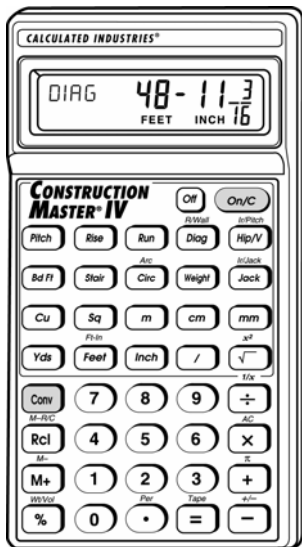


# CONSTRUCTION MASTER® IV

*For Today's Construction Professional*



## User's Guide



# **CALCULATED INDUSTRIES®**

*Putting answers at your fingertips since 1978*

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# THE CONSTRUCTION MASTER® IV

Designed for today's construction professional, the *Construction Master® IV* is so simple, even the novice user will find it easy to solve hundreds of dimension-related problems right in feet, inches and fractions!

- ◆ Solve Dimensional Math
- ◆ English/Metric Conversions
- ◆ Calculate Areas/Volumes
- ◆ Solve Right-Triangle Problems
- ◆ Find Regular and Irregular Hip, Valley and Jack Rafters
- ◆ Calculate Stair Risers, Treads and Stringers
- ◆ Solve Raked Wall Stud Lengths
- ◆ Volume/Weight Conversions
- ◆ Estimate Board Feet
- ◆ Find Circular Areas, Circumferences and Arcs
- ◆ Material Estimations
- ◆ Paperless Tape Function
- ◆ **And much, much more!**

# GETTING STARTED

## Key Definitions/Functions

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### Basic Function Keys

---

**[+] [-] [x] [÷] [=]**

Arithmetic operation keys.

**[%]**

Four-function percent key.

**[0] – [9] and [ • ]**

Digits used for keying-in numbers.

**[Off] — Off Key**

Turns all power off, clearing all non-permanent registers.

**[On/C] — On/Clear Key**

Turns on power. Pressing once clears the display. Pressing twice clears all temporary values.

**[Conv] — Convert Key**

Used with the dimensional keys to convert between dimensions or with other keys to access special functions.

**[ $\sqrt{\quad}$ ] — Square Root Key**

Used to find the square root of a non-dimensional or area value.

### **[Conv] [ $\sqrt{\quad}$ ] — $x^2$ Function**

Finds the square of a linear or non-dimensional value.

### **[M+] — Memory Key**

Adds the displayed value to Memory. Clears when the calculator is shut off.

### **[Conv] [M+] — Memory Minus (M–)**

Subtracts the displayed value from Memory.

### **[Conv] [Rcl] — Memory Clear**

Clears Memory without changing current display.

### **[Rcl] — Recall Key**

Used with other keys to *recall* stored values and settings.

### **[Rcl] [x] — Imperial/Metric Mode**

Changes the defaults of the calculator by setting to Imperial (English) or Metric mode. **Note:** *This setting is not affected by the ALL CLEAR function.*

## Dimension Keys

---

### **[Weight] — Weight Key**

Enters or converts (a volume value) to *tons*, *pounds*, *metric tons* or *kilograms*. Repeated presses will cycle through these units.

### **[Conv] [%] — Weight/Volume**

Enters or converts the *Weight per Volume* setting as *Tons/Yard<sup>3</sup>*, *Lbs/Yd<sup>3</sup>*, *Lb/Ft<sup>3</sup>*, *Metric Ton/m<sup>3</sup>* or *kg/m<sup>3</sup>*. Repeated presses will cycle through these settings.

### **[Cu] — Cubic Key**

Defines a volume (e.g., **5 [Cu] [Yds]**).

### **[Sq] — Square Key**

Defines an area (e.g., **5 [Sq][Feet]**).

### **[Yds] — Yards Key**

Enters or converts to *yards*.

### **[Feet] — Feet Key**

Enters or converts to *feet* as whole or decimal numbers. Also used with the **[Inch]** and **[/]** keys for entering Feet-Inch values (e.g., **6 [Feet] 9 [Inch] 1 [/] 2**). Repeated presses toggle between Feet-Inch and Decimal Feet.

**[Inch] — Inch Key**

Enters or converts to *inches*. Entry can be whole or decimal numbers. Also used with the **[/]** key for entering fractional inch values (e.g., **9 [Inch] 1 [/] 2**). Repeated presses during conversions toggle between Fractional and Decimal Inches.

**[ / ] — Fraction Bar Key**

Used to enter fractions. Fractions can be entered as proper ( $1/2$ ,  $1/8$ ,  $1/16$ ) or improper ( $3/2$ ,  $9/8$ ). If the denominator (bottom) is not entered, the calculator's fractional accuracy setting is automatically used.

**[m] — Meter Key**

Enters or converts to *meters*.

**[cm] — Centimeter Key**

Enters or converts to *centimeters*.

**[mm] — Millimeter Key**

Enters or converts to *millimeters*.

**[Bd Ft] — Feet Key**

Enters or converts cubic values to *board feet*. One board foot is equal to 144 cubic inches (1 foot x 1 foot x 1 inch).

## **Right Triangle/Rafter Keys**

---

### **[Pitch]**

This key is used to enter or calculate the pitch (slope) of a roof (or right triangle). Pitch is the amount of "Rise" over 12 inches (1 meter, if metric) of "Run." Pitch may be entered as:

- a dimension      9 **[Inch] [Pitch]**
- an angle            30 **[Pitch]**
- a ratio             0.75 **[Conv] [Pitch]**
- a percentage      75 **[%] [Pitch]**

A pitch entry will remain in permanent storage until revised or reset. A solution will be replaced by its entered value once the calculator is cleared.

### **[Rise] — Rise Key**

Enters or calculates the rise or vertical leg (height) of a right triangle.

### **[Run] — Run Key**

Enters or calculates the run or horizontal leg (base) of a right triangle.

### **[Diag] — Diagonal Key**

Enters or calculates the common or diagonal leg (hypotenuse) of a right triangle. Typical applications are "squaring" slabs or finding common rafter lengths.



## **[Conv] [Diag] — Rake Walls**

This function finds the decreasing stud sizes in a raked wall based on computed or entered values for pitch, rise and/or run. Repeated presses display stud sizes from longest to shortest.

