MATH 10 Workplace

Unit 6: Learning Guides 18, 19 & 20
PROBABILITY

Student: _____

T.A.: _____

Teacher: _____

MARK:
<u>Continue to next guide</u>

COMPLETING THIS GUIDE:

Your job is to use the resources in your textbook and this package to complete the activities identified.

LEARNING OUTCOMES:

1) Determine the experimental and theoretical probability of an event.

COMPLETING THIS GUIDE:

ACTIVITIES:

- ☐ **Vocabulary & Formula definitions**

- ☐ **Textbook Questions**
  (Complete on **SEPARATE PAPER**.)

- ☐ **Review & Challenge Questions**
  (Complete on **SEPARATE PAPER**.)

- ☐ **Unit test**

Vocabulary & Formula definitions   Unit 6: Probability

Experimental Probability	
Theoretical Probability.	

Expectation #1: Learn how to determine which purchase is the best buy, considering quality and quantity as well as unit price.

We often hear about the probability of an event happening. For example, the probability of precipitation today is 60% or the chances of winning a prize in a lottery is 1 in 4. Consider the following probabilities:

Example #1: What is the probability of rolling a 4 on a 6 sided die?

Solution: Since each outcome (rolling a 1, 2, 3, 4, 5, or 6) is equally likely, then there is 1 favourable outcome (rolling a 4) out of a total of 6 possible outcomes. We would say the probability of rolling a 4 is $\frac{1}{6}$ or .167 or 16.7%.

Example #2: What is the probability of rolling an even number on a 6 sided die?

Solution: There are 3 favourable outcomes: 2, 4, and 6.
There are a total of 6 different outcomes: 1, 2, 3, 4, 5, or 6.
So the probability or rolling an even number is $\frac{3}{6}$ or $\frac{1}{2}$ or 0.5 or 50%.

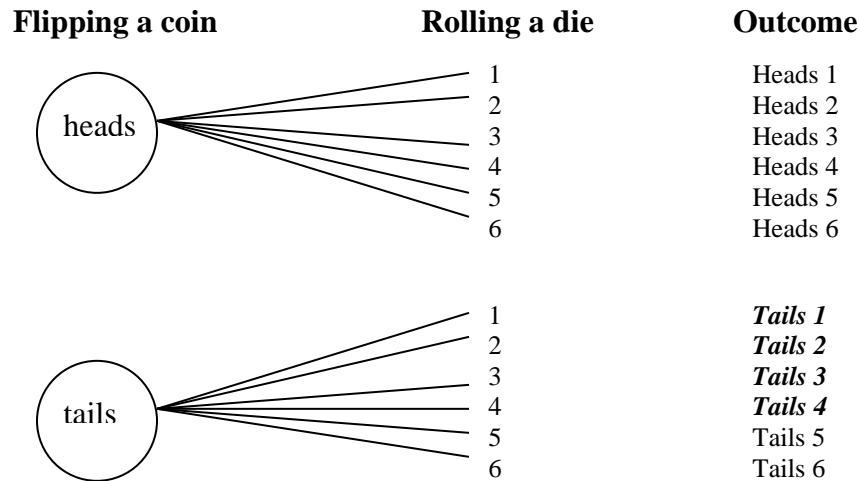If the outcomes of an experiment are equally likely, then the probability of an event occurring is:

$$PROBABILITY = \frac{NUMBER\ OF\ FAVOURABLE\ OUTCOMES}{TOTAL\ NUMBER\ OF\ OUTCOMES}$$

Note: Instead of writing "probability of rolling an even number", we can express this as P(even number).

Another Note: Probabilities can be expressed as a fraction, decimal or a percentage as shown in the examples.

Example #3: Suppose a coin is tossed and a six-sided die rolled. What is the probability of getting tails and rolling a number less than 5?

Solution: A tree diagram is often helpful to show the outcomes when there is more than one event.

