Trigonometry Help Contents

The Contents lists Help topics available for Introduction to Trigonometry.   Use the scroll bar to see entries not currently visible in the Help window.

To learn how to use Help, press F1 or choose Using Help from the Help menu

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Introduction

Historically, the goal of trigonometry is to find the distance across voids of space.   For the ancient astronomer this meant finding the distance to the sun, the moon, or another planet.   For a surveyor this means finding the inaccessible distance across a canyon or the height of a distant cliff.   To a military person it could mean finding the distance to an inaccessible enemy position.

Today, trigonometry is used to accomplish some of the same goals.   Imagine, if you will, standing on your deck looking across a lake at your neighbor's house and wondering how far it is across the lake from point A at your position to point B at your neighbor's house.   How could you measure this inaccessible distance?   One thing you could do is walk down the beach to a third position at point C and look back at your house and then at your neighbor's house in the distance.   These three points A, B, and C, form a triangle, and finding the distance across the lake is now translated into finding the length of a side of triangle ABC.   If you counted the number of steps from point A to point C, you would know the length of side AC of the triangle.   If you had some way to measure the angles at A and C, then you would actually have enough information to find the distance across the lake without ever leaving your side of the lake.

This example is what trigonometry is all about.   Chances are, in the above example, your triangle would be the most general case, an oblique triangle.   An oblique triangle is one with no right angle, just three angles that add up to 180 degrees.   By the time that you work through the material in this program, this problem will be routine to you.   We are going to start very gradually, however.   In chapter 0, we will begin by looking at some historical notes. Then we will gain some familiarity with the calculator by finding square roots.   Next, we will use square roots to find the length of sides of right triangles (triangles with a 90 degree angle) by using the Pythagorean Theorem.   Then, we will look at background information on similar triangles and congruent triangles, stating how this information will help us in the future.   We will then look at measuring angles in degree, radian, and revolution measures, converting from one unit of measure to another by hand and by calculator.   Also, we will look at the beginnings of analytic trigonometry by studying linear and angular velocity.

In chapter 1, we will begin in earnest looking at solving triangles.   We will start gradually by looking at solving the 30°- 60

$^{\circ}$ and 45

$^{\circ}$- 45

$^{\circ}$ triangles.   These triangles have sides and angles you can predict based on constant proportions.   Then, we will develop the trigonometric ratios of sides of right triangles.   These will be necessary to solve arbitrary right triangles.   This will be followed by the techniques necessary to solve the general oblique triangle.   At, this point, you will be able to solve the problem of the distance across the lake to your neighbor's house.   Chapter 2 is concerned completely with applications of these techniques in finding area, resultant vectors, surveying, navigation, and astronomy.

In chapter 3, we will begin the study of analytic trigonometry by graphing the trigonometric functions.   In later chapters, you will prove identities, solve equations, and express complex numbers in polar form.   This will be followed by polar equations in general, and a more detailed look at conic sections in polar form.

Selecting Chapters and Sections

To select a chapter or section double click with the mouse or use the up and down arrow keys to highlight the topic and then press the ENTER key.   This brings up the Problems window.

Click the part of the window that you want to know more about.

Trigonometric Table

Degrees	Radians	Cos θ	Sin θ
0°	0	1	0
30°	π/6	√3/2	1/2
45°	π/4	√2/2	√2/2
60°	π/3	1/2	√3/2
90°	π/2	0	1
120°	2π/3	-1/2	√3/2
135°	3π/4	-√2/2	√2/2
150°	5π/6	-√3/2	1/2
180°	π	-1	0
210°	7π/6	-√3/2	-1/2
225°	5π/4	-√3/2	-√2/2
240°	4π/3	-1/2	-√3/2
270°	3π/2	0	-1
300°	5π/3	1/2	-√3/2
315°	7π/4	√2/2	-√2/2
330°	11π/6	√3/2	-1/2
360°	2π	1	0

On this screen you will find a graph of the unit circle $x^2 + y^2 = 1$. Also shown are degree and radian measures for angles from the special triangles given in the first counter-clockwise revolution. Coordinates of the points on the circle are also displayed.

The values of the first coordinates generate the cosine curve, and the values of the second coordinates generate the sine curve.

These coordinates are also used to generate a brief trigonometric table. This information should help you a great deal in your study of trigonometry.

