

## Finding Probabilities of Compound Events- Teacher

**Goal:** The goal of this activity is for students to understand how to find probabilities of compound events by drawing tree diagrams and listing out sample spaces. Depending on the grade level, with or without replacement events can also be used and illustrated.

**Materials Needed:** Each person in the group will need a copy of the worksheet.

**Before having students complete the activity, review with them a couple of definitions and provide an example of a tree diagram and sample space for them.**

### Let's Review:

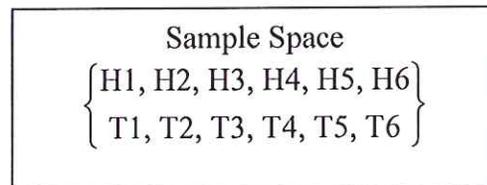
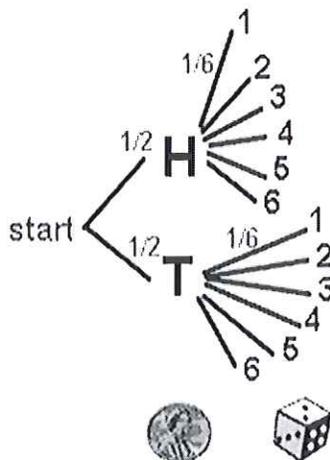
A **probability** experiment is an action, or trial through which specific results (counts, measurements, or responses) are obtained.

The result of a single trial in a probability experiment is an **outcome**.

The **sample space** is the set of all possible outcomes of a probability experiment.

An **event** is a subset of a sample space.

For example: A probability experiment consists of tossing a coin and rolling a six-sided die. Determine the number of outcomes and identify the sample space.



## Group Work

Please read each question carefully. You will need to draw a tree diagram, list the sample space and answer the probabilities for each question.

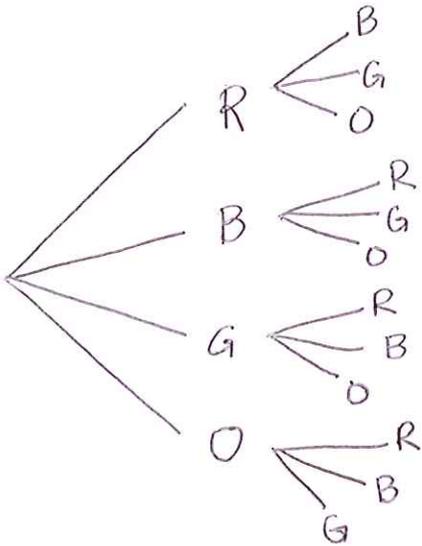
### Question #1

Two marbles are selected without replacement from a bag that contains one red, one blue, one green and one orange marble.

- a) Use the counting principle to determine the number of points in the sample space.

**There are four choices for the first marble, and then three choices for the second marble, so  $4 \cdot 3 = 12$**

- b) Construct a tree diagram and list the sample space.



Sample Space
RB, RG, RO
BR, BG, BO
GR, GB, GO
OR, OB, OG

- c) Determine the probability that one orange marble is selected.

$$P(\text{one orange selected}) = \frac{6}{12} = \frac{1}{2}$$

- d) Determine the probability that a green marble followed by a red marble is selected.

$$P(\text{red and then green}) = \frac{1}{12}$$

- e) Determine the probability that a blue and orange marble are selected.

$$P(\text{blue and orange}) = \frac{2}{12} = \frac{1}{6}$$

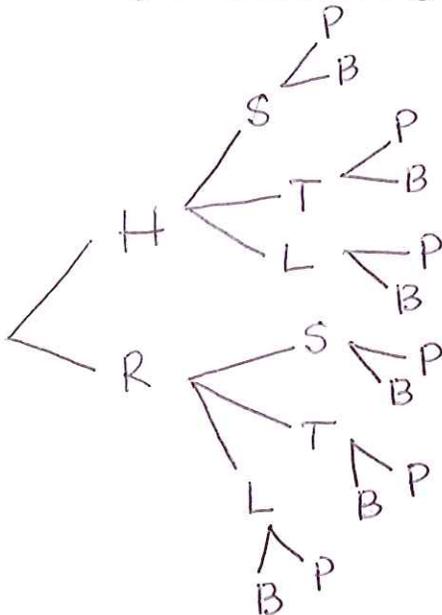
## Question #2

At a restaurant, each lunch special consists of a sandwich, beverage and a dessert. The sandwich choices are ham (H) and roast beef (R). The beverages choices are soda (S), tea (T) or lemonade (L) and the desserts are a pie (P) or brownie (B).

