|  |  |
| --- | --- |
| **Power Ratio** | **dB** |
| 1 | 0 |
|  | 1.5 |
| 2 | 3 |
|  | 5 |
| 4 | 6 |
| 5 | 7 |
| 8 | 9 |
| 10 | 10 |
| 0.1 | -10 |

**Table 7.1 Decibel table** Common values for the decibel. The decibel values for all but the powers of ten are approximate, but are accurate to a decimal place.

The accompanying table provides "nice" decibel values. Converting decibel values back and forth is fun, and tests your ability to think of decibel values as sums and/or diferences of the well-known values and of ratios as products and/or quotients. This conversion rests on the logarithmic nature of the decibel scale.

For example, to fnd the decibel value for



we halve the decibel value for 2; 26 dB equals 10 + 10 + 6 dB that corresponds to a ratio of 10 × 10 × 4 = 400. Decibel quantities add; ratio values multiply.

One reason decibels are used so much is the frequency-domain input-output relation for linear systems: *Y (f)= X (f) H (f)* . Because the transfer function multiplies the input signal's spectrum, to fnd the output amplitude at a given frequency we simply add the flter's gain in decibels (relative to a reference of one) to the input amplitude at that frequency. This calculation is one reason that we plot transfer function magnitude on a logarithmic vertical scale expressed in decibels.

### Permutations and Combinations

#### Permutations and Combinations

 Available under [Creative Commons-ShareAlike 4.0 International License](http://creativecommons.org/licenses/by-sa/4.0/) ([http://creativecommon](http://creativecommons.org/licenses/by-sa/4.0/) [s.org/licenses/by-sa/4.0/](http://creativecommons.org/licenses/by-sa/4.0/)).

The lottery "game" consists of picking *k* numbers from a pool of *n*. For example, you select 6 numbers out of 60. To win, the order in which you pick the numbers doesn't matter; you only have to choose the right set of 6 numbers. The chances of winning equal the number of diferent length-*k* sequences that can be chosen. A related, but