SONIN®

InchMate®+

Reference Guide

Professional Foot / Inch / Fraction Calculator

Model DT110 CE

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INTRODUCTION

If you build or design things you know the importance of working with accurate dimensions. The most frustrating and costly construction headaches can usually be traced to dimensional errors.

INCHMATE+ is a calculator for people who work with dimensions. The simple measurements – **Foot-Inch-Fraction** (or **fif**) – you make with rulers and tape measures become difficult and tedious when you try to add and subtract them ... let alone multiply and divide.

***INCHMATE+* calculates these dimensions automatically.**

INCHMATE+ was designed to be incredibly easy to use. It has a patented "self-prompting" system leading you through the process of entering **Foot-inch-Fraction** (or **fif**) dimensions.

INCHMATE+ accepts inputs to 1/16"... the practical limit of accuracy for common building and design projects.

GETTING STARTED

If you are familiar with simple hand-held calculators, the ***INCHMATE+*** keyboard looks similar, with one exception: the 6 gray and green keys are used to enter dimensions of **Foot-inch-Fraction** (or **fif**). Detailed functional definitions for these and other keys are found on pages 5 - 9. However, the best way to get to know your ***INCHMATE+*** is to start off by solving a simple dimensioning Problem.

2'- 9 11/16" + 17'- 5 3/4" = ??

Turn ***INCHMATE+*** on with the switch located to the right of the label. The mode indicator in the upper left corner of the display indicates it's in the **Foot-Inch-Fraction** mode.

The blinking **"FT"** is prompting you to enter the number of **FEET** in the first dimension.

Press: [2] and [ENTER] to move to the **INCH** field.

The display shows the number of **FEET** and the blinking **"IN"** is prompting you to enter **INCHES**:

GETTING STARTED

Press: [9] and [ENTER] to move to the **NUMERATOR** field.

Now both the **FOOT** and **INCH** digits are showing in the display, and the **numerator** (upper half) of the **FRACTION** is blinking:

Press: [1] [1] and [/ 16] to complete the entry.

The first dimension, **2'- 9 11/16"**, now appears in the display, just as you would write it. The function and second dimension are entered in the same left-to-right order, beginning with the function sign:

Press: [+] [1] [7] [ENTER]
[5] [ENTER] [3] [/ 4] [=]

Answer: 20'- 3 7/16"

KEY PAD INFORMATION

GENERAL PURPOSE KEYS

[on off] Turns calculator ON and OFF. To save the battery, calculator will turn off automatically after about 5 minutes of non use.

[·CE ··C] Pressing this key once clears the current entry. Pressing it twice clears display to "0". Memory register is not affected.

[STO] Stores the value displayed to the memory register, where it remains until another value is stored. **"MEMORY"** label on the display signals a value is in the memory register. Values stay in memory even after calculator is turned off. To clear memory label store "0" into memory.

Note: The **[STO]** function is not available for **Number** mode calculations.

[2nd FN] RCL [STO] Recalls to the display the value stored in memory register, without clearing that value.

[0] to [9] Enters the numbers 0 thru 9 into the display.

KEY PAD INFORMATION

[+] [−] [×] [÷] Performs arithmetic operation – the display "blinks" to confirm the key press.

[=] Completes all previously entered arithmetic operations and displays the result. See page 21 for the use of this key with constants.

[·] Enters a decimal point when in the **df, m** or **number mode**.

[2nd FN] Activates the "2nd function" of designated keys. Display blinks until a "2nd function" key is pressed. Press again to stop blinking.

[2nd FN] [X^2 =] Calculates the square of the value displayed. A **fif** or **if** display will automatically change to **df** when squared.

[2nd FN] [$\sqrt{X}$ C] Calculates the square root of the value displayed. A **fif** or **if** display will automatically change to **df** when the square root is taken.

