

1. ACT Warm-up

2. Probability Warm-up

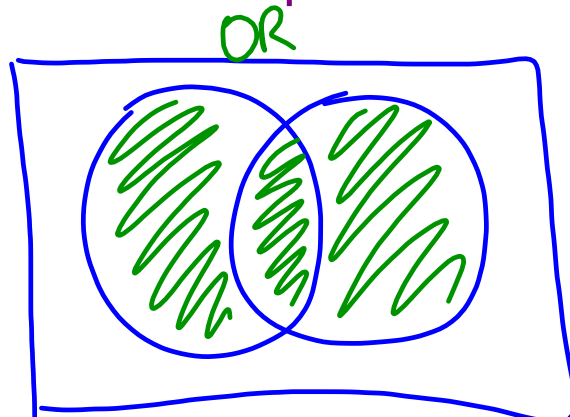
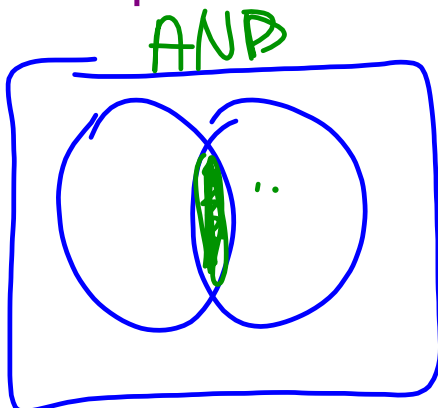
Two dice are rolled. What is the probability of rolling a sum greater than 8?

AND in math means....

use the overlap situation - where both things happen

OR in math means...

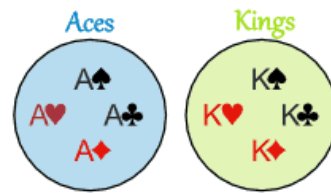
both options can occur - add all possibilities



Mutually Exclusive - 2 events that can't happen at the same time

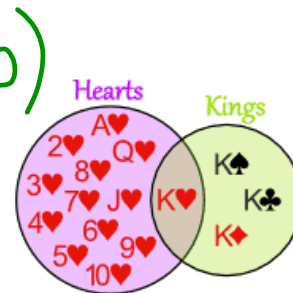
Disjoint

- Turning left and turning right are Mutually Exclusive (you can't do both at the same time)
- Tossing a coin: Heads and Tails are Mutually Exclusive
- Cards: Kings and Aces are Mutually Exclusive



What is not Mutually Exclusive: *(has overlap)*

- Turning left and scratching your head can happen at the same time
- Kings and Hearts, because we can have a King of Hearts!

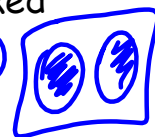


If events are mutually exclusive, then we ADD the probabilities - we use "or" when describing the events

In a group of 101 students 30 are freshmen and 41 are sophomores. Find the probability that a student picked from this group at random is either a freshman or sophomore.

$$P(F \text{ OR } S) = \frac{30}{101} + \frac{41}{101} = \frac{71}{101}$$

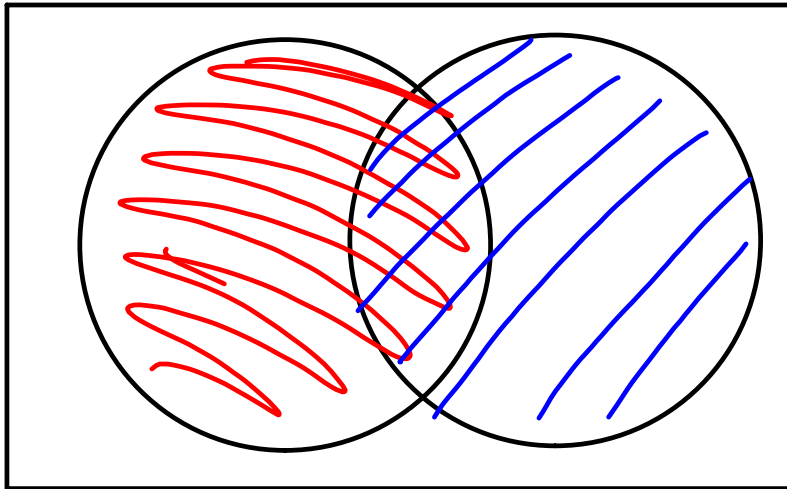
(Handwritten annotations: 'F' under 30, 'S' under 41, and a box around the final fraction)



