hp calculators

HP 20b Interest rate conversions

Converting interest rates

Converting interest rates on the HP 20b

Practice converting interest rates
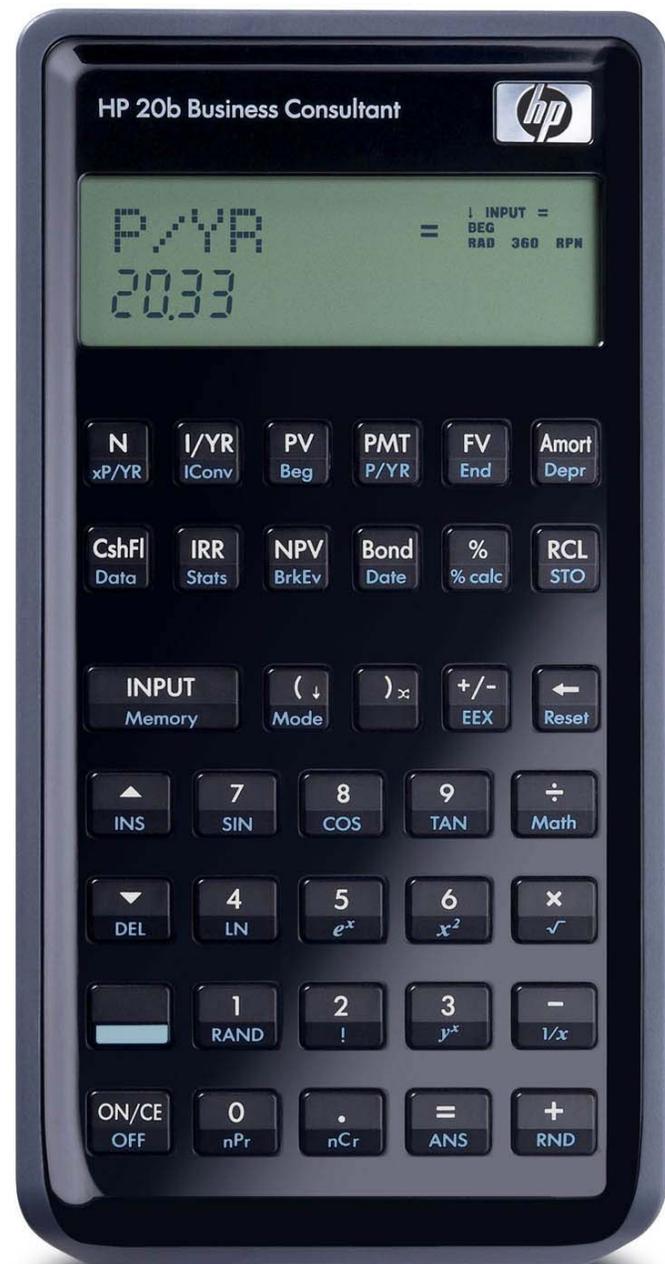
Converting interest rates

There are many situations where an interest rate with a specified compounding frequency must be converted into an equivalent rate with a different compounding frequency. Examples include situations where a need exists to compare alternative interest rates with different compounding frequencies and where the payment frequency does not match the compounding frequency in an annuity problem.

The basic relationship used to convert interest rates from one compounding frequency to another is shown in figure 1 below.

$$EffectiveRate = \left(\left(1 + \frac{No\min alRate}{NumberPeriodsYear} \right)^{NumberPeriodsYear} \right) - 1$$

Figure 1

The effective rate is an annually compounded interest rate that is equivalent to the nominal rate compounded more frequently. The nominal rate is the stated rate in a problem, such as 5%, compounded monthly. The number of periods per year is also stated in most problems. An interest rate compounded monthly involves 12 periods per year, for example.

Using the relationship shown in figure 1 above, any effective annual rate can be converted to a rate compounded more frequently and any rate compounded more frequently than once a year can be converted to an effective annual rate.

Converting interest rates on the HP 20b

The HP 20b calculator has the relationship shown in figure 1 built-in and available to the user through the Iconv menu environment. In addition, the HP 20b presents a unique function that allows for the solution to the number of periods per year, given an effective and nominal rate. This feature has never been available on a handheld financial calculator before. Be sure to read the note in example 5 about this feature. The menu map is presented below.


Figure 2 The Menu Map for the Interest Conversion Menu

Table 1 Interest Conversion Menu Items

Item	Description
Nom.%	Nominal interest rate: the stated annual interest rate compounded as represented by *P/YR*, such as 18% compounded monthly. Input/Output.
Eff.%	Effective annual interest rate taking compounding into account. Input/Output.
P/YR	Compounding periods per year. Default is *12*. Input/Output.

Practice converting interest rates

Example 1: What annual rate is equivalent to 8%, compounded monthly? Verify that the default P/YR is 12.

