GRADE 12 APPLIED
DEPENDENT AND INDEPENDENT EVENTS

Name: ________________

Read and do the related notes. Complete this instructional document, filling in blanks.

Mike is a star football quarterback but he sits out half the games due to injury. The way we say that is **P(Mike Play) = 0.5**.

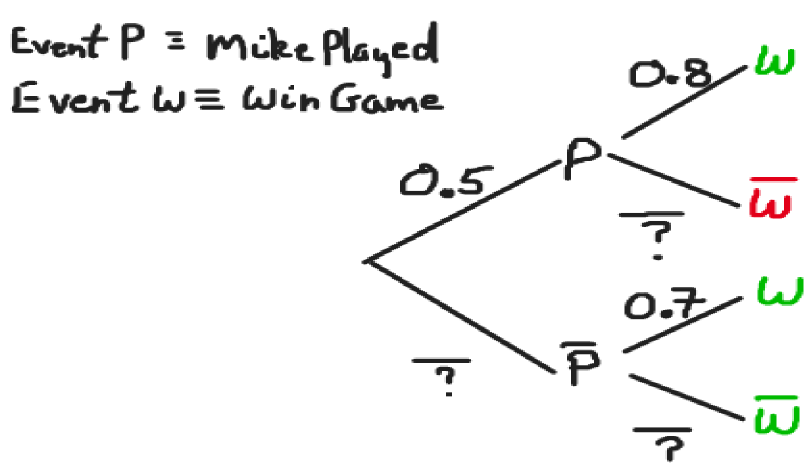
**If** Mike **does** play then the team has an **80%** chance of winning. The way we say that is **P( Win | Mike Plays) = 0.8**; which is read as '*the probability of a Win given that Mike played is 0.8*'. Or think of it as '***If*** *mike plays* ***then*** *the probability of a win is 0.8'*. Thus suggesting that a win likely depends on whether Mike plays or not. (but not necessarily, wait for it)

Of course if there is an 80% chance of winning there is a ____ % of **not winning**.

It turns out we know that when Mike Does Not Play that the team only wins 70% of the time. We can say this as P(Win | Mike Does NOT Play) = 70%. S0 given that Mike does not play there is 70% chance the team will still win, which means there is a ____ % chance they will Not Win.

(Notice I say NOT Win instead of **lose** since lose would exclude ties)

Inspect the probability tree below and complete the (?) blank values.



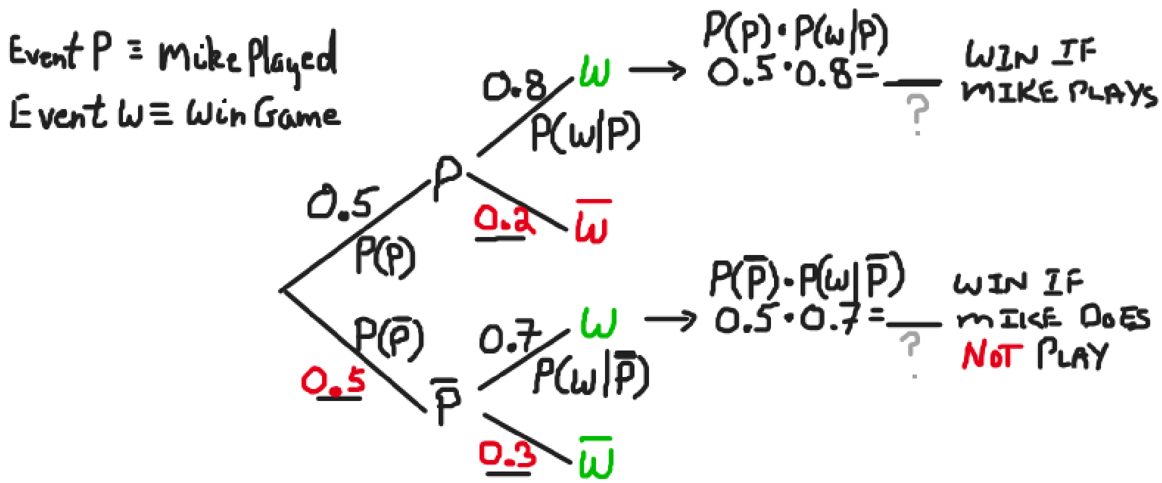
**Calculate the Probability the Teams wins a game**

Sometimes Mike plays sometimes he doesn't. He might play **OR** he might not play. The Probability of a Win is different depending on whether Mike Plays or not. P(Win | Mike Plays) = _______.
P(Win | Mike does not Play) = _______.

