EASYCOGO SURVEY PROGRAM FOR THE HP 35S

INTRODUCTION:

A basic understanding of the calculator and surveying techniques should enable the proper use and understanding of all of the programs and terms used therein. However, a quick review of the following information will help to make the content and general flow of the programs more evident. If you've purchased the instructions only, the task of programming your calculator may seem daunting at first, but once you get started and become more familiar with your calculator and the basic keystrokes, you will find it to be a fairly straightforward process. If you've purchased the preprogrammed calculator, a quick review of the 'Using the Programs' and 'Program Descriptions' topics is all you may want to do. The rest is for backup reference, in case you drop your calculator into a manhole, accidentally execute the 'Clear All' function, or remove both batteries at the same time, all of which you should NEVER, EVER do.

MENU = M

AREA BY COORDINATES = A
AZIMUTH ADD/SUBTRACT = Z
BEARING TRAVERSE/SIDESHOT = B
CUBIC VOLUME = C
GRADE = G
HORIZONTAL CURVE (CIRCULAR & SPIRAL) = H
INTERSECTIONS (BEARINGS & DISTANCES) = X
INVERSE = I
LEVELS = L
NUMBERED POINTS (EDIT, STORE, VIEW) = N
POLAR CONVERSION (y,x→θ,r) = P
RECTANGULAR CONVERSION (θ,r→y,x) = R
SLOPE TRAVERSE/SIDESHOT = S
TRIANGLES (AAA, ASA, SAA, SAS, SSA, SSS) = T
VERTICAL CURVE = V

USING THE PROGRAMS:

To run any of the individual programs, while in RPN mode, simply press XEQ, followed by the button with the appropriate letter, and then press ENTER. Example: For the menu, press XEQ, M, ENTER. Many of the programs have places where an option message is given, followed by a 'Y?' prompt for you to input a 'yes' or 'no' answer, where '1' (one) is a yes answer and '0' (zero) is a no answer, the default being '0' (no). To proceed without selecting the option presented by the message, simply press the 'R/S' button, or to proceed with the option presented, you must press '1' followed by the 'R/S' button (any number button 1-9 will work). Every prompt for data input is preceded by a quick description of the data needed, then displayed as a single letter with a question mark in the upper display register (upper line) and the default or previously entered/calculated value shown in the lower display register (lower line). To accept the value shown, simply press 'R/S'. To change the value, simply key in the desired value before pressing 'R/S'. On the occasion that you need to do a quick calculation to determine the necessary value, you do not need to exit the program. For example, to do an azimuth-bearing conversion at the prompt for a bearing, simply key in the azimuth angle, convert it to decimal degrees, key in the appropriate conversion value (such as 180 for the SW quadrant), press the appropriate math function (- for the SW quadrant), then don't forget to convert the angle back to HMS, since all program prompts require angle values in HMS format, then with the correct bearing displayed within the bearing prompt, simply continue the program by pressing 'R/S'. Some results are displayed by pausing the program to display values in both the upper and lower lines. Such information is always preceded by a message noting the two types of data, separated by a '-' (dash). For example, a triangle message of 'SIDE-ANGLE' will be followed by the length of a side in the upper line and an angle in the lower line.

All programs associated with northing and easting coordinates will display an 'ENTER PNT NUM' option for entering a stored point number prior to prompts for entering the actual coordinates. This is not a standard yes/no prompt. Instead, if the appropriate point has been previously stored, enter the point number while the prompt is displayed (attempting to recall an unused point number will result in an error), then press 'R/S' to continue the program, otherwise simply press 'R/S' to continue without entering a point number (some of the programs with elevation prompts will also use the same

point number entry process, for optional use of previously entered point elevation data). The 'N?' and 'E?' prompts will then be displayed in either case, for verification or editing (changing the prompted values will not change the stored point values). Following the 'N?' and 'E?' prompts, if a stored point number was not entered previously, a 'STORE PNT NUM' prompt will be displayed. To store the entered coordinates as a numbered point for later use, enter the desired point number while the prompt is displayed, then press 'R/S' (WARNING: if a coordinate is already stored under the same number, this will overwrite the existing point), otherwise simply press 'R/S' to continue without storing a point. Keep in mind that the number of points that can be stored is limited by the available memory of the calculator. Also, storing only one point with a value of '100' will take the same amount of memory as storing 100 points numbered 1-100, since the point registers below the highest number are all reserved for data, whether used or not (basically the same concept as the HP48). To get an approximation of the highest useable point number, display the available memory (yellow-shift, then MEM), then divide the lower-right number by 37. For example, approximately 135 points can be stored if the available memory is 5,000, assuming the point stack is empty. While viewing the available memory, the lower-left number shows the value of the lowest unreserved point number. For example, if the highest stored point number was 20 and the available memory was 5,000, the lower-left number would be 21 and the highest useable point number would be approximately 155. NOTE: leaving some memory available for other processes is highly suggested, so a rule of thumb could be to use a highest point number value that is 10 or 15 points below the actual highest possible amount. To clear a portion of the point stack, press blue-shift, CLEAR, 6 (or scroll down to 'CLVARx' and press 'ENTER'). At the 'CLVAR___' prompt, enter the 3-digit number of the highest point to keep in memory, or press '000' to clear all points. WARNING: This will permanently erase the stored points.

To escape out of the middle of a running program, simply press the 'C' (ON) button. The HP 35s has a known issue where it periodically fails to display the message prompt style that stops on the message and awaits a response (like the menu), which can be temporarily fixed by turning off the calculator, then back on again. Pressing 'C' to cancel a program before running another one seems to reduce the frequency of that issue. If at any time you try to run an equation and get an 'Invalid Equation' message, it is possible that the error is from having FLAG 10 set. To clear the flag, simply key in ↰ ^ 2 . 0 (described as: YELLOW SHIFT, FLAGS, TWO, DECIMAL, ZERO). The decimal button has been assigned as a 1 for the tens place entry of flags greater than 9, since the 1 button does not allow a 0 to be entered afterward. For more information on flags and general calculator usage, please see the User's Manual, available as a PDF from HP. A direct link is available at easycogo.com. For 'Getting Started' see chapter 1 (PDF pg. 17).

PROGRAM DESCRIPTIONS:

Please see the 'Using the Programs' section for typical, more generalized program data entry and display information.

MENU: The menu is a simple list of the individual programs in alphabetical order. Execute the Menu to access any of the programs from the Menu, then simply press the 'R/S' button to skip the displayed option until the appropriate program is listed, then press '1', followed by 'R/S' to execute the displayed program. If the entire menu is displayed without any programs being selected, it will restart at the beginning of the list in a continuous loop. All menu labels are followed by the executable letter label to enable faster direct access if remembered or quickly noted.

AREA BY COORDINATES: Enter each point's northing and easting values or use previously stored point numbers, while moving around the perimeter of the object. After each pair of northing/easting coordinates have been entered, a 'CLOSE' option with the standard 'Y?' prompt will be displayed. Simply press 'R/S' to continue entering additional coordinates and/or point numbers, or press '1', followed by 'R/S' to close the object. After the 'CLOSE' option is selected, the program will automatically use the first pair of coordinates to close the object, then the perimeter of the object (or length of traverse, as the case may be) will be displayed, followed by the area of the object in square feet and acres.

AZIMUTH ADD/SUBTRACT: Unlike other Easycogo programs, the 'Azimuth Add/Subtract' program is set up more like a simple conversion tool (without prompts) to enable the quickest possible results. If accessed from the menu, you will be reminded to enter 2 azimuths (or angles) as either positive (+) or negative (-) values, one in the upper line and the other in the lower line. Simply enter both angles as positive for addition or enter one angle as negative (use the +/- button) to subtract it from the other positive angle. Once both angles are entered, simply press 'R/S' and the result will be displayed in the

lower line. To add/subtract additional angles, simply key in one positive or negative angle, as appropriate, then press 'R/S'. The newly entered angle will be added to or subtracted from the previously calculated angle. Simply repeat for an unlimited number of angles. If you want to run the 'Azimuth Add/Subtract' program more like a simple conversion tool, first enter the two angles in the upper and lower lines as described above, then press XEQ, Z, ENTER and the result will be shown on the lower line. For unlimited additional angle addition/ subtraction, enter one additional angle as described above, then press 'R/S' to see the result on the lower line, and so on.

