



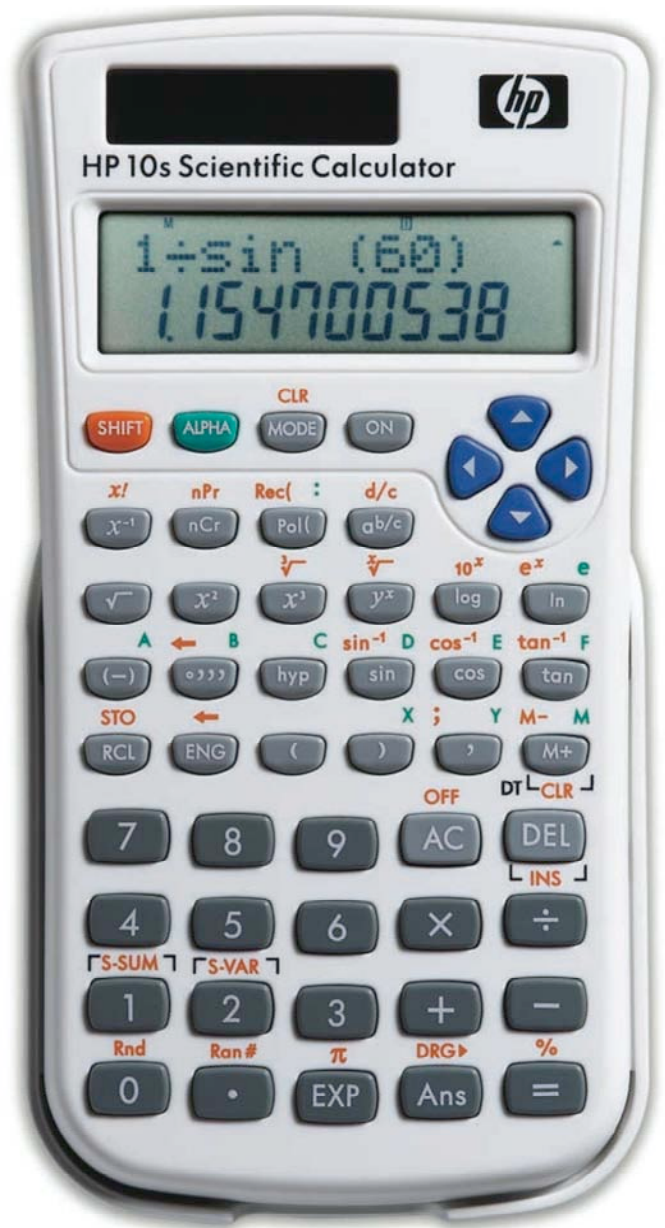
hp calculators

HP 10s Converting Angles and Times

Angle Measurements

Time Measurements

Practice Solving Problems Involving Angles and Times



Angle measurements

The amount of turning between two rays with a common origin, or the measure of change of direction, is what we call an angle. Angles cannot be measured in meters or yards. As measures of the amount of turning, we use degrees, radians and grads.



Figure 1.

A degree is one 360th of a complete turn and its symbol is °. Just like a meter which has multiples and submultiples (e.g. kilometer, millimeter, etc), degrees are broken down into minutes and seconds. The minute (′) is one sixtieth of a degree, and the second (″) is one sixtieth of a minute. The radian is defined as the angle subtended by an arc of a circle of length equal to its radius (see figure 1). Its symbol is ^c (but this symbol is not widely used). Note that the counterclockwise direction of turning is taken to be positive. Grads are a measure of angle equal to one hundredth of a right angle. Grads are also known as gradians and grades. Angle units can be easily converted since:

$2\pi \text{ radians} = 360 \text{ degrees} = 400 \text{ grads}$
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It is important to understand that there are two ways of expressing an angle in degrees: using decimal degrees and using degrees, minutes and seconds. In decimal degrees, an angle is simply given as 33.5 degrees, that is to say, 33 degrees and a half. In the degrees, minutes, seconds (or DMS) format, the same angle is 33 degrees, 30 minutes.

The HP 10s can work with angles in either measurement system and provides the DRG→ function (SHIFT DRG→) to convert between them. It also provides (→) and (SHIFT →) (labeled (SHIFT ←)) which are useful in converting between the two formats of angles in degrees.

Time measurements

As units of time, a minute is equal to 60 seconds and a second (abbreviated as s) is the fundamental unit of time in the SI system. Since an hour has 60 minutes, a useful application of the conversion between decimal degrees and DMS angles is that the exact same conversion can also work for time. A measurement of 10.5 hours can be converted into 10 hours and 30 minutes by the same process by which an angle of 10.5 degrees can be converted into 10 degrees, 30 minutes (i.e. using the same function, (→)).

Practice solving problems involving angles and times

Example 1: Convert an angle of 25 degrees into radians.

Solution: Like many other calculators, the HP 10s operates in an angle mode that the user should specify before doing certain calculations such as trigonometric functions and coordinate conversions. Such mode can be selected by pressing (MODE) (MODE) and then a 1, 2, or 3 for Degrees, Radians or Grads. First, set the HP 10s to radians mode (the ultimate conversion units): (MODE) (MODE) 2 . Then key in the angle value in degrees: 2 5 . To express this angle in radians, simply press (SHIFT) DRG→ 1 = . This tells the HP 10s that it should interpret the displayed number as degrees and convert it to the current angle mode, radians.

Answer: 0.43632313 radians.

HP 10s Converting Angles and Times

Example 2: Convert 25° into grads.

Solution: Press $\text{MODE} \text{MODE} \text{3}$ to place the HP 10s into Grads mode. Then key in the angle value in degrees: $\text{2} \text{5}$. To express this angle in grads, simply press $\text{SHIFT} \text{DRG} \text{1} \text{=}$.

Answer: 27.77777778 grads.

Example 3: Convert an angle of $\frac{2\pi}{3}$ radians into decimal degrees.

Solution: The current mode is assumed to be Degrees. Let's key in $2\pi/3$ radians:

$\text{2} \text{ } \times \text{ } \text{SHIFT} \text{ } \pi \text{ } \div \text{ } \text{3} \text{ } \text{=}$

To convert this angle into degrees press:

$\text{SHIFT} \text{DRG} \text{2} \text{=}$.

Answer: 120°

Example 4: Add 120° to 4.1^r and express the result in both decimal degrees and in the DMS format.

Solution: To add angles on the HP 10s, they must be expressed in the same angle unit. Let's convert 4.1 radians converted into degrees and add it to 120°. Set the angle mode to degrees.:

$\text{MODE} \text{MODE} \text{1}$
 $\text{4} \text{ } \cdot \text{ } \text{1} \text{ } \text{=}$ $\text{SHIFT} \text{DRG} \text{2} \text{ } \text{=}$ + $\text{1} \text{ } \text{2} \text{ } \text{0} \text{ } \text{=}$

It returns the sum expressed in decimal degrees. To express this number in the DMS format, press DMS .

Answer: 354.912696 or 354° 54' 45"

Example 5: Convert an angle of 2.3714 degrees into DMS.

Solution: Simply press:

2.3714 $\text{DMS} \text{=}$

In this case, the angle unit does not need to be set to degrees first, because DMS already assumes the argument is expressed in degrees.

Answer: 2° 22' 17.04. Note that seconds are expressed in decimal format (i.e. 17.04 .seconds)