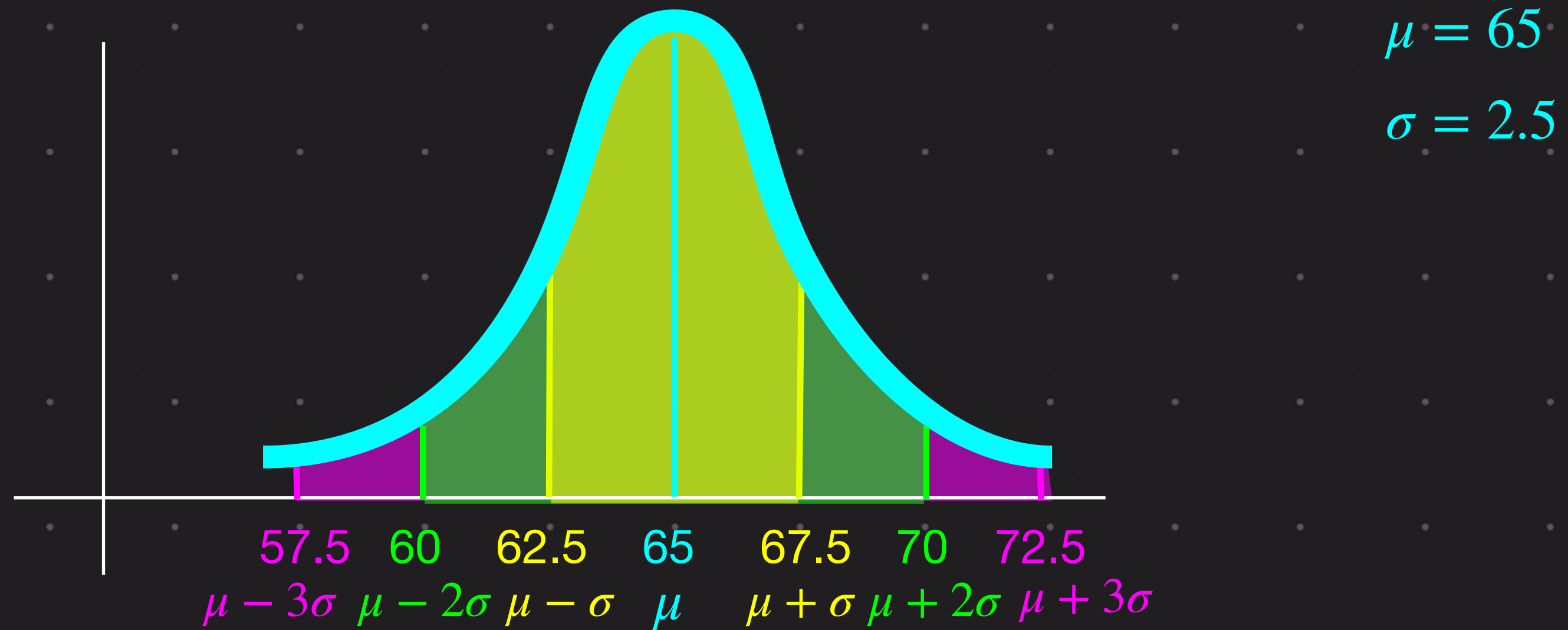


The height of people is Gaussian with mean 65 inches and standard deviation 2.5 inches