Animate	Explanation	Exit

90°; π/2 radians; (0,1)

120°; 2π/3 radians; (-1/2, √3/2)
135°; 3π/4 radians; (-√2/2, √2/2)
150°; 5π/6 radians; (-√3/2, 1/2)

60°; π/3 radians; (1/2, √3/2)
45°; π/4 radians; (√2/2,√2/2)
30°; π/6 radians; (√3/2,1/2)

180°; π radians; (-1,0)

0°; 0 radians; (1,0)

210°; 7π/6 radians; (-√3/2,-1/2)
225°; 5π/4 radians; (-√2/2,-√2/2)
240°; 4π/3 radians; (-1/2,-√3/2)

330°; 11π/6 radians; (√3/2,-1/2)
315°; 7π/4 radians; (√2/2,-√2/2)
300°; 5π/3 radians; (1/2,-√3/2)

270°
3π/2 radians; (0,-1)

Degrees	Radians	(Cos θ, Sin θ)
0°	0	1 0

y = cos θ

y = sin θ

Explanation of the Key Information Window

The previous screen contains a great deal of information that will help you in your study of trigonometry.   When you return to the window, click on the option circle in front of the 30° angle.   You will see a triangle on the unit circle at the 30

$^{\circ}$ angle. This angle is one of the special triangles you will study in Chapter 1.   Next to this angle is its equivalent in radian measure,
π/6.   The horizontal leg of this triangle has length
$\sqrt{3}$/2, and this is also the first coordinate of the point on the circle where the triangle touches the circle.   Likewise, the vertical leg of the triangle has length **1/2** and this is the second coordinate of the point on the circle.   The hypotenuse of this triangle has length **1** since it is the radius of the unit circle.   Later we will define the cosine of an angle to be the adjacent side of the angle over the hypotenuse.   Since the hypotenuse of this triangle is **1**, the adjacent side and hence the first coordinate of the point is the cosine of 30

$^{\circ}$.   You will see this value in the trigonometric table next to 30

$^{\circ}$ or
π/6.   You will see a point on the cosine curve at 30
$^{\circ}$.

Similarly, the sine of 30° is the side opposite the angle over the hypotenuse.   Thus the sine of 30

$^{\circ}$ is 1/2.   You will find this value in the second coordinate of the point on the circle.   It is also in the trigonometric table next to 30

$^{\circ}$, and is displayed as a point on the sine curve.
Activating a different angle will display similar information for the new angle.   From this explanation you can see that we can find the cosine and sine of many angles ranging from 0

$^{\circ}$ to 360

$^{\circ}$.   Each of the angles displayed is either a multiple of one of the special triangle angles or an angle on one of the coordinate axes.   Angles with more than one revolution have the same values.   We will eventually look at the cosine and sine of all angles.   Also, the trigonometric identities will allow us to use this information about the sine and cosine of an angle to find the tangent, cotangent, secant, and cosecant of any angle.
Now activate the **Animation** button.   You will see the angles open up in a counter-clockwise direction generating the trigonometric table and the two graphs.   This suggests treating the angle as a variable and points the way toward development and points the way toward the development of analytic trigonometry.   Notice that the values for the graphs of the sine and cosine curves come from coordinates on the unit circle, hence the origin of the expression **circular function**.

Trigonometric Table

This table shows the degree measure and the equivalent radian measure of angles ranging from

$0°$ to 360

$°$.   Also recorded are the values of the sine and cosine of a particular angle.   For example, at 30

$°$ or

$°/6$ you see that the value of the cos 30

$°$ is

$°/2$ and the value of the sin 30

$°$ is 1/2.   To activate a particular angle, just click on the option button in front of the angle in the trigonometric table.   You can also see the connection between this table and both the unit circle and the graphs of the sine and cosine functions.   For example, if you click on 30

$°$ you will see that the value of the cos 30

$°$,

$°/2$, is the length of the **green**, horizontal leg of the triangle in the unit circle and the vertical distance of the **green dot** above the x-axis in the graph of the cos
θ.   Likewise, the value of sin 30

$°$, 1/2, is the length of the **red**, vertical leg of the triangle in the unit circle and the vertical distance of the **red dot** above the x-axis in the graph of the sin
θ.

If you click on this button you will see the angles in the unit circle open up counter-clockwise from 0° through 360 $^{\circ}$. You will also see the **green** and **red** dots generate the cos and sin curves.

Click on this button to close the Key Information window.

Unit Circle

This display shows the unit circle, $x^2 + y^2 = 1$, with line segments drawn at $0°$, $30°$, $45°$, $60°$, $90°$, $120°$, $135°$, $150°$, $180°$, $210°$, $240°$, $270°$, $300°$, $315°$, $330°$, and $360°$.   Also shown on the display next to each of these angles are their equivalents in radian measure.   For example, next to $30°$ you see $π/6$ radians.   These units of measure of an angle are developed in section 0.5.   Next to the measure of the angle, you see the coordinates of the end point of the line segment on the unit circle.   For example, at $30°$ you see the ordered pair ($\sqrt{}π/2,1/2$).   This is both the endpoint of the line segment forming the $30°$ angle and a point on the unit circle satisfying the equation, $x^2 + y^2 = 1$.

