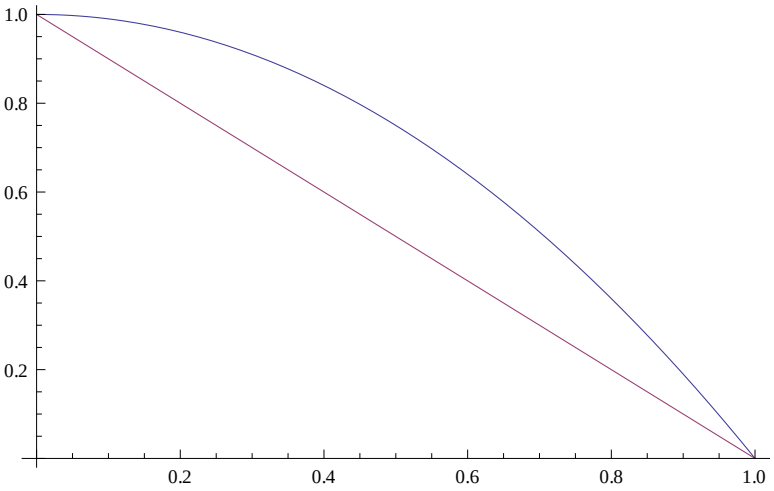
RAID failures
n redundant disks
p – probability of fail for 1 disk $0 < p < 1$
p^n – probability of fail of the system (fail for all n disks)
$1 - p^n$ – probability of not fail of the system
(not fail for some disk)

Probability of not fail of the system as a function of probability of fail of 1 disk

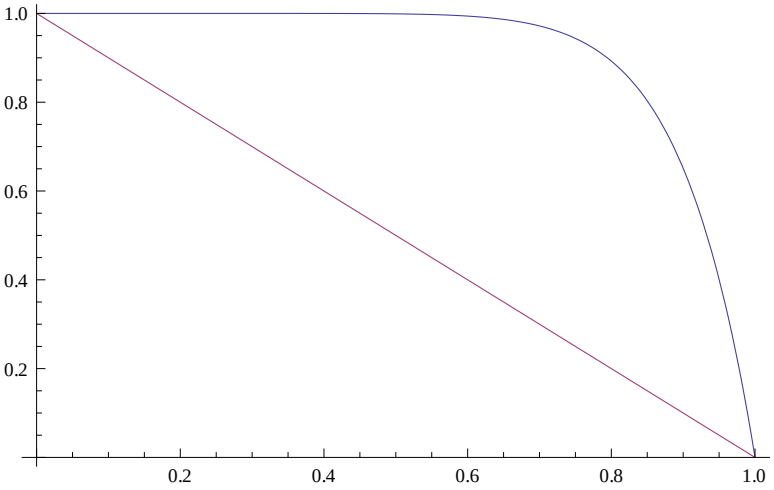
2 disks vs 1 disk

```
Plot[{1 - p^2, 1 - p}, {p, 0, 1}]
```



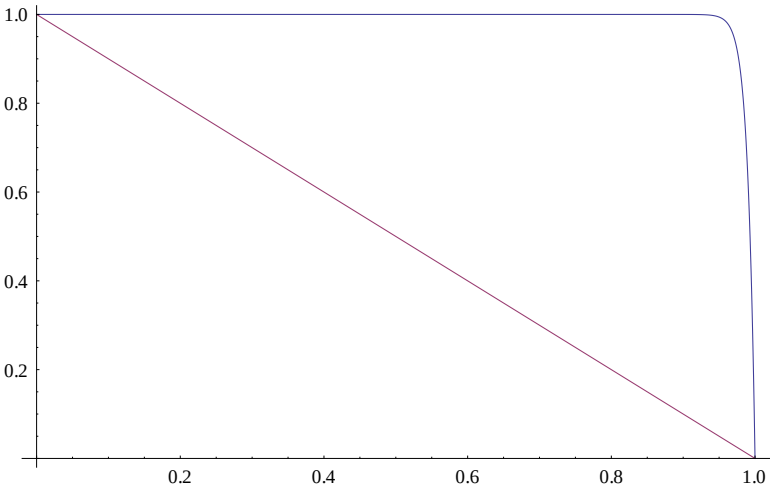
10 disks vs 1 disk

```
Plot[{1 - p^10, 1 - p}, {p, 0, 1}]
```



