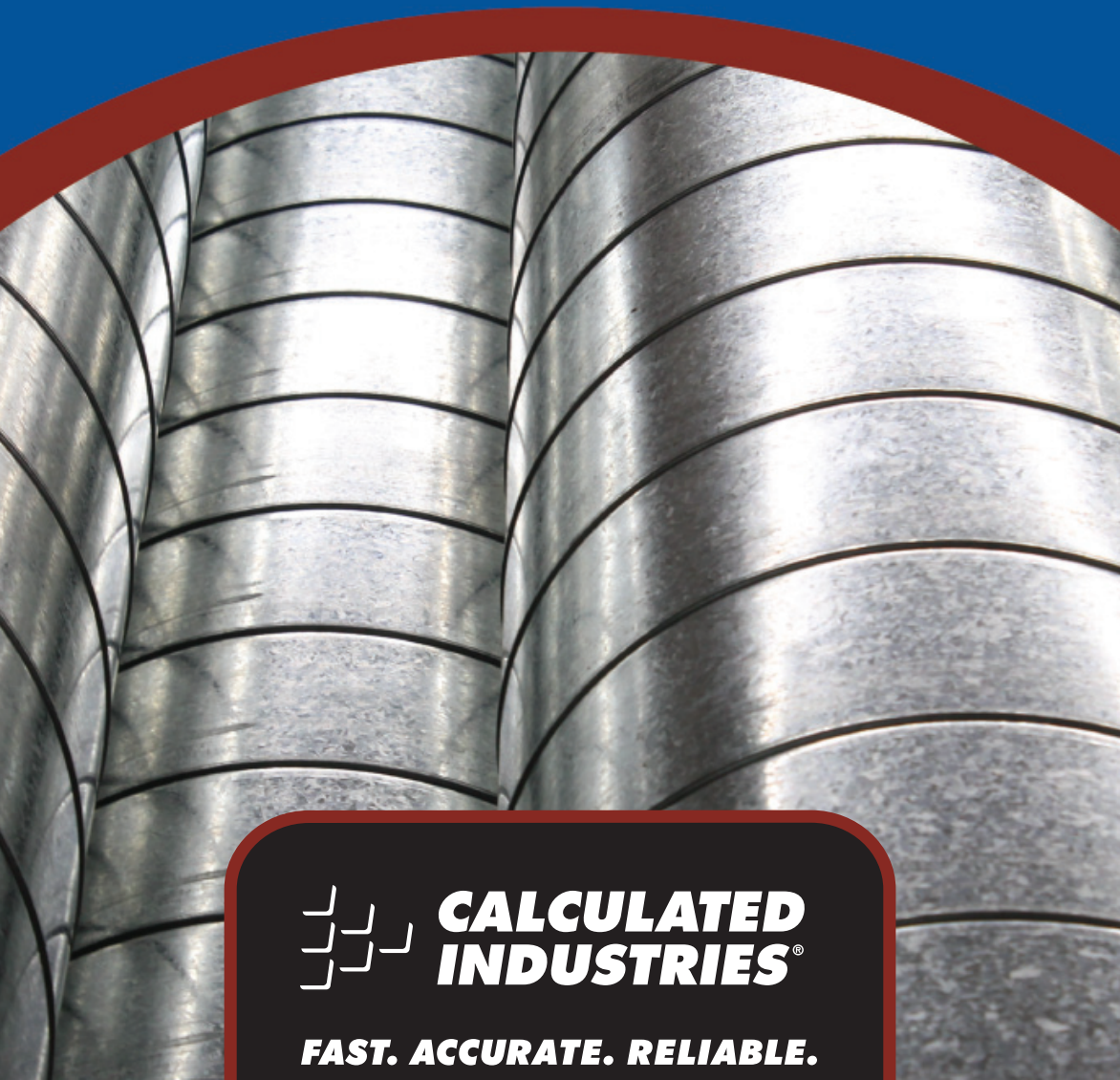
Sheet Metal/ HVAC Pro Calc

Advanced Construction-Math Calculator for Sheet Metal & HVAC Professionals

Model 4090

Pocket Reference Guide



CALCULATED INDUSTRIES®

FAST. ACCURATE. RELIABLE.

