

Grade 12 Applied

Probability Workbook

MrF

A selection of probability questions (from the Distance Learning website). Answers may be attached at the end. Full solutions are on the Merlin Black Board distance learning site

**GRADE 12 APPLIED
UNIT A - PROBABILITY
PROBABILITY WORKBOOK**

Round all decimal and percent answers to the nearest hundredth (0.01) or as indicated

Show work, so you know how you got the answer!

Label answers with the appropriate question number/letter.

All fractions and ratios should be properly **reduced** (ie: simplified)

PROBABILITY AND ODDS

1-1. Joey rolls a single die and flips a coin. Create a sample space for this event.

1-2. Kaitlynn rolls an 8-sided die numbered 1 to 8 and she flips a coin. All probabilities in this question will be answered as a decimal rounded to the nearest thousandth.

a) Construct a sample space.

b) What is the probability that she rolls an odd number and flips a tail?

c) What is the probability that she rolls a multiple of 3 and flips a head?

1-3. Mandy rolls a 4-sided [tetrahedron] die numbered 1 to 4 and a 10-sided die numbered 1 to 10. The following events are defined:

- Event A - rolling a sum greater than 10
- Event B - rolling doubles

All probabilities in this question are to be answered as a decimal rounded to the nearest thousandth *and* as a percent to the nearest tenth.

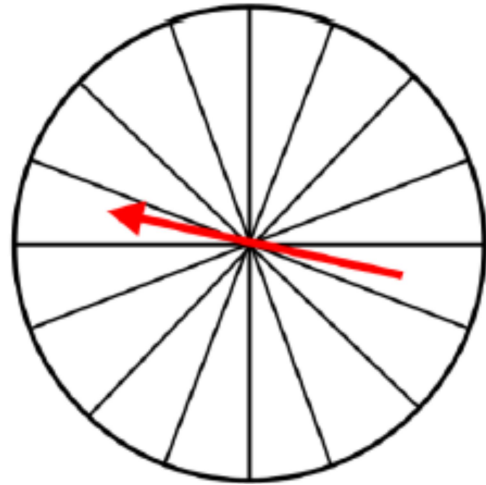
- a) Write out the sample space.
- b) Find $P[A]$.
- c) Find $P[B]$.
- d) Explain the event \bar{B} , aka NOT B, aka $\sim B$, in words
- e) Find $P[\bar{B}]$

1-4. Nickolas has a 75% chance of getting an A on any math test. He has 4 tests in the months of May and June. Find the probability, as a percent rounded to the nearest tenth, that:

- a) Nick gets an A on all four tests; *ie*: $\text{Prob}(A_1, A_2, A_3, A_4)$
- b) Nick gets an A on at least one test; *ie*: $\text{Prob}(\geq \text{one A})$

1-5. Consider the blank spinner to the right. Colour or shade it so that:

- $P[\text{blue}] = 0.25$
- $P[\text{green}] = 0.375$
- There are an equal number of orange and purple sectors.



You may use letters (B, G, O, P) to "colour or shade" the spinner.

1-6. The probability of a dog performing a trick successfully is 0.65.

- What are the odds in favour of the dog performing the trick?
- What are the odds against the dog performing the trick?
- How are the answers in a) and b) related?

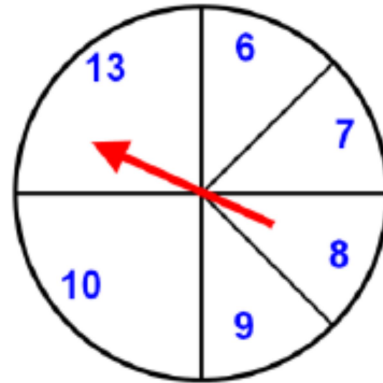
1-7. Olivia has a deck of well-shuffled playing cards. Using properly reduced ratios, what are the odds: [a diagram of a deck of cards is at the end of the workbook]

- in favour of her drawing a red face card?
- against her drawing a black card?

