

USER'S GUIDE

PIPE TRADES PRO™

Advanced Pipe Trades Math Calculator



Model 4095

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CALCULATED INDUSTRIES®

FAST. ACCURATE. RELIABLE.

Designing and building a new calculator like the *Pipe Trades Pro™* Advanced Pipe Trades Math Calculator could not have been done without the support of pipefitting and plumbing professionals. Calculated Industries gratefully acknowledges the many individuals and organizations who were so generous with their time and expertise.

- *United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada*
 - *David Kendrick, Secretary-Business Manager, Greater Kansas City Building and Construction Trades Council, AFL-CIO*
 - *Sprinkler Fitters Local 314*
 - *Plumber & Gas Fitters Local 8*
 - *Pipe Fitters Local 533*
- *Neil M. McCain, McCain Institutes*
- *Pete Nicacio, Training Coordinator, Plumbers & Steamfitters 598*
- *John Williams, Plumbing Technology Instructor, Kirkwood Community College*
- *Pipe Fitters Local 350*
- *James Witt, Instructor, Plumbers and Pipefitters Local 469*

PIPE TRADES PRO

The Pipe Trades Pro™ Advanced Pipe Trades Math Calculator has been specifically designed for today's pipe trade professionals. No matter what Pipe Trade you work in, you'll find it easy to use, fast, accurate, and reliable. Quickly calculate Offsets, Rolling Offsets, and Cutbacks. Immediately access Pipe Material and Type data, and Pipe Size dimensions. The *Pipe Trades Pro* will help you on the jobsite or in the office.

- *Built-in data and Pipe Sizing for 7 different Piping Materials*
- *Linear and Rolling Offset Solutions for Known and Unknown Fitting Angles*
- *Fitting Take-out and Cut Mark Solutions*
- *Cutback Solutions*
- *Trigonometric Solutions*
- *Circle, Circumference and Area Solutions*
- *Fractional Feet-Inch Input/Output*
- *Simple US/Metric and Flow Conversions and Solutions*
- *Problems Involving All Architectural Fractions — 1/2-1/64ths*
- *And more*

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GETTING STARTED

You may want to practice getting a feel for your calculator keys by reading through the key definitions and learning how to enter basic feet-inch-fractions and metric, how to store values in Memory, etc., before proceeding to the examples.

Order of Operations

Unlike other Calculated Industries calculators, which use the Chaining Method of Operations, this calculator uses the Order of Operation Method.

- Chaining Method (“as entered”): $10 + 4 \times 5 = 70$
- Order of Operations: $10 + 4 \times 5 = 30$

The Order of Operations method of computing is based on the following order of precedence:

- 1) Expressions inside of parentheses
- 2) Single-variable functions that perform the calculation and display the result immediately (trig functions, square, square root, x^y , percent, reciprocal, angle conversions)
- 3) Multiplication and division
- 4) Addition and subtraction
- 5) Equals (completes all operations)

If you need to calculate using the Chaining Method, you can change this in your calculator Preference Settings.

Using Parentheses

Your calculator has parentheses keys **(** and **)** for performing mathematical operations. (In the Order of Operations method, expressions inside of parentheses are performed first.)

The calculator offers up to 21 levels of parenthesis:

- 1) First parenthesis level opened – press **(** for one right-sided parenthesis.
- 2) Second level opened – press **(** a second time for two right-sided parentheses **((**.
- 3) Third level opened – press **(** a third time for three right-sided parentheses **(((**.****
- 4) Fourth level opened – press **(** a fourth time for four right-sided parentheses **((((**.

Numbers of levels greater than four are shown in the upper left corner of the display.

KEY DEFINITIONS

Basic Function Keys

On/C ***On/Clear Key*** – Turns on power. Pressing once clears the last entry and the display. Pressing twice clears all non-permanent values.

Off ***Off*** – Turns all power off. Clears all non-permanent memory.

+ - × ÷ = ***Arithmetic operation keys***

0 - 9
and **.** ***Keys used for entering numbers.***

Conv ***Convert*** – Used with the dimensional keys to convert between units or with other keys to access special functions.

Stor ***Store*** – Used for storing values.

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

Conv Rcl ***Memory Clear (M-R/C)*** – Clears Memory without changing current display.

M+ ***Accumulative Memory*** – Adds value to Accumulative Memory.

Conv M+ ***(M-)*** – Subtracts value from Accumulative Memory.

Dimensional Function Keys

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

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

/ ***Fraction Bar*** – 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. Results are always shown in typical building fractional format.

Conv 1 ***Gallons per Minute (gpm)*** – Enters or converts to gallons per minute.

Conv 2 ***Liters per Second (l/s)*** – Enters or converts to liters per second.

Conv 4 ***Cubic Feet per Minute (cfm)*** – Enters or converts to cubic feet per minute.

Conv 5 ***Cubic Feet per Second (cfs)*** – Enters or converts to cubic feet per second.

Conv 3 ***Degrees Celsius (°C)*** – Enters or converts to degrees Celsius.

Conv 6 ***Degrees Fahrenheit (°F)*** – Enters or converts to degrees Fahrenheit.

mm ***Millimeters*** – Enters or converts to millimeters.

Conv mm ***Meters (m)*** – Enters or converts to meters.

Conv 8 ***Gallons*** – Enters or converts to gallons.

Conv 9 ***Liters*** – Enters or converts to liters.

Weight/Volume Functions

Stor **+** **Weight/Volume** – Stores a new weight volume as pounds per cubic feet or other format as shown below. Default value is 62.42796 pounds per cubic foot of water (1000 kg/m³).

- Pounds per cubic foot
- Pounds per cubic inch
- Pounds per gallon
- Kilograms per cubic meter
- Kilograms per liter

Conv **7** **Pounds (lbs)** – Enters or converts a weight or volume value to pounds.

Conv **/** **Kilograms (kg)** – Enters or converts a weight or volume value to kilograms.

Circle Key

Circle **Circle** – Enters diameter and calculates circle area and circumference.

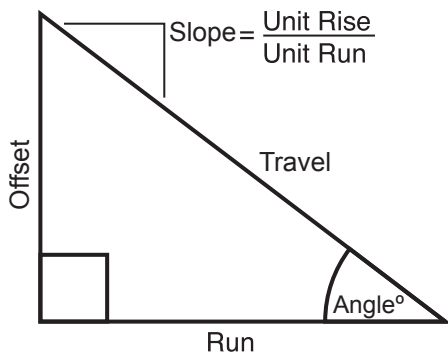
Trigonometric Keys

Sine Finds the sine of a degree or undimensioned value.
Conv **Sine** **Arcsine ($\sin^{-1}$)** – Gives the angle in degrees for the Sine value.

Cos Finds the Cosine.
Conv **Cos** **Arccosine ($\cos^{-1}$)** – Gives the angle in degrees for the Cosine value.

Tan Finds the Tangent.
Conv **Tan** **Arctangent ($\tan^{-1}$)** – Gives the angle in degrees for the Tangent value.

Pipefitting Project Keys



Angle/Slope

Angle/Slope – Enters or calculates a linear Slope, Slope Angle, or Percent Grade. The linear slope is the amount of "Offset" over 12 inches of "Run." Values may be entered as:

- a Dimension: **9** **Inch** **Angle/Slope**
- an Angle or Degrees: **4** **5** **Angle/Slope**
- a Percentage (percent grade): **7** **5** **Conv** **←** **Angle/Slope**

Once an angle or slope has been entered, consecutive presses of **Angle/Slope** will convert to the remaining formats listed above.

Conv

Angle/Slope

Take-Out (T.O./Arc) – Used to enter or solve fitting Take-Outs when calculating pipe cut lengths. Calculates inner, center, and outer arc lengths for marking field cut fittings.

Offset

Calculates or enters the Offset (Rise).

Conv

Offset

Welder's Gap – Defines the Welder's Gap subtracted from the end to end pipe length calculation. Default value is 1/8", 0 is a valid value.

Run

Enters or calculates the Run.

Travel

Enters or calculates the Travel (Diagonal).

**Pipe
Mat'l**

Pipe Material – Defines the Pipe Material. (Steel, Stainless Steel, Brass, Aluminum, Cast Iron, PVC or Copper).

Conv**Pipe
Mat'l**

Elbow Type – Defines the type of radius (long or short) and whether a factory or field cut 45° Butt Weld elbow is being used. Default value is Butt Weld — Long.

**Pipe
Size**

Pipe Size – Enters the nominal Pipe Size and provides data pertaining to the entered size.

Conv**Pipe
Size**

Pipe Type – Defines the Pipe Type based on Pipe Material.

Conv**Run**

Cutback – Calculates pipe Cutback after Bend Angle and Offset are entered.

Conv**Travel**

Rolling Offset (Roll)– Calculates Rolling Offset pipe length.

Conv**(**

Flow – Enter or calculate volumetric Flow Rate through a pipe.

