Sample Questions

Students who achieve the *acceptable standard* should be able to answer all the following questions, except for any part of a question labelled **SE**. Parts labelled **SE** are appropriate examples for students who achieve the *standard of excellence*.

Please be aware that the worked solutions shown are possible strategies; there may be other strategies that could be used.

1. The odds in favour of the Renegades winning the season final in the football league are listed as 10:7. The odds against the Renegades winning the season final are

   A. 3:7

   B. 3:10

   *C. 7:10

   D. 10:3

Numerical Response

SE 2. Statistics show that 6 out of 25 car accidents are weather-related. The odds that a car accident is weather-related can be expressed in the form a:b. The values of a and b are, respectively, _____ and _____.

   Possible Solution:
   6 and 19

   Note: This question is intended to be an alternate digital-format item. Please consult the site https://questaplus.alberta.ca/ for more examples of this item type.

SE 3. A class of 35 students has 17 males. One student will be selected at random from the class. Jeanette suggested that the odds in favour of selecting a male student would be 17:35. Is Jeannette correct? Justify your answer.

   Possible Solution:
   Jeanette is incorrect in stating that the odds are 17:35. Odds are measured as one "part" vs another "part". In this situation, there are two parts: male and female. As such, the odds of selecting a male should be stated as the number of males to the number of females. The odds of selecting a male student would therefore be 17:18.

A television game show has listed the following odds in favour of winning for three of their games.

Game	Odds of Winning
Flip'em	1:3
Central Eye	2:5
Minefield	1:4

4. a. What is the probability of winning the Flip'em game?

Possible Solution:

$\frac{1}{4}$ **or** 0.25

b. Which of the three games is a contestant most likely to win? Justify your answer.

Possible Solution:
The probabilities of winning for each game are

Flip'em   0.25
Central Eye   0.29
Minefield   0.20

The game with the highest probability of winning is Central Eye; therefore this is the game that a contestant is most likely to win.

An article from a Canadian newspaper has the following headline.

Bingo More Popular than Hockey in Cityville

The article presents the following facts for a particular year.

Population   1 160 000

Total attendance at a professional hockey game	670 000
Total bingo cards sold in the city	12 960 000

The article includes the odds of a randomly selected resident performing each activity and uses these odds to reach its conclusion that bingo is more popular than hockey.

Odds of a resident attending a bingo game are 300:29
Odds of a resident attending a hockey game are 67:116

After looking at the odds presented in the article, Randall feels that the headline of the article is correct in claiming that bingo is more popular than hockey because 300:29 are higher odds than 67:116.
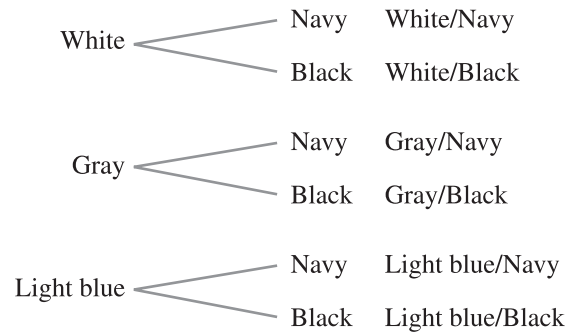
SE

5. Explain why you agree or disagree with Randall's belief that the headline of the article logically interprets the odds described. Be sure to include a detailed explanation of odds and probability in your response.

Possible Solution:
While the facts of the population given in the article are correct, Randall's agreement with the headline of the article is incorrect. In the article, it states that the number of bingo cards sold is 12 960 000. This does not address the issue that many people will buy more than one bingo card for themselves. This is not the case with tickets for professional hockey games. People attending this event will purchase only one ticket, so the odds as calculated will favour bingo as no distinction is made for multiple purchases. Also, there is the issue that they are comparing bingo with professional hockey. Bingo is practiced in multiple locations on many dates. Professional hockey will only occur in large centers a few times per year. A person would expect a larger bingo population based on this issue alone. Therefore Randall's belief that the headline logically interprets the events is incorrect.

6. At a private school, each student must wear a school uniform that includes a dress shirt and pants. The dress shirt can be white, gray, or light blue. The pants can be navy or black. Use a graphic organizer to show the different possible variations of the uniform.

