

Name: _____

REVIEW EXERCISES

A) In how many ways can three students be selected for a committee if there are 11 students from which to select?

B) A hockey player needs new skates, a new helmet, and a new stick. Hockey Central has 5 brands of skates, 6 brands of helmets, and 8 brands of sticks. In how many different ways can the player select one of each item?

C) On a TV game show, three contestants must each pick a box which they believe contains the day's grand prize. In how many different ways can this be done if there are 10 boxes from which to choose, each box contains a different prize, and each contestant must pick a different box?

Probability: 2-1 Calculating Basic Probabilities

Probabilities give us an idea of how likely it is for a certain event to happen. For example, when a coin is flipped, the chance that it comes up heads is 50%. Probabilities can be expressed in decimal, fraction, percent, or ratio form. We could have said the probability of flipping heads is 0.5, $1/2$, 50% or 1:2. Each of these conveys the idea that we should expect to get a heads half of the time. Probabilities only give us an idea of what to expect in the long run. However, they do not tell us what will happen in the short term.

Suppose we flip a coin 10 times in a row and get heads each time. The next coin flip is still a random event because while we cannot tell for certain what the next flip will be, we can be certain that about 50% of all tosses over a long set of tosses will be heads. Some people think that we are on a roll so we are more likely to get another head. Others will say that getting tails is more likely because we are past due for tails. The truth is that we cannot tell what will happen on the next flip. The only thing we know for certain is that there is a 50% chance that the coin will be heads on its next flip. If we continue to flip this same coin hundreds of times, we would expect the percent of heads to get closer and closer to 50%. Chance Behavior is not predictable in the short term; however, it has long term predictability. The *Law of Large Numbers* tells us that despite the results on a small number of flips, we will eventually get closer to the theoretical probability. The outcomes in any random event will always get close to the theoretical probability if the event is repeated a large number of times. We might roll a die 4 times in a row and get a 6 each time, however, if we rolled this die hundreds of times, the percent of time that we get a 6 will get closer and closer to the theoretical probability of $1/6$.

In probability, there are outcomes that are sure to happen and there are outcomes that are impossible. If we are once again dealing with a standard 52 card deck, the chance of being dealt either a red card or a black card if one card is dealt is 100%. The chance of being dealt a blue card is 0% since there are no blue cards in a standard deck. All random events have probabilities between 0 and 1. In addition, the sum total of the probabilities for all possible outcomes in the sample space is equal to 1. In other words, if an event occurs, there is a 100% chance that one of the possible outcomes will happen. The list below summarizes these rules. a) The probability of a sure thing is 1. b) The probability of an impossible outcome is 0. c) The sum of the probabilities of all possible outcomes is 1. d) The probability for any random event must be somewhere from 0 to 1.

EXAMPLE 1: In the game of pool, there are a total of 15 balls. Balls numbered 1-8 are solid and balls 9-15 are striped. There are two pool balls of each color, for example, there are two yellow pool balls. One of those are solid and one of those are striped. The only exception to this is that there is only 1 black pool ball, the eight ball, and it is solid.

Suppose the pool balls were put in a bag and a single pool ball is pulled out of the bag. What is the probability that the ball:

- a) is yellow?
- b) is striped?
- c) has a number on it that is greater than 10?
- d) is not striped?

EXAMPLE 2: Using a standard deck of playing cards, what is the probability of getting

- a.) A red card?
- b.) A spade?
- c.) A King of Hearts or Jack of Diamonds?
- d.) Not a Club?

EXAMPLE 3: Using the ENTIRE ALPHABET, what is the probability of:

- a.) Randomly Selecting a vowel?
- b.) Selecting anything but C?
- c.) Selecting a Consonant?

Problem Set 2.1

Exercises For problems 1-5, express your answer both as a fraction (reduce if possible) and as a decimal to the nearest hundredth.

1) Suppose a single card is dealt from a standard deck of 52 cards. Find the probability that the card is: a) a red card. b) a face card. c) an ace. d) a three. e) a club. f) the three of clubs. g) a black king. h) not a spade.

2) A bag contains some jelly beans. There is a total of 6 red jelly beans, 4 green jelly beans, 2 black jelly beans, 5 yellow jelly beans, and 3 orange jelly beans in the bag. Suppose one jelly bean is drawn from the bag. a) Find $P(\text{purple})$. b) Find $P(\text{yellow})$. c) Find $P(\text{red})$.

3) A single 6-sided die is rolled one time. Find the probability that the result is: a) a three b) a seven c) an even number d) a prime number e) a number equal to or greater than 5.

4) The game Scattogories uses a 20-sided die. It has all the letters of the alphabet on it except Q, U, V, X, Y, and Z. Find each probability below if the die is rolled one time.
a) $P(\text{Vowel})$ b) $P(\text{Vowel})$ c) $P(Q)$ d) $P(Q^c)$ e) $P(\text{a letter alphabetically after Q})$

5) The month of October in a 2011 calendar has 31 days with October 1st being a Saturday as shown in the calendar on the following page. Suppose a day is randomly selected. Find each probability. a) $P(\text{weekend})$ b) $P(\text{not a weekend})$ c) $P(\text{October 31st})$
d) $P(\text{October 32nd})$ e) $P(\text{October 31st})$ f) $P(\text{an odd-numbered day})$

6) A roulette wheel contains 38 slots. When the wheel is spun, a ball is dropped onto the wheel and the ball will stop on one of the slots. There are 18 black slots, 18 red slots, and 2 green slots. Suppose the ball on a roulette wheel has landed on red four times in a row. What is the chance that the ball will drop on red on the next spin?

7) A coin has been flipped 10 times. Suppose that it has come up heads on only 2 out of those ten times. a) What percent of the time has the coin come up heads? b) Suppose we flip the coin 90 more times and 45 of those 90 flips come up heads. Of the 100 flips completed so far, what percent of the time has the coin come up heads? c) Suppose we continue to flip the coin an additional 900 times and that 450 of those 900 flips come up heads. Of the 1000 flips completed, what percent of the time has the coin come up heads? d) As we flipped the coin more and more, the percentage of heads got closer and closer to 50% despite the fact that only 2 of the first 10 flips were heads. What rule does this illustrate?

8) Two 6-sided dice are rolled and we keep track of the total on the two dice. a) Make a 6 by 6 grid showing the different totals that you can get when rolling the two dice. b) What is the probability that you get doubles? c) What is the probability that you get a total of 7? d) What is the probability that you get a total of at least 8?

9) The high school concert choir has 7 boys and 15 girls. The teacher has three solos available for the next concert but all of the members are so good she decides to randomly select the three students for the solos. a) In how many ways can the teacher select the 3 students? b) What is the probability that all three students selected are girls? c) What is the probability that at least one boy is selected?

10) A test begins with 5 multiple choice questions with four options on each question. It then has 5 true/false questions. a) How many answer keys are possible? b) What is the probability of getting every question correct if a student guesses on each question. Leave your answer as a fraction.

11) A lawn and garden store is moving locations and needs to move its riding lawn mowers to the new store. They have 8 mowers with 36-inch decks, 15 mowers with 42-inch decks, and 6 mowers with 48-inch decks that need to be moved. The trailer they are using can move a total of 8 mowers on each load so several trips will have to be made. a) In how many ways can 8 mowers be randomly selected for the first load? b) What is the probability that all the mowers with 48-inch decks get selected for the first load? Leave your answer as a reduced fraction. c) What is the probability that the first load has exactly two 36-inch deck mowers, four 42-inch deck mowers, and two 48-inch deck mowers?