Flipping a coin	Rolling a die	Outcome

	1	Heads 1
heads	2	Heads 2
	3	Heads 3
	4	Heads 4
	5	Heads 5
	6	Heads 6

	1	*Tails 1*
	2	*Tails 2*
tails	3	*Tails 3*
	4	*Tails 4*
	5	Tails 5
	6	Tails 6

The bold italicized outcomes represent the favourable outcomes (tails and numbers less than 5). You can see there are a total of 12 outcomes, so the probability is:

$$P(\text{getting tails and rolling a number less than }5) = \frac{\#\ favourable\ outcomes}{total\ \#\ of\ outcomes} = \frac{4}{12} = \frac{1}{3} \text{ or } .333 \text{ or } 33.3\%$$

Another way of finding the probability of two events is to multiply their individual probabilities. In the above example, the probability of getting tails and rolling a number less than 5 is:

$$P(\text{tails \& \# less than 5}) = P(\text{tails}) \times P(\text{\# less than 5}) = \frac{1}{2} \times \frac{4}{6} = \frac{4}{12} = \frac{1}{3}$$

You can see you achieve the same result.

> The probability of two or more events can be summarized as follows:
>
> $$P(A \text{ and } B) = P(A) \times P(B)$$

Example #4: In a standard deck of 52 cards, there are 13 hearts, 13 clubs, 13 diamonds, and 13 spades. What is the probability of drawing 2 spades?

Solution: When you pick the first spade, the probability is $\dfrac{13}{52}$ but when you go to draw the second spade, there will only be 12 spades left (you have one in your hand) and there will be only 51 cards in total left in the pile. So,

$$P(2 \text{ spades}) = P(1^{st} \text{ spade}) \times P(2^{nd} \text{ spade}) = \frac{13}{52} \times \frac{12}{51} = \frac{156}{2652} = \frac{1}{17} \text{ or about } 5.88\%$$

Complete the following exercises. As always, write the question down, show your work, and check your answers.

1. What is the probability of rolling a 1 on a 6sided die?

2. What is the probability of rolling a 1 or a 5 on a 6 sided die?

3. If a jar contains 3 red marbles, 2 yellow marbles and 4 blue marbles, what is the probability of selecting a blue marble?

4. What is the probability of a family consisting of two girls? Assume there is equal probability of a boy or girl.

5. What is the probability that your birthday would be in the same month as your math teachers? Assume each month is equally likely.

6. If a die is rolled twice, what is the probability of the following:
   a) rolling a 4 and then rolling another 4?
   b) rolling an odd number then rolling an even number?
   c) rolling a number less than 3 then rolling a number more than 2?
   d) rolling 2 numbers that are the same?

7. Use the following information about a deck of cards to answer the following questions. If you are unfamiliar with cards, click **here** for a picture of all the cards.
Total number of cards in the deck: **52**
There are 4 suits: **hearts, clubs, spades, and diamonds.**
Each suit contains the following 13 cards: **ace, king, queen, jack and card #'s 2 – 10.**
The hearts and diamonds are **red** and the spades and clubs are **black**.
   a) What is the probability of drawing a heart?
   b) What is the probability of drawing a red card?
   c) What is the probability of drawing an ace?
   d) What is the probability of drawing a king, queen or jack?
   e) What is the probability of drawing a heart and then the ace of spades?
   f) What is the probability of drawing the ace of spades and then a heart?
   g) What is the probability of drawing a 10 and then a 7?

8. A jar contains 37 jelly beans: 8 red, 13 black, 9 orange, and 7 green.
   a) What is the probability of drawing an orange jelly bean?
   b) What is the probability of drawing a red jelly bean followed by a black jelly bean?
   c) What is the probability of drawing a red jelly bean followed by another red jelly bean?
   d) What is the probability of drawing a green jelly bean followed by a black jelly bean followed by another green jelly bean?
   e) What is the probability of not drawing a black jelly bean?

9. One lottery claims there is a 1 in 7 chance of winning a prize. Another lottery claims there is a 1 in 9 chance of winning a prize. If you entered both lotteries, what is the chance you win something from both lotteries?

10. The probability of precipitation in Vancouver on a given day in August is 30%. In the same month, the probability of precipitation in Kamloops is 20% and the probability of precipitation in Prince Rupert is 60%. What is the probability that it rains in all 3 cities?