Now click the dot in front of the $30°$ angle in the trigonometric table, and you will see a triangle appear inside the unit circle at the $30°$ angle.   This right triangle, called the $30° - 60°$ triangle, is one of the special triangles studied in section 1.1.   The hypotenuse of this triangle has length one.   The legs of this triangle have lengths exactly equal to the coordinate of the point, ($π/2,1/2$).   The vertical, red leg has length 1/2, and the green, horizontal leg has length $π/2$.   Later, the sine of $30°$ will be defined to be the length of the vertical red leg divided by the length of the hypotenuse.   This value of 1/2 is recorded in the trigonometric table under sin

^{0} and as the vertical distance to the red dot in the graph of the sin

^{0}.   Similarly, the cosine of 30

^{0} is the length of the horizontal green leg of the triangle divided by the hypotenuse.   This length,

^{0}/2, is recorded in the trigonometric table under the cos

^{0} and as a green dot on the graph of the cos

^{0}.

If you click the dot in the trigonometric table in front of the 45^{0} angle, you will likewise see a new triangle in the unit circle at the 45

^{0} angle.   This special triangle called the 45

^{0} - 45

^{0} triangle, will also be studied in Section 1.1 along with the 30

^{0} - 60

^{0} triangle.   Similar information for the 45

^{0} angle has been recorded in the trigonometric table and on the graphs of the sin

^{0} and cos

^{0}.   Continuing to click on the

60^{0} angle, the 90

^{0} angle, and so on, you will generate the remainder of the trigonometric table and the dots on the graphs of the sin

^{0} and cos

^{0}.

Throughout this program, we will continually refer to this **Key** feature and these familiar angles and their multiples to develop new concepts.   For example, to develop the tangent, cotangent, secant, and cosecant functions, we will return to this feature since these new functions are very precisely related to the sine and cosine functions.   To develop the techniques to solve triangles, we will first solve these familiar triangles.   To graph trigonometric functions, we will start with the two graphs in this feature.   To prove or disprove trigonometric identities, we will use information on this screen.   We will also use this information to develop complex numbers in polar form, polar equalities, and conics in polar form.

Key Feature Graphs

In this box you will see the graphs of one period of the cosine and sine functions.   The hash marks on the horizontal axis occur at the angles $0°$, 30

$°$, 45

$°$, 60

$°$, 90

$°$, 120

$°$, 135

$°$, 150

$°$, 180

$°$, 210

$°$, 225

$°$, 240

$°$, 270

$°$, 300

$°$, 315

$°$, 330

$°$, and 360

$°$.   These are exactly the same angles as the ones displayed on the unit circle above.   If you click on the animate button, you will see the **green** dot move along the cosine curve and the **red** dot along the sine curve.   The vertical distances from the **red** and **green** dots to the x-axis are the same as the lengths of the legs of the triangles in the unit circle.   For example, when the angle is 30

$°$, the **green** dot is

$°$/2 units above the x-axis, and this is exactly equal to the length of the green, horizontal leg of the triangle.   Also, the **red** dot is 1/2 unit above the x-axis, the length of the red, vertical leg of the triangle.   At 90

$°$, the sine curve reaches its highest point, 1, and the cosine curve passes through 0.   These values are recorded in the trigonometric table.   We will use this Key feature as our starting point for graphs of the trigonometric functions in Chapter 3.

This box shows the angle that is currently active in both degree and radian measure.   It also shows the sine and cosine of the active angle.

Viewing Problems

Click the part of the Problems window that you want to know more about.

Section 3.1 Graphing Sine Functions

Example Worked Details Calculator Key Plotter Print Score Help Exit

Instructions   Total Problems 17

Please find the amplitude of the following sine functions.

PROBLEM 2

Find the amplitude of

$$y = 2 \cdot \sin 3(\theta - \pi/3) - 2$$

A) $2\pi/3$ B) $\pi/3$ right   C) 2   D) 2 down

A   B   C   D   PgUp-Previous   PgDn-Next

Select **A**, **B**, **C** or **D** as your choice for the answer to the problem.   A right or wrong response will then appear.

Select   PageUp to view the previous problem and PageDown to see the next problem.

This is the display area for all problems.

Instructions for all problems of this type.

The Example window displays an example problem similar to the current one you are viewing in the Problems window.

The Worked window displays the current problem worked out step-by-step.

The Details window describes in depth the material needed to successfully complete the problem.