KEY PAD INFORMATION

DIMENSION KEYS

[fif•df•m modes] Converts between **Foot-Inch-Fraction (fif), Decimal Feet (df) and Meters (m)**. The small labels at the top of the display indicate which mode you're in. Switching modes works in both directions.

[ENTER] When in **fif** mode, this key ends a **FEET** or **INCH** entry and advances to the next input position.

[/ 2] [/ 4] [/ 8] [/ 16] When in **fif** mode, these denominator keys will complete your **FRACTION** entries.

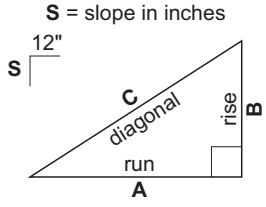
[2nd FN] [fif • if A] Changes display format between **Foot-Inch-Fraction (fif)** and **Inch-Fraction (if)**. Functional only when starting in the **fif** or **if** modes.

[2nd FN] [number mode fif•df•m modes] Puts calculator into the **number modes** where it works as a normal calculator (no dimensions) Return to the **fif** mode anytime by pressing [fif•df•m modes] again.

KEY PAD INFORMATION

TRIANGLE KEYS

Enter any 2: **A, B, C,** or **S** and automatically solve for the other 2.



If any 2 of the above values are entered pressing **A, B, C,** or **S** will display the calculated or stored value of the key.

The triangle key values are retained in memory even after **INCHMATE+** is turned off.

[A] **"run"** – Press keys after an entry or a calculated result is displayed to enter that value into **"run"** memory or to recall.

[B] **"rise"** – Press keys after an entry or a calculated result is displayed to enter that value into **"rise"** memory or to recall.

KEY PAD INFORMATION

[C] **"diagonal"** – Press keys after an entry or a calculated result is displayed to enter that value into **"diagonal"** memory or to recall.

[2nd FN] [S B] **"slope"** – Press keys after an entry or a calculated result is displayed to enter that value into **"slope"** memory or to recall.

Remember: "slope" is always **"rise"** in **INCHES** over a **"run"** of 12 inches.

EXAMPLE PROBLEM

WORKING IN INCHES & FRACTIONS

Given a string of dimensions in inches and fractions find the total.

39 5/8" + 147 3/16" = ??

From the **Foot-inch-Fraction mode**...

Press: [2nd FN] [fif • if A]

Note: From now on all entries will be in inches and fractions.

Press: [3] [9] [ENTER]
[5] [/ 8] [+]
[1] [4] [7] [ENTER]
[3] [/ 16] [=]

Answer: 186 13/16"

To return to **Foot-inch-Fraction** mode

Press: [2nd FN] [fif • if A]

If there is a value in the display it will toggle between the **fif** and **if** formats.

EXAMPLE PROBLEM

NORMAL CALCULATOR USE

56.75 x 18 = ??

From any mode ...

Press: [2nd FN] [number mode fif•df•m modes]

Note: From now on all entries will be non dimensional.

Press: [5] [6] [·] [7] [5]
[×] [1] [8] [=]

Answer: 102.15

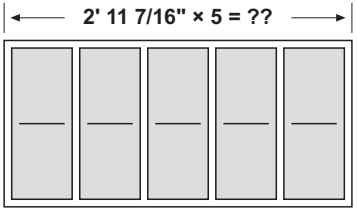
Return to **fif** mode anytime by ...

Pressing: [number mode fif•df•m modes]

EXAMPLE PROBLEM

CARPENTRY - ROUGH OPENING

Given 5 windows, each 2'- 11 7/16 wide, find their overall width if they are placed side-by-side in a wall.