Conv**)**

Velocity – Enter or calculate Velocity and convert between feet per second, feet per minute, and meters per second.

Conv**Circle**

Pressure – Enter Pressure value. Calculate Pressure loss. Convert between units of pressure.

Conv**x²**

Force – Enter or calculate Force and convert between lbf, newton.

Conv**√ x²**

Area – Enter pipe area for use in Flow, Velocity, Pressure, and Force calculations. Calculate Area given values for Flow/Velocity or Force/Pressure.

Miscellaneous Functions

	Open parenthesis key
	Close parenthesis key
	Enters an exponential value other than x^2 or Square Root.
	Exponential Root Value – Enters the exponential root value ($x^{1/y}$).
	Pi – Displays value of π (3.141593).
	Reciprocal (1/x) – Finds the reciprocal of a number (e.g.,   0.125).
	Change Sign (+/-) – Toggle displayed value between minus and plus value.
	Clear All – Returns all stored values to the default settings. (Does not affect Preference settings.)
	Squares the value in the display.
	Square Root – Calculates the Square Root.
	Cost - Cost function
	Store unit cost
	Degrees:Minutes:Seconds – Converts between D:M:S and decimal degree formats; repeated presses will toggle between the two formats.
	Paperless tape
	Preference settings
	Backspace Function – Used to delete entries one keystroke at a time (unlike the  function, which deletes the entire entry).
	Percent function
	Used to store values in Memory registers 1 through 9.

PREFERENCE SETTINGS

HOW TO SET PREFERENCES

The following sections detail Preference Setting options for the *Pipe Trades Pro* calculator.

Enter the Preference Mode by pressing **Conv Stor** (Prefs). Access each category by pressing the **Stor** key until you reach the desired setting. Within each category, press the **+** or **-** keys to toggle between individual selections. Press **On/C** to exit and set your Preference.

Note: Press **+** to advance and press **-** to back up. Pressing the **Stor** key continuously in this mode will cycle through all of the Preference Settings.

You may change these settings at any time by repeating the above, and setting in a new preference.

To reset preferences back to factory default settings, turn your calculator off, hold down the **X** key and turn the calculator back on.

For example, if you wish to display all your dimensional area answers in square meters, press **Conv Stor Stor** (Area Std), then the **+** key until “**AREA 0. SQ M**” is displayed. Simply exit this mode by pressing **On/C** and all your future area answers will be displayed in square meters.

KEYSTROKE

DISPLAY

Conv Stor

(Fractional Resolution)

+

+

+

+

+

+

+ (repeats options)

FRAC 0-1/16 INCH

FRAC 0-1/32 INCH

FRAC 0-1/64 INCH

FRAC 0-1/2 INCH

FRAC 0-1/4 INCH

FRAC 0-1/8 INCH

FRAC 0-1/16 INCH

KEYSTROKE**DISPLAY**

Second press of **Stor** :

(Area displays)



(repeats options)

AREA Std.

AREA 0. SQ FEET

AREA 0. SQ INCH

AREA 0. SQ M

AREA Std.

Third press of **Stor** :

(Volume displays)



(repeats options)

VOL Std.

VOL 0. CU FEET

VOL 0. CU M

VOL Std.

Fourth press of **Stor** :

(Meter Linear displays)

(floating point)

(repeats options)

METR 0.000 M

METR FLOAt M

METR 0.000 M

Fifth press of **Stor** :

(Decimal Degree displays)

(floating point)

(repeats options)

DEG 0.00°

DEG FLOAt

DEG 0.00°

Sixth press of **Stor** :

(Fractional mode)



(repeats options)

FRAC Std.

FRAC COntSt.

FRAC Std.

Seventh press of **Stor** :

(Mathematical Operation)



(repeats options)

MATH OrdEr

MATH CHAIIn

MATH OrdEr

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 number), pressing **/** (Fraction Bar key) and then the denominator (bottom number).

Note: If a denominator is not entered, the fractional setting value is used.

Examples of how linear dimensions are entered (press **On/C** after each entry):

DIMENSIONS

KEYSTROKE

5 feet

5 Feet

5 feet, 1 ½ inches

5 Feet 1 Inch 1 / 2

17.5 meters

1 7 . 5 Conv mm

1250 millimeters

1 2 5 0 mm

Square and Cubic Dimensions

Examples of how square and cubic dimensions are entered (press **On/C** after each entry):

DIMENSIONS

KEYSTROKE

14 square inches

1 4 Inch Inch

11 square feet

1 1 Feet Feet

3.3 square meters

3 . 3 Conv mm mm

3 cubic feet

3 Feet Feet Feet

ENTERING CONVERSIONS

Linear Conversions

Convert 10 feet 6 inches to other dimensions, including metric:

KEYSTROKE	DISPLAY
1 0 Feet 6 Inch	10 FEET 6 INCH
Conv Feet *	10.5 FEET
Conv Inch *	126. INCH
mm (mm)	3200.4 MM
Conv mm (m)	3.200 M

*Repeated presses of **Feet** or **Inch** will toggle between feet-inch-fractions and decimal feet or inches.

Volume Conversions

Enter 8.5 gallons and convert to liters:

KEYSTROKE	DISPLAY
On/C On/C	0.
8 . 5 Conv 8	GAL 8.5
Conv 9	LITR 32.176

Weight/Volume Conversions

Convert 20 pounds to kilograms:

KEYSTROKE	DISPLAY
On/C On/C	0.
2 0 Conv 7 (Pounds)	20 LB
Conv 1 (Kilograms)	9.071847 KG

Convert 5 cubic feet of water to pounds. Then convert the pounds to kilograms:

KEYSTROKE	DISPLAY
On/C On/C	0.
5 Feet Feet Feet	5 CU FEET
Conv 7 (Pounds)	312.1398 LB
Conv / (Kilograms)	141.5842 KG

Convert a cubic meter of concrete to pounds. The concrete weighs 111 lbs per cubic foot:

KEYSTROKE	DISPLAY
On/C On/C	0.
1 1 1 Stor + (Wt/Vol)	111. LB PER CU FEET
1 Conv mm mm mm	1 CU M
Conv 7 (Pounds)	3919.928 LB
Conv X *	ALL CLArEd

*Restores default weight conversion to the weight of water (62.42796 lbs Per Cubic Foot).

Temperature Conversions

Enter a temperature value, then **Conv** followed by **6** or **3** for Fahrenheit or Celsius, respectively.

Convert 78 °F to a °C temperature:

KEYSTROKE	DISPLAY
On/C On/C	0.
7 8 Conv 6 (°F)	78 °F
Conv 3 (°C)	25.55556 °C

Convert 11 °C to a °F temperature:

KEYSTROKE	DISPLAY
On/C On/C	0.
1 1 Conv 3 (°C)	11 °C
Conv 6 (°F)	51.8 °F

Flow Rate Conversions

You can enter a Flow value in cubic feet per second, liters per second, cubic feet per minute, or gallons per minute, then convert to other units.

Enter 47 cfs, then convert to other units:

KEYSTROKE	DISPLAY
On/C On/C	0.
4 7 Conv 5 (cfs)	CFS 47
Conv 2 (l/s)	L/S 1330.892
Conv 4 (cfm)	CFM 2820.
Conv 1 (gpm)	GPM 21095.07

BASIC MATH OPERATIONS

Adding and Subtracting Strings of Dimensions

Add the following measurements:

- 6 feet 2-1/2 inches
- 11 feet 5-1/4 inches
- 18.25 inches

Then subtract 2-1/8 Inches.

KEYSTROKE

DISPLAY

6 Feet 2 Inch 1 / 2 +
11 Feet 5 Inch 1 / 4 +
18 • 25 Inch =
- 2 Inch 1 / 8 =

19 FEET 2 INCH
18 FEET 11-7/8 INCH

Multiplying Dimensions

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

KEYSTROKE

DISPLAY

5 Feet 3 Inch X 11 Feet
6 Inch 1 / 2 =

60.59375 SQ FEET

Dividing Dimensions

Divide 30 feet 4 inches by 7 inches:

KEYSTROKE

DISPLAY

30 Feet 4 Inch ÷ 7 Inch =

52.

Divide 20 feet 3 inches by 9:

KEYSTROKE

DISPLAY

20 Feet 3 Inch ÷ 9 =

2 FEET 3 INCH

PERCENTAGE CALCULATIONS

The **Conv** $\leftarrow$ keys 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).

Calculating Percentages

Find 18% of 500 feet:

KEYSTROKE	DISPLAY
On/C On/C	0.
5 0 0 Feet X 1 8	
Conv $\leftarrow$	90 FEET 0 INCH

Take 20% from 286 Feet 6 inches:

KEYSTROKE	DISPLAY
On/C On/C	0.
2 8 6 Feet 6 Inch - 2 0	
Conv $\leftarrow$	229 FEET 2-3/8 INCH

Add a 10% waste allowance to 275 feet of pipe:

KEYSTROKE	DISPLAY
On/C On/C	0.
2 7 5 Feet + 1 0 Conv $\leftarrow$	302 FEET 6 INCH

MEMORY OPERATION

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

FUNCTION	KEYSTROKE
Add to Memory	M+
Subtract from Memory	Conv M+
Recall total in Memory	Rcl M+
Display/Clear Memory	Rcl Rcl
Clear Memory	Conv Rcl

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** (Clear All).