Printing Problems

⚙

Clicking this option allows you to print **one** or **all** of the problems in this section.
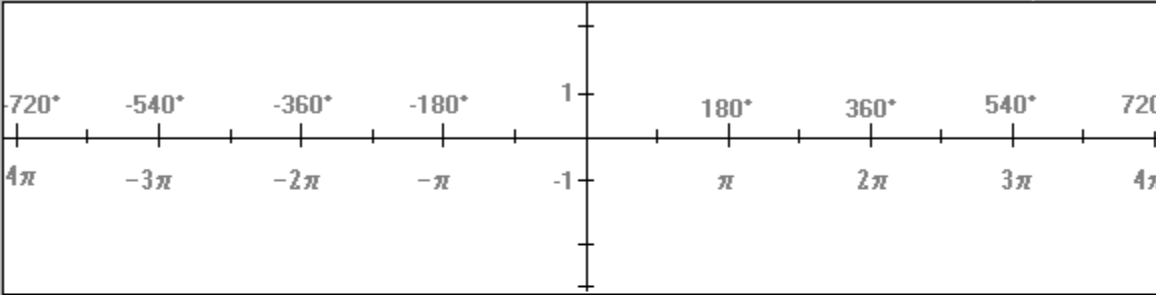
Your Score

Clicking on this option will display the number of correct and incorrect answers that you have chosen in this section.   If you answered a problem incorrectly and went back and changed it to the correct answer, it would no longer be counted as incorrect.   Your score is not available in a review section.

Closes the window.

Click the part of the Graphing window that you want to know more about.

Calculator   Help   Exit

-720°	-540°	-360°	-180°	1	180°	360°	540°	720
4π	-3π	-2π	-π	-1	π	2π	3π	4π

Y = A SIN B(X+C) + D

Coefficients

A=

B=

C=

D=

E=

F=

Function

- ● y=A sin B(x+C)+D
- ○ y=A cos B(x+C)+D
- ○ y=A tan B(x+C)+D
- ○ y=A csc B(x+C)+D
- ○ y=A sec B(x+C)+D
- ○ y=A cot B(x+C)+D
- ○ y=A cos B(x+C) + D sin E(x+F)

- ○ y=sin^{-1}x
- ○ y=cos^{-1}x
- ○ y=tan^{-1}x
- ○ y=csc^{-1}x
- ○ y=sec^{-1}x
- ○ y=cot^{-1}x

Clear

Draw

Exit

By clicking on one of these options, you can graph any of the trigonometric functions listed in this box.   For a detailed description of each function, please see chapter 3.

In general terms the **sine** and **cosine** functions have similar properties.   The number that you substitute for the letter **A** will determine the amplitude of the function.   The number that you substitute for letter **B**, when divided into 2°, will determine the period of the function.   The number that you use to replace the letter **C** will determine the sideways shifting or the phase shift of the function, and the number **D** will determine the up or down shifting or vertical translation of the graph.   Both y = sin**x** and y=cos**x** are periodic with the period equal to 2°.   They are also both bounded.

The **tangent** and **cotangent** functions are both unbounded, and unlike the sine and cosine functions, they have a basic period equal to °.   Since the tangent and cotangent functions periodically go off to infinity, they do not have an amplitude.   The number that you substitute for the letter **B,** when divided into °, does determine the period.   The letter **C** affects the phase shift.   Also, the number for the letter **D** determines the vertical translation.

The **secant** and **cosecant** functions are unbounded like the tangent and cotangent, but they have a basic period of 2° like the sine and cosine functions.   They have no amplitude, the letter **B** affects the period length, the letter **C** determines the phase shift, and **D** determines the vertical translation.

The function, **y = A cos B(x+C) + D sin E(x + F),** represents the sum of a cosine function and a sine function.   These two may or may not have the same amplitude, period, or phase shift.

The graphs of the inverse trigonometric functions appear to be abbreviated.   This is because the domains of the original trigonometric functions were restricted, so that they would be one-to-one, which allows the inverses to be functions.

The domains and ranges of the basic trigonometric functions and their inverses are listed below.

Function	Domain	Range
sin x	$-\infty < x < \infty$	$-1 \leq y \leq 1$
cos x	$-° < x < °$	$-1 \, ° \, y \, ° \, 1$
tan x	all real numbers except multiples of °/2	$-° < y < °$
csc x	all real numbers except multiples of °	$(-°, -1] \cup [1, °)$
sec x	all real numbers except multiples of °/2	$(-°, -1] \, ° \, [1, °)$

cot x	all real numbers except multiples of °	-° < y < °
Sin⁻¹ x	-1 ° x ° 1	-°/2 ° y ° °/2
Cos° x	-1 ° x ° 1	0 ° y ° °
Tan° x	-° < x < °	-°/2 < y < °/2
Csc° x	(-°, -1] ° [1,°)	[-°/2, 0) ° (0,°/2]
Sec° x	(-°, -1] ° [1,°)	[0,°/2) ° (°/2,°]
Cot° x	-° < x < °	0 < y < °

This is the trigonometric function that is currently active.

