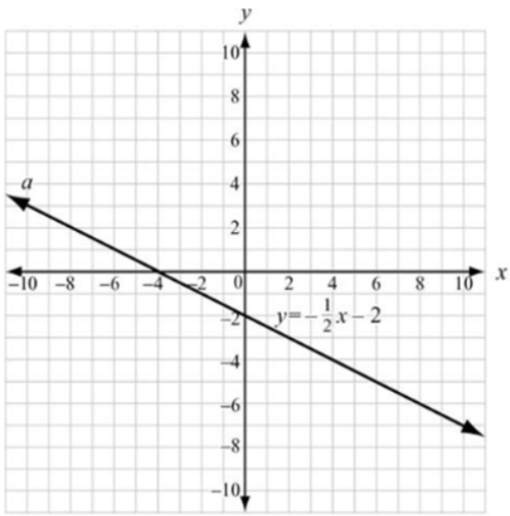
The equation of line *a* is $y = -\frac{1}{2}x - 2$. $\rightarrow \perp m = 2$

Which is an equation of the line that is perpendicular to line *a* and passes through the point (-4, 0)?

$\perp m$
→ opposite
→ reciprocal

x y



$A.\ y = -\frac{1}{2}x + 2$

$B.\ y = -\frac{1}{2}x + 8$

$C.\ y = 2x - 2$

$D.\ y = 2x + 8$

$y = 2x + 8$

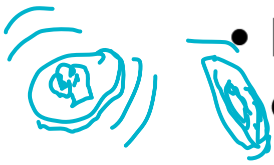
$y = 2x + b$
$0 = 2(-4) + b$
$0 = -8 + b$
$+8 \quad +8$

$b = 8$

Independent Events

flip two coins

- Two events A and B, are independent if the fact that A occurs DOES NOT affect the probability of B occurring.



- EX 1. Landing on heads from two different coins;
- EX 2. rolling a 4 on a die, then rolling a 3 on a second roll of the die.

Probability of A and B occurring:

multiply

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

$P(A \cap B)$

Experiment 1

A coin is tossed, and a 6-sided die is rolled. Find the probability of landing on the head side of the coin and rolling a 3 on the die.

head, tail } 2 total

- P (head)= $\frac{1}{2}$
- P(3)= $1/6$
- P (head and 3)=P (head) • P(3)

$$= \left(\frac{1}{2}\right)\left(\frac{1}{6}\right)$$

$$= \boxed{\frac{1}{12}}$$

or 0.083

Experiment 2

A card is chosen at random from a deck of 52 cards. It is then replaced and a second card is chosen. What is the probability of choosing a jack and an eight?

- P (jack)= $4/52$
- P (8)= $4/52$
- P (jack and 8)= $(4/52)(4/52)$

$= \frac{16}{2704} = \frac{1}{169}$ or $.0059$

Experiment 3

A jar contains three red, five green, two blue and six yellow marbles. A marble is chosen at random from the jar. After replacing it, a second marble is chosen. What is the probability of choosing a green and a yellow marble?

Total = 16

And = multiply
OR = add

$P\left(\text{Drawing Green}\right) = 5/16$

$P\left(\text{Drawing yellow}\right) = 6/16$

$P(G \text{ and } Y) = \left(5/16\right)\left(\frac{6}{16}\right) = \frac{30}{256} = \frac{15}{128}$ or 0.1171

Experiment 4

- A school survey found that 9 out of 10 students like pizza. If three students are chosen at random with replacement, what is the probability that all three students like pizza?

$P(\text{pizza}) = \frac{9}{10}$

$P(\text{Pizza} \cap \text{Pizza} \cap \text{Pizza})$

$= \left(\frac{9}{10}\right)\left(\frac{9}{10}\right)\left(\frac{9}{10}\right)$

$= \frac{729}{1000}$ or $.729$

Dependent Events

- Two events A and B, are dependent if the fact that A occurs DOES affect the probability of B occurring.

52
-1
51

- Example: Picking a card from a deck of cards and then picking another card without replacing the first one.

$\left(\frac{1}{52}\right)\left(\frac{1}{51}\right)$

- Probability of A and B occurring:

(A) (B given that A happened) P(A and B) = P(A) • P(B | A)

Given

Experiment 1

- A jar contains three red, five green, two blue and six yellow marbles. A marble is chosen at random from the jar. A second marble is chosen without replacing the first one. What is the probability of choosing a green and a yellow marble?

3 + 5 + 2 + 6 = 16 total

dependent →

① P (green) = $\frac{5}{16}$

② P (yellow given green) = $\frac{6}{15}$ ← you took out a green marble!

P (green and then yellow) = P (green) • P (yellow | green)

$= \left(\frac{5}{16}\right)\left(\frac{6}{15}\right)$

$= \frac{30}{240} = \frac{1}{8}$ or 0.125

Experiment 2

Dependent

- An aquarium contains 6 male goldfish and 4 female goldfish. You randomly select a fish from the tank, do not replace it, and then randomly select a second fish. What is the probability that both fish are male?

10 total
-take 1
9 left

$P(M \cap M) = P(\text{male}) \cdot P(\text{male} \mid \text{drew another male})$

given

$= \left(\frac{6}{10}\right)\left(\frac{5}{9}\right)$

$= \frac{30}{90} = \frac{1}{3}$ or $.\overline{33}$

Experiment 3

A random sample of parts coming off a machine is done by an inspector. He found that 5 out of 100 parts are bad on average. If he were to do a new sample, what is the probability that he picks a bad part and then, picks another bad part if he doesn't replace the first?