Press: [2] [ENTER]
[1] [1] [ENTER]
[7] [/ 16] [×] [5] [=]

Answer: 14.765625'

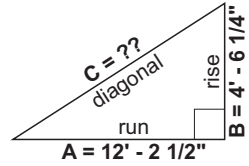
Press: [fif•df•m modes] to see the **fif** answer

14'- 9 3/16"

EXAMPLE PROBLEM

CARPENTRY - RAFTER LENGTH

Right triangle problems are easy with ***INCHMATE+***. In this example enter the two known sides, A and B, and press [C] to automatically solve for the 3rd side:



Press: [1] [2] [ENTER] [2] [ENTER]
[1] [/ 2] [A]
[4] [ENTER] [6] [ENTER]
[1] [/ 4] [B]

To find the unknown Rafter Length:

Press: [C]

Answer: 13'- 0 1/4"

Note: Press **A**, **B**, **C**, or **S** to review the 4 variables associated with this right triangle.

EXAMPLE PROBLEM

CARPENTRY - STAIR RISERS

Given 8'- 10 3/ 4" for a Floor-to-Floor dimension, how many risers will be required approximately 8" high? What is the exact height of each riser?

Press: [8] [ENTER] [1] [0] [ENTER]
[3] [/ 4] [STO]

Remember: Store in memory for later use.

Press: [÷] [ENTER] [8] [=]

Answer: 13.34375'

Remember: The answer reads as 13 units (risers) plus a remainder. If the answer is 13.4 or less round down to 13 risers.

To find the dimension of each riser you must now recall the Floor-to-Floor dimension from memory...

Press: [2nd FN] [RCL STO] [÷] [1] [3] [=]

Answer: 0.6842948'

EXAMPLE PROBLEM

Remember: To see the answer in **fif** you must convert from **Decimal Feet** (or **df**).

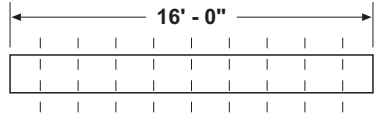
Press: [fif•df•m modes] to see the **fif** answer :

0' - 8 3/16"

Important: Turn to page 29-30 for help with possible rounding errors in division problems.

EXAMPLE PROBLEM

CARPENTRY - BOARD CUTTING



How many 9 1/2" pieces can be cut from a 16' long 2" x 4".

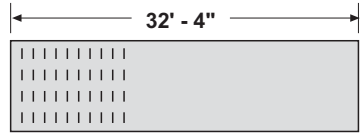
Press: [1] [6] [÷] [ENTER]
[9] [ENTER] [1] [/ 2] [=]

Answer: 20.2 10526'

(Round down to twenty whole pieces.)

EXAMPLE PROBLEM

CARPENTRY - JOIST NUMBERS



Find the number of joists on 16" centers needed for a 32'- 4" long room.

Press: [3] [2] [ENTER] [4] [÷]
[ENTER] [1] [6] [=]

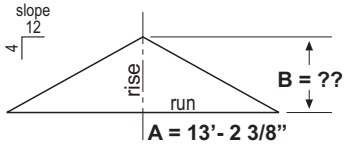
Answer: 24.25'

(Add 1 for the end = 25.25 and round up to 26.)

EXAMPLE PROBLEM

ROOF RISE

This is a useful calculation in determining wall heights. This example will figure the **RISE** of a roof knowing the **SLOPE** is 4 in 12 and the **RUN** is 13'- 2 3/8"



Remember: The **SLOPE** of a roof equals its **RISE** in **INCHES** over a **RUN** of **12"**, thus a 4/12 roof has a **SLOPE** of "4".

When using the **SLOPE** function always enter it in **INCHES**.

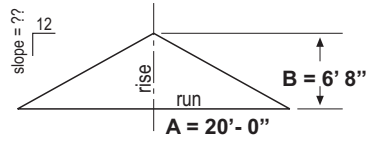
Press: ENTER 4 2nd FN S B
1 3 ENTER 2 ENTER
3 / 8 A
B

Answer: 4'- 4 13/16"

Note: Inputs may be reviewed by pressing the A or 2nd FN S B keys.