11. A true-false test consists of 5 questions. What is the probability of getting 100% on the test?

12. A multiple choice test has 5 questions. Each question has 4 choices. What is the probability of getting all 5 questions correct?

SOLUTIONS FOR – PROBABILITY

NOTE: You can express your answer as a fraction or a decimal or a percent.

1. $\frac{1}{6}$ or 0.167 or 16.7%

2. $\frac{1}{3}$ or 0.333 or 33.3%

3. $\frac{4}{9}$ or 0.444 or 44.4%

4. $\frac{1}{4}$ or 0.25 or 25%

5. $\frac{1}{12}$ or 0.083 or 8.3%

6.a) $\frac{1}{36}$ or 0.028 or 2.8%   b) $\frac{1}{4}$ or 0.25 or 25%   c) $\frac{2}{9}$ or 0.222 or 2.22%

d) $\frac{1}{6}$ or 0.167 or 16.7%

7.a) $\frac{1}{4}$ or .25 or 25%   b) $\frac{1}{2}$ or 0.5 or 50%   c) $\frac{1}{13}$ or 0.077 or 7.7%

d) $\frac{3}{13}$ or 0.231 or 23.1%   e) $\frac{1}{204}$ or 0.005 or 0.5%   f) $\frac{1}{204}$ or 0.005 or 0.5%

g) $\frac{4}{663}$ or 0.006 or 0.6%

8.a) $\frac{9}{37}$ or 0.243 or 24.3%   b) $\frac{26}{333}$ or 0.078 or 7.8%   c) $\frac{14}{333}$ or 0.042 or 4.2%

d) $\frac{13}{1110}$ or 0.012 or 1.2%   e) $\frac{24}{37}$ or 0.649 or 64.9%

9. $\frac{1}{63}$ or 0.016 or 1.6%

10. $\frac{9}{250}$ or 0.036 or 3.6%

11. $\frac{1}{32}$ or 0.031 or 3.1%

12. $\frac{1}{1024}$ or 0.000977 or .0977%

☺The answers to questions 11 & 12 prove it is always a good idea to study well for tests! ☺

1. What is the probability of rolling a 2 on a 5 sided die?

2. What is the probability of rolling an odd number on a 6 sided die?

3. A jar contains 4 blue marbles, 3 red marbles and 6 green marbles. What is the probability of drawing:
   a) a red marble?
   b) a green marble followed by a blue marble?

4. Use the following information about a deck of cards to answer the following questions:
   Total number of cards in the deck: **52**
   There are 4 suits: **hearts, clubs, spades, and diamonds.**
   Each suit contains the following 13 cards: **ace, king, queen, jack and card #'s 2 – 10.**
   The hearts and diamonds are **red** and the spades and clubs are **black**.
   a) What is the probability of drawing an ace?
   b) What is the probability of drawing a black card?
   c) What is the probability of drawing a king followed by another king?
   d) What is the probability of not drawing a king, queen or jack?

5. A true-false test has 6 questions. What is the probability of getting all of them correct?

6. A multiple choice test has 6 questions. What is the probability of getting them all correct if each question has 4 choices?

SOLUTIONS FOR– REVIEW AND CHALLENGE

1. $\dfrac{1}{5}$ or 0.2 or 20%

2. $\dfrac{1}{2}$ or 0.5 or 50%

3. a) $\dfrac{3}{13}$ or 0.231 or 23.1%

   b) $\dfrac{2}{13}$ or 0.154 or 15.4%

4. a) $\dfrac{1}{13}$ or 0.077 or 7.7%

   b) $\dfrac{1}{2}$ or 0.5 or 50%

   c) $\dfrac{1}{221}$ or 0.0045 or 0.45%

   d) $\dfrac{10}{13}$ or 0.769 or 76.9%

5. $\dfrac{1}{64}$ or 0.016 or 1.6%

6. $\dfrac{1}{4096}$ or 0.000244 or 0.0244%

Online Practice Tests

None available

UNIT TEST

☐		**Complete the Unit 6 Test**

Done