BEARING TRAVERSE: Being the main traverse/ sideshot program, it will have a few options for running the different types of incorporated traverse/sideshot methods, along with the option to carry elevations using the 'Slope Traverse' program. First, a standard yes/no prompt will ask if you want to use a bearing to define a foresight point, (accept '0' for no, press '1', 'R/S' for yes). If yes, input the bearing angle from the known point to the desired point, select the appropriate quadrant when displayed, then enter the coordinates to traverse from or use a previously stored point number, followed by the horizontal distance to the desired point. If the bearing option was not selected, a turned-angle type traverse/sideshot option will run, the next required input being the reference azimuth from the backsight (BS) to the occupied (OCC) point, for which the program will first use a standard yes/no prompt to ask if you need to use the 'Inverse' program to determine the necessary azimuth. Accept '0' if you have the azimuth available, or press '1', 'R/S' to execute the 'Inverse' program. If you execute the 'Inverse' program, you will be seamlessly returned to the 'Bearing Traverse' program after the inversed azimuth has been displayed. The azimuth from the 'Inverse' program will automatically be entered into the azimuth prompt of the 'Bearing Traverse' program (or a previously entered azimuth for easy acceptance if the Inverse option was not selected), otherwise it must be entered manually. The next prompt is for the horizontal turned angle from the backsight to the foresight. A right or left turned angle may be entered, right being a positive angle, left being a negative angle. Then enter the coordinates to traverse from or use a previously stored point number, followed by the horizontal distance to the foresight (if the 'Slope Traverse' program was executed for vertical data entry before the 'Bearing Traverse' program, the calculated horizontal distance will automatically be displayed in the prompt for easy acceptance). After either the bearing or the turned-angle traverse/sideshot entry options, the azimuth to the desired point (or foresight) will be displayed, followed by its coordinates and a prompt to store the coordinates with a point number, if desired. A standard yes/no option to 'MOVE UP' will then be displayed. Accepting the default '0' (no) answer will cause the program to proceed in a 'sideshot' type mode, keeping the same occupied point horizontal/vertical data as entered or derived previously. Pressing '1', 'R/S' (yes answer) will cause the program to proceed in a 'traverse' type mode, placing the previously derived foresight horizontal/ vertical data into the appropriate 'occupied point' prompts. Finally, you may choose to execute the 'Slope Traverse' program or continue with 'Bearing Traverse', which in turn will let you choose to enter data by bearing or by turned angle. Please see the 'Slope Traverse' and 'Inverse' programs for more information.

CUBIC VOLUME: Volume is calculated by the average-end area formula, so in the case of calculating road fill volume, for example, the first applicable station should entered, followed by the width of the top of the cross section, then the width of the base of the cross section, and finally the height of the cross section. Repeat the previous steps for each applicable station in sequential order. The distance between each station will be displayed (segment distance), along with the volume in cubic feet and cubic yards as applicable, followed by the total length entered with the total volume in cubic feet and cubic yards.

GRADE: Enter the station, then the elevation of the reference point or use a previously stored point number, followed by the applicable percent of grade (Example: for 5%, enter 5, not 0.05). Finally, enter the desired station in either direction for a display of the station and elevation. Press R/S to enter another station for the display of its elevation using the previously entered reference data. For grade calculation at a distance without stations, simply use 0 as the reference station and the desired distance for the station entry following.

HORIZONTAL CURVE (CIRCULAR & SPIRAL): The first prompt will be a standard 'Y?' (yes/no) option to enter 'SPIRAL CURVE' data. At the 'Y?' prompt, press '1', followed by 'R/S' to enter spiral curve data, or simply press 'R/S' to enter circular curve data. CIRCULAR CURVE: If the circular curve option is selected, you may define the circular horizontal curve with only two known variables, the four different options being: Radius & Internal Angle (Delta), Radius & Arc Length, Internal Angle & Arc Length, or Arc Length & Degree of Curvature (arc definition). Any of the first three options

must be selected by entering '1' at the 'Y?' prompt that follows the appropriate option. The fourth option will be automatically selected if the first three options are not selected. After entry of the selected known curve data, the program will display all of the curve information, including the radius, arc length, internal angle, tangent length, long chord length, PI-PC-PT (tangent-chord) deflection angle, degree of curvature (arc definition), mid ordinate length, external ordinate length, sector area (portion of circle inside radii), fillet area (portion lying between arc and tangents), and segment area (portion lying between arc and long chord). SPIRAL CURVE: If the spiral curve option is selected, you will be prompted to enter the length of the spiral curve, followed by the radius of the adjacent circular curve. The program will then display all of the spiral curve information, including the spiral's internal angle, A value (flatness), tangent distance to the SC, tangent offset of the SC, deflection angle from the tangent to the SC (tangent-chord angle), chord distance, long tangent distance, short tangent distance, tangent distance to the shifted circular PC, tangent offset to the shifted circular PC, and the velocity (speed) rating in MPH. Following the display of the spiral data, a 'SCS CURVE' option with the standard 'Y?' prompt will be displayed. Simply press 'R/S' to end the program or press '1', followed by 'R/S' to calculate additional information associated with a spiral-curve-spiral configuration. If you pressed '1', 'R/S', the next prompt will be for the input of the tangent deflection angle of the full SCS curve, followed by the display of the full-tangent length and the total arc length for the SCS curve. Then another standard 'Y?' prompt will be displayed with the option to view the information for the associated circular curve. Simply press 'R/S' to end the program or press '1', followed by 'R/S' to display all of the resultant data for the circular arc, as listed in the 'circular curve' section of these instructions.

INTERSECTIONS: The 'Intersection' program will first display a menu to prompt for the type of intersection to solve, including Bearing-Bearing, Bearing-Distance, and Distance-Distance. All intersection program options are configured in as much the same manner as possible, with more specific instructions displayed during program execution, such as orienting the unknown intersection point to the left of the known line (or base line) in the Bearing-Bearing and Distance-Distance Intersection programs, or in the case of a Bearing-Distance intersection, entering the coordinates accompanied by the known bearing first. In all cases, the known coordinates may be entered directly or recalled from stored point numbers, and the coordinates of the resulting intersection point(s) will be displayed, along with the option to store the point(s) for future use, the Bearing-Distance option typically having two possible solutions. Entering data with no valid intersection will result in an error.

INVERSE: This can be used for standard inversing, reference azimuth for traverse/sideshot, or for easy staking by using the displayed azimuths for backsight and foresight turned angles. Use along with the 'Slope Traverse' program to also easily stake points with vertical data. To inverse, enter the coordinates of the point to inverse from or use a previously stored point number, followed by the coordinates of the point to inverse to, or also use a previously stored point number. The appropriate from-to bearing quadrant labels will be displayed, followed by the from-to bearing angle in the upper display line and the distance between the inversed points in the lower line. The from-to azimuth will then be displayed, followed by a standard 'Y?' prompt to 'MOVE UP'. Accepting the default '0' (no) answer will execute the 'Inverse' program again in a 'sideshot' type mode, keeping the same 'from point' coordinates as entered previously. Pressing '1', then 'R/S' (yes) will execute the 'Inverse' program again in a 'traverse' type mode, placing the previously entered 'to point' coordinates into the 'from point' coordinate prompts. Please see the 'Slope Traverse' program for more information.

LEVELS: Enter the reference mark (or bench mark) elevation or use a previously stored point number, followed by the backsight rod height to view the elevation of the instrument (HI). Then enter the foresight rod height to view the foresight turning point (TP) elevation, followed by the sum of the plus (+) column in the upper display line and the sum of the minus (-) column in the lower line. Finally, the elevation difference from the reference mark to the turning point will be displayed. Continuing will prompt for the next backsight rod height and so on, repeating all subsequent steps again and again until the levels are completed. If a level loop is completed, the final display of the elevation difference from the reference mark to the turning point will be the closing error, if any.

NUMBERED POINTS: The 'Numbered Points' program will first display a standard menu of the options to either copy/edit points, store new points, or view previously stored points. Press 'R/S' to skip the displayed option, or press '1', followed by 'R/S' to select the displayed option. COPY/EDIT POINTS: Selecting the 'COPY-EDIT PNTS' option will result in a prompt for entering

the number of a previously stored point. This is not a standard yes/no prompt. Instead, enter the desired point number, then press 'R/S' to display the previously stored northing, then easting coordinates, followed by the stored elevation, any or all of which can be edited and subsequently stored as the same point number or any other point number (memory permitting). Enter the desired point number at the standard 'STORE PNT NUM' prompt, which is also not a standard yes/no prompt. Instead, enter the desired point number to store with the previously entered coordinate/elevation data, then press 'R/S' to store the point. The originally stored point values will not be changed, unless any value is changed and the stored point number is the same as the original point number. STORE POINTS: Selecting the 'STORE PNTS' option will result in prompts for the northing, easting and elevation values of the point you want to store, followed by the standard 'STORE PNT NUM' prompt as displayed in all other appropriate programs. Enter the desired point number to store with the previously entered coordinates, then press 'R/S' to store the point. The process will repeat for storing additional points. VIEW POINTS: Selecting the 'VIEW PNTS' option will result in the standard prompt for entering the number of a previously stored point. Enter the desired point number, then press 'R/S' to display the previously stored coordinates and elevation. Press 'R/S' again to repeat the process for viewing additional points. Please see the 'Using the Programs' section for more information.