Possible Solution:

White — Navy   White/Navy
        — Black   White/Black

Gray — Navy   Gray/Navy
       — Black   Gray/Black

Light blue — Navy   Light blue/Navy
             — Black   Light blue/Black

or

| | **Pants** | |
	Navy	Black
White	White/Navy	White/Black
Gray	Gray/Navy	Gray/Black
Light blue	Light blue/Navy	Light blue/Black

Shirts

For the set of numbers 1 to 20 inclusive, Theresa knows that some numbers are divisible by 3 and some numbers are even. She is going to write each number on a ball and place them in a box.

SE

7. a. Model this set using a graphic organizer.

Possible Solution:
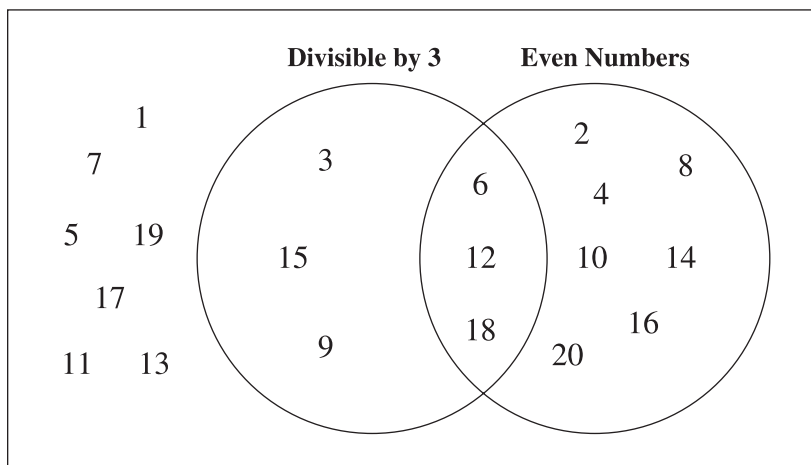
SE

b. If one ball is randomly selected from the box, what is the probability that the number written on it is divisible by 3 or is an even number?

Possible Solution:
P(Divisible by 3 $\cup$ Even number)
$= P$(Div. by 3) $+ P$(Even Number) $- P$(Div. by 3 $\cap$ Even Number)
$$= \frac{6}{20} + \frac{10}{20} - \frac{3}{20}$$
$$= \frac{13}{20}$$

SE

c. Explain why 14 and 17 would be examples of numbers that belong to the set P(Divisible by 3 $\cap$ Even Number).

Possible Solution:
The complement of event X is the entire set of outcomes that are not favorable to X. In this case, the complement of P(Divisible by 3 and Even Number) would be any number that is not both divisible by 3 and an even number. In this case, all of the numbers except 6, 12, and 18 would belong to the complement.

8. A particular traffic light at the outskirts of a town is red for 30 s, green for 25 s, and yellow for 5 s in every minute. When a vehicle approaches the traffic light, the probability that the light will be red or yellow is

*A. $\frac{7}{12}$

 B. $\frac{1}{2}$

 C. $\frac{1}{12}$

 D. $\frac{1}{24}$

Use the following information to answer the next question.

Malaga, Spain, lies in a region of Europe known as the Costa Del Sol (Coast of the Sun). The probability of sunshine on any given day in the region is approximately 0.89.

Numerical Response

SE **9.** In a non-leap year of 365 days, the average number of days of the year that a tourist could expect to experience weather other than sunshine, to the nearest whole number, is _____ days.

Possible Solution:
$1 - 0.89 = 0.11$
$0.11 \times 365 = 40.15$
$ \approx 40 \text{ days}$

Use the following information to answer the next question.

Some possible events for rolling a regular six-sided die are listed below.

1   An even number
2   A number less than 3
3   A number that is a multiple of 3
4   A number that is greater than or equal to 2

Numerical Response

10. From the list above, the two events that are mutually exclusive are numbered
_____ and _____.

Possible Solution:
23 **or** 32

A recent survey determined that 85% of a population watches TV at least once a day, 35% of the population uses a computer at least once a day and 25% of the population do both.