EXAMPLE PROBLEM

ROOF SLOPE - GIVEN RISE & RUN



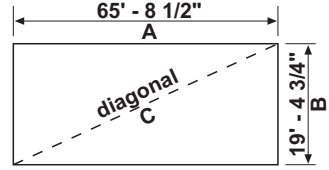
Press: 6 ENTER 8 B
2 0 A
2nd FN S B

Answer: 4"

Remember: "slope" is always "**rise**" in **INCHES** over a **"run"** of 12 inches.

EXAMPLE PROBLEMS

SQUARING A FOUNDATION



Calculate the **DIAGONAL** of the above rectangle.

Press: 6 5 ENTER 8 ENTER
1 / 2 A
1 9 ENTER 4 ENTER
3 / 4 B
C

Answer: 68'- 6 1/8"

The sides will be **SQUARE** when the **DIAGONAL** measures **68'- 6 1/8"**.

EXAMPLE PROBLEMS

MASONRY - BRICK COURSING

Using a standard brick of 2 1/4" and a 3/8 joint, create a "Coursing Table".

Press: ENTER 2 ENTER
1 / 4 +
ENTER ENTER 3 / 8 =

Answer: 0'- 2 5/8"

Remember: + = takes the value in the display and adds it to itself – then each successive press of = adds **0'- 2 5/8"** to the current total.

Press: + =

Answer: 0'- 5 1/4"

Press: =

Answer: 0'- 7 7/8"

This technique can be applied to any repetitive dimensioning problem, such as studs spaced at 16" on center.

EXAMPLE PROBLEMS

AREA OF A BEARING PLATE

Find the area (in square inches) of a bearing plate measuring 1'- 2 3/4" x 8 5/8.

Press: 1 ENTER 2 ENTER
3 / 4 ×
ENTER 8 ENTER
5 / 8 =

Answer: 0.8834635' (Sq. Ft.)

Remember: This answer is expressed in sq. feet. For sq. inches multiply by 144.

Press: × 1 4 4 =

Answer: 127.21875' (Sq. In.)

EXAMPLE PROBLEMS

AREA OF A CIRCLE

Given a circle with a radius of 7'- 7 7/8" find the area in square feet.

$A = \pi r^2$ $\pi = 3.1416$

Note: These formulas are found in the Appendix, on pages 34 and 35.

Press: 7 ENTER 7 ENTER
7 / 8
X^2
2nd FN =

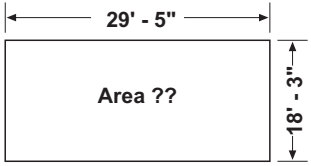
Answer: 58.618164'

Press: ×
3 · 1 4 1 6
=

Answer: 184.15482' (Sq. Ft.)

EXAMPLE PROBLEMS

AREA OF A RECTANGLE



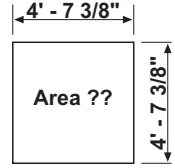
Press: [2] [9] [ENTER] [5] [×]
[1] [8] [ENTER] [3] [=]

Answer: 536.854 16' (Sq. Ft.)

Remember: Areas can only be expressed in **Decimal** format, not **Foot-Inch-Fraction** format.

EXAMPLE PROBLEMS

AREA OF A SQUARE

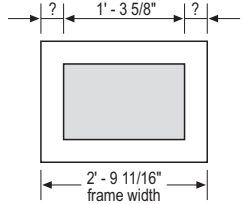


Press: [4] [ENTER]
[7] [ENTER]
[3] [/ 8]
[2nd FN] [X^2] [=]

Answer: 21.294379' (Sq. Ft.)

EXAMPLE PROBLEMS

MATTING A PICTURE



MATT WIDTH = $\frac{\text{Frame Width - Picture Width}}{2}$

Press: [2] [ENTER] [9] [ENTER]
[1] [1] [/ 16] [−]
[1] [ENTER] [3] [ENTER]
[5] [/ 8] [÷] [2] [=]

Answer: 0.752604 1'

Press [fif•df•m modes] To see the **fif** answer

0'- 9"

This is the mat space on each side of the picture.