- a) Use the counting principle to determine the number of different lunch specials offered by the restaurant.

$$2 \cdot 3 \cdot 2 = 12$$

- b) Construct a tree diagram and list the sample space.



Sample Space
HSP, HSB, HTP, HTB, HLP, HLB
RSP, RSB, RTP, RTB, RLP, RLB

- c) If a customer randomly selects one of the lunch specials, determine the probability that both a ham sandwich and brownie are selected.

$$P(\text{ham and brownie}) = \frac{3}{12} = \frac{1}{4}$$

- d) If a customer randomly selects one of the lunch specials, determine the probability the neither tea nor pie is selected.

$$P(\text{neither tea nor pie}) = \frac{4}{12} = \frac{1}{3}$$

- e) If a customer randomly selects one of the lunch specials, determine the probability that the person chooses pie as their dessert.

$$P(\text{pie}) = \frac{6}{12} = \frac{1}{2}$$

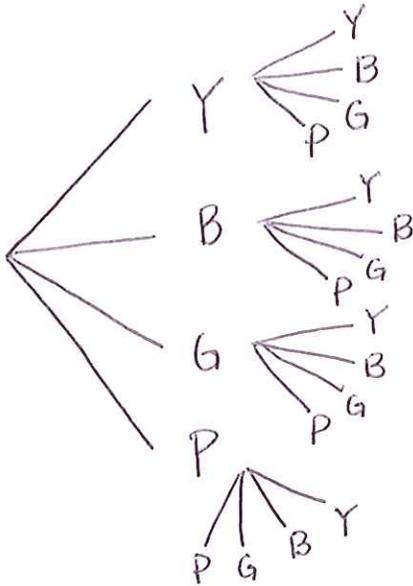
Question #4

A hat contains four marbles: 1 yellow, 1 blue, 1 green and 1 purple. Two marbles are selected at random with replacement.

- a) Determine the number of points in the sample space.

$$4 \cdot 4 = 16$$

- b) Construct a tree diagram and list the sample space.



Sample Space
YY, YB, YG, YP
BY, BB, BG, BP
GY, GB, GG, GP
PY, PB, PG, PP

- c) Determine the probability of selecting exactly one purple marble.

$$P(\text{Exactly one purple}) = \frac{6}{16} = \frac{3}{8}$$

- d) Determine the probability of selecting at least 1 marble that is not purple.

**This means either choosing exactly one purple marble or no purple marbles**

$$P(\text{at least one marble not purple}) = \frac{15}{16}$$

- e) Determine the probability of selecting no green marbles.

$$P(\text{no green marbles}) = \frac{9}{16}$$

### Question #5

Now that you have completed all of the questions, look back at Question 1 and 3, what differences do you see in these questions? How are their tree diagrams affected by this difference?

**The difference between questions 1 and 3 is the idea of with and without replacement. If we perform the experiment without replacement, there is no possibility of choosing the same colored marble twice. We also see that the sample space is smaller in question 1 than 3, also due to the idea of without replacement. In question 3 we see that we are able to choose the same colored marble twice since we are putting our first selection back in and are able to choose it again.**

### Question #6

What do you think are the benefits of drawing tree diagrams? What do you think some of the disadvantages could be to drawing tree diagrams?

**Answers may vary. The benefits include being able to see all the possibilities that you could choose. It also helps organize your work. Disadvantages include very large tree diagrams, especially when we start trying to draw them with a deck of cards.**