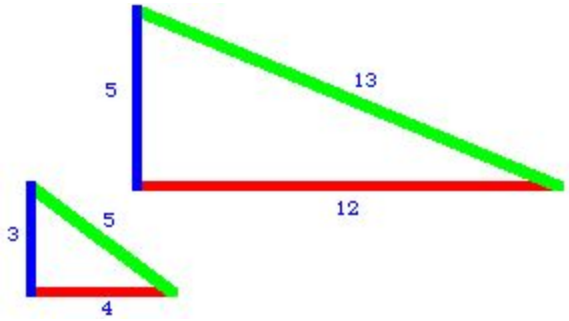
Triangles

A pythagorean triple is a solution to the equation $a^2 + b^2 = c^2$ such that a, b and c are positive integers. Equivalently, they are right-angle triangles with whole numbers for sides:

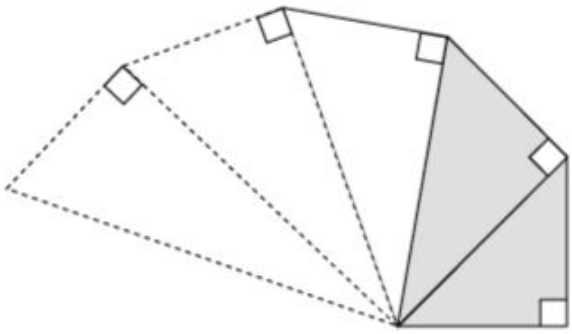


a) Find five different pythagorean triples

b) How many pythagorean triples are there such that c < 30 ?
Note: (a=3, b=4, c=5) should be counted the same as (a=4, b=3, c=5)

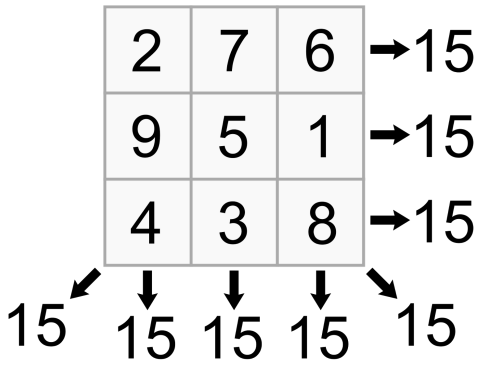
c) Demonstrate that there are no solutions for **cubes** up to 500
Hint: The default 'int' type ranges from -128 to 127. You'll need something bigger.

d) [challenging] Find a spiral of pythagorean triples:



Squares

A magic square contains positive integers and the rows, columns and diagonals all sum to the same number. Here is a 3x3 square:

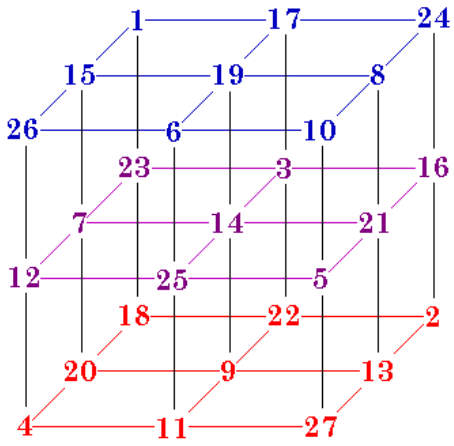


a) How many magic squares are there that sum to 24, 30 and 51?
Hint: You can 'expose' and assign a 'target' to avoid re-compiling the program.

b) Find a magic square with a square number in the middle

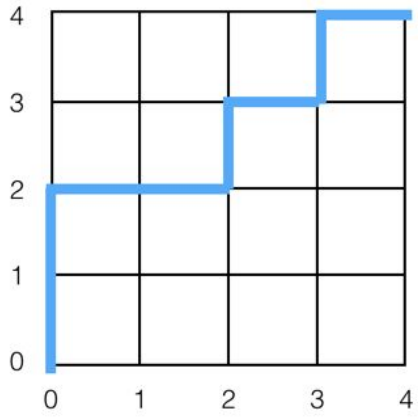
c) [challenging] What's the smallest total for a 4x4 magic square?

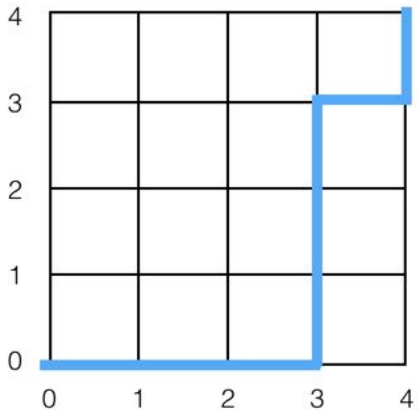
d) [extra challenging] Find a magic **cube** of any dimension
Note: Don't worry about the diagonals. Find a basic solution first, then add them in later.



Take a walk

How many ways are there to walk from (0, 0) to (4, 4) on a grid if you can only take one step north or east at a time? Here are two possible walks:

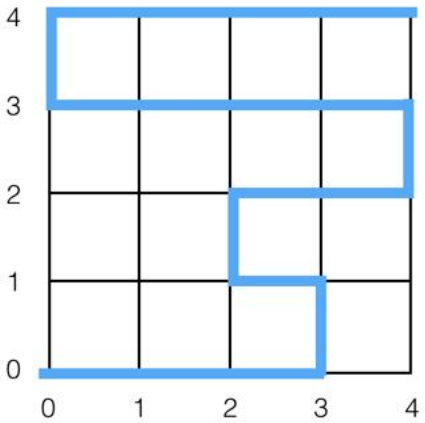


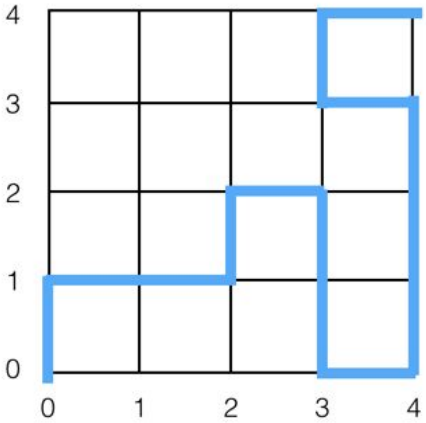


Hint: Use eachCons to iterate through consecutive coordinates of a path

[extremely challenging]

How many ways are there if you can go in any direction, but can't step over your own path? This is called a self-avoiding walk. Here are two examples:





How many of these ways begin by going entirely along one side of the grid first?

- How many of these ways travel vertically more than they travel horizontally?