Important Concepts . . .

Preview Review

Mathematics Grade 6 TEACHER KEY

W3 - Lesson 5: Probability and Outcomes

V5-07

Important Concepts of Grade 6 Mathematics

Materials Required: A textbook is not needed. This is a stand-alone course.

Mathematics Grade 6
Version 5
Preview/Review W3 - Lesson 5 TEACHER KEY

Publisher: Alberta Distance Learning Centre
Author: Elgin Pawlak
In-House Teacher: Sue Rees

Project Coordinator: Dennis McCarthy
Preview/Review Publishing Coordinating Team: Nina Johnson, Laura Renkema, and Donna Silgard

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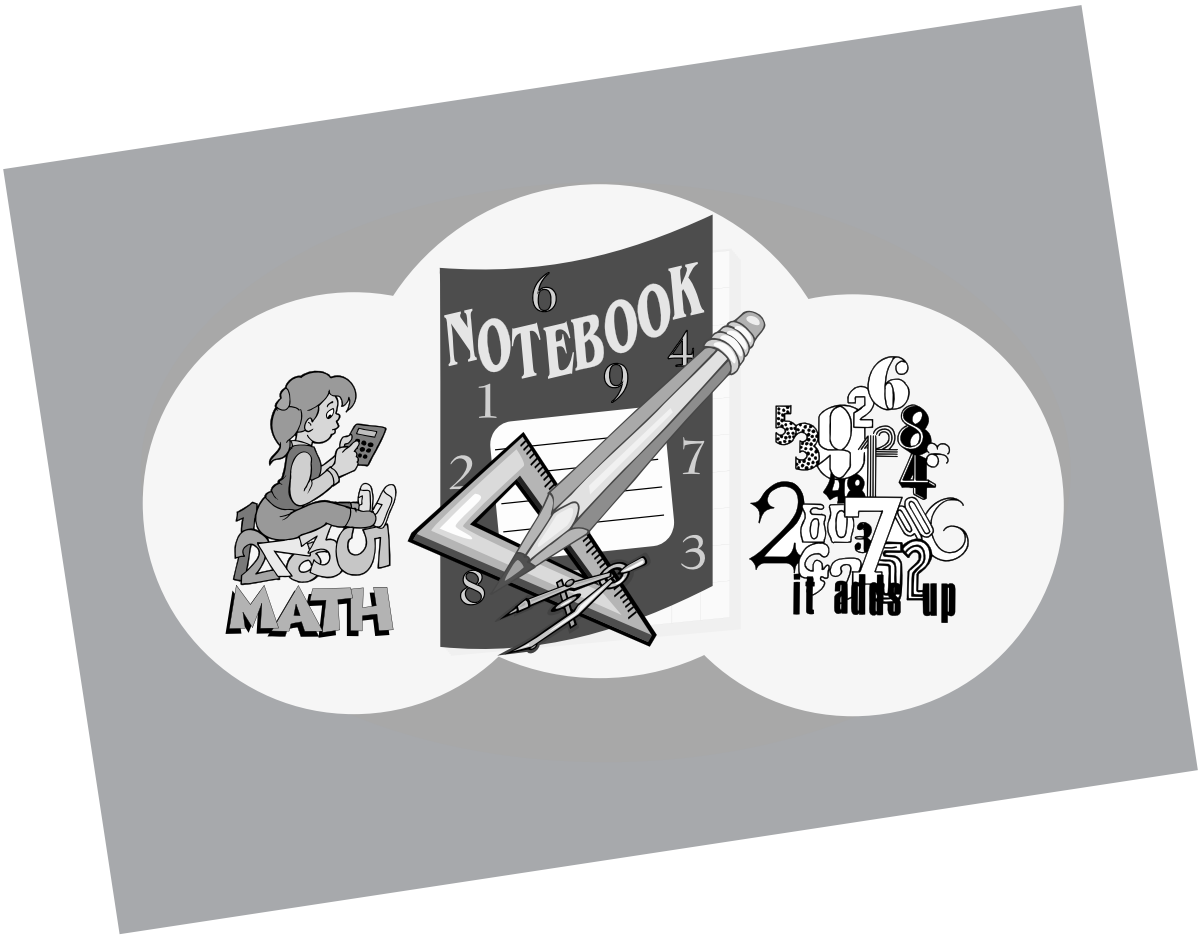
Preview/Review Concepts for Grade Six Mathematics

TEACHER KEY



W3 - Lesson 5:
Probability and Outcomes

OBJECTIVES

By the end of this lesson, you should

- understand the basics of probability
- use probability in math formulas
- understand congruity of geometric figures

GLOSSARY

congruent - "exactly the same"; one figure is the same size and shape as another

face - any flat surface on a geometric shape

probability - the likelihood that a certain outcome will occur

W3 - Lesson 5: Probability and Outcomes

Welcome to W3 - Lesson 5! Has anyone ever said you made a 'lucky guess"? How likely is any guess of being accurate? If you flip a coin, is it as likely to be *heads* as it is to be *tails*?

