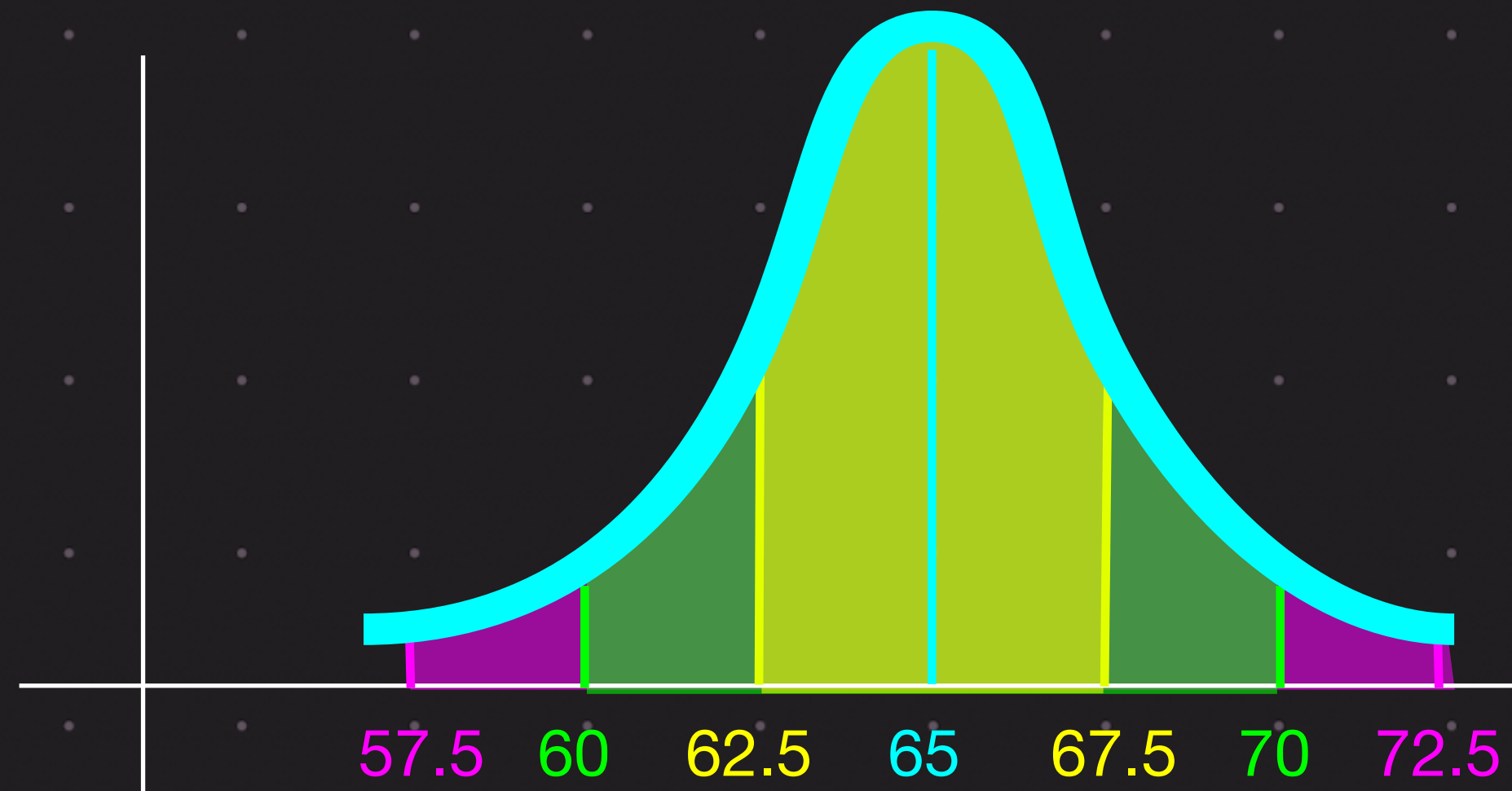


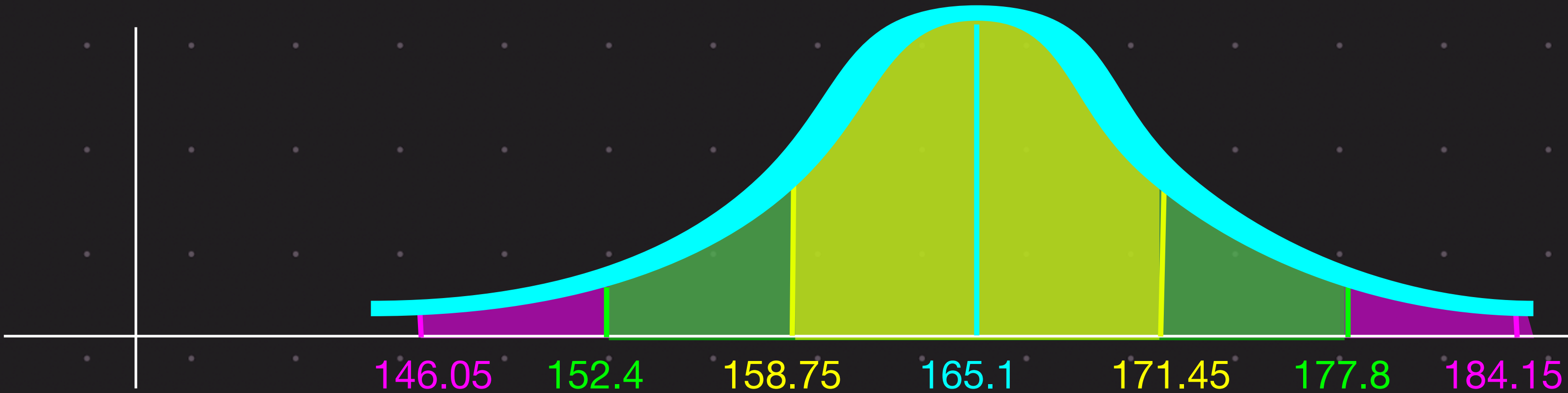
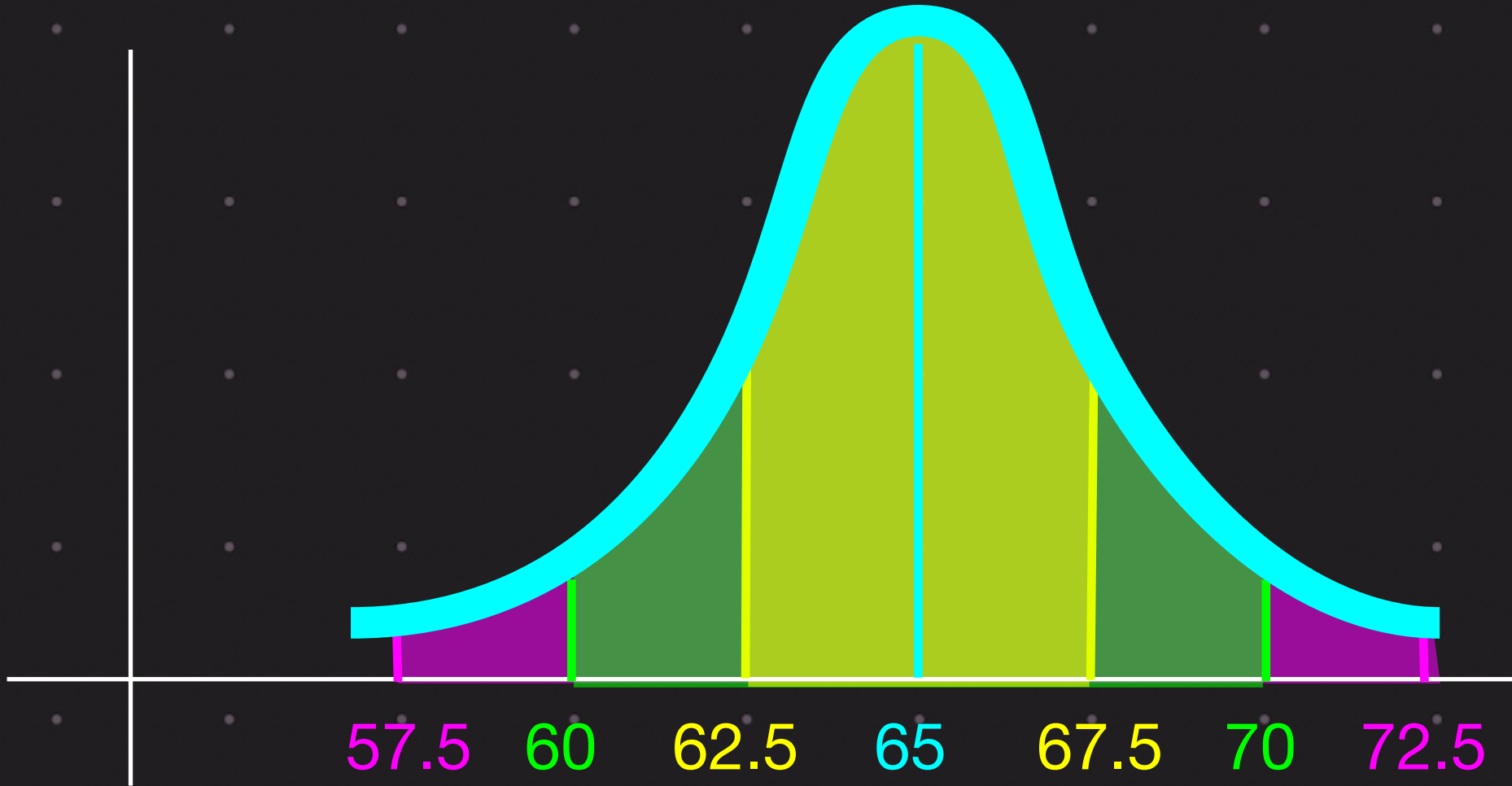
Recap: Heights example. Mean is 65, std dev is 2.5

How would this look like if we look at heights in centimetres?