Fraction of people whose height is between 62.5 and 67.5 is 68%

$$P[62.5 < X < 67.5] = 0.68$$

$$P[\mu - \sigma < X < \mu + \sigma] = 0.68$$

Fraction of people whose height is between 60 and 70 is 95%

$$P[60 < X < 70] = 0.95$$

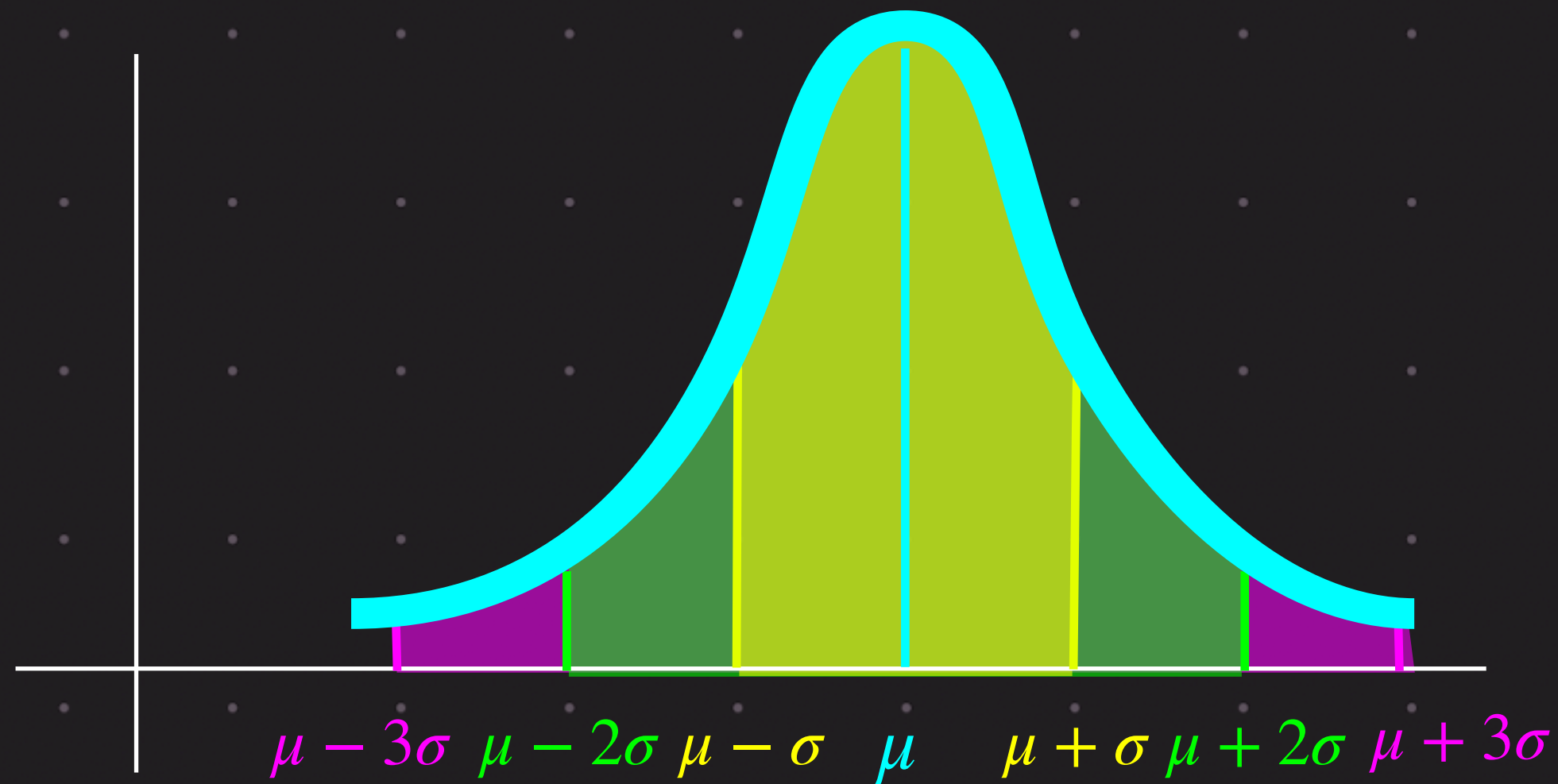
$$P[\mu - 2\sigma < X < \mu + 2\sigma] = 0.95$$