So clearly the probability of a win depends on whether Mike plays or not; which is why we call it **Dependent Probability**.

Lets us calculate the probability of just a any Win regardless of whether Mike plays or not.

Complete the blanks below:



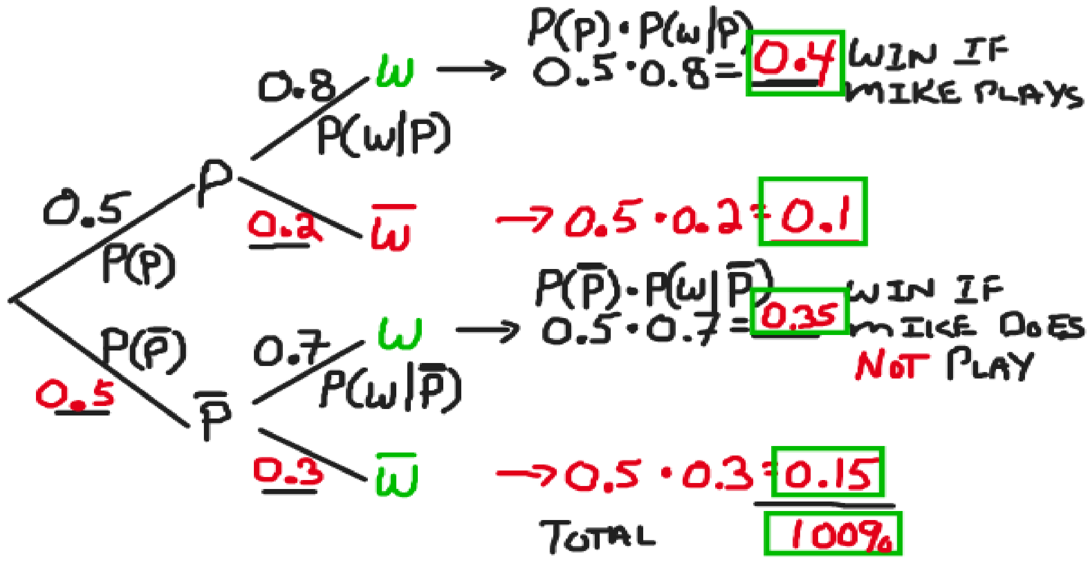

So there are two ways to win. With Mike **or** Without Mike

**OR**!!! '**Or**' pretty much always means **ADD**! We add the probabilities.

Probability of any Win = $\boldsymbol{P}(\boldsymbol{P}) * \boldsymbol{P}(\boldsymbol{W}| \mathbf{P}) + \boldsymbol{P}(\overline{\boldsymbol{P}}) * \boldsymbol{P}(\boldsymbol{W}| \overline{\boldsymbol{P}})$

= 0.4 + 0.35 = 0.75 = 75%

Notice that following and including the other branches, the 'losing' paths, makes everything work out to 100%. (otherwise a bit suspicious)




So that was easy, the chance of a Win depended on whether Mike played or not. This was a dependent situation. The Win event was Dependent on the Mike Plays event

So can we do the same type of calculations backwards?

Sure.

