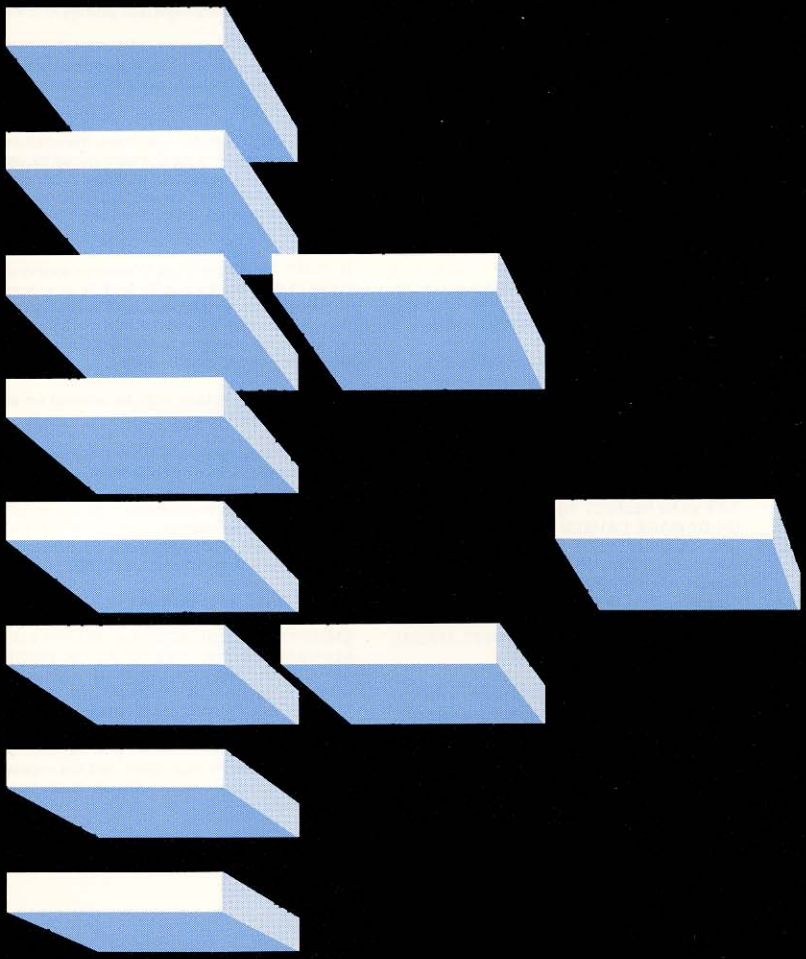
TK!Solver® Introductory Guide



Your Quick Introduction to the TK!Solver Program for the TRS-80® Model 4

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TK!Solver®
Introductory Guide

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Introduction

This Introductory Guide will help you to begin using the TK!Solver® program immediately. It provides a quick overview of the program and introduces you to some of the program's commands and features.

The Guide does not provide explanations or descriptions of the commands and features of the program or of what you will see on the screen. For a detailed explanation of the program, see the TK!Solver Instruction Manual and Reference Manual.

To produce the results illustrated in the figures, you should follow the directions in this Guide. The program does not distinguish between uppercase and lowercase characters for program commands and filenames.

What you type is printed in blue in the text.

The TK!Solver Program

The TK!Solver program makes it easy to solve mathematical problems. You simply enter one or more equations and then tell the program to solve them. All the tools needed for problem solving are built into the program, including mathematical functions, facilities for converting units of measurement, and the ability to produce graphs and tables.

The TK!Solver program can solve a broad range of problems using **models**, sets of equations with variables of known and unknown values. Given a model and the values of the variables, the TK!Solver program solves for as many unknown values as is possible. The program's problem-solving ability is powerful and versatile enough to apply to many fields, from financial planning to architectural design to chemical analysis.

Required Equipment

To use the TK!Solver program, you need:

Hardware

- The Radio Shack® TRS-80® Model 4 computer with at least 128K bytes of memory and one or more disk drives. A hard

disk is optional. Hard disks must be formatted with TRS-DOS®. Refer to the *TRS-80 Model 4 Hard Disk Start-Up Manual* for more information.
- Blank, formatted storage diskettes. See the *TRS-80 Model 4 Disk System Owner's Manual* or Chapter 2 of the TK!Solver Instruction Manual for information on formatting diskettes.
- A Radio Shack parallel printer (optional).

Software
- The TK!Solver program diskette. The program diskette contains all the TRSDOS files needed to boot the system.