These boxes are for entering coefficients.   To enter your coefficients, just click on the appropriate box and enter the number. You may enter integers or decimal numbers as coefficients.   This includes negative values.   The coefficients, depending on the function, are **A, B, C, D, E, F**.

To see the graph of a basic trigonometric function, enter the number ,1, for both **A** and **B** and click on draw.   You should experiment by entering different numbers for each letter. The letter **A** affects the amplitude for the sine and cosine functions.   The letter **B** affects the length of the period, the letter **C** affects the phase shift or horizontal shifting.   Also, the letter **D** affects the vertical translation or vertical shifting of the curve.

Click this button to draw the currently displayed function.

Click this button to clear the drawing area.

Click this button to close and exit the function plotter.

This is the drawing area. The scale above the x-axis represents degrees and the scale below the x-axis is represented in radians.   The function that is currently active will be plotted on this screen if you click the Draw button.
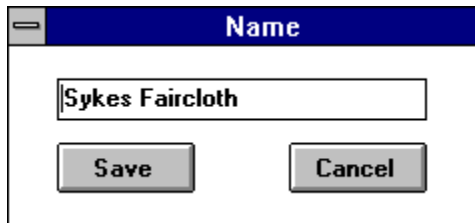
The Resume Feature

By clicking this option the program will automatically return you to the chapter, section and problem that you were working on before you last exited the program.   All your previous answers for that section are also restored.

Playing Sounds

To play the sounds that come with this program, you'll need to click over the **<u>S</u>ound** option located on the main menu bar.   You can either enable or disable the programs ability to play sounds by clicking over the appropriate command.   The current option selected will have a check mark in front of it and the settings are automatically saved when they are changed. To properly hear the sound (.WAV) files you'll need to have a sound driver installed as well as a sound card that gives you sound capabilities.   Consult your Windows or sound card documentation for further assistance.

Many thanks to **Jim Faircloth** for the use of his voices and music**.**   Also**,** many thanks to **Beachware** for letting us use some of the sounds from their Shareware Breakthrough Sound Works Collection in this program.

Entering Your Name

Clicking this option allows you to enter and save your name.   When you send problems to the printer the name saved here will be displayed at the top of the printout.

Review Sections

Reviews are a compilation of all the sections in the chapter.   No examples, worked, or details text can be displayed in a review section; however, your score and right or wrong responses are available.

Calculator Help

Edit   Exit   Help

0.   CE/C

| $\sqrt[n]{y}$ | y^n | $\sqrt{}$ | | STO | RCL | SUM | EXC |

| x^2 | pi | $1/x$ | | <bcksp | (|) | / |

| log | 10^n | e^n | lnx | | 7 | 8 | 9 | * |

| sin | Sin^{-1} | >dd | >dms | | 4 | 5 | 6 | – |

| cos | Cos^{-1} | tan | Tan^{-1} | | 1 | 2 | 3 | + |

| r>p | p>r | x,y | | 0 | . | +/– | = |

Memory

○ Deg   ○ Rad   ○ Grad   0
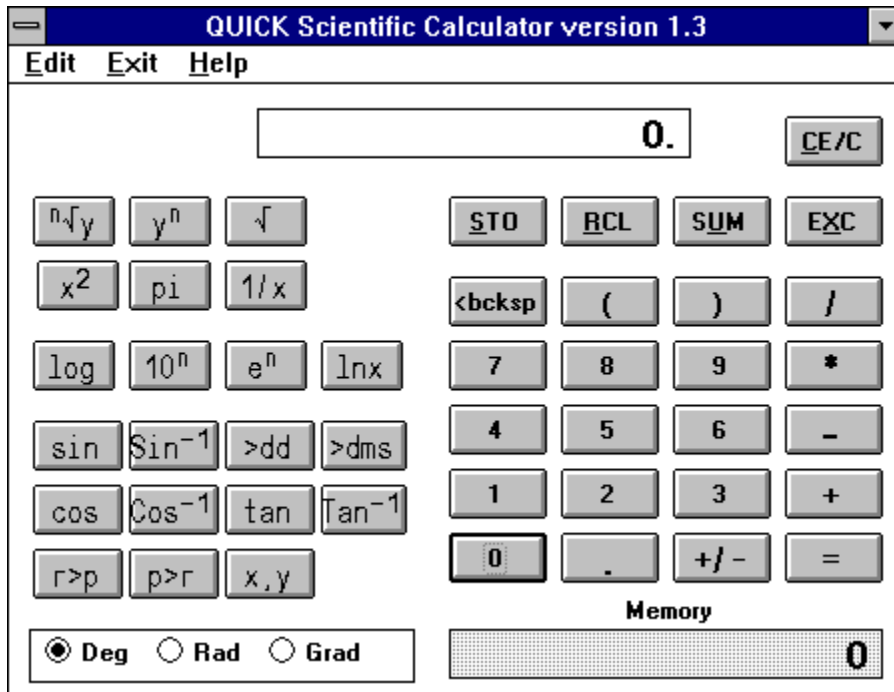
Click the part of the Calculator window that you want to know more about.