SE   **11.**   **a.**   What is the probability that a person chosen at random from the population watches TV at least once a day or uses a computer at least once a day?

Possible Solution:
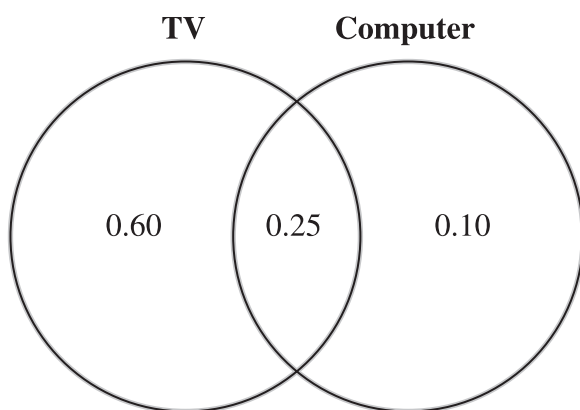$P(\text{TV}) = 0.85$
$P(\text{Computer}) = 0.35$
$P(\text{TV} \cap \text{Computer}) = 0.25$

$$P(\text{TV} \cup \text{Computer}) = P(\text{TV}) + P(\text{Computer}) - P(\text{TV} \cap \text{Computer})$$
$$= 0.85 + 0.35 - 0.25$$
$$= 0.95$$

SE   **b.**   Use a graphic organizer to model the probabilities described above.

Possible Solution:

TV   **Computer**

0.60   0.25   0.10

c.   Are the events of watching TV at least once a day and using the computer at least once a day mutually exclusive events? Justify your answer.

Possible Solution:
These events are not mutually exclusive because some of the survey participants do both activities.

The probability of Brenda getting a hit in a baseball game is 0.345. The probability of Brenda or Deborah getting a hit during the game is 0.617. The probability of both Brenda and Deborah getting hits during the game is 0.224.

SE

12. Determine the probability of Deborah getting a hit in the game.

Possible Solution:
$$P(B \cup D) = P(B) + P(D) - P(B \cap D)$$
$$0.617 = 0.345 + P(D) - 0.224$$
$$0.496 = P(D)$$

Tom is selecting a shirt to wear to school. Event A is choosing a particular shirt to wear on Monday, and event B is choosing a particular shirt to wear on Tuesday.

13. a. Describe a situation where event A and event B are dependent events.

Possible Solution:
Dependent events: Tom does not wear the same shirt two days in a row.

b. Describe a situation where event A and event B are independent events.

Possible Solution:
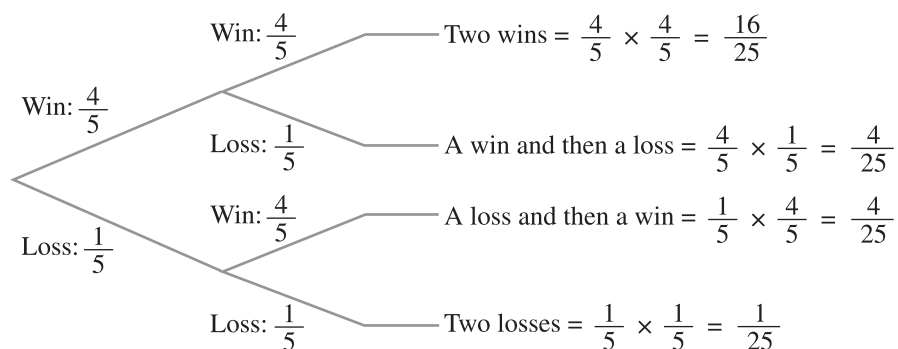Independent events: Tom could select the same shirt on Tuesday that he wore on Monday.

14. A box contains 6 blue balls and 4 red balls. Two balls are drawn from the box, one after the other, without replacement. The probability, to the nearest hundredth, that the first ball drawn is blue and the second ball drawn is red is _____.