Getting Started

Before you begin, you must make a backup copy of your TK!Solver diskette. Formatting and backup instructions are found in Chapter 2 of the Instruction Manual. Keep the original TK!Solver diskette in a safe place as a master.

To use this Guide, you need the backup copy of your TK!Solver program diskette and your Radio Shack TRS-80 Model 4. Even if you have stored TRSDOS on a hard disk, please load TRSDOS using the TK!Solver program diskette, as directed below.

Turn on your computer. The ON/OFF switch is in the front on the right, under the keyboard. Insert the TK!Solver program diskette into the disk drive so that the oval cutout enters first and the label enters last, as illustrated in Figure 1. If you have a two-drive system, insert the diskette into the lower drive (drive 0).

Figure 1

Close the latch as illustrated in Figure 2.

Figure 2

After you have inserted the program diskette, press the recessed button on the right of the keyboard, called the RESET button.

When the disk drive light has gone out, respond to any prompts displayed by TRSDOS. If you make a mistake while typing, use the left arrow key to erase your error.

Computers distinguish between numerals and letters, so be sure to use the numeral 1 to represent the number 1.

When you see the TRSDOS system prompt **TRSDOS Ready**, you are ready to load the TK!Solver program. To enter information or complete a command in the TK!Solver program, use the Enter key. In the text, this key is represented by the symbol ♦. When you see ♦, press this key.

To load the TK!Solver program, type:

```
TK♦
```

When your screen looks like Figure 3, the TK!Solver program has begun loading.

On the screen is the TK!Solver copyright notice and version number. The version number may be different on your program.

There is a message at the bottom of the screen:

```
Press ENTER to Start
```

Press ♦.

At the top of the screen is the message:

```
Loading the TK!Solver program
Copyright (c) 1984 Software Arts, Inc.
```

```
                Version 01.00.00
            of the TK!Solver (R) Program


              This program is a product of

                    SOFTWARE ARTS, INC.

          Copyright (c) 1984 Software Arts, Inc.

                    All Rights Reserved.
      Licensed for Distribution to Tandy Corporation

            Except as specifically authorized,
           copying of any part of this program
                      is prohibited.


              ***** Press ENTER to Start *****
```

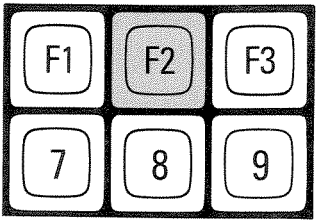
Figure 3

```
(1r) Rule:
For Help, type ?
==================== VARIABLE SHEET ================
St Input      Name    Output    Unit      Comment
-- -----      ----    ------    ----      -------









==================== RULE SHEET ====================
S Rule
- ----
```

Figure 4

When the program has finished loading, the screen should look like Figure 4. The TK!Solver program is now ready to be used. Leave the TK!Solver diskette in the drive while you are using this Guide.

Correcting Mistakes



If you make a typing mistake while you are in the TK!Solver program, erase it using the key marked **F2**. This key is located at the top of the numeric keypad on the right side of the keyboard. In this text, the F2 key is referred to as the Backspace key and is represented by the symbol ◄. When you see ◄, press this key.

The Backspace key erases one character at a time. For example, type:

```
abcde
```

Do not press ♦. Now press ◄. The character **e** is erased from the line.

To break out of or cancel an entry or command in the TK!Solver program, press the Break key. The Break key is on the upper right side of the keyboard and is marked **BREAK**. It is represented in this text by the symbol ⊗. When you see ⊗, press this key.

The **abcd** should still be on your screen. Cancel this entry by pressing ⊗. The characters are gone and the screen looks the same as it was before, but without the Help prompt.

Quitting the Program

Quitting the TK!Solver program clears the TK!Solver display from the screen.

Quit by typing:

```
/QY
```

To return to the program, type:

```
TK ↵
```

Again, you should see the TK!Solver copyright screen (Figure 3). Press ↵ to continue loading the program.

Working with the TK!Solver Program

Many features of the TK!Solver program are named with familiar words. For example, in the TK!Solver program you enter information on a variety of forms displayed on the screen, just as you would write down information on sheets of paper. These forms are called **sheets**. The equations, variables, values, comments, and other information contained on the TK!Solver sheets constitute what is referred to as a **model** in the text.

The TK!Solver program can display either one or two sheets at a time. The sections of the screen showing the sheets are called **windows**, because you look through them to see the sheets.

Your screen now shows two sheets in two windows: the Variable Sheet is in the top window; the Rule Sheet is in the bottom window.

