Mr. Ward Answer Key

Independent and Dependent Events

Independent Events

Events are **independent** if the occurrence of one event does not affect the probability of the other.

For example, if we toss a coin twice, having it land heads up on first toss and landing heads up on the second toss are independent events. The outcome of one toss does not affect the probability of heads on the second toss.

To find the probability of tossing heads twice, multiply the two individual probabilities together. ($\frac{1}{2} \bullet \frac{1}{2} = \frac{1}{4}$)

**** If A and B are independent events, then P(A and B) = P(A) • P(B) ****

Example #1

Find the probability of rolling a 4 on one number dice and an even number on another dice.

Take the probability of the first event and multiply it by the probability of the second event. $\frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$

Practice Problem #1

Find the probability of tossing a coin and having it land heads 4 times in a row.

$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \boxed{\frac{1}{16}}$

Dependent Events

Events are **dependent** if the occurrence of one event affects the probability of the other.

For example, say we have a bag with 2 apples and 1 orange. If you pull out 2 pieces of fruit, the probabilities will change *depending* on the outcome of the first pull.

Before I pull a piece of fruit I have a $\frac{2}{3}$ probability of picking an apple and a $\frac{1}{3}$ probability of picking an orange.

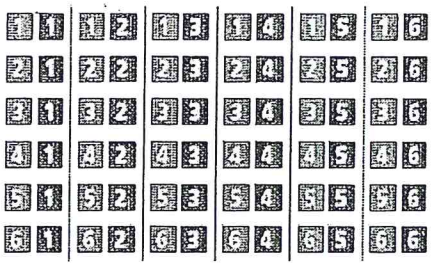
Let's say I pull an apple first. For my **next** pull, I have both a ½ probability of picking an apple and a ½ probability of picking an orange.

This would have changed if I had pulled an orange from the bag first. If this has been the case, then on my second pull there would have been a 100% chance of grabbing an apple and a 0% chance of grabbing an orange.

**** If A and B are dependent events, then P(A and B) = P(A) • P(B | A), where P(B | A) is the probability of B, given that A has occurred. ****

Example #1

Two numbered dice are rolled, one red die and one blue die. Find the probability that the red die shows a 1, and the sum is less than 4.



These events are dependent because the probability that the sum is less than 4 ***depends*** on whether or not the red die shows a 1 first.

$P(\text{red } 1) = \frac{6}{36} = \frac{1}{6}$ *(Of 36 outcomes, 6 of them have a red 1)*

$P(\text{sum} < 4 \mid \text{red } 1) = \frac{2}{6} = \frac{1}{3}$ *(Of 6 outcomes with red 1, only 2 have a sum <u>less</u> than 4)*

Practice Problem #1

Two cards are drawn from a deck of 52. Find the probability of selecting a face card and then selecting a 7, when the first card is <u>not</u> replaced.

First, find the probability of selecting a face card.

$12/52$

Then, find the probability of selecting a 7. (Remember there is one less card because we do not replace the first one.)

$4/51$

Now multiply these two probabilities together to get our final answer.

$\frac{12}{52} \cdot \frac{4}{51} = \frac{48}{2652} \longrightarrow \boxed{\frac{4}{221}}$

<u>Come show me your answer so I know you're on the right track!</u>

Assignment: Practice B Worksheet + pg 815 #2-4, 8-14, 17-18

Name Mr. Ward Date _____ Class _____

LESSON 11-3

Practice B

Independent and Dependent Events

Find each probability.

1. A bag contains 5 red, 3 green, 4 blue, and 8 yellow marbles. Find the probability of randomly selecting a green marble, and then a yellow marble if the first marble is replaced. $\frac{3}{20} \cdot \frac{8}{20} = \frac{24}{400} \longrightarrow \frac{3}{50}$
2. A sock drawer contains 5 rolled-up pairs of each color of socks, white, green, and blue. What is the probability of randomly selecting a pair of blue socks, replacing it, and then randomly selecting a pair of white socks? $\frac{5}{15} \cdot \frac{5}{15} = \frac{25}{225} \longrightarrow \frac{1}{9}$

Two 1–6 number cubes are rolled—one is black and one is white.

3. The sum of the rolls is greater than or equal to 6 and the black cube shows a 3.
   a. Explain why the events are dependent.

   the sum being ≥ 6 depends on whether or not black cube shows a 3

   b. Find the probability. $\frac{1}{6} \cdot \frac{4}{6} = \frac{4}{36} \longrightarrow$ 1/9
4. The white cube shows an even number, and the sum is 8.
   a. Explain why the events are dependent.

   the sum being = to 8 depends on whether the white cube shows an even #

   b. Find the probability. $\frac{3}{6} \cdot \frac{1}{6} = \frac{3}{36} \longrightarrow$ 1/12

The table below shows numbers of registered voters by age in the United States in 2004 based on the census. Find each probability in decimal form.

Age	Registered Voters (in thousands)	Not Registered to Vote (in thousands)	
18–24	14,334	13,474	27,808
25–44	49,371	32,763	82,134
45–64	51,659	19,355	71,014
65 and over	26,706	8,033	34,739
	142,070	73,625	

5. A randomly selected person is registered to vote, given that the person is between the ages of 18 and 24. $\frac{14,334}{27,808} \approx 0.52$
6. A randomly selected person is between the ages of 45 and 64 and is not registered to vote. $\frac{19,355}{215,695} \approx 0.09$
7. A randomly selected person is registered to vote and is at least 65 years old. $\frac{26,706}{215,695} \approx 0.12$

A bag contains 12 blue cubes, 12 red cubes, and 20 green cubes. Determine whether the events are independent or dependent, and find each probability.

8. A green cube and then a blue cube are chosen at random with replacement. $\frac{20}{44} \cdot \frac{12}{44} = \frac{240}{1936} \longrightarrow$ Independent; 15/121
9. Two blue cubes are chosen at random without replacement. Dependent; 33/473

$\frac{12}{44} \cdot \frac{11}{43} = \frac{132}{1892} \longrightarrow$

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2. $\frac{1}{6} \cdot \frac{1}{6} = \boxed{1/36}$

3. $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \boxed{1/8}$

4. the product being < than 20 is dependent on blue cube being a 4
$1/6 \cdot 4/6 = 4/36 = \boxed{1/9}$

8. Independent ; $\frac{10}{20} \cdot \frac{10}{20} = \frac{100}{400} = \boxed{1/4}$

9. Dependent ; $\frac{10}{20} \cdot \frac{9}{19} = \frac{90}{380} = \boxed{9/38}$

10. $\frac{1}{4} \cdot \frac{1}{4} = \boxed{1/16}$

11. $\frac{3}{6} \cdot \frac{1}{6} = 3/36 = \boxed{1/12}$

12. the product being > 24 is dependent on the yellow cube being > 5
$\frac{1}{6} \cdot \frac{2}{6} = 2/36 = \boxed{1/18}$

13. the product being 8 is dependent on the blue cube being < 3
$\cancel{\frac{2}{6}} \cdot \frac{1}{6}$
$\frac{1}{6} \cdot \frac{1}{6} = \boxed{1/36}$ (only way to get product of 8 is by rolling a blue 2)

14. a) $\frac{10,695}{16,997} \approx 0.63$ b) $\frac{1,264}{65,846} \approx 0.019$ c) $\frac{3,158}{11,962} \approx 0.26$

17. Dependent ; $\frac{4}{9} \cdot \frac{3}{8} = \frac{12}{72} = \boxed{1/6}$

18. Independent ; $\frac{4}{9} \cdot \frac{4}{9} = \boxed{16/81}$