SHEET METAL/HVAC PRO CALC

The *Sheet Metal/HVAC Pro* Calc calculator helps you save time and prevent costly errors!

Quickly Solve:

- *Feet-Inches-Fractions, Metric Dimensional Problems and Conversions*
- *Problems Involving All Fractions — 1/2-1/64ths!*
- *Trigonometry Keys*
- *Law of Cosines*
- *Offsets*
- *Fan Laws 1, 2 and 3*
- *Velocity/Velocity Pressure*
- *Right Angle/Rafters*
- *Stair Layout*
- *Areas and Volumes*
- *Circle/Arc, Columns/Cone Area and Volume*
- *And more!*

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KEY DEFINITIONS

Dimension Keys

m	Meters
Conv m	Millimeters
Feet	Feet
Inch	Inch
/	Fraction Bar

Miscellaneous Functions

←	Backspace Key
Conv ×	Clear All
Conv ÷	(1/x) Reciprocal
Conv −	(+/–) Toggle
Conv +	(%) Percent
Conv =	Pref. Settings (see large User's Guide for details)
Conv ⊙	Converts between d:m:s and decimal degrees
x^2	Squares the value in the display
Conv x^2	x^3 — Cubes the value in the display

√x	Square root
Conv √x	Cube root
Conv /	Exponent ($x10^y$)
M+	(M+) Memory +
Conv M+	(M–) Memory –
Rcl Rcl	Recall and Clear M+
Conv 1	(M1) Storage Register M1
Conv 2	(M2) Storage Register M2
Conv 3	(M3) Storage Register M3
Rcl M+, 1, 2, or 3	Recall M+, M1, M2 or M3

Trig. Keys

Sine	Finds the sine of a degree or undimensioned value
Conv Sine	***Arcsine (sin^{-1})*** — Gives the angle for the sine value
Cos	Finds the cosine
Conv Cos	***Arccosine (cos^{-1})*** — Gives the angle for the cosine value
Tan	Finds the tangent

Conv Tan	***Arctangent (tan^{-1})*** — Gives the angle for the tangent value

Pythagorean Theorem Keys

x	Enters or calculates “x” or the horizontal leg of a right triangle
y	Enters or calculates “y” or the vertical leg of a right triangle
r	Enters or calculates “r” or the hypotenuse (diagonal) leg of a right triangle
θ	Enters or calculates the “theta” or the pitch/slope of a right triangle

Law of Cosines Keys

Conv 9	Calculates angles A, B and C, as well as triangle area, given below entries
Conv 4	Enters Side “a” of a triangle
Conv 5	Enters Side “b” of a triangle
Conv 6	Enters Side “c” of a triangle

Offset Keys

Conv (	Calculates offset measurements including: centerline radius, wrapper length/stretch-out, heel radius, throat radius and theta, given below entries
x	Enters the actual length “x”
y	Enters the offset “y”
Conv 4	Enters length of “end a”

Fan Law Keys

Conv x	***Fan Law 1*** — Calculates the missing variable (e.g., “a-new” or “b-new”, for CFM new or RPM new) for Fan Law 1, given the three known variables into the applicable Storage Registers below
Conv y	***Fan Law 2*** — Calculates the missing variable (e.g., “a-new” or “b-new”, for CFM new or SP new) for Fan Law 2

Conv ***r*** ***Fan Law 3*** — Calculates the missing variable (e.g., “a-new” or “b-new”, for CFM new or BHP new) for Fan Law 3

STORAGE REGISTERS USED FOR FAN LAWS:

Conv **4** Enters “a-old” or current “a” value

Conv **7** Enters “a-new”

Conv **5** Enters “b-old” or current “b” value

Conv **8** Enters “b-new”

Velocity Pressure/FPM Keys

Conv **0** VP ◄► FPM

Press	**Result**
1	*Calculates velocity (FPM)* – assumes entry is velocity pressure
2	*Calculates velocity pressure* – assumes entry is velocity (FPM)

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Press	Result
3	*Calculates Metric velocity (MPS)* – assumes entry is kPA
4	*Calculates Metric velocity pressure (kPA)* – assumes entry is MPS

