Chapter 2 **Probability**

Chapter 2 Prerequisite Skills

Chapter 2 Prerequisite Skills Question 1 Page 58

a) $\frac{97}{100} = 0.97$

b) $\frac{2}{5} = \frac{2 \times 2}{5 \times 2}$
$= \frac{4}{10}$
$= 0.4$

c) $\frac{3}{20} = \frac{3 \times 5}{20 \times 5}$
$= \frac{15}{100}$
$= 0.15$

d) $\frac{5}{8} = \frac{5 \times 125}{8 \times 125}$
$= \frac{625}{1000}$
$= 0.625$

Chapter 2 Prerequisite Skills Question 2 Page 58

a) $\frac{17}{40} = 0.425$

b) $\frac{4}{13} = 0.3077$

c) $\frac{5}{6} = 0.8333$

d) $\frac{4}{9} = 0.4444$

Chapter 2 Prerequisite Skills Question 3 Page 58

a) $0.75 = \frac{75}{100}$
$= \frac{3}{4}$

b) $0.16 = \frac{16}{100}$
$= \frac{4}{25}$

c) $0.65 = \frac{65}{100}$
$= \frac{13}{20}$

d) $0.125 = \frac{125}{1000}$
$= \frac{5}{40}$
$= \frac{1}{8}$

e) $0.3333... = \frac{1}{3}$

f) $0.001 = \frac{1}{1000}$

Chapter 2 Prerequisite Skills **Question 4 Page 58**

a) $30\% = \frac{30}{100}$
$= \frac{3}{10}$

b) $25\% = \frac{25}{100}$
$= \frac{1}{4}$

c) $80\% = \frac{80}{100}$
$= \frac{4}{5}$

d) $45\% = \frac{45}{100}$
$= \frac{9}{20}$

e) $66.\overline{6}\% = \frac{66\frac{2}{3}}{100}$
$= \frac{2}{3}$

f) $100\% = \frac{100}{100}$
$= 1$

Chapter 2 Prerequisite Skills **Question 5 Page 58**

a) $1 - \frac{1}{4} = \frac{4-1}{4}$
$= \frac{3}{4}$

b) $\frac{1}{2} - \frac{1}{6} = \frac{3-1}{6}$
$= \frac{2}{6}$
$= \frac{1}{3}$

c) $\frac{1}{5}$ of $80 = \frac{1}{5} \times \frac{80}{1}$
$= \frac{80}{5}$
$= 16$

d) $\frac{3}{13} \times \frac{1}{6} = \frac{3}{78}$
$= \frac{1}{26}$

Chapter 2 Prerequisite Skills **Question 6 Page 58**

a) 0.75 or $\frac{3}{4}$

b) $0.\overline{3}$ or $\frac{1}{3}$

c) 16.0 or 16

d) 0.0385 or $\frac{1}{26}$

Chapter 2 Prerequisite Skills Question 7 Page 58

a) 18 rolls; add the frequencies.

b) 5 out of 18 rolls resulted in a 4, so $\frac{5}{18} \times 100\% = 27.\overline{7}\%$.

c) 10 out of 18 rolls resulted in an even number, so $\frac{10}{18} = \frac{5}{9}$.

d) Of the 10 even rolls, 4 were twos, so $\frac{4}{10} \times 100\% = 40\%$.

Chapter 2 Prerequisite Skills Question 8 Page 58

a) a bar graph

b) 25; add the values for each type of vehicle.

c) It was a van.

d) Of the 25 vehicles observed, 5 were cars.
$\frac{5}{25} = \frac{1}{5}$

e) Of the 25 vehicles observed, 2 were trucks.
$\frac{2}{25} \times 100\% = \frac{200\%}{25} = 8\%$

Chapter 2 Prerequisite Skills Question 9 Page 59

a) 10% of 200 people preferred the Boston Red Sox.
$\frac{1}{10} \times 200 = 20$ people

b) 40% of 200 people preferred the Toronto Blue Jays.
$\frac{40}{200} = \frac{2}{5}$ of the people

c) The combined percent of people who preferred the Jays or Yankees is
40% + 30% = 70%.

Chapter 2 Prerequisite Skills **Question 10 Page 59**

a) There are 20 students in the class (add the height of each column).

b) Eight students are between 160 cm and 170 cm tall.

c) Seven students out of 20 are shorter than 160 cm.

$$\frac{7}{20} \times 100\% = 35\%$$

d) 17 students out of 20 are taller than 150 cm, i.e., $\frac{17}{20}$.

Chapter 2 Section 1 **Probability Experiments**

Chapter 2 Section 1 **Question 1 Page 66**

a) For 15 successful trials out of 50, the experimental probability of a successful trial is:

$$P(\text{successful trial}) = \frac{\text{number of successful trials}}{\text{total number of trials}}$$
$$= \frac{15}{50}$$
$$= \frac{3}{10} = 30\% = 0.3$$

The probability of a successful trial is $\frac{3}{10}$ or 30% or 0.3.

b) Answers may vary. For example:
The probability of an unsuccessful trial is:

$$P(\text{unsuccessful trial}) = \frac{\text{number of unsuccessful trials}}{\text{total number of trials}}$$
$$= \frac{35}{50}$$
$$= \frac{7}{10}$$

Chapter 2 Section 1 **Question 2 Page 66**

$$P(\text{rolling doubles}) = \frac{\text{number of successful trials}}{\text{total number of trials}}$$
$$= \frac{4}{20}$$
$$= \frac{1}{5} = 20\% = 0.2$$

The probability of rolling doubles is $\frac{1}{5}$ or 20% or 0.2.