Fraction of people whose height is between 57.5 and 72.5 is 99.7%

$$P[57.5 < X < 72.5] = 0.997$$

$$P[\mu - 3\sigma < X < \mu + 3\sigma] = 0.997$$

Gaussian Empirical Rule or 68/95/99 Rule

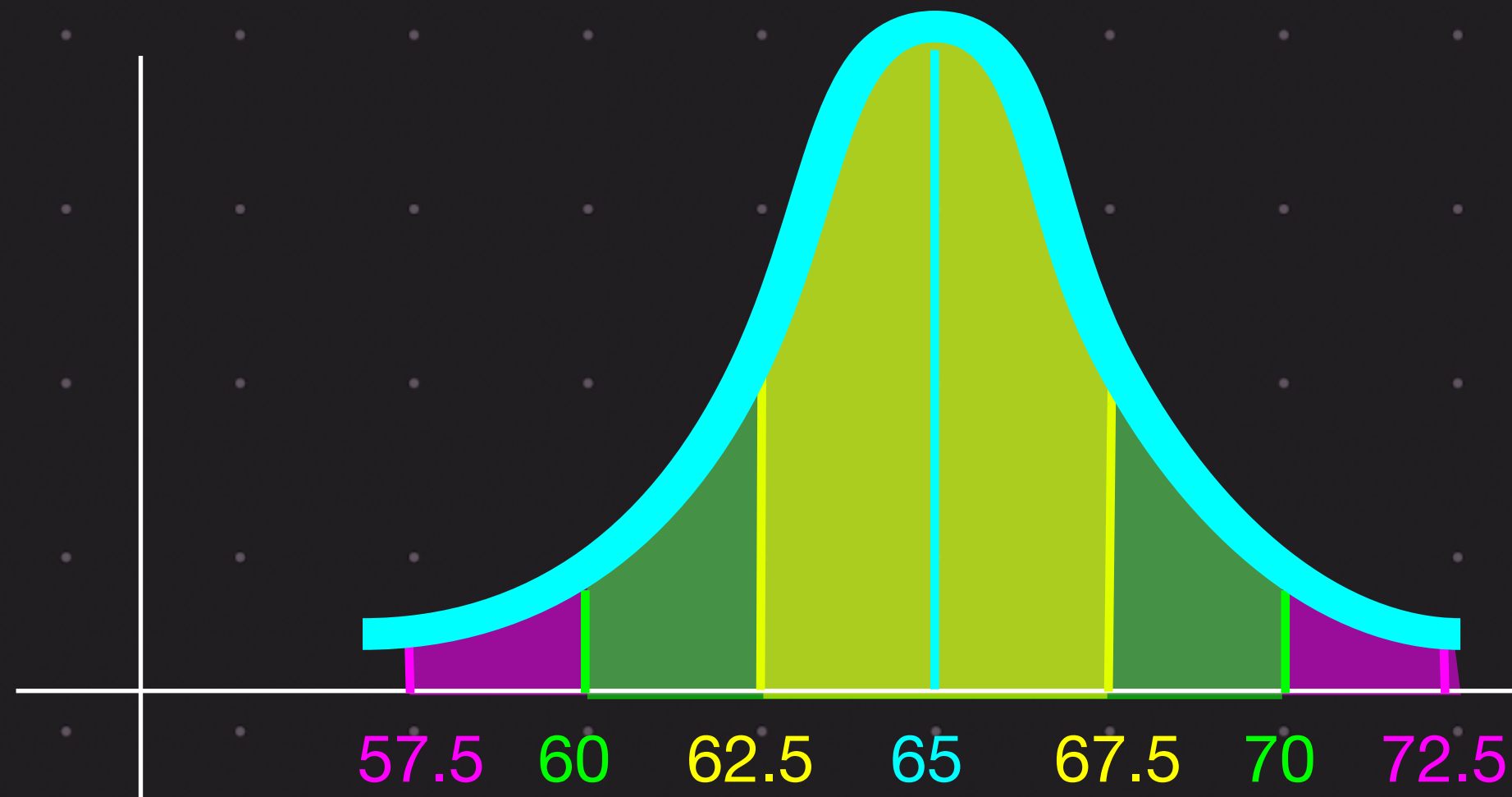


$$P[\mu - \sigma < X < \mu + \sigma] = 0.68$$

$$P[\mu - 2\sigma < X < \mu + 2\sigma] = 0.95$$

$$P[\mu - 3\sigma < X < \mu + 3\sigma] = 0.997$$

The height of people is Gaussian with mean 65 inches and standard deviation 2.5 inches