Finds y raised to the nth power.   3 <key> 2 = <u>9</u>

Returns the square root of the number.

Returns the number squared.

Returns the constant pi.

Calculates the common logarithm (base 10) of the number being displayed.

Calculates the common antilogarithm of the number being displayed, by raising 10 to the displayed power.

Calculates the natural antilogarithm of the number being displayed. It raises the constant **e** to the displayed power.

Calculates the natural logarithm (base e) of the number being displayed.

Returns the sine of the value being displayed.

Returns the sine inverse of the value being displayed.

Returns the cosine of the value being displayed.

Returns the cosine inverse of the value being displayed.

Returns the tangent of the number being displayed.

Returns the tangent inverse of the value being displayed.

Converts degrees, minutes, seconds to decimal degrees.

Converts decimal degrees to degrees, minutes, seconds.

Changes rectangular coordinates to polar coordinates.

Changes polar coordinates to rectangular coordinates.

Values will display in degrees.

Values will display in radians.

Values will display in gradients.

The display area for the entered/computed values.

Parentheses - used for parenthetical expressions.   i.e.   (7+3)/2= <u>5</u>

Used to separate x,y values when changing polar to rectangular or rectangular to polar coordinates.   i.e. to convert (7,8) from rectangular to polar enter: 7 <x,y> 8 <p>r> 36.8698 <x,y>   10.

Clicking on this key causes the displayed value to be stored in the memory register replacing any value already in that register.

Clicking on this key copies the contents of the memory register to the displayed value window.   The value in the memory register now becomes the displayed   value.

Clicking on this key sums the displayed value and the contents of the memory register with the result being stored in the memory register.

Clicking on this key causes the displayed value and the contents of the memory register to be exchanged.

Clicking on this key clears the current calculation and displayed value.   This key **does not** clear the memory register.   To do that click on this key and then click the STO key.

Clicking on this key deletes the last digit of the displayed value during the entry process. This key is general used to edit an entry if the wrong digit was pressed.

division operator.

multiplication operator

subtraction operator

addition operator

= performs any calculation on the previous two numbers.

square root function

Clicking on the key finds the **nth** root of **x**.   Enter **x**, click this key, enter **n** and click the EQUAL key.

Clicking on this key calculates **x** to the **nth** power.

the memory register

changes the sign of the displayed value

inserts a decimal point

returns the reciprocal of the displayed value 1/x

Glossary

Term	Definition
acute angle	an Acute Angle is any angle less than 90 degrees.
addition laws	cos(A+B)=cosA cosB - sinA sinB. cos(A-B)=cosA cosB + sinA sinB. sin(A+B)=sinA cosB + cosA sinB. sin(A-B)=sinA cosB - cosA sinB. tan(A+B)=(tanA + tanB)/(1 - tanA tanB) tan(A-B)=(tanA - tanB)/(1+ tanA tanB)
adjacent side	the side of a right triangle that forms one side of the angle.
ambiguous case	when an angle and two sides of a triangle are known with one side opposite the given angle, and the side opposite is less than the other side but greater than the altitude of the triangle allowing two triangle solutions.
amplitude	the maximum value of sin or cosine function.
angle	two rays or half-lines with the same initial point.
arc	part of a circle.
Arccosecant	a function that is the principal branch of the inverse cosecant relation.
arccosecant	the inverse cosecant relation.
Arccosine	a function that is the principal branch of the inverse cosine relation.
arccosine	the inverse cosine relation.
Arccotangent	a function that is the principal branch of the inverse cosine relation.
arccotangent	the inverse cosine relation.
Arcsecant	a function that is the principal branch of the inverse secant relation.
arcsecant	the inverse secant relation.