1-8. A man at a fair plays a game with shells in which he uses four shells, one of which has a prize under it. What are the odds against winning the prize?

1-9. Consider the spinner shown to the right.
Find:

- the odds in favour of spinning a 6.
- the odds against spinning a single digit number.
- the odds in favour spinning an even number.
- the odds against spinning a prime number.



[Workspace]

1-10. The odds against a volleyball team winning a game are 5:3. What is the probability, as a reduced fraction, that they will win the game?

DEPENDENT AND INDEPENDENT EVENTS

2-1. Are the following events dependent or independent?

a) event A - it rains tomorrow; event B - Bill plays golf tomorrow

b) event A - Rebecca goes to class on time; event B - Rebecca passes her quiz

c) event A - Josh drains a free throw; event B - hot dogs sell out at the basketball game.

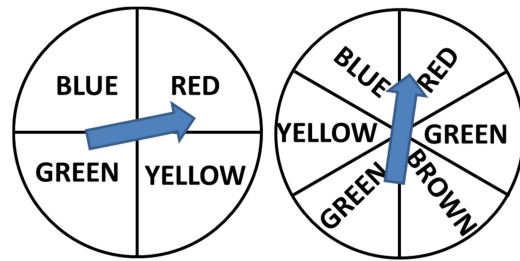
2-2. What is the probability, as a reduced fraction, of rolling doubles when rolling a pair of dice and flipping a head of a coin?

2-3. If both spinners to the right are spun, what is the probability, as a reduced fraction, of spinning:

a) red on the first spinner; green on the second spinner; $P(R_1, G_2)$

b) green on the first spinner; red on the second spinner, $P(G_1, R_2)$

c) red on at least one spinner;
 $P(\geq \text{one RED})$



[Workspace]

2-4. A well-shuffled deck of cards is taken out. To the nearest tenth of a percent, find the probability of drawing:

a) two kings with replacement.

b) two kings without replacement.

c) three black cards with replacement.

d) three black cards without replacement.

e) a diamond on the first drawing and a club on the second drawing with replacement.

f) a king and a diamond with replacement.

g) four kings in a row without replacement

2-5. The probability Aaron hits the green with his first shot, event G , on a par 3 hole in golf **and** sinks the putt on his next shot, event P , is 0.05; ie: $P(G \text{ AND } P) = 0.05$.

The probability Aaron hits the green with his first shot is 0.18; ie: $P(G) = 0.18$. Given that Aaron has hit the green with his first shot, what is the probability, as a decimal to 3 decimal places, that Aaron will sink the putt? ie: find $P(P|G)$.

2-6. The probability it rains on any given day in April, event R , in Vancouver **AND** Jill remembers her umbrella, Event B , is 0.32 ie: $P(R \cap B) = 0.32$. The probability that it rains on any given day in April in Vancouver is 0.44; ie: $P(R) = 0.44$. Given that it is raining in Vancouver in April, what is the probability Jill remembered her umbrella? ie: find $P(B|R)$.

MUTUALLY EXCLUSIVE EVENTS

3-1. Are the following events mutually exclusive? If not, state a common outcome.

a. You want to find the probability of drawing a queen or a red card from a deck of cards.

b. You want to find the probability of rolling doubles or rolling a sum of 7 on a pair of dice.

c. You want to find the probability of drawing a prime number or a multiple of 3 from a hat that has numbers 1 to 50 on a piece of paper.

3-2. The numbers 1 to 30 are written on pieces of paper in a well shaken basket. What is the probability (rounded to 3 decimal places) of drawing:

a. an odd number or a prime number?

b. a number less than 12 or a double digit number?

c. a perfect square or an even number?

d. a multiple of 5 or a number between 16 and 19?

3-3. A well shuffled deck of cards is used to deal out a single card. What is the probability (rounded to 3 decimal places) of dealing:

- a. an ace or a club?
- b. an ace or a black card?
- c. an ace or a face card?

