

BIG PICTURE of this UNIT:	<ul style="list-style-type: none">• How can we visualize events and outcomes when considering probability events?• How can we count outcomes in probability events?• How can we calculate probabilities, given different types of events• Can we predict how likely it is that an event occurs? How can we use that knowledge?
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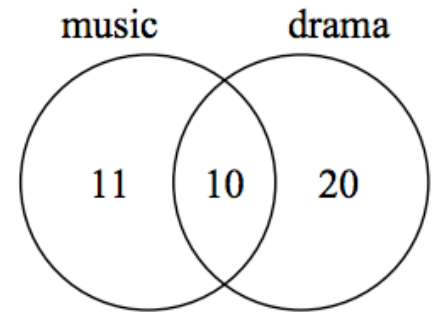
This lesson will be based upon a STUDENT DIRECTED DISCUSSION model in your groups, you should be having DISCUSSIONS about how to think and work through and then present the solutions to the following questions. The questions will involve basic ideas including (i) visualizing the outcomes of probability events/experiments, (ii) determining probabilities of single and compound probability events, (iii) counting outcomes, and (iv). EVERY PROBLEM SET will involve **spiralling through** these major concepts as you will be given the opportunity to deepen and extend your conceptual knowledge & skill set on these major themes as you see them multiple times in our lessons.

So, in your group, discuss & prepare solutions to the following questions. Record the key ideas of your discussions/solutions in your notebook. Then, once you have had your discussions, present your solutions on the board. Solutions do NOT necessarily NEED to be correct – they simply form the basis for DISCUSSIONS !!!! If your group has (i) multiple solutions that lead to the same answers OR (ii) same/different solutions that lead to different answers, present them ANYWAY!!

1. Shirts at Teez R Us can be purchased in 4 sizes (S, M, L, XL), 2 sleeve lengths (short or long sleeves), and 3 colors (brick, orange, sage). Use this information to answer the questions.
 - a. How many possible arrangement of **size** and **sleeve style** are available? Support your answer using words, numbers and/or diagrams.
 - b. How many possible arrangements of **size**, **sleeve style**, and **color** are available? Support your answer using words, numbers and/or diagrams.
2. Here are some simple die (number cube) probability questions. Determine how probable it is that you:
 - a. Roll an even number on one roll of a die.
 - b. Roll an odd number on one roll of a die.
 - c. Roll a prime number on one roll of a die.
 - d. Roll an odd prime number on one roll of a die.
 - e. Roll an odd prime number greater than 4 on one roll of a die.
 - f. Roll an even prime number greater than 4 on one roll of a die.
 - g. Roll an odd prime number or a multiple of 2 on one roll of a die.
 - h. Roll an odd prime number and a multiple of 2 on one roll of a die.
3. Determine the number of different ways in which a pencil sharpener, compass, and ruler can be distributed between Amina and Jana (order does not matter). How does your answer change if the order in which the items were distributed DID matter?

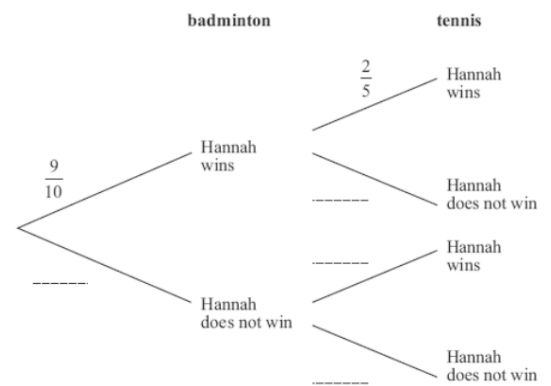
4. The diagram below shows the classes students are taking music and drama

- How many students are taking music AND drama?
- How many students are taking music OR drama?
- Determine the probability that a randomly selected student takes drama?
- Determine the probability that a randomly selected student takes music?
- Determine the probability that a randomly selected student takes music AND drama?
- Determine the probability that a randomly selected student takes music OR drama?



5. Hannah is going to play one badminton match and one tennis match. The probability that she will win the badminton match is $\frac{9}{10}$. The probability that she will win the tennis match is $\frac{2}{5}$.

- Complete the probability tree diagram.
- What is the probability that Hannah will win both matches?
- What is the probability that Hannah loses one match?
- What is the probability that Hannah loses at least one match?

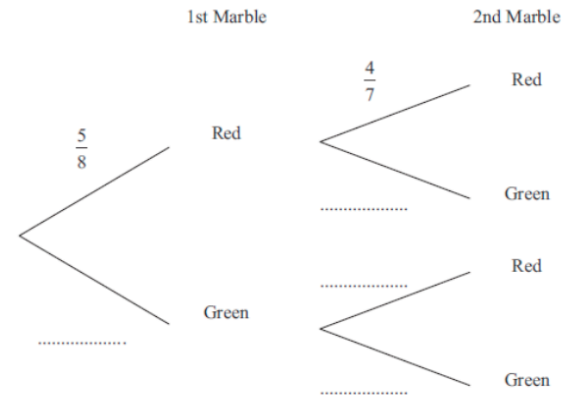


6. Ten students are trying out for three positions on a coed soccer team. The students include four boys (Adam, Alex, Anthony and Arnold) and six girls (Abbey, Aurora, Agnes, Alice, Amanda and Anna). All the students have an equal chance of being selected for the team.

- How many different three-member teams can be formed? Support your answer using words, numbers and/or diagrams.
- Determine the probability that the team would include: (in each answer, support your answer using words, numbers and/or diagrams)
 - Three boys.
 - One boy and two girls.
 - At most one girl.
 - Adam, Anthony and Alice.
 - Agnes and two other students.