P(Bad and then Bad)

$P(\text{Bad} \cap \text{Bad}) = P(\text{Bad})\,P(\text{Bad} \mid \text{Bad})$

$= \left(\frac{5}{100}\right)\left(\frac{4}{99}\right)$

$= 20/9900 = 1/495$ or $.0020$

Independent vs. Dependent

Determining if 2 events are independent

Independent Events

- Two events are independent if any of the following are true:

  $P(A \mid B) = P(A)$ because B does not affect A.

  $P(B \mid A) = P(B)$ because A does not affect B

  $P(A \text{ AND } B) = P(A) \cdot P(B)$

- To prove 2 events are independent, you must show one of the above statements is true.

Experiment 1

- Let event G = taking a math class.
- Let event H = taking a science class.
- Then, G AND H = taking a math class and a science class.

math science math and science

If $\boxed{P(G) = 0.6}$, $\boxed{P(H) = 0.5}$, and P(G AND H) = 0.3, are G and H independent?

$P(G \text{ and } H) = P(G)\,P(H)$

$.3 = .6\,(.5)$

$.3 = .3$

✓ yes, they are independent!!!

Experiment 2

In a specific college class:

- $P(F)=.6$ 60% of the students are female.
- $P(L)=.5$ 50% of all students in the class have long hair.
- $P(F \cap L)=.45$ 45% of the students are female and have long hair.
- $P(L|F)=.75$ Of the female students, 75% have long hair.

Are the events of being female and having long hair independent? $P(F \cap L) = P(F) \bullet P(L)?$

$.45 = .6(.5)$

$.45 \neq .3$

not independent!

Experiment 2: Another Approach

- If they are independent, P(L | F) should equal P(L).
- P(L | F)= .75
- P(L)= .5

$.75 \neq .5$

not independent!

having long hair is dependent on being female [from this sample].

GSE Geometry Unit 6 Probability Day 7

Name________________________________ Date: ______________________________

Based on the definition of independence, determine if events A and B are independent in each case. $P(A)\cdot P(B) = (.2)(.14) = .028 = P(A\cap B)$

$P(A\cap B) = P(A)\cdot P(B)$

Independent 1. $P(A)=0.2$ $P(B)=0.14$ $P(A\cap B)=0.028$

$(.32)(.16) = .0512 \neq .48$

Dependent 2. $P(A)=0.32$ $P(B)=0.16$ $P(A\cap B)=0.48$

_______ 3. $P(A)=\frac{1}{3}$ $P(B)=\frac{3}{5}$ $P(A\cap B)=\frac{4}{15}$

_______ 4. $P(A)=\frac{7}{8}$ $P(B)=\frac{2}{5}$ $P(A\cap B)=\frac{7}{20}$

Paola is playing a word game in which she draws letter tiles from a bag without looking. The bag contains 7 tiles: 2 As, 3 Es, and 2 Rs.
Find the probability of getting an E first and getting an E second. In each problem, state whether the events are independent, and find the probabilities.

_______ 5. Paola takes a tile, then replaces it, and then takes a second tile.

_______ 6. Paola takes a tile, does not replace it, and then takes a second tile.

P(E and then E)

7. Employment Survey. A random survey was conducted to gather information about age and employment status.
This table shows the data that were collected.

Employment Survey Results

	Age (in Years)		
Employment Status	**Less than 18**	**18 or greater**	
Has Job	20	587	607
Does Not Have Job	245	92	337
	265	679	944

$P(J|18^+) = P(J)$
$607/944$
$.0755 \neq .643$
$.0755 \neq .643$
not ind.

a) What is the probability that a randomly selected person surveyed has a job, given that the person is less than 18 years old? $\frac{20}{265} = \frac{4}{53}$ $.0755$

b) What is the probability that a randomly selected person surveyed has a job, given that the person is greater than or equal to 18 years old? $\frac{587}{679} = .8645$ 679

c) Are having a job (A) and being 18 or greater (B) independent events? Explain.
$P(Job \wedge 18\ older) = 587/944 = \boxed{.6218}$ $P(Job)\cdot P(18^+)$ $\left(\frac{607}{944}\right)\cdot\left(\frac{679}{944}\right) = \boxed{.4625}$

not independent b/c $P(Job \wedge 18^+) \neq P(Job)P(18^+)$

8. In a certain town, the probability that a person plays sports is 65%. The probability that a person is between the ages of 12 and 18 is 40%. The probability that a person plays sports and is between the ages of 12 and 18 is 25%. Are the events independent? How do you know?

9. The probability of playing basketball is 12%, and the probability of playing both basketball and football is 5%. Find the probability of a person playing football, given they play basketball.

GSE Geometry Unit 6 Probability Day 7

Using the letters in the state ARKANSAS:

________ 10.Find the probability of picking an S and then an A without replacement.

________ 11.Find the probability of picking a K and then a N without replacement.

________ 12. A test includes several multiple choice questions, each with 5 choices. Suppose you don't know the answers for three of these questions, so you guess. What is the probability of getting all three correct?

The following chart shows favorite subjects of students based on their gender.

	Math	Science	English	History	
Male	46	42	13	25	
Female	12	21	45	36	

________ 13. What is the probability that a randomly chosen student likes history the most?

________ 14. What is the probability that a randomly chosen student is a female?

________ 15. What is the probability that a randomly chosen student is a male <u>or</u> likes Math?

________ 16. What is the probability that a randomly chosen student both likes science <u>and</u> is a male?

________ 17. What is the probability that a randomly chosen student likes history <u>given</u> that they are a female?

________ 18. Does the probability of liking a subject depend on whether the students are male or female? Use calculations.