EXAMPLE PROBLEMS

CONVERTING DIMENSIONS

21'- 7 3/16" = ?? Decimal Feet

Press: [2] [1] [ENTER]
[7] [ENTER] [3] [/ 16]
[fif•df•m modes]

Answer: 21.598958' (Dec. Ft.)

To convert the original dimension to Meters ...

Press: [fif•df•m modes]

Answer: 6.5833625 (Meters)

Remember: The label at the top of the display tells you what dimension mode you are working in. You may switch modes in either direction by depressing the [fif•df•m modes] button as the arrows indicate.

REFERENCE

CHAINING

INCHMATE+ utilizes chaining logic allowing you to carry out successive intermediate operations using the [=] key to finalize operations.

Since the chaining logic works from left to right, you must use care when combining operations such as addition and multiplication by first addressing operations within brackets.

Example: 1 + 2 x 3 + 4 = 13

Enter the values and operators as they are written and press [=] to get the answer.

Example: (1 + 2) x (3 + 4) = 21

Press: [1] [+] [2] [=] [STO]

Press: [3] [+] [4] [×] [2nd FN] RCL [STO] [=]

[STO] Puts current display into memory.

[2nd FN] RCL [STO] Can be used anytime in the midst of a chain operation and acts like a typical numerical entry.

REFERENCE

ROUNDING

INCHMATE+ rounds **Foot-Inch-Fraction** answers to the nearest 1/16" in the display, but an accurate decimal value is always contained in the internal memory.

In **DIVISION** problems, an error of up to 1/32" may be contained in answers if the numerator is not exactly divisible by 1/16". If you use such an answer repetitively, as in a stair riser calculation, this rounding error could accumulate into a larger error. There is an easy way to check if this is occurring...

Example: In the STAIR RISER problem found on page 14-15, a floor-to-floor height of 8'- 10 3 /4" is divided by 13 risers, displaying a riser height of 8 3/16 ". To check for an error in this answer, first clear the calculator. Then enter 8 3/16" and multiply it by 13 risers...

Press: [CE C] [CE C]
[ENTER] [8] [ENTER] [3] [/ 16] [×]
[1] [3] [=]

Answer: 8.86979 16'

Since this result is 5/16" less than the original 8'-10 3/4", YOU must lay out each riser a hair more than 8 3/16.

Remember: Only calculations using the DIVISION function can produce an error. The error will never exceed 1/32", so you only need to check the result of such calculations if you intend to multiply it by a large enough number to accumulate a significant error.

ERROR / OVERFLOW

An error/overflow condition occurs when the result of a calculation has more than 8 digits to the left of the decimal point, or when you attempt to divide a value by zero.

An error/overflow condition is indicated by the "**ERROR**" label in the upper right corner of the display. You must clear the calculator display by pressing the [CE/C] key twice before continuing operations. Clearing an error/overflow condition will not clear values stored in the memory registers.

CARE

Don't leave calculator in direct sunlight for long periods, or store it where excessive temperatures are possible.

Don't leave the calculator on when not in use. (NOTE - To save the battery, calculator will turn off automatically after about 5 minutes of non use.)

BATTERIES

This unit requires one 3V lithium battery (CR2016 or equivalent) The average battery operating life is 1000 hours. When the display slows down and/or becomes dim, it is time for a new battery.

To change batteries:

1. Turn power off.
2. Remove screw from battery lid.
3. Before removing battery, be sure to touch a metal object. This is to avoid any accidental discharge of static electricity, which may harm the circuit board.
4. Install new battery with the (+) side up.

RESETTING YOUR CALCULATOR

To reset your calculator, turn unit over and see “RESET”. Press with point of ball point pen. You calculator is now reset.

NOTE: RESETTING YOUR CALCULATOR WILL ERASE ANYTHING IN MEMORY.