The on-center spacing of a raked wall can be permanently stored by entering a dimension prior to solving for stud sizes (**12 [Inch] [Conv] [Diag]**). Default on-center spacing is 16 inches (Metric Mode: 600 mm).

## **[Hip/V] — Hip/Valley Rafter Key**

Finds the regular or irregular hip/valley rafter length. If an irregular pitch is entered, the irregular hip/valley rafter length is displayed, otherwise the regular (45°) hip/valley rafter length is displayed.

## **[Conv] [Hip/V] — Irregular Pitch**

Enters and displays the irregular pitch value used to calculate lengths of the irregular hip/valley and jack rafters.

### **[Jack] — Jack Rafter Key**

Finds the jack rafter sizes – from largest to smallest – for both regular and irregular pitched roofs. The initial jack rafter values displayed are from the regular pitched side. After showing the minimum value, the calculator will display the sizes for the irregular pitched side. An on-center spacing can be entered by pressing **[Jack]** (i.e., **12 [Inch] [Jack]**). The default spacing is 16 inches (Metric Mode: 600 millimeters).

### **[Conv] [Jack] — Irregular Side Jacks**

Operates same as **[Jack]**, but displays the irregular pitched side jack rafters first. The calculator uses the same on-center spacing as the regular pitch sided jack rafters unless a new on-center spacing is entered (e.g., **19.2 [Inch] [Conv] [Jack]**).

## Stair & Circle Keys

---

### [Stair] — Stair Key

A multi-function key that enters a *desired riser height* and uses the rise and run values to compute and display the following:

<u>Press</u>	<u>Result</u>
1	Number of Risers
2	Actual Riser Height
3	Riser Overage/Underage
4	Number of Treads
5	Actual Tread Width
6	Tread Overage/Underage
7	Stringer Length
8	Inclination Angle

Default value is 7-1/2 inches (Metric Mode: 185 millimeters).

### [Circ] — Circle

Displays the following values, given an entered diameter:

- 1) diameter,
- 2) area, and
- 3) circumference.

### [Conv] [Circ] — Arc Length

Calculates the arc length based on an entered diameter and angle.

## **Additional [Conv] Key Functions**

---

When used in conjunction with the following keys, the **[Conv]** key gives access to these additional functions:

### **[Conv] [ ÷ ]**

Reciprocal, or 1/x function.

### **[Conv] [ x ] — All Clear**

Clears all values, including Memory. Resets all permanent settings to defaults. **Note:** *Will not change the Imperial/Metric mode setting. [Rcl] [x] changes this setting.*

### **[Conv] [ + ] — Pi ( $\pi$ )**

Constant = 3.141593.

### **[Conv] [ - ] — Sign (+ / -) Toggle**

Toggles the sign of the displayed value.

### **[Conv] [ = ] — Paperless Tape**

Accesses the paperless tape mode.

### **[Conv] [ • ] — Per Function**

Allows you to compute a total material cost given a unit dimension and an entered *Per Unit Cost*. **Note:** *Board feet calculations are per 1,000 Bdft (Mbm)*

# Fractional Settings

---

## Setting Fractional Accuracy

---

When your calculator is in a default condition (battery change or full reset), it is set to round fractional values to the nearest 1/16th of an inch. The fractional level can be revised by using the following keystrokes:

[Conv] 1 = Accuracy set to 1/16

[Conv] 2 = Accuracy set to 1/2

[Conv] 3 = Accuracy set to 1/32

[Conv] 4 = Accuracy set to 1/4

[Conv] 6 = Accuracy set to 1/64

[Conv] 8 = Accuracy set to 1/8

A star (★) will appear in the bottom left of the display when the calculator is turned on, if the setting is different from the default. The fractional setting can be displayed at any time by pressing **[Rcl] [ / ]**.

# Entering Dimensions

---

## Linear Dimensions

---

When entering feet-inch values, enter dimensions from largest to smallest — feet before inches, inches before fractions. Enter fractions by entering the numerator (top), pressing [ / ] (fraction bar key) and then the denominator (bottom). **Note:** *If a denominator is not entered, the fractional setting value is used.*

Examples of how linear dimensions are entered:

<u>Dimension</u>	<u>Keystrokes</u>
5 Yards	5 [Yds]
5 Feet 1-1/2 Inch	5 [Feet] 1 [Inch] 1 [ / ] 2
17.5 Meters	17.5 [m]

## Square and Cubic Dimensions

---

Examples of how square and cubic dimensions are entered:

<u>Dimension</u>	<u>Keystrokes</u>
5 Cubic Yards	5 [Cu] [Yds]
130 Square Feet	130 [Sq] [Feet]
33 Square Meters	33 [Sq] [m]

## Linear Conversions

---

Convert 14 feet to other dimensions:

<b>Keystroke</b>	<b>Display</b>
14 [Feet] . . .	
[Conv] [Yds]	<b>4.666667 YD</b>
[Conv] [Feet]	<b>14 FT 0 IN</b>
[Conv] [Feet]	<b>14 FT</b>
[Conv] [Inch]	<b>168 IN</b>
[Conv] [mm]	<b>4267.2 MM</b>
[Conv] [cm]	<b>426.72 CM</b>
[Conv] [m]	<b>4.2672 M</b>

## Square Conversions

---

Convert 14 square feet to other square dimensions:

<b>Keystroke</b>	<b>Display</b>
14 [Sq] [Feet] . . .	
[Conv] [Inch]	<b>2016 SQ IN</b>
[Yds] *	<b>1.555556 SQ YD</b>
[m]	<b>1.300643 SQ M</b>
[mm]	<b>1300643 SQ MM</b>
[cm]	<b>13006.43 SQ CM</b>

---

\* When performing conversions, [Conv] only has to be pressed once.

## Cubic Conversions

---

Convert 14 cubic feet to other cubic dimensions:

Keystroke	Display
14 [Cu] [Feet] . . .	
[Conv] [Inch]	24192 CU IN
[Yds]	0.518519 CU YD
[m]	0.396436 CU M
[cm]	396435.9 CU CM
[mm] *	0.396436 CU M

## Basic Math Operations

---

Your calculator uses standard chaining logic, which simply means that you enter your first value, the operator (+, −, x, ÷), the second value and then the Equals sign (“=”).

