

Vectorized Code, Logical Indexing

Exercises

Pythagorean

- Write a function `pythagorean(A)` that finds all of the positive integer numbers $x, y, z \leq A$ that satisfy $x^2 + y^2 = z^2$. Your function will print these numbers as formatted in the sample output below, and also return a matrix with 3 columns, each row containing the integers x, y , and z .
- Do not use any loops to solve this problem.
- Hints: `meshgrid`, `reshape`, `elementwise-and`, `logical indexing`. It takes four statements to solve this problem.

```
>> pythagorean(20)
ans =
     3     4     5
     6     8    10
     5    12    13
     9    12    15
     8    15    17
    12    16    20
```

geomser

- Write a function called `geomser` that will receive values of r and n , and will calculate and return the sum of the geometric series:

$$1 + r + r^2 + r^3 + r^4 + \dots + r^n$$

```
>> geomser(1,5)
ans =
     6
>> disp(geomser(2,4))
    31
```

CRUX, Problem 1746, K. Guy and Richard J. Nowakowki

- Write a function `crux1746(B)` that takes a positive integer B and returns all pairs of integers a, b in a two column matrix such that:

$$1 < a < b$$

$$ab \text{ exactly divides } a^2 + b^2 - 1$$

- What are the possible values of:

$$\frac{a^2 + b^2 - 1}{ab}$$

Japan 1999

- Let $f(x) = x^3 + 17$. Prove that for each natural number $n \geq 2$, there is a natural number x for which $f(x)$ is divisible by $3n$ but not $3n + 1$
- Write a function `japan1999` that takes an input `N` and for each $n=2\dots N$, returns values of n and x satisfying the above property as column vectors.