Example 1: Try these problems from last time:

a) Calculate the following probabilities: There are 10 pink, 5 yellow, 3 red, 18 blue, and 4 green color cubes in a jar. I pick two color cubes, with replacement. 40 Total put it back

P(green then yellow)
$P(G)\cdot P(Y) = \frac{4}{40}\cdot\frac{5}{40} = \frac{20}{1600}$

P(blue then pink)
$P(B)\cdot P(P) = \frac{18}{40}\cdot\frac{10}{40} = \frac{180}{1600}$

P(red then green)
$P(R)\cdot P(G) = \frac{3}{40}\cdot\frac{4}{40} = \frac{12}{1600}$

b) Would it make a difference if I don't replace the first one before I pick the second one? Calculate each of the probabilities again, this time without replacement. NOT putting back

P(green then yellow)
$P(G)\cdot P(Y) = \frac{4}{40}\cdot\frac{5}{39} = \frac{20}{1560}$

P(blue then pink)
$P(B)\cdot P(P) = \frac{18}{40}\cdot\frac{10}{39} = \frac{180}{1560}$

P(red then green)
$P(R)\cdot P(G) = \frac{3}{40}\cdot\frac{4}{39} = \frac{12}{1560}$

Try a few more!

a) A drawer contains 15 socks; 6 of which are blue socks, 8 of which are white socks, and 1 is purple. If two socks are drawn, without replacement, what is the probability that a pair of blue socks will be drawn?

$P(\text{Both B}) = \frac{6}{15}\cdot\frac{5}{14} = \frac{30}{210}$ (both)

b) If two socks are drawn, with replacement, what is the probability that a white and then purple will be drawn?

$P(W)\cdot P(P) = \frac{8}{15}\cdot\frac{1}{15} = \frac{8}{225}$

c) A bag of candy contains 4 lemon flavored sour balls, and 5 lime flavored sour balls. If Tim reaches in, takes one out and eats it, and then 20 minutes later selects another and eats that one as well, what is the probability that the first was lemon flavored and the second was lime flavored? w/o Repl. 9 total

$P(\text{Lemon then Lime}) = \frac{4}{9}\cdot\frac{5}{8} = \frac{20}{72}$

d) Mary has 4 dimes, 3 quarters and 7 nickels in her purse. She reaches in and pulls out a coin, only to have it slip from her fingers and fall back into the purse. She then picks out another coin. What is the probability that she picked a nickel on both tries? w/ Repl. 14 total

$P(\text{Both N}) = \frac{7}{14}\cdot\frac{7}{14} = \frac{49}{196}$

What if some info is known before you calculate the probability?

Conditional Probability: the probability of an event (A), given that another (B) has already occurred.

From the color cubes example (10 pink, 5 yellow, 3 red, 18 blue, and 4 green color cubes in a jar), calculate this probability:

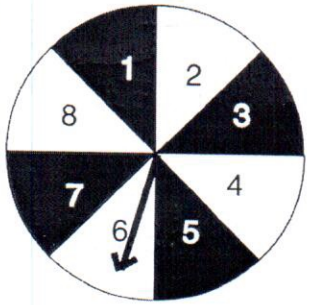
$P(\text{Red}) = \frac{3}{40}$

What if I first tell you that the color I picked is a primary color? 3 Red | 5 Yellow | 18 Blue, 26 Total

$P(\text{Red}) = \frac{3}{26}$ ✓ given

We write this as: $P(\text{red} \mid \text{primary})$ whatever is "given" is your new total.

Try a few more about the spinner:



$P(2) = \frac{1}{8}$

$P(2 \mid \text{white}) = \frac{1}{4}$

$P(\text{even}) = \frac{4}{8}$

$P(\text{even} \mid \text{top half}) = \frac{2}{4}$

We can also calculate probabilities from two-way tables and Venn diagrams.

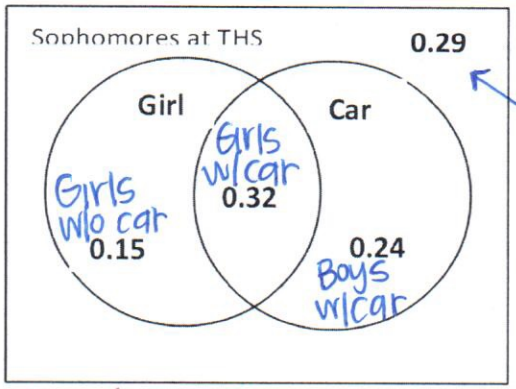
Example 2: If you could have just one of these superpowers, which would you choose?

	Male	Female	**Total**
Fly	0	1	1
Freeze time	11	1	12
Invisibility	0	0	0
Superstrength	4	0	4
Telepathy	7	4	11
Total	22	6	28

Now, let's calculate the following probabilities:

$P(\text{Fly}) = \frac{1}{28}$	$P(\text{Male and Superstrength}) = \frac{4}{28}$	$P(\text{Male or Superstrength}) = P(M) + P(S) - P(M \text{ and } S) = \frac{22}{28} + \frac{4}{28} - \frac{4}{28} = \frac{22}{28}$
$P(\text{Invisibility}) = \frac{0}{28}$	$P(\text{Invisibility} \mid \text{Female}) = \frac{0}{6}$	$P(\text{Invisibility or Female}) = P(I) + P(F) - P(F \text{ and } I) = \frac{0}{28} + \frac{6}{28} - \frac{0}{28} = \frac{6}{28}$
$P(\text{Telepathy} \mid \text{Male}) = \frac{7}{22}$	$P(\text{Telepathy and Male}) = \frac{7}{28}$	$P(\text{Female}) = \frac{6}{28}$

Example 3:



The decimals are percentages

Boys w/o cars

Total = 1

Given its a girl, what is prob she has a car?

$P(\text{Car} \mid \text{Girl}) = \frac{0.32}{0.47}$ ($0.15 + 0.32$)	$P(\text{Car and Girl}) = \frac{0.32}{1}$	$P(\text{Boy} \mid \text{Car}) = \frac{0.24}{0.56}$ ($0.32 + 0.24$)
What is the probability that Rebecca has a car? $P(\text{car} \mid \text{Girl}) = \frac{0.32}{0.47}$	Taylor has a car. What is the probability that Taylor is a boy? $P(\text{Boy} \mid \text{car}) = \frac{0.24}{0.56}$	$P(\text{Boy or No Car}) = P(B) + P(\text{No car}) - P(B \text{ and No car}) = \frac{0.53}{1} + \frac{0.44}{1} - \frac{0.29}{1} = \frac{0.68}{1}$