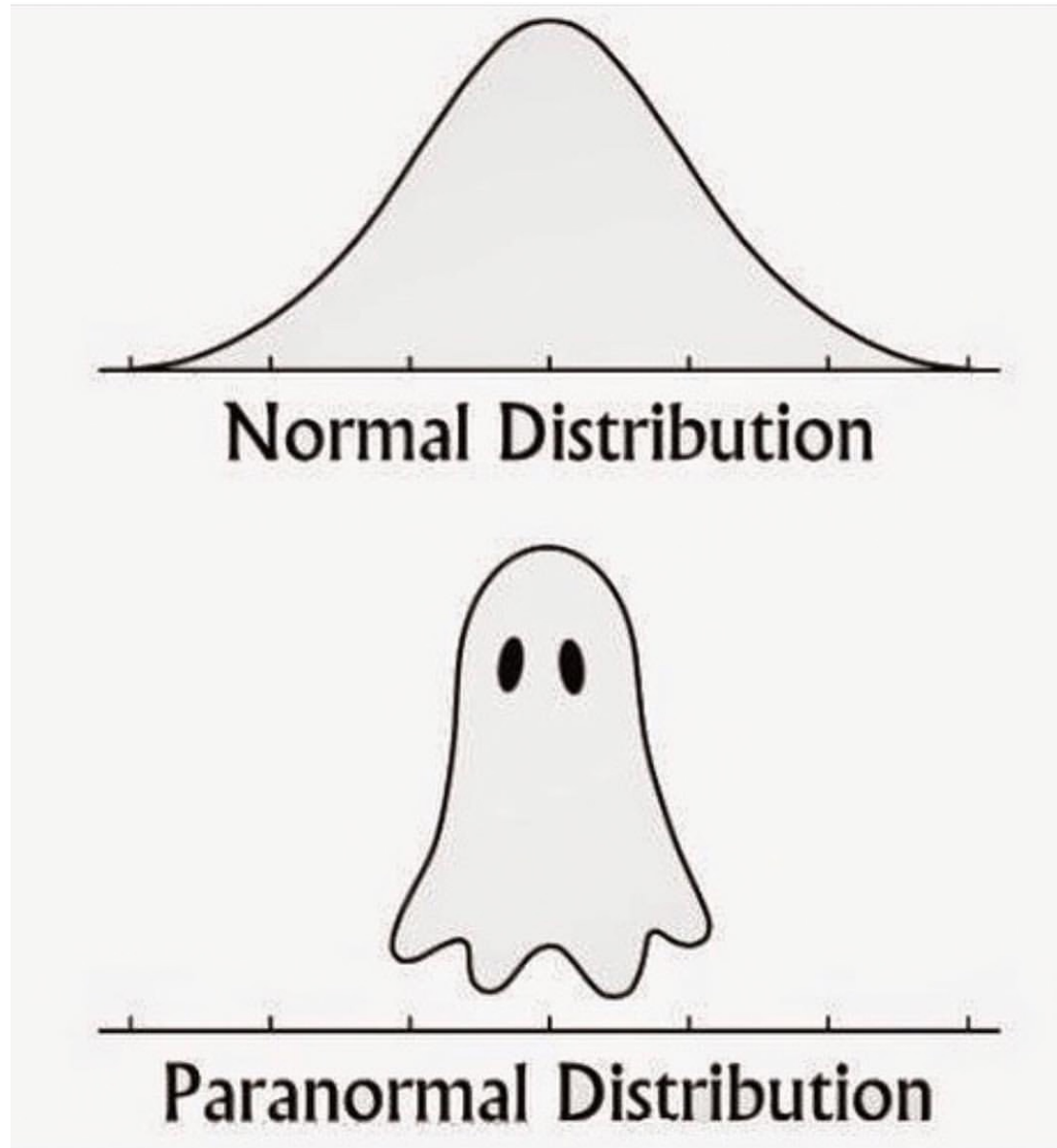
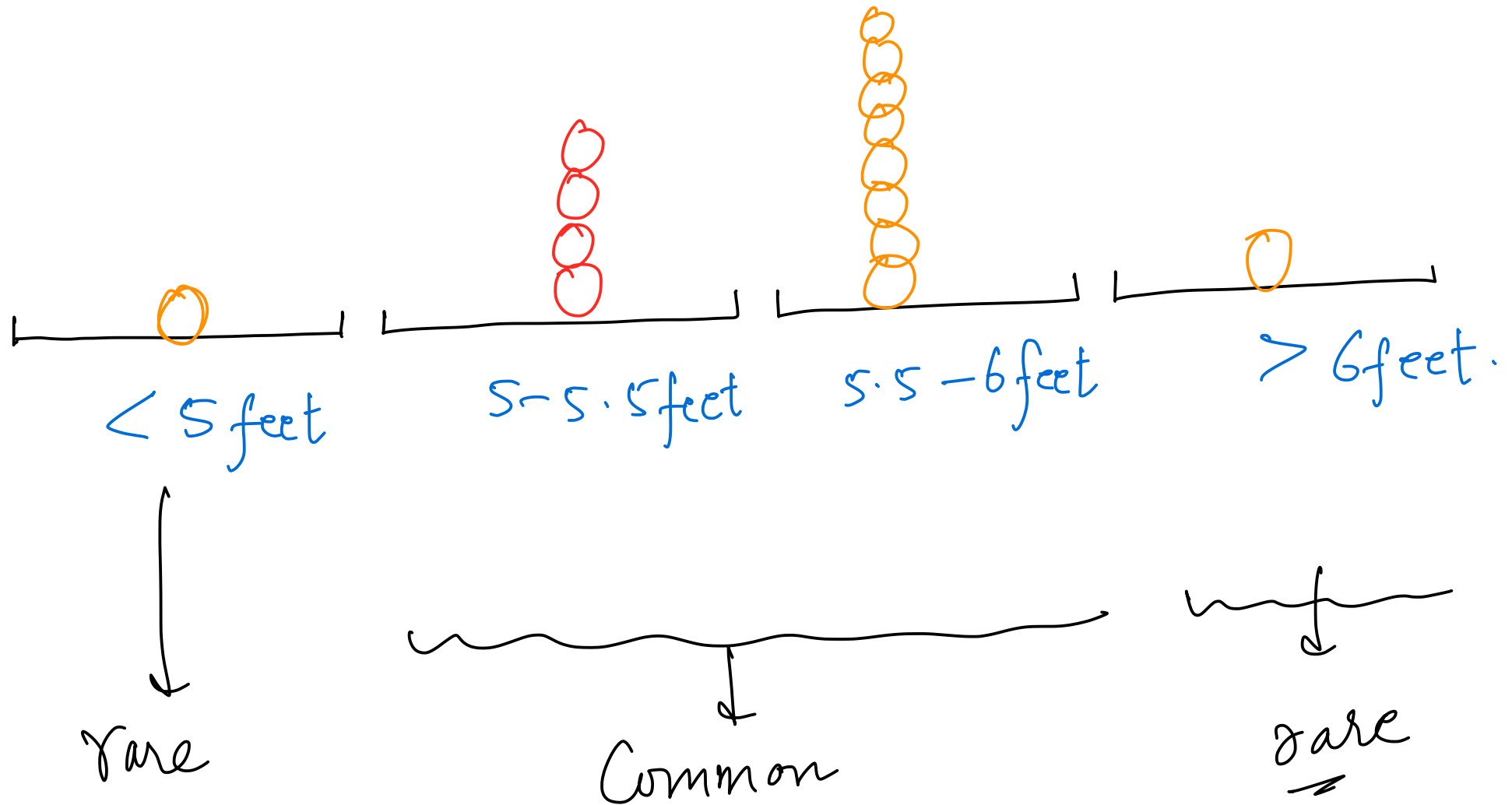