$$\mu = 65$$

$$\sigma = 2.5$$

$$P[62.5 < X < 67.5] = 0.68$$

$$P[60 < X < 70] = 0.95$$

$$P[57.5 < X < 72.5] = 0.997$$

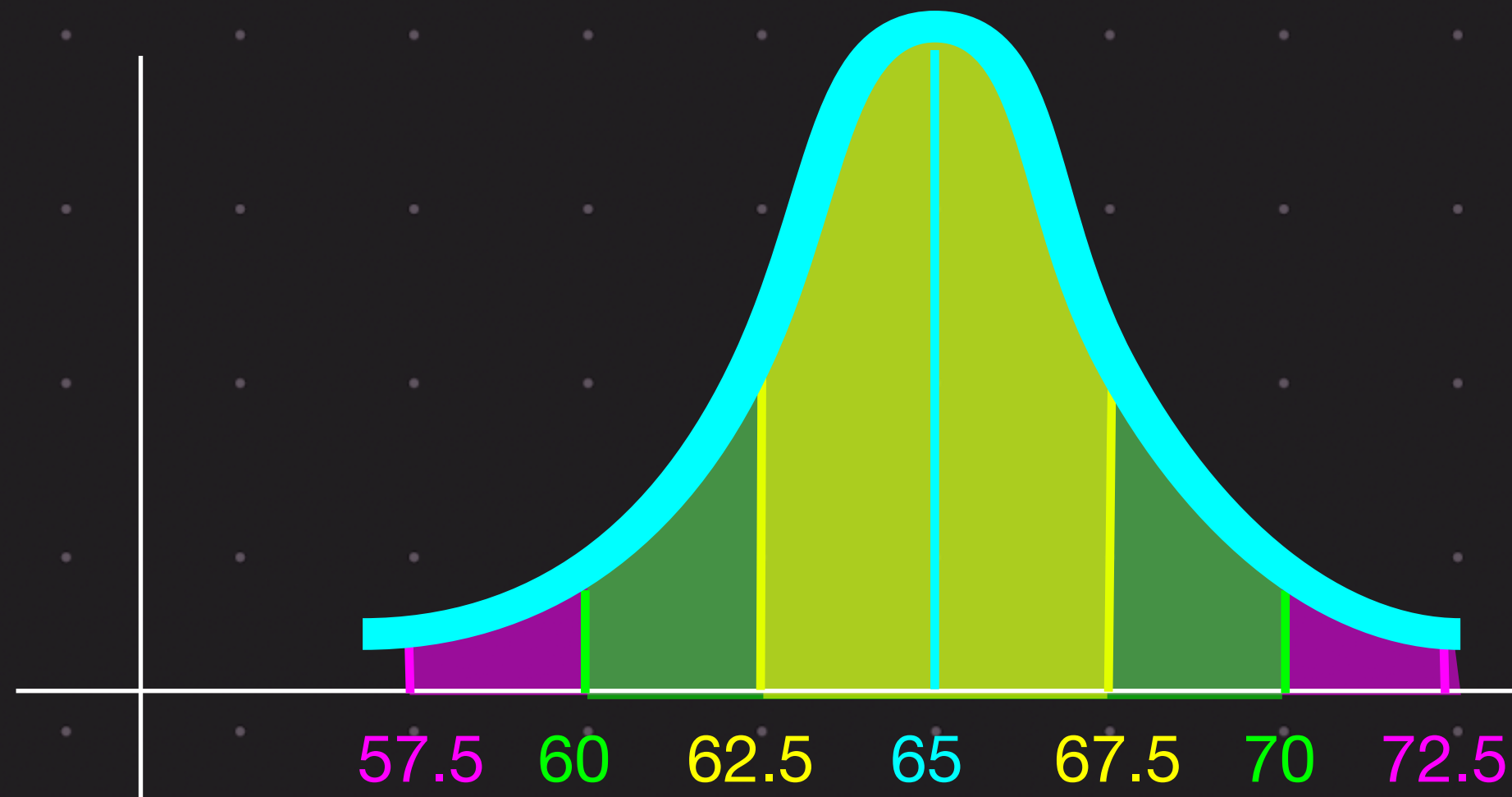
What is the fraction of people whose height is between 60 and 72.5?

Between 60 and 65? $\frac{95}{2} = 47.5$

Between 65 and 72.5? $\frac{99.7}{2} = 49.85$

Totally, $47.5 + 49.85 = 97.35$

The height of people is Gaussian with mean 65 inches and standard deviation 2.5 inches



