

VectorCalc

User's Manual



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VectorCalc User's Manual

1.0 Introduction

VectorCalc is a Palm-hosted program that performs several different vector calculations. It is comprised of three different forms that display different calculated values. Table 1.1-1 shows in which form each calculation appears.

Form	Calculation	Requires Input
One	Magnitude of either A or B	A and/or B
	Unit vector of either A or B	A and/or B
Two	Angle between A and B	A and B
	Distance between A and B	A and B
	Dot product of A and B	A and B
	Cross product of A and B	A and B
A±B	Sum of A and B	A and B
	Difference between A and B	A and B

Table 1.1-1 Calculations Performed in VectorCalc

A vector in three-dimensional space is represented as a directed line segment, has a magnitude and a direction, and is composed of three separate components along the axes that define the three-dimensional space (known most commonly as either x, y, and z or i, j, and k). A vector \vec{A} can be represented in several different ways, two of which are (a_1, a_2, a_3) , or $(a_1\hat{i} + a_2\hat{j} + a_3\hat{k})$.

Figure 1.1-1 shows a vector in three-dimensional space and its decomposition along the three axes.

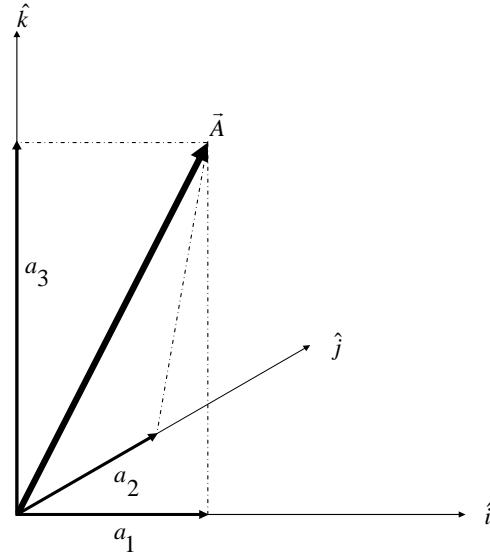


Figure 1.1-1. Vector in three-dimensional space

The magnitude of a vector, \vec{A} , is a scalar that represents the vector's length, given by

$|\vec{A}| = \sqrt{a_1^2 + a_2^2 + a_3^2}$, where the small a's are the vector components.

A unit vector is a vector with a length of one in the direction of the original vector, and it is the original vector divided by its magnitude:

$$\hat{A} = \frac{\vec{A}}{|\vec{A}|}$$

The sum of two vectors is a vector whose result is the addition of the individual components of the two vectors:

$$\vec{A} + \vec{B} = (a_1 + b_1)\hat{i} + (a_2 + b_2)\hat{j} + (a_3 + b_3)\hat{k}$$



In a similar manner the difference is:

$$\vec{A} - \vec{B} = (a_1 - b_1)\hat{i} + (a_2 - b_2)\hat{j} + (a_3 - b_3)\hat{k}$$

The distance between two vectors is the (scalar) magnitude of the difference between two vectors, and is given by:

$$\sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2}$$

The dot product (or inner product) of two vectors is a scalar whose magnitude is the sum of the products of the vector components:

$$\vec{A} \bullet \vec{B} = a_1 b_1 + a_2 b_2 + a_3 b_3.$$

The cosine of the angle (and therefore the angle) between two vectors can be derived from the dot product and the magnitudes of the two vectors, and is given by:

$$\cos \theta = \frac{\vec{A} \bullet \vec{B}}{|\vec{A}| |\vec{B}|}.$$

The cross product (or vector product) of two vectors is the vector

$$\vec{A} \times \vec{B} = (a_1, a_2, a_3) \times (b_1, b_2, b_3) = (a_2 b_3 - a_3 b_2, a_3 b_1 - a_1 b_3, a_1 b_2 - a_2 b_1)$$

which can be written as

$$\vec{A} \times \vec{B} = \begin{vmatrix} a_2 & a_3 \\ b_2 & b_3 \end{vmatrix} \hat{i} + \begin{vmatrix} a_3 & a_1 \\ b_3 & b_1 \end{vmatrix} \hat{j} + \begin{vmatrix} a_1 & a_2 \\ b_1 & b_2 \end{vmatrix} \hat{k}$$

or more compactly written as

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}.$$

The resulting vector from a cross product is always perpendicular to the original two vectors and its direction can be determined from the right-hand rule.

