

Sieve of Eratosthenes

Here is a description of the sieve of Eratosthenes (Scheinerman, E.R., *Mathematics: A Discrete Introduction*, 2000.):

Make a list of all integers from 2 to any number N . Notice that the smallest number on this list (2) is a prime number. Cross off all multiples of 2 (except for 2 itself). The next smallest number on the list is also a prime number (3). Cross off all multiples of 3 (except for 3 itself). The next number in the list is 4, but it has been crossed off. The next smallest number on the list that is not crossed off is a 5. Cross off all multiples of 5 (except 5 itself).

Continue this process until you have reached the smallest integer whose square is greater than N . The list now only contains prime numbers. Output the list of primes.

Input: N - the function outputs all primes from 2 to N

Output: L, the list of primes from 2 to N .

Good luck. Here are several examples.

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> eratosthenes(37)
[1] 2 3 5 7 11 13 17 19 23 29 31 37
> eratosthenes(81)
[1] 2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79
> eratosthenes(11)
[1] 2 3 5 7 11
> eratosthenes(2)
[1] 2
> eratosthenes(6000)
[1] 2 3 5 7 11 13 17 19 23 29 31 37 41
[14] 43 47 53 59 61 67 71 73 79 83 89 97 101
[27] 103 107 109 113 127 131 137 139 149 151 157 163 167
[40] 173 179 181 191 193 197 199 211 223 227 229 233 239
[53] 241 251 257 263 269 271 277 281 283 293 307 311 313
[66] 317 331 337 347 349 353 359 367 373 379 383 389 397
[79] 401 409 419 421 431 433 439 443 449 457 461 463 467
[92] 479 487 491 499 503 509 521 523 541 547 557 563 569
[105] 571 577 587 593 599 601 607 613 617 619 631 641 643
[118] 647 653 659 661 673 677 683 691 701 709 719 727 733
[131] 739 743 751 757 761 769 773 787 797 809 811 821 823
[144] 827 829 839 853 857 859 863 877 881 883 887 907 911
[157] 919 929 937 941 947 953 967 971 977 983 991 997 1009
[170] 1013 1019 1021 1031 1033 1039 1049 1051 1061 1063 1069 1087 1091
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[183] 1093 1097 1103 1109 1117 1123 1129 1151 1153 1163 1171 1181 1187
[196] 1193 1201 1213 1217 1223 1229 1231 1237 1249 1259 1277 1279 1283
[209] 1289 1291 1297 1301 1303 1307 1319 1321 1327 1361 1367 1373 1381
[222] 1399 1409 1423 1427 1429 1433 1439 1447 1451 1453 1459 1471 1481
[235] 1483 1487 1489 1493 1499 1511 1523 1531 1543 1549 1553 1559 1567
[248] 1571 1579 1583 1597 1601 1607 1609 1613 1619 1621 1627 1637 1657
[261] 1663 1667 1669 1693 1697 1699 1709 1721 1723 1733 1741 1747 1753
[274] 1759 1777 1783 1787 1789 1801 1811 1823 1831 1847 1861 1867 1871
[287] 1873 1877 1879 1889 1901 1907 1913 1931 1933 1949 1951 1973 1979
[300] 1987 1993 1997 1999 2003 2011 2017 2027 2029 2039 2053 2063 2069
[313] 2081 2083 2087 2089 2099 2111 2113 2129 2131 2137 2141 2143 2153
[326] 2161 2179 2203 2207 2213 2221 2237 2239 2243 2251 2267 2269 2273
[339] 2281 2287 2293 2297 2309 2311 2333 2339 2341 2347 2351 2357 2371
[352] 2377 2381 2383 2389 2393 2399 2411 2417 2423 2437 2441 2447 2459
[365] 2467 2473 2477 2503 2521 2531 2539 2543 2549 2551 2557 2579 2591
[378] 2593 2609 2617 2621 2633 2647 2657 2659 2663 2671 2677 2683 2687
[391] 2689 2693 2699 2707 2711 2713 2719 2729 2731 2741 2749 2753 2767
[404] 2777 2789 2791 2797 2801 2803 2819 2833 2837 2843 2851 2857 2861
[417] 2879 2887 2897 2903 2909 2917 2927 2939 2953 2957 2963 2969 2971
[430] 2999 3001 3011 3019 3023 3037 3041 3049 3061 3067 3079 3083 3089
[443] 3109 3119 3121 3137 3163 3167 3169 3181 3187 3191 3203 3209 3217
[456] 3221 3229 3251 3253 3257 3259 3271 3299 3301 3307 3313 3319 3323
[469] 3329 3331 3343 3347 3359 3361 3371 3373 3389 3391 3407 3413 3433
[482] 3449 3457 3461 3463 3467 3469 3491 3499 3511 3517 3527 3529 3533
[495] 3539 3541 3547 3557 3559 3571 3581 3583 3593 3607 3613 3617 3623
[508] 3631 3637 3643 3659 3671 3673 3677 3691 3697 3701 3709 3719 3727
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[534] 3851 3853 3863 3877 3881 3889 3907 3911 3917 3919 3923 3929 3931
[547] 3943 3947 3967 3989 4001 4003 4007 4013 4019 4021 4027 4049 4051
[560] 4057 4073 4079 4091 4093 4099 4111 4127 4129 4133 4139 4153 4157
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[638] 4729 4733 4751 4759 4783 4787 4789 4793 4799 4801 4813 4817 4831
[651] 4861 4871 4877 4889 4903 4909 4919 4931 4933 4937 4943 4951 4957
[664] 4967 4969 4973 4987 4993 4999 5003 5009 5011 5021 5023 5039 5051
[677] 5059 5077 5081 5087 5099 5101 5107 5113 5119 5147 5153 5167 5171
[690] 5179 5189 5197 5209 5227 5231 5233 5237 5261 5273 5279 5281 5297

[703] 5303 5309 5323 5333 5347 5351 5381 5387 5393 5399 5407 5413 5417
[716] 5419 5431 5437 5441 5443 5449 5471 5477 5479 5483 5501 5503 5507
[729] 5519 5521 5527 5531 5557 5563 5569 5573 5581 5591 5623 5639 5641
[742] 5647 5651 5653 5657 5659 5669 5683 5689 5693 5701 5711 5717 5737
[755] 5741 5743 5749 5779 5783 5791 5801 5807 5813 5821 5827 5839 5843
[768] 5849 5851 5857 5861 5867 5869 5879 5881 5897 5903 5923 5927 5939
[781] 5953 5981 5987