Chapter 2 Section 1　　　　Question 3 Page 66

a) There were $30 \times \frac{2}{5} = 12$ heads out of 30 tosses.

b) There were 30 – 12 = 18 tails out of 30 tosses.

c) Answers may vary. For example:

The experimental probability of turning up tails is $\frac{18}{30} = \frac{3}{5}$.

This result can also be found by subtracting $\frac{2}{5}$ (the probability of heads) from 1.

Chapter 2 Section 1　　　　Question 4 Page 66

a)
$$\begin{aligned} P(\text{tossing 2 heads}) &= \frac{\text{number of successful tosses}}{\text{total number of tosses}} \\ &= \frac{45}{200} \\ &= \frac{9}{40} \end{aligned}$$

b)
$$\begin{aligned} P(\text{tossing 1 head}) &= \frac{\text{number of successful tosses}}{\text{total number of tosses}} \\ &= \frac{95}{200} \\ &= \frac{19}{20} \end{aligned}$$

c)
$$\begin{aligned} P(\text{tossing 2 tails}) &= \frac{\text{number of successful tosses}}{\text{total number of tosses}} \\ &= \frac{60}{200} \\ &= \frac{3}{10} \end{aligned}$$

Chapter 2 Section 1 Question 5 Page 66

a) Answers may vary. For example:
When two coins are tossed the results can be HH, HT, TH, TT.

The probability of tossing two heads or two tails is $\frac{1}{4}$.

Therefore, in a bar graph of the number of tails versus their frequency, the bars for zero tails (two heads) and two tails should be about the same height because both events are equally likely with a probability of 25%.

b) One head comes from HT and from TH.

c) Based on the information in the graph, $\frac{95}{200}$ or $\frac{19}{40}$ of the time one should expect the event "one head."

d) Adding the frequencies for 0 tails and 2 tails gives the number of successful trials:
$\frac{105}{200} = \frac{21}{40}$.

Chapter 2 Section 1 Question 6 Page 66

a)
$$\begin{aligned} P(\text{tossing heads}) &= \frac{\text{number of successful tosses}}{\text{total number of tosses}} \\ &= \frac{9}{10} \\ &= 90\% \end{aligned}$$

b) Answers may vary. For example:
Since the result of a toss can be H or T, we would expect that the experimental probability for heads would be about $\frac{1}{2}$ = 50%. This is not the case in part a).

Chapter 2 Section 1 Question 7 Page 67

a) Answers may vary. For example:
A batch of 240 light bulbs will be rejected if more than 5% are defective.

5% of 240 bulbs = $\dfrac{240 \times 5}{100}$ = 12 bulbs

If 8 bulbs are defective, the batch will be accepted.

b) Answers may vary. For example:
Yes. It is possible that the batch may be rejected.
If 100 out 1000 bulbs are defective, then in a sample of 200 bulbs, we would expect that x bulbs are defective where,

$$\frac{x}{200} = \frac{100}{1000}$$
$$x = \frac{20\ 000}{1000}$$
$$x = 20$$

5% of 200 bulbs is $200 \times \dfrac{5}{100} = 10$ bulbs .

The batch will be rejected.

c) Answers may vary. For example:
Given a large batch of bulbs, if the sample tested is small enough, it is possible that 5% of the bulbs tested may be defective.

Chapter 2 Section 1 Question 8 Page 67

a) Explanations may vary. For example:

True. $P(\text{drawing evens}) = \dfrac{\text{number of successful draws}}{\text{total number of draws}}$

$$= \frac{12}{20}$$
$$= \frac{3}{5}$$

b) Explanations may vary. For example:

True. The experimental probability of drawing “evens” is $\dfrac{3}{5}$ and of drawing “odds” is $\dfrac{2}{5}$.

Therefore the event “evens” was more likely than the event “odds.”

Chapter 2 Section 1 Question 9 Page 67

a) Answers may vary. For example:

Since 100 fish were caught, of which 10 were tagged, $\frac{1}{10}$ of the population was tagged.

If the lake contains x fish, we would estimate $\frac{x}{10}$ to be tagged.

If $\frac{x}{10} = 100$, then x = 1000 fish.

b) Answers may vary.

Chapter 2 Section 1 Question 10 Page 67

a) Answers may vary. For example:
The percent of “evens” should be less than 50%. If a blue tile is chosen, there are only 4 chances of a second blue and 5 chances of a red.

b) Answers may vary.

Chapter 2 Section 1 Question 11 Page 67

Explanations may vary. For example:
If a red tile is chosen, there are 9 other possibilities for the second tile: 4 red and 5 blue.
Then the probability of “evens” is $\frac{4}{9}$ and the probability of “odds” is $\frac{5}{9}$.

$\frac{4}{9} < \frac{1}{2}$, so $\frac{4}{9} < 50\%$; the probability of “evens” is less than 50%.