Vectors form the basis for much of our science and mathematics. For more detailed information on the definition and use of vectors, the reader should consult any good textbook on mathematics, physics, or one of the other sciences that uses them.

2.0 Installation and Removal

2.1 System Requirements

VectorCalc is designed to run on any Palm handheld that runs version 3.0 or greater of the Palm operating system. If an operating system is in use that is lower than version 3.0, then an Alert dialog will appear, and the application will exit.

VectorCalc requires that MathLib be installed, which is a free PalmOS shared library that provides a full set of IEEE-754 double-precision math library functions for Palm applications to use. If MathLib is not installed, an alert screen will appear, as shown in Figure 2.1-1, and VectorCalc will exit when the OK button is pressed. There is, however, a good chance that MathLib is already installed on your system; if so, there is no need to install it again.

The MathLib.prc file is included with this distribution of VectorCalc, so it may be installed along with VectorCalc if needed. It can be used with any OS 2.0+ Palm program. It is distributed under the terms of the GNU Library General Public License, and it is freely available with full source code and documentation at the [MathLib Information](#) web page. It is not a part of the VectorCalc program, and you are not paying anything for its use; a copy is simply included in this archive for your convenience.

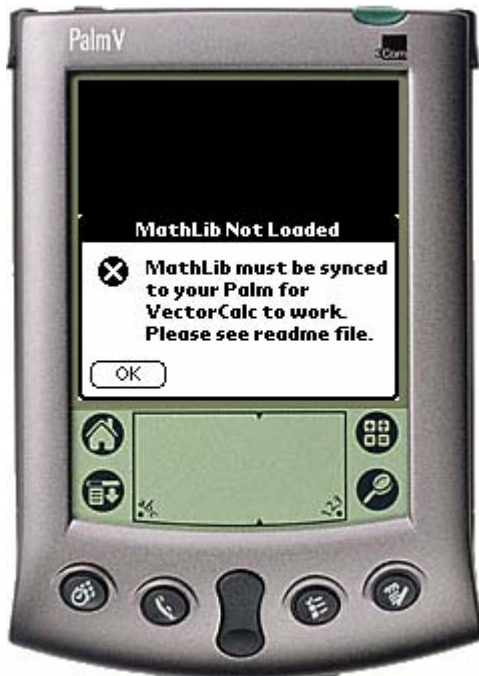


Figure 2.1-1. Alert Screen if MathLib Not Installed

2.2 New Installation

If MathLib is already installed on your system, the only file that needs to be synced to your Palm is the VectorCalc.prc file, and it installs the same way as all other Palm applications. If MathLib is not already installed, it must be installed along with VectorCalc. Both MathLib and VectorCalc may be installed by just double clicking the appropriate .prc file (either VectorCalc.prc or MathLib.prc) or using any of the install tools that are available for the Palm. Once this is done, a hotsync should be performed to transfer one or both to the Palm.

2.3 Program Removal

To remove VectorCalc from your handheld, simply go to the Application launcher (tap your handheld's Applications button) on the Palm, select the "Delete..." menu choice from the "App" menu, and then select VectorCalc. Then confirm your choice when the "Delete the VectorCalc application and all data?" alert appears.

3.0 VectorCalc Use

3.1 Data Input

Each screen in VectorCalc is divided into two main areas—the data input area at the

top of each screen and the calculated data output area at the bottom of each screen (Figure 3.1-1). Data is entered into the X, Y, and Z components of Vector A and/or B at the top, and once the "Calculate" button is pressed, the remaining fields are filled in on the current screen. The same data input fields appear in all three screens. There are up to four actions that may be taken with each input value (i.e., the X field for Vector A):

- (1) Changing the sign of the mantissa
- (2) Entering the value of the mantissa
- (3) Changing the sign of the exponent
- (4) Entering the value of the exponent