Recap: Heights example. Mean is 65, std dev is 2.5

How would this look like if we look at heights in centimetres?



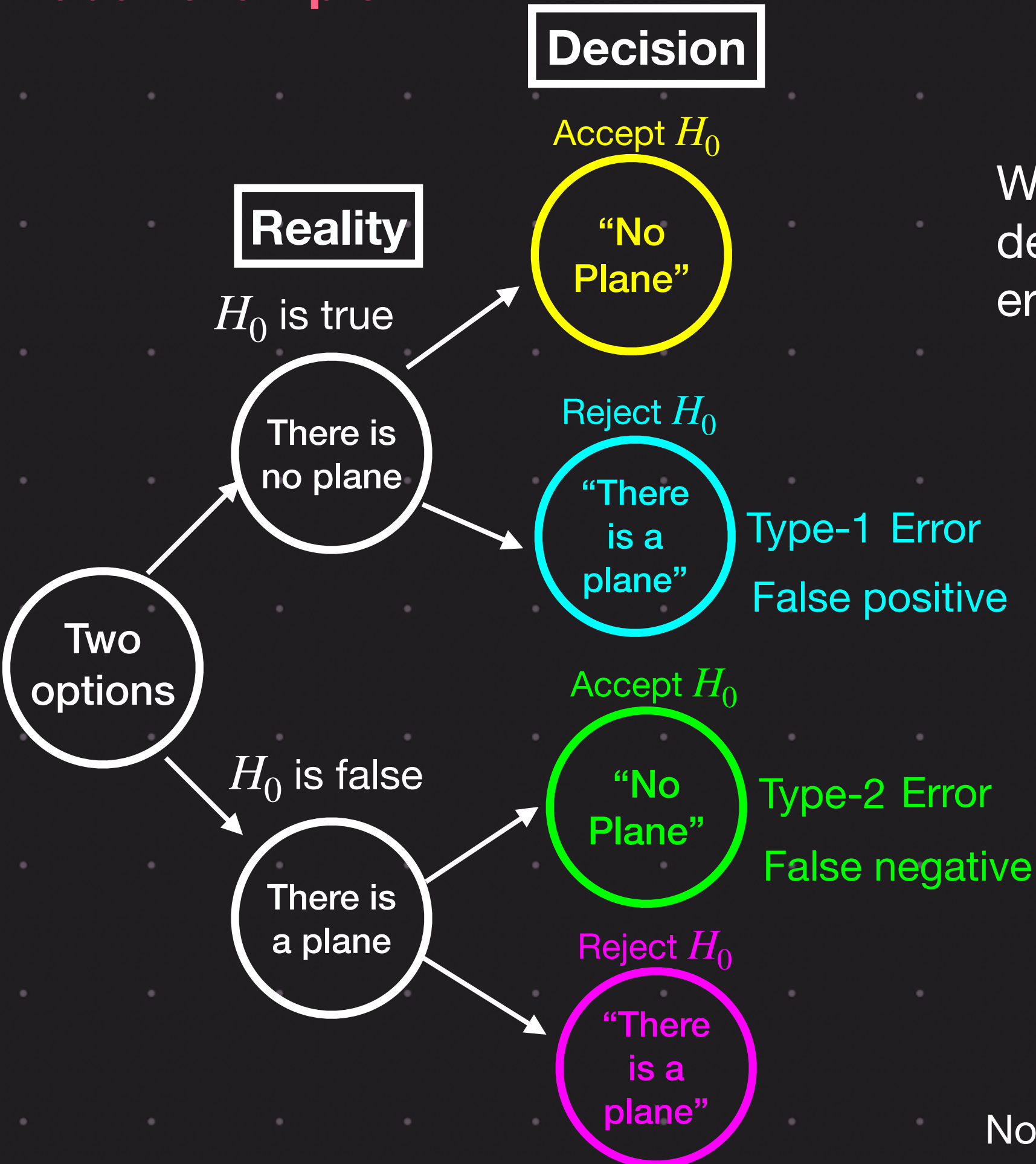


Radar example

$H_0$  : There is no plane



Which of these decisions are errors?