Moving Around

Each of the spaces on a TK!Solver sheet that can hold information is called a **field**. Before you can use the program, you need to know how to move the cursor around the sheet from field to field and between the windows. The TK!Solver cursor is the rectangular highlight that marks your position on the screen. Your cursor should be at the top of the Rule Sheet in the first field of the column labeled **Rule**.

The semicolon (;) switches the cursor between windows. Within a window, the cursor is moved with the Arrow keys.

The Arrow keys are located on either side of the top row of alphabetic keys. Each Arrow key moves the cursor in the direction indicated by the arrow on it. In this text, the symbols ⬆, ⬇, ⬅, and ➡ designate the Arrow keys. When you see one of these symbols, press the appropriate Arrow key.

Try moving the cursor around the sheets from field to field with the Arrow keys and between the windows with the semicolon. The two sheets displayed, the Variable and Rule Sheets, move up and down but not right and left. Notice the beep when the cursor hits the edge of a sheet.

When you feel comfortable moving the cursor around the sheets and between the windows, move the cursor back to the top of each sheet using the colon (:) as a shortcut.

Start with the cursor in the Variable Sheet and type:

```
:1I♦
```

Move the cursor to the top of the Rule Sheet by typing:

```
;
:1R♦
```

The screen should again look like Figure 2, but without the Help prompt.

Entering and Solving a One-Equation Model

You can type information directly onto any of the TK!Solver sheets and enter it with ♦. The following directions show you how to enter and solve the model made up of the equation $a+b=c*d$.

The TK!Solver program uses the asterisk (*) as a multiplication symbol. To type the multiplication sign (*), the addition sign (+), and the equals sign (=), you must hold down a Shift key. There are two Shift keys on your keyboard; they are located on either side of the bottom row of alphabetic keys and are marked **SHIFT**.

While you are typing, notice the cue marking your current character position within the field. If you make a mistake while typing, use ◄.

Type:

```
a+b=c*d♦
```

The screen should look like Figure 5. The variable names *a, b, c,* and *d* appear automatically in the column labeled **Name** on the Variable Sheet.

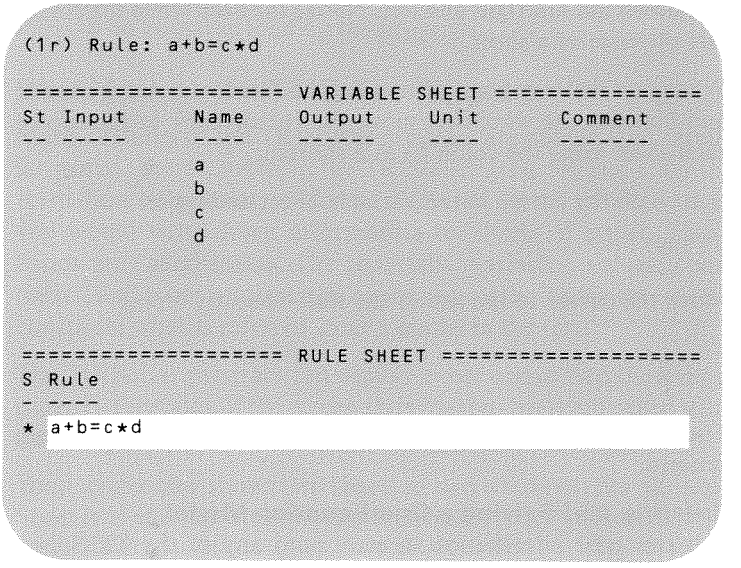


Figure 5

The asterisk (*) to the left of the equation indicates that the equation has not been satisfied. Using ⇦, move the cursor over the asterisk and look at the message at the top of the screen:

```
* Unsatisfied
```

Now give values to some of the variables. First, move the cursor into the Variable Sheet by typing:

```
;
```

The cursor should be at the top of the column labeled **Input** and beside the variable name *a*. Type:

```
50⇩
20⇩
10◆
```

The screen should look like Figure 6.