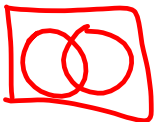
A card is randomly selected from a standard deck of 52 cards. What is the probability that it is a 10 or a face card?

$$P(10 \text{ or Face}) = \frac{4}{52} + \frac{12}{52} = \frac{16}{52} = \frac{4}{13}$$

Part II: Non - Mutually Exclusive



$$P(A) + P(B) - \underbrace{P(A \cap B)}_{\text{overlap}}$$

Ex 1) A card is randomly selected from a standard deck of 52 cards. What is the probability that it is a face card or a heart? 

$P(\text{Face OR Heart}) =$

$$\underbrace{\frac{12}{52}}_{\text{Face}} + \underbrace{\frac{13}{52}}_{\heartsuit} - \underbrace{\frac{3}{52}}_{\substack{\text{Face} \heartsuit \\ \text{Face} \spadesuit}} = \frac{22}{52} = \frac{11}{26}$$

Ex 2) A six-sided die is rolled. What is the probability of rolling a number greater than 4 or even?

$$P(>4 \text{ OR Even}) = \frac{2}{6} + \frac{3}{6} - \frac{1}{6} = \frac{4}{6}$$

$\frac{2}{6}$ $\frac{3}{6}$ $\frac{1}{6} = \frac{4}{6}$
 1, 2, 3, 4, 5, 6 $\frac{2}{6}$ $\frac{3}{6}$ $\frac{1}{6}$
 >4 Even Overlap

3) What is the probability of the teacher randomly choosing a girl or a junior from this class today?

$$\frac{14}{23} + \frac{11}{23} - \frac{5}{23} = \frac{20}{23}$$

$\frac{14}{23}$ $\frac{11}{23}$ $\frac{5}{23}$ $= \frac{20}{23}$
 Girl JR JR girls

You Try:

1) A card is randomly selected from a standard deck of 52 cards. Find the probability of the given event.

a. $P(\text{ace or eight}) =$

b. $P(\text{10 or diamond}) =$

Independent vs. Dependent

Does each event depend on a previous event?

Without replacement

You tossed a coin and got heads 5 times in a row... what are the chances of you landing on heads again?

If multiple events are mutually exclusive and you are looking for the combination of probabilities, then we **MULTIPLY** these probabilities. These problems frequently have an "and" in the phrasing. Be aware of whether events are independent or dependent

A bag contains 6 red marbles and 4 black marbles. Two marbles are drawn without replacement from the bag.

What is the probability that both of the marbles are black?

$P(\text{Black AND black})$

$$\frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90}$$

dependent

A bag contains 6 red marbles and 4 black marbles. Two marbles are drawn with replacement from the bag. What is the probability that both of the marbles are black? *Indep.*

$$P(B \text{ AND } B) = \frac{4}{10} \cdot \frac{4}{10} = \frac{16}{100}$$

You Try: There are 8 movie DVDs, 3 exercise DVDs, and 5 cartoon DVDs on the shelf. Suppose two DVDs are to be selected at random from the shelf. Find each probability.

a) P(selecting 2 movie DVDs, no replacement)

$$\text{Dep. } \frac{8}{16} \cdot \frac{7}{15} = \frac{56}{240} \quad (\text{Movie AND Movie})$$

b) P(selecting 2 movie DVDs, with replacement)

$$\text{Indep. } \frac{8}{16} \cdot \frac{8}{16} = \frac{64}{256} \quad (\text{Movie + Movie})$$

c) P(selecting an exercise DVD, then a cartoon DVD, no replacement)=

$$\text{dep. } \frac{3}{16} \cdot \frac{5}{15} = \frac{8}{240}$$

Other probability thoughts

The sum of the probabilities of an event = 1

Micheal Jordan had a free throw percentage of 83%. What is the chance of him missing a free throw.