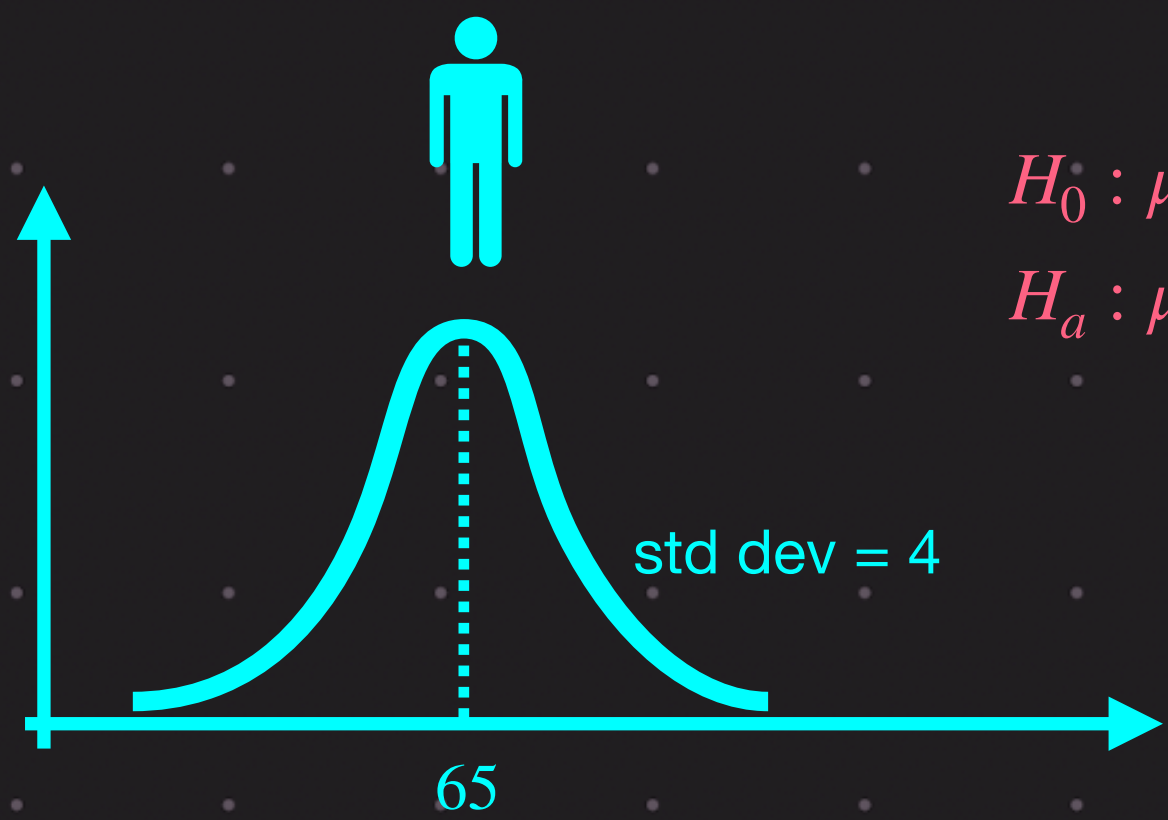


|       |       | Decision              |                       |
|-------|-------|-----------------------|-----------------------|
|       |       | Accept                | Reject                |
| $H_0$ | True  | <b>True negative</b>  | <b>False positive</b> |
|       | False | <b>False negative</b> | <b>True positive</b>  |

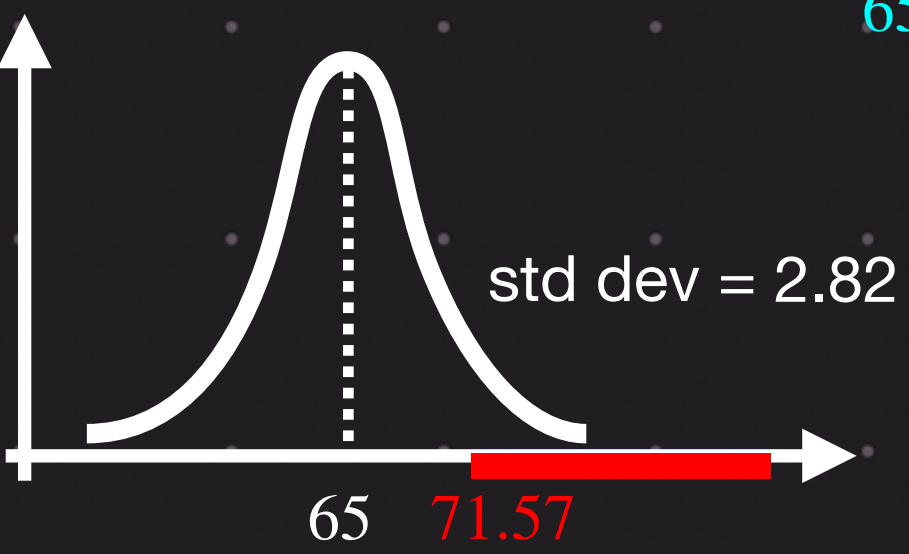
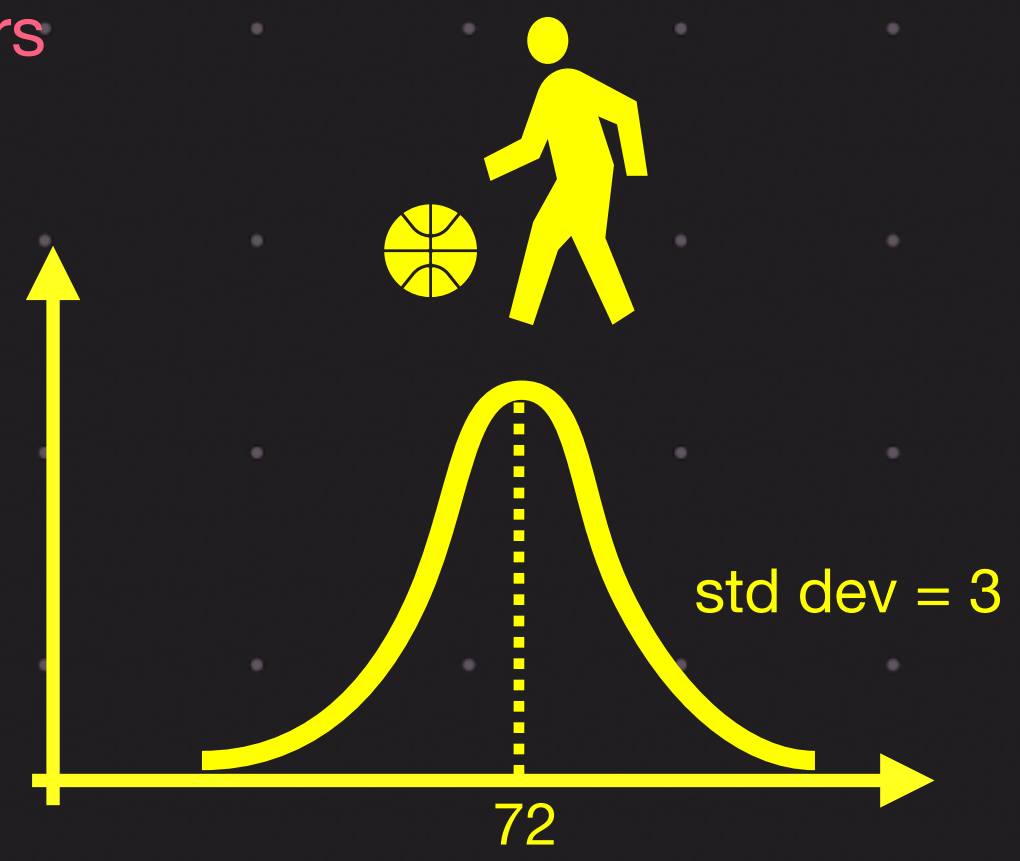
Note: Statisticians do not say "Accept". They say "fail to reject"