Chapter 2 Section 2 **Theoretical Probability**

Chapter 2 Section 2 **Question 1 Page 73**

a) $$P(\text{a spade}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{13}{52}$$
$$= \frac{1}{4}$$

b) $$P(\text{a face card}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{12}{52}$$
$$= \frac{3}{13}$$

c) $$P(\text{not a face card }) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{40}{52}$$
$$= \frac{10}{13}$$

d) $$P(\text{a black jack}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{2}{52}$$
$$= \frac{1}{26}$$

e) $$P(\text{a red or black card}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{52}{52}$$
$$= 1$$

f) $$P(\text{a red face card}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{6}{52}$$
$$= \frac{3}{26}$$

Chapter 2 Section 2 **Question 2 Page 73**

a) $P(\text{an } 11) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{4}{64}$$

$$= \frac{1}{16}$$

b) $P(\text{an } 11, 12, \text{ or } 13) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{12}{64}$$

$$= \frac{3}{16}$$

Chapter 2 Section 2 **Question 3 Page 73**

a) $P(\text{rolling a } 6) = \dfrac{\text{number of successful outcomes}}{\text{total number of outcomes}}$

$$= \frac{1}{6}$$

b) $P(\text{rolling a number greater than } 3) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{3}{6}$$

$$= \frac{1}{2}$$

c) $P(\text{rolling an } 8) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{0}{6}$$

$$= 0$$

d) $P(\text{rolling an even number}) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{3}{6}$$

$$= \frac{1}{2}$$

Chapter 2 Section 2 Question 4 Page 74

a) $P(\text{choosing a cat}) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{10}{10+12+3}$$
$$= \frac{10}{25}$$
$$= \frac{2}{5}$$

b) $P(\text{choosing a turtle}) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{3}{25}$$

c) $P(\text{choosing a dog or a turtle}) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{15}{25}$$
$$= \frac{3}{5}$$

Chapter 2 Section 2 **Question 5 Page 74**

a) To get a sum of 2, roll 1 and 1. Therefore,

$$P(\text{rolling a sum of 2}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{1}{36}$$

b) To get a sum of 11, roll 6 and 5, or 5 and 6. Therefore,

$$P(\text{rolling a sum of 11}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{2}{36}$$
$$= \frac{1}{18}$$

c) All rolls of two dice will be greater than 5 except:
1 and 1, 1 and 2, 1 and 3, 1 and 4
2 and 1, 2 and 2, 2 and 3
3 and 1, 3 and 2
4 and 1
36 – 10 = 26 rolls are greater than 5. Therefore,

$$P(\text{rolling a sum less than 5}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{26}{36}$$
$$= \frac{13}{18}$$

d) There are six ways to roll a sum equal to 7: (1, 6), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1).

$$P(\text{rolling a sum of 7 }) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{6}{36}$$
$$= \frac{1}{6}$$

e) Since there are six ways to roll a sum equal to 7, there are 36 – 6 = 30 ways to roll a sum not equal to 7.

$$P(\text{rolling a sum other than 7}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{30}{36}$$
$$= \frac{5}{6}$$

Chapter 2 Section 2 **Question 6 Page 74**

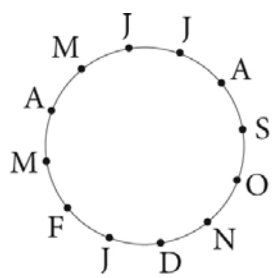
Since there are 10 people and eight chairs, two people will not get a chair.

$$P(\text{not getting a chair}) = \frac{\text{number of people without a chair}}{\text{total number of people}}$$
$$= \frac{2}{10}$$
$$= \frac{1}{5}$$

Chapter 2 Section 2 **Question 7 Page 74**

There are 12 charm symbols and 12 spaces on the bracelet in which to place one clasp. Therefore, the probability of the clasp being between June and July is $\frac{1}{12}$.

Diagrams may vary. For example:



Chapter 2 Section 2 **Question 8 Page 74**

a) Answers may vary. For example:
The greatest possible sum is 12 so a sum of 14 has 0 possibilities.

$$P(\text{rolling a sum of 14}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{0}{36}$$
$$= 0$$

b) Answers may vary. For example:
Every possible sum that can be rolled is equal to 2, 3, 4, …, 12. Therefore, all 36 sums are in this range.

$$P(\text{rolling a sum from 2 to 12}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$
$$= \frac{36}{36}$$
$$= 1$$

Chapter 2 Section 2 **Question 9 Page 74**

a) There are $(3\times2\times1)=6$ possible sandwich choices.

b) i) $P(\text{selecting tuna on white bread})=\frac{1}{6}$

ii) $P(\text{selecting egg salad or ham on whole wheat bread})=\frac{2}{6}$

$$=\frac{1}{3}$$

iii) $P(\text{selecting ham on white or whole wheat bread})=\frac{2}{6}$

$$=\frac{1}{3}$$

iv) $P(\text{selecting egg salad on white or whole wheat bread})=\frac{2}{6}$

$$=\frac{1}{3}$$

Chapter 2 Section 2 **Question 10 Page 75**

a) From the table in Example 2, there are $6\times6=36$ pairs. Only 6 of these are doubles.

$$P(\text{not rolling doubles}) = \frac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$$

$$=\frac{30}{36}$$

$$=\frac{5}{6}$$

b) Answers may vary. For example:
There are 5 possibilities that the second die will not match the first one. This gives a probability of $\frac{5}{6}$ that the two dice will not match.

c) Answers may vary. For example:
The probability of rolling doubles is $\frac{6}{36}=\frac{1}{6}$.

Therefore the probability of not rolling doubles is $\frac{5}{6}$.

$P(\text{not doubles}) + P(\text{doubles}) =\frac{5}{6}+\frac{1}{6}=1$

This means that a roll of the two dice will either give doubles or not give doubles. They are the only possible outcomes.

Chapter 2 Section 2 **Question 11 Page 75**

a) The area of the entire dartboard is $\pi(40)^2$ cm^2.