Circle/Arc Keys

Circ	***Circle*** — Calculates circumference and circle area
Conv θ	***Radius*** — Enters or calculates circle radius
Conv Circ	***Arc*** — Calculates: arc length or degree, chord length, segment area, pie slice area, segment rise, and length of arched wall studs
π	***Pi (π)*** — 3.141593
Conv π	***ArcK*** — constant = 0.017453

Column/Cone Key

Conv)	***Column/Cone*** — Calculates volume and surface area of column or cone upon consecutive presses of) following Conv

Right Triangle/Roof Framing Keys

θ *(Theta)*	Enters/calculates the pitch/slope (amount of "Rise" over 12" of "Run")
x *(Run)*	Enters or calculates the horizontal leg of a right triangle
y *(Rise)*	Enters or calculates the vertical leg of a right triangle
r *(Diag)*	Enters or calculates the diagonal leg/hypotenuse, or Common rafter length
Hip/V	Calculates length of the regular or irregular Hip/Valley rafter
Conv Hip/V	Enters irregular pitch used to calculate lengths of the irregular Hip/Valley and Jack rafters

Jack Calculates Jack rafter lengths on the regular-pitched roof side

Conv **Jack** Calculates Jack rafter lengths on the irregular-pitched roof side

Stair Layout Key

Stair Given rise and/or run and stored* variables, calculates or displays:

Press	Result
1	Riser Height
2	Number of Risers
3	Riser Overage/ Underage
4	Tread Width
5	Number of Treads
6	Tread Overage/ Underage
7	Stairwell Opening
8	Stringer Length
9	Angle of Incline
10	Run (entered or calculated)
11	Rise (entered or calculated)

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Press	Result
12	Stored Riser Height*
13	Stored Tread Width*
14	Stored Headroom Height*
15	Stored Floor Thickness*

STAIR DEFAULT (STORED) VALUES

- 7-1/2" Desired Riser Height
- 10" Desired Tread Width
- 10" Floor Thickness (used in calculation of Stairwell Opening)
- 6'8" Headroom Height

**Note: See large User's Guide for details on Customizable Stair Settings.*

EXAMPLES

Note: This pocket guide is limited due to space; see large User's Guide for more examples and details on calculator features.

Adding and Subtracting Strings of Dimensions

Add the following measurements:

- *6 feet 2-1/2 inches*
- *18.25 inches*
- *2.5 meters*

Then subtract 5.5 feet:

KEYSTROKE	DISPLAY
6 Feet 2 Inch 1 / 2 +	
1 8 • 2 5 Inch +	
2 • 5 m −	15 FEET 11-3/16 INCH
− 5 • 5 Feet =	10 FEET 5-3/16 INCH

Dividing Dimensions

Divide 15 feet 3-3/4 inches into thirds (divide by 3):

KEYSTROKE	DISPLAY
1 5 Feet 3 Inch 3 / 4 ÷ 3 =	5 FEET 1-1/4 INCH

Converting Feet-Inches to Decimal Feet

Convert 5’ 7-1/2” to decimal feet, then decimal inches (also, convert to fractional inches):

KEYSTROKE	DISPLAY
5 Feet 7 Inch 1 / 2	5 FEET 7-1/2 INCH
Conv Feet	5.625 FEET
Inch	67.5 INCH
Inch	67-1/2 INCH

Converting Feet-Inches to Meters and Millimeters

Convert 8’ 6” to meters and millimeters:

KEYSTROKE	DISPLAY
8 Feet 6 Inch Conv m	2.591 M
m *(mm)*	2590.8 MM

Converting Fractions to Decimals (and Vice Versa)

Convert 7/32” to decimal inch (and round answer). Then convert 5.875” to the nearest 16ths of an inch:

KEYSTROKE	DISPLAY
7 / 3 2 Conv Inch	0.21875 INCH
	(Answer = 0.219”)
5 • 8 7 5 Inch Conv Inch	5-7/8 INCH

Circle Circumference and Area

Find the circumference and area of a circle with a diameter of 25 inches:

KEYSTROKE	DISPLAY
On/C On/C	0.
2 5 Inch Circ	DIA 25 INCH
Circ	CIRC 78-9/16 INCH
Circ	AREA 490.8739 SQ INCH

Rectangular Area and Volume

Find the area and volume:

- *Length: 20 feet 6-1/2 inches*
- *Width: 12 feet 8-1/2 inches*
- *Height: 18 inches*

