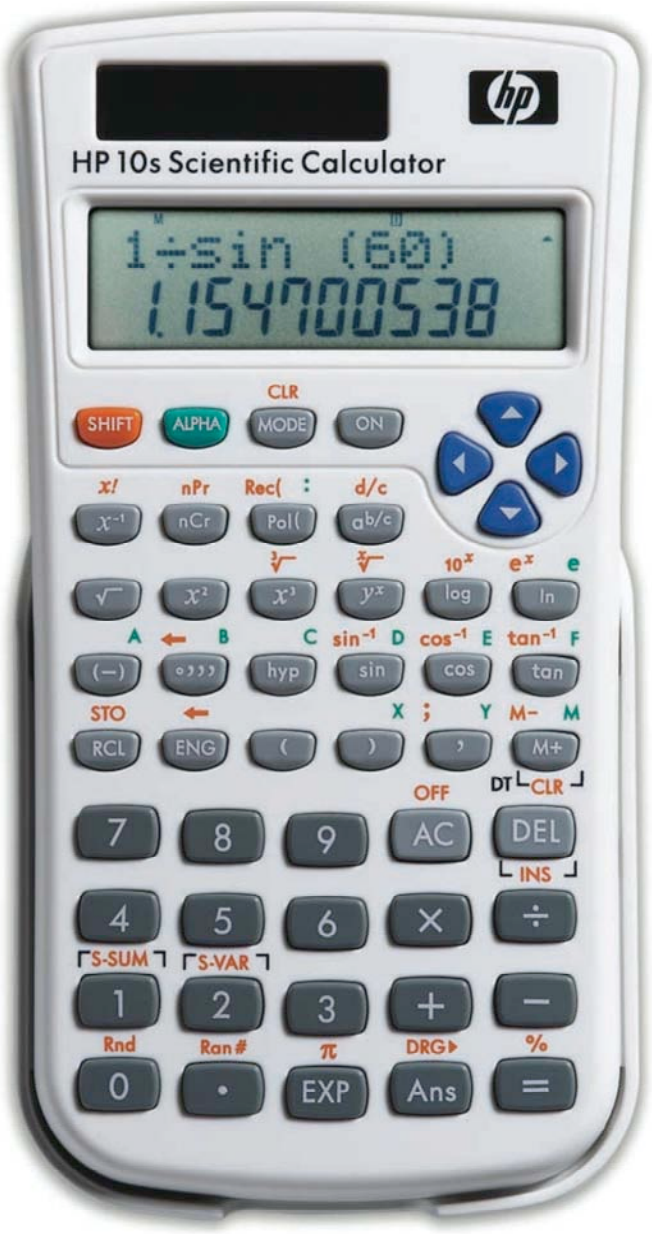
hp calculators

HP 10s Solving Trigonometry Problems



The Trigonometric Functions

The Angular Unit

Practice Solving Problems Involving Trigonometric Functions

The trigonometric functions

The trigonometric functions are sine, cosine and their reciprocals (cosecant and secant, respectively) which repeat their values every 360º, and tangent and its reciprocal (cotangent), whose period is 180º. All these functions have their inverse functions (e.g. $\sin^{-1} x$ or arcsin x) which are defined for specific ranges. The trigonometric functions are also known as circular functions because they are defined in geometric terms. These functions are extensively used in geometry, surveying, astronomy, building, design, etc. They play a lead role in electromagnetism. In fact, they describe the alternating current as well as the movement of a pendulum!

The HP 10s provides the three basic functions [sin], [cos] and [tan], and their inverse functions: the "arc" functions [SHIFT][sin⁻¹], [SHIFT][cos⁻¹] and [SHIFT][tan⁻¹]. All these functions work in degrees, radians and grads. Additionally, π is provided as a shortcut on the shifted [SHIFT][EXP] ([SHIFT][π]) key.

The angular unit

In a complete circle there are 360 degrees, 2π radians (used in mathematical analysis) or 400 grads (which are common in surveying). Before doing any calculation involving trigonometric functions, you should always make sure that the appropriate angle unit is set. Just look at the top of the display, where the angle unit annunciator is located. Either D, R or G is always lit. To change the mode, press the [MODE] key twice, and choose 1, 2, or 3 for the desired mode.

Practice solving problems involving trigonometric functions

Example 1: Find the height of the flag pole shown in Figure 1.

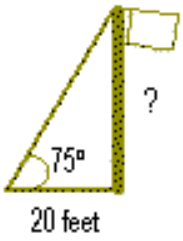


Figure 1.

Solution: From the figure we know that:

$$\tan 75° = \frac{height}{20} \Rightarrow height = 20 \cdot \tan 75°$$

Press [MODE] [MODE] [1] (if R was lit – indicating radians mode) to set DEG mode.

[2] [0] [×] [tan] [7] [5] [=]

Answer: 74.64 feet, rounded to two decimal digits.

Example 2: Show that the double angle formula for the tangent holds for α is 30°

Solution: The double angle identity is as follows:

$$\tan 2\alpha = \frac{2\tan\alpha}{1-\tan^2\alpha}$$

[2] [×] [tan] [3] [0] [÷] [(] [1] [−] [(] [tan] [3] [0] [)] [x^2] [)] [−] [tan] [(] [2] [×] [3] [0] [=]

Answer: Pressing [=] should return 0,[1] implying that both quantities are the same.

[1] Or, in many cases, slightly different than zero because of roundoff.

Example 3: A designer wants to use triangular tiles with sides 3 inches, 5 inches and 7 inches long, to put a mosaic on a floor. What is the angle opposite the 7 inch side? Will it be possible to lay three tiles next to each other with this angle pointing inwards? Make sure the HP 10s is in degrees mode first.

Solution: The law of cosines states that for a triangle with sides a, b, and c and C being the angle opposite side c:

$$c^2 = a^2 + b^2 - 2ab\cos C$$

C can be calculated as:

$$C = \arccos \frac{a^2 + b^2 - c^2}{2ab}$$

which can be calculated on the HP 10s by pressing:

SHIFT cos⁻¹ ((3 x^2 + 5 x^2 − 7 x^2) ÷ (2 × 3 × 5 =

Answer: The angle opposite the 7 inch side is 120 degrees. This means that three tiles will fit together exactly with this angle pointing inwards, as they would make up 360 degrees.