When Memory is recalled (**Rcl M+**), consecutive presses of **M+** will display the calculated average and total count of the accumulated values.

Using M+

KEYSTROKE	DISPLAY
3 5 5 M+	M+ 355. M
2 5 5 M+	M+ 255. M
7 4 5 Conv M+ (M-)	M- 745. M
Rcl M+	TTL - 135. M
M+	AVG - 45. M
M+	CNT 3. M
Rcl Rcl	M+ - 135.

Using Memory Storage Keys (M1 - M9)

In addition to the standard cumulative Memory (as previously described), your calculator has nine independent Storage Registers – M1 through M9 – that can be used to permanently store single, noncumulative values. The following example shows the use of M1 (**Stor** **1**). To use M2 - M9, replace the presses of the **1** key with presses of the corresponding number key (**2** - **9**).

You can replace a value in one of these Memory registers by storing a new value in place of the stored value.

FUNCTION	KEYSTROKE
Store single value in M1	Stor 1
Clear M1	0 Stor 1
Recall M1	Rcl 1

Example: Store 175 into M1, recall the value, and then clear the value:

KEYSTROKE	DISPLAY
1 7 5 Stor 1	M-1 175.
Off On/C	0.
Rcl 1	M-1 175.
0 Stor 1	M-1 0.

PAPERLESS TAPE

The Paperless Tape allows you to display and review the last 30 entries of a calculation. **Conv** **=** accesses the tape mode and **+** or **-** scrolls forward or backward through the entries. *Note: The Paperless Tape is cleared each time **On/C** is pressed twice, the unit is shut off, or an All Clear (**Conv** **X**) is performed.*

Paperless Tape Function — Normal Mathematics

1. Enter a string of numbers:

KEYSTROKE	DISPLAY
On/C On/C	0.
4 <i>Feet</i> +	4 FEET 0 INCH
5 <i>Feet</i> +	9 FEET 0 INCH
6 <i>Feet</i> +	15 FEET 0 INCH
7 <i>Feet</i> =	22 FEET 0 INCH

2. Access the Tape function:

Conv =	TTL= 22 FEET 0 INCH
----------------------	---------------------

3. Scroll from first value and total:

+	01 4 FEET 0 INCH
+	02+ 5 FEET 0 INCH
+	03+ 6 FEET 0 INCH
+	04+ 7 FEET 0 INCH
+	TTL= 22 FEET 0 INCH

4. Scroll to last two values:

-	04+ 7 FEET 0 INCH
-	03+ 6 FEET 0 INCH

5. Exit Tape function and continue:

=*	TTL= 22 FEET 0 INCH
+	22 FEET 0 INCH
2 <i>Feet</i> =	24 FEET 0 INCH

**Displays total before exiting.*

CALCULATE COSTS

The Cost function provides the total cost for material, based on a stored unit cost and an entered quantity of material. This is convenient for quickly calculating costs on a job that requires many of the same kind of items.

Example: You are doing an installation that includes 120 feet of pipe that comes in 10' lengths at \$3.21 per 10' pipe.

KEYSTROKE

DISPLAY

Store the unit cost of the pipes needed:

On/C **On/C**

0.

3 **•** **2** **1** **Stor** **0**

COST PER 3.21

Enter the number required:

1 **2**

12

Calculate total cost:

Conv **0** (Cost)

TTL\$ 38.⁵²

You can then quickly calculate costs for a different number of the same item.

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1 **7**

17

Conv **0** (Cost)

TTL\$ 54.⁵⁷

You can also find costs of different items on the fly without overwriting your stored unit cost.

Determine the cost of 17 fittings at \$2.89 each:

KEYSTROKE

DISPLAY

Enter number of pipes needed:

On/C **On/C**

0.

1 **7**

17

Multiply by the cost:

X **2** **•** **8** **9**

2.89

Conv **0** (Cost)

TTL\$ 49.¹³

USING THE PIPE TRADES PRO

Pipe Material Key

The Pipe Material key lets you choose a pipe material, which defines the available sizes and surface roughness used by the calculator. See Appendix A on page 53 for more information. The default material for the Pipe Trades Pro is Steel, but the user can choose from material types as shown.

KEYSTROKE	DISPLAY
On/C On/C	0.
Pipe Mat'l (Steel)	MATL StEEL
Pipe Mat'l (Stainless Steel)	MATL S.StEEL
Pipe Mat'l (Brass)	MATL brASS
Pipe Mat'l (Aluminum)	MATL AL.
Pipe Mat'l (Cast Iron)	MATL CAST
Pipe Mat'l (Plastic)	MATL PLAStIC
Pipe Mat'l (Copper)	MATL COPPER

The last material setting displayed is selected, and the calculator will retain your setting even after the power has been turned off. Once a material is selected, you can easily toggle through the available types (Schedules, etc.) using the Pipe Type function (**Conv** **Pipe Size**). Available types of pipe are dependent upon the material setting.

Keystrokes below show the pipe types available for Plastic (press **Pipe Mat'l** until "PLAStIC" is shown in the display).

KEYSTROKE	DISPLAY
On/C On/C	0.
Rcl Pipe Mat'l	MATL PLAStIC
Conv Pipe Size (Schedule 40)	TYPE 40 PLAStIC

KEYSTROKE**DISPLAY****Pipe Size** (Schedule 80)**TYPE 80 PLASTIC****Pipe Size** (Schedule 120)**TYPE 120 PLASTIC****Pipe Size** (SDR 21)**TYPE SD21 PLASTIC****Pipe Size** (SDR 26)**TYPE SD26 PLASTIC****Pipe Size** (SDR 32.5)**TYPE SD32 PLASTIC****Pipe Size** (SDR 41)**TYPE SD41 PLASTIC**

You can also directly enter a Pipe Type, e.g., Schedule 80, by entering a number corresponding to the pipe type.

KEYSTROKE**DISPLAY****On/C On/C****0.****Pipe Mat'l****MATL PLASTIC****8 0 Conv Pipe Size****TYPE 80 PLASTIC****Pipe Size Key**

When you have chosen a Pipe Material and Type and then enter Pipe Size, the pipe data will be displayed.

For this example we are using 3" Steel, Schedule 80 pipe.

KEYSTROKE**DISPLAY****Conv X****0.**

1. Choose the Pipe Material:

Pipe Mat'l**MATL STEEL**

2. Enter the Pipe Type:

8 0 Conv Pipe Size**TYPE 80 STEEL**

3. Enter the Pipe Size:

3 Inch**3 INCH**

4. Toggle through the Pipe data:

Pipe Size**80 SIZE 3 INCH****Pipe Size** (Outside Diameter)**OD SIZE 3.5 INCH****Pipe Size** (Internal Diameter)**ID SIZE 2.9 INCH****Pipe Size** (Wall Thickness)**THK SIZE 0.3 INCH**

KEYSTROKE

DISPLAY

 (Material)	MATL SIZE STEEL
 (Weight per Foot)	PIPE SIZE 10.2528 LB PER FEET
 (Filled Weight/Foot)	FILL SIZE 13.11634 LB PER FEET
 (Internal Area)	AREA SIZE 6.605199 SQ INCH

Elbow Type

The Elbow Type function lets you chose between long or short radius, and between factory and field cut 45° Butt Weld (B.W.) elbow types. The default value is for long radius, factory cut 45° B.W. elbow type.

The Elbow option setting has an impact on the Take-Out calculations as the radii vary between long and short Butt Weld fittings. Additionally, factory made 45° B.W. elbow fittings can have a different Take-Out calculation from the field cut variants.

This function toggles the Elbow types between the following options:

Butt Weld – Long

Default. Use this option when utilizing 90° long radius or factory 45° long radius B.W. elbow fittings, or any odd-angle long radius fitting cut from a 90° B.W. elbow.

Butt Weld – Short

Use this option when utilizing 90° short radius or factory 45° short radius fittings, or any odd-angle short radius fitting cut in the field from a 90° B.W. elbow.

Field Cut – Long

Use this option when utilizing long radius B.W. elbows, or any odd-angle long radius fitting cut from a 90° B.W. elbow, including a 45° B.W.

Field Cut – Short

Use this option when utilizing short radius B.W. elbows, or any odd-angle short radius fitting cut from a 90° B.W. elbow, including a 45° B.W.

