Name_____ **Probability Packet**

Introduction: Rock, Paper, Scissors

With a partner, you are going to play Rock, Paper, Scissors.

Choose one person to be player A and one to be Player B. Keep track of all the matches. Play a total of **18 times**.

_____	_____	_____	_____18_____
A wins	B wins	Tie	Total

1. Looking at this information, what is the probability of A winning?

2. What is the probability of B winning?

3. What is the probability of getting a tie?

4. What kind of probability is this?

We will now add up all the wins for the whole class.

_____	_____	_____	_____
A wins	B wins	Tie	Total

5. Looking at this information, what is the probability of A winning?

6. What is the probability of B winning?

7. What is the probability of getting a tie?

8. What kind of probability is this?

9. Draw a tree diagram showing first what player A chooses (rock, paper, scissors), then what player b chooses (rock, paper, scissors).

10. Circle where A wins, Put a square where B wins, and a Triangle where it's a tie.

11. How many outcomes are there?

12. According to the tree diagram, what is the probability that A wins?

13. What is the probability that B wins?

14. What is the probability that it's a tie?

15. What kind of probability is this?

16. Do you think this game is fair? Why?

17. Compare these results to what actually happened when you just you and your partner played. Are the probabilities the same? Are they close?

18. Compare the results to the probability when the whole class played. Are these probabilities the same? Are they close? Are they closer than when just you and your partner played?

19. What do you think this says about experimental, and theoretical probability?

Now we will consider another game, this time using 3 players.

A wins if all 3 hands are the same. B wins if all 3 hands are different. C wins if 2 hands are the same.

20. Make a tree diagram showing the possible results of the hands.

21. Is the game "fair?" Why or why not?

Definition:

22. **Probability** is a number between _____ and _____ .

_____ means it never happens

_____ means it always happens

Experimental Probability = $\frac{(\qquad\qquad)}{(\qquad\qquad)}$

Theoretical Probability = $\frac{(\qquad\qquad)}{(\qquad\qquad)}$

Example: When school is over, I time how long it takes me to get out of the parking lot. Last week, Monday took me 4:32, Tues=2:49, Wed=5:02, Thur=3:28, and Fri=4:45.

23. a.What was the probability last week that I got out in under 5 minutes?

b. Under 4 minutes? c. Under 3 minutes? d. Under 2 minutes?

Independent Events

24. If I toss a coin once, the probability of getting heads is _____.

25. If I toss the coin again, what is the probability of getting a head this time is _____.

26. If I continue tossing the coin, the probability each time of getting a head is always _____.

27. Does the first toss affect any other toss?

28. If the probability of one event does not affect the probability of another event, the two events are said to be…

29. Find the probability of rolling a die and getting a 6, then rolling it again and getting a 3.

30. Find the probability of picking a card from a 52-card-deck and getting a queen, then replacing the card and picking king.

When two events are independent, the probability of both of them occurring is found by multiplying their probabilities together.

P(A and B) = P(A) · P(B) *Only if they are independent*

31. A coin is flipped, and a die is rolled. Find the probability of getting a head on the coin, and a 4 on the die.

32. A card it drawn from a normal deck of cards and then replaced; then a second card is drawn. Find the probability of getting a 4 then getting an ace.

33. A poll found that 46% of Americans say they suffer stress at least once a week. If three people are selected at random, find the probability that all three will say they suffer stress at least once a week.

34. The probability the a medical test will come back positive is 0.32. If four people are tested, find the probability that all four will show positive.

Conditional Probability

When two events are independent, one probability does not affect the other.
However, we are going to look at what happens when the probability does change.

35. If I select a random card from a deck, the probability of getting an ace on the first draw is…

36. Without replacing that card, if I did draw an ace, the probability of drawing a king is…

37. The probability of both happening is:

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

38. The event of getting a king on the second draw ***given*** that an ace was drawn the first time is called…

$P(B \mid A)$ = The probability of B, given A.

39. In a shipment of 25 ovens, 2 are defective. If two ovens are randomly selected and tested, find the probability that both will be defective if the first one ***not replaced*** after being tested.

40. Three cards are drawn from an ordinary deck of cards and not replaced. Find the probability that:

a. Getting three jacks

b. Getting an ace, a king, and a queen in that order.

c. Getting a club, a spade, and a heart in that order.

d. Getting three clubs.

41. A recent survey asked 100 people if they thought women in the armed forces should be permitted to participate in combat. The results are shown in the table:

Gender	**Yes**	**No**	**Total**
Male	32	18	50
Female	8	42	50
Total	40	60	100

a. Find the probability a person answered "yes", given that person was female.

b. Find the probability the person asked was male, given that they answered "no".

Formula:

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

42. The probability that Sam parks in a no-parking zone ***and*** gets a ticket is 0.06, and the probability that Sam parks in a no parking zone is 0.20. Sam arrives late to school and parks in a no-parking zone. Find the probability that he will get a ticket.

Exclusivity

43. Two events are_____ when they cannot happen at the same time.

44. Which events are mutually exclusive when rolling a single die?

a. Getting an odd number and getting an even number

b. getting a 3 and getting an odd number

c. getting an odd number and getting a number less than 4

d. getting an number less than 4 and getting a number greater than 4

When two events (A and B) are mutually exclusive, the probability that A or B will happen is the two separate probabilities added up.

P(A or B) = P(A) + P(B)

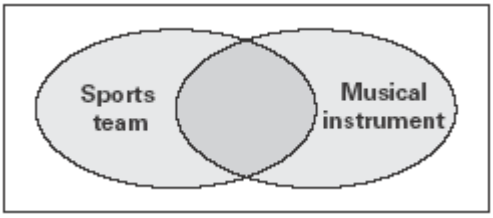
45. At a political Rally, there are 20 Republicans, 13 Democrats, and 6 Independents. If is person is selected at random, find the probability that he or she is either a Democrat or Independent.