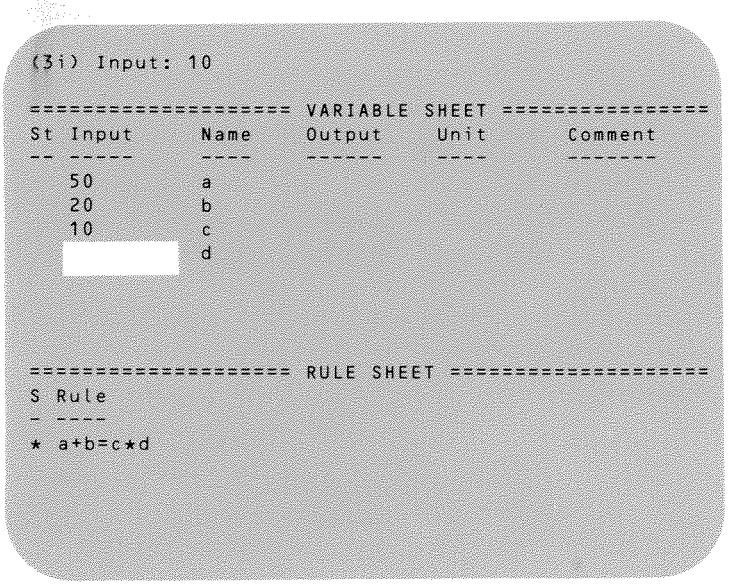


Figure 6

Solve the model by holding down the Shift key and typing:

!

When the TK!Solver program has finished solving, the answer **7** is displayed next to the variable *d* in the column labeled **Output**. The screen should look like Figure 7. Notice that the asterisk beside the equation has disappeared now that the equation is satisfied and the model is solved.

Using the TK!Solver program, you have entered and solved a model.

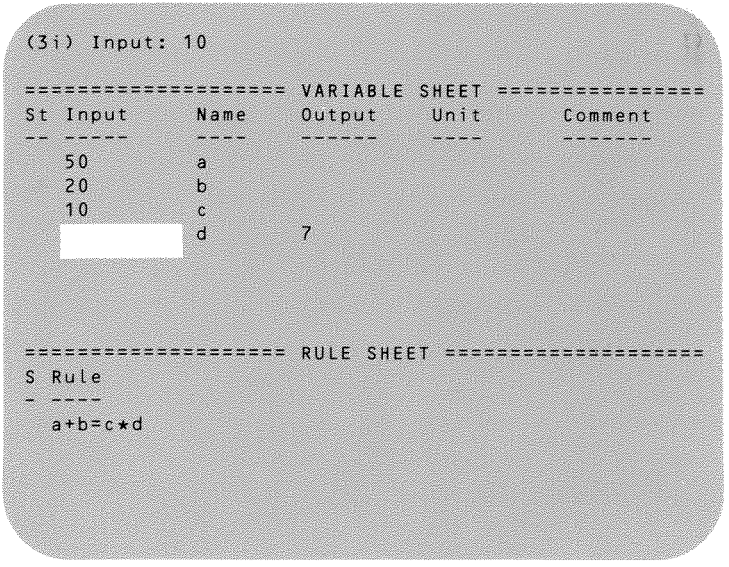


Figure 7

Making Changes

Try changing the input value for *b* to 100. Move the cursor to the Input field next to the variable *b* and type:

```
100◆
```

To solve for the new value of *d*, type:

```
!
```

The new value of *d* is **15**.

Suppose you want to solve for *a* instead of *d*. Move the cursor to the Input field for *a*. Blank out the value by typing:

```
/B◆
```

Move the cursor to the Input field for *d* and set a new value by typing:

```
20◆
```

The screen should look like Figure 8.

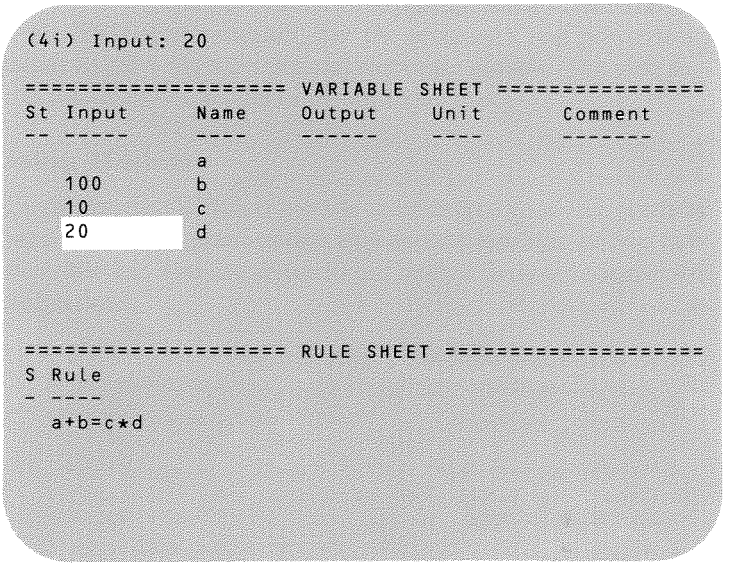


Figure 8

To solve for *a*, type:

```
!
```

The output value for *a* is **100**.