KEYSTROKE

DISPLAY

Conv **Pipe Mgt'l** (Default)

BW-L EL. tYPE

Pipe Mgt'l

BW-S EL. tYPE

Pipe Mgt'l

FC-L EL. tYPE

Pipe Mgt'l

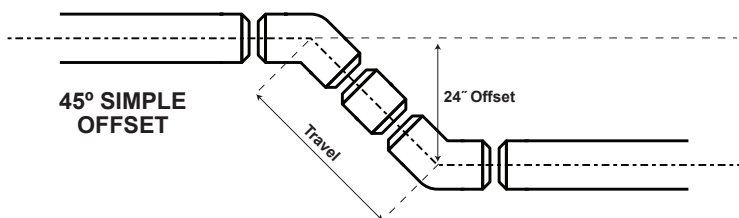
FC-S EL. tYPE

Pipe Mgt'l (Default)

BW-L EL. tYPE

Simple Offset – Known Bend Angle

Find the center-to-center travel for a pipe offset with a 24" Offset using 45° factory made long radius butt weld elbows.



KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter Offset:

2 **4** **Inch** **Offset**

OFST 24 INCH

2. Enter bend angle:

4 **5** **Angle/Slope**

∠Ø 45.00°

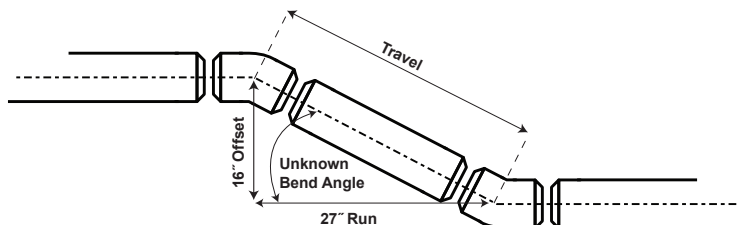
3. Find the pipe length:

Travel

TRAV 33-15/16 INCH

Simple Offset – Unknown Bend Angle

Find the center-to-center travel and unknown bend angle for a pipe offset with a 16" Offset and 27" Run.



KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter Offset:

1 **6** **Inch** **Offset**

OFST 16 INCH

2. Enter Run:

2 **7** **Inch** **Run**

RUN 27 INCH

3. Find the pipe length:

Travel

TRAV 31-3/8 INCH

4. Find the bend angle:

Angle
Slope

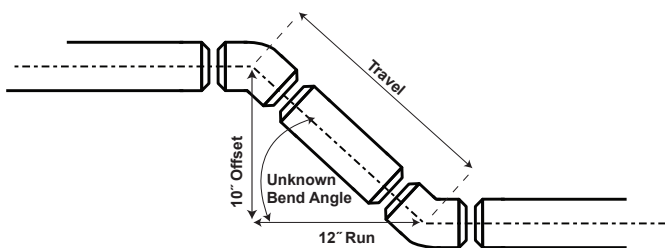
∠Ø 30.65°

Continue pressing the Travel key to view all related values.

Simple Offset – Cut Length

Find the cut length (end-to-end) for a pipe offset with a 10" Offset and a 12" Run. The bend angle is unknown. This example assumes 6" Steel, factory made long radius butt weld elbows are used. The following example shows an optional override of the Welder's Gap when working with Stainless Steel.

Note: All Take-Out calculations are based on Carbon Steel O.D. See the **Cut Length – Known Take-Out Value** example to solve Cut Lengths for known Take-Out values.



KEYSTROKE

DISPLAY

Conv **X**

ALL CLEARed

1. Select Stainless Steel:

Pipe Mat'l **Pipe Mat'l**

MATL S.StEEL

2. Enter Pipe Size:

6 **Inch** **Pipe Size**

40 SIZE 6 INCH

3. Enter 0 for Welder's Gap:

0 **Conv** **Offset**

GAP 0 INCH

4. Enter Offset:

1 **0** **Inch** **Offset**

OFST 10 INCH

5. Enter Run:

1 **2** **Inch** **Run**

RUN 12 INCH

6. Find the pipe length:

Travel

TRAV 15-5/8 INCH

Travel

CUT 9-1/8 INCH

Travel

TO 3-1/4 INCH

Travel

GAP 0 INCH

Travel

FIT° 39.81°

Travel

IARC 3-15/16 INCH

Travel

CARC 6-1/4 INCH

Travel

OARC 8-9/16 INCH

The cut length for the pipe is 9 and 1/8 inches and bend angle is 39.81°. Included in the outputs are the arc lengths to be used to cut your butt weld elbow to the calculated bend angle. These are inner arc length of 3 and 15/16 inches, center arc length of

KEYSTROKE**DISPLAY**

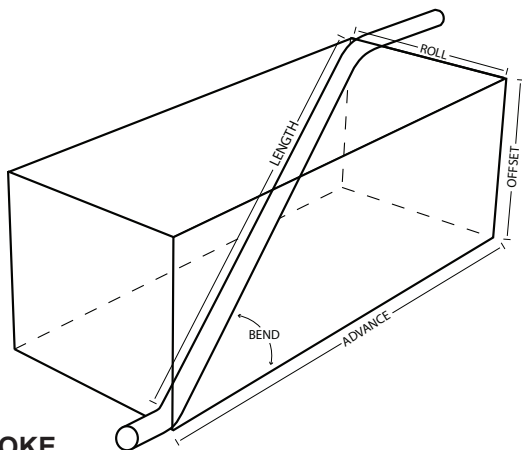
6 and 1/4 inches, and outer arc length of 8 and 9/16 inches.

Note: To return the Welder's Gap to the default 1/8", press

Conv **X** to reset your calculator back to default values.

Rolling Offset – Known Bend Angle

Find the center-to-center travel for a rolling pipe offset with a 4" Roll and a 24" Offset using 45° factory-made long radius butt weld elbows.

**KEYSTROKE****DISPLAY**

Conv **X**

ALL CLEAR**Ed**

1. Enter Offset:

2 **4** **Inch** **Offset**

OFST 24 INCH

2. Enter bend angle:

4 **5** **Angle/**
slope

∠Ø 45.00°

3. Enter the Roll and calculate the pipe length:

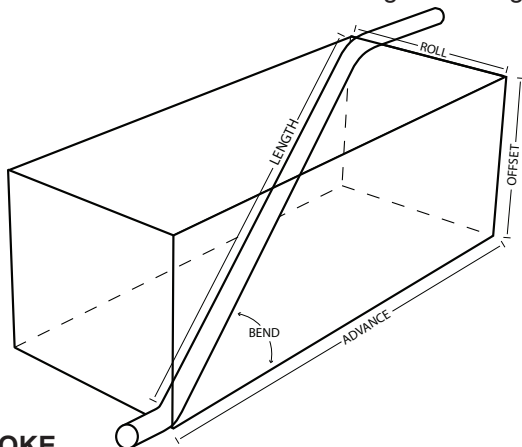
4 **Inch** **Conv** **Travel**

LNTH 34-7/16 INCH

Continue pressing the Travel key to view all related values.

Rolling Offset – Unknown Bend Angle

Find the center-to-center travel for a rolling pipe offset with a 6 1/2" Roll, a 17" Offset, and an advance of 28". The bend angle is unknown. This example assumes factory made long radius butt weld elbows will be used to create degreed fittings.



KEYSTROKE

DISPLAY

Conv **X**

ALL CLEAR**Ed**

1. Enter Offset:

1 **7** **Inch** **Offset**

OFST 17 INCH

2. Enter the advance:

2 **8** **Inch** **Run** (Advance)

RUN 28 INCH

3. Enter the Roll and calculate the pipe length and unknown bend angle:

6 **Inch** **1** **7** **2** **Conv** **Travel**

LNTH 33-3/8 INCH

Travel

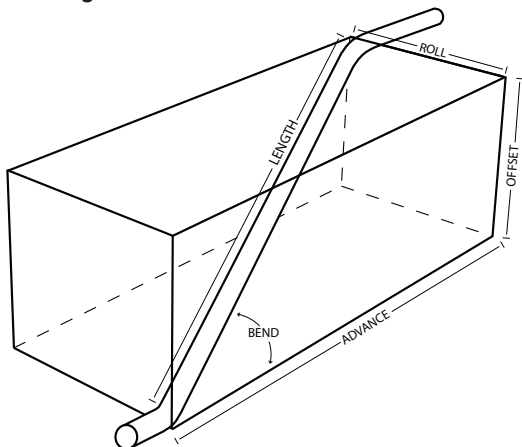
FIT° 33.02°

Continue pressing the Travel key to view all related values.

Rolling Offset – Cut Length

Find the end-to-end pipe length for a rolling pipe offset with a 13" Roll, a 24" Offset, and an advance of 32". The bend angle is unknown. This example assumes 6" Steel, factory made long radius butt weld elbows are used with a Welder's Gap of $3/32$ ". Note: the default Welder's Gap is $1/8$ ".

Note: All Take-Out calculations are based on Carbon Steel O.D. See the **Cut Length – Known Take-Out Value** example to solve Cut Lengths for known Take-Out values.