CONVERSION TABLES

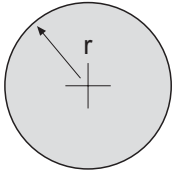
1 square inch	= 6.4515 sq centimeters
1 square foot	= 144 square inches
1 square foot	= 0.92903 sq meters
1 square yard	= 9 square feet
1 square yard	= 0.836127 sq meters
1 cubic inch	= 16.3871 cu centimeters
1 cubic foot	= 1728 cubic inches
1 cubic foot	= 0.02831 cu meters
1 cubic yard	= 27 cubic feet
1 cubic yard	= 0.76455 cu meters
1 mile	= 5,280 feet
1 mile	= 1.609344 kilometers
1 acre	= 43,560 square feet
1 ounce	= 28.349532 grams
1 pound	= 0.4535924 kilograms
1 (U.S.) gallon	= 3.7854118 liters
1 (U.K.) gallon	= 4.546090 liters
1 fluid ounce	= 29.574 milliliters
Fahrenheit	= 9/5 (C) + 32
Centigrade	= 5/9 (F - 32)
pi (π)	= 3.141593

APPENDIX

AREA FORMULAS

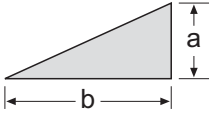
Circle

$$\pi r^2$$



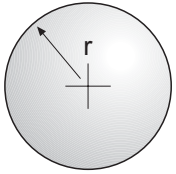
Triangle

$$\frac{ab}{2}$$



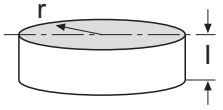
Sphere

$$4\pi r^2$$



Cylinder

$$2\pi r(r+l)$$

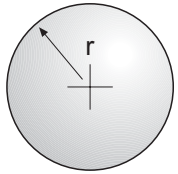


APPENDIX

VOLUME FORMULAS

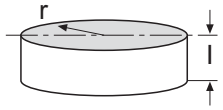
Sphere

$$\frac{4\pi r^3}{3}$$



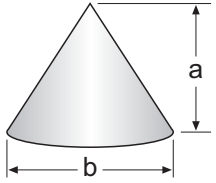
Cylinder

$$\pi r^2 l$$



Cone

$$\frac{\pi b^2 a}{12}$$



APPENDIX

LUMBER SIZES

Normal Size	Actual Size (S4S)
1" x 2"	3/4" x 1 1/2"
1" x 3"	3/4" x 2 1/2"
1" x 4"	3/4" x 3 1/2"
1" x 6"	3/4" x 5 1/2"
1" x 8"	3/4" x 7 1/4"
1" x 10"	3/4" x 9 1/4"
1" x 12"	3/4" x 11 1/4"
2" x 2"	1 1/2" x 1 1/2"
2" x 3"	1 1/2" x 2 1/2"
2" x 4"	1 1/2" x 3 1/2"
2" x 6"	1 1/2" x 5 1/2"
2" x 8"	1 1/2" x 7 1/4"
2" x 10"	1 1/2" x 9 1/4"
2" x 12"	1 1/2" x 11 1/4"
4" x 4"	3 1/2" x 3 1/2"
4" x 6"	3 1/2" x 5 1/2"
4" x 8"	3 1/2" x 7 1/4"
4" x 10"	3 1/2" x 9 1/4"
4" x 12"	3 1/2" x 11 1/2"

APPENDIX

FCC STATEMENT

This device has been tested and found to comply with the limits for a Class B device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses and can radiate radio frequency energy and, if not used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase separation between the device and receiver

CUSTOMER SERVICE

TECHNICAL ASSISTANCE

If you have any questions or need technical assistance, e-mail to:

technicalsupport@sonin.com

CUSTOMER SERVICE

SONIN takes pride in offering unmatched customer service to owners of SONIN products. If you have any questions or would like additional information, please call:

1 - 800 - 223 - 7511 (USA)

or e-mail to:

customerservice@sonin.com