- |    |   |     |   |     |     |
|----|---|-----|---|-----|-----|
| A. | 3 | [+] | 2 | [=] | 5   |
| B. | 3 | [−] | 2 | [=] | 1   |
| C. | 3 | [x] | 2 | [=] | 6   |
| D. | 3 | [÷] | 2 | [=] | 1.5 |

This feature also makes the calculator simple to use for dimensional applications:

---

\* The calculator's auto-range function forced the answer to be in meters, as it is out of the calculator's normal 7-digit range (See Appendix A—Auto-Range).



## **Adding Dimensions**

---

**Add 11 inches to 2 feet 1 inch:**

11 [Inch] [+] 2 [Feet] 1 [Inch] [=] **\*36 IN**

## **Subtracting Dimensions**

---

**Subtract 3 feet from 11 feet**

**7-1/2 inches:**

11 [Feet] 7 [Inch] 1 [ / ] 2

[-] 3 [Feet] [=] **8 FT 7-1/2 IN**

## **Multiplying Dimensions**

---

**Multiply 5 feet 3 inches by 11 feet 6-1/2 inches:**

5 [Feet] 3 [x] 11 [Feet]

6 [Inch] 1 [ / ] 2 [=] **60.59375 SQ FT**

## **Dividing Dimensions**

---

**Divide 30 feet 4 inches by 7 inches:**

30 [Feet] 4 [Inch] [÷] 7 [Inch] [=] **52**

**Divide 20 feet 3 inches by 9:**

20 [Feet] 3 [Inch] [÷] 9 [=] **2 FT 3 IN**

---

*\* The format of the first value entered determines the answer format. [Conv] can be used to change to any format desired, provided convention is maintained.*

## Percentage Calculations

---

The Percent [%] key can be used for finding a given percent of a number or for working add-on, discount or division percentage calculations. It can be used with any type of number, in any dimension (feet, inch, millimeter, etc) and any type of convention (non-dimensioned, linear, square or cubic).

### Computing Percentages

---

**Find 18% of 500 feet:**

500 [Feet] [x] 18 [%]                      **90 FT 0 IN**

**Add 10% to 137 square feet:**

137 [Sq] [Feet] [+] 10 [%] **150.7 SQ FT**

**Take 20% from 552 feet 6 inches:**

552 [Feet] 6 [Inch] [–] 20 [%]  
**442 FT 0 IN**

**Divide 350 cubic yards by 80%:**

350 [Cu] [Yds] [÷] 80 [%] **437.5 CU YD**

# Memory Operation

---

Whenever the **[M+]** key is pressed, the displayed value will be added to the Memory. Other memory functions:

<b>Function</b>	<b>Keystrokes</b>
Add to Memory	<b>[M+]</b>
Subtract from Memory	<b>[Conv] [M+]</b>
Recall total in Memory	<b>[Rcl] [M+]</b>
Display/Clear Memory	<b>[Rcl] [Rcl]</b>
Clear Memory	<b>[Conv] [Rcl]</b>
Replace Memory	<b>[Conv] [Rcl]</b> <b>[M+]</b>

Memory is semi-permanent, clearing only when you:

- 1) turn off the calculator;
- 2) press **[Rcl] [Rcl]**;
- 3) press **[Conv] [Rcl]**;
- 4) press **[Conv] [x]** (all clear).

<b>Examples/Keystroke</b>	<b>Display</b>
355 <b>[M+]</b>	355. <b>M</b>
255 <b>[M+]</b>	255. <b>M</b>
745 <b>[Conv] [M+]</b> <b>[Rcl] [Rcl]</b>	745. <b>M</b> – 135.
10 <b>[Feet]</b> 5 <b>[Inch] [M+]</b>	10 FT 5 IN <b>M</b>
5 <b>[Feet]</b> 3 <b>[Inch] [M+]</b> <b>[Rcl] [Rcl]</b>	5 FT 3 IN <b>M</b> 15 FT 8 IN

## Paperless Tape

---

The Paperless Tape allows the user to display and review the last 20 entries of a calculation. **[Rcl]** **[=]** accesses the tape mode and **[+]** or **[-]** scrolls forward or backward through the entries.

While in the Paperless Tape mode, the display will show the entered or calculated value, along with the sequence number of entry (e.g., **01**, **02**, **03**, etc.) and the math operator (**+**, **-**, **x**, **÷**, **%**) in the upper left corner of the display. If **[=]** has been used in the middle of a string, **SUB** (for Subtotal) will display in the upper left. If **[=]** was the last operation performed, the display will show **TTL** (Total) as the last entry.

Pressing any key other than **[Off]**, **[+]** or **[-]** exits the Paperless Tape mode. The last entry made (or **TTL**) will be displayed, allowing you to either exit completely, or to continue using the last tape value for another operation.

*Note: The Paperless Tape is cleared each time **[On/C]** is pressed twice, or the unit is shut off.*

## Previewing Paperless Tape

---

<b>Keystroke</b>	<b>Display</b>
<i>1. Enter a string of numbers:</i>	
4 [Feet] [+]	4 FT 0 IN
5 [Feet] [+]	9 FT 0 IN
6 [Feet] [+]	15 FT 0 IN
7 [Feet] [=]	22 FT 0 IN
<i>2. Access the Tape function:</i>	
[Rcl] [=]	TTL= 22 FT 0 IN
<i>3. Scroll from first value to total:</i>	
[+]	01 4 FT 0 IN
[+]	02+ 5 FT 0 IN
[+]	03+ 6 FT 0 IN
[+]	04+ 7 FT 0 IN
[+]	TTL= 22 FT 0 IN
<i>4. Scroll to last 2 values:</i>	
[−]	04+ 7 FT 0 IN
[−]	03+ 6 FT 0 IN
<i>5. Exit Tape function and continue:</i>	
[=] *	TTL= 22 FT 0 IN
[+]	22 FT 0 IN
2 [Feet] [=]	24 FT 0 IN

---

\* Can press any key besides [Off], [+] or [−].

# EXAMPLES

## Linear Calculations

---

### Cutting Boards

---

How many 2 feet 2 inch pieces can be made from fifteen 10-foot boards?