6th JUNE 2023



heights of 1000 people. → ADULTS

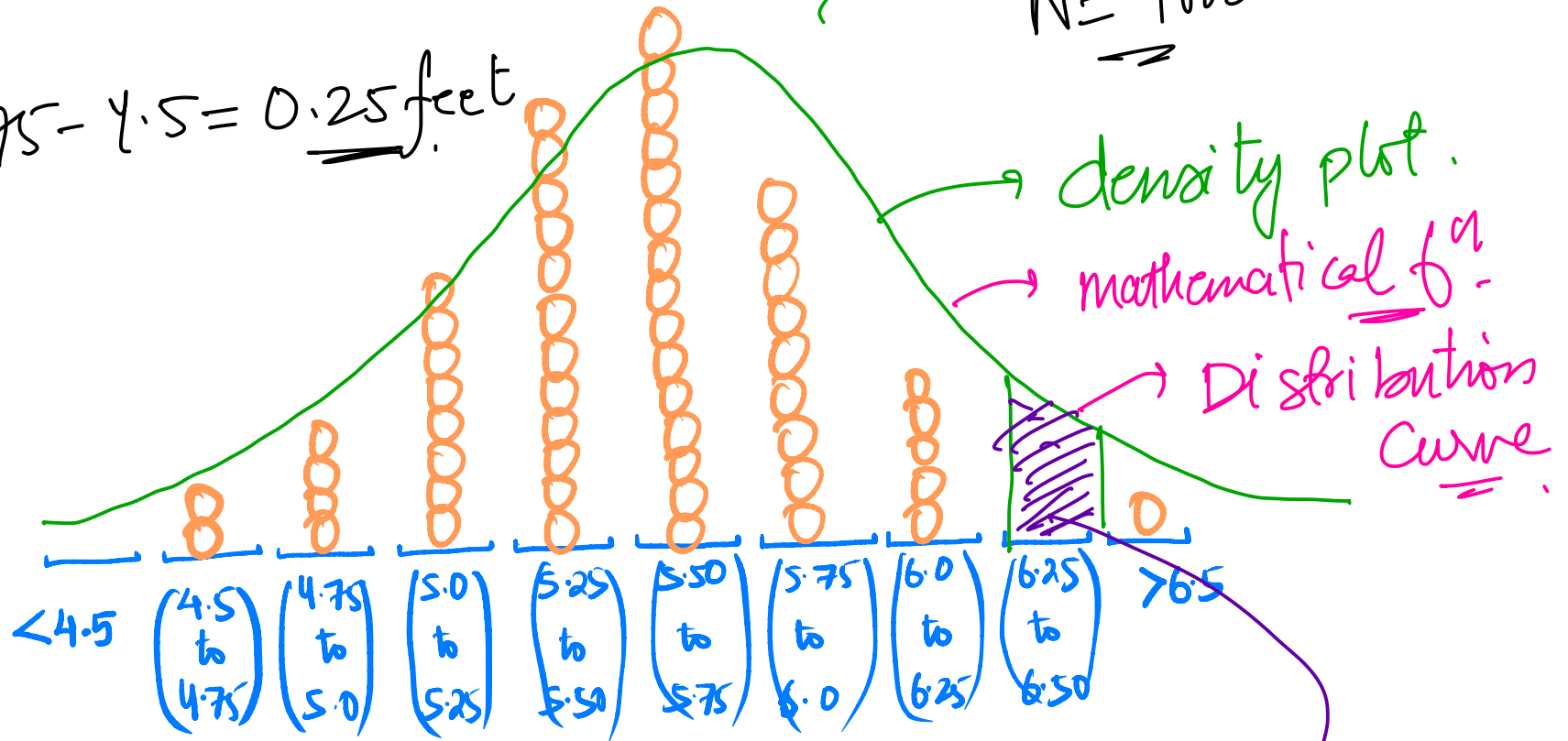
* 5.5, 5.1, 5.5, 5.6, 5.8, - - - - , 6.2, 5.5, 5.3, - - -



$N = 1000$ (\uparrow # of people).

Bin size smaller:

Bin size = $4.75 - 4.5 = \underline{0.25}$ feet



4.5 to 4.75 = $\frac{2}{N}$
what fraction \rightarrow

frac of people
6.25 to 6.50 feet

- $P(6.25 \text{ to } 6.50) = \text{Area under curve}$

IQ, class marks in a test, shoe size, BP

GAUSSIAN Distribution.

• 68/95/99 rule → Empirical Rule / Theoretical

• Z scores

• Compute prob.

• 1 Retail chain e.g.