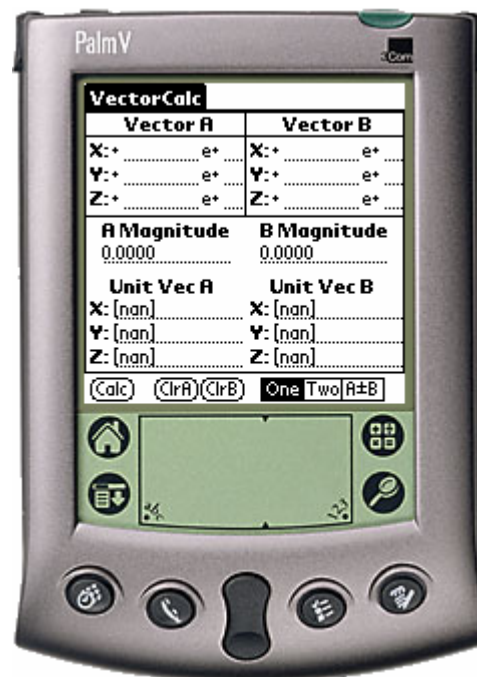


Figure 3.1-1. Initial Launch of VectorCalc

The sign for the mantissa or exponent may be changed by clicking on it, and this will toggle the value from plus (+) to minus (-) or vice-versa. Placing the cursor in either the mantissa field or the exponent field will automatically place the Palm into numeric entry mode and is particularly useful for those using keyboards. On some Palm models, the graffiti shift indicator in the lower right corner of the screen will denote this numeric shift. The fields for the mantissa and exponent will only accept numeric values (0-9 and a decimal point). Values may be entered by either Graffiti strokes,

keyboard input for Palms equipped with a keyboard, or the software keyboard which can be invoked from the edit menu (or with the shortcut /K). The software keyboard and Graffiti help can only be accessed when the cursor is within one of the numeric entry fields.

3.2 Program Control

VectorCalc is composed of three main screens that are selected by the buttons labeled "One", "Two" and "A±B" at the bottom of each screen.

The "One" button shows calculations requiring only a single vector, i.e., the magnitude and unit vector (Figure 3.2-1). If only one vector is entered, only the magnitude and unit vector will be calculated for that vector. The label "[nan]" (not a number) will show up if a vector is not entered for either "A" or "B".

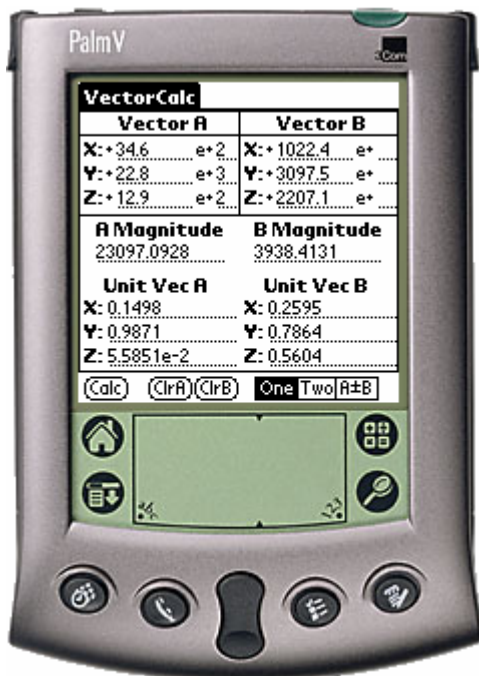


Figure 3.2-1. The "One" Vector Screen

The "Two" button shows calculations that require both vectors be input for valid answers to appear. The angle between the two vectors (in either degrees or radians, depending on the selection in the "Preferences" menu), the distance between "A" and "B", the dot product of "A" and "B" and the cross product of "A" and "B" are calculated here (Figure 3.2-2).

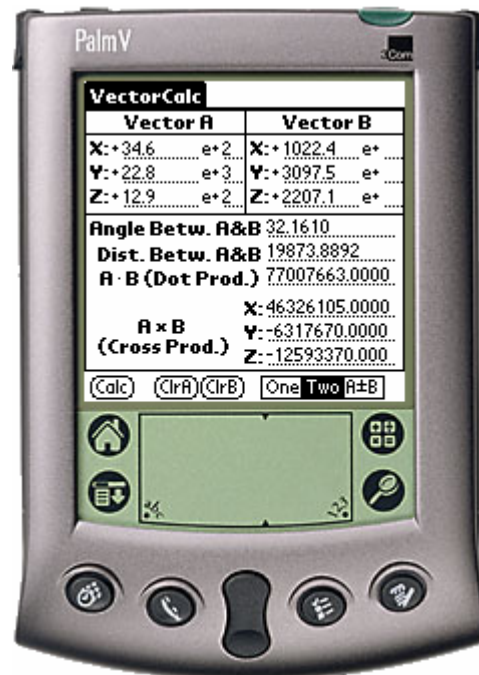


Figure 3.2-2. The "Two" Vector Screen

The "A±B" button shows calculations that generally require both vectors be input. However, if only the "A" vector is input then A+B and A-B will just be A, and if only the "B" vector is input, then A+B will just be B and A-B will be -B (Figure 3.2-3).

