Pre-Calculus: Algebra on the TI-89/92

Conics

Example#1: Graphing the conic $2x^2-12x+3y^2+24y=0$.

1. Solve for y by hand.

$$2x^2-12x+3y^2+24y = 6$$
$$3(y^2+8y\ ) = 6+12x-2x^2$$
$$3(y^2+8y+16) = 6+12x-2x^2+48$$
$$3(y+4)^2 = 54+12x-2x^2$$
$$(y+4)^2 = (54+12x-2x^2)/3$$
$$y+4 = \pm\sqrt{54+12x-2x^2}\,/\,3$$
$$y = -4 \pm \sqrt{54+12x-2x^2}\,/\,3$$

2. Enter the function(s) into the calculator.
   Set $Y1=-4+\sqrt{((54+12X-2X^2)/3)}$ and $Y2=-4-\sqrt{((54+12X-2X^2)/3)}$.
3. Graph them in an appropriate window.
   In this case the standard window will work.
4. Why didn't it connect the ends of the ellipse?

Other conics are graphed the same way. Though some require only one function, Y1.

Matrices

Entering matrices:

Example#2: Storing $\begin{bmatrix} 5 & -2 \\ 0 & 4 \end{bmatrix}$ into b.

1. The matrix is entered in the form "[row1 row2 row3 ...]" where each row is in the form "[x1,x2,x3,...]".
   Press **2nd [2nd [5 , (-) 2 2nd] 2nd [0 , 4 2nd] 2nd] ENTER**.
2. It returns "$\begin{bmatrix} 5 & -2 \\ 0 & 4 \end{bmatrix}$".
3. To store the matrix use the STO▶ key.
   Type **STO▶ alpha b**.
4. It returns "$\begin{bmatrix} 5 & -2 \\ 0 & 4 \end{bmatrix}$".

Note: a matrix can also be created using the APPS 6:Data/Matrix Editor.

The MATH:Matrix Menu Explained:

^{T}	interchanges the rows and columns.
det(	takes the determinant of a matrix.
identity(	returns an identity matrix.
Fill	fills a matrix with a specified number.
dimensions: dim(	gives the dimensions of a matrix as a list.
Row ops: rowSwap(	swaps two rows of a matrix.
Row ops: rowAdd(	adds two rows of a matrix.
Row ops: mrow(	multiplies a row of a matrix by a number.
Row ops: mrowAdd(	multiplies one row of a matrix and add it to another row.
the rest aren't needed	for PC:Algebra.

Basic Operations:

The following examples assumes that you have stored the matrices $\begin{bmatrix} 2 & 3 \\ -1 & 5 \end{bmatrix}$ in a and $\begin{bmatrix} 5 & -2 \\ 0 & 4 \end{bmatrix}$ in b.

Example#3: Perform b-a.
1. Type **alpha b - alpha a ENTER**.
2. It returns "[[3 -5] "
[1 -1]] .

Example#4: Find the determinant of A.
1. Press **2nd MATH 4:Matrix 2:det(alpha a) ENTER**.
2. It returns "13".

Example#5: Find the dimensions of B.
1. Type **2nd MATH 4:Matrix I:Dimensions 1:dim(alpha b) ENTER**.
2. It returns "{2 2}". Thus, the dimensions are 2by2.

Example#6: Filling B with 4's.
1. Type **2nd MATH 4:Matrix D:Fill 4 , alpha b ENTER**.
2. It returns "Done".
3. Press **alpha b ENTER** to check.
4. It returns "[[4 4] "
[4 4]] .

Example#7: Store a 3by3 identity matrix in C.
1. Type **MATH 4:Matrix 6:identity(3) STO► alpha c ENTER**.
2. It returns "[[1 0 0] "
[0 1 0]
[0 0 1]] .

Example#8: Deleting the matrices A, B and C.
1. The easiest way to delete these variables since we used 1-letter names is use the clean Up menu.
Press **F6:Clean Up 1:Clear a-z** on the TI-92.
Press **2nd F6:Clean Up 1:Clear a-z** on the TI-89.

Sequences & Series

The calculator stores finite sequences as lists. For instance, the sequence 3,6,5,8 is stored on the calculator as {3,6,5,8}. Note: this isn't a set because order matters.

There are two commands used to generate and add up lists.

seq(***expression*** , ***variable*** , ***start*** , ***end*** , ***step***)

:generates a list by setting the ***variable*** to ***start*** and plugging it into the ***expression*** to get the first number of the sequence. It then adds ***step*** to the ***variable*** and finds the second number. It repeats this until the ***variable*** gets to ***end***. For instance the command "seq(x^2,x,1,7,2)" would return "{1 9 25 49}" the squares of 1,3,5 and,7 which are 2 units apart. For PC-Alg. ***step*** should be set to 1.

sum(***list***)

:adds the elements of the ***list***. For example, "sum({3,5,8})" returns "16".

Σ(***expression*** , ***variable*** , ***start*** , ***end***)

:adds the elements of the ***list***. For example, "sum({3,5,8})" returns "16".

Example#9: Find the sum of the first 10 terms of the geometric sequence where r=2 and $a_1=1$.

1. Find the formula for the x^{th} term.
   Since the x^{th} term is a_1 multiplied by x-1 r's, $a_x=a_1r^{x-1}=(1)(2^{x-1})=2^{x-1}$.
2. Determine the starting and ending values of x.
   Because we want the first 10 terms, x starts at 1 and ends at 10.
3. Enter the comand.
   TI-89: Press **F3:CALC 4:Σ(2 ^ (x - 1) , x , 1 , 10) ENTER.**
   TI-92: Press **2nd Σ 2 ^ (x - 1) , x , 1 , 10) ENTER.**
4. It returns "1023".

Note: x is used as the variable solely because it is easy to type into the calculator.

Factorial & Combinations

The calculator use the same notation as writing, n!. While, combinations uses a variation on the ${}_nC_r$ notation where

$$ {}_nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!} . $$

The calculator's command is ***n*** ${}_nC_r$ ***r*** . Where "${}_nC_r$" is the command, and ***n*** and ***r*** are whole numbers. Therefore, the command **5 $_nC_r$ 3** would return 5!/[3!(5-3)!]=10.

Example#10: Find 10! on the calculator.

1. Type **10 2nd MATH 7:Probability 1:! ENTER.**
2. It returns "3628800".

Example#11: Find 500!.

1. Type **500 2nd MATH 7:Probability 1:! ENTER.**
2. Why does 500! cause an error? (HINT: look at 449!)

Example#12: Find the 5^{th} term of $(x-3)^{15}$.

1. This would be the $x^{(15-4)}=x^{11}$ term and the full term would be ${}_{15}C_4\ x^{11}(-3)^4$.
2. Calculate the combination.
   Type **2nd MATH 7:Probability 3:nCr 15, 4) ENTER.**
3. It returns "1365".
4. Multiply that by $(-3)^4$.
   Press **X ((-) 3) ^ 4 ENTER.**
5. It returns "110565". Thus, the 5^{th} term is $110565x^{11}$.