Solution: ☐ Iconv ☐ Reset INPUT

```
Nom. %      =   INPUT =
0.00
```
Figure 3

8 INPUT
▼ ▼

```
P/YR        =   INPUT =
12.00
```
Figure 4

▲ =
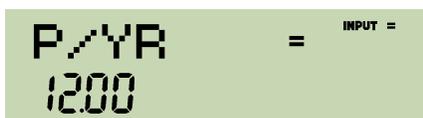
```
Eff. %      =   INPUT =
8.30
```
Figure 5

Answer: 8.30%. Over time, an annual rate of 8.30% would produce the same effects as 8%, compounded monthly.

Example 2: What rate, compounded monthly, is equivalent to an effective annual rate of 8.30%?

Solution: ☐ Iconv ☐ Reset INPUT
▼ 8 · 3 INPUT
▲ =
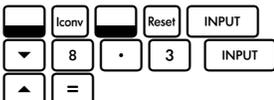
```
Nom. %      =   INPUT =
8.00
```
Figure 6

Answer: 8%, as it should be since this is the inverse relationship to example 1. Note that the keystrokes shown to reset the Iconv environment are not strictly necessary each time, as long as you are always aware of what is stored in each menu item when you do a new calculation.

Example 3: Which interest rate would give you better returns as an investor? 4.25%, compounded quarterly or 4.15%, compounded monthly?

Solution: The way to solve problems like these is to convert each rate to an effective annual rate and then compare them.

☐ Iconv ☐ Reset INPUT
4 · 2 5 INPUT
▼ ▼ 4 INPUT
▲ =
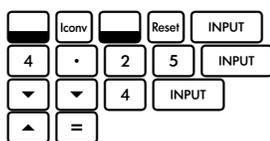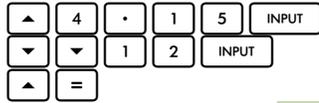
Figure 7

Figure 8

Answer: 4.25% compounded quarterly is equivalent to 4.32% compounded annually (or to an effective rate of 4.33%), while 4.15% compounded monthly is equivalent to 4.23% compounded annually. The higher rate of return is offered by the 4.25%, compounded quarterly rate.

Example 4: Convert 5%, compounded monthly to an equivalent semiannual rate.

Solution: First, convert the monthly rate to an effective rate.
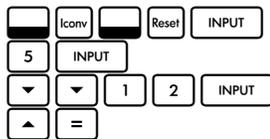
Figure 9

Then convert this rate to a semiannual rate.

Figure 10

Answer: 5%, compounded monthly is equivalent to 5.05%, compounded semiannually (to more decimal places, it is actually 5.052373591%, compounded semiannually).

Example 5: John is told that the nominal rate is 10% and the effective annual rate is 10.4959%. How many periods per year is this nominal rate being compounded?

Solution:
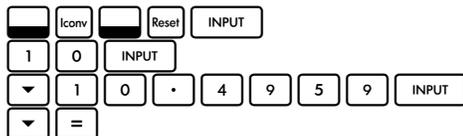
```
P/YR              =    INPUT =
26.01
```
Figure 11

Answer: 26.01 times a year. This is very nearly bi-weekly, which is probably what the rate is being compounded.

NOTE 1:	When you compute a value for P/YR, the computed value is stored into the P/YR value used by the time value of money (TVM) calculations. If this value is not an integer or is negative, you will encounter errors when solving TVM problems, since P/YR must be an integer for those types of problems. If you wish to use a computed value in future TVM calculation, make the value an integer and store it by pressing ▭ P/YR.
NOTE 2:	It will be very easy to forget that you have computed a value for P/YR and did not restore the P/YR valued used by the TVM calculations. If you get an error stating "ER: Invalid P/YR", this is the cause.
NOTE 3:	The solution to this type of problem involves a solver technique known as iteration. However, due to the incredible speed of the HP 20b calculator, you will likely never notice an delay in response at all.

Example 6: Cindy is told that the nominal rate is 12% and the effective annual rate is 12.7474%. How many periods per year is this nominal rate being compounded?

Solution: ▭ Iconv ▭ Reset INPUT
1 2 INPUT
▼ 1 2 . 7 4 7 4 INPUT
▼ =
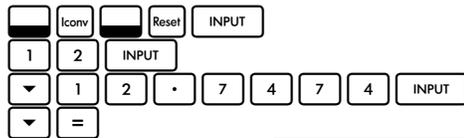
```
P/YR              =    INPUT =
355.16
```
Figure 12

Answer: 355.16 times a year. This is very daily compounding, which is probably what the nominal rate is being compounded. The true effective rate for a 12% nominal rate compounded 365 times a year is 12.7474615639%, which is not that different from the rate Cindy was quoted.