POLAR CONVERSION: Because the extremely useful Rectangular to Polar Conversion function (y,x→θ,r) was left off of the HP 35s in its typical form, it has been included in the Easycogo Survey Program, and enhanced for surveying functionality. In keeping with the theme of the Easycogo Survey Program, the program will prompt for the necessary data, then display the results. After entering the vertical distance (a.k.a. 'y') and the horizontal distance (a.k.a. 'x'), the resultant vertical angle will be displayed (a.k.a. 'θ') in HMS format (not decimal degrees as in the original function), followed by the slope distance (a.k.a. 'r').

RECTANGULAR CONVERSION: The opposite, and also extremely useful Polar to Rectangular Conversion function (θ,r→y,x) was also left off of the HP 35s in its typical form, so it has also been included in the Easycogo Survey Program, also similarly enhanced for surveying functionality. In keeping with the theme of the Easycogo Survey Program, the program will prompt for the necessary data, then display the results. After entering the vertical angle (a.k.a. 'θ') in HMS format (not decimal degrees as in the original function), and the slope distance (a.k.a. 'r'), the resultant vertical distance (a.k.a. 'y') will be displayed, followed by the horizontal distance (a.k.a. 'x').

SLOPE TRAVERSE: To be used for entering vertical data in total station traverse or sideshot form, and can easily be used with the 'Inverse' program for staking points with vertical data. Always run the 'Slope Traverse' program first when horizontal and vertical data is to be entered (Example: trig-level traverse), as it will allow a simple and continuous loop of data entry, automatically integrating and presenting the appropriate horizontal and vertical programs where necessary for a complete solution. First, enter the elevation of the occupied point or use a previously stored point number, then the instrument measure up (MU) distance, the zenith angle to the foresight (FS), the slope distance to the foresight, and finally, the foresight rod height. The horizontal distance from the occupied point to the foresight will be displayed, followed by the elevation of the foresight point. A standard 'Y?' prompt will be displayed (yes/no) for the option to execute the 'Bearing Traverse' program. Accepting the default '0' (no) answer will re-execute the 'Slope Traverse' program, while a '1', 'R/S' (yes) answer will execute the 'Bearing Traverse' program. If horizontal and vertical data is desired for traversing or sideshots, executing the 'Slope Traverse' program first will display the vertical information and automatically input the derived horizontal distance into the "Bearing Traverse' program for simplified entry. In order to calculate vertical data without instrument and rod heights, simply input '0' at those prompts. If you accepted the default 'no' answer to the 'BEARING TRAV' prompt because only vertical information is needed, a standard yes/no option to 'MOVE UP' will be displayed. Accepting the default '0' (no) answer will execute the 'Slope Traverse' program again in a 'sideshot' type mode, keeping the same occupied point elevation data as entered previously. Pressing '1', 'R/S' (yes) will execute the 'Slope Traverse' program again in a 'traverse' type mode, placing the previously displayed foresight point elevation into the 'occupied point' elevation prompt. Please see the 'Bearing Traverse' and 'Inverse' programs for more information.

TRIANGLES: The 'Triangles' program will first display a standard menu of the types of triangles to solve, including Area-Angle-Angle, Angle-Side-Angle, Side-Angle-Angle, Side-Angle-Side, Side-Side-Angle, and Side-Side-Side. Press 'R/S' to skip the displayed option or '1', followed by 'R/S' to select the displayed option.

All are configured in as much the same manner as possible, prompting for the appropriate sequential sides and/or angles as the name indicates, followed by displaying each adjacent set of side-angle values in the same clockwise or counterclockwise direction around the perimeter of the triangle as the appropriate known values were entered. Since the AAA triangle needs a size limitation, it requires an area value. The first side-angle answer pair will include at least one of the first entered values, always beginning with a side. Finally, the area of the triangle will be displayed in square feet and acres.

VERTICAL CURVE: Enter the beginning station of the vertical curve (PVC), the beginning elevation at the PVC or use a previously stored point number, the percentage of grade into the vertical curve (Example: enter 5 for 5%), and the percentage of grade out of the vertical curve, followed by the total length of the vertical curve. The station at the end of the vertical curve (PVT) will be displayed, followed by the point of vertical tangent intersection (PVI) station in the upper display line and elevation in the lower line, then the K value. The high point or low point station, as applicable, is then displayed, followed by a prompt to enter any station within the vertical curve for a display of its on-curve elevation and the grade of the curve at the entered station (useful for calculating appropriate in/out grades for return radii). The initial default station will be the high or low point station, for a convenient display of its elevation, if desired.

PROGRAMMING KEYSTROKE REFERENCE

Program List	Button faces	Actual button function descriptions
∑-	↰ ∑+	YELLOW ∑-
∑y	↱ - > > ENTER	BLUE SUMS RIGHT RIGHT ENTER
√x	√x	SQUARE ROOT
π	↰ COS	YELLOW PI
>	>	CURSOR KEY - RIGHT
x	X	MULTIPLY
HMS→	↰ 8	YELLOW HMS→
→HMS	↱ 8	BLUE →HMS
ANY TEXT	EQN RCL R/S RCL +/-…	EQN RCL A RCL N RCL Y BLUE SPACE RCL T…ENTER
ABS	↱ +/-	BLUE ABS
CF 10	↰ ^ 2 . 0	YELLOW FLAGS TWO DECIMAL ZERO
CL∑	↱ ← 4	BLUE CLEAR FOUR
CLVARS	↱ ← 2	BLUE CLEAR TWO
FS? 1	↰ ^ 3 1	YELLOW FLAGS THREE ONE
GTO A001	GTO R/S ENTER	GTO (LETTER) ENTER
GTO A057	GTO R/S 0 5 7	GTO (LETTER) (NUMBER) (NUMBER) (NUMBER)
INPUT A	↰ x<>y R/S	YELLOW INPUT (LETTER)
PSE	↱ x<>y	BLUE PSE
RCLx(J)	RCL X .	RCL MULTIPLY DECIMAL
REGT	EQN R↓ > > ENTER	EQN R↓ > > ENTER
SF 10	↰ ^ 1 . 0	YELLOW FLAGS ONE DECIMAL ZERO
SPACE	↱ 0	BLUE SPACE
STO A	↱ RCL R/S	BLUE STO (LETTER)
STO+ A	↱ RCL + R/S	BLUE STO + (LETTER)
STO(J)	↱ RCL .	BLUE STO DECIMAL
STOP	R/S	R/S
x≠0?	↱ MODE 1	BLUE x?0 ≠
x>0?	↱ MODE 4	BLUE x?0 >
x≠y?	↰ MODE 1	YELLOW x?y ≠

PROGRAMMING INSTRUCTIONS:

In order to make full use of all aspects of the Easycogo Survey Program, while in RPN mode, you should enter the following programs exactly as written and in the order shown, though some can function separately from the others. You do not, however, need to enter them in their entirety at any given time. You may stop entering the lines at any time and continue from that point whenever you like, though an incomplete program will obviously not function properly until it and any referenced program(s) are completed. You may even enter each program in whatever order you prefer, though the menu should be placed first, just after the program top (displayed as 'PRGM TOP') to function completely as intended. To begin programming, press buttons ↱ PRGM. The display should show 'PRGM TOP'. The program stack does not need to be completely empty before beginning, however, all labels used by the Easycogo Survey Program must not be used (including A, B, C, G, H, I, L, M, N, P, R, S, T, V, X, and Z), and there should be at least 17 KB of memory available in order for the entire Easycogo Survey Program to be entered, not including any memory required for storing numbered points. The program headings are not to be entered, as each program begins with the label (LBL) line immediately following the previous program. Upon entering ↱ LBL (letter), the alphanumeric program identification on the left side will be revised to match, beginning with line 1. Essentially, all program lines that are calculator commands should be entered with the appropriate calculator functions, while all program lines that are informational text should be entered as equations, which always begin with pressing 'EQN', followed by whichever keystrokes are necessary to display the required info, all letters entered in equation format being preceded by a press of the 'RCL' button. Each program list is followed by a program check (CK) and line (LN) number for verification of proper program entry. To display the program information at any time, press buttons ↰ MEM 2, then use the up/down buttons to scroll through the program labels. To display the check number for the displayed program, press buttons ↰ SHOW (ENTER button) (hold down the SHOW button to keep it displayed longer). If the 'CK' and 'LN' values match the values shown in the instructions, the program has been entered correctly. One of the odd issues with any older HP 35s is that the program check (CK) numbers do not necessarily seem to match in comparison with another older HP 35s, even though the program is entered exactly the same. HP appears to have fixed the issue in the currently distributed HP 35s. As for the older HP 35s, the program line (LN) numbers seem to match almost always. The best way to check if the program(s) are entered correctly in an older HP 35s is to test the program(s) with known data, such as the Easycogo Sample Maps and Problems sheets. If at any time you need to stop programming, simply press the 'C' button to exit back to standard calculator mode. To pick up where you left off, before entering program mode, press buttons GTO (decimal) (decimal) to jump to the beginning of the program stack. Upon entering program mode (↱ PRGM), your last entered program line should be displayed in the upper display line and 'PRGM TOP' should be in the lower line. Since program lines will enter below the lower displayed line, you must use the '^' button to scroll up one line before continuing where you left off. If you've stopped programming in the middle of entering an Equation line, use the '>' or '<' buttons to move the cursor to the appropriate position within the line. For more in-depth programming information, please see the User's Manual, available as a PDF from HP. A direct link is available at easycogo.com. For 'Simple Programming' see chapter 13 (PDF pg. 183). For 'Operation Index' (button functions & operations) see Appendix G (PDF pg. 353).