Height

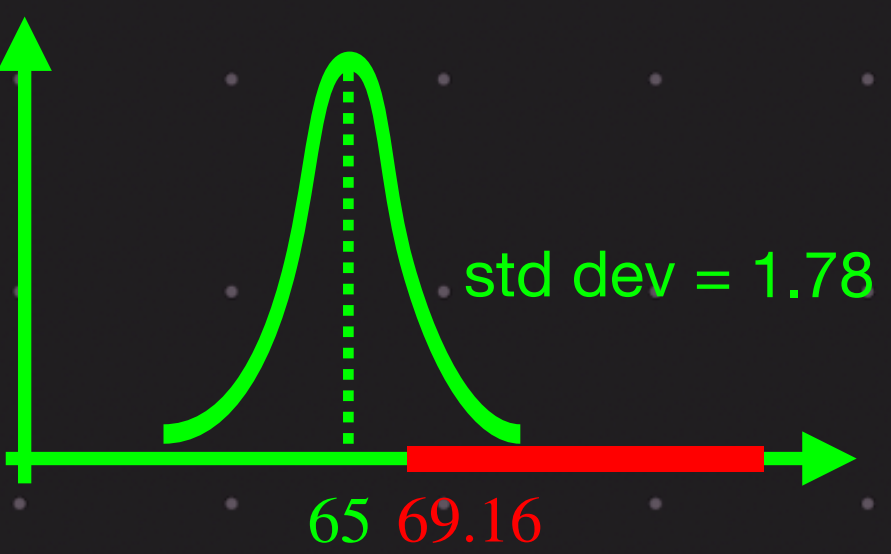
Ordinary people Vs Basketball players



$H_0 : \mu = 65$   
 $H_a : \mu = 72$



A random sample of 2 people from one group is seen to have an average of 70.  
Would you reject the null hypothesis at 99% confidence? "Fail to Reject"  
What is the p-value? P-value =  $1 - \text{norm.cdf}((70-65)/(4/\text{np.sqrt}(2))) = 0.038$   
What is the CR? UCR =  $65 + (4/\text{np.sqrt}(2))*\text{norm.ppf}(0.99) = 71.57$