Possible Solution:
$$\frac{6}{10} \cdot \frac{4}{9} = 0.27$$

15. Based on previous performance, the probability of a particular baseball team winning any game is $\frac{4}{5}$. The probability that this team will win their next 2 games is

    A. $\frac{1}{5}$

    B. $\frac{4}{5}$

    C. $\frac{1}{25}$

  *__D.__ $\frac{16}{25}$

Possible Solution:

Win: $\frac{4}{5}$ — Two wins $= \frac{4}{5} \times \frac{4}{5} = \frac{16}{25}$

Win: $\frac{4}{5}$

Loss: $\frac{1}{5}$ — A win and then a loss $= \frac{4}{5} \times \frac{1}{5} = \frac{4}{25}$

Win: $\frac{4}{5}$ — A loss and then a win $= \frac{1}{5} \times \frac{4}{5} = \frac{4}{25}$

Loss: $\frac{1}{5}$

Loss: $\frac{1}{5}$ — Two losses $= \frac{1}{5} \times \frac{1}{5} = \frac{1}{25}$

The probability that the baseball team wins their next two games is given by two wins $= \frac{16}{25}$.

In a particular class, the probability that a student has a home video game system is 0.62. In the same class, the probability that a student will have a home video game system and a TV in their bedroom is 0.46.

SE **16.** Assuming that having a home video game system and having a TV in their bedroom are independent, determine the probability, to the nearest hundredth, that a student in the class has a TV in their bedroom.

Possible Solution:
$P(A \cap B) = P(A) \cdot P(B)$
$\quad 0.46 = 0.62 \cdot P(B)$
$\quad 0.74 = P(B)$

17. A hotel offers free breakfast to its guests. One morning the hotel has 3 different kinds of juice, 4 different kinds of cereal, and 2 different types of pastries available. If a guest can choose one kind of juice, one kind of cereal and one type of pastry, how many different possible breakfasts can be ordered?

Possible Solution:
$3 \cdot 4 \cdot 2 = 24$

Use the following information to answer the next question.

A new licence plate in Alberta consists of three letters followed by four numbers. Letters are chosen from a list of 24 acceptable letters that may be repeated.

Maureen wants the first letter on her licence plate to be an M, which is an acceptable letter, and she also wants the four numbers to match the last four digits of her cell phone number.

Numerical Response

SE **18.** The number of licence plates that will meet Maureen's criteria is _____.

Possible Solution:
$1 \cdot 24 \cdot 24 \cdot 1 \cdot 1 \cdot 1 \cdot 1 = 576$

SE **19.** Determine the number of six-digit odd numbers that can be created using the digits 0 to 9 without repetition. Describe any restrictions that exist.

Possible Solution:
$8 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 5 = 67\ 200$

The sixth digit is restricted if the number is going to be odd. The first digit is also restricted – it cannot be 0, nor can it be the same digit as the sixth digit.

20. Determine the number of arrangements of all the letters in the word TATTOO.

Possible Solutions:

$$\frac{6!}{3!2!} = 60 \quad \textbf{or} \quad \frac{_6P_6}{3!2!} = 60 \quad \textbf{or} \quad \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3!2!}$$
$$= 60$$

21. Determine the number of 3-letter arrangements of the letters of the word DIPLOMA.

Possible Solutions:

$$_nP_r = \frac{n!}{(n-r)!}$$
$$_7P_3 = \frac{7!}{(7-3)!}$$
$$_7P_3 = 210$$

or

$$_7P_3 = 210$$

or

$$7 \cdot 6 \cdot 5 = 210$$

or

$$_7C_3 \cdot 3! = 210$$

22. Only six people have tickets for 2 prizes in a school draw. Once a ticket is drawn for a prize, it is not reentered in the draw. What is the probability that Bill wins the first prize and Mary wins the second prize?

Possible Solutions:

$$\frac{1}{6} \cdot \frac{1}{5} = \frac{1}{30} \qquad \textbf{or} \qquad \frac{1}{_6P_2} = \frac{1}{30}$$

23. A 7-player volleyball team must stand in a straight line for a picture.

    a. Determine the number of different arrangements that can be made for the picture.

    Possible Solutions:
    $7! = 5\,040$ **or** $_7P_7 = 5\,040$ **or** $7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 5\,040$

    b. Determine the number of arrangements that can be made for the picture if the tallest player must stand in the middle.