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        PRGM TOP

"M"     MENU
M001    LBL M
M002    SF 10
M003    EASYCOGO                        EQN
        *Enter line M3 as:
        EQN
        RCL E
        RCL A
        RCL S
        RCL Y
        RCL C
        RCL O
        RCL G
        RCL O
        ENTER
M004    PSE
M005    MENU=M                          EQN
M006    PSE
M007    RS TO SKIP                      EQN
M008    PSE
M009    1 RS TO SELECT                  EQN
M010    PSE
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M011    0
M012    AREA-COORDS=A                EQN
M013    x>0?
M014    GTO A001
M015    AZIMUTH +-=Z                 EQN
M016    x>0?
M017    GTO Z006
M018    BEARING TRAV=B               EQN
M019    x>0?
M020    GTO B001
M021    CUBIC VOL=C                  EQN
M022    x>0?
M023    GTO C001
M024    GRADE=G                      EQN
M025    x>0?
M026    GTO G001
M027    HORIZ CURVE=H                EQN
M028    x>0?
M029    GTO H001
M030    INTERSECTION=X               EQN
M031    x>0?
M032    GTO X001
M033    INVERSE=I                    EQN
M034    x>0?
M035    GTO I001
M036    LEVELS=L                     EQN
M037    x>0?
M038    GTO L001
M039    NUMBER PNTS=N                EQN
M040    x>0?
M041    GTO N001
M042    POLAR CONV=P                 EQN
M043    x>0?
M044    GTO P001
M045    RECTANG CONV=R               EQN
M046    x>0?
M047    GTO R001
M048    SLOPE TRAV=S                 EQN
M049    x>0?
M050    GTO S001
M051    TRIANGLE=T                   EQN
M052    x>0?
M053    GTO T001
M054    VERT CURVE=V                 EQN
M055    x>0?
M056    GTO V001
M057    GTO M012

LBL M   CK=8C76
        LN=384
```

```
"A"     AREA BY COORDINATES
A001    LBL A
A002    SF 10
A003    0
A004    STO P
A005    STO F
A006    STO Y
A007    AREA-COORDS=A                EQN
A008    PSE
A009    BEGIN COORDS                 EQN
A010    PSE
A011    XEQ N064
A012    INPUT N
A013    STO L
A014    STO U
A015    INPUT E
A016    STO D
A017    STO R
A018    FS? 1
A019    XEQ N031
A020    NEXT COORDS                  EQN
A021    PSE
A022    XEQ N064
A023    INPUT N
A024    INPUT E
A025    FS? 1
A026    XEQ N031
A027    RCL E
A028    RCL D
A029    -
A030    RCL N
A031    RCL L
A032    -
A033    XEQ P031
A034    STO+ P
A035    RCL N
A036    RCL D
A037    x
A038    RCL E
A039    RCL L
A040    x
A041    -
A042    STO+ F
A043    RCL N
A044    STO L
A045    RCL E
A046    STO D
A047    RCL Y
A048    x>0?
A049    GTO A060
A050    CLOSE                        EQN
A051    PSE
A052    INPUT Y
```

```
A053    x=0?
A054    GTO A020
A055    RCL U
A056    STO N
A057    RCL R
A058    STO E
A059    GTO A028
A060    RCL F
A061    ABS
A062    2
A063    ÷
A064    STO F
A065    43560
A066    ÷
A067    STO A
A068    RCL F
A069    x<>y
A070    PERIMETER                  EQN
A071    PSE
A072    VIEW P
A073    SQ FT-ACRES                EQN
A074    PSE
A075    CF 10
A076    STOP
A077    RTN

LBL A   CK=3F69
        LN=299
```

"Z" AZIMUTH ADD/SUBTRACT

```
Z001    LBL Z
Z002    CF 10
Z003    →HMS(HMS→(REGY)+HMS→(REGX))
```

Enter Line Z3 as:
EQN
→HMS
HMS→
REGY
>
+
HMS→
REGX
ENTER

```
Z004    STOP
Z005    GTO Z001
Z006    ENTER 2 +-ANG              EQN
Z007    PSE
Z008    STOP
Z009    GTO Z001

LBL Z   CK=32F1
        LN=67
```

"B" BEARING TRAVERSE

```
B001    LBL B
B002    CF 2
B003    SF 10
B004    0
B005    STO Y
B006    BEARING TRAV=B             EQN
B007    PSE
B008    USE BEARING                EQN
B009    PSE
B010    INPUT Y
B011    x>0?
B012    GTO B118
B013    AZIMUTH FROM               EQN
B014    PSE
B015    BS TO OCC                  EQN
B016    PSE
B017    RCL D
B018    STO L
B019    INVERSE                    EQN
B020    PSE
B021    0
B022    STO I
B023    INPUT Y
B024    x>0?
B025    XEQ I013
B026    RCL I
B027    x>0?
B028    GTO B115
B029    INPUT A
B030    RCL A
B031    HMS→
B032    STO Q
B033    180
B034    +
B035    TURNED ANGLE               EQN
B036    PSE
B037    RT=+ LT=-                  EQN
B038    PSE
B039    INPUT T
B040    HMS→
B041    +
B042    STO A
B043    360
B044    RCL A
B045    x<0?
B046    +
B047    STO A
B048    360
B049    x>y?
B050    GTO B053
B051    -
B052    STO A
```

```
B053   0
B054   STO Y
B055   FROM COORDS                EQN
B056   PSE
B057   XEQ N064
B058   INPUT N
B059   STO U
B060   INPUT E
B061   STO W
B062   FS? 1
B063   XEQ N031
B064   RCL A
B065   ABS
B066   STO A
B067   DISTANCE                   EQN
B068   PSE
B069   INPUT D
B070   XEQ R020
B071   STO+ N
B072   x<>y
B073   STO+ E
B074   RCL A
B075   →HMS
B076   STO A
B077   AZIMUTH TO FS              EQN
B078   PSE
B079   VIEW A
B080   RCL N
B081   RCL E
B082   FS N-E                     EQN
B083   PSE
B084   STOP
B085   XEQ N031
B086   FS? 2
B087   XEQ B151
B088   MOVE UP                    EQN
B089   PSE
B090   INPUT Y
B091   x>0?
B092   XEQ B111
B093   x>0?
B094   GTO B102
B095   RCL U
B096   STO N
B097   RCL W
B098   STO E
B099   RCL Q
B100   →HMS
B101   STO A
B102   0
B103   STO Y
B104   SLOPE TRAV                 EQN
B105   PSE
B106   CF 10
B107   INPUT Y
B108   x>0?
B109   GTO S001
B110   GTO B001
B111   RCL F
B112   STO O
B113   RCL Y
B114   RTN
B115   RCL L
B116   STO D
B117   GTO B030
B118   INPUT B
B119   HMS→
B120   STO A
B121   QUADRANT                   EQN
B122   PSE
B123   0
B124   STO Y
B125   NE                         EQN
B126   PSE
B127   INPUT Y
B128   x>0?
B129   GTO B053
B130   NW                         EQN
B131   PSE
B132   INPUT Y
B133   x>0?
B134   -360
B135   STO+ A
B136   x<0?
B137   GTO B053
B138   SW                         EQN
B139   PSE
B140   INPUT Y
B141   x>0?
B142   180
B143   STO+ A
B144   x>0?
B145   GTO B053
B146   SE                         EQN
B147   PSE
B148   -180
B149   STO+ A
B150   GTO B053
B151   RCL J
B152   x=0?
B153   GTO B156
B154   RCL F
B155   XEQ N047
B156   CF 2
B157   RTN
```