Now try changing the equation to $a*b=c+d$. Move the cursor into the Rule Sheet by typing:

```
;
```

Move it into the column labeled **Rule** with ➡.

Instead of retyping the whole equation, you can edit it. Type:

```
/E
```

The cue appears in the field containing the cursor. The Arrow keys move the cue within the field. ⬅ and ➡ move the cue left and right; ⬆ moves the cue to the beginning of the field and ⬇ moves

it to the end of the information in the field. ◀ deletes the character to the left of the cue. Type:

➡
➡
◀
*
⬇
⬅
◀
+
◆

The screen should look like Figure 9.

```
(1r) Rule: a*b=c+d

==================== VARIABLE SHEET ================
St Input      Name     Output     Unit       Comment
-- -----      ----     ------     ----       -------
              a        100
   100        b
   10         c
   20         d



==================== RULE SHEET ====================
S Rule
- ----
* a*b=c+d
```

Figure 9

Solve the new model by typing:

!

The output value for *a* is **.3**.

These instructions have taken you through some of the features of the TK!Solver program, but the program's real power is its ability to solve both simple and elaborate models. The next section uses a simple model to demonstrate this.

Using Models

You can create TK!Solver models according to your own needs by entering sets of equations that express relationships among variables. You can also use prepackaged models designed for specific applications.

A simple model, named GRAVITY, has been provided on the TK!Solver program diskette for this demonstration. To look at it, first reset the program by typing:

```
/RAY
```

The values and comments in the two sheets have now been erased. Load the new model by typing:

```
/SL
```

The prompt asks for a **filename**. A filename is a name that identifies a specific collection of information on a diskette. The model you are about to use is on the TK!Solver program diskette and is identified by the filename GRAVITY.

If you make a mistake while typing the filename, use ◄ to erase your error. Enter the filename for the model by typing:

```
GRAVITY♦
```

While the TK!Solver program finds the file containing GRAVITY and loads it, the red light on the drive may go on and off more than once. When the model has been loaded, the screen should look like Figure 10.

Note: In this Guide, a caret (^) is used to show exponentiation. To type ^, hold down the Clear key and type a semicolon (;). The Clear key is on the right side of the keyboard and is marked **CLEAR**.

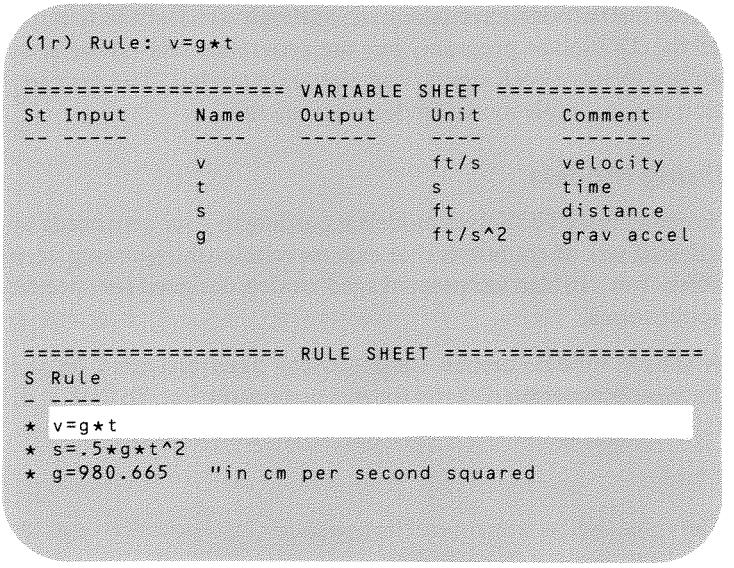


Figure 10

On the screen are the variables and equations for a simple model that determines the final velocity of an object dropped from a resting point in a vacuum.

As you can see, the variable names, units, and equations have already been entered. The third equation contains a comment, which begins with a quotation mark. The TK!Solver program ignores comments when it solves a model.

Because *g* has been set as a constant, all you have to do to solve the model is enter one value.

For example, if the distance of the fall is 300 feet, what are the final velocity and time for the fall?