<b>Keystroke</b>	<b>Display</b>
1. <i>Divide board length by smaller cuts</i>	
[On/C] [On/C]	0.
10 [Feet]	10 FT
[÷] 2 [Feet] 2 [Inch] [=]	4.615385
	(or 4 whole boards)
2. <i>Find total boards</i>	
4 [x] 15 [=]	60 (pieces)

### Carpentry — Calculating Number of Studs

---

Find the number of 16-inch on-center studs needed for an 18 feet 7-1/2 inch wall.

<b>Keystroke</b>	<b>Display</b>
1. <i>Divide length by spacing</i>	
[On/C][On/C]	0.
18 [Feet] 7 [Inch] 1 [ / ] 2	18 FT 7-1/2 IN
[÷] 16 [Inch] [=]	13.96875 (14 studs)
2. <i>Add one for the end</i>	
[+] 1 [=]	14.96875 (15 studs)

**Note:** Also applies to trusses and joists.

## Masonry — Estimating Bricks

---

How many standard bricks (3-3/4 inch by 8 inch) are required for a 36.5 feet by 8 feet wall?

<b>Keystroke</b>	<b>Display</b>
1. <i>Find Brick Area</i>	
[On/C] [On/C]	0.
3 [Inch] 3 [ / ] 4 [x] 8 [Inch] [=]	<b>30 SQ IN</b>
2. <i>Store in Memory and Find Wall Area</i>	
[M+]	<b>30 SQ IN</b>
36.5 [Feet] [x] 8 [Feet] [=]	<b>292 SQ FT</b>
3. <i>Divide by brick area to find total bricks</i>	
[÷] [Rcl] [M+] [=]	<b>1401.6 (Bricks)</b>
4. <i>Add 5% for spoilage</i>	
[+] 5 [%]	<b>1471.68 (1472 Bricks)</b>

## Area Calculations

---

### Area of a Rectangle

---

What is the area of a room measuring 12 feet 6 inches by 15 feet 8 inches?

Keystroke	Display
[On/C] [On/C]	0.
12 [Feet] 6 [Inch]	12 FT 6 IN
[x] 15 [Feet] 8 [Inch] [=]	195.8333 SQ FT

### Area of a Square

---

Using the  $x^2$  ([Conv][ $\sqrt{\quad}$ ]) function, find the area of a square with sides of 4 feet 7 inches.

Keystroke	Display
[On/C] [On/C]	0.
4 [Feet] 7 [Inch]	4 FT 7 IN
[Conv][ $\sqrt{\quad}$ ]	21.00694 SQ FT



## Area — Floor Covering

---

You have an apartment with two rooms of carpet that need to be replaced. The room dimensions are as follows: 12 feet 4 inches by 10 feet and 14 feet 8 inches by 16 feet. How many square yards of carpet are needed and what is the total cost at \$11.75 per square yard?

Keystroke	Display
[On/C] [On/C]	0.
1. Find Area of Room 1 & Add to Memory	
12 [Feet] 4 [Inch]	12 FT 4 IN
[x] 10 [Feet] [=] [M+]	123.3333 SQ FT
Enter in Memory	
2. Find Area of Room 2 & Add to Memory	
14 [Feet] 8 [Inch]	14 FT 8 IN
[x] 16 [Feet] [=] [M+]	234.6667 SQ FT
3. Find Total Area and Cost	
[Rcl] [Rcl] [Conv] [Yds]	39.77778 SQ YD
[x] 11.75 [Conv] [•]	\$467.39

## Roof Covering — No. of Shingles

---

You're going to use 12 inch wide by 36-inch long asphalt (strip) shingles with 5-inch weather exposure. How many shingles are required for a 1745 square foot roof? (**Note:** *Shingle exposure area = Exposure x length, and Number of Shingles = Roof area ÷ shingle exposure area.*)

Keystroke	Display
-----------	---------

---

- |  |                        |
|--|------------------------|
| 1. Find and save shingle exposure area |                        |
| [On/C] [On/C]                          | 0.                     |
| 5 [Inch] [x] 36 [Inch] [=]             | 180 SQ IN              |
| [M+]                                   | 180 SQ IN              |
| 2. Find Total Shingles Required        |                        |
| 1745 [Sq] [Feet]                       | 1745 SQ FT             |
| [÷] [Rcl] [Rcl] [=]                    | 1396 (shingles)        |
| 3. Add 10% for waste                   |                        |
| [+] 10 [%]                             | 1535.6 (1536 shingles) |

# Volume Calculations

---

## Rectangular Containers

---

What is the volume of a container 3 feet by 1 foot 9-5/8 inches by 2 feet 4 inches? (LxWxH)

Keystroke	Display
[On/C] [On/C]	0.
3 [Feet]	3 FT
[x] 1 [Feet] 9 [Inch] 5 [ / ] 8	1 FT 9-5/8 IN
[x] 2 [Feet] 4 [Inch] [=]	12.61458 CU FT

## Simple Concrete Volume

---

You're going to form up and pour your own driveway and you need to accurately calculate the cubic yards of concrete required for the job. The measurements are as follows: 36 feet 3 inches long by 11 feet 6 inches wide by 4 inches deep. What's the volume of your driveway, and if concrete costs \$55 per cubic yard, how much will your concrete cost you?

Keystroke	Display
[On/C] [On/C]	0.
1. Find Volume	
36 [Feet] 3 [Inch]	38 FT 3 IN
[x] 11 [Feet] 6 [Inch]	11 FT 6 IN
[x] 4 [Inch] [=]	138.9583 CU FT

(Cont'd)

(Cont'd)

<b>Keystroke</b>	<b>Display</b>
[Conv] [Yds]	<b>5.146605 CU YD</b>
<i>2. Multiply by Cost</i>	
[x] 55 [Conv] [•]	<b>\$ 283.06 Per</b>

## **Concrete Columns**

---

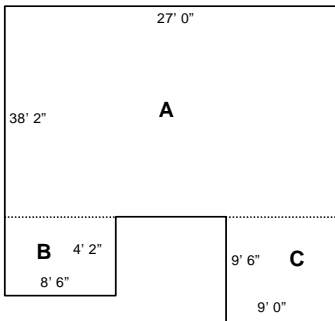
You're going to pour five columns, each of which has a diameter of 3 feet 4-1/2 inches and a height of 11 feet 6 inches. How many cubic yards of concrete will you need for all five columns?

