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Homework 10

(1) Fully understand and be able to reproduce the proof that there are infinitely many primes
We will prove by contradiction. Suppose there are only finitely many primes. We can label these finitely many primes $p_1, p_2, p_3, \cdots, p_n$ for some $n \in \mathbb{N}$. Next let us consider the prime $p = p_1 p_2 p_3 \cdots p_n + 1$. This prime has a remainder 1 when divided by any prime from $p_1, \cdots, p_n$. Hence we can say that p is a larger prime or p is divisible by a prime larger than p_n. This contradicts our initial assumption that p_n is the largest prime.

(2) Compute from scratch all the primes ≤ 140.

~~1~~	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~	11	~~12~~	13	~~14~~
~~15~~	~~16~~	17	~~18~~	19	~~20~~	~~21~~	~~22~~	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~
29	~~30~~	31	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	37	~~38~~	~~39~~	~~40~~	41	~~42~~
43	~~44~~	~~45~~	~~46~~	47	~~48~~	~~49~~	~~50~~	~~51~~	~~52~~	53	~~54~~	~~55~~	~~56~~
~~57~~	~~58~~	59	~~60~~	61	~~62~~	~~63~~	~~64~~	~~65~~	~~66~~	67	~~68~~	~~69~~	~~70~~
71	~~72~~	73	~~74~~	~~75~~	~~76~~	~~77~~	~~78~~	79	~~80~~	~~81~~	~~82~~	83	~~84~~
~~85~~	~~86~~	~~87~~	~~88~~	89	~~90~~	~~91~~	~~92~~	~~93~~	~~94~~	~~95~~	~~96~~	97	~~98~~
~~99~~	~~100~~	101	~~102~~	103	~~104~~	~~105~~	~~106~~	107	~~108~~	109	~~110~~	~~111~~	~~112~~
113	~~114~~	~~115~~	~~116~~	~~117~~	~~118~~	~~119~~	~~120~~	~~121~~	~~122~~	~~123~~	~~124~~	~~125~~	~~126~~
127	~~128~~	~~129~~	~~130~~	131	~~132~~	~~133~~	~~134~~	~~135~~	~~136~~	137	~~138~~	139	~~140~~

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139

(3) Write 3003 as a product of prime powers.

$3 \cdot (1001)$

$3(11)(91)$

$3(11)(7)(13)$

$3(7)(11)(13)$

(4) How many primes, roughly are there $\leq e^{100}$?

(I am not sure how to proceed).