3-4. A pair of dice is placed in a container and shaken well. What is the probability (rounded to 3 decimal places) of rolling:

- a. doubles or a sum of 9?
- b. at least one 4 or a sum of 8?
- c. a sum less than 6 or doubles?

3-5. Sixty shoppers are polled at a store to see what brand of laundry detergent they use. Thirty-three use detergent A and nineteen use detergent B. If eight use both, find the probability that a random shopper chooses either laundry detergent A or B (rounded to 3 decimal places).

3-6. Seven blue marbles and five yellow marbles are placed in a bag. A marble is drawn, placed back in the bag and a second marble is chosen. What is the probability rounded to 3 decimal places of drawing two blue marbles or two yellow marbles?

3-7. A well shuffled deck of cards is used to deal out a single card. Once it is viewed, it is put back in the deck and a second card is dealt out. What is the probability (rounded to 3 decimal places) of drawing:

- a. two non-face cards or two red cards?
- b. two queens or two diamonds?

3-8. A manufacturer produces 200 televisions and 150 computer monitors during a week in May. From past practice, they know that there is a 3.8% chance that a television will have a defect, and a computer monitor will have a 1.5% chance of being defective. A customer calls the company, complaining that they bought a defective product. What is the probability that the customer is calling about a defective television?

3-9. Grace, Ann and Doreen are 3 friends that all have the same unique background: they all have training in business and (their true passion), engineering.

The three friends are the final 3 candidates for a job as a manager at a playing card manufacturer. After interviewing the 3 candidates, it is said that Grace has a 45% chance of getting the job, Ann has a 35% chance and Doreen has a 20% chance.

Within 5 years, there is 60% chance Grace will be working as an engineer, an 85% chance Ann will be working as an engineer and a 55% chance Doreen will be working as an engineer.

Given that within 5 years after being hired as the manager they leave the job for engineering, what is the probability that Ann was the manager?

REVIEW AND SUMMARY

4-1. Bret flips a coin three times.

- a) Create a sample space for this event.
- b) What is the probability Bret flips exactly two heads?

4-2. Martha draws a card from a well-shuffled deck of cards. The event A is defined as the event where a face card is drawn.

- a) Find $P[A]$.
- b) Explain event A in words.
- c) Find $P[\bar{A}]$.

4-3. An 8-sided die (octahedron) numbered from 0 to 7 and a 4-sided (tetrahedron) die numbered from 1 to 4 are rolled at the same time.

- a) Create a sample space for this experiment.
- b) Determine the probability that the sum of the two dice will be 10.
- c) Determine the probability, as a reduced fraction, that the sum of the two dice will be an even number.
- d) Which sums have the greatest probability of occurring?
- e) Which sums have a probability of occurring of $3/32$?

4-4. An unfair coin has a probability of 0.6 of showing heads when flipped. The coin is flipped three times. Find the probability that:

- a) 3 heads are flipped.
- b) 2 heads are flipped.
- c) at least one head is flipped.

4-5. Consider the blank spinner to the right.

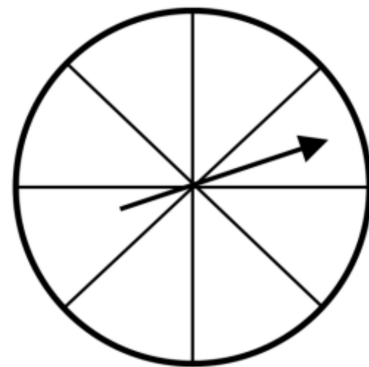
a) Label the colours so that:

$$P[\text{red}] = \frac{1}{8};$$

$$P[\text{green}] = 0.25;$$

$$P[\text{blue}] = 0.375;$$

There is purple in the remaining sectors.



You may use letters (R, G, B, P) to "colour" label the spinner.

b) What is the probability of spinning red or green?

4-6. The odds against finding a parking spot in front of the movie theatre on a Friday night are 8:3. What is the probability, as a percent, of finding a parking spot on a Friday night?