For this lesson, you need two or more dice, five or more pennies, and a deck of playing cards.

Probability

The likelihood that a certain outcome will occur is called **probability**. The symbol for probability is P.

Roll a normal die (with sides marked 1, 2, 3, 4, 5, and 6).

Note: *Dice* is plural; *die* is singular.

The probability of a 1 (P1) is $\frac{1}{6}$.

The probability of a 2 (P2) is $\frac{1}{6}$.

The probability of a 3 (P3) is $\frac{1}{6}$.

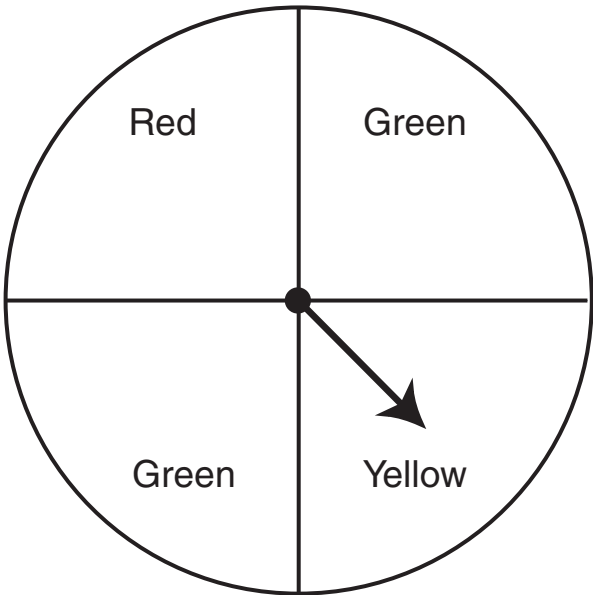
The probability of a 4 (P4) is $\frac{1}{6}$.

The probability of a 5 (P5) is $\frac{1}{6}$.

The probability of a 6 (P6) is $\frac{1}{6}$.

Example 2: Twirl a spinner.

P(red) = 1/4
P(yellow) = 1/4
P(green) = 2/4 or 1/2

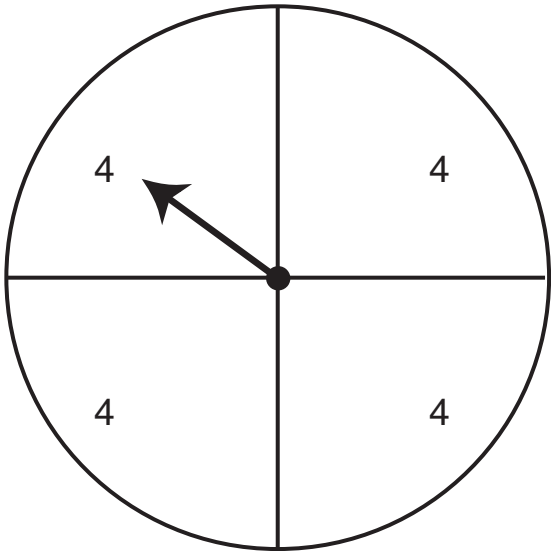


If no probability of the outcome happening is possible, we say the probability is 0.

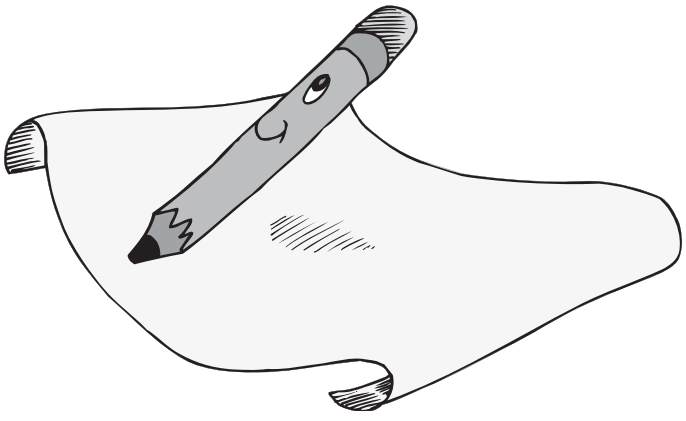
Example: Roll a die and get 7.

P(7) = 0 (There is no chance of getting a 7 because there is no 7 on the die.)