KEYSTROKE	DISPLAY
2 0 Feet 6 Inch 1 / 2 ×	
	20 FEET 6-1/2 INCH
1 2 Feet 8 Inch 1 / 2 =	
	261.0503 SQ FEET
× 1 8 Inch =	391.5755 CU FEET

Area of a Triangle

Find the area of a triangle if its base is 45” and altitude/height is 30”:

KEYSTROKE	DISPLAY
4 5 Inch ÷ 2 =	**22-1/2 INCH**
× 3 0 Inch =	**675. SQ INCH**

Volume of a Cylinder

Find the volume of a cylinder with a diameter of 2 feet 4 inches and a height of 4 feet 6 inches:

Note: Use Column/Cone function.

KEYSTROKE	DISPLAY
1. Enter diameter to find circle area:	
On/C On/C	**0.**
2 Feet 4 Inch Circ Circ Circ	**AREA 4.276057 SQ FEET**
2. Enter height and find volume:	
4 Feet 6 Inch y Conv)	**COL 19.24226 CU FEET**

Cubed Function

What is 50^3?

KEYSTROKE	DISPLAY
On/C On/C	0.
5 0 Conv x^2	125000.

Cubed Root

What are the three dimensions of a cube with a volume of 2028 in^3?

KEYSTROKE	DISPLAY
On/C On/C	0.
2 0 2 8 Conv $\sqrt{x}$	12.65773 (INCH)

Scientific Notation

Add $1.78x10^{10}$ and $3.90x10^9$:

KEYSTROKE	DISPLAY
On/C On/C	0.
1 • 7 8 Conv / 1 0 + 3 • 9	
Conv / 9 =	2.17000^{10}

Converting D:M:S

Convert 23°42’39” to decimal degrees:

KEYSTROKE	DISPLAY
On/C On/C	0.
2 3 • 4 2 • 3 9	DMS 23.42.39
Conv •	23.71083°

Finding Sine, Cosine, Tangent

Find Sin 12°, Cos 33° and Tan 75°:

KEYSTROKE	DISPLAY
On/C On/C	0.
1 2 Sine	0.207912
3 3 Cos	0.838671
7 5 Tan	3.732051

Finding ArcSin, ArcCos, ArcTan

Find angle A if Sin A=0.57544, Cos A=0.06753 and Tan A=0.87421; round to the nearest whole angle:

KEYSTROKE	DISPLAY
On/C On/C	**0.**
• 5 7 5 4 4 Conv Sine	**35.13045°** *(35°)*
• 0 6 7 5 3 Conv Cos	**86.12787°** *(86°)*
• 8 7 4 2 1 Conv Tan	**41.16028°** *(41°)*

Using Trigonometry to Find Unknown Side

Using the Pythagorean Theorem ($a^2 + b^2 = c^2$) keys, find Side a ("x") of a right triangle, if Side b ("y") is 6-1/2" and Side c ("r"), the hypotenuse, is 12-1/16":

Note: Use the calculator's x, y and r keys; substitute triangle legs a, b and c for x, y *and* r.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
6 Inch 1 / 2 y	**Y 6-1/2 INCH**
1 2 Inch 1 / 1 6 r	**R 12-1/16 INCH**
x	**X 10-3/16 INCH**

Offset Basic Example

If an offset is 5 feet, the actual length 10 feet, and the height of the "end A" equal to 7 feet, calculate all offset values:

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter actual length as "x":	
1 0 Feet x	**X 10 FEET 0 INCH**
2. Enter offset length as "y":	
5 Feet y	**Y 5 FEET 0 INCH**
3. Enter "end A" as "a":	
7 Feet Conv 4	**A STORED 7 FEET 0 INCH**
4. Find Centerline Radius, Wrapper Length, Heel Radius, Throat Radius and Theta:	
Conv (	**RAD 6 FEET 3 INCH**
(	**WL 11 FEET 7-1/8 INCH**
(	**HEEL 9 FEET 9 INCH**
(	**THRT 2 FEET 9 INCH**
(	**THET 26.56505°**

Law of Cosines/Triangle Area

Using Sides a, b and c, find the corresponding angles A, B and C:

--Side a: 38 feet 5 inches
--Side b: 23 feet 4-9/16 inches
--Side c: 26 feet 1-13/16 inches