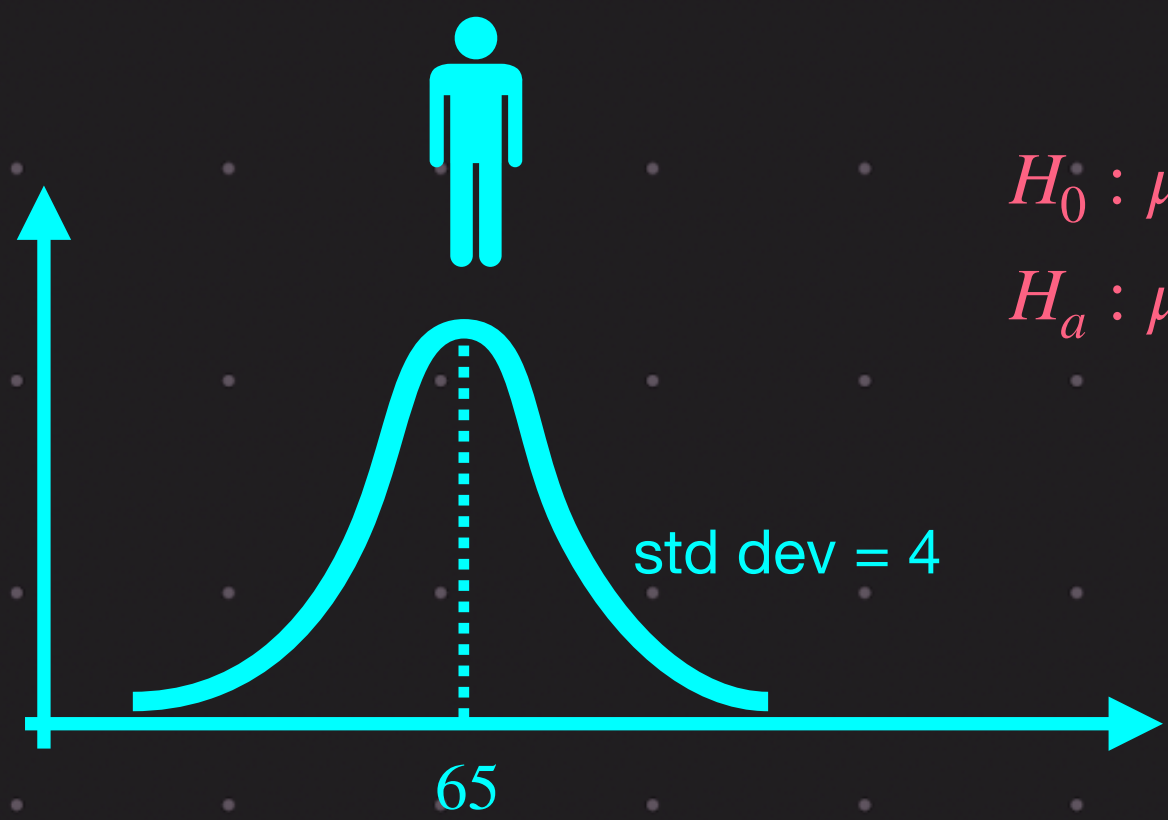


A random sample of 5 people from one group is seen to have an average of 70.  
Would you reject the null hypothesis at 95% confidence? "Reject"  
What is the p-value? P-value =  $1 - \text{norm.cdf}((70-65)/(4/\text{np.sqrt}(5))) = 0.0025$   
What is the CR? UCR =  $65 + (4/\text{np.sqrt}(5))*\text{norm.ppf}(0.99) = 69.16$