4-7. Owen rolls a pair of dice. What are the odds:

- a) in favour of him rolling doubles?
- b) against him rolling a sum of 8 or higher?

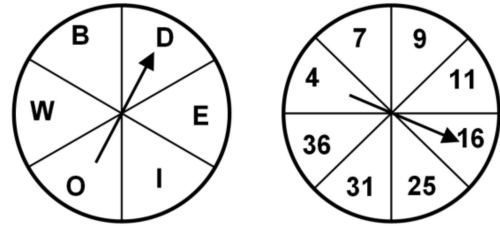
4-8. The probability Natalia goes out for a run in the morning is 0.76.

- a) What are the odds in favour of Natalia going out to run in the morning?
- b) What are the odds against Natalia going out in the morning to run?

4-9. If both spinners to the right are spun, what is the probability of spinning:

a) a vowel on the first spinner and an odd number on the second spinner?

b) a consonant on the first spinner and a perfect square on the second spinner?



4-10. A jar has 7 green marbles, 3 blue marbles and 5 red marbles. What is the probability of drawing:

a) two red marbles with replacement?

b) two red marbles without replacement?

c) a green or blue marble on the first draw and a red marble on the second drawing without replacement?

d) a blue and a red marble with replacement?

4-11. The probability that Walt hits a fastball for a homerun is 0.15 and the probability that the pitcher will throw a fastball is 0.35. Given that the pitcher throws a fastball, what is the probability that Walt will hit a homerun?

4-12. A well shuffled deck of cards is used to deal out a card. What is the probability of dealing:

- a) a heart or a diamond?
- b) a face card or a spade?
- c) a black card or any card with a value of "10"?

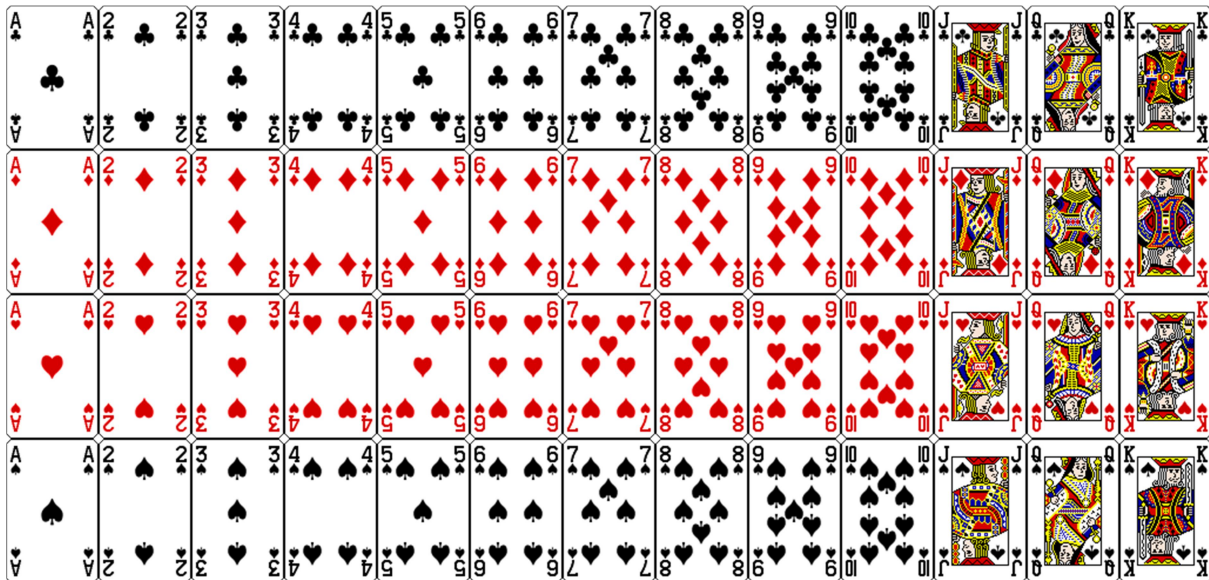
4-13. Danny and Ray play three games of squash. There is a 0.58 probability that Danny will win a single game of squash. Find the probability that Danny or Ray will win all three games they play.