KEYSTROKE	DISPLAY
On/C On/C	**0.**

1. Enter side a, b and c:

3 8 Feet 5 Inch Conv 4
A STORED 38 FEET 5 INCH

2 3 Feet 4 Inch 9 / 1 6 Conv 5
B STORED 23 FEET 4-9/16 INCH

2 6 Feet 1 Inch 1 3 / 1 6 Conv 6
C STORED 26 FEET 1-13/16 INCH

2. Calculate angles A, B and C:

Conv 9 **<A 101.5734°**
9 **<B 36.59978°**
9 **<C 41.8268°**

3. Calculate triangle area:

9 **AREA 299.4929 SQ FEET**

Fan Law 1

A 1,250 CFM fan is running at 750 RPM, but it needs to supply 1,400 CFM. What is the RPM required?

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter current CFM into "a" old:	
1 2 5 0 Conv 4	**A STORED 1250.**
2. Enter new CFM into "a-new":	
1 4 0 0 Conv 7	**An STORED 1400.**
3. Enter current RPM into "b" old:	
7 5 0 Conv 5	**B STORED 750.**
4. Calculate new RPM or "b-new":	
Conv x	**RPMn FAN LAW1 840.**

Fan Law 2

A fan is producing 15,300 CFM at 3.2” SP. If the fan is adjusted to 14,000 CFM, what will the new SP be?

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter current CFM into “a” old: 1 5 3 0 0 Conv 4	**A STORED 15300.**
2. Enter new CFM into “a-new”: 1 4 0 0 0 Conv 7	**An STORED 14000.**
3. Enter current SP into “b” old: 3 • 2 Conv 5	**B STORED 3.2**
4. Calculate new SP or “b-new”: Conv y	**SPn FAN LAW2 2.679311**

Fan Law 3

A fan is running at 15,800 CFM using 6.3 BHP. If the CFM is increased to 20,000 CFM, what is the new BHP?

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter current CFM into "a" old: 1 5 8 0 0 Conv 4	**A STORED 15800.**
2. Enter new CFM into "a-new": 2 0 0 0 0 Conv 7	**An STORED 20000.**
3. Enter current BHP into "b" old: 6 • 3 Conv 5	**B STORED 6.3**
4. Calculate new BHP or "b-new": Conv r	**BHPn FAN LAW 3 12.77789**

Converting Velocity Pressure

After obtaining velocity pressures (VPs) from taking a traverse, convert the following to feet per minute (FPM):

0.049”
0.123”
0.027”

KEYSTROKE	DISPLAY
On/C On/C	0.
• 0 4 9 Conv 0*	FPM 886.5445
On/C On/C	0.
• 1 2 3 Conv 0	FPM 1404.608
On/C On/C	0.
• 0 2 7 Conv 0	FPM 658.0887

**The VP ◄► FPM function begins with the last displayed value. If FPM is not displayed with the first press of Conv 0, continue pressing 0 until FPM is displayed.*

Converting FPM

Calculate the velocity pressure if the feet per minute (FPM) is 500:

KEYSTROKE	DISPLAY
On/C On/C	**0.**

Enter 500 FPM to calculate velocity pressure (VP):

5 0 0 Conv 0 0*	**VP 0.015586**

**The VP ◄► FPM function begins with the last displayed value. If VP is not displayed with the first press of Conv 0, continue pressing 0 until VP is displayed.*

RIGHT ANGLE/FRAMING

Degree of Pitch

If the degree of pitch is 30.45°, what is the percent grade, slope and pitch in inches?

KEYSTROKE	DISPLAY
On/C On/C	0.
3 0 • 4 5 θ	<Ø 30.45°
θ	%GRD 58.78702
θ	SLP 0.58787
θ	PTCH 7-1/16 INCH

Note: To convert Pitch in Inches: Simply enter the pitch in inches first (e.g., 7 Inch θ), then continuously press the θ key to calculate the pitch conversions, as above.