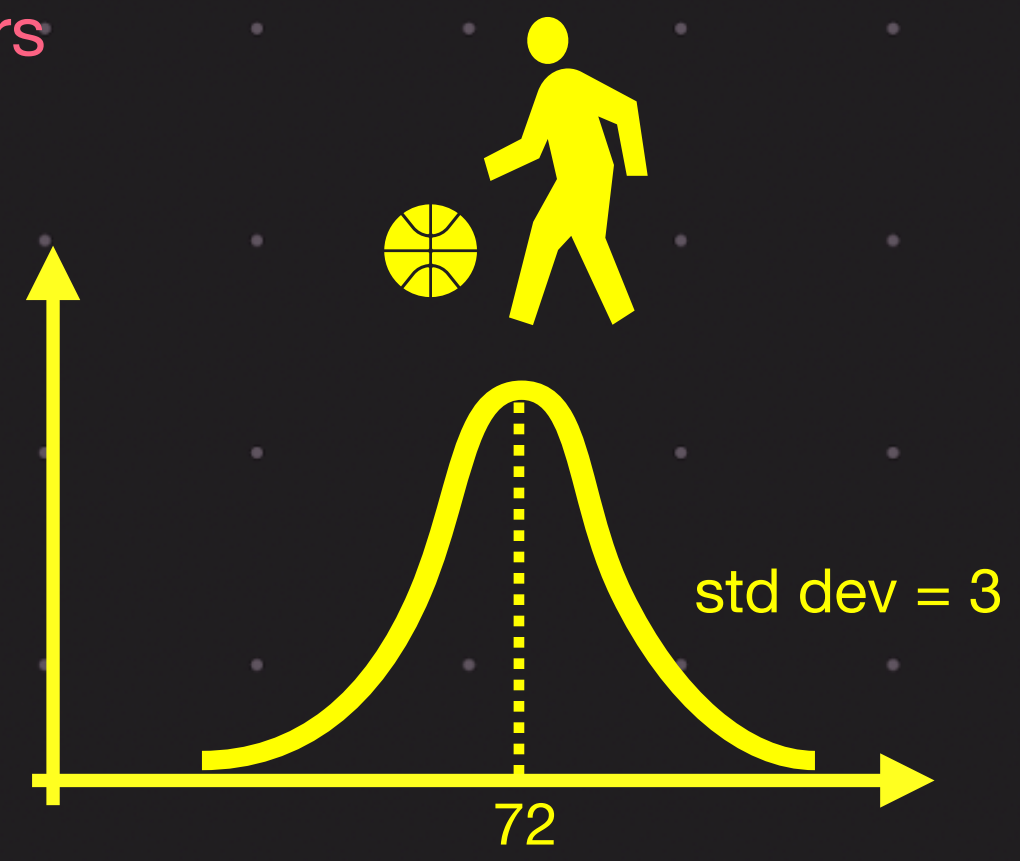


Height

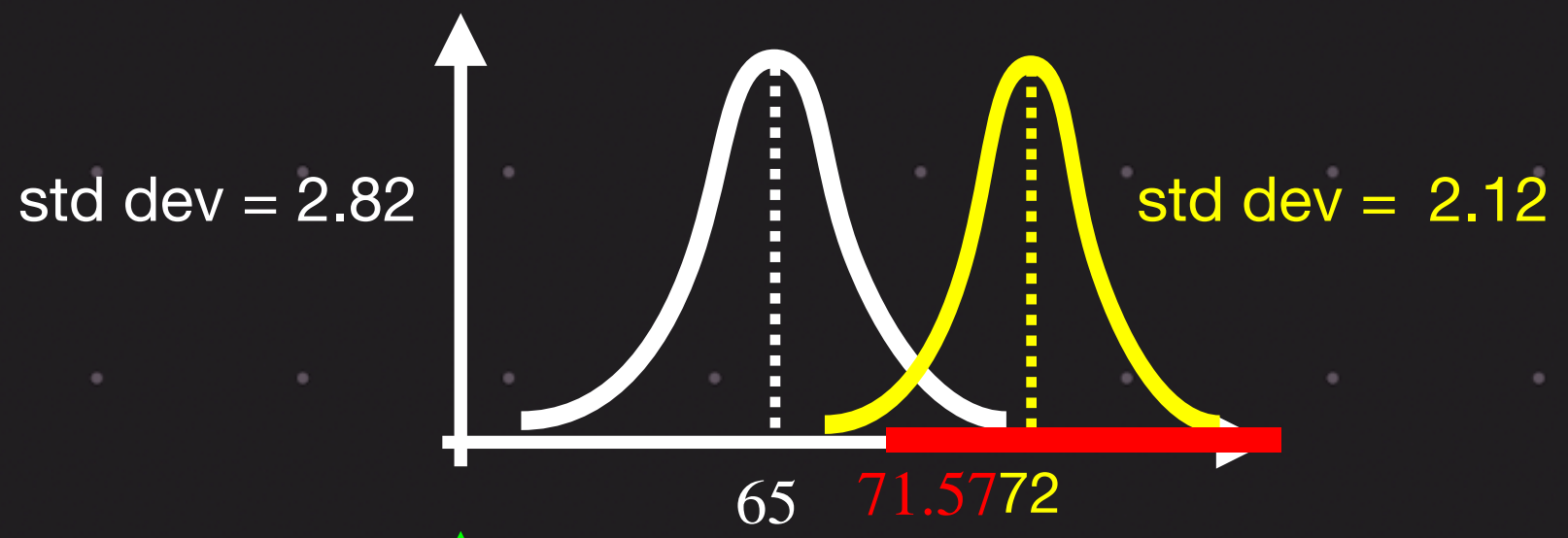
Ordinary people Vs Basketball players



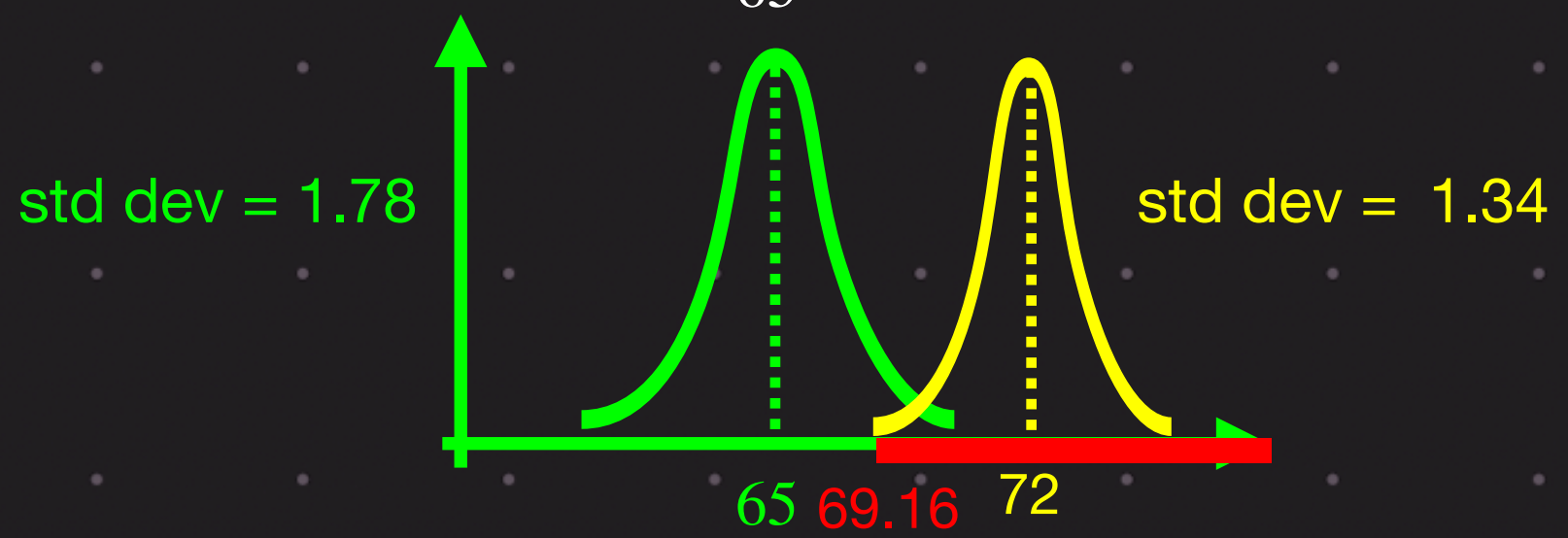
$H_0 : \mu = 65$   
 $H_a : \mu = 72$

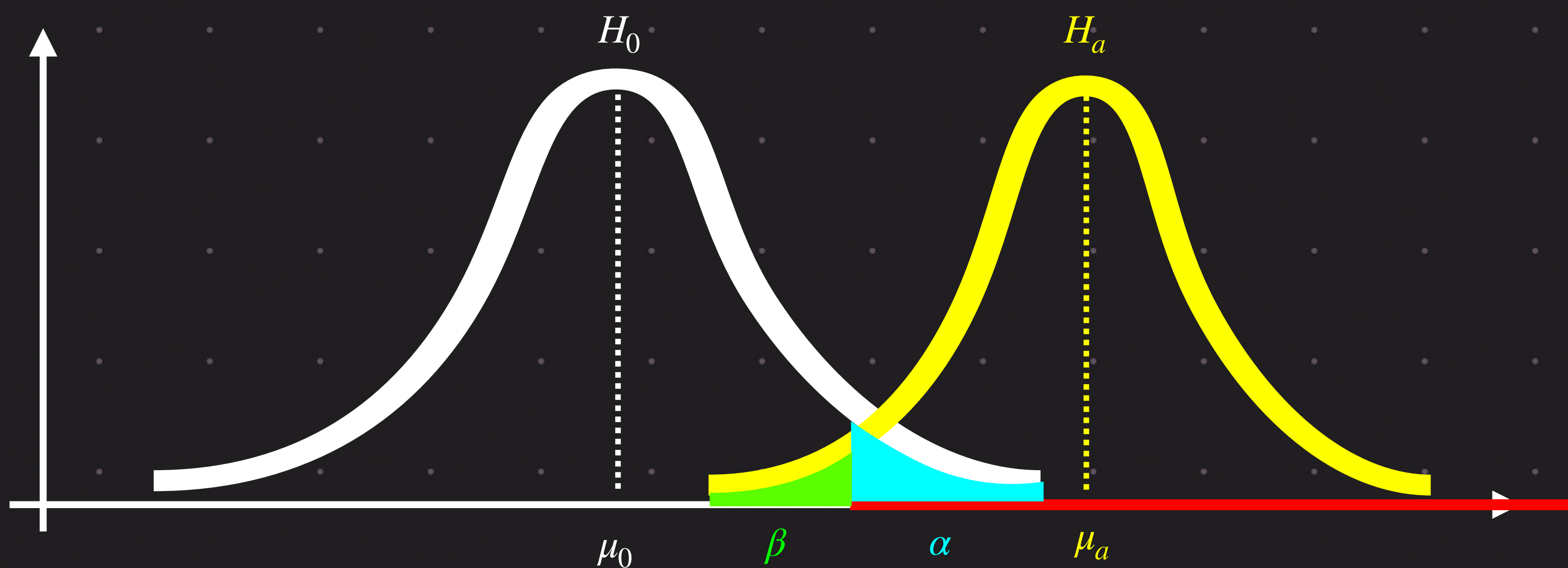


2 samples



5 samples





Effect size is proportional to  $\mu_a - \mu_0$

We need to account for the standard deviation

$$\text{Effect size} = \frac{\mu_a - \mu_0}{s}$$

Here,  $s$  is the pooled standard deviation

|       |       | Decision  |  |
|-------|-------|---|--|
|       |       | Accept  | Reject   |
| $H_0$ | True  | <b>True negative</b><br>$1 - \alpha$<br><b>Confidence level</b> | <b>False positive</b><br>$\alpha$<br><b>Significance level</b> |
|       | False | <b>False negative</b><br>$\beta$                                | <b>True positive</b><br>$1 - \beta$<br><b>Power</b>            |