The area of the red inner circle is $\pi(20)^2$ cm^2.

$$\begin{aligned} P(\text{landing in the red circle}) &= \frac{\text{area of the red circle}}{\text{area of the entire dartboard}} \\ &= \frac{\pi(20)^2}{\pi(40)^2} \\ &= \frac{20 \times 20}{40 \times 40} \\ &= \frac{1}{4} \end{aligned}$$

b) Answers may vary. For example:
It is assumed that the dart will hit the dartboard.

Chapter 2 Section 2 Question 12 Page 75

a) Since there are 60 fish and 15 are catfish,

$$P(\text{tagging a catfish}) = \frac{\text{number of catfish}}{\text{total number of fish}}$$
$$= \frac{15}{60}$$
$$= \frac{1}{4}$$

b) Answers may vary. For example:
There are 20 bass and 25 carp.

$$P(\text{tagging a bass or a carp}) = \frac{\text{number of bass and carp}}{\text{total number of fish}}$$
$$= \frac{45}{60}$$
$$= \frac{3}{4}$$

Alternately, if the fish is not a catfish, it is a bass or a carp, so that the probability is $1 - \frac{1}{4} = \frac{3}{4}$.

c) Since the fish selected must be a carp or catfish,

$$P(\text{tagging a carp}) = \frac{\text{number of carp}}{\text{number of carp and catfish}}$$
$$= \frac{25}{25+15}$$
$$= \frac{25}{40}$$
$$= \frac{5}{8}$$
$$= 0.625$$

Chapter 2 Section 2 Question 13 Page 75

a) There are $3\times2\times1=6$ possible arrangements for the three people (Ann, Bob, and Cathy) to stand: ABC, ACB, BAC, BCA, CAB, CBA. In four of these arrangements, Ann is not in the middle, so the probability of her not standing in the centre is $\frac{4}{6}=\frac{2}{3}$.

b) There are 4 cases where Bob and Cathy stand beside each other, so the probability of their standing side by side is: $\frac{4}{6}=\frac{2}{3}$.

c) Yes. If Ann is not standing between them, then Bob and Cathy are beside each other. The two questions are the same.

Chapter 2 Section 2 Question 14 Page 75

Answers may vary. For example:
The volume of the cylindrical drum is $\pi r^2 h,$ where r is the radius and h the height of the drum.

The volume of the conical container is $\frac{1}{3}\pi r^2 h$.

$$
\begin{aligned}
P(\text{red pellet staying in drum}) &= \frac{\pi r^2 h - \frac{1}{3}\pi r^2 h}{\pi r^2 h} \\
&= \frac{\frac{2}{3}\pi r^2 h}{\pi r^2 h} \\
&= \frac{2}{3}
\end{aligned}
$$

Chapter 2 Section 3 **Compare Experimental and Theoretical Probabilities**

Chapter 2 Section 3 **Question 1 Page 82**

a) $P(\text{landing on rain}) = \dfrac{\text{area of quarter circle}}{\text{area of the circle}}$

$= \dfrac{1}{4}$

b) $P(\text{no rain}) = \dfrac{\text{number of landings on rain}}{\text{total number of spins}}$

$= \dfrac{13}{15}$

Chapter 2 Section 3 **Question 2 Page 82**

a) Experimental: $P(\text{tossing heads}) = \dfrac{\text{number of heads}}{\text{number of tosses}}$

$= \dfrac{8}{10}$

$= \dfrac{4}{5}$

b) Theoretical: $P(\text{tossing heads}) = \dfrac{\text{number of sides with a head}}{\text{total number of sides}}$

$= \dfrac{1}{2}$

c) Answers may vary. For example:

Since the theoretical probability is $\dfrac{1}{2}$, we would expect the experimental probability to approach that value for additional trials. So we should expect it to decrease.

Chapter 2 Section 3 **Question 3 Page 82**

a) Experimental: $P(\text{drawing a yellow marble}) = \dfrac{\text{frequency of drawing a yellow marble}}{\text{total number of trials}}$

$$= \frac{17}{20} \times 100\%$$
$$= 85\%$$

b) Theoretical: $P(\text{drawing a yellow marble}) = \dfrac{\text{number of yellow marbles}}{\text{total number of marbles}}$

$$= \frac{14}{20} \times 100\%$$
$$= 70\%$$

Chapter 2 Section 3 **Question 4 Page 82**

a) $$P(\text{Outcome 1}) = \frac{\text{frequency of outcome}}{\text{total number of rolls}} = \frac{14}{30} = \frac{2}{15}$$

$$P(\text{Outcome 2}) = \frac{\text{frequency of outcome}}{\text{total number of rolls}} = \frac{6}{30} = \frac{1}{5}$$

$$P(\text{Outcome 3}) = \frac{\text{frequency of outcome}}{\text{total number of rolls}} = \frac{7}{30}$$

$$P(\text{Outcome 4}) = \frac{\text{frequency of outcome}}{\text{total number of rolls}} = \frac{5}{30} = \frac{1}{6}$$

$$P(\text{Outcome 5}) = \frac{\text{frequency of outcome}}{\text{total number of rolls}} = \frac{6}{30} = \frac{1}{5}$$

$$P(\text{Outcome 6}) = \frac{\text{frequency of outcome}}{\text{total number of rolls}} = \frac{2}{30} = \frac{1}{15}$$

b) Answers may vary. For example:
Each probability is experimental since the results come from a number of trials.