Angle and Hypotenuse

Find the diagonal (hypotenuse) and degree of angle of a right triangle that is 9 feet high and 12 feet long:

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter rise and run:	
9 Feet y	Y 9 FEET 0 INCH
1 2 Feet x	X 12 FEET 0 INCH
2. Solve for diagonal/hypotenuse and pitch in inches and degree of angle:	
r	R 15 FEET 0 INCH
θ	<Ø 36.8699°
θ θ θ	PTCH 9 INCH

Common Rafter Length

Find the point-to-point length of the common rafter on a 7/12-pitched roof with a span of 28 feet. What are the angle cuts?

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter pitch:	
7 Inch θ	**PTCH 7 INCH**
2. Enter half the span as the run:	
2 8 Feet ÷ 2 =	**14 FEET 0 INCH**
x	**X 14 FEET 0 INCH**
3. Find the Common and cuts:	
r	**R 16 FEET 2-1/2 INCH**
r	**PLMB 30.25644°**
r	**LEVL 59.74356°**

Regular Hip/Valley and Jacks

A roof's pitch is 9/12 and half the total span is 6 feet. Find the lengths of the Common, Hip/Valley and Jack rafters. Also find the cut angles:

Note: Jack rafters are set at 16" on-center spacing; to change on-center, use **Jack** *— e.g., for a 17" o.c., enter* 1 7 **Jack**.

KEYSTROKE	DISPLAY
On/C **On/C**	**0.**
1. Find the Common rafter length:	
6 **Feet** **x**	**X 6 FEET 0 INCH**
9 **Inch** **θ**	**PTCH 9 INCH**
r *(Common)*	**R 7 FEET 6 INCH**
2. Find the Hip/Valley rafter length and cut angles; then Jack rafter lengths and cut angles:	
Hip/V	**H/V 9 FEET 7-1/4 INCH**
Hip/V	**PLMB 27.94°***
Hip/V	**LEVL 62.06°***
Hip/V	**CHK1 45.°**
Jack	**JKOC 16 INCH**
Jack	**JK 1 5 FEET 10 INCH**
Jack	**JK 2 4 FEET 2 INCH**
Jack	**JK 3 2 FEET 6 INCH**
Jack	**JK 4 0 FEET 10 INCH**

(Cont'd)

(Cont'd)

KEYSTROKE	DISPLAY
Jack	JK 5 0 FEET 0 INCH
Jack	PLMB 36.87°*
Jack	LEVL 53.13°*
Jack	CHK1 45.°

**Angle answers are rounded.*

Irregular Hip/Valley

A roof has a 9/12 pitch, an irregular pitch of 8/12, and half the span is 6 feet 7 inches. Solve the hip/valley length. On-center spacing is 16" (default):

KEYSTROKE	DISPLAY
On/C On/C	0.

1. Find Common rafter length:

9 Inch θ	PTCH 9 INCH
6 Feet 7 Inch x	X 6 FEET 7 INCH
r	R 8 FEET 2-3/4 INCH

2. Enter irregular pitch and find irregular Hip rafter:

8 Inch Conv Hip/V	IPCH 8 INCH
Hip/V	IH/V 11 FEET 0-7/8 INCH

STAIRS

Stairs — *Given Rise and Run*

You're going to build a stairway that has a floor-to-floor height of 10 feet 1 inch, a run of 12 feet 5 inches, and a desired riser height of 7-1/2 inches (default). Find the following: riser height, number of risers, riser overage/underage (if any), tread width, number of treads, tread overage/underage (if any), stairwell opening, stringer length, and angle of incline:

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter rise and run:	
1 0 Feet 1 Inch y	Y 10 FEET 1 INCH
1 2 Feet 5 Inch x	X 12 FEET 5 INCH
2. Recall stored 7-1/2" desired riser height and find stair values:	
Rcl Stair	STORED R-HT 7-1/2 INCH
Stair	R-HT ↑ 7-9/16 INCH
Stair	RSRS 16.
Stair	R+/– 0 INCH
Stair	T-WD ↑ 9-15/16 INCH
Stair	TRDS 15.

(Cont'd)

(Cont'd)

KEYSTROKE	DISPLAY
Stair	T+/– 0-1/16 INCH
Stair	OPEN 9 FEET 10-1/4 INCH
Stair	STRG 15 FEET 7-5/16 INCH
Stair	INCL 37.27136°

APPENDIX

Preference Settings

See large User's Guide for details.

Battery and Warranty Information

See large User's Guide for details.

• Your calculator uses Two (2) LR44 batteries.

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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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