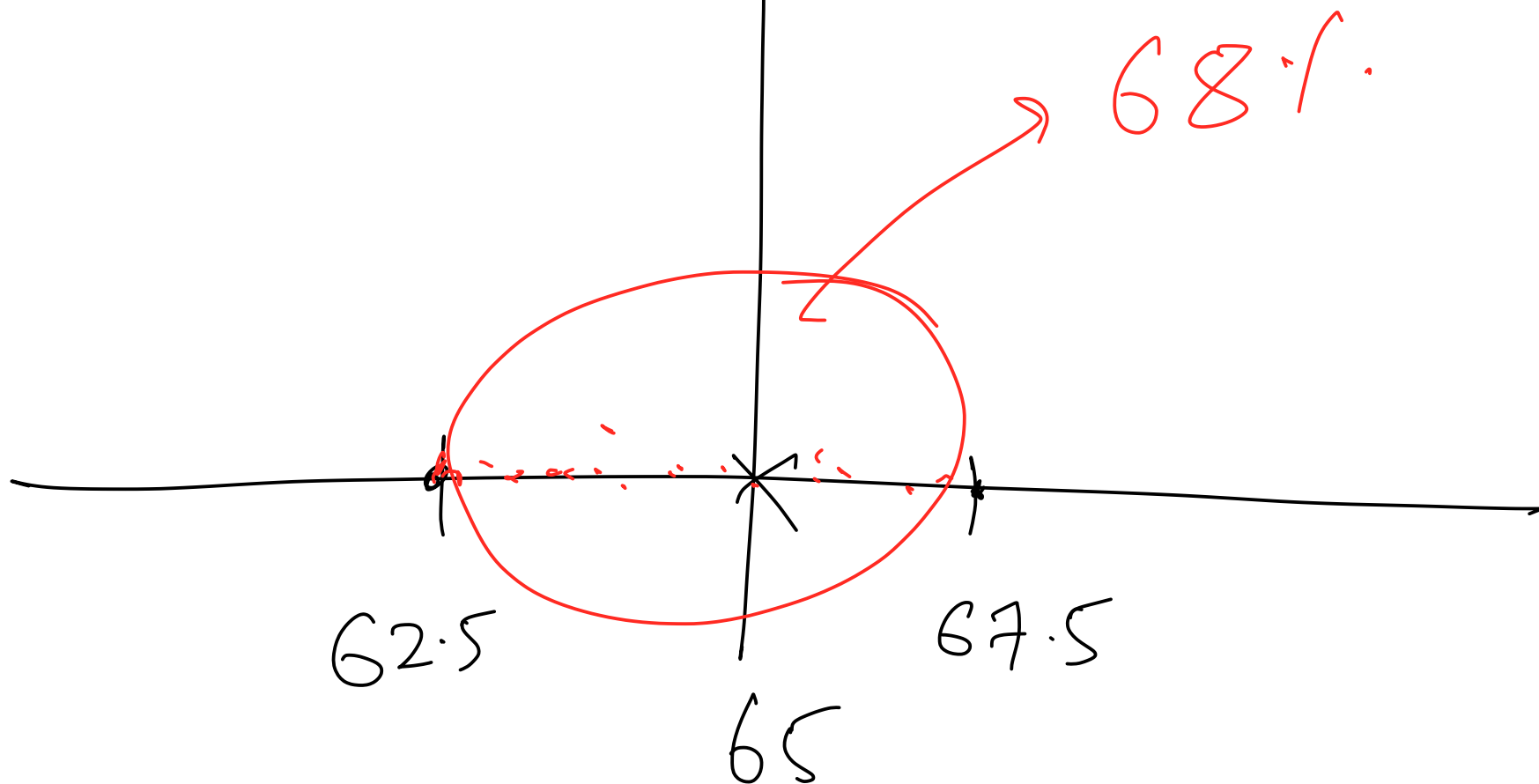
• 1 Interview Questⁿ

100000 = N

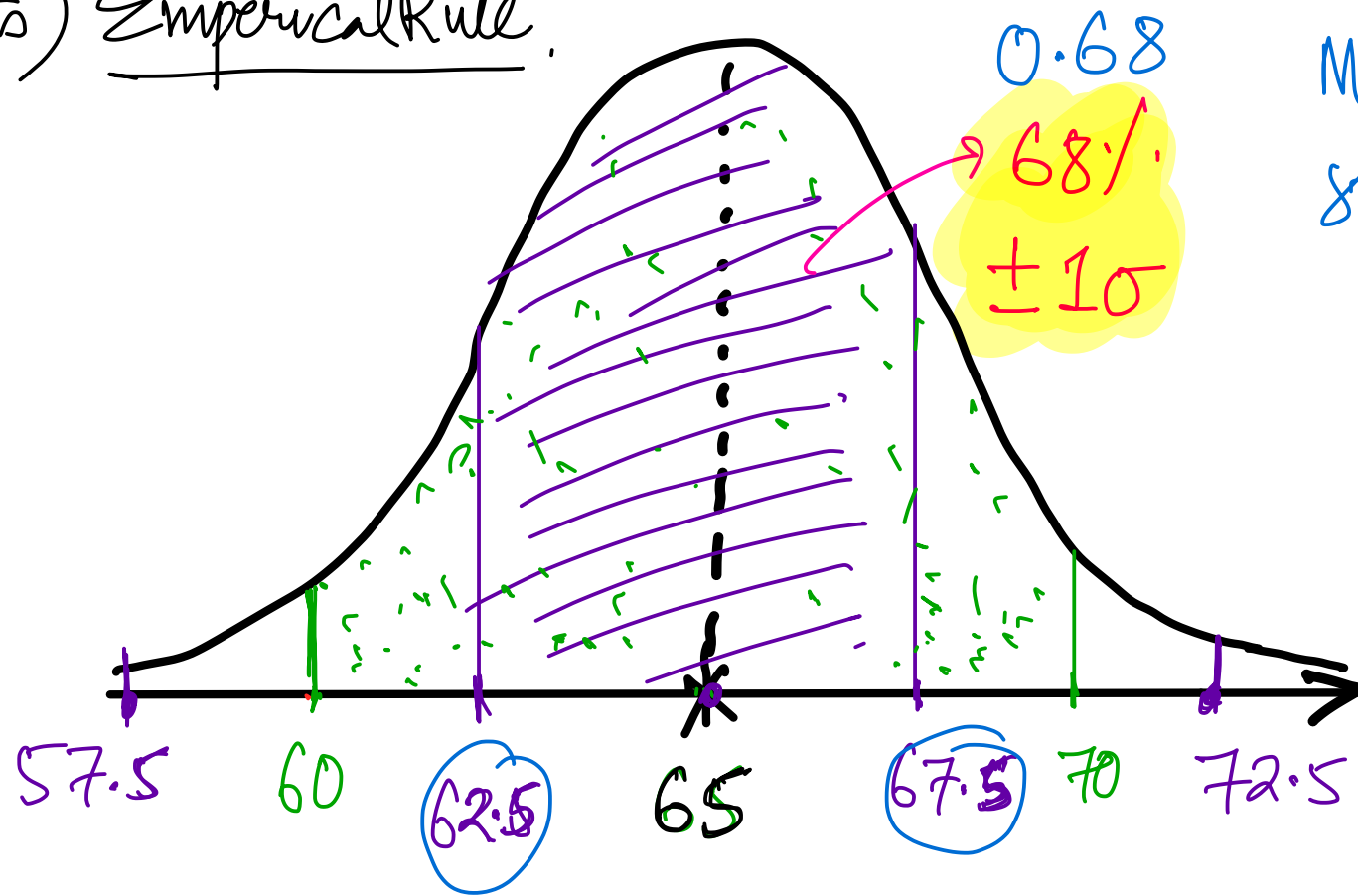
62, 65, 67, 71, ...