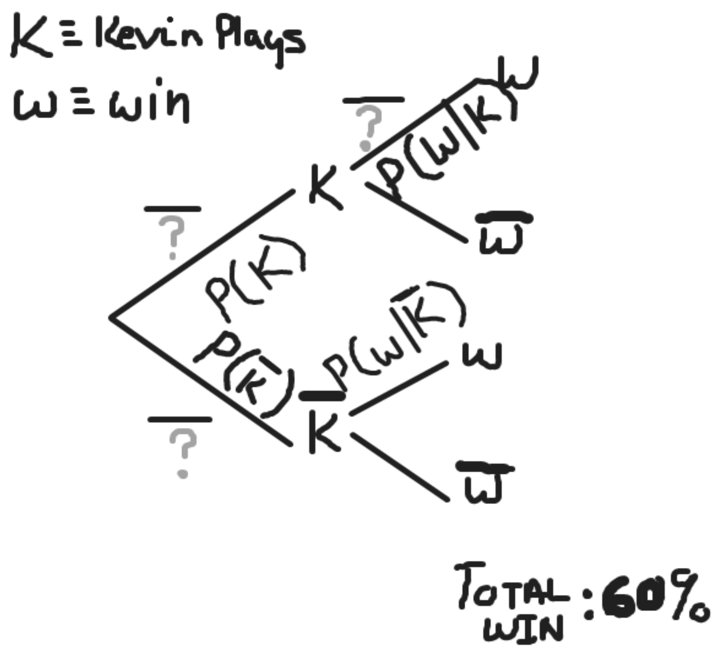
**KEVIN PLAYS FOOTBALL TOO**

Kevin is another football player. The probability he **does not** play is 20%. **If** he plays the team wins 60% of their games. This season the team won 60% their games overall. So does winning depend on whether or not Kevin played?

What do you think? Does winning depend on whether Kevin Plays? Circle one choice: **Yes / No**

Now fill out the Probability Tree with what we know!

You fill in the blanks




So:

Probability of any Win = $\boldsymbol{P(K) * P(W|\,\mathrm{K}) + P(\bar{K}) * P(W|\,\bar{K})}$ **= 0.6**

ie: the probability that the teams wins if Kevin plays or does not play is 60%

so:

$\boldsymbol{P(K) * P(W|\,\mathrm{K}) + P(\bar{K}) * P(W|\,\bar{K})}$**= 0.6**

$\boldsymbol{0.8 * 0.6 + 0.2 * P(W|\,\bar{K})}$ **=0.6**

So solve for $P(W|\,\bar{K})$ ; the probability the team wins '*given that*' Kevin **does not** play.

$0.48 + 0.2 \cdot x = 0.6$

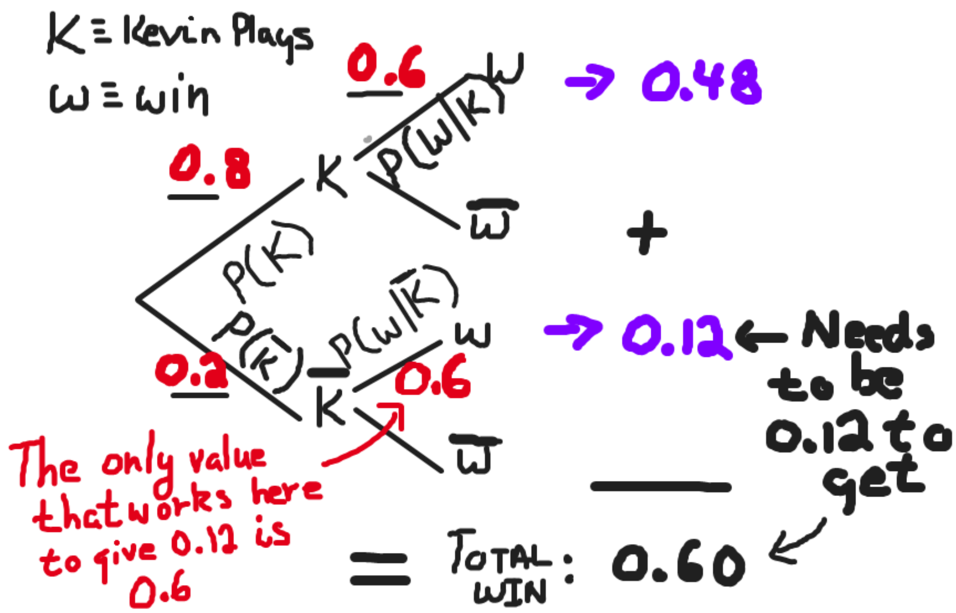
$-0.48 \qquad -0.48$

$\frac{0.2x}{0.2} = \frac{0.12}{0.2}$

$x = 0.6 = 60\%$

So it does not matter whether Kevin Plays or not!

Probability of a win when **he does play**, $P(W|\,K)$, is 60% and Probability of a win when he **does not play, $\boldsymbol{P(W|\,\bar{K})}$**, is 60%. So winning or losing is independent of whether or not he plays.




So we now have a method to calculate whether situations two events are dependent or independent.

NOW Calculate Kevin all over again, this time the team still wins 60% of the time. But the $\boldsymbol{P(W|\mathrm{K})}$ **is 0.5.**

**So** calculate what is $P(W|\bar{K})$, probability of a win if Keven does not play!

$P(W|\bar{K})$ = ____________

Explain if Kevin is a useful team member in a proper paragraph!