$$\mu = 65$$

$$\sigma = 2.5$$

$$P[62.5 < X < 67.5] = 0.68$$

$$P[60 < X < 70] = 0.95$$

$$P[57.5 < X < 72.5] = 0.997$$

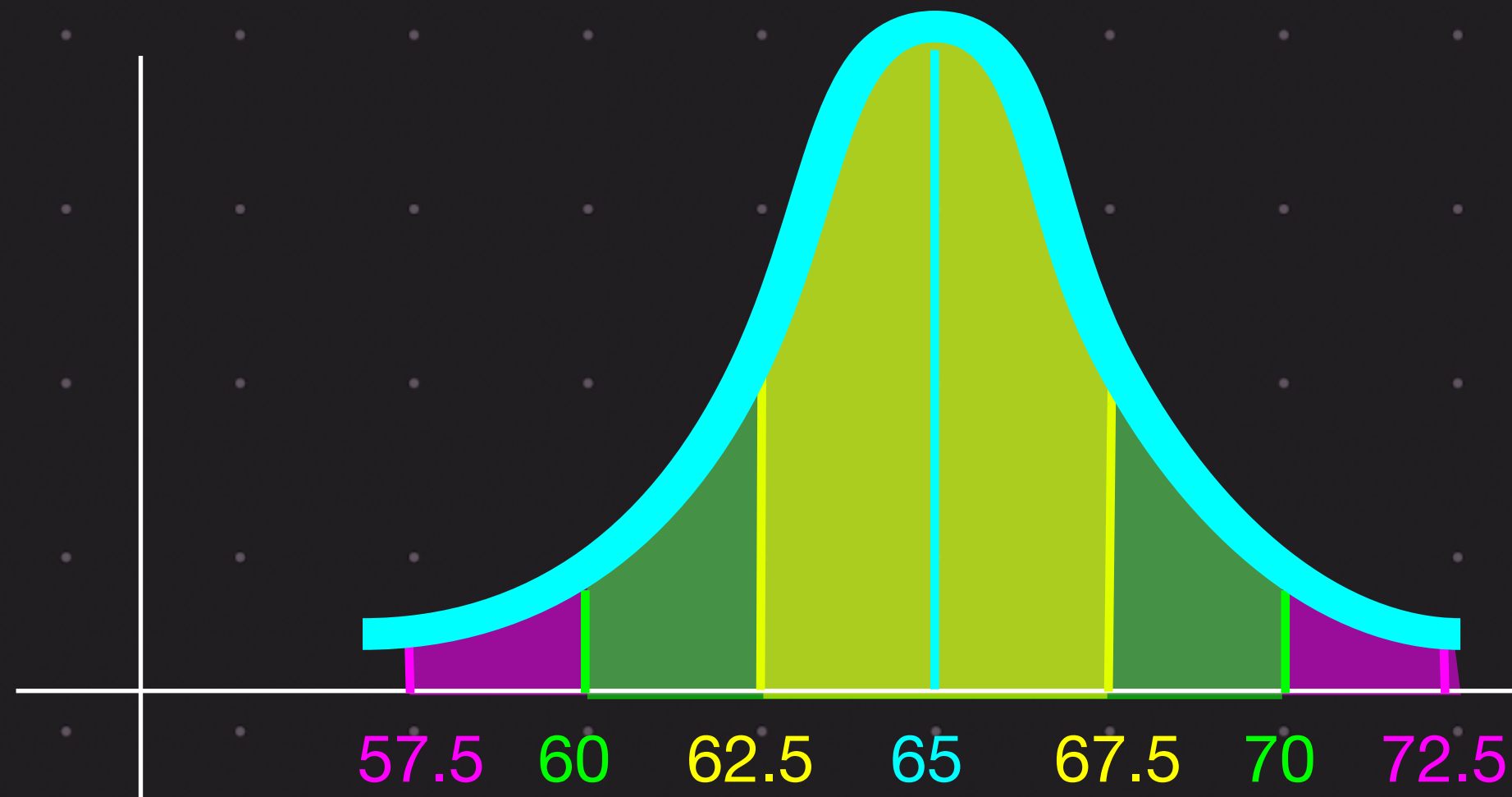
What fraction of people are shorter than 67.5?

What fraction of people are shorter 65? 50%

What fraction of people are in between 65 and 67.5? $68/2 = 34\%$

Totally $50 + 34 = 84\%$ $P[X < 67.5] = P[X < 65] + P[65 < X < 67.5] = 0.5 + 0.34 = 0.84$

The height of people is Gaussian with mean 65 inches and standard deviation 2.5 inches



$$\mu = 65$$

$$\sigma = 2.5$$

$$P[62.5 < X < 67.5] = 0.68$$

$$P[60 < X < 70] = 0.95$$

$$P[57.5 < X < 72.5] = 0.997$$

What fraction of people are shorter than 69.1?