The probability of getting the same outcome every time is shown as P(4) = 1

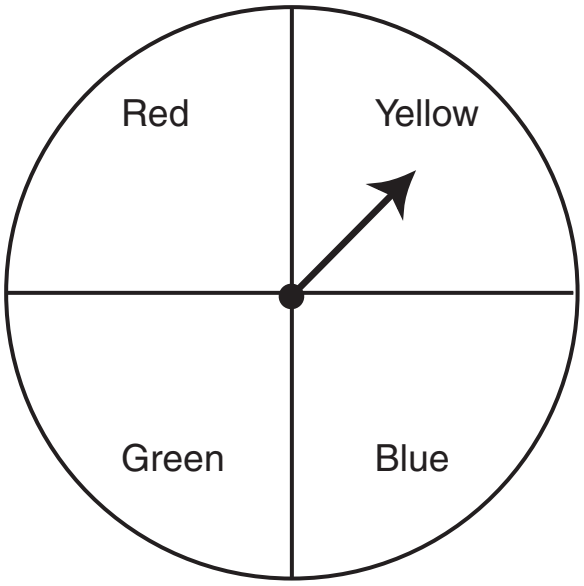


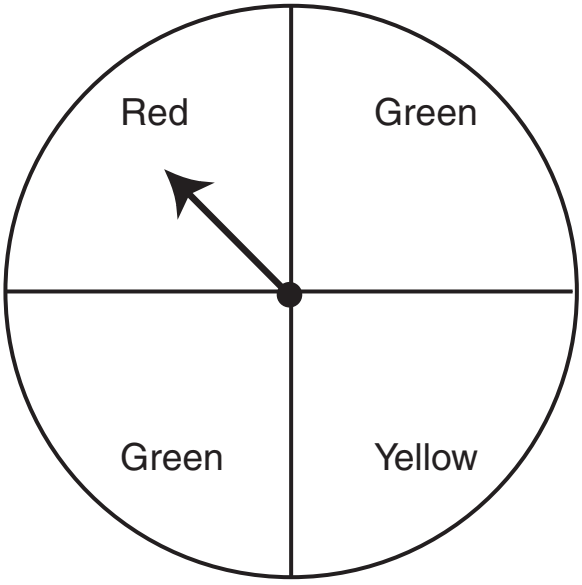
With this spinner, the chance of getting a four is certain because there are no other numbers available.



Construct Two Spinners

If you can use a spinner from a game, do so. If none is available, you can make these with paper, a piece of plastic (perhaps cut from a yogurt lid, for example), and a pin or thumb tack.





Questions

You may choose to do this activity with a partner.

1. Roll a single die 50 times and record your results. Keep a tally in the space provided.

Number	Probability	Tally	Totals
1	$P(1) = \frac{1}{6}$		
2	$P(2) = \frac{1}{6}$		
3	$P(3) = \frac{1}{6}$		
4	$P(4) = \frac{1}{6}$		
5	$P(5) = \frac{1}{6}$		
6	$P(6) = \frac{1}{6}$		

**** Answers will vary.***

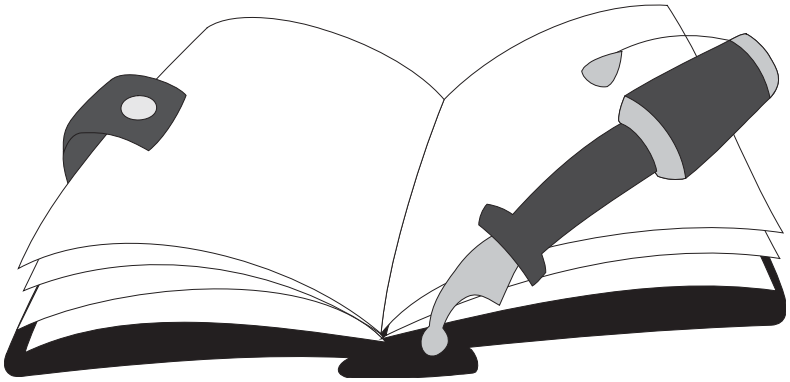
2. Twirl the spinner 50 times and record your results. Keep a tally in the space provided. Use the same spinner for all 50 spins.

Colour	Probability	Tally	Totals
Red	$P(1) = \frac{1}{4}$		
Yellow	$P(2) = \frac{1}{4}$		
Green	$P(3) = \frac{2}{4}$		

3. Flip a coin (penny) 50 times. Keep a tally of the number of heads and tails in the space provided.

Side	Probability	Tally	Totals
Heads	$P(\text{heads}) = \frac{1}{2}$		
Tails	$P(\text{tails}) = \frac{1}{2}$		

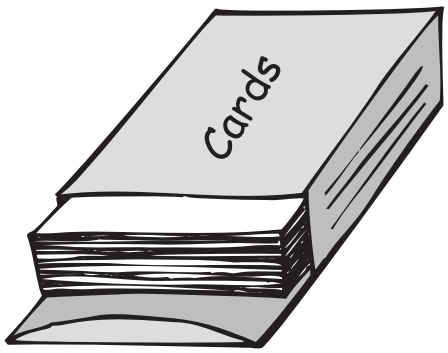
**** Answers will vary.***



4. Cut a deck of cards 50 times and record your results. After 5 cuts, shuffle the deck. Repeat this pattern until you have completed the 50 cuts. Record your data carefully in three places. Example: If you cut a Spade 7, put a tally mark in the 7s row (next page) Column, Spades row (below) and in Black row (below) Column. At the end of the 50 cuts, fill in the Totals column.