<b>Keystroke</b>	<b>Display</b>
[On/C] [On/C]	<b>0.</b>
<i>1. Find Surface Area of Column</i>	
3 [Feet] 4 [Inch] 1 [ / ] 2	<b>3 FT 4-1/2 IN</b>
[Circ] [Circ]	<b>AREA 8.946176 SQ FT</b>
<i>2. Find Total Volume</i>	
[x] 11 [Feet] 6 [Inch] [=]	<b>102.881 CU FT</b>
[Conv] [Yds]	<b>3.810408 CU YD</b>
[x] 5 [=]	<b>19.05204 CU YD</b>

## Complex Concrete Volume

---

You're going to pour an odd-shaped patio 4-1/2 inches deep with the dimensions shown below. First, calculate the total area (by dividing the drawing into three individual rectangles) and then determine the total yards of concrete required for this job.



*(Cont'd)*

(Cont'd)

<b>Keystroke</b>	<b>Display</b>
[On/C] [On/C]	0.
<i>1. Find Area of Part A</i>	
38 [Feet] 2 [Inch] [–]	
4 [Feet] 2 [Inch] [=]	<b>34 FT 0 IN</b>
[x] 27 [Feet] [=]	<b>918 SQ FT</b>
[M+]	
<i>2. Find Area of Part B</i>	
4 [Feet] 2 [Inch]	<b>4 FT 2 IN</b>
[x] 8 [Feet] 6 [Inch] [=]	<b>35.41667 SQ FT</b>
[M+]	
<i>3. Find Area of Part C</i>	
9 [Feet]	<b>9 FT</b>
[x] 9 [Feet] 6 [Inch] [=]	<b>85.5 SQ FT</b>
[M+]	
<i>4. Find Total Area</i>	
[Rcl] [Rcl]	<b>1038.917 SQ FT</b>
<i>5. Find Total Cubic Yards</i>	
[x] 4 [Inch] 1 [ / ] 2 [=]	<b>389.5937 CU FT</b>
[Conv] [Yds]	<b>14.4294 CU YD</b>

# Volume/Weight Calculations

---

## Concrete Footing

---

Find the total volume\* of concrete required to pour five 24 inch by 12 inch footings, each 2 feet deep. Then find the weight of the concrete (use 1.5 tons per cubic yard).

Keystroke	Display
[On/C] [On/C]	0.
1. Enter Weight Per Volume	
1.5 [Conv] [%]	<b>**1.5 Tons Per CU YD</b>
2. Find Volume of Footings	
2 [Feet]	<b>2 FT</b>
[x] 24 [Inch]	<b>24 IN</b>
[x] 12 [Inch] [=]	<b>4 CU FT</b>
[Conv] [Yds]	<b>0.148148 CU YD</b>
[x] 5 [=]	<b>0.740741 CU YD</b>
3. Find the Weight of Concrete	
[Conv] [Weight]	<b>1.111111 Ton</b>
[Weight]	<b>2222.222 LB</b>
[Weight]	<b>1.008 M Ton</b>
[Weight]	<b>1007.983 KG</b>

---

\* See Appendix B for other geometric shape formulas.

\*\* Continue pressing the [%] key if the units are not shown as Tons/Yd<sup>3</sup>

## Board Feet/ Lumber Calculations

---

Board Feet and lumber problems can easily be solved with the *Construction Master IV*'s built-in Board Feet and material estimating function.

### Total Board Feet — *With Dollar Cost*

---

Find the total board feet for one each of the following sizes:

2 x 4 x 14

2 x 10 x 16

2 x 12 x 18

In addition, if this board cost \$250 per Mbm., how much will this order cost?

Keystroke	Display
[On/C] [On/C]	0.
2 [x] 4 [x] 14 [BdFt] [M+]	9.333333 B FT
2 [x] 10 [x] 16 [BdFt] [M+]	26.66667 B FT
2 [x] 12 [x] 18 [BdFt] [M+]	36 B FT
[Rcl] [Rcl]	72 B FT
[x] 250 [Conv] [•]	\$ 18.00 Per

## Right-Triangle



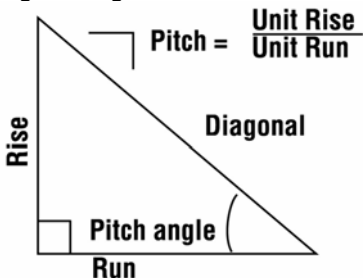
## Calculations

The top row of keys provide you with built-in solutions to right triangles. The solutions are available in any of the linear dimensions offered on the calculator. Thus, you can solve right triangles directly in feet and inches, decimal feet, meters, etc.

Any value of a right triangle can be found given two of the four variables: 1) Rise, 2) Run, 3) Diagonal or 4) Pitch.

Pitch is a permanent entry that can be entered as the Rise per foot (meter for Metric Mode), as an angle, or as a ratio/percentage (**[Conv] [Pitch]**).

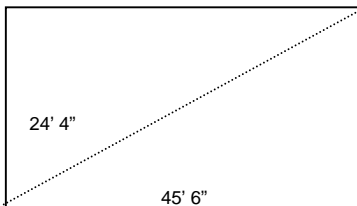
### Right Triangle:



## Squaring a Concrete Slab

---

Assume you want to “square-up” the forms for a concrete foundation measuring 45 feet 6 inches by 24 feet 4 inches. In order for the forms to be square, what should the diagonal measurements (Square-Up) be?



Keystroke	Display
[On/C] [On/C]	0.
1. Enter Sides as Rise/Run	
45 [Feet] 6 [Inch] [Run]	
	<b>RUN 45 FT 6 IN</b>
24 [Feet] 4 [Inch] [Rise]	
	<b>RISE 24 FT 4 IN</b>
2. Find the Square Up (Diagonal)	
[Diag]	<b>DIAG 51 FT 7-3/16 IN</b>

## Area for Roofing Materials

---

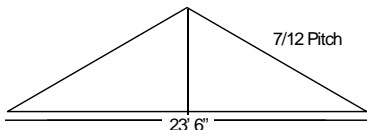
You're ordering roofing materials for a roof with a 5/12 Pitch, an overall span of 27 feet and a length of 34 feet 6 inches. How many squares, at 100 square feet each, are there?