KEYSTROKE

DISPLAY

Conv X

ALL CLEARed

1. Enter Pipe Size:

6 Inch Pipe Size

STD SIZE 6 INCH

2. Change the default Welder's Gap from $1/8$ " to $3/32$ ".

3 1 3 2 Conv Offset *

GAP 0-3/32 INCH

3. Enter Offset:

KEYSTROKE**DISPLAY****2** **4** **Inch** **Offset****OFST 24 INCH**

4. Enter the advance:

3 **2** **Inch** **Run** (Advance)**RUN 32 INCH**

5. Enter the Roll and calculate the pipe length and unknown bend angle:

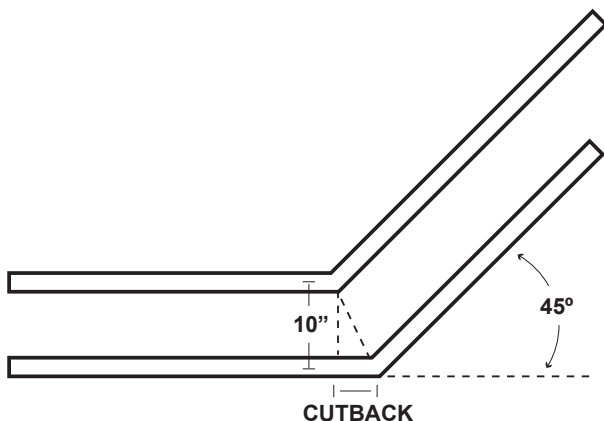
1 **3** **Inch** **Conv** **Travel** (Roll)**LNTH 42-1/16 INCH****Travel****CUT 35-1/4 INCH****Travel****TO 3-5/16 INCH****Travel****GAP 0-3/32 INCH****Travel****FIT° 40.46°****Travel****IARC 4-1/32 INCH****Travel****CARC 6-11/32 INCH****Travel****OARC 8-11/16 INCH**

***Note:** Setting welder's gap to 3/32 inch will temporarily set the outputs to 1/32 fractional resolution. To keep outputs in their current fractional resolution (default is 1/16) press **On/C** once after entering the welder's gap. For example, if you keep the fractional resolution at 1/16, the outputs above for IARC would be 4 inches, and CARC would be 6-3/8 inches.

The cut length for the pipe is 35 and 1/4 inches and bend angle is 40.46°. Included in the outputs are the arc lengths to be used to cut your butt weld elbow to the calculated bend angle. These are inner arc length of 4 and 1/32 inches, center arc length of 6 and 11/32 inches, and outer arc length of 8 and 11/16 inches.

Concentric Pipe Bend Cutback

Find the pipe Cutback when you are running pipes through a 45° bend with a 10" offset.



KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter the bend angle:

4 **5** **Angle/**
Slope

∠Ø 45.00 °

2. Enter the Offset:

1 **0** **Inch** **Offset**

OFST 10 INCH

3. Calculate the Cutback:

Conv **Run**

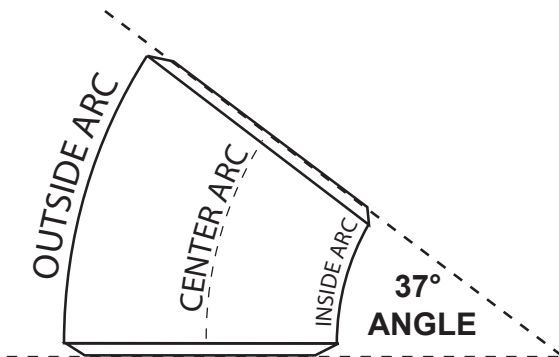
CUT 4-1/8 INCH

Calculate Take-Out and Butt Weld Elbow Cut Marks

The Take-Out function can be used to quickly solve a Take-Out and butt weld elbow cut marks for a known bend angle and Pipe Size.

Find the arc lengths for an odd bend angle of 37° for 12" pipe.

Note: All Take-Out calculations are based on Standard type steel pipes. O.D. See the **Cut Length – Known Take-Out Value** example to solve Cut Lengths for known Take-Out values.



KEYSTROKE

DISPLAY

Conv **X**

ALL CLEARed

1. Enter the Pipe Size:

1 **2** **Inch** **Pipe Size**

STD SIZE 12 INCH

2. Enter the known bend angle:

3 **7** **Angle/slope**

$\angle$ 37.00°

3. Calculate the Take-Out and Arc Lengths:

Conv **Angle/slope**

TO 6 INCH

Angle/slope

IARC 7-1/2 INCH

Angle/slope

CARC 11-5/8 INCH

Angle/slope

OARC 15-3/4 INCH

Continue pressing the **Angle/slope** key to view all related values.

Cut Length – Known Take-Out Value

The Pipe Trades Pro can solve cut lengths for materials and fittings not currently built into the calculator by entering a known Take-Out value.

Find the cut length (end-to-end) for a pipe offset with a 10" Offset and bend angle of 45°. This example assumes 4" Type 40 PVC, with a known Take-Out value of 2 and 3/16 inches.

Note: Override the Welder's Gap for this example.

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Select PVC: Pipe Matl (press until PLASTIC is displayed)	PLASTIC
2. Enter Pipe Size: 4 Inch Pipe Size	40 SIZE 4 INCH
3. Enter Offset: 1 0 Inch Offset	OFST 10 INCH
4. Enter bend angle: 4 5 Angle/Slope	∠Ø 45.00°
5. Enter known Take-Out: 2 Inch 3 / 1 6 Conv Angle/Slope	TO 2-3/16 INCH
6. Enter 0 for Welder's Gap: 0 Conv Offset	GAP 0 INCH
7. Find the pipe cut length: Travel Travel Travel	TRAV 14-1/8 INCH CUT 9-3/4 INCH TO 2-3/16 INCH

Continue pressing the **Travel** key to view all related values.

The cut length for the Type 40 PVC pipe is 9 and 3/4 inches when using 4", 45° fittings with a user-defined Take-Out value of 2 and 3/16 inches.

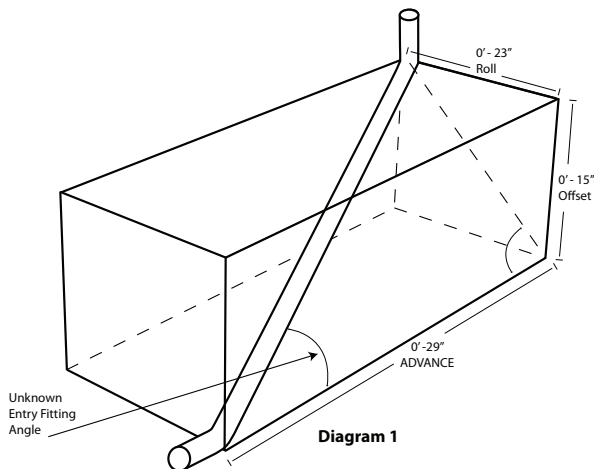
Note: To return the Welder's Gap to the default 1/8", press **Conv X** to reset your calculator back to default values.

Combination Rolling Offset

Unlike a regular rolling offset, the entry and exit fittings for a combination rolling offset are on different planes and therefore have different fitting angles from each other.

Horizontal to Vertical

Find the pipe length, and entry and exit fitting angles for a combination rolling offset with a vertical pipe exit, given a Roll of 23", Offset of 15", and Advance of 29". Use the box in Diagram 1 to review the entry and exit pipe perspectives.



KEYSTROKE

Conv **X**

1. Solve for the pipe length and entry fitting angle

1 **5** **Inch** **Offset**

2 **9** **Inch** **Run** (Advance)

2 **3** **Inch** **Conv** **Travel** (Roll)

Travel

DISPLAY

ALL CLEAR**Ed**

OFST 15 INCH

RUN 29 INCH

LNTH 39-15/16 INCH

FIT° 43.44°

Do not clear or reset the calculator.

If the box is oriented in a 2-dimensional perspective (Diagram 2),

a triangle is formed which will allow for an easy solution of the exit fitting angle in step 2.

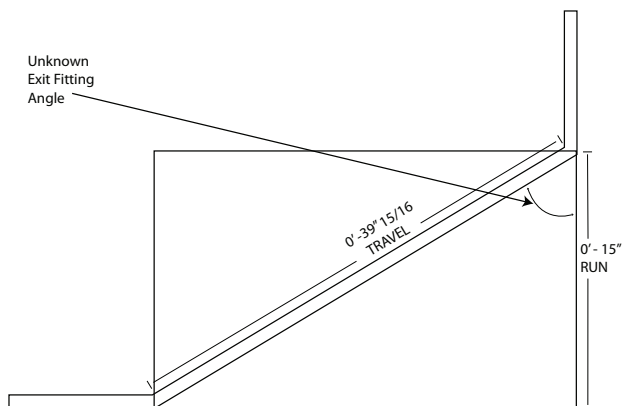


Diagram 2

2. Next, use the Pipe Trades Pro's built-in right-angle functions to solve the triangle in Diagram 2 and calculate the exit fitting angle. Use the pipe length from step 1 as your Travel.

