# ClassPad Action menu commands syntax – Examples

**Transformation**

| | | |
|---|---|---|
| approx($\sqrt{2}$ ) | 1.414213562 | |
| simplify(2x + 3x) | 5.x | |
| expand((x+2)^2) | $x^2$ +4.x + 4 | |
| expand($\frac{1}{x^2-1}$),x) | $\frac{-1}{2.(x+1)}+\frac{1}{2.(x-1)}$ | inclusion of x forces partial fractions |
| factor(x^2+5x+6) | (x + 3)(x + 2) | |
| rfactor (x^2 − 3) | $\left(x-\sqrt{3}\right)\left(x+\sqrt{3}\right)$ | factors to roots |
| factorout($2x^2 + 4x + 10, 2$) | $2.(x^2 +2x + 5)$ | |
| combine($\frac{x}{2}+\frac{x}{3}$ ) | $\frac{5.x}{6}$ | common denominator |
| collect($x + 2x^2 + 3x + x^2$) | $3.x^2 + 4x$ | |
| tExpand(sin(a + b)) | cos(b).sin(a) + sin(b).cos(a) | |
| tCollect(2sin(a) cos(b)) | sin(2.a) | |
| expToTrig($e^{ix}$) | cos(x) + sin(x).i | |
| trigToExp(cos(x)) | $\frac{e^{x.i}+e^{-x.i}}{2}$ | |
| toFrac(5.28) | $\frac{132}{25}$ | |
| propFrac(1.2) | $1+\frac{1}{5}$ | |
| dms(30,25,59) | 30.49972222 | deg, min, sec to decimal or frac. |
| toDMS(30.49922220) | dms(30, 29, 59) | decimal to deg, min, sec. |

**Calculation**

| | | |
|---|---|---|
| diff(x^6) | $6.x^5$ | differentiate |
| impDiff(x^2 + y^3 = 1) | $y'=\frac{-2.x}{3.y^2}$ | implicit differentiation |
| ∫(x) | $\frac{x^2}{2}$ | andifferentiation/integration (indefinite) |
| ∫(sin(x), x, 0, π) | 2 | definite integral |
| lim(x/sin(x),x,0) | 1 | limit |
| lim(1/x,x,0,1) | ∞ | limit from right (above) |
| lim(1/x,x,0,−1) | −∞ | limit from left (below) |
| Σ(x^2,x,1,3) | 14 | sum of expression's terms |
| Π(x^2,x,1,3) | 36 | product of expression's terms |
| rangeApoint({x=1,x=2,x=3},0,2) | {x=1,x=2} | finds expression/value within specified range |
| mod(7,5) | 2 | remainder after division |
| tanLine (x^2, x, 1) | 2x − 1 | returns RHS of tangent equation at a point |
| normal(x^2, x, 1) | $\frac{-x}{2}+\frac{3}{2}$ | returns RHS of normal equation at a point |
| arcLen(x^2,x,0,3) | 9.747088759 | can get exact value if desired, rather than dec. |
| fMin(x^2+2,x) | {MinValue = 2, x = 0} | minimum of a function |

## Calculation (ctd)

| | | |
|---|---|---|
| fMin(x^2+2,x,1,3) | {MinValue = 1, x = 1} | minimum within specified range of $x$–values |
| fMax(−x^2+1,x) | {MaxValue = 1, x = 0} | maximum of a function |
| fMax(−x^2+1,x,−1,−0.5) | {MaxValue = $\dfrac{3}{4}$, x = $-\dfrac{1}{2}$} | maximum within specified range of $x$–values |
| gcd(12, 30) | 6 | greatest common divisor |
| lcm(5,6) | 30 | lowest common multiple |
| denominator(7/9) | 9 | extracts denominator |
| numerator(7/9) | 7 | extracts numerator |

## Complex

| | | |
|---|---|---|
| arg(2+i) | $\tan^{-1}\left(\dfrac{1}{2}\right)$ | |
| conjg(1 + i) | $1 - i$ | |
| re(3 − 4i) | 3 | |
| im(3 − 4i) | −4 | |
| cExpand($\cos^{-1}$(2)) | $\ln\left(\sqrt{3}+2\right)i$ | Expands complex expression to rect. form |
| compToPolar(1 + i) | $\sqrt{2}.e^{\frac{\pi.i}{4}}$ | Converts complex no. to polar form. |
| compToTrig(1 + i) | $\sqrt{2}.\left(\cos\left(\dfrac{\pi}{4}\right)+\sin\left(\dfrac{\pi}{4}\right).i\right)$ | Converts complex no. to trig/hyperb. form. |