Card Value and Probability	Tally	Totals
Suit		
Spades P = $\frac{1}{4}$		
Hearts P = $\frac{1}{4}$		
Diamonds P = $\frac{1}{4}$		
Clubs P = $\frac{1}{4}$		
Colour		
Red P = $\frac{1}{2}$		
Black P = $\frac{1}{2}$		

**** Answers will vary.***



Card Value and Probability	Tally	Totals
2 P (2) = $\frac{1}{13}$		
3 P (3) = $\frac{1}{13}$		
4 P (4) = $\frac{1}{13}$		
5 P (5) = $\frac{1}{13}$		
6 P (6) = $\frac{1}{13}$		
7 P (7) = $\frac{1}{13}$		
8 P (8) = $\frac{1}{13}$		
9 P (9) = $\frac{1}{13}$		
10 P (10) = $\frac{1}{13}$		
Jack P (J) = $\frac{1}{13}$		
Queen P (Q) = $\frac{1}{13}$		
King P (K) = $\frac{1}{13}$		
Ace P (A) = $\frac{1}{13}$		

**** Answers will vary.***

Congruency

Any flat surface on a geometric shape is called its **face**. For example, a cube has 6 faces.

When two faces or two figures are "exactly the same", they are called **congruent** figures. If two triangles are congruent, then they are exactly the same in shape and size. A cube has six congruent faces.

Questions

1. Pretend you are rolling a geometric shape the way you roll a die. Find the probability of each colour landing face down when the following solids (with differing number of faces) are rolled.

   Example: 4 congruent faces: 1 face is red, 1 is blue, and 2 are yellow.

   Answer: P(red) = $\frac{1}{4}$, P(blue) = $\frac{1}{4}$, P(yellow) = $\frac{2}{4} = \frac{1}{2}$

   a. 4 congruent faces: 2 faces are red and 2 are yellow.

   P(red) = ***2/4 or 1/2***, P(yellow) = ***2/4 or 1/2***

   b. 5 congruent faces: all 5 faces are green.

   P(green) = ***1 or 5/5***

   c. 5 congruent faces: 3 faces are green and 2 faces are yellow.

   P(green) = ***3/5***, P(yellow) = ***2/5***

d. 6 congruent faces: 4 faces are blue, 1 face is green and 1 face is yellow.

P(blue) = $\frac{4}{6}$ ***or*** $\frac{2}{3}$, P(green) = $\frac{1}{6}$ P(yellow) = $\frac{1}{6}$

e. 6 congruent faces: 2 faces are blue, 2 faces are green and 2 faces are yellow.

P(blue) = $\frac{2}{6}$ ***or*** $\frac{1}{3}$, P(green) = $\frac{2}{6}$ ***or*** $\frac{1}{3}$, P(yellow) = $\frac{2}{6}$ ***or*** $\frac{1}{3}$

2. If you cut a deck of cards, what is the probability of cutting each of the following cards?

a. P(spade) = $\frac{1}{4}$

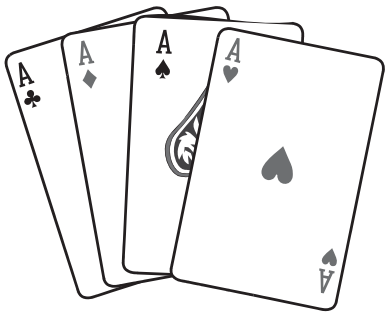
b. P(red card) = $\frac{1}{2}$

c. P(black 5) = $\frac{2}{52}$ ***or*** $\frac{1}{26}$ ***(black 5 would be 5 of spades or 5 of clubs)***

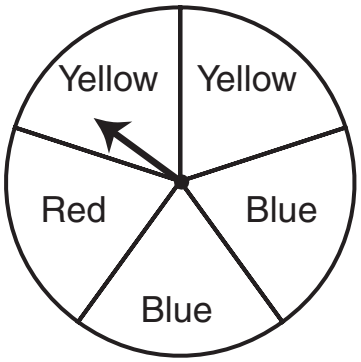
d. P(diamond 9) = $\frac{1}{52}$

e. P(club Ace) = $\frac{1}{52}$

f. P(black card) = $\frac{1}{2}$ ***(***$\frac{26}{52}$ ***would be original fraction, it simplifies to*** $\frac{1}{2}$***)***



3. What is the probability of the spinner shown here landing on each of the following colours?



a. P(yellow) = $\frac{2}{5}$

b. P(Blue) = $\frac{2}{5}$

c. P(red) = $\frac{1}{5}$

d. P(blue or red) = $\frac{3}{5}$

e. P(blue or yellow) = $\frac{4}{5}$

f. If probability worked exactly as predicted, how many times will the arrow point to each colour if you twirled the spinner 20 times?