Keystroke	Display
[On/C] [On/C]	0.
1. <i>Find Common Rafter Length</i>	
5 [Inch] [Pitch]	<b>PTCH 5 IN</b>
27 [Feet] [ $\div$ ] 2 [=] [Run]	<b>RUN 13 FT 6 IN</b>
[Diag]	<b>DIAG 14 FT 7-1/2 IN</b>
2. <i>Find Area of One Side</i>	
[x] 34 [Feet] 6 [Inch] [=]	<b>504.5625 SQ FT</b>
3. <i>Find Area of Both Sides</i>	
[x] 2 [=]	<b>1009.125 SQ FT</b>
4. <i>Find Number of Squares</i>	
[ $\div$ ] 100 [Sq] [Feet][=]	<b>10.09125</b> (squares)

## Common Rafter Length — (*Pitch Known*)

---

The roof you are working on has a 7/12 Pitch, with a span of 23 feet 6 inches. What length should you cut the Common rafters (not counting the overhang or ridge adjustments)?



Keystroke	Display
[On/C] [On/C]	0.
7 [Inch] [Pitch]	PTCH 7 IN
23 [Feet] 6 [Inch] [ $\div$ ] 2 [=]	11 FT 9 IN
[Run]	RUN 11 FT 9 IN
[Diag]	DIAG 13 FT 7-1/4 IN

## **Finding Rise — (*Pitch and Run Known*)**

---

Though not commonly asked for, you can compute the rise or run of a right angle just as you would the diagonal. Find the rise given a 7/12 pitch and a run of 11 feet 6 inches:

<b>Keystroke</b>	<b>Display</b>
[On/C] [On/C]	0.
7 [Inch] [Pitch]	PTCH 7 IN
11 [Feet] 6 [Inch] [Run]	RUN 11 FT 6 IN
[Rise]	RISE 6 FT 8-1/2 IN

## **Finding Rise & Diagonal — (*Degrees of Pitch & Run Known*)**

---

Find the Rise and Diagonal sides of a right angle given a 30° Pitch and a Run of 20 feet 5 inches:

<b>Keystroke</b>	<b>Display</b>
[On/C] [On/C]	0.
30 [Pitch]	PTCH 30°
20 [Feet] 5 [Inch] [Run]	RUN 20 FT 5 IN
[Rise]	RISE 11 FT 9-7/16 IN
[Diag]	DIAG 23 FT 6-7/8 IN

## Raked Wall – Stud Sizes

---

Find each stud size in a raked wall with a peak of 15 feet 5 inches, and a length of 30 feet 7 inches. Use 16 inches as your on-center spacing.

Keystroke	Display
[On/C] [On/C]	0.

1. *Enter Rise, Run and O.C. Spacing*

15 [Feet] 5 [Inch] [Rise]

**RISE 15 FT 5 IN**

30 [Feet] 7 [Inch] [Run]

**RUN 30 FT 7 IN**

16 [Inch] [Conv] [Diag]

**OC 16 IN**

2. *Find Stud Lengths*

[Conv] [Diag]

**RW 1 14 FT 8-15/16 IN**

[Diag]

**RW 2 14 FT 0-7/8 IN**

[Diag]

**RW 3 13 FT 4-13/16 IN**

[Diag]

**RW 4 12 FT 8-3/4 IN**

[Diag]

**RW 5 12 FT 0-11/16 IN**

*Etc.....Continue pressing [Diag] until last stud size or "0" is reached.*

# Hip/Valley & Jack Rafters

---

## Regular (45°) Hip/Valley & Jack Rafters

---

You're working with a 7/12 Pitch, and half your total span is 13 feet 9 inches: (A) Find the point-to-point length for the common rafter; (B) Find the length of an adjoining hip (or valley); and (C) Find the lengths of the regular jack rafters (jack rafters at 16" on-center spacing).

<b>Keystroke</b>	<b>Display</b>
[On/C] [On/C]	0.
1. <i>Find Common Rafter Length</i>	
13 [Feet] 9 [Inch] [Run]	
	<b>RUN 13 FT 9 IN</b>
7 [Inch] [Pitch]	<b>PTCH 7 IN</b>
[Diag]	<b>DIAG 15 FT 11 IN</b>
2. <i>Find Hip Rafter Length</i>	
[Hip/V]	<b>H/V 21 FT 0-7/16 IN</b>
3. <i>Find Jack Rafter Lengths</i>	
16 [Inch] [Jack]	<b>OC 16 IN</b>
[Jack]	<b>JK1 14 FT 4-1/2 IN</b>
[Jack]	<b>JK2 12 FT 10 IN</b>
[Jack]	<b>JK3 11 FT 3-7/16 IN</b>

*Etc.....Continue pressing [Jack] until last Jack is reached or until display shows "0."*

## **Jack Rafters — (with other than 16 inch on-center spacing)**

---

You're working with a roof having a 7/12 pitch and a run of 30 feet 9 inches. Find the jack rafter lengths at 18 inch on-center spacing.

<b>Keystroke</b>	<b>Display</b>
[On/C] [On/C]	0.
1. <i>Enter Pitch, Run and Spacing</i>	
7 [Inch] [Pitch]	PTCH 7 IN
30 [Feet] 9 [Inch] [Run]	RUN 30 FT 9 IN
18 [Inch] [Jack]*	OC 18 IN
2. <i>Find Jack Rafter Lengths</i>	
[Jack]	JK1 33 FT 10-3/8 IN
[Jack]	JK2 32 FT 1-1/2 IN
[Jack]	JK3 30 FT 4-11/16 IN

*Etc.....Continue pressing [Jack] until last Jack is reached or until display shows "0."*

---

\* If the entered value is not dimensioned, the calculator will assume the value as inches for English and millimeters for Metric calculations.



## Irregular (non-45°) Hip/Valley & Jack Rafters

---

You're working with a 7/12 pitch and half your overall span is 15 feet 7 inches. The irregular pitch is 8/12. Find the common rafter length, irregular hip/valley and jack rafter lengths.