KEYSTROKE

DISPLAY

On/C **Conv** **Travel** **Travel** **=**

39-15/16 INCH

Travel

TRAV 39-15/16 INCH

1 **5** **Inch** **Run**

RUN 15 INCH

**Angle/
Slope**

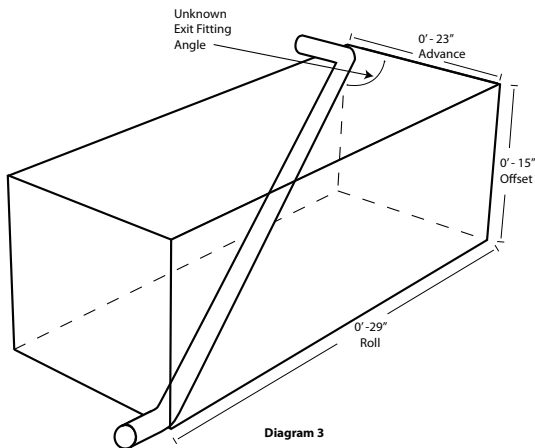
∠Ø 67.94°

The entry fitting angle (lower pipe fitting in Diagram 1) is 43.44° and the exit fitting angle (upper pipe fitting in Diagram 2) is 67.94°.

Horizontal to Horizontal

In the next example, the same box dimensions are used except the exit fitting now creates a pipe exit horizontally instead of vertically. The entry fitting angle of 43.44° and pipe length of 39 and 15/16 inches remain the same since the dimensions in this example are the same (if they were different, steps 1 and 2 on the previous pages could be repeated to calculate them).

However, by re-orienting the box dimensions to show the Advance on the same plane as the horizontal exit fitting (Diagram 3), the exit fitting angle can easily be solved using the Rolling Offset feature.



KEYSTROKE

DISPLAY

On/C On/C

0.

3. Calculate the exit fitting angle.

1 5 Inch Offset

2 3 Inch Run (Advance)

2 9 Inch Conv Travel (Roll)

Travel

OFST 15 INCH

RUN 23 INCH

LNTH 39-15/16 INCH

FIT° 54.84°

The entry fitting angle is still 43.44° . However, the exit fitting angle is calculated to be 54.84° .

Calculating Drop

If a pipe Run requires 1/8" drop per foot for drainage, how much total drop is required for a 25' Run?

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Enter the Slope (Drop):

1 / 8 Angle/Slope

SLP 0-1/8 INCH

2. Calculate the total drop (Offset):

2 5 Feet Run Offset

OFST 0 FEET 3-1/8 INCH

*Find the slope of a pipe Run if it drops 6 inches over 50 feet.
What is its Angle and Percent Grade?*

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Enter the Run:

5 0 Feet Run

RUN 50 FEET 0 INCH

2. Enter the Offset:

6 Inch Offset

OFST 6 INCH

3. Calculate the Slope, Angle and Percent Grade:

Angle/Slope

SLP 0-1/8 INCH

Angle/Slope

∠Ø 0.57°

Angle/Slope

% GRD 1.

Angle/Slope

GRD 0.01

Calculating Flow Rate

If you know the Area and Velocity, you can calculate the Flow Rate. For this example, the velocity is 5 feet per second, and the Area is 1.8 square inches.

KEYSTROKE	DISPLAY
Conv X	ALL CLEARed
1. Enter the Velocity:	
5 Conv) (Velocity)	FPS 5.
2. Enter the Area:	
1 . 8 Inch Inch Conv √x (Area)	AREA 1.8 SQ INCH
3. Calculate Flow Rate (default is Gallons per Minute):	
Conv ((Flow)	GPM 28.05195
4. Convert to different units of flow rates:	
((Cubic Feet per Minute)	CFM 3.75
((Cubic Feet per Second)	CFS 0.0625
((Liters per Second)	L/S 1.769803
((Cubic Meters per Second)	M3/S 0.00177
((Gallons per Minute)	GPM 28.05195

If you clear the display, you can recall the last Flow Rate shown.

KEYSTROKE	DISPLAY
On/C	0.
Rcl Conv (	GPM 28.05195

If you clear the calculator, you will only recall the last unit shown.

KEYSTROKE	DISPLAY
On/C On/C	0.
Rcl Conv (	GPM 0.

If you know the Flow Rate, you can convert to other dimensional units.

KEYSTROKE	DISPLAY
Conv X	ALL CLEARed
5 Conv 1 (Gallons per Minute)	GPM 5

KEYSTROKE**DISPLAY****Conv** **4** (Cubic Feet per Minute)**CFM 0.668403****Conv** **5** (Cubic Feet per Second)**CFS 0.01114****Conv** **2** (Liters per Second)**L/S 0.315451**

Velocity

You can enter a known Velocity, calculate Velocity and convert between different units of Velocity.

If you know the Flow and Area, you can calculate Velocity and then convert to other Velocity units. The default is feet per second (FPS). For this example, we know that the Flow is 5 gallons per minute, and the Area is 1.8 square inches.

KEYSTROKE**DISPLAY****Conv** **X****ALL CLEARED**

1. Enter the Flow:

5 **Conv** **(** (Flow)**GPM 5.**

2. Enter the Area:

1 **.** **8** **Inch** **Inch** **Conv** **√x** (Area)**AREA 1.8 SQ INCH**

3. Calculate Velocity:

Conv **)** (Feet per Second)**FPS 0.891204****)** (Feet per Minute)**FPM 53.47222****)** (Meters per Second)**M/S 0.271639**

If you clear the display, you can recall the last velocity shown.

KEYSTROKE**DISPLAY****On/C****0.****Rcl** **Conv** **)****M/S 0.271639**

If you clear the calculator, you will only recall the last unit shown.

KEYSTROKE	DISPLAY
On/C On/C	0.
Rcl Conv)	M/S 0.

If you know the velocity, you can convert to other dimensional units.

KEYSTROKE	DISPLAY
Conv X	ALL CLEARed
5 Conv) (Velocity)	FPS 5.
= Conv) (Feet per Second)	FPS 5.
) (Feet per Minute)	FPM 300.
) (Meters per Second)	M/S 1.524

Pressure Loss

If you know Flow/Velocity, Pipe Size and Length, you can calculate Pressure Loss. If no Run (Length) is entered, Pressure Loss per foot is calculated. For this example we will use the default Material, Steel. Calculate for 2" Pipe with a Flow Rate of 4 gallons per minute and then convert to different dimensional units.

KEYSTROKE	DISPLAY
Conv X	ALL CLEARed
1. Enter the Pipe Size:	
2 Inch Pipe Size	STD SIZE 2 INCH
2. Find the Area:	
Conv $\sqrt{x}$ (Area)	AREA 3.355605 SQ INCH
3. Enter the Flow Rate:	
4 Conv (	GPM 4.
4. Calculate Pressure Loss:	
Conv Circle	PSI PER FEET 0.000205
Circle	REY 6120.09
Circle	PSF PER FEET 0.029469

KEYSTROKE**DISPLAY**

Circle	inHG PER FEET	0.000417
Circle	HEAD PER FEET	0.000472
Circle	BAR PER FEET	0.000014
Circle	KPA PER FEET	0.001411
Circle	PSI PER FEET	0.000205

Using values above, add the Run (Length) to calculate the Pressure Loss over the length of the pipe.

KEYSTROKE**DISPLAY**

5 0 Feet Run	RUN 50 FEET 0 INCH
--	--------------------

Calculate Pressure Loss

Conv Circle	PSI 0.010232
Circle	REY 6120.09
Circle	PSF 1.47346
Circle	inHG 0.020833
Circle	HEAD 0.023603
Circle	BAR 0.000705
Circle	KPA 0.07055
Circle	PSI 0.010232

You can also change the Flow Rate and recalculate the Pressure Loss.

KEYSTROKE**DISPLAY**

4 0 Conv (	GPM 40.
Conv Circle	PSI 0.575408
Circle	REY 61200.9
Circle	PSF 82.85877
Circle	inHG 1.171543
Circle	HEAD 1.32727
Circle	BAR 0.039673
Circle	KPA 3.9673
Circle	PSI 0.575408

Pressure/Force

If you know the Force and Area, you can calculate Pressure and convert the solution to different units of Pressure. For this example the Force is 100 lbf and the Area is 2 square inches.

KEYSTROKE

DISPLAY

Conv **X**

ALL CLEARed

1. Enter the Force:

1 **0** **0** **Conv** **x²** (Force)

LBF 100.

2. Enter the Area:

2 **Inch** **Inch** **Conv** **√x** (Area)

AREA 2. SQ INCH

3. Calculate Pressure:

Conv **Circle**

PSI 50.

Circle

PSF 7200.