$$\mu = 65$$

$$\sigma = 2.5$$



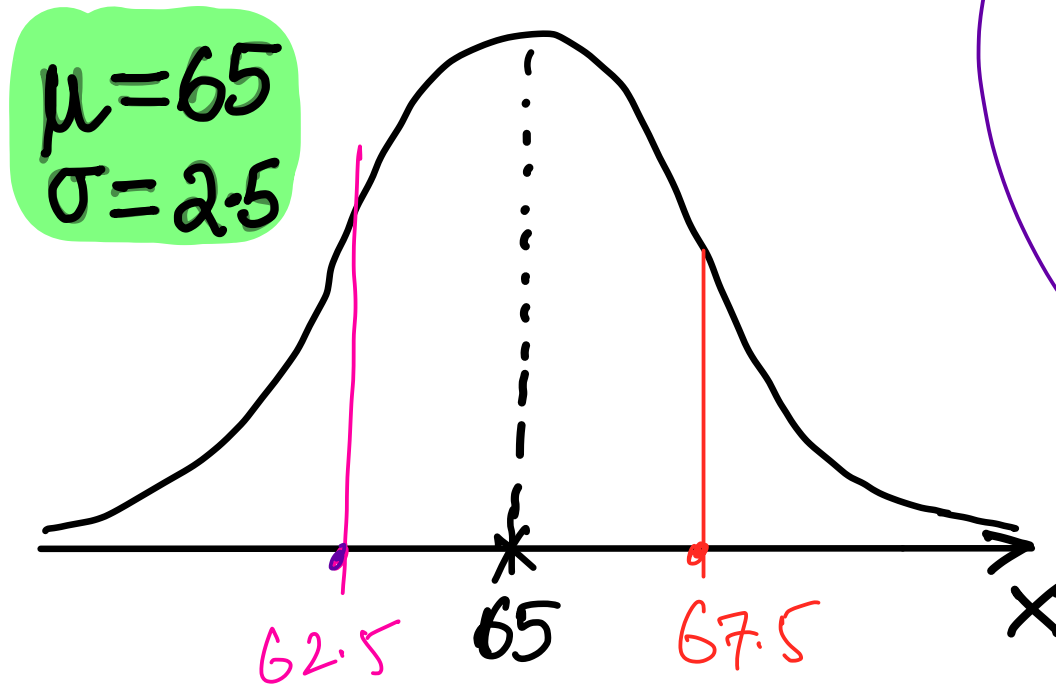
Heights) Empirical Rule.



- ① b/w 62.5 to 67.5 ($\pm 1\sigma$) \rightarrow 0.68 \rightarrow 68%.
- ② b/w 60 to 70 ($\pm 2\sigma$) \rightarrow 0.95 \rightarrow 95%.
- ③ b/w 57.5 to 72.5 ($\pm 3\sigma$) \rightarrow 0.997 \rightarrow 99.7%.

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

What fraction of people are shorter than 67.5?



42 users have participated

A	0.34	10%
B	0.68	33%
C	0.84	40%
D	0.95	17%



$$[65 + 1(\sigma)]$$

(i) fr. of people shorter than 65 $\rightarrow 0.5$

(ii) fr. (62.5 to 67.5) $\rightarrow ? \rightarrow 6\sigma \rightarrow 0.68$

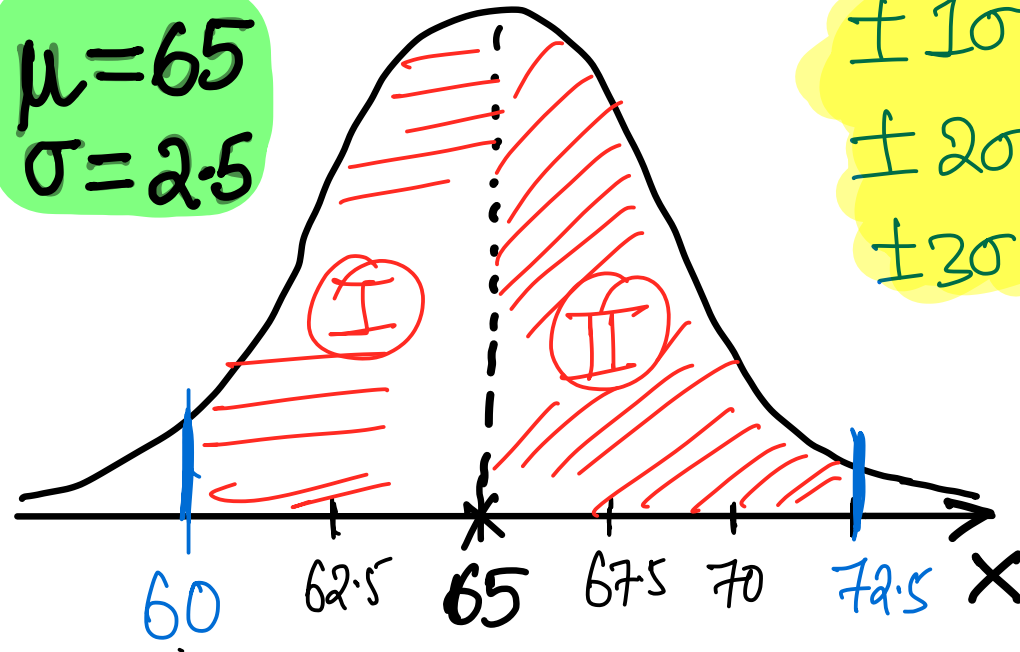
(iii) 65 to 67.5 $\rightarrow 0.68/2 = 0.34$

$$0.5 + 0.34 = 0.84$$

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

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

$$\mu = 65$$
$$\sigma = 2.5$$



$$\pm 1\sigma \rightarrow 0.68$$
$$\pm 2\sigma \rightarrow 0.95$$
$$\pm 3\sigma \rightarrow 0.997$$

