

5 Math

Key terms: `**` `//` `%` `math` `random`

Reading: Severance 4.4, 4.5

Reading: WikiBooks Python Programming's "Basic Math"¹¹

Exercise: Write a program that prints out a number so great that it is at least ten lines long in your terminal.

Mathematical expressions in Python are made of objects (literal or named) and operators that are infix, or between them. Besides the classic four arithmetic operators (+, -, *, / or //), several more useful operators are available. `**` raises a base number to a power — and since floating point exponents work fine, roots and reciprocals can be found with the same operator (e.g., `2**0.5`).

Python has two division operators which return different types when operating on integers. `/`, a single slash, always returns a `float`. `//`, a double slash, always returns an `int`, perhaps leaving some remainder. Correspondingly, `%`, modulo, indicates that remainder. (This arrangement finally retires the confusing C-style division operator which let the types passed determine the type returned.)

```
# Share out balls equally between jugglers.
# Integer division is used because balls stay whole.

jugglers = 6
balls = 100
balls_per_juggler = balls // jugglers
balls_left_over = balls % jugglers
```

Rounding off is the process of abandoning the fine details of a numeric figure for readability: e.g., it's easier and less precise to read 25% than it is 24.853%. Remember to round only at output time, never before mathematical operations. We can obtain a rounded figure by calling the built-in function `round()`:

```
# Print a high power of two.
print ( 2 ** 10 )

# Print a fractional power of two and the same, rounded.
print ( 2 ** 0.1, round ( 2 ** 0.1 ) )
```

Some useful data and functions are located in the `math` module. Among these are functions for geometry, trigonometry, combinatorics, and various kinds of tests. The transcendental constants `math.e` and `math.pi` are defined too.

Expect to write programs that require randomness and the use of the `random` package. Call on `random.randint()` for random integers, or `random.random()` for a positive `float` under 1. When we learn about lists, we can use `random.choice()` or `random.sample()` to take samples from them.

```
# Model the roll of an 18 sided die.
import random
die_roll = random.randint(1,18)
print(die_roll)
```

Next, we will review basic types of containers.

¹¹https://en.wikibooks.org/wiki/Python_Programming/Basic_Math