Yellow = 8 times

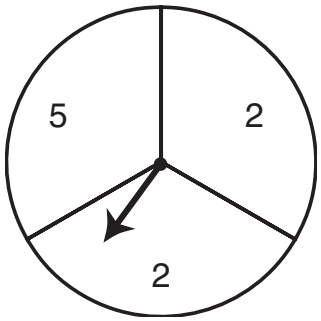
Blue = 8 times

Red = 4 times

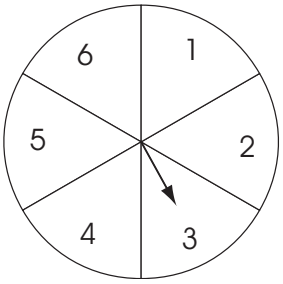
Hint: ***Student can use equivalent fractions to help solve this question.***

4. Design a spinner to show each probability listed below.

Example: $P(2) = \frac{2}{3}$



a. $P(3) = \frac{1}{6}$

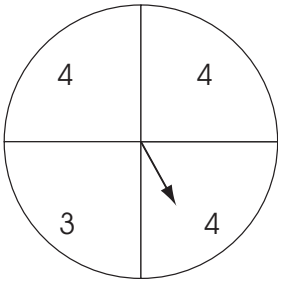


b. $P(4) = \frac{3}{4}$

3-4's *

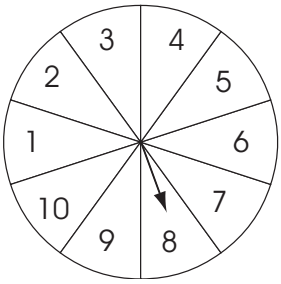
There is one 3.

****Other numbers will vary.***



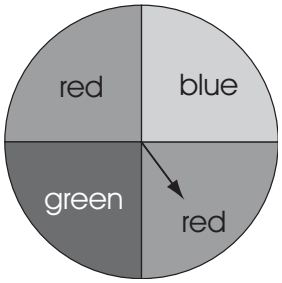
c. $P(8) = \frac{1}{10}$

1-8 *



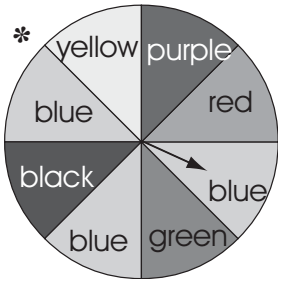
d. $P(\text{red}) = \frac{2}{4}$

2 red pies *



e. $P(\text{blue}) = \frac{3}{8}$

3 blue pies *



This exercise must be discussed with the students.

More Probability

When two activities occur at the same time, the probability of the two outcomes happening at the same time can be calculated by multiplying.

The two activities: Roll a die and cut a deck of cards.

Find the probability of rolling a 3 and cutting a Queen.

$P(3) = \frac{1}{6}$

$P(\text{queen}) = \frac{1}{13}$ or $\frac{4}{52}$

The probability of both occurring at the same time:

$\frac{1}{6} \times \frac{1}{13} = \frac{1}{78}$

$P(3, \text{queen}) = \frac{1}{78}$

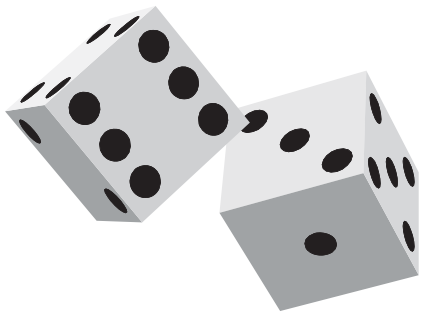
On average, 78 tries would be necessary to get the 3 and the queen together.

Find the probability of flipping a coin and landing heads and rolling a dice and getting a 2.

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

The probability of both occurring at the same time: $\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

$P(\text{heads}, 2) = \frac{1}{12}$. On average, 12 tries would be necessary to get a heads and a 2.