```
LBL B  CK=6BF2
       LN=641
```

"C" CUBIC VOLUME

```
C001   LBL C
C002   SF 10
C003   CUBIC VOL=C                EQN
C004   PSE
C005   0
C006   STO Y
C007   STO L
C008   CL∑
C009   STATION                    EQN
C010   PSE
C011   INPUT S
C012   STO X
C013   XEQ C055
C014   STO A
C015   NEXT STATION               EQN
C016   PSE
C017   INPUT S
C018   RCL X
C019   -
C020   STO D
C021   SEG DIST                   EQN
C022   PSE
C023   VIEW D
C024   STO+ L
C025   XEQ C055
C026   STO Z
C027   STO+ A
C028   RCL D
C029   RCL A
C030   2
C031   ÷
C032   x
C033   STO F
C034   RCL F
C035   27
C036   ÷
C037   STO Y
C038   SEG CU FT-YD               EQN
C039   PSE
C040   STOP
C041   ∑+
C042   TOTAL LENGTH               EQN
C043   PSE
C044   VIEW L
C045   ∑y
C046   ∑x
C047   TOTAL CU FT-YD             EQN
C048   PSE
C049   STOP
C050   RCL Z
C051   STO A
C052   RCL S
C053   STO X
C054   GTO C015
C055   TOP WIDTH                  EQN
C056   PSE
C057   INPUT T
C058   BASE WIDTH                 EQN
C059   PSE
C060   INPUT B
C061   HEIGHT                     EQN
C062   PSE
C063   INPUT H
C064   RCL T
C065   RCL B
C066   +
C067   RCL H
C068   x
C069   2
C070   ÷
C071   RTN

LBL C  CK=D236
       LN=319
```

"G" GRADE

```
G001   LBL G
G002   CF 1
G003   SF 10
G004   GRADE=G                    EQN
G005   PSE
G006   REFERENCE STA              EQN
G007   PSE
G008   INPUT R
G009   REFERENCE ELEV             EQN
G010   PSE
G011   XEQ N064
G012   FS? 1
G013   GTO G016
G014   RCL Z
G015   STO E
G016   INPUT E
G017   PERCENT                    EQN
G018   PSE
G019   INPUT P
G020   STATION                    EQN
G021   PSE
G022   INPUT S
G023   RCL R
G024   -
G025   x<>y
G026   %
```

```
G027   RCL E
G028   +
G029   RCL S
G030   x<>y
G031   STA-ELEV                    EQN
G032   PSE
G033   STOP
G034   RCL P
G035   GTO G020

LBL G  CK=64BA
       LN=161
```

"H" HORIZONTAL CURVE

```
H001   LBL H
H002   SF 10
H003   HORIZ CURVE=H               EQN
H004   PSE
H005   0
H006   STO Y
H007   SPIRAL CURVE               EQN
H008   PSE
H009   INPUT Y
H010   x>0?
H011   GTO H200
H012   USE KNOWN                   EQN
H013   PSE
H014   RADIUS-INT ANG              EQN
H015   PSE
H016   INPUT Y
H017   x=0?
H018   GTO H024
H019   XEQ H062
H020   XEQ H066
H021   XEQ H076
H022   XEQ H088
H023   GTO H094
H024   RADIUS-LENGTH               EQN
H025   PSE
H026   INPUT Y
H027   x=0?
H028   GTO H034
H029   XEQ H062
H030   XEQ H072
H031   XEQ H082
H032   XEQ H088
H033   GTO H094
H034   INT ANG-LENGTH              EQN
H035   PSE
H036   INPUT Y
H037   x=0?
H038   GTO H050
H039   XEQ H066
H040   XEQ H072
H041   RCL I
H042   π
H043   180
H044   ÷
H045   x
H046   ÷
H047   STO R
H048   XEQ H088
H049   GTO H094
H050   LENGTH-DEGREE               EQN
H051   PSE
H052   XEQ H072
H053   DEGREE                      EQN
H054   PSE
H055   5729.58
H056   INPUT D
H057   HMS→
H058   ÷
H059   STO R
H060   XEQ H082
H061   GTO H094
H062   RADIUS                      EQN
H063   PSE
H064   INPUT R
H065   RTN
H066   INTERN ANG                  EQN
H067   PSE
H068   INPUT I
H069   HMS→
H070   STO I
H071   RTN
H072   ARC LENGTH                  EQN
H073   PSE
H074   INPUT L
H075   RTN
H076   RCL I
H077   →RAD
H078   RCL R
H079   x
H080   STO L
H081   RTN
H082   RCL L
H083   RCL R
H084   →RAD
H085   ÷
H086   STO I
H087   RTN
H088   5729.58
H089   RCL R
H090   ÷
H091   →HMS
H092   STO D
```

```
H093   RTN
H094   RCL I
H095   2
H096   ÷
H097   TAN
H098   RCL R
H099   x
H100   STO T
H101   RCL I
H102   2
H103   ÷
H104   SIN
H105   RCL R
H106   2
H107   x
H108   x
H109   STO C
H110   1
H111   RCL I
H112   2
H113   ÷
H114   COS
H115   -
H116   RCL R
H117   x
H118   STO M
H119   RCL R
H120   1
H121   RCL I
H122   2
H123   ÷
H124   COS
H125   ÷
H126   1
H127   -
H128   x
H129   STO E
H130   RCL R
H131   RCL L
H132   x
H133   2
H134   ÷
H135   STO A
H136   RCL R
H137   RCL T
H138   RCL L
H139   2
H140   ÷
H141   -
H142   x
H143   STO F
H144   RCL A
H145   RCL R
H146   x²
H147   RCL I
H148   SIN
H149   x
H150   2
H151   ÷
H152   -
H153   STO S
H154   RCL I
H155   2
H156   ÷
H157   →HMS
H158   STO P
H159   RCL I
H160   →HMS
H161   STO I
H162   RADIUS                  EQN
H163   PSE
H164   VIEW R
H165   ARC LENGTH              EQN
H166   PSE
H167   VIEW L
H168   INTERN ANG              EQN
H169   PSE
H170   VIEW I
H171   TANGENT                 EQN
H172   PSE
H173   VIEW T
H174   LONG CHORD              EQN
H175   PSE
H176   VIEW C
H177   PI-PC-PT ANG            EQN
H178   PSE
H179   VIEW P
H180   DEGREE CURVE            EQN
H181   PSE
H182   VIEW D
H183   MID ORDINATE            EQN
H184   PSE
H185   VIEW M
H186   EXTERNAL ORD            EQN
H187   PSE
H188   VIEW E
H189   SECTOR AREA             EQN
H190   PSE
H191   VIEW A
H192   FILLET AREA             EQN
H193   PSE
H194   VIEW F
H195   SEGMENT AREA            EQN
H196   PSE
H197   CF 10
H198   VIEW S
```

```
H199   RTN
H200   SPIRAL LENGTH                EQN
H201   PSE
H202   INPUT L
H203   RCL L
H204   CURVE RADIUS                 EQN
H205   PSE
H206   INPUT R
H207   2
H208   x
H209   ÷
H210   STO I
H211   RCL L
H212   0.5
H213   RCL I
H214   x²
H215   60
H216   ÷
H217   -
H218   x
H219   STO K
H220   RCL L
H221   RCL R
H222   x
H223   √x
H224   STO A
H225   5729.58
H226   RCL R
H227   ÷
H228   RCL L
H229   ÷
H230   100
H231   x
H232   0.0727
H233   RCL L
H234   100
H235   ÷
H236   3
H237   yˣ
H238   x
H239   x
H240   STO P
H241   RCL L
H242   RCL R
H243   x
H244   1.6
H245   ÷
H246   3
H247   ˣ√y
H248   STO V
H249   RCL L
H250   1
H251   RCL I
H252   x²
H253   10
H254   ÷
H255   -
H256   x
H257   STO X
H258   RCL L
H259   RCL I
H260   3
H261   ÷
H262   RCL I
H263   3
H264   yˣ
H265   42
H266   ÷
H267   -
H268   x
H269   STO Y
H270   RCL X
H271   ÷
H272   ATAN
H273   STO D
H274   RCL Y
H275   x²
H276   RCL X
H277   x²
H278   +
H279   √x
H280   STO C
H281   RCL I
H282   →DEG
H283   STO I
H284   RCL X
H285   RCL Y
H286   1
H287   RCL I
H288   TAN
H289   ÷
H290   x
H291   -
H292   STO T
H293   RCL Y
H294   RCL I
H295   SIN
H296   ÷
H297   STO S
H298   RCL I
H299   →HMS
H300   STO I
H301   RCL D
H302   →HMS
H303   STO D
H304   INTERN ANG                   EQN
```