Chapter 2 Section 3 **Question 5 Page 83**

a) **i)** $P(\text{rolling a 3}) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{2}{6}$$

$$= \frac{1}{3}$$

ii) $P(\text{rolling a 2}) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{4}{6}$$

$$= \frac{2}{3}$$

iii) $P(\text{rolling a 6}) = \dfrac{\text{number of successful outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{0}{6}$$

$$= 0$$

b) Answers may vary. For example:
There are too few trials to give a reasonably accurate experimental probability.

Chapter 2 Section 3 Question 6 Page 83

a) Experimental: $P(\text{rolling doubles}) = \dfrac{\text{number of successful outcomes}}{\text{total number of outcomes}}$

$$= \frac{15}{60}$$

$$= \frac{1}{4}$$

b) Theoretical: $P(\text{rolling doubles}) = \dfrac{\text{number of possible doubles outcomes}}{\text{total number of possible outcomes}}$

$$= \frac{6}{36}$$

$$= \frac{1}{6}$$

c) Answers may vary. For example:
Yes. In experiments where there are a limited number of trials, the experimental probability can be quite different from the theoretical probability.

d) Answers may vary. For example:
No. The number of doubles rolled could turn up more frequently or less frequently.

Chapter 2 Section 3 Question 7 Page 83

a) Answers may vary. For example:
Use the **rand** command on the graphing calculator 6 times. Use a number less than 0.25 to represent that it rains, and use a number greater than 0.25 to represent that it does not rain.

b) Use **randInt** (1,4,1) on the graphing calculator.

Chapter 2 Section 3 Question 8 Page 83

a) If a student guesses there is a $\frac{1}{4}$ chance of getting the right answer. So for 10 questions, it is likely that the student will get $10 \times \frac{1}{4} = 2.5$ questions correct.

You should expect that the student will get 2 or 3 questions correct out of 10.

b) Answers may vary. For example:
By using **randInt** (1,4,10), the simulation is for 4 possible answers to each of 10 questions. In this case 1 has been chosen to be recorded as the correct answer.

Chapter 2 Section 3 **Question 9 Page 83**

a) From the table given, the number 1 occurs in 4 out of 20 trials.

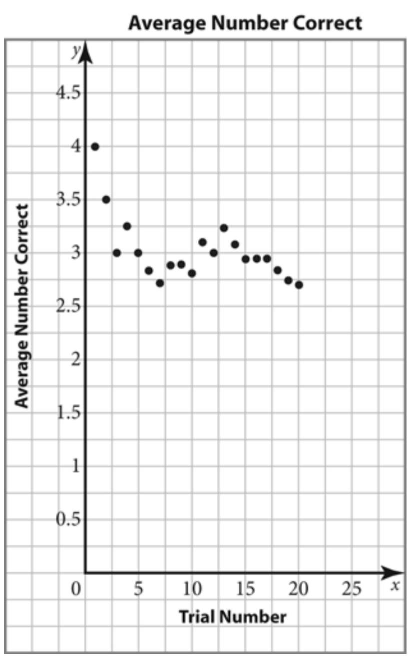
$$\begin{aligned} P(\text{passing by guessing}) &= \frac{\text{number of occurrences of 1}}{\text{total number of occurrences}} \\ &= \frac{4}{20} \\ &= \frac{1}{5} \end{aligned}$$

Using this experimental probability for a 10 question test, we would expect a student guessing to get $10 \times \frac{1}{5} = 2$ questions correct, so the experimental probability of passing is $\frac{2}{10} = \frac{1}{5}$.

b) Answers may vary.

Chapter 2 Section 3 **Question 10 Page 84**

a) Answers may vary. For example:
The formula in the third row calculates the average number of correct answers up to that number of trial.



b) Answers may vary. For example:
Question 8 a) indicated that the theoretical expectation would be 2.5 answers correct out of 10 questions. The scatter plot demonstrates the theory by showing a downward trend toward an average number correct of 2.5. For a greater number of trials the entries in the graph would likely continue to get closer to 2.5.

Chapter 2 Section 3 **Question 11 Page 84**

a) Experimental: $P(\text{landing in the red circle}) = \dfrac{\text{number of successful outcomes}}{\text{total number of outcomes}}$

$$= \frac{16}{40}$$

$$= \frac{2}{5}$$

b) Theoretical $P(\text{landing in the red circle}) = \dfrac{\text{area of the red circle}}{\text{area of the entire dartboard}}$

$$= \frac{1}{4}$$

Since $\frac{2}{5} > \frac{1}{4}$, the experimental probability is larger.

c) Answers may vary. For example:

The skill level of the players will be a factor because they will aim for red to score more points.

Chapter 2 Section 3 **Question 12 Page 84**

a) Experimental: $P(\text{catching a bass}) = \dfrac{\text{number of successful outcomes}}{\text{total number of outcomes}}$

$$= \frac{3}{(3+5+2)}$$

$$= \frac{3}{10}$$

b) Theoretical: $P(\text{catching a bass}) = \dfrac{\text{number of bass}}{\text{total number of fish}}$

$$= \frac{3}{(3+3+2)}$$

$$= \frac{3}{8}$$

c) Answers may vary. For example:
Some fish may be easier to catch than others. Catfish and carp are bottom feeders, which may affect the ease or difficulty with which they are caught.

Chapter 2 Section 3 Question 13 Page 85

Solutions for Achievement Checks are shown in the Teacher's Resource.