How many σ (std devs) away from 65 is this number?

$$65 + z(2.5) = 69.1$$

$$z = \frac{(69.1 - 65)}{2.5} = 1.64$$

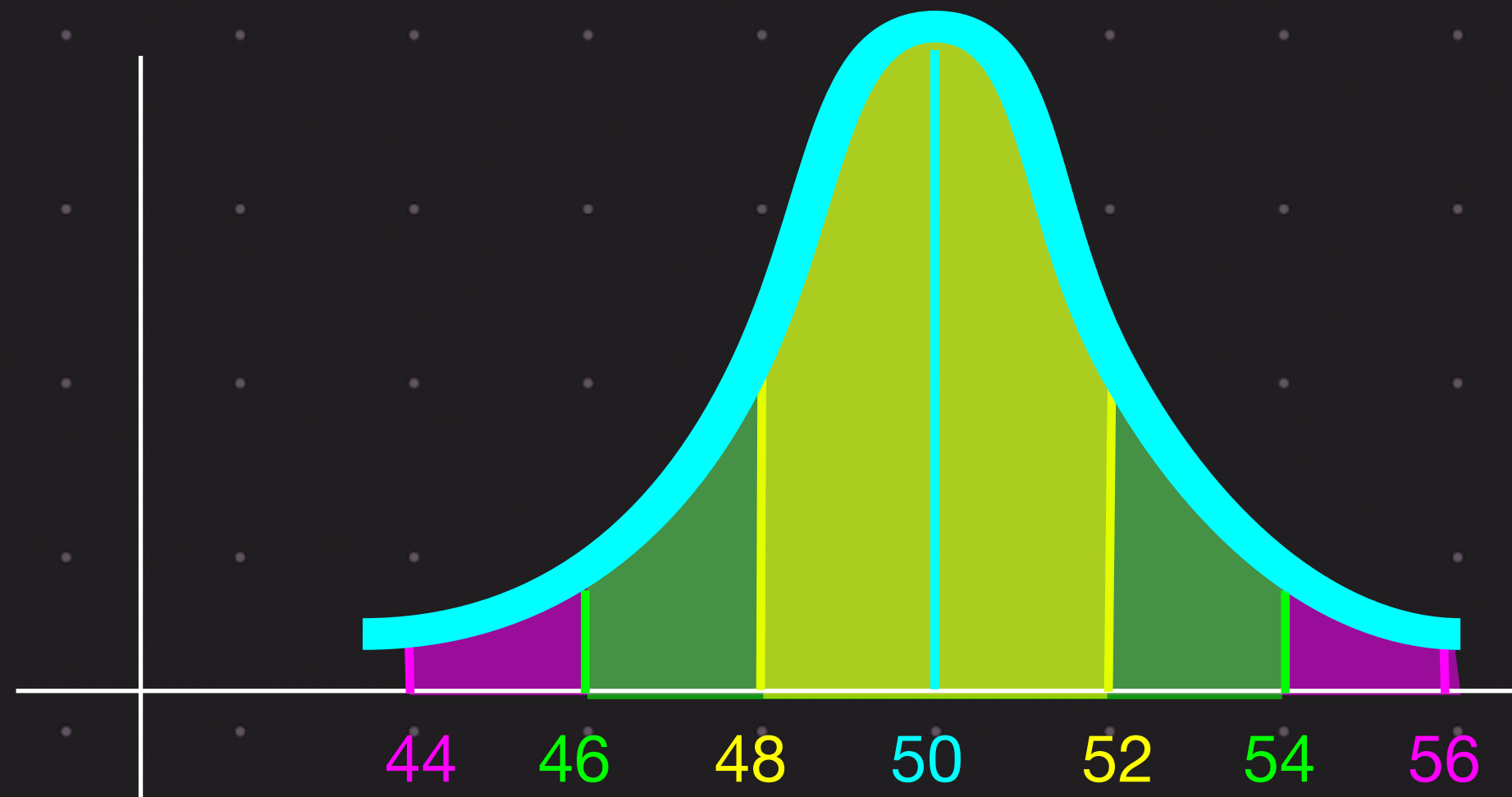
Z-Score

$$z = \frac{(x - \mu)}{\sigma}$$

To find this probability, we use the Z-table 94.9%

```
from scipy.stats import norm
norm.cdf(1.64)
```