Questions

1. For each of the following, find the probability of the two activities happening at the same time.

   Example:

   P(tails) = $\frac{1}{2}$

   P(dice 3) = $\frac{1}{6}$

   P(tails, dice 3) = $\frac{1}{12}$

   a. P(heads) = $\frac{1}{2}$ P(dice 6) = $\frac{1}{6}$

   P(heads, dice 6) = $\frac{1}{12}$ $\left(\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}\right)$

   b. P(tails) = $\frac{1}{2}$ P(dice 4) = $\frac{1}{6}$

   P(tails, dice 4) = $\frac{1}{12}$

   c. P(dice 4) = $\frac{1}{6}$ P(dice 5) = $\frac{1}{6}$

   P(dice 4, dice 5) = $\frac{1}{36}$ $\left(\frac{1}{6} \times \frac{1}{6}\right)$

   d. P(dice 2) = $\frac{1}{6}$ P(7 spades) = $\frac{1}{52}$

   P(dice 2, 7 spades) = $\frac{1}{312}$

e. P(tails) = $\frac{1}{2}$ P(jack of diamonds) = $\frac{1}{52}$

P(tails, jack of diamonds) = $\frac{1}{104}$

f. P(dice 3) = $\frac{1}{6}$ P(red 9) = $\frac{2}{52} = \frac{1}{26}$

P(dice 3, red 9) = $\frac{1}{156}$

2. For each of the following, find the probability of the three activities happening at the same time.

Example: Flip a coin and land with the heads up; P(heads) = $\frac{1}{2}$

Roll a dice with a 6 up; P(6) = $\frac{1}{6}$

Cut a deck of cards and turn up an Ace; P(ace) = $\frac{1}{13}$

P(heads, 6, ace) = $\frac{1}{2} \times \frac{1}{6} \times \frac{1}{13} = \frac{1}{156}$. The probability of the 3 outcomes happening at the same time is 1 chance in 156 tries.

a. P(tails) = $\frac{1}{2}$ P(dice 3) = $\frac{1}{6}$

P(club king) = $\frac{1}{52}$ P(tails, dice 3, club king) = $\frac{1}{624}$

b. P(heads) = $\frac{1}{2}$ P(dice 1) = $\frac{1}{6}$

P(black 3) = $\frac{1}{26}$ P(heads, dice 1, black 3) = $\frac{1}{312}$

c. P(heads) = $\frac{1}{2}$ P(dice 5) = $\frac{1}{6}$

P(card 6) = $\frac{1}{13}$ P(heads, dice 5, card 6) = $\frac{1}{156}$

d. P(tails) = $\frac{1}{2}$ P(dice 2) = $\frac{1}{6}$

P(card 5 or 6) = $\frac{2}{13}$ P(tails, dice 2, card 5 or 6) = $\frac{2}{156}$ or $\frac{1}{78}$

e. P(tails) = $\frac{1}{2}$ P(dice 3) = $\frac{1}{6}$

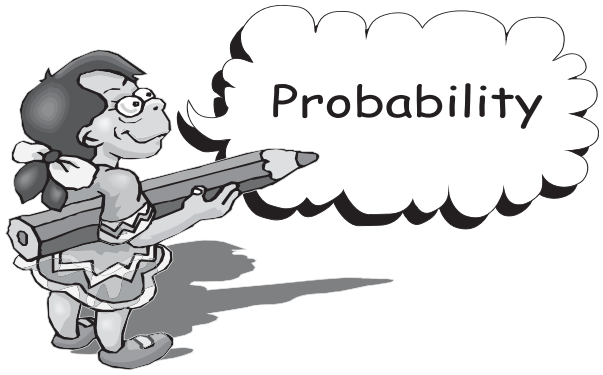
P(red 10) = $\frac{1}{26}$ or $\frac{2}{52}$ P(tails, dice 3, red 10) = $\frac{2}{624}$ or $\frac{1}{312}$

f. P(heads) = $\frac{1}{2}$ P(a number less than 4) = $\frac{3}{6}$

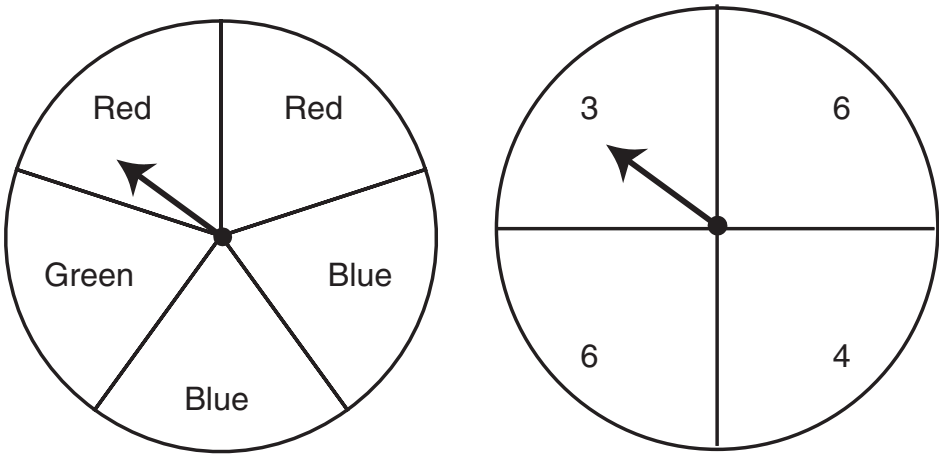
P(a picture card) = $\frac{12}{52}$

P(heads, less than 4, picture card) = $\frac{1}{2} \times \frac{3}{6} \times \frac{12}{52}$