4-14. There are 30 graduates at a secondary school. Twenty worked part time jobs during the school year. Twelve of the students are on the honour roll. If seven students that worked are on the honour roll, what percent of students worked or were on the honour roll?

4-15. Ken wants to buy a video game console. His friend estimates there is a 55% chance he will buy Console A, a 25% chance he will buy Console B and a 20% chance he will buy Console C.

Each of the consoles has improved since they were first released but all still have some issues with becoming defective within a year. Console A has a 10% chance of becoming defective, Console B has a 5% chance of becoming defective and Console C has a 1% chance of becoming defective.

Assuming that Ken buys a video game console and it becomes defective within one year, what is the probability that it is Console A?

Deck of Cards:**Clubs ♣ Black; Diamonds ♦ Red; Hearts ♥ Red; Spades ♠ Black**

ANSWERS

1-1 $\{(1, H), (2, H), (3, H), (4, H), (5, H), (6, H), (1, T), (2, T), (3, T), (4, T), (5, T), (6, T)\}$

1-2 a. $\{(1, H), (2, H), (3, H), (4, H), (5, H), (6, H), (7, H), (8, H), (1, T), (2, T), (3, T), (4, T), (5, T), (6, T), (7, T), (8, T)\}$ b. $P(\text{Odd AND Tail}) = 0.250$
 c. $P(\text{mult of 3 AND head}) = 0.125$

1-3. a. sample space set. B. 0.25 c. 0.10 d. no doubles e. 0.90

1-4. 31.6% b. 99.6%

1-5. 4 blue, 6 green, 3 orange, 3 purple

1-6a. 13:7 b. 7:13 c. reversed

1-7 a. 3:23 b. 1:1

1-8 3 : 1

1-9. a. 1:7 b. 1:1 c. 1:1 d. 5:3

1-10. $\frac{3}{8}$

2-1. a. dependent b. dependent c. independent

2-2. $\frac{1}{12}$

2-3. $\frac{1}{12}, \frac{1}{24}, \frac{3}{8}$

2-4. a. 0.006 b. 0.005 c. 0.125 d. 0.118 e. 0.063 f. 0.038
 g. 0.00000369 so in practice we would call this zero!

2-5. 0.278

2-6. 0.727

3-1. a) Non-mutually exclusive. One common outcome is a queen of hearts.
 b) Mutually exclusive.
 c) Non-mutually exclusive. 3 is prime and a multiple of 3.

3-2. a. 0.533 b. 1 c. 0.600 d. 0.333

3-3. a. 0.308 b. 0.538 c. 0.308

3-4. a. 0.278 b. 0.417 c. 0.500

3-5. 0.733

3-6. 0.514

3-7. a. 0.694 b. 0.068

3-8. 0.772

3-9. 0.439

4-1. a. {(HHH), (HHT), (HTH), (THH), (HTT), (THT), (TTH), (TTT)}

b. $\frac{3}{8}$

4-2. a. 0.231 b. not face cards c. 0.769

4-3. a. set b. 0.065 c. $\frac{1}{2}$ d. 4 ways e. 32 ways

4-4. a. 0.216 b. 0.432 c. 0.936

4-5. a. colour accordingly b. 27%

4-6. a. 1:5 b. 7:5

4-7. a. 19:6 b. 6:19

4-8. a. $\frac{15}{48}$ or 0.313 b. $\frac{15}{48}$ or 0.313

4-9. a. 0.111 b. 0.095 c. 0.222 d. 0.133

4-10. 0.429

4-11. a. 0.500 b. 0.423 c. 0.654

4-12. 0.269

4-13. 0.833

4-14. 0.791