7. Consider the event of rolling two six-sided number cubes with the numbers 1 through 6 placed one number on each side. How many arrangements are possible if you were to roll both dice? (For example: 1 and 2; 2 and 1 are two unique arrangements). Support your answer using words, numbers and/or diagrams.
8. Given your work in Question 7, determine the probability that you
 - a. Roll a total of 8 on one roll of 2 dice.
 - b. Roll a total of 18 on one roll of 2 dice.
 - c. Roll a total that is a prime number on one roll of two dice.
 - d. Roll a total that is a prime number or a multiple of 5 on one roll of two dice.

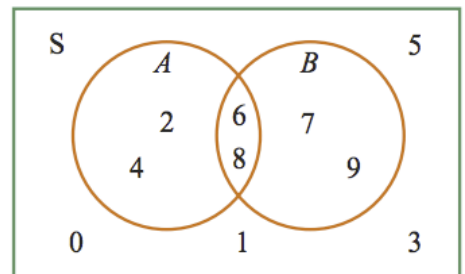
9. There are only red marbles and green marbles in a bag. There are 5 red marbles and 3 green marbles. Seung Jee takes at random a marble from the bag. She does not put the marble back in the bag. Hae Lin takes at random a second marble from the bag.



- a. Complete the probability tree diagram.
- b. How probable is it that the girls finish with two green marbles?
- c. Work out the probability that the girls take marbles of different colours.

10. To help you understand and work with Venn diagrams, answer the following questions:

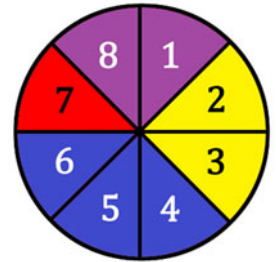
Numbers are written on cards, the cards are shuffled and one is selected at random. The outcomes for this experiment and events A and B are shown in the Venn diagram. Complete the following.



- a** The sample space $S = \{\underline{\hspace{1cm}}\}$ (outcomes inside the rectangle)
- b** Event $A = \{\underline{\hspace{1cm}}\}$ (outcomes inside the circle A)
- c** Event 'not A ' = $\{\underline{\hspace{1cm}}\}$ (outcomes outside the circle A)
- d** Event $B = \{\underline{\hspace{1cm}}\}$ (outcomes inside circle B)
- e** Event 'not B ' = $\{\underline{\hspace{1cm}}\}$ (outcomes outside circle B)
- f** Event ' A and B ' = $\{\underline{\hspace{1cm}}\}$ (outcomes in the intersection of the circles)
- g**
 - i** Event ' A or B or both' = $\{\underline{\hspace{1cm}}\}$ (outcomes within both circles, including the intersection)
 - ii** Is this an 'inclusive or' event or an 'exclusive or' event?
- h**
 - i** Event ' A or B but not both' = $\{\underline{\hspace{1cm}}\}$ (outcomes within both circles, excluding the intersection)
 - ii** Is this an 'inclusive or' event or an 'exclusive or' event?
- i** Event 'neither A nor B ' = $\{\underline{\hspace{1cm}}\}$ (outcomes outside both circles)

11. Given a “spinner”, determine the probability that you will:

- Spin an even number on a 1-to-8 spinner.
- Spin a prime number less than 7 on a 1-to-10 spinner.
- Spin an odd prime number less than 7 on a 1-to-12 spinner.
- Spin a positive integer on a 1-to-6 spinner.



12. A bag of MM’s contains 6 red, 4 green and 2 brown candies. Sam takes one MM and then offers another one to his friend Roeland. What is the probability that they both have the same color MM’s.



Higher Level Questions for More Complex Concepts in Probability. Determine the probability of the event described in each exercise. Unless stated otherwise, assume all items of chance (dice, coins, cards, spinners, etc.) are fair.

Problem 1

In a survey, 100 students were asked “do you prefer to play Minecraft or play Super Mario?” Of the 46 boys in the survey, 33 said they would choose Minecraft, while 29 girls made this choice. A student is selected at random, find the probability that

- the student selected at random prefers to play Minecraft;
- the student prefers to play Super Mario given that the student is a boy.

Problem 2

Two fair dice are thrown and the number showing on each is noted. The sum of these two numbers is S. Find the probability that

- S is less than 8
- at least one die shows a 3;
- at least one die shows a 3, given that S is less than 8.
- at least one die shows a 4, given that S is an even number.

Problem 3

In the Grade 10 class of 100 kids, there are two sports commonly played, soccer and basketball. 76 students do only one of the sports, 14 students don't do any sport and 46 students play basketball. What is the probability when a student is selected that they play soccer?

Problem 4

Three friends decide to meet up at High Street one day during the school week, but have not decided which day. Given that the phone lines are all dead, internet is not working and school is on holiday, what is the probability that all three girls meet at High Street on the same day?

Problem 5

The probability that a person has a deadly virus is 5 in one thousand. If a patient does have the disease, a medical test will CORRECTLY diagnose the presence of the disease 95% of the time. Otherwise, the test INCORRECTLY diagnose the presence of the disease 20% of the time. Find the probability of this test giving a correct diagnosis.

Problem 6

Determine the following probabilities

- Toss 3 heads on five flips of a coin.
- Toss at least 3 heads on five flips of a coin.
- Toss less than 1 tail on eight flips of a coin.
- Toss no more than 1 tail on eight flips of a coin.
- Toss at most 1 tail on eight flips of a coin.
- Toss no less than 1 tail on eight flips of a coin.
- Toss more than 1 tail on eight flips of a coin