```
H305   PSE
H306   VIEW I
H307   A (FLATNESS)              EQN
H308   PSE
H309   VIEW A
H310   TAN-SC DIST               EQN
H311   PSE
H312   VIEW X
H313   TAN-SC OFFSET             EQN
H314   PSE
H315   VIEW Y
H316   TAN-SC DEFLECT            EQN
H317   PSE
H318   VIEW D
H319   SPIRAL CHORD              EQN
H320   PSE
H321   VIEW C
H322   LONG TAN                  EQN
H323   PSE
H324   VIEW T
H325   SHORT TAN                 EQN
H326   PSE
H327   VIEW S
H328   K (PC SHIFTED)            EQN
H329   PSE
H330   VIEW K
H331   P (PC OFFSET)             EQN
H332   PSE
H333   VIEW P
H334   VELOCITY-MPH              EQN
H335   PSE
H336   VIEW V
H337   0
H338   STO Y
H339   SCS CURVE                 EQN
H340   PSE
H341   INPUT Y
H342   x=0?
H343   RTN
H344   TAN DEFLEC ANG            EQN
H345   PSE
H346   INPUT D
H347   HMS→
H348   2
H349   ÷
H350   TAN
H351   RCL R
H352   RCL P
H353   +
H354   x
H355   RCL K
H356   +
H357   STO F
H358   SCS FULL TAN              EQN
H359   PSE
H360   VIEW F
H361   RCL L
H362   2
H363   x
H364   RCL D
H365   HMS→
H366   RCL I
H367   HMS→
H368   2
H369   x
H370   -
H371   STO I
H372   XEQ H077
H373   +
H374   STO L
H375   TOTAL SCS LEN             EQN
H376   PSE
H377   VIEW L
H378   0
H379   STO Y
H380   VIEW CIRC ARC             EQN
H381   PSE
H382   INPUT Y
H383   x>0?
H384   GTO H021
H385   RTN

LBL H  CK=2CFC
       LN=1687
```

INTERSECTION

"X"	(BEARINGS & DISTANCES)	
X001	LBL X	
X002	SF 10	
X003	INTERSECTION=X	*EQN*
X004	PSE	
X005	0	
X006	BEAR-BEAR X	*EQN*
X007	x>0?	
X008	GTO X016	
X009	BEAR-DIST X	*EQN*
X010	x>0?	
X011	GTO X147	
X012	DIST-DIST X	*EQN*
X013	x>0?	
X014	GTO X214	
X015	GTO X006	
X016	XEQ X068	
X017	XEQ N064	
X018	XEQ X075	
X019	INPUT N	

```
X020   INPUT E
X021   FS? 1
X022   XEQ N031
X023   x<>y
X024   ∑-
X025   XEQ X128
X026   XEQ X138
X027   BEAR TO INTX                EQN
X028   PSE
X029   XEQ X091
X030   RCL A
X031   STO K
X032   360
X033   RCL H
X034   x<0?
X035   +
X036   STO H
X037   180
X038   RCL K
X039   RCL H
X040   -
X041   STO D
X042   RCL C
X043   +
X044   -
X045   STO B
X046   RCL X
X047   RCL C
X048   SIN
X049   x
X050   RCL B
X051   SIN
X052   ÷
X053   STO Y
X054   RCL K
X055   x<>y
X056   XEQ R020
X057   STO+ N
X058   x<>y
X059   STO+ E
X060   RCL N
X061   RCL E
X062   INTX N-E                    EQN
X063   PSE
X064   CF 10
X065   STOP
X066   XEQ N031
X067   RTN
X068   INTX LEFT OF                EQN
X069   PSE
X070   KNOWN LINE                  EQN
X071   PSE
X072   1ST PNT                     EQN
X073   PSE
X074   RTN
X075   INPUT N
X076   INPUT E
X077   FS? 1
X078   XEQ N031
X079   x<>y
X080   CL∑
X081   ∑+
X082   BEAR TO INTX                EQN
X083   PSE
X084   XEQ X091
X085   RCL A
X086   STO V
X087   2ND PNT                     EQN
X088   PSE
X089   XEQ N064
X090   RTN
X091   INPUT B
X092   HMS→
X093   STO A
X094   QUADRANT                    EQN
X095   PSE
X096   0
X097   STO Y
X098   NE                          EQN
X099   PSE
X100   INPUT Y
X101   x>0?
X102   RTN
X103   NW                          EQN
X104   PSE
X105   INPUT Y
X106   x=0?
X107   GTO X113
X108   360
X109   RCL A
X110   -
X111   STO A
X112   RTN
X113   SW                          EQN
X114   PSE
X115   INPUT Y
X116   x=0?
X117   GTO X121
X118   180
X119   STO+ A
X120   RTN
X121   SE                          EQN
X122   PSE
X123   180
X124   RCL A
X125   -
```

```
X126   STO A
X127   RTN
X128   ∑y
X129   ∑x
X130   XEQ P031
X131   STO X
X132   x<>y
X133   STO H
X134   180
X135   +
X136   STO I
X137   RTN
X138   RCL V
X139   -
X140   STO C
X141   360
X142   RCL C
X143   x<0?
X144   +
X145   STO C
X146   RTN
X147   PNT WITH KNOWN          EQN
X148   PSE
X149   BEAR 1ST                EQN
X150   PSE
X151   XEQ N064
X152   XEQ X075
X153   INPUT N
X154   STO U
X155   INPUT E
X156   STO R
X157   FS? 1
X158   XEQ N031
X159   x<>y
X160   ∑-
X161   XEQ X192
X162   STO W
X163   XEQ X128
X164   XEQ X138
X165   RCL X
X166   RCL C
X167   SIN
X168   x
X169   RCL W
X170   ÷
X171   ASIN
X172   XEQ X196
X173   INTX N-E                EQN
X174   PSE
X175   OPTION 1                EQN
X176   PSE
X177   STOP
X178   XEQ N031
X179   RCL U
X180   STO N
X181   RCL R
X182   STO E
X183   180
X184   RCL B
X185   -
X186   XEQ X196
X187   OPTION 2                EQN
X188   PSE
X189   STOP
X190   XEQ N031
X191   RTN
X192   DIST TO INTX            EQN
X193   PSE
X194   INPUT D
X195   RTN
X196   STO B
X197   180
X198   RCL B
X199   RCL C
X200   +
X201   -
X202   STO D
X203   RCL H
X204   +
X205   STO K
X206   RCL W
X207   XEQ R020
X208   STO+ N
X209   x<>y
X210   STO+ E
X211   RCL N
X212   RCL E
X213   RTN
X214   XEQ X068
X215   XEQ N064
X216   INPUT N
X217   STO U
X218   INPUT E
X219   STO R
X220   FS? 1
X221   XEQ N031
X222   x<>y
X223   CL∑
X224   ∑+
X225   XEQ X192
X226   STO W
X227   2ND PNT                 EQN
X228   PSE
X229   XEQ N064
X230   INPUT N
X231   INPUT E
```

```
X232   FS? 1
X233   XEQ N031
X234   x<>y
X235   ∑-
X236   XEQ X128
X237   XEQ X192
X238   STO Y
X239   RCL X
X240   x²
X241   RCL W
X242   x²
X243   +
X244   RCL Y
X245   x²
X246   -
X247   2
X248   RCL X
X249   RCL W
X250   x
X251   x
X252   ÷
X253   ACOS
X254   STO C
X255   RCL I
X256   x<>y
X257   -
X258   STO V
X259   360
X260   RCL V
X261   x<0?
X262   +
X263   STO V
X264   RCL W
X265   XEQ R020
X266   STO+ U
X267   x<>y
X268   STO+ R
X269   RCL U
X270   STO N
X271   RCL R
X272   STO E
X273   INTX N-E                    EQN
X274   PSE
X275   CF 10
X276   STOP
X277   XEQ N031
X278   RTN

LBL X  CK=1808
       LN=1071
```

"I" INVERSE

```
I001   LBL I
I002   SF 10
I003   0
I004   STO Y
I005   XEQ I013
I006   MOVE UP                     EQN
I007   PSE
I008   CF 10
I009   INPUT Y
I010   x>0?
I011   GTO I001
I012   GTO I077
I013   INVERSE=I                   EQN
I014   PSE
I015   1
I016   STO I
I017   FROM PNT                    EQN
I018   PSE
I019   XEQ N064
I020   INPUT N
I021   STO U
I022   INPUT E
I023   STO W
I024   FS? 1
I025   XEQ N031
I026   x<>y
I027   CL∑
I028   ∑+
I029   TO PNT                      EQN
I030   PSE
I031   XEQ N064
I032   INPUT N
I033   INPUT E
I034   FS? 1
I035   XEQ N031
I036   x<>y
I037   ∑-
I038   ∑x
I039   x≤0?
I040   N                           EQN
I041   x>0?
I042   S                           EQN
I043   ∑y
I044   x≤0?
I045   E                           EQN
I046   x>0?
I047   W                           EQN
I048   ABS
I049   ∑x
I050   ABS
I051   XEQ P031
I052   STO D
```