    Possible Solutions:
    $6! = 720$ **or** $_6P_6 = 720$ **or** $6 \cdot 5 \cdot 4 \cdot 1 \cdot 3 \cdot 2 \cdot 1 = 720$

A student is classifying the following contexts that require the use of either permutations or combinations.

Context A   Dialing a 10-digit telephone number with distinct digits
Context B   Choosing 5 people for a committee
Context C   Selecting 4 fruits to put in a salad
Context D   Opening a lock with a 3-number combination

Numerical Response

24. For each context, use a 1 to indicate if it should be solved using a **permutation** and use a 2 to indicate if it should be solved using a **combination**.

Context A would be solved using a _____ (Record in the **first** column)

Context B would be solved using a _____ (Record in the **second** column)

Context C would be solved using a _____ (Record in the **third** column)

Context D would be solved using a _____ (Record in the **fourth** column)

Possible Solution:
1221

25. Triangles can be formed in an octagon by connecting any 3 of its verticies. Determine the number of different triangles that can be formed in an octagon.

Possible Solution:

$$_nC_r = \frac{n!}{(n-r)!\,r!}$$

$$_8C_3 = \frac{8!}{(8-3)!\,3!}$$
$$= 56$$

There are 56 possible triangles that can be formed within an octagon.

26. A school committee consists of 1 vice-principal, 2 teachers, and 3 students. The number of different committees that can be selected from 2 vice-principals, 5 teachers, and 9 students is

    A.   20 160

    B.   8 008

  *C.   1 680

    D.   90

Possible Solution:

$_2C_1 \times {_5}C_2 \times {_9}C_3 = 1\ 680$

27. In a group of 9 students, there are 4 females and 5 males.

a. How many different committees consist of 2 or 3 students?

Possible Solution:

$_9C_2 + {_9}C_3 = 120$

b. How many different 4-member committees have 2 females and 2 males?

Possible Solution:

$_4C_2 \cdot {_5}C_2 = 60$

c. Determine the probability that a 4-member committee chosen at random from this group will consist of 2 males and 2 females.

Possible Solution:

$$\frac{_4C_2 \cdot {_5}C_2}{_9C_4} = \frac{10}{21}$$

d. In the group of 9 students, 3 are in Grade ten, 3 are in Grade eleven and 3 are in Grade twelve. Determine the probability that 2 Grade 10 students are chosen to be on a two-person committee.

Possible Solutions:

$$\frac{_3C_2}{_9C_2} = \frac{\dfrac{3!}{(3-2)!2!}}{\dfrac{9!}{(9-2)!2!}} \qquad \text{or} \qquad \frac{3}{9} \cdot \frac{2}{8} = \frac{1}{12}$$

$$= \frac{1}{12}$$

Note: This example is considered acceptable standard even though it is technically possible to consider $_6C_0$ in the numerator of the solution at left. Since this is a step that students will not have to perform in order to arrive at the correct answer, it is considered to involve a single combination.

SE | **28.** Ralph knows that there are 15 distinguishable possibilities when 2 people are chosen to form a committee from a particular group of n people.

a. Describe what values of n would be admissible in this problem.

Possible Solution:
The value of n represents the number of people in the larger group. This must be a positive number, as mathematically you cannot have a negative number of people. Also, n must be greater than 2 because it is impossible to select two objects from a group smaller than what is needed.

b. Determine the number of people in the larger group, n.

Possible Solution:

$$\frac{n!}{(n-2)!2!} = 15$$
$$\frac{n(n-1)(n-2)!}{(n-2)!} = 30$$
$$n(n-1) = 30$$

$$n^2 - n - 30 = 0$$
$$(n-6)(n+5) = 0$$

$n = 6$ since $n \neq -5$. Therefore, the larger group contains 6 people.

A committee of 3 girls and 2 boys is to be chosen from a group of 9 girls and 7 boys. The total number of different committees that can be formed can be expressed in the form

$$_wC_x \cdot {_yC_z}$$

where $_wC_x$ represents the number of possible choices of girls for the committee and $_yC_z$ represents the number of possible choices of boys for the committee.

Numerical Response

29. The values of w, x, y, and z are _____, _____, _____, and _____, respectively.

Possible Solution:
9372