formula, do some careful arithmetic, and get the values you need from the table.

$$\sin \alpha \cdot \sin ß = 1/2[\cos (\alpha - ß) - \cos (\alpha + ß)]$$
$$\sin(7\pi/6) \cdot \sin(5\pi/6) = 1/2[\cos (7\pi/6 - 5\pi/6) - \cos (7\pi/6 + 5\pi/6)]$$
$$\sin(7\pi/6) \cdot \sin(5\pi/6) = 1/2[\cos (2\pi/6) - \cos (12\pi/6)]$$
$$\sin(7\pi/6) \cdot \sin(5\pi/6) = 1/2[\cos (\pi/3) - \cos (2\pi)]$$
$$\sin(7\pi/6) \cdot \sin(5\pi/6) = 1/2[1/2 - 1]$$
$$\sin(7\pi/6) \cdot \sin(5\pi/6) = 1/2\ (-1/2)$$
$$\sin(7\pi/6) \cdot \sin(5\pi/6) = -1/4$$

All of this math is very nice, but this is another problem that you could have done on your calculator. Make sure your calculator is set to *radians* and carefully (keep an eye on the parentheses) enter sin(7π/6)*sin(5π/6). You should get -.25

Your calculator shows you fairly quickly that the correct answer is Choice C.

About the Author

Art Cockerham is an educator who has taught at the middle school, high school and college levels. He has an undergraduate degree from Boston College and master's degrees from Sacred Heart University and Wesleyan University.

In 2011, Art founded Cardinal Educational Consulting, a test preparation and college counseling firm in Fairfield, Connecticut. He now dedicates his time to helping students navigate the college admissions process.

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