```
I053   x<>y
I054   →HMS
I055   STO B
I056   x<>y
I057   BEARING-DIST                EQN
I058   PSE
I059   STOP
I060   ∑y
I061   ∑x
I062   XEQ P031
I063   x<>y
I064   180
I065   +
I066   STO A
I067   360
I068   x≤y?
I069   STO- A
I070   RCL A
I071   →HMS
I072   STO A
I073   AZIMUTH                    EQN
I074   PSE
I075   VIEW A
I076   RTN
I077   RCL U
I078   STO N
I079   RCL W
I080   STO E
I081   GTO I001

LBL I  CK=EB7C
       LN=304
```

"L" LEVELS

```
L001   LBL L
L002   CF 1
L003   SF 10
L004   0
L005   STO P
L006   STO M
L007   LEVELS=L                   EQN
L008   PSE
L009   REF MARK ELEV              EQN
L010   PSE
L011   XEQ N064
L012   FS? 1
L013   GTO L016
L014   RCL Z
L015   STO R
L016   INPUT R
L017   STO E
L018   RCL E
L019   BACK ROD                   EQN
L020   PSE
L021   INPUT B
L022   STO+ P
L023   +
L024   STO H
L025   HI                         EQN
L026   PSE
L027   VIEW H
L028   FORE ROD                   EQN
L029   PSE
L030   RCL H
L031   INPUT F
L032   STO- M
L033   -
L034   STO E
L035   TP ELEV                    EQN
L036   PSE
L037   VIEW E
L038   RCL R
L039   -
L040   STO D
L041   RCL P
L042   RCL M
L043   + AND - SUMS               EQN
L044   PSE
L045   STOP
L046   RM TO TP DIFF              EQN
L047   PSE
L048   VIEW D
L049   GTO L018

LBL L  CK=1398
       LN=219
```

"N" NUMBERED PNTS

```
N001   LBL N
N002   SF 10
N003   NUMBER PNTS=N              EQN
N004   PSE
N005   0
N006   COPY-EDIT PNTS             EQN
N007   x=0?
N008   GTO N026
N009   XEQ N064
N010   XEQ N012
N011   GTO N009
N012   ENTER COORD                EQN
N013   PSE
N014   INPUT N
N015   INPUT E
N016   ELEV                       EQN
N017   PSE
N018   INPUT Z
```

```
N019   XEQ N031
N020   RCL J
N021   x=0?
N022   RTN
N023   RCL Z
N024   XEQ N047
N025   RTN
N026   STORE PNTS                  EQN
N027   x=0?
N028   GTO N053
N029   XEQ N012
N030   GTO N029
N031   SF 10
N032   0
N033   STORE PNT NUM               EQN
N034   x=0?
N035   STO J
N036   x=0?
N037   GTO N045
N038   STO J
N039   R↓
N040   R↓
N041   CF 10
N042   [N,E,0]                     EQN
```

Enter Line N42 as:
EQN
[]
RCL N
, *(COMMA – 0 BUTTON)*
RCL E
,
0
ENTER

```
N043   STO(J)
N044   SF 10
N045   R↓
N046   RTN
N047   XEQ N087
N048   x
N049   RCL(J)
N050   +
N051   STO(J)
N052   RTN
N053   VIEW PNTS                   EQN
N054   x=0?
N055   GTO N006
N056   XEQ N064
N057   PNT N-E                     EQN
N058   PSE
N059   STOP
N060   ELEV                        EQN
N061   PSE
N062   VIEW Z
N063   GTO N056
N064   SF 1
N065   SF 10
N066   0
N067   ENTER PNT NUM               EQN
N068   x=0?
N069   GTO N081
N070   STO J
N071   XEQ N083
N072   RCLx(J)
N073   STO N
N074   XEQ N085
N075   RCLx(J)
N076   STO E
N077   XEQ N087
N078   RCLx(J)
N079   STO Z
N080   CF 1
N081   R↓
N082   RTN
N083   [1,0,0]
```

Enter Line N83 as:
[] *(NOT EQN)*
1
, *(COMMA – 0 BUTTON)*
0
,
0
ENTER

```
N084   RTN
N085   [0,1,0]
N086   RTN
N087   [0,0,1]
N088   RTN

LBL N  CK=7A8D
       LN=393
```

"P" POLAR CONVERSION (y,x→θ,r)

```
P001   LBL P
P002   SF 10
P003   XEQ P019
P004   INPUT V
P005   XEQ P022
P006   INPUT H
P007   XEQ P031
P008   STO S
P009   x<>y
P010   →HMS
P011   STO A
P012   x<>y
P013   XEQ P025
P014   VIEW A
```

```
P015    XEQ P028
P016    VIEW S
P017    CF 10
P018    RTN
P019    VERT DIST(Y)                EQN
P020    PSE
P021    RTN
P022    HORIZ DIST(X)               EQN
P023    PSE
P024    RTN
P025    VERT ANGLE(θ)               EQN
P026    PSE
P027    RTN
P028    SLOPE DIST(R)               EQN
P029    PSE
P030    RTN
P031    CF 10
P032    REGX+ixREGY                 EQN
```

*Enter Line P32 as:
EQN
REGX
+
i
x
REGY
ENTER

```
P033    ARG(REGX)                   EQN
```

*Enter Line P33 as:
EQN
ARG
REGX
ENTER

```
P034    ABS(REGY)                   EQN
```

*Enter Line P34 as:
EQN
ABS
REGY
ENTER

```
P035    SF 10
P036    RTN

LBL P   CK=0B01
        LN=188
```

"R" RECTANGULAR CONVERSION (θ,r→y,x)

```
R001    LBL R
R002    SF 10
R003    XEQ P025
R004    INPUT A
R005    HMS→
R006    STO A
R007    XEQ P028
R008    INPUT S
R009    XEQ R020
R010    STO H
R011    x<>y
R012    STO V
R013    x<>y
R014    XEQ P019
R015    VIEW V
R016    XEQ P022
R017    VIEW H
R018    CF 10
R019    RTN
R020    CF 10
R021    REGXxSIN(REGY)              EQN
```

*Enter Line R21 as:
EQN
REGX
x
SIN
REGY
ENTER

```
R022    REGYxCOS(REGZ)              EQN
```

*Enter Line R22 as:
EQN
REGY
x
COS
REGZ
ENTER

```
R023    SF 10
R024    RTN

LBL R   CK=3C33
        LN=100
```

"S" SLOPE TRAVERSE

```
S001    LBL S
S002    CF 1
S003    SF 2
S004    SF 10
S005    SLOPE TRAV=S                EQN
S006    PSE
S007    OCC PNT ELEV                EQN
S008    PSE
S009    RCL Z
S010    STO Q
S011    XEQ N064
S012    FS? 1
S013    GTO S018
S014    RCL Z
S015    STO O
S016    RCL Q
S017    STO Z
```

```
S018    INPUT O
S019    MEASURE UP                  EQN
S020    PSE
S021    INPUT M
S022    +
S023    STO H
S024    ZENITH ANGLE                EQN
S025    PSE
S026    INPUT Z
S027    HMS→
S028    90
S029    -
S030    +/-
S031    STO V
S032    SIN
S033    SLOPE DIST                  EQN
S034    PSE
S035    INPUT S
S036    x
S037    RCL H
S038    +
S039    ROD HEIGHT                  EQN
S040    PSE
S041    INPUT R
S042    -
S043    STO F
S044    RCL V
S045    RCL S
S046    XEQ R020
S047    STO D
S048    HORIZ DIST                  EQN
S049    PSE
S050    VIEW D
S051    FS PNT ELEV                 EQN
S052    PSE
S053    VIEW F
S054    0
S055    STO Y
S056    BEARING TRAV                EQN
S057    PSE
S058    INPUT Y
S059    x>0?
S060    GTO B003
S061    MOVE UP                     EQN
S062    PSE
S063    CF 10
S064    INPUT Y
S065    x=0?
S066    GTO S001
S067    RCL F
S068    STO O
S069    GTO S001
```