34 users have participated

A	0.68	3%
B	0.895	9%
C	0.9735	65%
D	0.997	24%

(i) $\pm 2\sigma \rightarrow 0.95$

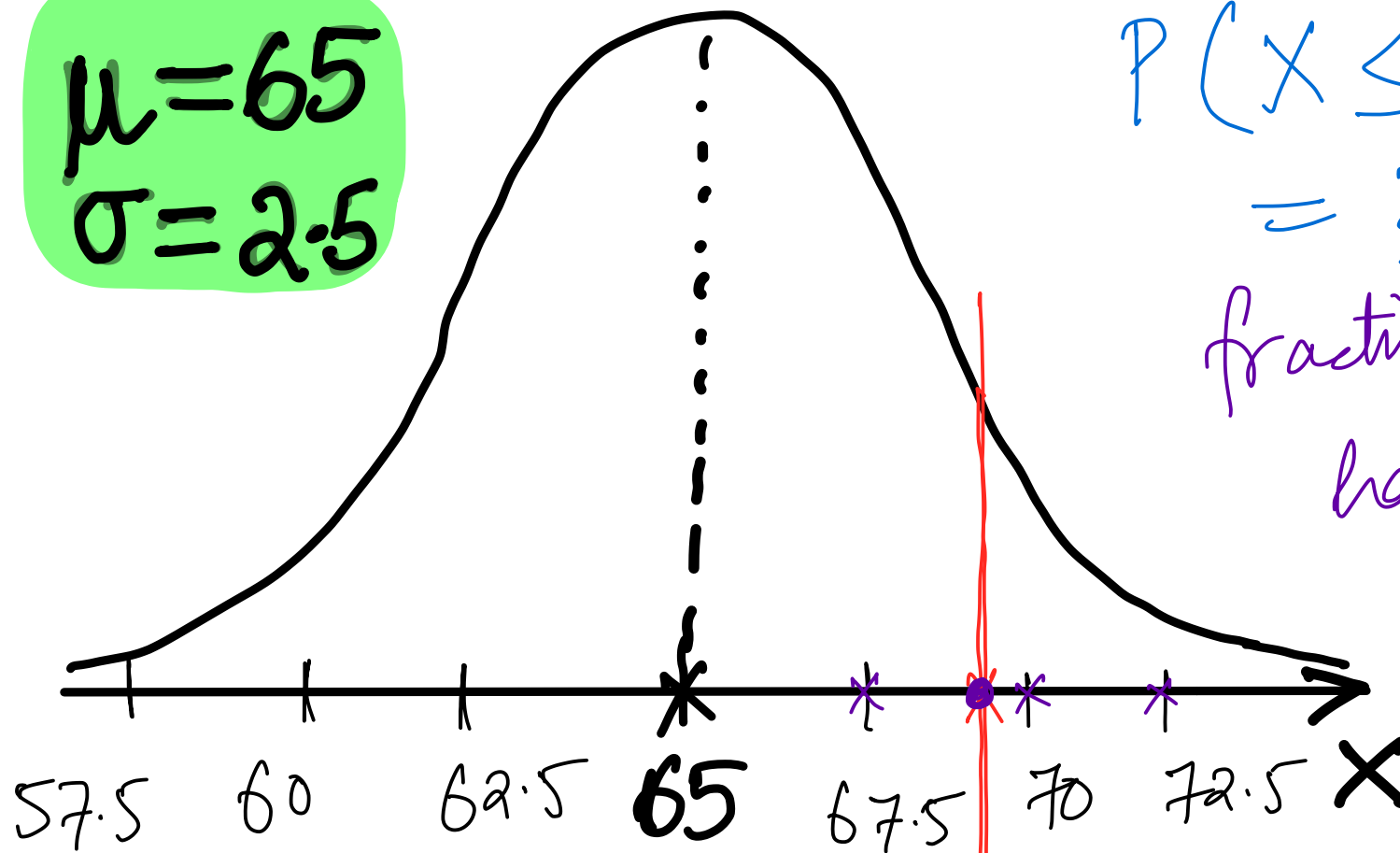
$$(60 - 65) \rightarrow 0.95/2 = 0.475 \rightarrow \text{I}$$

(iii) $\pm 3\sigma \rightarrow 99.7$

$$(65 - 72.5) \rightarrow 99.7/2 = 0.4985 \rightarrow \text{II}$$

$$60 - 72.5$$
$$= 0.475 + 0.4985$$
$$= 0.9735$$

$$\mu = 65$$
$$\sigma = 2.5$$



$$P(X \leq 68 \text{ inches}) = ?$$

fraction of people
having ht. ≤ 68 inches

68 inches

Z-SCORE ***

$$\mu = 65$$
$$\sigma = 2.5$$

$$67.5 = 65 + 1(2.5)$$

$$70 = 65 + 2(2.5)$$

$$72.5 = 65 + 3(2.5)$$

$$Z_{62.5} = -1$$

$$62.5 = 65 + (-1) \cdot 2.5$$

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

$$Z = \frac{69.1 - 65}{2.5}$$

$$Z = 1.64$$

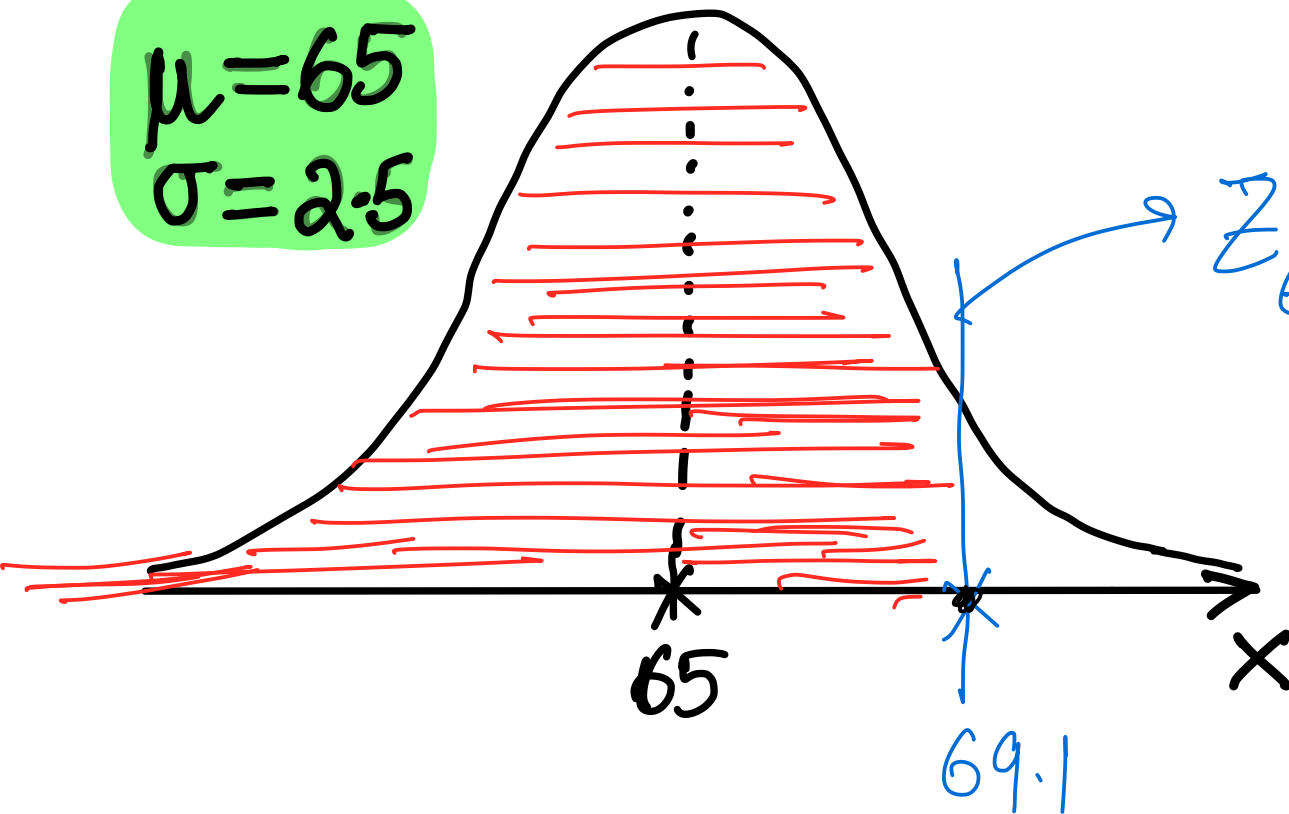
how many
sd. away
my 'x' is
from mean
(μ).