Keystroke	Display
-----------	---------

---

[On/C] [On/C]	0.
---------------	----

1. *Find Common Rafter Length*

7 [Inch] [Pitch]	<b>PTCH 7 IN</b>
------------------	------------------

15 [Feet] 7 [Inch][Run]	<b>RUN 15 FT 7 IN</b>
-------------------------	-----------------------

[Diag]	<b>DIAG 18 FT 0-1/2 IN</b>
--------	----------------------------

2. *Find Irregular Hip Rafter Length*

8 [Inch] [Conv] [Hip/V]	<b>IPCH 8 IN</b>
-------------------------	------------------

[Hip/V]	<b>IH/V 22 FT 7-3/8 IN</b>
---------	----------------------------

3. *Find Irregular Jack Lengths*

16 [Inch] [Conv] [Jack]	<b>OC 16 IN</b>
-------------------------	-----------------

[Conv] [Jack]	<b>IJ1 14 FT 11-13/16 IN</b>
---------------	------------------------------

[Jack] *	<b>IJ2 13 FT 7 IN</b>
----------	-----------------------

[Jack]	<b>IJ3 12 FT 2-3/16 IN</b>
--------	----------------------------

[Jack]	<b>IJ4 10 FT 9-3/8 IN</b>
--------	---------------------------

[Jack]	<b>IJ5 9 FT 4-1/2 IN</b>
--------	--------------------------

*Etc.....Continue pressing [Jack] until last regular jack or "0." is reached.*

*(Cont'd)*

---

\* It is not necessary to keep on pressing [Conv] when displaying the Irregular Jack sizes.

*(Cont'd)*

*4. Find Regular Jack Lengths*

16 [Inch] [Jack]	<b>OC 16 IN</b>
[Jack]	<b>JK1 16 FT 3-5/16 IN</b>
[Jack]	<b>JK2 14 FT 6-1/8 IN</b>
[Jack]	<b>JK3 12 FT 9 IN</b>
[Jack]	<b>JK4 10 FT 11-13/16 IN</b>
[Jack]	<b>JK5 9 FT 2-5/8 IN</b>

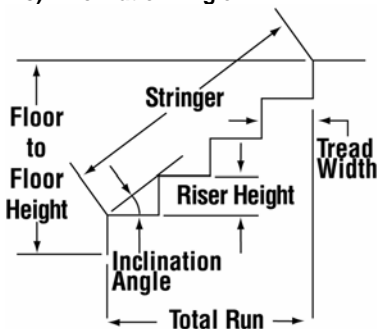
*Etc.....Continue pressing [Jack] until last regular jack or "0." is reached.*

## Stair Problems (Risers/Treads)

---

The *Construction Master IV* easily computes the various values pertaining to stair building. Given values for total rise, total run and a *desired stair riser height*, your calculator will compute the following with the press of the **[Stair]** key:

- 1) Number of Risers
- 2) Riser Height
- 3) Underage/Overage for Risers
- 4) Number of Treads
- 5) Tread Width
- 6) Underage/Overage for Treads
- 7) Stringer (Carriage) Length
- 8) Inclination Angle



The *desired stair riser height* (default = 7-1/2) inches can be permanently revised by entering the new height and pressing **[Stair]**.

## Risers Only — Custom Height

---

You're building an access stairway for a client who can't handle conventional-height risers. If the total rise is 3 feet 8-3/4 inches and your *desired riser height* is approximately 5-1/2 inches, find the number of stair risers, actual riser height, and any underage or overage remaining.

Keystroke	Display
[On/C] [On/C]	0.
1. <i>Enter Rise and Riser Height</i>	
3 [Feet] 8 [Inch]	
3 [ / ] 4 [Rise]	RISE 3 FT 8-3/4 IN
5 [Inch] 1 [ / ] 2 [Stair]	R-HT 5-1/2 IN
2. <i>Find Stair Values</i>	
[Stair]	RSRS 8
[Stair]	R-SZ 5-5/8 IN
[Stair]	R+/- - 0-1/4 IN
[Conv] [x] ( <i>Optional</i> ) *	0.

## Risers & Treads —

---

\* An ALL CLEAR is performed here to set the calculator to its default settings.

## **(7-1/2 Inch Desired Riser Height)**

You need to build a stairway having a floor-to-floor height of 28 feet 5-1/2 inches, a run of 35 feet 6 inches and a nominal riser height of 7-1/2 inches (default). Find the number of risers, the riser height and underage/overage, the number of treads, the tread width and underage/ overage, stringer length and inclination angle.

<b>Keystroke</b>	<b>Display</b>
[On/C] [On/C]	0.
1. <i>Enter Rise and Run</i>	
28 [Feet] 5 [Inch] 1 [ / ] 2	
[Rise]	<b>RISE 28 FT 5-1/2 IN</b>
35 [Feet] 6 [Inch] [Run]	
	<b>RUN 35 FT 6 IN</b>
2. <i>Find Stair Values</i>	
[Rcl] [Stair]	<b>R-HT 7-1/2 IN</b>
[Stair]	<b>RSRS 46</b>
[Stair]	<b>R-SZ 7-7/16 IN</b>
[Stair]	<b>R+/- 0-5/8 IN</b>
[Stair]	<b>TRDS 45</b>
[Stair]	<b>T-SZ 9-7/16 IN</b>
[Stair]	<b>T+/- -1-5/16 IN</b>
[Stair]	<b>STRG 45 FT 1-3/8 IN</b>
[Stair]	<b>INC° 38.10298</b>

# Circle Problems

---

## Circumference and Area

---

Find the circumference and area of a circle having a diameter of 10 inches.

Keystroke	Display
[On/C] [On/C]	0.
10 [Inch] [Circ]	DIA 10 IN
[Circ]	AREA 78.53982 SQ IN
[Circ]	CIRC 31-7/16 IN
[Inch]	31.41593 IN

## Arc Lengths

---

Find the arc length of an 85° portion of a circle with a 5-foot diameter.

Keystroke	Display
[On/C] [On/C]	0.
5 [Feet] [Circ]	5 FT 0 IN DIA
85 [Conv] [Circ]	3 FT 8-1/2 IN ARC
[Feet]	3.708825 FT

# APPENDIX A

## Battery & Auto Shut-Off

Your calculator is powered by a single 3-Volt Lithium CR-2032 battery. This should last upwards of 800 hours of actual use (1 year plus for most people). Should the display become very dim or erratic, replace the battery.\*

Your calculator is designed to shut itself off after about 8-12 minutes of non-use.