Circle

inHG 101.801

Circle

HEAD 115.3329

Circle

BAR 3.447379

Circle

KPA 344.7379

Circle

PSI 50.

Area

If you know the Force and Pressure, you can calculate Area. For this example the Force is 85 lbf and the Pressure is 15 psi.

KEYSTROKE

DISPLAY

Conv **X**

ALL CLEARed

1. Enter the Force:

8 **5** **Conv** **x²** (Force)

LBF 85.

2. Enter the Pressure:

1 **5** **Conv** **Circle** (Pressure)

PSI 15.

3. Calculate the Area:

Conv **√x** (Area)

AREA 5.666667 SQ INCH

Pipe Capacity

How many gallons of water will a 20' long 6" pipe hold?

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Enter the Pipe Size:

6 **Inch** **Pipe Size**

STD SIZE 6 INCH

2. Find the Area:

Conv **$\sqrt{x}$**

AREA 28.89026 SQ INCH

3. Multiply by the Pipe length:

X **2** **0** **Feet** **=**

4.012536 CU FEET

4. Find the Pipe capacity:

Conv **8**

GAL 30.01586

Weight of Filled Pipe

Find the weight of a 10 foot length of 6 inch Type 5 stainless steel pipe filled with water:

KEYSTROKE

DISPLAY

On/C **On/C**

0.

1. Choose the Pipe Material:

Pipe Mat'l **Pipe Mat'l**

MATL S.StEEL

2. Choose the Pipe Type:

5 **Conv** **Pipe Size**

TYPE 5 S.StEEL

3. Choose the Pipe Size:

6 **Inch** **Pipe Size**

5 SIZE 6 INCH

4. Find the weight of one foot of water-filled pipe:

Pipe Size (6 times)

FILL SIZE 21.71418 LB PER FEET

5. Find the weight of the filled 10' length of pipe:

X **1** **0** **=**

217.1418 LB

Find the weight of the same length of pipe filled with ethanol (one gallon of ethanol weighs 6.59 lbs.) Do not clear previous keystrokes.

KEYSTROKE

DISPLAY

1. Enter the weight of one gallon of ethanol:

6 5 9 Stor + + +

LB/G 6.59

2. Find weight of one foot of ethanol-filled pipe:

Pipe Size (7 times)

FILL SIZE 18.77419 LB PER FEET

3. Find the weight of the filled 10' length of pipe:

X 1 0 =

187.7419 LB

Conv X

ALL CLEAREd

(Restores default weight conversion to the weight of water—62.42796 lbs per cubic foot.)

Force

Given Pressure and Area, you can calculate Force and convert between newtons and pound-force. For this example the Pressure is 100 PSI and the Area is 2 square inches.

KEYSTROKE

DISPLAY

Conv X

ALL CLEAREd

1. Enter Pressure and Area

1 0 0 Conv Circle

PSI 100.

2 Inch Inch Conv $\sqrt{x}$

AREA 2. SQ INCH

2. Calculate Force

Conv x^2

LBF 200.

x^2

NEWT 889.6443

Circle Area and Circumference

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

KEYSTROKE

DISPLAY

On/C **On/C**

0.

2 **5** **Inch** **Circle**

DIA 25 INCH

Circle

AREA 490.8739 SQ INCH

Circle

CIRC 78-9/16 INCH

Basic D:M:S and Trigonometry Examples

Converting Degrees:Minutes:Seconds

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 **◦** (dms◀▶deg)

23.71°

Convert 44.29° to degrees:minutes:seconds format:

KEYSTROKE

DISPLAY

On/C **On/C**

0.

4 **4** **◦** **2** **9** **Conv** **◦** (dms◀▶deg)

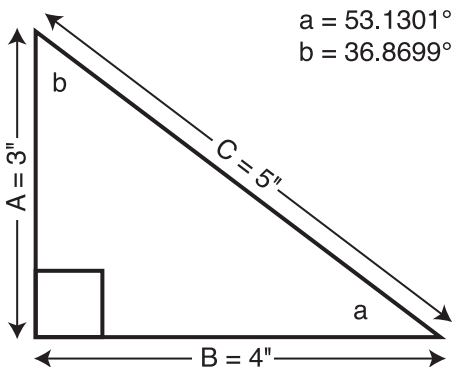
DMS 44.17.24

Note: Improperly formatted entries will be redisplayed in the correct convention after any operator key is pressed. For example, 30° 89′ entered will be corrected and displayed as 31° 29′ 0″ or 31.48°.

Trigonometric Functions

Trigonometric functions are available on the Pipe Trades Pro calculator.

The drawing and formulas below list basic trigonometric formulas, for your reference:



Given side A and angle a, find:

Side C $A \div a \text{ Cos} =$
 (e.g., $3 \text{ Feet} \div 53 \cdot 13 \text{ Cos} =$)
 Side B $A \times a \text{ Tan} =$
 Angle b $90^\circ - a =$

Given side A and angle b, find:

Side B $A \div b \text{ Tan} =$
 Side C $A \div b \text{ Sine} =$
 Angle a $90^\circ - b =$

Given side B and angle a, find:

Side A $B \div a \text{ Tan} =$
 Side C $B \div a \text{ Sine} =$

Given side C and angle a, find:

Side A $C \times a \text{ Cos} =$
 Side B $C \times a \text{ Sine} =$

Given side A and side C, find:

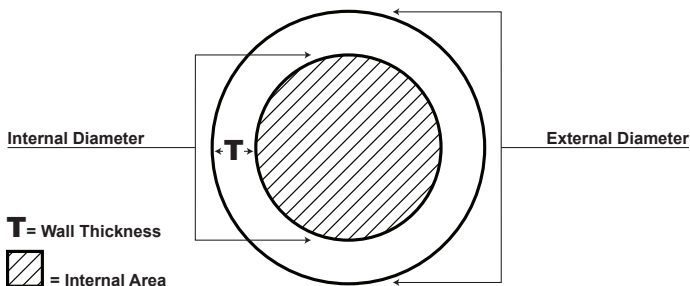
Angle a $A \div C = \text{Conv Cos}$
 Angle b $A \div C = \text{Conv Sine}$

Given side B and angle b, find:

Side C $B \div b \text{ Cos} =$
 Side A $B \times b \text{ Tan} =$

APPENDIX A – Pipe Material, Pipe Type And Data Tables

After selecting a Pipe material, you can select Pipe Types for that material and get data for each type, including Outside Diameter, Internal Diameter, Wall Thickness, Pipe Weight per Foot, Filled Weight per Foot, and Internal Area.



PIPE MATERIALS

Plastic, Copper, Steel, Stainless Steel, Brass, Aluminum and Cast Iron. The default is Steel. The calculator will recall the last material used. After a Clear All or Factory Reset, the default is displayed first.

PIPE TYPES FOR EACH MATERIAL

Stainless Steel

Schedules: 40-S, 80-S, 160, 5-S, 10-S

Plastic

Schedules: 40, 80, 120; SDR 21, SDR 26, SDR 32.5, SDR 41

Copper

Type L, Type K, Type M, Type DWV, Medical Type L, Medical Type K, ACR-Annealed, ACR-Drawn

Steel, Brass, Aluminum, Cast Iron

Schedules: Std, 40, 60; XS, 80, 100, 120, 140, 160; XSS, 10, 20, 30

APPENDIX B – Default Settings

After a Clear All (**Conv** **X**), your calculator will return to the following settings:

Stored Values	Default Value
Material	Steel
Pipe Type	Standard
Elbow Type	Long Radius Butt Weld
Weight to Volume	62.42796 pounds per cubic foot
Welder's Gap	1/8 inch

If you replace your batteries or perform a Full Reset* (press **Off** , hold down **X**, and press **On/C**), your calculator will return to the following settings (in addition to those listed above):

Preference Settings	Default Value
Fractional Resolution	1/16
Area Display	Standard
Volume Display	Standard
Meter Linear Display	0.000
Decimal Degree Display	0.00°
Fractional Mode	Standard
Mathematical Operations	Order of Operations Method

Depressing the Reset button located above the **Angle/Scope key will also perform a Full Reset.*

APPENDIX C – Preference Settings

The Pipe Trades Pro has Preference Settings that allow you to customize or set desired dimensional formats and calculations. If you replace your batteries or perform a Full Reset* (press **Off** hold down **X**, and press **On/C**), your calculator will return to the following settings (in addition to those listed on the previous page):

Depressing the Reset button located above the **Angle/Slope will also perform a Full Reset. Asterisks below indicate default values.*

Preference	Options
1) Fractional Resolution	– *1/16 (displays fractional values to the nearest 16th of an Inch) – 1/32 – 1/64 – 1/2 – 1/4 – 1/8
2) Area Display Format	– *Standard (if units entered are the same—e.g., Feet x Feet—the answer will remain in this format (Square Feet), but if units entered are different — e.g., Inches x Feet—area answer will be displayed in Square Feet) – Square Feet (area answers always displayed in Square Feet, regardless of unit entry — e.g., Inches x Inches = Square Feet) – Square Inches (area answers always displayed in Square Inches — e.g., Feet x Feet = Square Inches) – Square Meters (area answers always displayed in Square Meters — e.g., Feet x Feet = Square Meters)