Chapter 2 Section 3 Question 14 Page 85

Answers may vary. For example:

Theoretical: $P(\text{rolling doubles}) = \dfrac{\text{number of possible doubles}}{\text{total number of outcomes}}$

$$= \frac{1}{6}$$

The probability is that you will win $\$5 \times \frac{1}{6} = \$\frac{5}{6} = 83$ cents.

The theoretical probability of not getting a double is $\frac{5}{6}$.

The probability is that you will lose is $\$1 \times \frac{5}{6} = \$\frac{5}{6} \times 100 = 83$ cents.

Theoretically you should break even.

Chapter 2 Section 3 Question 15 Page 85

a) Answers may vary. For example:
The game is fair. There are four possible results (HH, TH, HT, TT).
For (HH, TT) you gain 3 + 1 = 4 marbles and for (HT, TH) you lose 2 + 2 = 4 marbles.

b) Answers may vary.

c) Answers may vary. For example:
Use **randInt** (1,4,1000) where 1 represents (H, H), 2 represents (T, T), and 3 and 4 represent a head and tail.

d) Answers may vary.

Chapter 2 Section 3 **Question 16 Page 85**

Answers may vary. For example:
Marucia is correct.
randInt (2, 12, 10) will generate a list of ten randomly chosen integers between 2 and 12 with an equal probability of $\frac{1}{11}$ for each integer from 2 to 12.
However, when tossing a pair of dice, the sum of the total is not equally likely. There is one possibility of getting a sum of 2 or 12, two possibilities of getting a sum of 3 or 11, three possibilities of getting a 4 or 10, four possibilities for 5 and 9, five possibilities for 6 and 8 and six possibilities for 7.

Therefore, using two dice, the probabilities for rolling sums will vary as shown below.

$$P(\text{rolling 2 or 12}) = \frac{1}{36}$$
$$P(\text{rolling 3 or 11}) = \frac{1}{18}$$
$$P(\text{rolling 4 or 10}) = \frac{1}{12}$$
$$P(\text{rolling 5 or 9}) = \frac{1}{9}$$
$$P(\text{rolling 6 or 8}) = \frac{5}{36}$$
$$P(\text{rolling 7}) = \frac{1}{6}$$

Chapter 2 Section 4 — Interpret Information Involving Probability

Chapter 2 Section 4 — Question 1 Page 89

a) P(likes rock but not rap) = 25%

b) $P(\text{likes either rock or rap but not both}) = 25\% + 40\%$
$= 65\%$

c) $P(\text{likes rock or rap or both}) = 25\% + 40\% + 20\%$
$= 85\%$

Chapter 2 Section 4 — Question 2 Page 90

a) The quarterback has completed $\frac{125}{200} \times 100 = 62.5\%$ of his passes.

b) We would expect the quarterback to complete $30 \times \frac{125}{200} = 18.75$ of his passes.
This is about 19 of 30 passes in the game.

c) Answers may vary. For example:
Factors such as weather and injuries might affect the estimate.

Chapter 2 Section 4 — Question 3 Page 90

a) The Leafs have 5(2) + 3(1) + 4(0) = 13 points.

b) The Leafs are predicted to have $\frac{13}{12} \times 82 \doteq 89$ points in the regular season.

Chapter 2 Section 4 — Question 4 Page 90

a) The volleyball team has $7 \times 3 + 4 \times 0 + 2 \times 1$ = 23 points after 13 games.

b) In a 20 game season, the team is predicted to have $\frac{23}{13} \times 20 \doteq 35$ points.

Chapter 2 Section 4 — Question 5 Page 91

a) Answers may vary. For example:
The batting average is the number of hits that the player has made divided by the total number of times at bat.

b) The player is expected to get $40 \times 0.300 = 12$ hits in the next 10 games.

c) Answers may vary. For example:
The player could be injured or go into a slump and have fewer than 12 hits.
Alternately, the player could go on a hot streak and have more than 12 hits.

Chapter 2 Section 4 Question 6 Page 91

a) Since 1 in 4 teens has tried smoking, $P(\text{has not tried smoking by 14}) = \frac{3}{4}$.

b) 100% – 36% = 64% of people who have tried smoking do not become smokers.

c) 64% of 25% = 16% have tried smoking by age 14, but have not become smokers.

d) 36% of 25% = 9% of the population will have tried smoking by age 14 and will become smokers. So, the estimate for a population of 33 million is $\frac{9 \times 33\ 000\ 000}{100} = 2\ 970\ 000$.

Chapter 2 Section 4 Question 7 Page 91

a) The percent of those born in the thirties who have MS are female is:

$$\begin{aligned}\left(\frac{1.9}{1+1.9}\right)\times 100\% &= \frac{1.9}{2.9}\times 100\% \\ &\approx 65.5\%\end{aligned}$$

b) The percent of those born in the 1980s who have MS and are female is:

$$\begin{aligned}\left(\frac{3.2}{1+3.2}\right)\times 100\% &= \frac{3.2}{4.2}\times 100\% \\ &\approx 76.2\%\end{aligned}$$

c)

$$\begin{aligned}\frac{\text{Answer Part a)}}{\text{Answer Part b)}} &= \frac{76.2}{65.5} \\ &= 1.16\end{aligned}$$

$$\frac{3.2}{1.9} = 1.68$$

The value 1.68 seems to indicate a greater increase, since the division compares raw scores.

d) Answers may vary. For example:
An increase in the number of females with MS from 1.9 to 3.2 makes the increase seem dramatically larger than an increase from 65.5% to 76.2%.