$\frac{1}{2} \times \frac{1}{2} \times \frac{3}{13} = \frac{3}{52}$



3. Using the two spinners below, what is the probability of the following outcomes happening at the same time? Show your work.



a. Spinning a 6 and a green pie

P(6, green) = $\frac{2}{4} \times \frac{1}{5} = \frac{2}{20}$ *or* $\frac{1}{10}$ *(lowest-terms)*

b. Spinning a 3 and a blue pie

P(3, blue) = $\frac{1}{4} \times \frac{2}{5} = \frac{2}{20}$ *or* $\frac{1}{10}$ *(lowest-terms)*

c. Spinning a 2 and a blue pie

P(2, blue) = ***Probability = 0, there is no chance of getting a 2.***

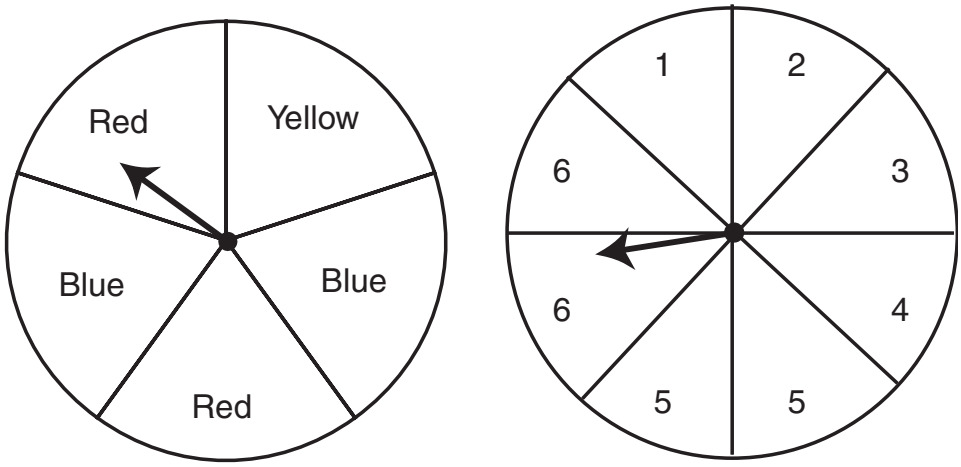
d. Spinning a 4 and a red or blue pie

P(4, red or blue) = $\frac{1}{4} \times \frac{4}{5} = \frac{4}{20}$ *or* $\frac{1}{5}$ *(lowest-terms)*

e. Spinning a 6 or 3 and a green or blue pie

P(6 or 3, green or blue) = $\frac{3}{4} \times \frac{3}{5} = \frac{9}{20}$

4. Using the two spinners below, what is the probability of the following outcomes happening at the same time? Show your work.



a. Spinning a 4 and a blue pie

P(4, blue) = $\frac{1}{8} \times \frac{2}{5} = \frac{2}{40}$ *or* $\frac{1}{20}$

b. Spinning a 6 and a red pie

P(6, red) = $\frac{2}{8} \times \frac{2}{5} = \frac{4}{40}$ *or* $\frac{1}{10}$

c. Spinning a 1 and a yellow pie

P(1, yellow) = $\frac{1}{8} \times \frac{1}{5} = \frac{1}{40}$

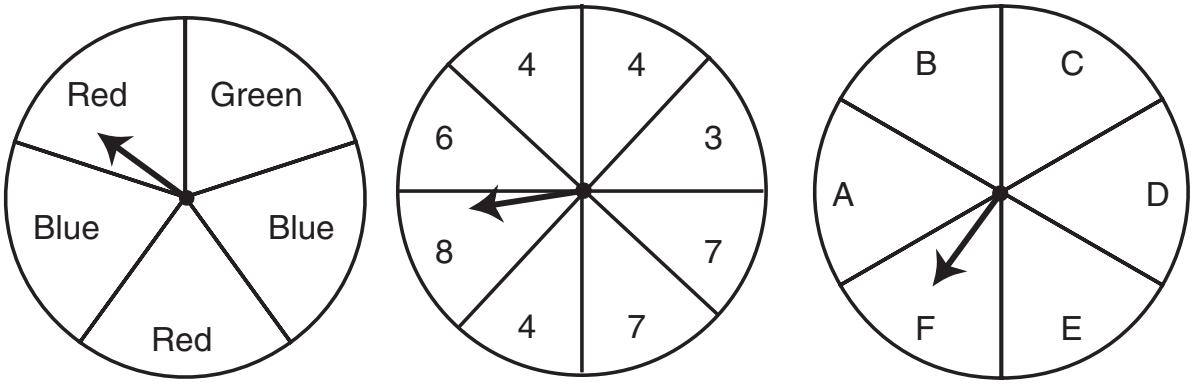
d. Spinning a 5 and a blue pie

P(5, blue) = $\frac{2}{8} \times \frac{2}{5} = \frac{4}{40} = \frac{1}{10}$

e. Spinning a 2 or 3 and a blue or red pie

P(2 or 3, blue or red) = $\frac{2}{8} \times \frac{4}{5} = \frac{8}{40}$ *or* $\frac{1}{5}$