Z - Zscore

$$Z = \left(\frac{x - \mu}{\sigma} \right)$$

* what fraction of people shorter than 69.1 inches.

$$\mu = 65$$
$$\sigma = 2.5$$



$$Z = \left(\frac{x - \mu}{\sigma} \right)$$

$$Z_{69.1} = +1.64$$

$(-\infty, +\infty)$

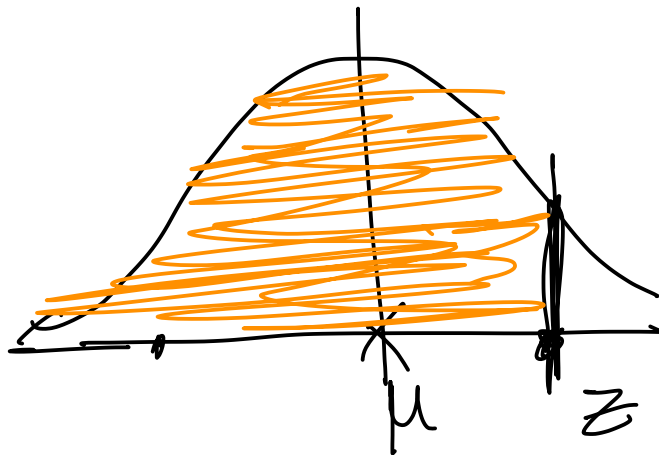
$(-3 \text{ to } +3)$

99.7%

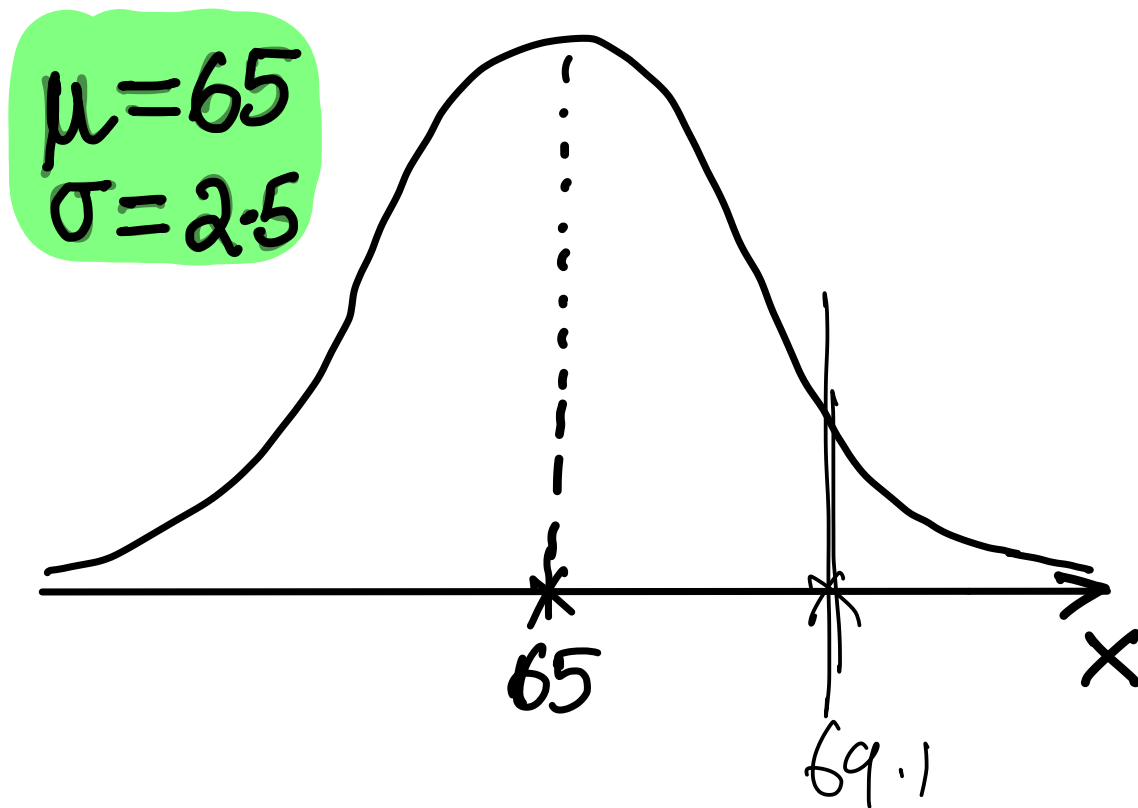
$$P(X \leq 69.1)$$

$$= 0.9495$$

$$= 94.95\%$$



Z score tables



Z score. \rightarrow

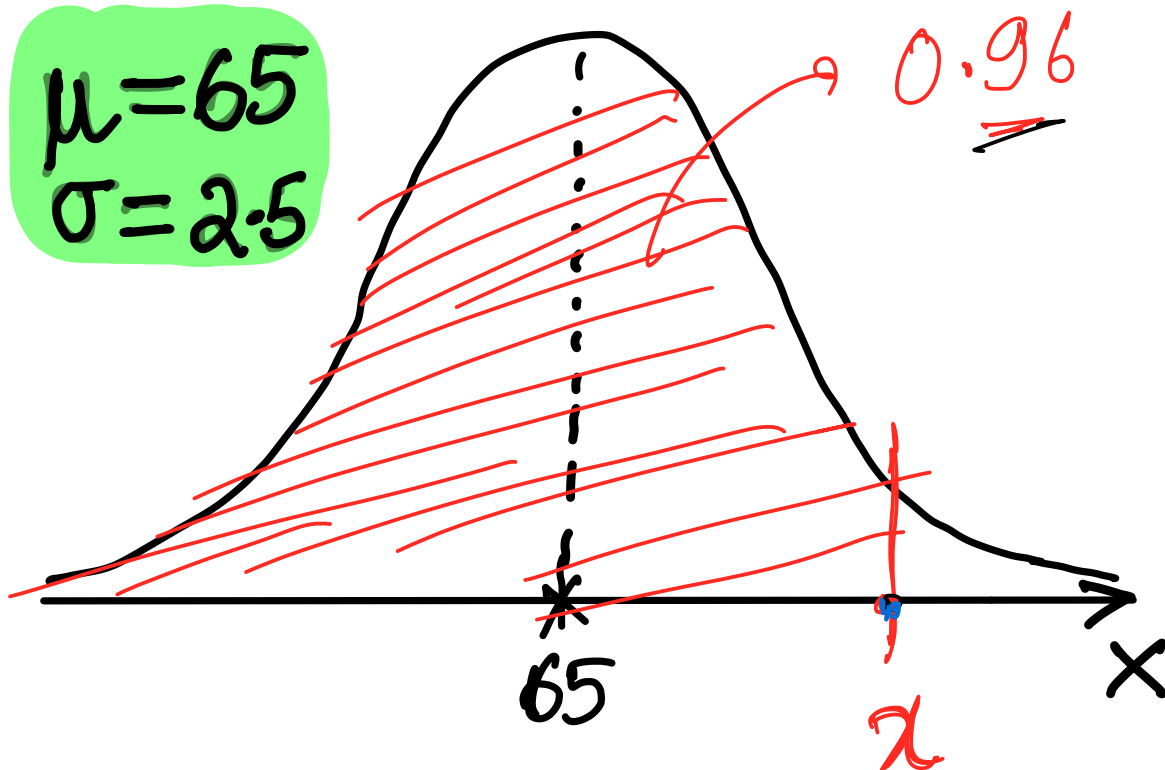
1.64

Area.

$$P(X \leq 69.1) = 94.95\%$$

$$\mu = 65$$

$$\sigma = 2.5$$



$$Z = \left(\frac{x - \mu}{\sigma} \right) **$$

find height = ?
 such that
 96% of people
 are shorter than
 you?

norm. pdf (0.96)

$$Z = 1.75$$

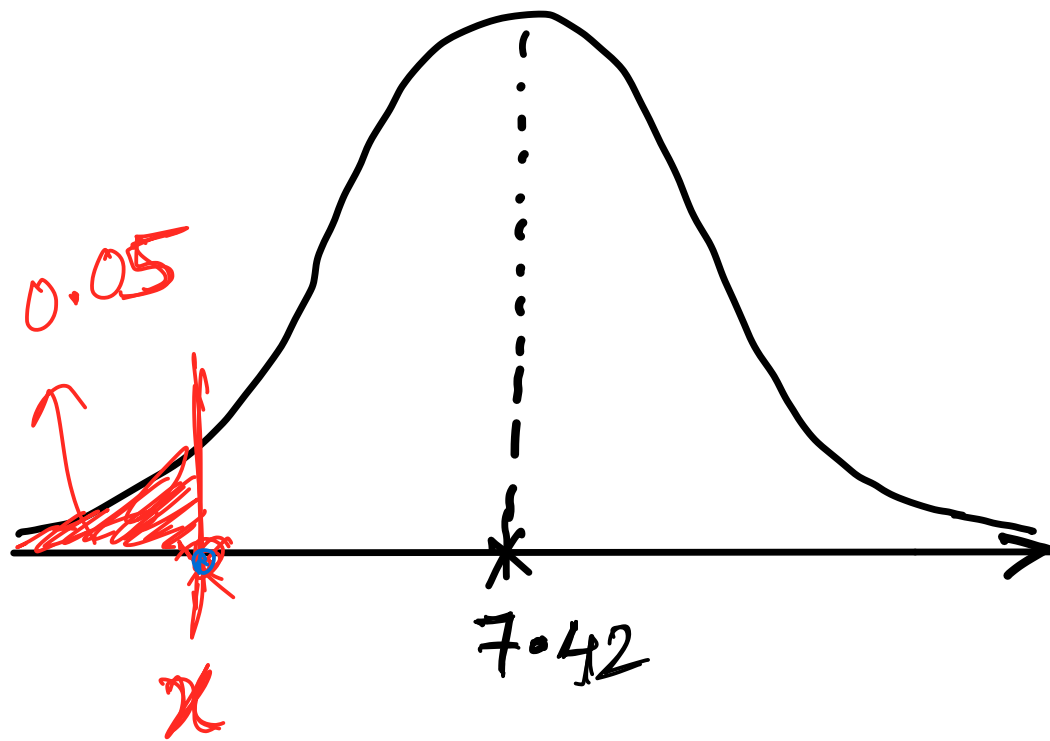
$$x = 65 + z(2.5)$$

height

$$x = 65 + (1.75) \times (2.5)$$

$$x \approx 69.375 \text{ ins.}$$

Q.1
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?



only 5% of people take less time than 'x' second.

↓
your time.

Z score of $x \rightarrow \text{norm.ppf}(0.05)$
 $\rightarrow -1.645$

$$S = \frac{d}{t}$$

$$Z = \left(\frac{x - \mu}{\sigma} \right) \Rightarrow -1.645 = \frac{x - 7.42}{0.34}$$

$$x = +7.42 - 0.34 \times 1.645$$

$$x = 6.86 \text{ sec. } \text{time}$$

distance \rightarrow 500

$$\text{Speed} = \frac{d}{t} = \frac{500 \text{ m}}{6.86} = \underline{\underline{72.87 \text{ m/s}}}$$

①. Retail store

↓
Avg. 1000 tooth past a week.

$$\mu = 1000$$

$$\sigma = 200$$

Normal
dist'n

900
950
960
970
1250
950
270
⋮

Avg.

gets inventory only on Sundays.