```
LBL S   CK=24BA
        LN=316

"T"     TRIANGLES
T001    LBL T
T002    SF 10
T003    TRIANGLE=T                  EQN
T004    PSE
T005    0
T006    AAA TRIANG                  EQN
T007    x>0?
T008    GTO T025
T009    ASA TRIANG                  EQN
T010    x>0?
T011    GTO T171
T012    SAA TRIANG                  EQN
T013    x>0?
T014    GTO T183
T015    SAS TRIANG                  EQN
T016    x>0?
T017    GTO T200
T018    SSA TRIANG                  EQN
T019    x>0?
T020    GTO T226
T021    SSS TRIANG                  EQN
T022    x>0?
T023    GTO T267
T024    GTO T006
T025    AREA (SQ FT)                EQN
T026    PSE
T027    INPUT F
T028    ANGLES                      EQN
T029    PSE
T030    180
T031    INPUT A
T032    HMS→
T033    STO C
T034    INPUT A
T035    HMS→
T036    STO D
T037    +
T038    -
T039    STO B
T040    RCL F
T041    2
T042    RCL C
T043    SIN
T044    x
T045    x
T046    RCL B
T047    SIN
T048    RCL D
T049    SIN
```

```
T050   x
T051   ÷
T052   √x
T053   STO Y
T054   RCL B
T055   SIN
T056   x
T057   RCL C
T058   SIN
T059   ÷
T060   STO X
T061   XEQ T130
T062   RCL B
T063   →HMS
T064   STO B
T065   RCL C
T066   →HMS
T067   STO C
T068   RCL D
T069   →HMS
T070   STO D
T071   SIDE-ANGLE                EQN
T072   PSE
T073   SAME DIRECTION            EQN
T074   PSE
T075   RCL X
T076   RCL D
T077   STOP
T078   RCL Y
T079   RCL B
T080   STOP
T081   RCL Z
T082   RCL C
T083   STOP
T084   RCL X
T085   RCL Y
T086   RCL Z
T087   +
T088   +
T089   2
T090   ÷
T091   STO V
T092   RCL X
T093   -
T094   RCL V
T095   RCL Y
T096   -
T097   RCL V
T098   RCL Z
T099   -
T100   x
T101   x
T102   RCL V
T103   x
T104   √x
T105   STO F
T106   RCL F
T107   43560
T108   ÷
T109   STO A
T110   SQ FT-ACRES               EQN
T111   PSE
T112   STOP
T113   RTN
T114   180
T115   RCL C
T116   RCL D
T117   +
T118   -
T119   STO B
T120   RTN
T121   RCL X
T122   RCL C
T123   SIN
T124   x
T125   RCL B
T126   SIN
T127   ÷
T128   STO Y
T129   RTN
T130   RCL X
T131   RCL D
T132   SIN
T133   x
T134   RCL B
T135   SIN
T136   ÷
T137   STO Z
T138   RTN
T139   RCL Y
T140   RCL X
T141   RCL Z
T142   +
T143   +
T144   2
T145   ÷
T146   STO Q
T147   RTN
T148   RCL X
T149   -
T150   RCL Q
T151   RCL Z
T152   -
T153   x
T154   RCL X
T155   RCL Z
```

```
T156   x
T157   ÷
T158   √x
T159   ASIN
T160   2
T161   x
T162   STO C
T163   RTN
T164   180
T165   RCL B
T166   RCL C
T167   +
T168   -
T169   STO D
T170   RTN
T171   INPUT A
T172   HMS→
T173   STO C
T174   INPUT S
T175   STO X
T176   INPUT A
T177   HMS→
T178   STO D
T179   XEQ T114
T180   XEQ T121
T181   XEQ T130
T182   GTO T062
T183   INPUT S
T184   STO X
T185   INPUT A
T186   HMS→
T187   STO D
T188   INPUT A
T189   HMS→
T190   STO B
T191   180
T192   RCL D
T193   RCL B
T194   +
T195   -
T196   STO C
T197   XEQ T130
T198   XEQ T121
T199   GTO T062
T200   INPUT S
T201   STO X
T202   INPUT A
T203   HMS→
T204   STO D
T205   INPUT S
T206   STO Y
T207   x²
T208   RCL X
T209   x²
T210   +
T211   2
T212   RCL Y
T213   x
T214   RCL X
T215   x
T216   RCL D
T217   COS
T218   x
T219   -
T220   √x
T221   STO Z
T222   XEQ T139
T223   XEQ T148
T224   XEQ T114
T225   GTO T062
T226   INPUT S
T227   STO X
T228   INPUT S
T229   STO Y
T230   INPUT A
T231   HMS→
T232   STO B
T233   RCL Y
T234   RCL B
T235   SIN
T236   x
T237   RCL X
T238   ÷
T239   ASIN
T240   STO C
T241   XEQ T164
T242   XEQ T130
T243   OPTION 1                    EQN
T244   PSE
T245   XEQ T062
T246   180
T247   RCL C
T248   HMS→
T249   -
T250   STO C
T251   180
T252   RCL B
T253   HMS→
T254   STO B
T255   RCL C
T256   +
T257   -
T258   x<0?
T259   GTO T265
T260   STO D
T261   XEQ T130
```

```
T262   OPTION 2                  EQN
T263   PSE
T264   GTO T062
T265   NO OPTION 2               EQN
T266   RTN
T267   INPUT S
T268   STO X
T269   INPUT S
T270   STO Y
T271   INPUT S
T272   STO Z
T273   XEQ T139
T274   XEQ T148
T275   RCL Q
T276   RCL Y
T277   -
T278   RCL Q
T279   RCL Z
T280   -
T281   x
T282   RCL Y
T283   RCL Z
T284   x
T285   ÷
T286   √x
T287   ASIN
T288   2
T289   x
T290   STO B
T291   XEQ T164
T292   GTO T062

LBL T  CK=E7D9
       LN=1056
```

"V" VERTICAL CURVE

```
V001   LBL V
V002   CF 1
V003   SF 10
V004   VERT CURVE=V              EQN
V005   PSE
V006   BEGIN STA                 EQN
V007   PSE
V008   INPUT B
V009   STO P
V010   STO T
V011   BEGIN ELEV                EQN
V012   PSE
V013   XEQ N064
V014   FS? 1
V015   GTO V018
V016   RCL Z
V017   STO E
V018   INPUT E
V019   GRADE IN                  EQN
V020   PSE
V021   INPUT I
V022   GRADE OUT                 EQN
V023   PSE
V024   INPUT O
V025   LENGTH CURVE              EQN
V026   PSE
V027   INPUT L
V028   STO+ T
V029   PVT STA                   EQN
V030   PSE
V031   VIEW T
V032   2
V033   ÷
V034   STO M
V035   STO+ P
V036   RCL E
V037   RCL M
V038   RCL I
V039   100
V040   ÷
V041   x
V042   +
V043   STO Z
V044   PVI STA-ELEV              EQN
V045   PSE
V046   RCL P
V047   RCL Z
V048   STOP
V049   RCL O
V050   RCL I
V051   -
V052   RCL L
V053   ÷
V054   STO R
V055   RCL I
V056   x<>y
V057   ÷
V058   +/-
V059   RCL B
V060   +
V061   STO H
V062   STO S
V063   RCL L
V064   RCL O
V065   RCL I
V066   -
V067   ÷
V068   ABS
V069   STO K
V070   K=1% CHG DIST             EQN
```

```
V071   PSE
V072   VIEW K
V073   RCL I
V074   x>0?
V075   XEQ V139
V076   x<0?
V077   XEQ V142
V078   RCL B
V079   RCL S
V080   x<y?
V081   XEQ V145
V082   RCL T
V083   x<y?
V084   XEQ V145
V085   CF 10
V086   VIEW S
V087   SF 10
V088   ENTER STA                  EQN
V089   PSE
V090   INPUT S
V091   RCL B
V092   x>y?
V093   XEQ V145
V094   x>y?
V095   GTO V088
V096   RCL S
V097   RCL T
V098   x<y?
V099   XEQ V145
V100   x<y?
V101   GTO V088
V102   RCL S
V103   RCL B
V104   -
V105   100
V106   ÷
V107   STO X
V108   x²
V109   STO Y
V110   RCL R
V111   50
V112   x
V113   RCL Y
V114   x
V115   RCL I
V116   RCL X
V117   x
V118   +
V119   RCL E
V120   +
V121   STO Z
V122   RCL S
V123   x<>y
V124   STA-ELEV                   EQN
V125   PSE
V126   STOP
V127   RCL I
V128   RCL S
V129   RCL B
V130   -
V131   RCL R
V132   x
V133   +
V134   STO G
V135   GRADE ON CURVE             EQN
V136   PSE
V137   VIEW G
V138   GTO V087
V139   HIGH PNT STA               EQN
V140   PSE
V141   RTN
V142   LOW PNT STA                EQN
V143   PSE
V144   RTN
V145   OUT OF LIMITS              EQN
V146   PSE
V147   RTN

LBL V  CK=3D8F
       LN=609

Memory used = ±16,205
```