1. 46. A day of the week is selected at random. Find the probability that it is a weekend.

Finding Probabilities of Compound Events

QUESTION
How can you find the probabilities of compound events?

STEP 1 Use a Venn diagram. Copy the Venn diagram shown underneath STEP 2 below.



STEP 2 Survey class. Ask the members of your math class if they play a musical instrument, play on a school sports team, do both, or do neither. Write their names in the appropriate part of the Venn diagram.

47. **Copy diagram here:**

48. Complete frequency table. When determining the frequency for a category, be sure to include all the students in your math class who are in the category.

Description	**Number of students**
Play a musical instrument	
Play on a school sports team	
Play a musical instrument *and* play on a school sports team	
Play a musical instrument *or* play on a school sports team	
Do not play an instrument and do not play on a school sports team	

DRAW CONCLUSIONS
Use your observations to complete these exercises.

49. A student from your class is chosen at random. Find the probability of each event. *Explain* how you found the probability.

a. Choosing a student who plays a musical instrument

b. Choosing a student who plays on a school sports team

c. Choosing a student who plays a musical instrument *and* plays on a school sports team

d. Choosing a student who plays a musical instrument *or* plays on a school sports team

e. Choosing a student who does not play a musical instrument and does not play on a school sports team

Notes:

When two events (A and B) are **not** mutually exclusive, you must subtract the probabilities that are common to both events, because otherwise they are counted twice.

P(A or B) = P(A) + P(B) – P(A and B)

50. In a regular deck of cards, find the probability that you will pick a king or a club.

A hospital has male and female nurses and physicians.

Staff	**Females**	**Males**	**Total**
Physicians	3	2	5
Nurses	7	1	8
Total	10	3	13

51. What is the probability of talking to a male or a nurse?

52. On New Year's Eve the probability of a person driving while intoxicated is 0.32, the probability of a person getting into a car accident is 0.09, and the probability that a person gets into a car accident while driving intoxicated is 0.06. What is the probability of a person driving while intoxicated, or getting into a car accident?

Practice:

In Exercises 53 - 58, you draw a card from a bag that contains 4 yellow cards numbered 1–4 and 4 blue cards numbered 1–4 Tell whether the events A *and* B are *mutually exclusive* or *overlapping*. Then find *P*(A *or* B).

53. **Event A**: You choose a yellow card.
Event B: You choose a blue card.

54. **Event A**: You choose a blue card.
Event B: You choose a number 3 card.

55. **Event A**: You choose a number 1 card.
Event B: You choose a yellow card.

56. **Event A**: You choose a card with an odd number.
Event B: You choose a number 2 card.

57. **Event A**: You choose a blue number 4 card.
Event B: You choose a blue card.

58. **Event A**: You choose a card with an odd number.
Event B: You choose a yellow card.

In Exercises 59 - 61, tell whether the events A and B are dependent or independent. Then find P(A and B).

A bag contains 3 red balls and 4 green balls. You randomly draw one ball, replace it, and randomly draw a second ball.

59. **Event A**: The first ball is red.
Event B: The second ball is red.

You write each of the letters of the word LISTED on pieces of paper and place them in a bag. You randomly draw one letter, do not replace it, then randomly draw a second letter.

60. **Event A**: The first letter is an L.
Event B: The second letter is a T.

You write each of the letters of the word BRIGHTNESS on pieces of paper and place them in a bag. You randomly draw one letter, replace it, then randomly draw a second letter.

61. **Event A**: The first letter is a B.
Event B: The second letter is an H.

62. **Lunch:** One of your friends eats lunch in the cafeteria sometime between 12:00 P.M. and 12:30 P.M. Another friend eats lunch in the cafeteria sometime between 12:15 P.M. and 12:45 P.M. Today you get to the cafeteria at 12:20 P.M. What is the probability that you have missed both friends in the cafeteria?

63. **Sports:** A survey of 500 students in a school found that about 225 households consist of students who participate in some kind of sport, 250 consist of students who do and do not participate in some kind of sport, and 25 consist of students who do not participate in some kind of sport.

a. What is the probability that one of the households surveyed, chosen at random, consists of students who do *or* do not participate in some kind of sport?

b. What is the probability that one of the households surveyed, chosen at random, consists of students who do *and* do not participate in some kind of sport?

In Exercises 64 and 65, tell whether the events A *and* B are *dependent* or *independent*. Then find *P*(A *and* B).

64. A bag contains 6 red balls and 5 green balls. You randomly draw one ball, replace it, and randomly draw a second ball.

Event A: The first ball is green.
Event B: The second ball is green.

65. You write each of the letters of the word BRILLIANT on pieces of paper and place them in a bag. You randomly draw one letter, do not replace it, then randomly draw a second letter.

Event A: The first letter is an L.
Event B: The second letter is a T.

66. Eating Habits: A survey of 500 students in a school found that about 100 households consist of only vegetarians, 240 consist of vegetarians and non-vegetarians, and 160 consist of non-vegetarians.

a. What is the probability that one of the households surveyed, chosen at random, consists of vegetarians or non-vegetarians?

b. What is the probability that one of the households surveyed, chosen at random, consists of vegetarians and non-vegetarians?

c. *Explain* how your answers to parts (a) and (b) are related.

67. Coordinating Time: You study with a group for an upcoming math competition on Mondays, Tuesdays, and Thursdays. You volunteer at a hospital on Mondays, Wednesdays, and Thursdays.

a. Make a Venn diagram that shows the days of the week that you participate in each activity.

b.Your class is taking a field trip that could be scheduled for any day of the week (Monday through Friday). Find the probability that it is scheduled for a day when you are studying with your group or are volunteering.