Chapter 2 Section 4 Question 8 Page 92

a) The total immigrant population is 5 450 000 (add the immigrant populations for each group by place of birth).
The percent of immigrants from Eastern Asia or Southern Asia is:
$$\frac{750\ 000 + 500\ 000}{5\ 450\ 000} \times 100\% \approx 23\%$$

b) China and India have the two largest populations in the world.

c)
$$\begin{aligned} P(\text{the immigrant is from the USA}) &= \frac{250\ 000}{(250\ 000 + 450\ 000 + 600\ 000)} \\ &= \frac{250\ 000}{1\ 300\ 000} \\ &= \frac{25}{130} \\ &= \frac{5}{26} \end{aligned}$$

Chapter 2 Section 4 Question 9 Page 93

Solutions for Achievement Checks are shown in the Teacher's Resource.

Chapter 2 Section 4 Question 10 Page 93

a) The amount of Canadian content required by the CRTC is 35% for radio. The requirements for television are:
i) 60% from 6:00 A.M. to 12 midnight
ii) 50% between 12:00 midnight and 6:00 A.M.

b) No. Canadian radio shows must be broadcast between 6:00 A.M. and 6:00 P.M.. Canadian television content must satisfy the requirements stated above in part a).

c) No. A show must meet certain requirements to be considered Canadian:
i) The key producer must be Canadian.
ii) The key creative personnel (e.g., writers) must be Canadian.
iii) 75% of the service costs and post-production lab costs must be paid to Canadians.

d) Answers may vary. For example:
What is the probability that a show broadcast at 8 P.M. is a Canadian-made show?

Chapter 2 Section 4 Question 11 Page 93

a) Use the **rand** command on the graphing calculator. If random number $x < 0.3$ it can represent precipitation; if $x > 0.3$ then it can represent no precipitation. Here are five trials for two-day periods: {(0.47, 0.21), (0.09, 0.36), (0.63, 0.14), (0.67, 0.01), (0.60, 0.28)}. In this experiment, precipitation was predicted to occur in four of the five two-day periods. That is, the experimental probability of precipitation in a two-day period is $\frac{4}{5}$.

b) Answers may vary. For example:
Use 10 tiles or similar items, 3 of one colour (red) and 7 of another colour (blue).
i) Select a tile and replace it; record its colour.
ii) Select again and record the colour.
Red means precipitation and blue means no precipitation. After repeating the experiment a number of times, find the experimental probability.

c) The theoretical probability of having no precipitation over two days is:

$$\begin{aligned} 70\% \times 70\% &= \frac{7}{10} \times \frac{7}{10} \\ &= \frac{49}{100} \times 100\% \\ &= 49\% \end{aligned}$$

Chapter 2 Review

Chapter 2 Review Question 1 Page 94

a) $$\begin{aligned} P(\text{person will buy both a coffee and a doughnut}) &= \frac{60}{160} \\ &= \frac{6}{16} \\ &= \frac{3}{8} \end{aligned}$$

b) $\frac{3}{8} \times 100 = 37.5\%$

c) $\frac{3}{8} = 0.375$

Chapter 2 Review Question 2 Page 94

a) No. The computer chips may or may not be working perfectly. Examining only ten out of likely thousands of chips is too small a sample to judge if the chips are all working properly.

b) Answers may vary. For example:
Test a reasonable sample on a regular basis.

Chapter 2 Review Question 3 Page 94

a) $P(\text{selecting a red card}) = \frac{26}{54}$

b) $$\begin{aligned} P(\text{selecting a black face card}) &= \frac{6}{54} \\ &= \frac{1}{9} \end{aligned}$$

c) $$\begin{aligned} P(\text{selecting an ace, a 2 or a 3}) &= \frac{12}{54} \\ &= \frac{2}{9} \end{aligned}$$

d) $$\begin{aligned} P(\text{selecting a red card that is not a face card}) &= \frac{20}{54} \\ &= \frac{10}{27} \end{aligned}$$

Chapter 2 Review **Question 4 Page 94**

If two dice are rolled the probability that:

a) $P(\text{a sum of 11 is rolled}) = \frac{2}{36}$
$= \frac{1}{18}$

b) $P(\text{a sum not equal to 11 is rolled}) = 1 - \frac{1}{18}$
$= \frac{17}{18}$

c) $P(\text{a sum equal to 2, 3, or 4 is rolled}) = \frac{1+2+3}{36}$
$= \frac{6}{36}$
$= \frac{1}{6}$

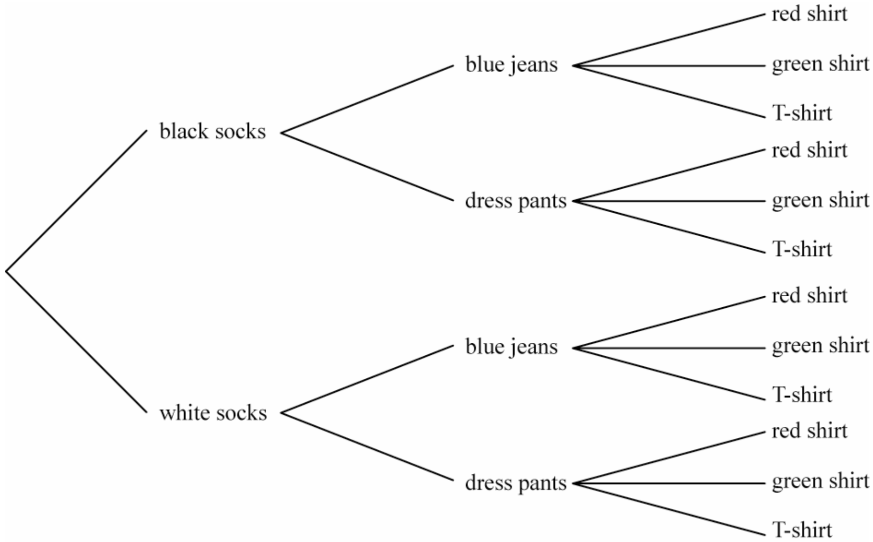
d) $P(\text{a sum that is a multiple of 3 is rolled}) = \frac{(2+5+4+1)}{36}$
$= \frac{12}{36}$
$= \frac{1}{3}$