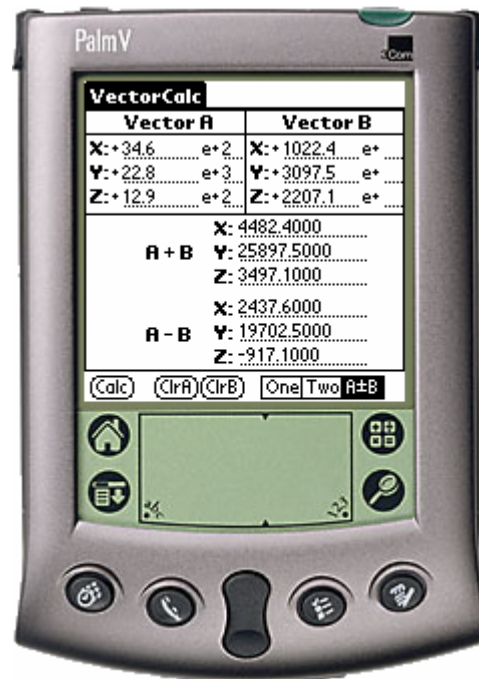


Figure 3.2-3. The "A±B" Vector Screen



The "ClrA" and "ClrB" buttons at the bottom of each screen simply clear out the input values for "A" and "B" respectively, clear any data values associated with "A" or "B", and change all mantissa and exponent signs back to "+".

Rounding is not performed when results are displayed. Therefore, if the accuracy of the last displayed digit is important, then more numbers after the decimal should be used (set with the "Fix # of Digits" on the "Preferences" screen).

3.3 Program Preferences

The preferences dialog allows the user to change the way VectorCalc looks and the way it calculates data (Figure 3.3-1).

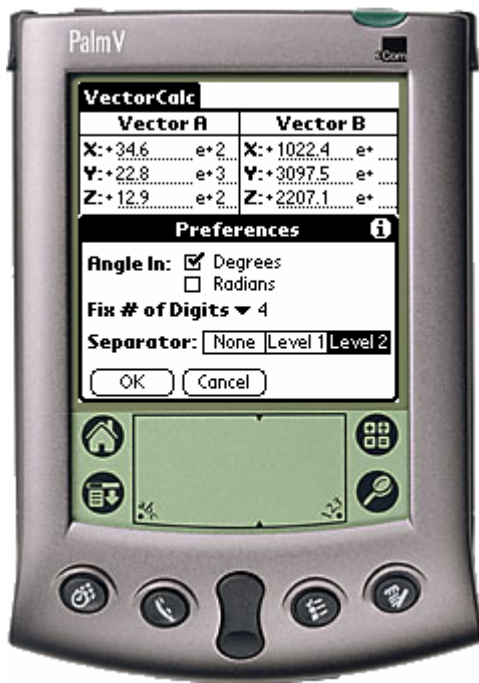


Figure 3.3-1. Preferences Screen

The "Radians/Degrees" checkbox determines in which units the "Angle Between A&B" field will be. This value will be updated immediately upon returning to that screen. The default value is "Degrees".

The "Fix # of Digits" popup will fix the number of digits displayed after the decimal for each calculated field. For example, if "4" is chosen, then four places to the right of the decimal will display. This formatting will only take effect after the "Calculate" button is

again pressed. One to nine digits may be specified and the default value is "4".

The "Separator" choice specifies how the screen is divided up with separators. The screen shots below (Figures 3.3-2 through 3.3-4) show the three alternatives for the separators. The default value is "Level 2".