- 3) Volume Display Format
- ***Standard** (if units entered are the same — e.g., Feet x Feet x Feet — the answer will remain in this format (cu. ft), but if units entered are different — e.g., Feet x Feet x Inches — vol. answer will always be displayed in Cubic Feet)
 - **Cubic Feet** (vol. answers always displayed in Cubic Feet, regardless of unit entry — e.g., Inches x Inches x Inches = Cubic Feet)
 - **Cubic Meters** (vol. answers always displayed in Cubic Meters, regardless of unit entry — e.g., Feet x Feet x Feet = Cubic Meters)
- 4) Meter Linear Display
- ***0.000** (linear Meter answers are always displayed to third decimal place)
 - **FLOAt** (linear Meter answers are displayed to the maximum number of decimal places — e.g., 1.2345 M + 2.56 M = 3.7945 M)
- 5) Decimal Degree Display
- ***0.00°**
 - **FLOAt**
- 6) Fractional Mode
- ***Standard** (fractions are displayed to the nearest fraction)
 - **Constant** (fractions are displayed in the set fractional resolution)

*Note: To check the current Fractional Resolution, press **Rcl** **1**. Either “Std” (standard fractional resolution) or “Cnst” (constant) will be displayed, along with the fractional resolution).*

- 7) Mathematical Operation
- ***Order** (the calculator uses the Order of Operation Method ($10 + 4 \times 5 = 30$))
 - **Chain** (the calculator uses the Chaining Method of Operations (as entered: $10 + 4 \times 5 = 70$))

APPENDIX D – Constants

For material surface roughness, we use the following:

Material	Roughness Factor
	e (x 10^{-6} ft)
PVC	15.6
Copper	4.9
Steel (low carbon)	221
Stainless Steel (austenitic)	49.2
Brass	4.9
Aluminum	4.9
Cast Iron	850

For water properties:

Viscosity = 0.001 Pascal-seconds

Density = 1000 kg/m³

Depending upon flow type and Reynolds Number value, we use one of the following methods for computing Pressure Loss:

- 1) Laminar Flow method (if Reynolds Number < 3,000)
- 2) Smooth Pipe method (if Reynolds Number > 3,000 and Boundary Layer Thickness < Pipe Roughness)
- 3) Prandtl equation method (if Reynolds Number < 100,000 and Pipe Roughness > Boundary Layer Thickness)
- 4) Karman Equation method (all other conditions)

APPENDIX E – Care Instructions

Please follow the guidelines listed in this section for proper care and operation of your calculator. Not following the instructions listed below may result in damage not covered by your warranty. Refer to the Repair and Return section on page 62 for more details.

Do not expose calculator to temperatures outside the operating temperature range of 32°F – 104°F (0°C – 40°C).

Do not expose calculator to high moisture such as submersion in water, heavy rain, etc.

APPENDIX F –

Accuracy/Errors, Auto Shut-Off, Batteries, Reset

Accuracy/Errors

Accuracy/Display Capacity — Your calculator has a twelve-digit display made up of eight digits (normal display) and four fractional digits. You may enter or calculate values up to 19,999,999.99. Each calculation is carried out internally to twelve digits.

Errors — When an incorrect entry is made, or the answer is beyond the range of the calculator, it will display the word “**ERROR**.” To clear an error condition you must hit the **On/C** button once. At this point you must determine what caused the error and re-key the problem.

Error Codes

DISPLAY	ERROR TYPE
OFLO	Overflow (<i>too large</i>)
MATH Error	Divide by 0
DIM Error	Dimension error
ENT Error	Invalid entry error

Auto-Range — If an “overflow” is created because of an input and calculation with small units that are out of the standard seven-digit range of the display, the answer will be automatically expressed in the next larger units (instead of showing “**ERROR**”) — e.g., 20,000,000 mm is shown as 20,000 m. Also applies to inches and feet.

Auto Shut-Off

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

Reset

If your calculator should ever “lock up”, insert the tip of a paperclip into the small Reset hole located above the **Angle/slope** key – to perform a total reset.

Batteries

The Pipe Trades Pro uses two LR-44 batteries.

Replacing Batteries

Should your calculator display become very dim or erratic, replace the batteries.



Note: Please use caution when disposing of your old batteries, as they contain hazardous chemicals.

Replacement batteries are available at most discount or electronics stores.

Battery Replacement Instructions

Loosen the screw and remove the battery door located on the back of calculator. Remove the old batteries and insert two new LR44 batteries, making sure they face positive-side (+) up. Replace the battery door and retighten the screw.

Battery Warnings

- Remove and immediately recycle or dispose of used batteries according to local regulations and keep away from children. Do NOT dispose of batteries in household trash or incinerate.
- Even used batteries may cause severe injury or death.
- Call a local poison control center for treatment information.
- Compatible battery type is LR44 (2x1.5 V).
- Non-rechargeable batteries are not to be recharged.
- Do not force discharge, recharge, disassemble, heat above manufacturer's specified temperature rating or incinerate. Doing so may result in injury due to venting, leakage or explosion resulting in chemical burns.
- Ensure the batteries are installed correctly according to polarity (+ and -).
- Do not mix old and new batteries, different brands or types of batteries, such as alkaline, carbon- zinc, or rechargeable batteries.
- Remove and immediately recycle or dispose of batteries from equipment not used for an extended period of time according to local regulations.
- Always completely secure the battery compartment. If the battery compartment does not close securely, stop using the product, remove the batteries, and keep them away from children.

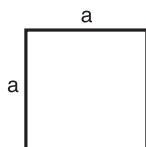
WARNING

- **INGESTION HAZARD:** This product contains a button cell or coin battery.
- **DEATH** or serious injury can occur if ingested.
- A swallowed button cell or coin battery can cause **Internal Chemical Burns** in as little as **2 hours**.
- **KEEP** new and used batteries **OUT OF REACH of CHILDREN**.
- **Seek immediate medical attention** if a battery is suspected to be swallowed or inserted inside any part of the body.

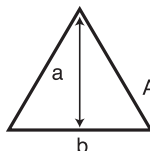


APPENDIX G – Formulas

Area Formulas



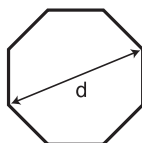
Square
Area = a^2



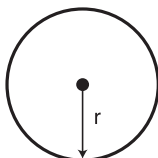
Triangle
Area = $1/2 ab$



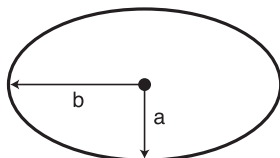
Rectangle
Area = lw



Octagon
Area = $(d/2)^2 \times 2.828$

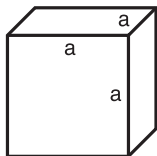


Circle
Circumference = $2\pi r$
Area = πr^2



Ellipse
Area = πab

Surface Area/Volume Formulas



Cube

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

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

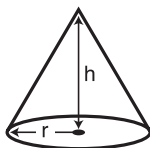


Rectangle

$$\text{Surface Area} =$$

$$2hw + 2hl + 2lw$$

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

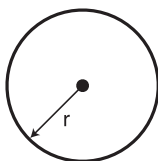


Cone

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

(+ πr^2 if you add the base)

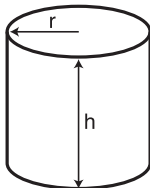
$$\text{Volume} = \frac{\pi r^2 h}{3}$$



Sphere

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

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



Cylinder

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

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

WARRANTY AND RETURN

Return Guidelines

1. Please read the **Warranty** in this User's Guide to determine if your Calculated Industries product remains under warranty **before** calling or returning any device for evaluation or repairs.
2. If your product won't turn on, check the batteries as outlined in the User's Guide.
3. If you need more assistance, please go to the website listed below.

www.calculated.com/warranty

Warranty

Warranty Repair Service

Calculated Industries ("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 calculator) 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, A BLACK "INK SPOT" 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., please go to the website.

www.calculated.com/warranty

Non-Warranty Repair Service

Non-warranty repair covers service beyond the warranty period, or service requested due to damage resulting from misuse or abuse. Contact Calculated Industries at the number listed above to obtain current product repair information and charges.

www.calculated.com/warranty

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Calculated Industries, a leading manufacturer of special-function calculators and digital measuring instruments, is always looking for new product ideas in these areas.

If you have a new product idea, please visit our "Bright Idea" page at www.calculated.com/brightidea.asp. For suggestions about improving this product or other products, please visit us at www.calculated.com under "Contact Us". Thank You.



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FCC Caution: *This device complies with part 15 of the FCC Rules.*

Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.