• If the starting inventory on Sunday = 1300

⇒ What is the prob. of Replenishment within the week?
of out of stock. → refill

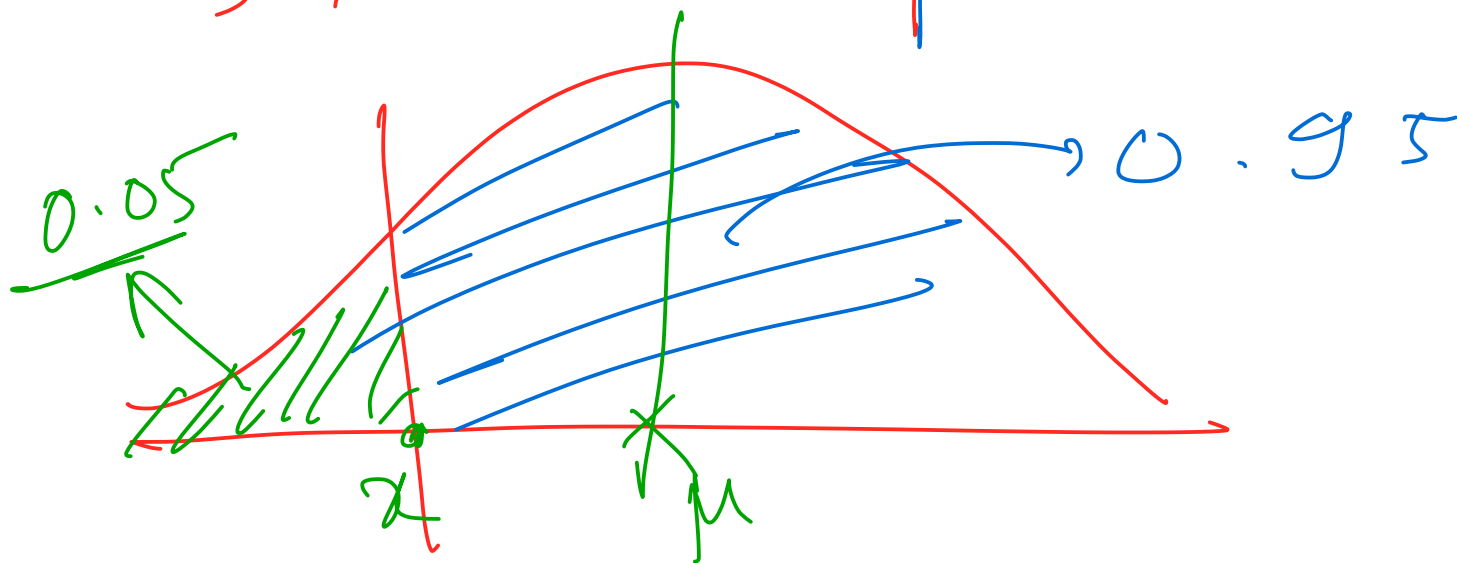
1 2 3 4 5 6 7 8 9 10 11



50%



50%



30 30 (35)



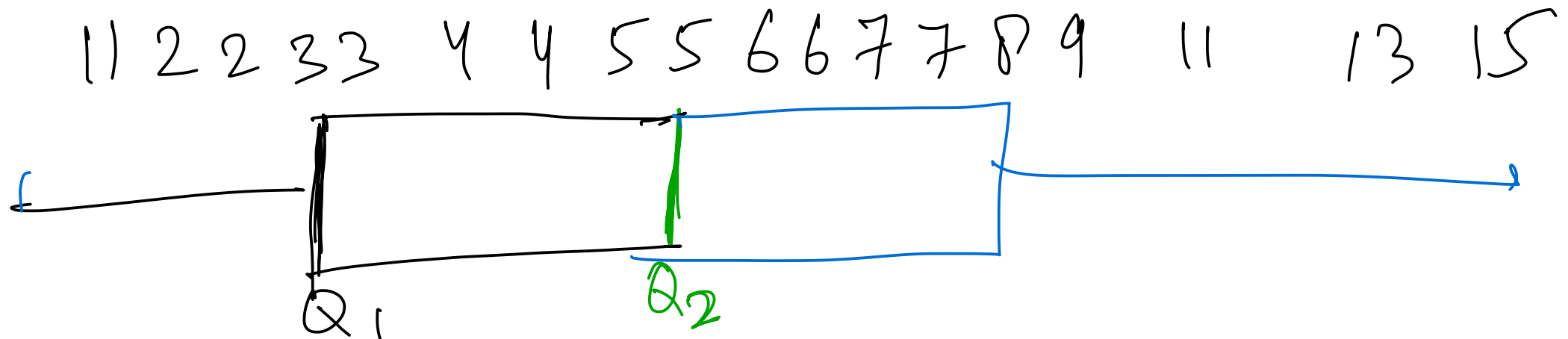
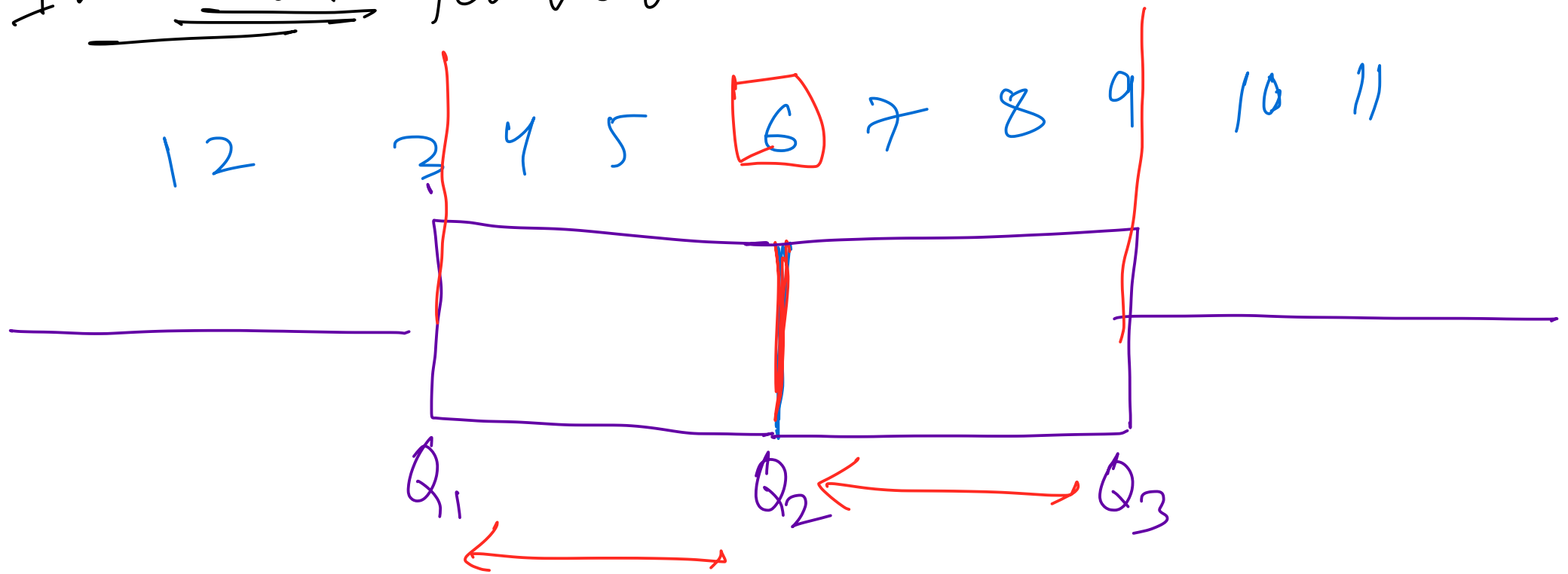
> 35
 < 35

40 0 40 } ✓
50%

30 30 35
50%

40 40 300
M 50%

I have collected few heights



Boxplot
Right skewed