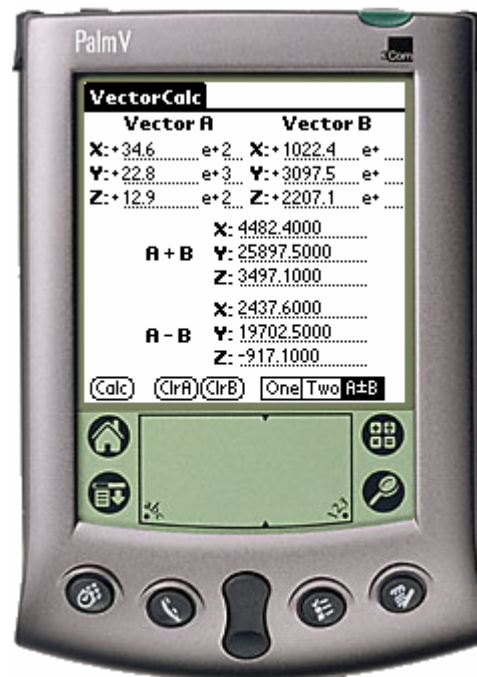


Figure 3.3-2. "None" Separators Option

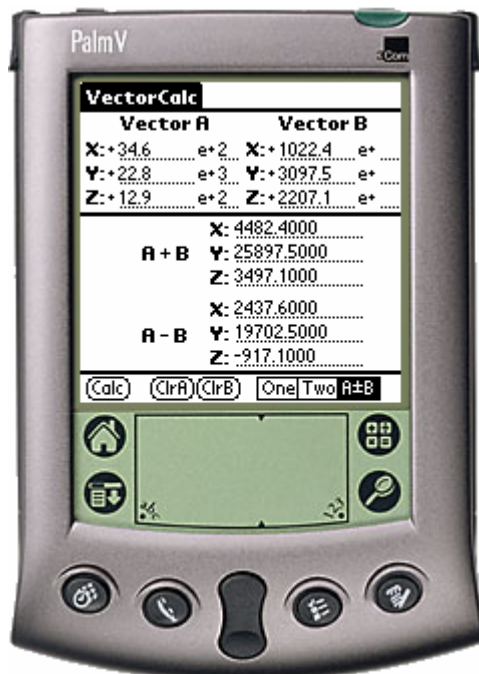


Figure 3.3-3. "Level 1" Separators

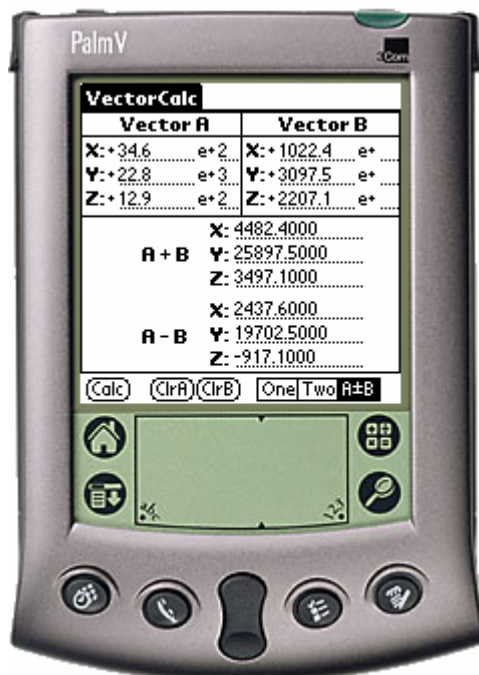


Figure 3.3-4. "Level 2" Separators

3.4 Program Help

At any time, the "About VectorCalc" menu item can be selected from the "Options" menu and the "Help..." button chosen to display online program help. Alternatively, the "i" button in the upper right hand corner may be chosen to display the same help

screen. Figure 3.4-1 shows the "About VectorCalc" screen.

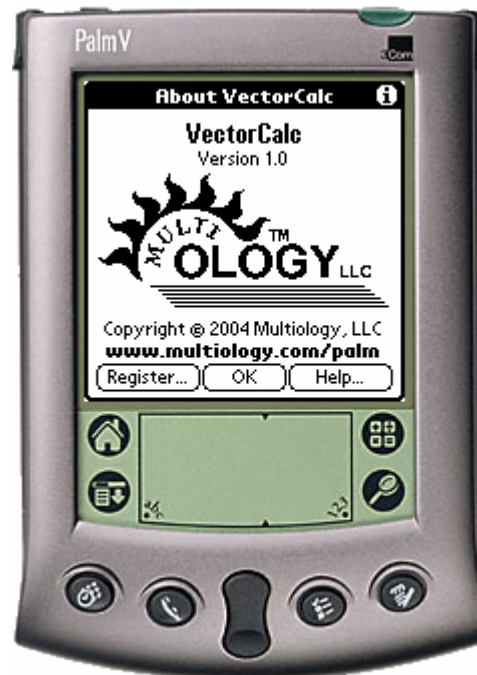


Figure 3.4-1. About VectorCalc Screen

3.5 VectorCalc Registration

Once VectorCalc is installed the user will have 15 days in which to evaluate the software. Each time the software is invoked during this 15-day period, a reminder will appear to let the user know how many days remain for evaluation (Figure 3.5-1). After this 15-day period is up, the software will become disabled. The words "Expired" will be displayed in all the input fields, and the "Calculate" button will insert zero values into all the calculated fields (Figure 3.5-2).