Move the cursor into the Variable Sheet by typing:

```
;
```

Move the cursor down to the Input field for *s* (distance) and type:

```
300 ♦
```

The screen should look like Figure 11.

```
(3i) Input: 300

==================== VARIABLE SHEET ================
St Input      Name     Output     Unit       Comment
-- -----      ----     ------     ----       -------
              v                   ft/s       velocity
              t                   s          time
   300        s                   ft         distance
              g                   ft/s^2     grav accel



==================== RULE SHEET ====================
S Rule
- ----
* v=g*t
* s=.5*g*t^2
* g=980.665    "in cm per second squared
```

Figure 11

To solve the model, type:

```
!
```

The screen should look like Figure 12.

The velocity is given in feet per second, expressed as ft/s. Suppose you are interested in finding what the velocity would be in centimeters per second, expressed as cm/s.

Move the cursor to the Units field for *v*. Type:

```
cm/s ◆
```

The value in the Output field is converted to centimeters per second. The screen should look like Figure 13.

Now change the unit for velocity to inches per second, expressed as in/s. Type:

```
in/s ◆
```

```
(3i) Input: 300

==================== VARIABLE SHEET ================
St Input      Name    Output     Unit       Comment
-- -----      ----    ------     ----       -------
              v       138.94024  ft/s       velocity
              t       4.3184033  s          time
   300        s                  ft         distance
              g       32.173985  ft/s^2     grav accel



==================== RULE SHEET ====================
S Rule
- ----
  v=g*t
  s=.5*g*t^2
  g=980.665    "in cm per second squared
```

Figure 12

```
(1u) Unit: cm/s

==================== VARIABLE SHEET ================
St Input      Name    Output     Unit       Comment
-- -----      ----    ------     ----       -------
              v       4234.9069  cm/s       velocity
              t       4.3184033  s          time
   300        s                  ft         distance
              g       32.173985  ft/s^2     grav accel



==================== RULE SHEET ====================
S Rule
- ----
  v=g*t
  s=.5*g*t^2
  g=980.665    "in cm per second squared
```

Figure 13

The output value again changes, this time to **1667.2829**.

Using the Unit Sheet, you can convert between different units of measurement. A unit conversion must be defined on that sheet before it can be used by the TK!Solver program. The GRAVITY model includes some unit conversions. To look at the Unit Sheet for GRAVITY, type:

```
=U
```

Suppose you want to see the velocity in meters per second, expressed as m/s. Since that unit does not appear on the Unit Sheet, you must define the conversion.

Using ↓, move the cursor to the bottom of the column labeled **From**. Type:

```
m/s➡
cm/s➡
100◆
```

The screen should look like Figure 14.

Now return to the Variable Sheet by typing:

```
=V
```

Change the unit for velocity to m/s by typing:

```
m/s◆
```

Because you added m/s to the Unit Sheet, the TK!Solver program was able to make the conversion. The value of *v* is **42.349069**.

This is the end of the quick introduction to the TK!Solver program. To quit the program, type:

```
/QY
```

If you are ready to stop, remove the TK!Solver diskette and put it away. Then turn off your computer.

```
(8m) Multiply By: 100

==================== UNIT SHEET ====================
From       To         Multiply By  Add Offset
----       --         -----------  ----------
ft         cm         30.48006
in         cm         2.540005
m          cm         100
km         cm         100000
ft/s^2     cm/s^2     30.48006
ft/s       cm/s       30.48006
in/s       cm/s       2.540005
m/s        cm/s       100
==================== RULE SHEET ====================
S Rule
- ----
  v=g*t
  s=.5*g*t^2
  g=980.665    "in cm per second squared
```

Figure 14

More Information About the TK!Solver Program

This Introductory Guide has demonstrated only a few of the features of the TK!Solver program. As you become more familiar with the program, you will learn more about these and other features for building models to solve problems and for tailoring models to meet your specific needs.

The TK!Solver program includes a Help Facility that is a quick reference to features and commands. The Help Facility is **only** a reference; it is not intended to replace the Instruction and Reference Manuals. Both the Instruction and Reference Manuals include a description of the Help Facility.

The TK!Solver package provides several tools to teach you how to use the program:

- The **Instruction Manual** provides step-by-step instructions on how to use each feature of the program by guiding you through a variety of models and helping you learn to build models.

- The **TK!Solver Program Diskette** contains the models used as examples in the Instruction Manual.
- The **Reference Manual** presents a complete and detailed description of each feature of the program with cross-references, a glossary, and an index.
- The **Reference Card** is a quick reference to the features of the TK!Solver program.
- The **Reference Poster** graphically displays the TK!Solver commands and sheets and lists the built-in functions.

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