Arcsine	a function that is the principal branch of the inverse sine relation.
arcsine	the inverse sine relation.
Arctangent	a function that is the principal branch of the inverse tangent relation.
arctangent	the inverse tangent relation.
area	the area of a triangle can be found by multiplying one-half times the product of two sides and the sine of the included angle.
argument	the angle used when expressing a complex number in trigonometric form.
asymptote	is a line that a curve gets closer and closer to as x gets larger.
bearing	the bearing of a path is an acute angle made with a north=south line (S 30° E is a direction that is 30° east of due south.)
central angle	an angle with its vertex at the center of a circle.
circular functions	sin t, cos t, tan t, sec t, cos t, cot t, where t is any real number.
circumference	the distance around a circle.
cofunction identities	$\cos(^{\circ}/2 - ^{\circ}) = \sin^{\circ}$, $\sec(^{\circ}/2 - ^{\circ}) = \csc^{\circ}$ $\tan(^{\circ}/2 - ^{\circ}) = \cot^{\circ}$
complementary relationships	in a right triangle a trigonometric function of one of the acute angles is equal to corresponding co-function of the other acute angle.
complex number	a number of the form a + bi where a and b are real numbers and i = the square root of -1.
complex plane	a graphical representation of the entire set of complex numbers.
components	when a resultant vector, R, is found by adding to vectors u and v, then u and v are called the components of R.

conic section	a curve found by slicing through a cone and looking at the sectional view. i.e. circle, ellipse, hyperbola, or parabola.
conjugate	of a + bi is a - bi
cosecant	the cosecant of an angle in a right triangle is the hypotenuse over the side opposite.
cosecant curve	is the graph of the cosecant function
cosine	the cosine of an angle in a right triangle is the adjacent side over the hypotenuse.
cosine curve	is the graph of the cosine function.
cotangent	the cotangent of an angle in a right triangle is the adjacent side over the opposite side.
cotangent curve	is the graph of the cotangent function.
coterminal angles	angles that have the same initial side and same terminal side.
counterexample	to prove an identity is not true, you have to find at least one angle where it is untrue. This is proof by counterexample.
degenerate conic	when slicing a cone, it is possible to get a degenerate conic in the form of a point, line, or two intersecting lines.
degree	a unit measure of an angle equal to 1/360 of a circle. A minute is 1/60 of a degree, and a second is 1/60 of a minute.
DeMoiure's formula	$(r \cos x + i \sin x)^n = r^n(\cos nx + \sin nx)$
depression angle	The angle formed by looking at the horizon and then looking down to an object.
directrix	A fixed line such that the distance from points on a conic to a fixed point called the focus forms a constant ratio with the corresponding distance to the fixed line.
double-angle identities	$\sin 2x = 2\sin x \cos x$ $\cos 2x = \cos^o x - \sin^o x = 2\cos^o x - 1 = 1-$

$2\sin^2 x$

$\tan 2x = 2\tan x/(1-\tan^2 x)$

eccentricity	The constant ratio of the distance from a point on a conic to a fixed point called the focus and the distance from a point on the conic to the directrix.
elevation angle	The angle formed by looking at the horizon and then looking up to an object.
ellipse	A conic section whose eccentricity is less than 1.
focus	A fixed point such that the ratio of the distance to a point on a conic to the distance to a fixed line is constant.
fundamental identities	$\sin x = 1/\csc x$ $\cos x = 1/\sec x$ $\tan x = 1/\cot x$ $\tan x = \sin x/\cos x$ $\cot x = \cos x/\sin x$ $\sin^2 x + \cos^2 x = 1$ $1 + \tan^2 x = \sec^2 x$ $1 + \cot^2 x = \csc^2 x$
Greek letter	alpha (α), beta (β), gamma(γ), delta(δ), lambda (λ), mu (μ), omega (ω), phi (ϕ), theta ($^\circ$)..
half-angle identities	$\cos x/2 = \pm\sqrt{(1 + \cos x)/2}$, $\sin x/2 = \pm\sqrt{(1 - \cos x)/2}$, and $\tan x/2 = (1-\cos x)/\sin x = \sin x/(1 + \cos x)$
heading	the direction of a vector found by measuring the angle in a clockwise direction from the north.
hyperbola	a conic section whose eccentricity is greater than 1.
hypotenuse	the long side of a right triangle
i	is the square root of minus one. It is also the vector (1,0).
identity	an equation involving trigonometric functions that is true for all angles except for those angles where the functions involved do not exist.

imaginary axis   the vertical axis in the complex plane.

initial side   the first side of an angle.

inverse trigonometric functions $y = Sin^o(x)$, $y = Cos^o(x)$, $Tan^o x$, $Cot^o x$, $Sec^o x$, $Csc^o x$

j   is the vector (0,1).

law of cosines $c^o = a^o + b^o - 2ab \cos C$

law of sines   a/sinA = b/sinB = c/sinC.