Balls produced by manufacturer have mean 50 mm and std dev 2 mm

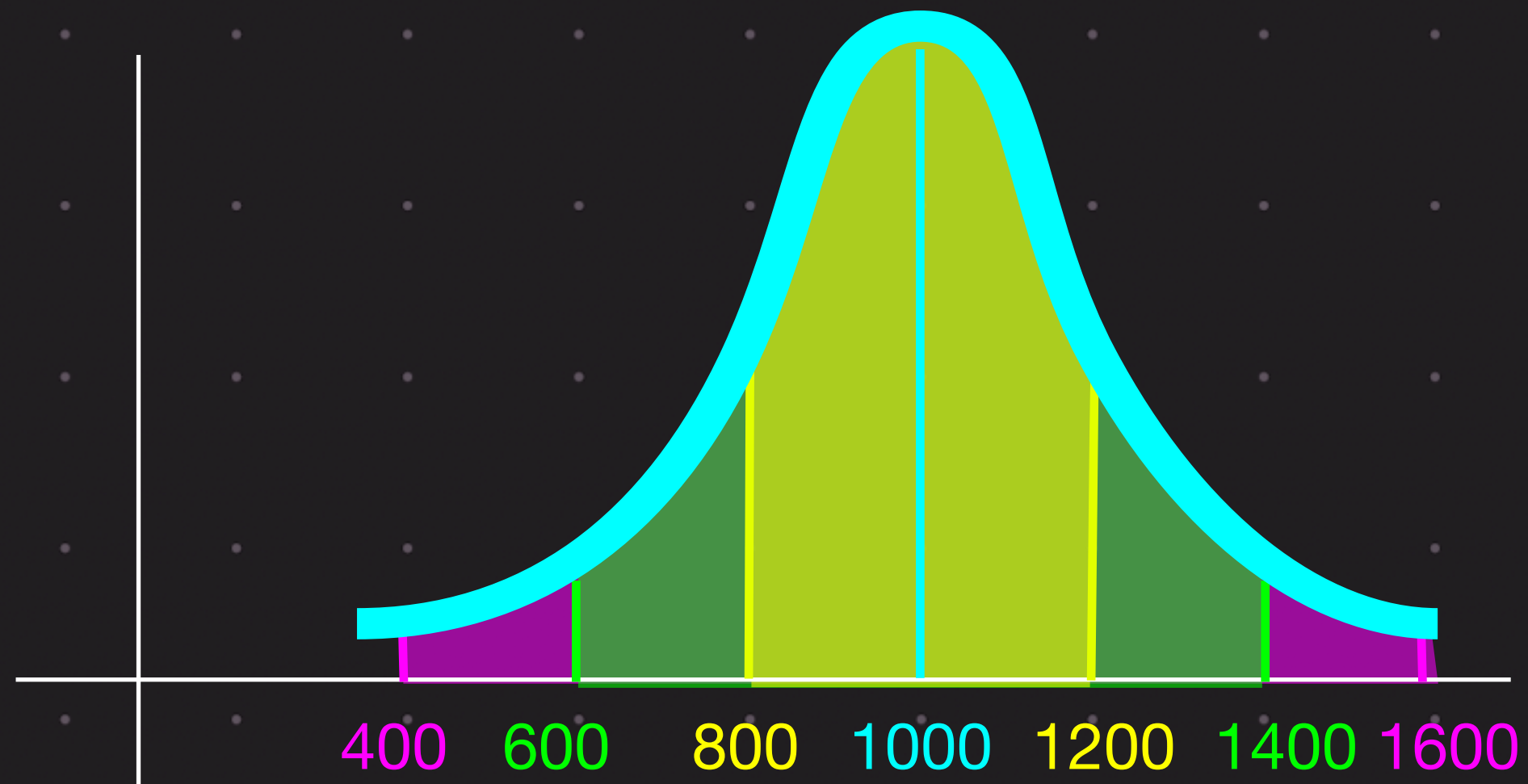


What fraction of balls are smaller than 53 mm?

$$z = \frac{(53 - 50)}{2} = 1.5$$

From Z-table, we see that the answer is 93.32%

A retail outlet sells around 1000 toothpastes a week, with std dev = 200.
If the on-hand inventory is 1300, what is the need for replenishment within the week?