## List−Create

| | | |
|---|---|---|
| seq(x^2,x,1,3) | {1, 4, 9} | |
| augment({1,2},{3,4}) | {1, 2, 3, 4} | Joins two lists. |
| fill(2,4) | {2, 2, 2, 2} | Creates list containing four 2's. |
| fill(7,{1,2,3}) | {7, 7, 7} | Replaces each element in list with 7. |
| fill({a,b,c},{2,5,3}) | {a, a, b, b, b, b, b, c, c, c} | Creats list with elements given by first list and frequencies by second list. |
| subList({5,10,15,20,25},3,5) | {15, 20, 25} | subList(list, start no., end no.). |
| shift({1,2,3,4,5,6},2) | {3, 4, 5, 6, Undef, Undef} | shift(list, shift amount). |
| rotate({1,2,3,4,5,6},2) | {3, 4, 5, 6, 1, 2} | rotate(list, rotate amount). |
| sortA({6,3,12,9}) | {3, 6, 9, 12} | sorts into ascending order. |
| sortD({6,3,12,9}) | {12, 9, 6, 3} | sorts into descending order. |
| listToMat({1,2},{3,4}) | $\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ | Puts lists into columns of matrix. |
| MatToList($\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$,2) | {2, 4} | Extracts specified column (second argument) of a matrix to a list. |

## List−Calculation

| | | |
|---|---|---|
| min({1,2,3}) | 1 | |
| cuml({1,2,3}) | {1,3,5} | Returns cumulative sums of a list. |
| max({1,2,3}) | 3 | |
| mean({1,2,3}) | 2 | |
| mean({1,2,3},{5, 10, 1}) | 1.75 | Second list gives frequencies. |
| median({1,2,3}) | 2 | Can input second list for frequencies. |
| mode({1,2,2,3,4,4,4,5}) | 4 | Can input second list for frequencies. |
| $Q_1$({1,2,2,3,4,4,4,5}) | 2 | Can input second list for frequencies. |
| $Q_3$({1,2,2,3,4,4,4,5}) | 4 | Can input second list for frequencies. |

## List–Calculation (ctd)

| | | |
|---|---|---|
| percentile({1,2,3,4},70} | 3.1 | Finds 70th percentile point in a list. |
| stdDev({1,2,3,4}) | $\dfrac{\sqrt{15}}{3}$ | sample standard deviation |
| variance({1,2,3,4}) | $\dfrac{5}{3}$ | sample variance |
| dim({1,2,3,4}) | 4 | dimension of list |
| sum({1,2,3,4}) | 10 | sum of list elements.<br>Can input second list for frequencies. |
| prod({1,2,3,4}) | 24 | product of all list elements.<br>Can input second list for frequencies. |
| cuml({1,2,3,4}) | {1, 3, 6, 10} | cumulative sums. |
| $\Delta$list({1,3,8,11}) | {2, 5, 3} | differences between adjacent elements. |
| percent({5,6,9}) | {25, 30, 45} | percentage each element is of total. |
| polyEval({1,5,6}) | $x^2 + 5x + 6$ | polynomial co–efficients $\rightarrow$ polynom'l |
| sequence({2,5,10, 17}) | $x^2 + 1$ | fits polynomial to list of {$y$ values}, assuming list values correspond to $x = 1$, $x = 2$, $x = 3$ ….etc. |
| sequence({0,3,8},{–2,7,62}) | $x^2 - 2$ | fits polynomial to lists of {$x$ values},{$y$ values}. |
| sumSeq({3,5,7,9}) | $x^2 + 2x$ | Gives polynomial which calculates cumulative sum of sequence for $x = 1$, 2, 3 … |
| sumSeq({0,1,2},{0,2,4}) | $x^2 + x$ | maps list1 to list 2 where poly gives cummulative sums of list2. |