5. Using the three spinners below, what is the probability of the following outcomes happening at the same time? Show your work.



a. Spinning an 8, an A and a red pie

P(8, A, red) = $\frac{1}{8} \times \frac{1}{6} \times \frac{2}{5} = \frac{2}{240} = \frac{1}{120}$

b. Spinning a 7, a B and a blue pie

P(7, B, blue) = $\frac{2}{8} \times \frac{1}{6} \times \frac{2}{5} = \frac{4}{240} = \frac{1}{60}$

c. Spinning a 4, a C and a green pie

P(4, C, green) = $\frac{3}{8} \times \frac{1}{6} \times \frac{1}{5} = \frac{3}{240} = \frac{1}{80}$

d. Spinning a 5, a D and a red pie

P(5, D, red) = ***0, there is no chance of spinning a 5.***

e. Spinning a 4 or 3, an E and a blue or red pie

P(4 or 3, E, blue or red) = $\frac{4}{8} \times \frac{1}{6} \times \frac{4}{5} = \frac{16}{240} = \frac{1}{15}$

Homework Assignment

Use the spinner when solving some of the following problems. (Hint: Remember how many faces on a die, how many sides to a coin, and how many cards in a deck.) Match these answers with the questions below.

a. $P = \frac{1}{8}$

b. $P = \frac{1}{18}$

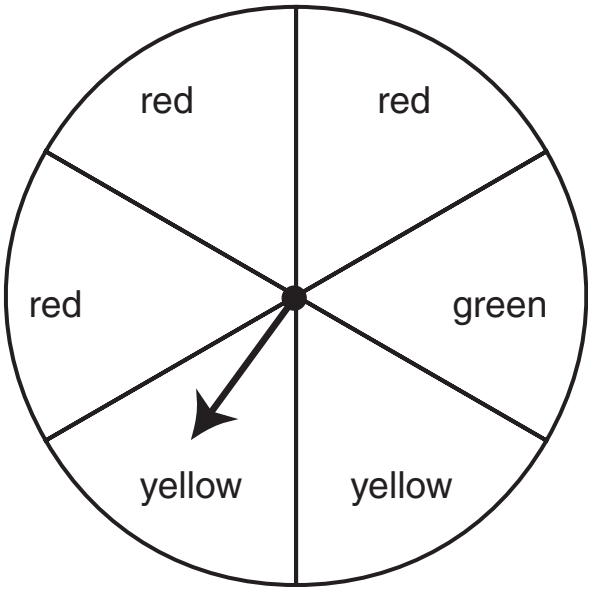
c. $P = \frac{1}{9}$

d. $P = \frac{1}{624}$

e. $P = \frac{1}{312}$

f. $P = \frac{1}{12}$

g. $P = \frac{3}{12}$ or $\frac{1}{4}$



1. What is the probability of rolling a 3 and cutting a jack of diamonds?

   e. $\frac{1}{6} \times \frac{1}{52} = \frac{1}{312}$

2. What is the probability of spinning a red and flipping a heads?

   g. $\frac{3}{6} \times \frac{1}{2} = \frac{3}{12} = \frac{1}{4}$

3. What is the probability of rolling a 5 or 6 and spinning a yellow?

   c. $\frac{2}{6} \times \frac{2}{6} = \frac{4}{36}$ ***or*** $\frac{1}{9}$

4. What is the probably of flipping tails and spinning a green?

f. $\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

5. What is the probability of rolling a 4 and spinning a yellow pie?

b. $\frac{1}{6} \times \frac{2}{6} = \frac{2}{36}$ ***or*** $\frac{1}{18}$

6. What is the probability of cutting a spade and flipping a heads?

a. $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$

7. What is the probability of cutting a Club 3, flipping a tails, and spinning a green pie?

d. $\frac{1}{52} \times \frac{1}{2} \times \frac{1}{6} = \frac{1}{624}$

Self-Evaluation

Ask yourself some important questions. Write your answers in sentences for your teacher.

1. In this lesson, what part of your work was **excellent**?

2. In this lesson, what part of your work **needs improvement**?

3. If you want help for some of the work in this lesson, ask your teacher in this space.