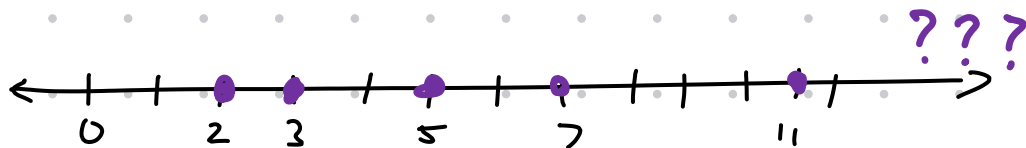


12 April 2024

What is the distribution of primes?



Given any positive integer n , how many primes are less than n ?

DEF: The prime counting function $\pi(x)$ gives the number of primes less than or equal to x .

$$\pi: \mathbb{R} \rightarrow \mathbb{Z}^{\geq 0}$$

π is a function that takes any real number input and outputs a nonnegative integer.

examples: $\pi(1) = 0$

$$\pi(10) = 4$$

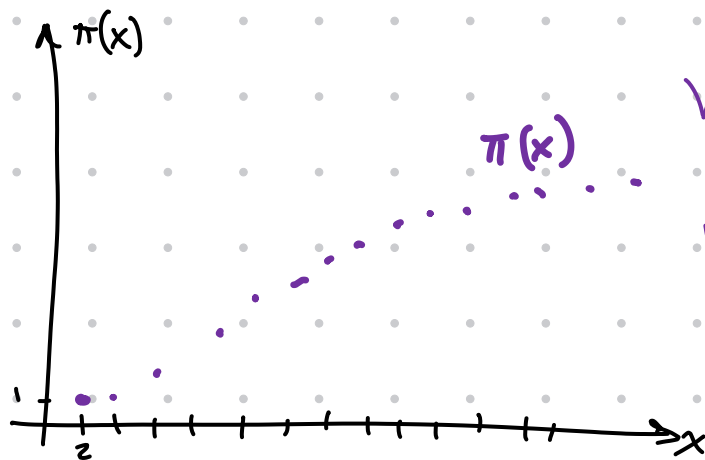
$$\pi(17) = 7$$

$$\pi(18.2) = 7$$

primes: 2, 3, 5, 7

2, 3, 5, 7, 11, 13, 17

Want a plot:



What is the shape of the prime-counting function?

Efficiently computing $\pi(x)$ for $x=0,1,2,3,\dots,n_{\text{Max}}$:

primes: $[2, 3, 5, 7, 11, 13, 17, 19, 23, 29, \dots, n_{\text{Max}}]$

prime counts:
 $\pi(x)$ $[0, 0, 1, 2, 2, 3, \dots, n_{\text{Max}}+1]$