## Matrix–Create

| | | |
|---|---|---|
| trn($\begin{bmatrix} 1 & 2 \\ 10 & 20 \end{bmatrix}$) | $\begin{bmatrix} 1 & 10 \\ 2 & 20 \end{bmatrix}$ | Transposes rows to columns. |
| trn([1,2][10,20]) | $\begin{bmatrix} 1 & 10 \\ 2 & 20 \end{bmatrix}$ | Transposes rows to columns.<br>Alternative matrix input. |
| augment($\begin{bmatrix} 1 & 2 \\ 10 & 20 \end{bmatrix}$,$\begin{bmatrix} 3 & 4 \\ 30 & 40 \end{bmatrix}$) | $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 10 & 20 & 30 & 40 \end{bmatrix}$ | Joins two matrices together.<br>May use alternative input for each matrix as per above example's input. |
| indent(2) | $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ | Creates identity matrix of order 2. |
| fill(7,2,4) | $\begin{bmatrix} 7 & 7 & 7 & 7 \\ 7 & 7 & 7 & 7 \end{bmatrix}$ | Fills 7 in each position a matrix with 2 rows and 4 columns. |
| subMat($\begin{bmatrix} 1 & 2 & 3 \\ 10 & 20 & 30 \\ 20 & 40 & 60 \end{bmatrix}$,2,1,3,3) | $\begin{bmatrix} 10 & 20 & 30 \\ 20 & 40 & 60 \end{bmatrix}$ | Creates sub–matrix starting from row 2, coulumn 1 and extending to row 3, coulm 3. |
| diag($\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$) | [1, 4] | Turns diagonal into a row matrix. |
| listToMat({1,2},{3,4}) | $\begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$ | Places lists into <u>columns</u> of a matrix. |
| matToList($\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$,2) | {2, 4} | Extracts column 2 to a list. |

## Matrix–Calculation

| See Main manual section 2.8.33 | | |
|---|---|---|

## Vector submenu

| augment([1,2],[3,4]) | [1  2  3  4] | Jons two vectors. |
|---|---|---|
| fill(x,[1,0]) | [x  x] | Replaces elements of a row matrix with x. |
| fill(3,1,5) | [3  3  3  3  3] | Fills 3 in each place of a $1 \times 5$ matrix. |
| dim([1,2,3]) | {1, 3} | Returns dimensions of a matrix or vector in list form {Rows, Cols}. |
| unitV([1,3,5]) | $\left[ \dfrac{\sqrt{35}}{35} \quad \dfrac{3.\sqrt{35}}{35} \quad \dfrac{\sqrt{35}}{7} \right]$ | Returns unit vector parallel to original. |
| angle([1,2],[3,4]) | $\cos^{-1}\left( \dfrac{11\sqrt{5}}{25} \right)$ | Returns angle bewteen two vectors. |
| norm([1,2,3]) | $\sqrt{14}$ | Returns magnitude of a vector. |
| crossP([1,3,5],[2,4,6]) | [−2  4  −2] | Cross product. |
| dotP([1,3,5],[2,4,6]) | 44 | Dot product. |
| toRect([$\sqrt{2}$,$\angle\left(\dfrac{\pi}{4}\right)$]) | [1, 1] | Returns rectangular form vector [x, y], with polar input $[r, \angle\theta]$. |
| toPol([1, 1]) | [$\sqrt{2}$,$\angle\left(\dfrac{\pi}{4}\right)$] | Returns polar form vector $[r, \angle\theta]$, with rectangular input [x, y]. |

## Equation/Inequality

| solve(2x+1=7) | {x = 3} | |
|---|---|---|
| solve({x+y=10},{x−y=2},{x,y}) | {x = 6, y = 4} | |
| dSolve(y'=x,x,y,x=0,y=1) | $\{ y = \dfrac{x^2}{2} + 1 \}$ | Diff eqn, x, y, initial conditions. |
| rewrite(x+3=5x−x^2) | $x^2 - 4x + 3 = 0$ | Moves all terms to left side of eqn. |
| exchange(3>5x−2y) | $5x - 2y < 3$ | Swaps sides. |
| eliminate(x+y=9,x,y=x/2) | $3.y = 9$ | Uses second eqn to eliminate x in first eqn. |
| absExpand(\|2x−3=9\|) | $2.x - 3 = 9$ or $2.x - 3 = -9$ | Converts expression involving absolute value into ones without. |
| andConnect(x>−1,x<3) | $-1 < x < 3$ | |
| getRight(y=2x+1) | 2x + 1 | |
| getLeft(y=2x+1) | y | |

## Assistant

| arrange(2x+3−5x+8y) | −3x + 8y + 3 | Collects and arranges like terms. |
|---|---|---|
| 2x⇒s<br>replace(x+s) | 3x | replaces varaible with its stored equivalent. |
| invert(2x=y) | 2y = x | Swaps two varaibles in an expession (e.g. as in inverse functions). |
| Clear_a_z | done | Clears all single character variables. |

**Command**

| | | |
|---|---|---|
| Define f(x)=x^2 | done | Defines a function. |
| DispStat | | Displays last stat calc screen. |
| Clear_a_z | | Clears all single character variables. |
| DelVar *a* | done | Deletes the varaible *a*. |

**Distribution**

Command followed by space, then parameters separated by commas.

NormPD  x, σ, μ
NormCD  lower, upper, σ, μ
InvNorm  L or R or C tail setting, Area value, σ, μ
BinomialPD  x, n, p
BinomialCD  x, n, p
InvBinomialCD  Prob, n, p