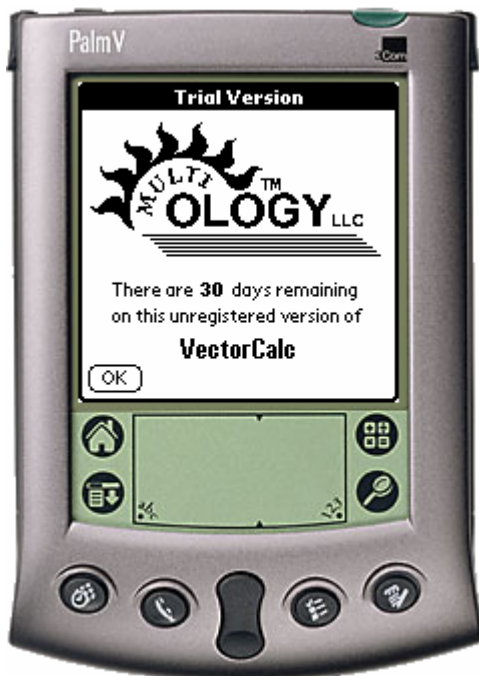


Figure 3.5-1. Days to Expiration

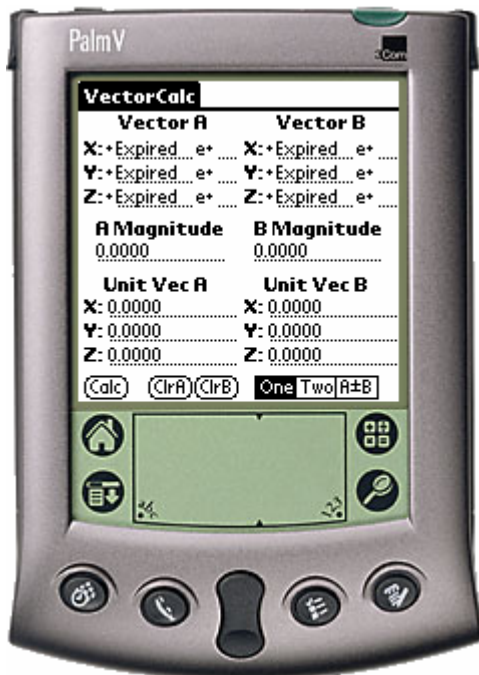


Figure 3.5-2. Expired Application

To register VectorCalc, visit either www.handango.com or www.palmgear.com and purchase a license (search for VectorCalc). The purchaser will have to supply the exact HotSync ID of their device, which is displayed on the registration screen

for VectorCalc. An unlock code will be generated and sent to the purchaser by email. This code must then be entered in the input field at the bottom of the VectorCalc registration screen (Figure 3.5-4). To get to this field, choose the "Register..." option from the "Options" menu.

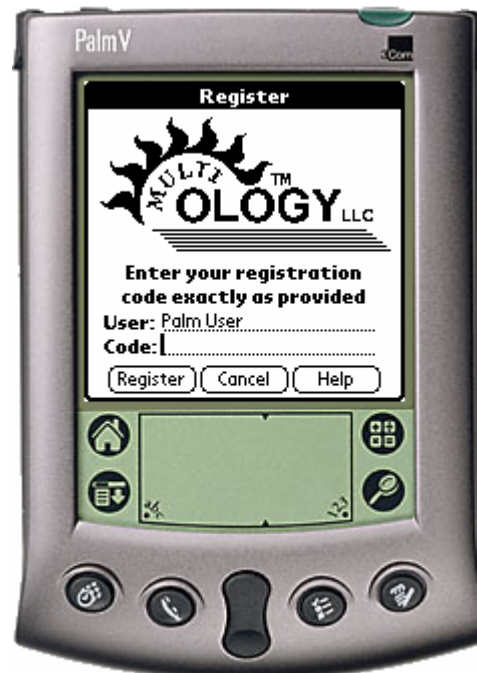


Figure 3.5-4. VectorCalc Registration Screen

The registration screen may be displayed by selecting either the "Register..." menu item from the "Options" menu or selecting the "About VectorCalc" menu item from the "Options" menu and then selecting the "Register..." button. If the software has previously been registered, a dialog will appear stating that the software has already been registered.

4.0 Release History

VectorCalc 1.0 (February 1, 2004)

- Initial version.



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