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Drill Comparing Orders Of Growth – 1

	Double The input size	Increase input size by one
1. n^2	(2n)^2/n^2 = 4n^2/n^2 = **4x slower**	Lim n → ∞ (n+1)^2/n^2 = n^2 + 2n + 1 / n^2 (ignore lower order terms when find the limit at ∞) -> n^2/n^2 = **1x or the same.**
2. n^3	(2n)^3/n^3 = 8n^3/n^3 = **8x slower**	Lim n → ∞ (n+1)^3/n^3 = n^3 + 3n^2 +3n + 1 / n^3-> n^3/n^3 = **1x or the same.**
3. 100n^2	100(2n)^2/100n^2 = 100(4)(n^2)/100(n^2) = **4x slower**	Lim n → ∞ 100(n+1)^2/100n^2 = 100(n^2 + 2n + 1) / 100(n^2) = n^2 + 2n + 1 / n^2 -> n^2/n^2 = **1x or the same.**
4. nlogn	(2n)log(2n)/nlogn = 2log(2n)/logn = 2(log(2n/n) = 2log2 ~ **2x slower**	Lim n → ∞ ((n+1) log(n+1))/ n logn (get rid of lower order terms)→ n+1/ n → n/n = **1x or the same**
5. 2^n	2^2n/2^n, subtract the exponents of like bases in division (2n – n = n) → 2^2n/2^n = **(2^n)x slower**	2^(n+1)/2^n = **2x slower** (subtract exponents (n+1) – n = 1)

10^10 operations per second * 3600 seconds in an hour **= 36 * 10^13 operations a hour.** Since each mathematical description of algorithm performance reflects on operations that are performed for a given input size we can set our algorithms to, **36 * 10^13,** and solve for n and that will show us for which input size does that algorithm perform , **36 * 10^13** operations which is the amount of operations the computer can do anyways in an hour.

1. N^2	N^2 = 36 *10^12 →sqrt(n^2) = sqrt(36*10^12) → **n = 60 *10^5 or 6,000,000**
2. n^3	N^3 = 36*10^12→ cbrt(n^3) = cbrt(36*10^12) →**n = floor(33,019.2725) = 33,019**
3. 100n^2	100n^2 = 36 * 10^12 → sqrt(n^2) = sqrt((36*10^12)/100) → **n = 600,000**
4. nlogn	Nlogn = 36*10^12 → **Nmax =~ 28.9 * 10^11**(basically the logn takes away one order of magnitude so its almost constant but not quite – so with calculator tweaking you can get the approximate value of n.)
5. 2^n	2^n = 36 * 10^12→ $\log_2$(36 * 10^12) = 45.033→floor(45.033) = **45 = Nmax**
6. 2^2n	2^2n = 36*10^12→ ($\log_2$(36 * 10^12))/2 =22.5165 → floor(22.5165) = **22 = Nmax**