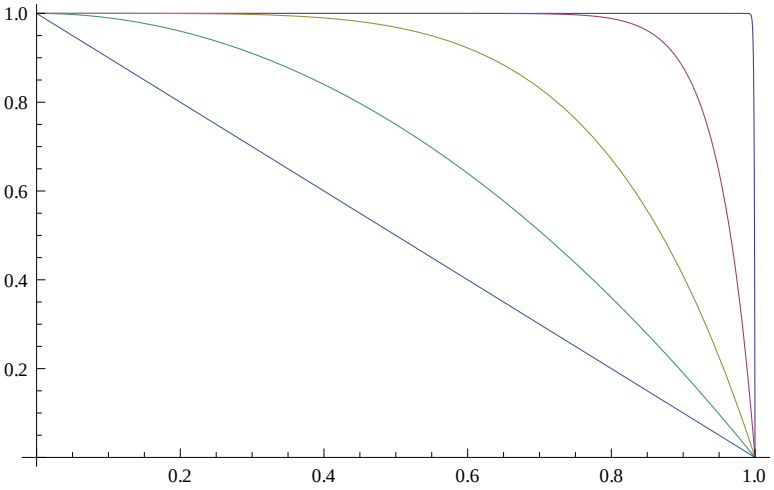
100 disks vs 1 disk

```
Plot[{1 - p^100, 1 - p}, {p, 0, 1}]
```



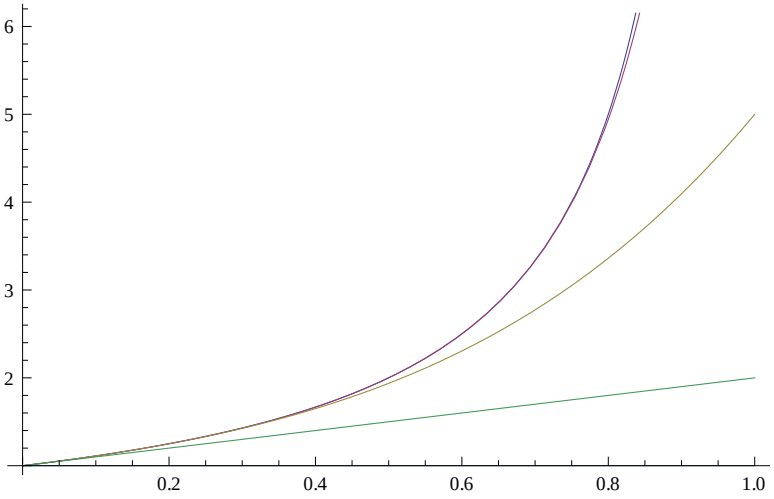
Comps for 1 disk, 2 disks, 5 disks, 20 disks, 1000 disks

```
Plot[{1 - p^1000, 1 - p^20, 1 - p^5, 1 - p^2, 1 - p}, {p, 0, 1}]
```

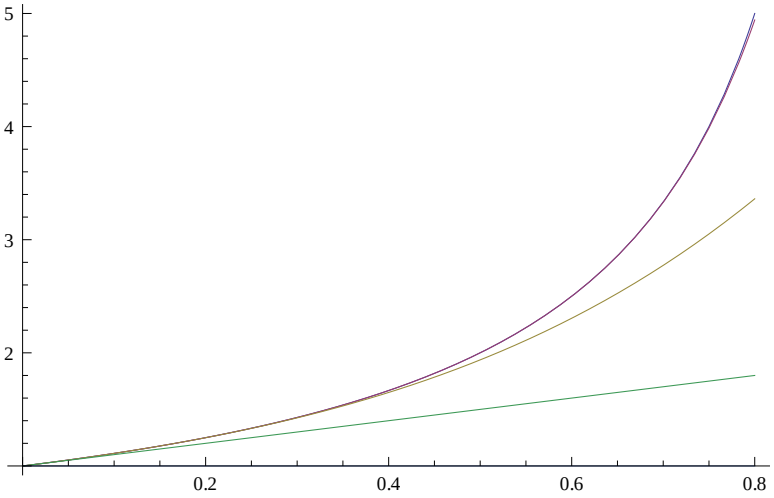


An increase of probability of not fail of a system relative to probability of not fail for a single disk as a function of probability of fail of a single disk.