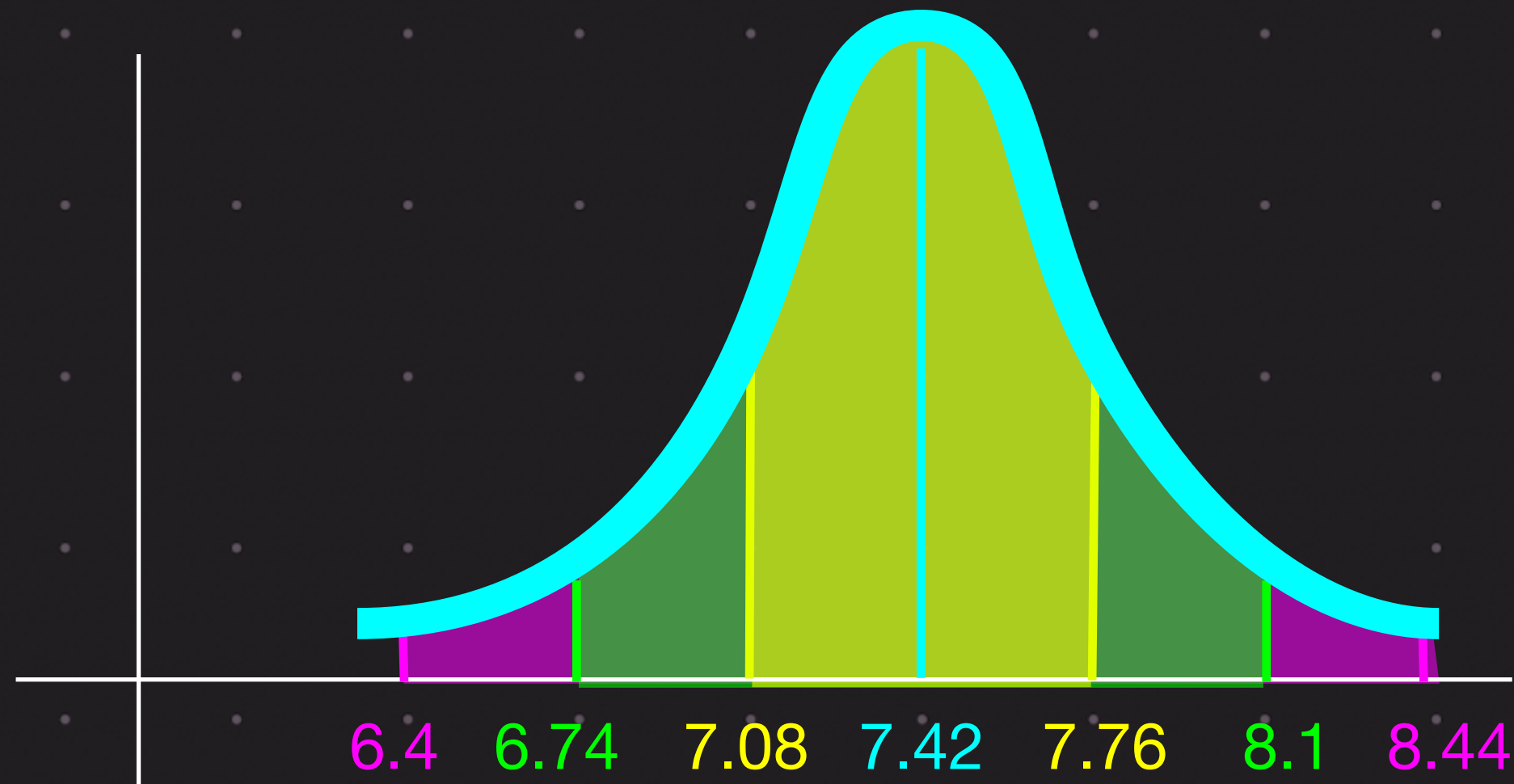
Let X denote the weekly sales. The question asks for the probability that $X > 1300$
What is the Z-score of 1300?

$$z = \frac{1300 - 1000}{200} = 1.5$$

From Z-table, we see that $P[X \leq 1300] = 0.933$

$$P[X > 1300] = 1 - 0.933 = 0.067$$

Skaters take a mean of 7.42 seconds and std dev of 0.34 seconds for 500 meters.
What should his speed be such that he is faster than 95% of his competitors?



Unlike earlier examples, here the fraction is given, and we have to find Z-score

Let us use the Z-table We need the Z-score of the area corresponding to 0.05

From Z-table, z-score is -1.65

$$z = \frac{(x - \mu)}{\sigma} \quad x = \sigma z + \mu = (0.34) (-1.65) + 7.42 = 6.859$$