magnitude   of a vector v is $|v| = \sqrt{a^2 + b^2}$

modulas   of a complex number a + bi is ^{o}

negative angle   an angle measured in the clockwise direction.

nth root formula $\sqrt[n]{a+bi} = \sqrt[n]{r}$ (cos (x+360° • K)/n + i sin(x+360° • K)/n) where K= 0, 1, 2, ..., n-1.

obtuse angle   an angle between 90° and 360°.

opposite side   in a triangle, the side opposite a given angle.

opposite-angle identities   cos(-**x**) = -cos**x**
sin(**-x**) = -sin**x**
tan(-**x**) = -tan**x**

orthogonal   is when two vectors are at right angles to each other.

period   the interval on the x-axis required to complete one cycle of a trigonometric function.

phase shift   the interval on the x-axis that a trigonometric function is shifted or translated to the right or left.

positive angle   an angle measured in the counter clockwise direction.

primary angles   when solving an equation, the primary angles are the solutions between 0° and 360°.

principal nth root   of a real number, r, is $\sqrt[n]{r} = r^{1/n}$.

product-to-sum identities

2 cosA cosB = cos(A-B)+cos(A+B)
2 sinA sinB = cos(A-B)-cos(A+B)
2 sinA cosB = sin(A+B)+sin(A-B)
2 cosA sinB = sin(A+B)-sin(A-B)

pure imaginary number   a number of the form bi where b is a real number.

Pythagorean identities

$\sin^2 x + \cos^2 x = 1$

$1 + \tan^2 x = \sec^2 x$

$1 + \cot^2 x = \csc^2 x$

quadrant   one of the four equal sections of the cartesian plane.

quadrantal angle   an angle whose initial side is on the positive half of the x-axis, and whose terminal side is at $90°$, $180°$, $270°$, or $360°$.

radian   is the ratio of the arclength subtended by a central angle to the radius of the circle.

radius   the distance from the center of a circle to a point on the circle.

ratio identities $\tan x = \sin x/\cos x$ and $\cot x = \cos x/\sin x$

real axis   is the horizontal axis in the complex plane.

reciprocal identities $\sin x = 1/\csc x$, $\cos x = 1/\sec x$, and $\tan x = 1/\cot x$.

rectangular components   when a vector is resolved into a sum of two vectors that are right angles to each other.

reduction identity

$A\sin x + B\cos x = \sqrt{A^2 + B^2}\ \sin (x + \theta)$, where

$\cos\theta = A/\sqrt{A^2 + B^2}$ and $\sin\theta = B/\sqrt{A^2 + B^2}$.

reference angle θ   is the acute angle, θ, given to you by the calculation when you use the inverse trigonometric buttons. It is the angle made by the terminal side of angle θ and the x-axis

resultant vector   a sum of two vectors gives the resultant vector.

right angle	is a 90° angle.
scalar multiplication	the product of a number times a vector.
scalar product	of two vectors u and v is the sum of the products of corresponding components.
secant	the secant of an angle in a right triangle is the ratio of the hypotenuse and the side adjacent.
secant curve	a graph of the secant function.
sector	is a pie shaped wedge of a circle.
similar triangles	two triangles that have the same shape, but not necessarily the same size.
sine	the sine of an angle in a right triangle is the ratio of the side opposite and the hypotenuse.
sine curve	a graph of the sine function.
solve a triangle	find the measures of all the sides and angles.
standard position	of an angle has the initial side on the positive half of the x-axis and the terminal side rotated in the clockwise direction.
straight angle	an angle of 180°.
subtended angle	the central angle subtended by an arc on a circle.
sum-to-product identities	cosA + cosB = 2 cos(A+B)/2 $^\circ$ cos(A-B)/2
	cosA - cosB = -2 sin(A+B)/2 $^\circ$ sin(A-B)/2
	sinA + sinB = 2 sin(A+B)/2 $^\circ$ cos(A-B)/2
	sinA - sinB = 2 sin(A-B)/2 $^\circ$ cos(A+B)/2
tangent	of an angle in a right triangle is the ratio of the side opposite and the side adjacent.
tangent curve	a graph of the tangent function.
terminal side	of an angle is the second side.
triangle	a three sided polygon.

trigonometric form	of a complex number is $r(\cos^{\circ} + i \sin^{\circ})$, where $r = {}^{\circ}$ and ${}^{\circ} = \text{Tan}^{\circ}(b/a)$.
unit circle	$x^{\circ} + y^{\circ} = 1$
vector	a directed line segment specifying both magnitude and direction.
vertex	is a corner of a triangle or the common initial point of the two half-lines forming an angle.