$$\text{Plot}\left[\left\{\frac{1-p^{1000}}{1-p}, \frac{1-p^{20}}{1-p}, \frac{1-p^{5}}{1-p}, \frac{1-p^{2}}{1-p}, \frac{1-p}{1-p}\right\}, \{p, 0, 1\}\right]$$

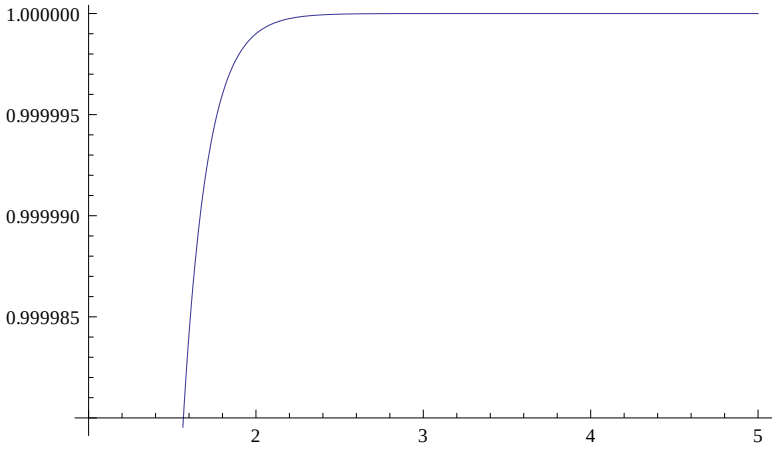


$$\text{Plot}\left[\left\{\frac{1-p^{1000}}{1-p}, \frac{1-p^{20}}{1-p}, \frac{1-p^{5}}{1-p}, \frac{1-p^{2}}{1-p}, \frac{1-p}{1-p}\right\}, \{p, 0, .8\}\right]$$



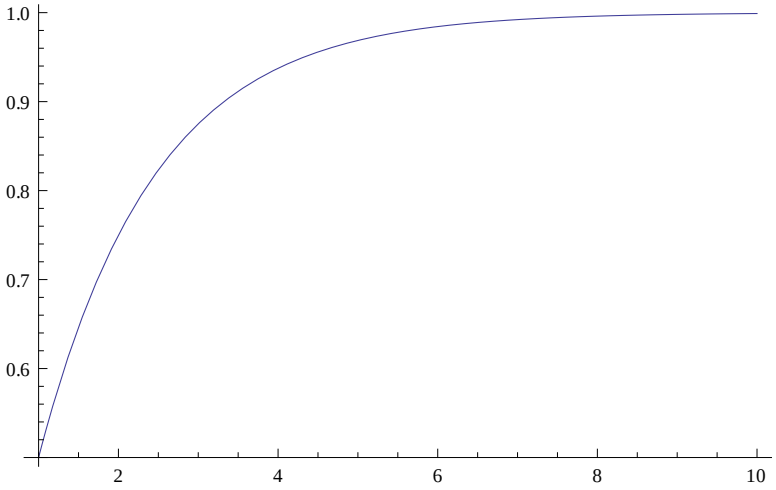
Probability of not fail of the system as a function of n, given the probability of fail of 1 disk = .001

```
Plot[{1 - .001^n,}, {n, 1, 5}]
```



Probability of not fail of the system as a function of n, given the probability of fail of 1 disk = .5

```
Plot[{1 - .5^n,}, {n, 1, 10}]
```



Now, in 3 D, the probability (ranging from 0 to 1) of not fail of the RAID as a function of the probability (ranging from 1 to 0) of fail of its single component (one disk) and the number (ranging from 1 to 18) of its components (disks):

```
Plot3D[{1 - p^n,}, {n, 1, 18}, {p, 0, 1}]
```