## Default Values

After a Full Reset/All-Clear, the calculator will return to the following settings:

<b>Setting</b>	<b>Imperial</b>	<b>Metric</b>
Stair Riser Ht	7-1/2 Inch	185 mm
R/Wall o.c.	16 Inch	600 mm
Jack o.c.	16 Inch	600 mm
IR/Jack o.c.	16 Inch	600 mm
Wt per Vol.	1.5 Tons/Yd <sup>3</sup>	1775 kg/M <sup>3</sup>
Fractional Setting	1/16	1/16
Fractional Mode	Normal	Normal

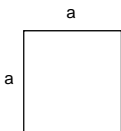
---

\* **WARNING:** Please use caution when disposing of your old batteries as they contain hazardous chemicals.

# APPENDIX B

## Area Formulas

---



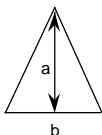
Square

$$\text{Area} = a^2$$



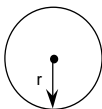
Rectangle

$$\text{Area} = lw$$



Triangle

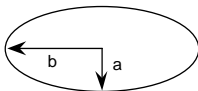
$$\text{Area} = \frac{1}{2} ab$$



Circle

$$\text{Circumference} = 2\pi r$$

$$\text{Area} = \pi r^2$$



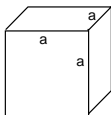
Ellipse

$$\text{Area} = \pi ab$$



# Surface Area & Volume Formulas

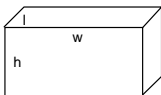
---



## Cube

$$\text{Surface area} = 6a^2$$

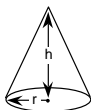
$$\text{Volume} = a^3$$



## Rectangle

$$\text{Surface area} = 2hw + 2hl + 2lw$$

$$\text{Volume} = l \times w \times h$$

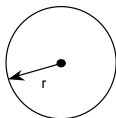


## Cone

$$\text{Surface area} = \pi r \sqrt{r^2 + h^2}$$

( $+\pi r^2$  if you add the base)

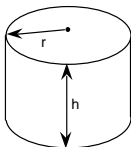
$$\text{Volume} = \frac{\pi r^2 h}{3}$$



## Sphere

$$\text{Surface area} = 4\pi r^2$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$



## Cylinder

$$\text{Surface area} = 2\pi rh + 2\pi r^2$$

$$\text{Volume} = \pi r^2 h$$

# REPAIR AND RETURN

## Warranty, Repair and Return Information

### Return Guidelines:

1. Please read the **Warranty** in this User's Guide to determine if your Calculated Industries calculator, measuring device or electronic tool remains under warranty **before** calling or returning any device for evaluation or repairs.
2. If your calculator won't turn on try pressing the "Reset Button" first. If it still won't turn on, check the batteries as outlined in the User's Guide.
3. If there is a black spot on the LCD screen, **THIS IS NOT A WARRANTY DEFECT.** The unit can be repaired. Call for a repair quote before returning your unit.
4. If you need more assistance, please go to our website at [www.calculated.com](http://www.calculated.com) and click on Support, then Repair Services FAQs.
5. If you believe you need to return your calculator, please speak to a Calculated Industries representative for additional information!

**Call Toll Free: 1-800-854-8075**

# **WARRANTY**

## **Warranty Repair Service – U.S.A.**

Calculated Industries, Inc. ("CI") warrants this product against defects in materials and workmanship for a period of one (1) year from the date of original consumer purchase in the U.S. If a defect exists during the warranty period, CI at its option will either repair (using new or remanufactured parts) or replace (with a new or remanufactured unit) the product at no charge.

THE WARRANTY WILL NOT APPLY TO THE PRODUCT IF IT HAS BEEN DAMAGED BY MISUSE, ALTERATION, ACCIDENT, IMPROPER HANDLING OR OPERATION, OR IF UNAUTHORIZED REPAIRS ARE ATTEMPTED OR MADE. SOME EXAMPLES OF DAMAGES NOT COVERED BY WARRANTY INCLUDE, BUT ARE NOT LIMITED TO, BATTERY LEAKAGE, BENDING, OR VISIBLE CRACKING OF THE LCD, WHICH ARE PRESUMED TO BE DAMAGES RESULTING FROM MISUSE OR ABUSE.

To obtain warranty service in the U.S., ship the product postage paid to the CI Authorized Service Provider listed on the back page of the User's Guide. Please provide an explanation of the service requirement, your name, address, day phone number and dated proof of purchase (typically a sales receipt). If the product is over 90 days old, include payment of \$6.95 for return shipping and handling within the contiguous 48 states. (Outside the contiguous 48 states, please call CI for return shipping costs.)

A repaired or replacement product assumes the remaining warranty of the original product or 90 days, whichever is longer

## **Non-Warranty Repair Service – U.S.A.**

Non-warranty repair covers service beyond the warranty period or service requested due to damage resulting from misuse or abuse. Contact the CI Authorized Service Provider listed on the back page of the User's Guide to obtain current product repair information and charges. Repairs are guaranteed for 90 days.

## **Repair Service – Outside the U.S.A.**

Not all countries have CI Authorized Service Providers or the same warranty and service policies. To obtain warranty or non-warranty repair service for goods purchased outside the U.S., contact the dealer through which you initially purchased the product. If you cannot reasonably have the product repaired in your area, you may contact CI to obtain current product repair information and charges, including freight and duties.

## **Disclaimer**

CI MAKES NO WARRANTY OR REPRESENTATION, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT'S QUALITY, PERFORMANCE, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. AS A RESULT, THIS PRODUCT, INCLUDING BUT NOT LIMITED TO, KEYSTROKE PROCEDURES, MATHEMATICAL ACCURACY AND PREPROGRAMMED MATERIAL, IS SOLD "AS IS," AND YOU THE PURCHASER ASSUME THE ENTIRE RISK AS TO ITS QUALITY AND PERFORMANCE.

IN NO EVENT WILL CI BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECT IN THE PRODUCT OR ITS DOCUMENTATION.

The warranty, disclaimer, and remedies set forth above are exclusive and replace all others, oral or written, expressed or implied. No CI dealer, agent, or employee is authorized to make any modification, extension, or addition to this warranty.

Some states do not allow the exclusion or limitation of implied warranties or liability for incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.

## **FCC Class B**

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC rules.

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4/03