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Propose: To introduce the students who are preparing to teach K-4 to the basic algebraic manipulation capabilities and procedures of the TI-85.

Target: Ability, and confidence, to use the TI-85 for algebraic manipulations and reinforcement of basic algebra manipulation skills.

The so-called *super graphing calculators* like the TI-85, henceforth referred to as IT are having a revolutionary impact on mathematics education at all levels, both in terms of content and pedagogy. As a future teacher it is imperative that you become familiar with the capabilities of this modern and ever changing technology. But don't be alarmed, you don't have to learn it all at once.

We will begin by learning some very basic algebraic operations. Turn the machine on by pressing the **on** button from the keyboard. Turn it off by pressing first the **2nd** button then **off** ("under **on**") from the keyboard. Notice, yellow button first accesses the "yellow commands" from the keyboard.

Turn your machine on and press **CLEAR** from the keyboard. What happens?_____

Next press 1 *divide by* 2 from the keyboard. What happens?_____

_____ Now press **ENTER** from the keyboard.

What happens?_____ Notice that the expression ,in usual algebraic form, and IT's calculation of the result, both appear on the same screen. This will turn out to be a nice feature of these machines.

In each of the following, first compute the result by hand (just the way you would expect your students to do it), then "input" the expression into IT just as given, with the expression on the screen press **ENTER** to compute the result. Record the answers in the appropriate places.

(The third column is to be filled in after doing exercise #13.)

	<i>by hand</i>	<i>with IT</i>	<i>via exercise 13</i>
1. $1/3$	_____	_____	_____
2. $+ 1/3$	_____	_____	_____
3. $2/3 + 1/6$	_____	_____	_____

4. $2(2 + 3)$ _____ . _____

What happens if you leave off () and enter only $2*2 + 3$? _____

5. $2*3+2*4$ _____ . _____

6. $2(1/4)$ _____ . _____

7. $(1/4-2/3)3$ _____ . _____

8. ()⁶ _____ . _____

9. ()⁵ _____ . _____

10. $(1+3)/2$ _____ . _____

What happens if you leave off () and enter only $1 + 3 / 2$? _____

11. $(-1/3)(3/5)$ _____ . _____

(Here you must distinguish between the operation of subtraction and that of negation. To enter the negative of $1/3$ you must press (-) 1 *divided by* 3 on the keyboard.)

12. ()(5/4 + 1/4) _____ . _____

Notice, when asked to calculate the expression, IT gives a decimal representation (approximation) to the number. Wouldn't it be nice if IT could give the "exact" fractional representation of the expression that we expect our students to be able to obtain. For example in #3 we know that $2/3 + 1/6 = 5/6$ "exactly." Well, IT does have some limited "exact arithmetic" capabilities. Computer algebra systems like MAPLE have much greater exact arithmetic capabilities. (You may see some of these in 2370.)

Open IT's CATALOG of built-in commands by pressing **2nd** then **CATALOG** on the keyboard. The menu that appears across the bottom of the screen will henceforth be referred to as the *bar menu*. A command in the bar menu is accessed by pressing the "F key" directly under it. For example, pressing the **F1** key should invoke the command **PAGE arrow down**. What is the result of this command? _____

Keep using this command until you see the command **>Frac**. This is the command for converting a decimal to a fraction form. Boy is

there a lot of stuff in the CATALOG, fortunately we will not need to use very much of it in this course. In fact, let's start building a *CUSTOM CATALOG* containing only those commands we plan to use. To do this use the *down arrow* in the upper right hand portion of the keyboard to "designate the command **>Frac** on the CATALOG screen."

This done, choose **CUSTM** from the bar menu (press **F3**). We will load this command into our custom catalog by pressing the F-key under a blank spot in the new active bar menu. Unless you have already done such customization, pressing **F1** will suffice. (Warning, if something is already in the **F1** position this will replace it with **>Frac**.)

Pressing **EXIT** from the keyboard always takes you back to the previous active screen. Try it now. What happens?_____

_____Try it again. What happens?_____

Now let's use our new command.

13. Redo IT's calculations for each of the expressions in 1 - 12 above, except now after IT computes each decimal representation, press **CUSTOM** on the keyboard and choose **>Frac** from the bar menu. What happens?_____ Now press **ENTER** and record the results in the third column above.

Enter the command sequence **.6666666666666666>Frac ENTER**. What happens?_____

Two more keyboard commands will be very useful. Choosing **2nd** then **ANS** recalls the last result (answer or output) calculated by the TI, and the command **2nd ENTRY** recalls to the screen the last expression (or input) placed on the screen. To see how this works put the expression $((2/4 + 2/7) + 9)/3$ on the screen and compute it's decimal representation._____

Now suppose we wanted to compute a similar expression (input) except the 2's is to be replaced by 3's. Rather than retype the expression, simply press **2nd ENTRY** to recall the original to the screen where it can be "edited" by using the left/right arrow keys and "over-writing" each 2 with a 3. Try this and compute the resulting decimal representation._____

_____Try the **>Frac** command on this last result. What did you get?_____

Calculate the fraction by hand. Did you get the same result?_____

Two other editing features of IT are handy. The keyboard command **INS** is an abbreviation for the verb "insert," and the command **DEL** is short for "delete." Experiment with these commands to edit an expression like above.

The operations of squaring and square root are relatively obvious keyboard key strokes; however, more general exponent calculations

require what has become a common symbolism in computer/calculator jargon. Complete the following exercises as done in 1 -13 above:

14. 2^2 _____ . _____ _____

15. 2^3 _____ . _____ _____

16. $()^4$ _____ . _____ _____

What happens if we leave off $()$ and input only 4 ? _____

17. $4^()$ _____ . _____ _____

18. $(2^2)^3$ _____ . _____ _____

19. $(3^4)/(3^2)$ _____ . _____ _____

20. $(3^2)/(3^4)$ _____ . _____ _____

21. $(6^2)/(3)$ _____ . _____ _____

22. $(2/3)^2$ _____ . _____ _____

23. $(2+1)^2$ _____ . _____ _____

24. $(-1)^()$ _____ . _____ _____

Now let's practice our new TI computation and editing skills on some more interesting commonly occurring expressions.

In each of the following exercises input the appropriate expression, using the given specific data, onto the screen and press **ENTER** one time to calculate it. To calculate the next number simply edit the expression on the screen appropriately. (Use **2nd ENTRY** to recall the expression to the screen.)

Exercise A. Use the quadratic formula to find the two roots of each of the following polynomials:

If $a*x^2 + b*x + c = 0$ then

$x =$ _____ or _____

i. If $2x^2-5x-3 = 0$ then

ii. $x =$ _____ or _____
If $2x^2 - 1 = 0$ then

iii. $x =$ _____ or _____
If $x^2 + x + 1 = 0$ then

$x =$ _____ or _____

Exercise B. The monthly mortgage payments are given by the formula

$$p = iA / (1 - (1+i)^{-n}),$$

where A is the amount borrowed, i is the interest per month ($\text{APR}/12$), and n is the total number of payment periods ($12 \times \text{number of years}$). What are the monthly payments if 100,000 is borrowed at 9% APR for each of the following time periods:

i. 30 years?

ii. _____
20 years?

iii. _____
10 years?

In each of the above cases what is the total amount, TA, paid back at the end of the loan period?

TA = _____

i. _____

ii. _____

iii. _____

Exercise C.

i. 30 years?

ii. 20 years?

iii. 10 years?

In each of the above cases what is the total amount, TA, paid back at the end of the loan period?

TA =

i.

ii.

iii.