e) $P(\text{a sum that is greater than 1 is rolled}) = \frac{36}{36}$
$= 1$

f) $P(\text{a sum that is greater than 3 is rolled}) = (1 - \frac{3}{36})$
$= \frac{33}{36}$
$= \frac{11}{12}$

Chapter 2 Review **Question 5 Page 94**

a)



b) **i)** $P(\text{Matthew selects blue jeans and T-shirt}) = \frac{2}{12}$

$= \frac{1}{6}$

ii) $P(\text{Matthew selects white socks}) = \frac{6}{12}$

$= \frac{1}{2}$

iii) $P(\text{Matthew selects black socks, dress pants, and a red shirt}) = \frac{1}{12}$

iv) $P(\text{Matthew selects white socks and not the T-shirt}) = \frac{4}{12}$

$= \frac{1}{3}$

Chapter 2 Review **Question 6 Page 94**

a) Experimental: $P(\text{rolling doubles}) = \frac{5}{20} \times 100\%$
$= 25\%$

b) Answers may vary. For example:
No. In an experiment the results for the second set of trials are unlikely to be exactly the same as for the first set.

c) Theoretical: $P(\text{rolling doubles}) = \frac{6}{36}$
$= \frac{1}{6}$

The expectation for 20 finals would be $20 \times \frac{1}{6} = 3\frac{1}{3}$.

We should expect about 3 sets of doubles.

Chapter 2 Review **Question 7 Page 95**

a) Since half the board is red, the theoretical probability is: $P(\text{landing on red}) = \frac{1}{2}$.

b) The experimental probability is: $P(\text{landing on red}) = \frac{32}{40}$
$= \frac{4}{5}$

c) Answers may vary. For example:
If it is worth more points to land on red then players will aim for the red sections.

Chapter 2 Review **Question 8 Page 95**

a) Answers may vary. For example:
The calculator will generate 10 random numbers between 1 and 5, for example, {1, 5, 5, 2, 4, 2, 1, 4, 2, 3}.

b) Explanations may vary. For example:

The theoretical probability of randomly picking a 2 for a list of integers from 1 to 5 is $\frac{1}{5}$.

We should expect two 2s in the list of 10 random numbers.

Chapter 2 Review **Question 9 Page 95**

a) Explanations may vary. For example:
The calculator will generate a random number between 0 and 1, to 10 decimal places, for example, 0.8196622075.

b) Explanations may vary. For example:
Look at the range of 0.2 to 0.7 = 0.5 in a total range of 1.0 to 0 = 1.0.

The probability of a number being between 0.2 and 0.7 is $\frac{0.5}{1.0} = \frac{1}{2}$.

In 20 repetitions, we should expect $20 \times \frac{1}{2} = 10$ numbers between 0.2 and 0.7.

Chapter 2 Review **Question 10 Page 95**

a) The player's free throw percentage is $\frac{40}{50} \times 100\% = 80\%$.

b) Since the player averages eight free throws a game, she should expect to make $8 \times 80\% \approx 6$ throws.

Chapter 2 Review **Question 11 Page 95**

a) From the chart, 20% of students voted for a bulldog. If 80 students voted, then 20% × 80 = 16 voted for a bulldog.

b) Consider what the results are if only the votes for a bulldog, a colt, or a bear are used. These votes comprised 65% of 80 students = 52 students. Of the 80 students, 15% voted for a bear, and 15% of 80 = 12.

The probability of voting for a bear is $\frac{12}{52} = \frac{3}{13}$.

Chapter 2 Practice Test

Chapter 2 Practice Test **Question 1 Page 96**

C

Chapter 2 Practice Test **Question 2 Page 96**

A

Chapter 2 Practice Test **Question 3 Page 96**

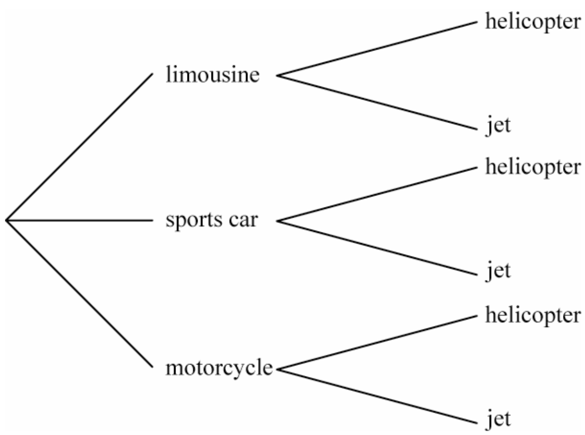
D

Chapter 2 Practice Test **Question 4 Page 96**

False. For example, there is only one way to roll the sum 2. There are 6 ways to roll the sum 7.

Chapter 2 Practice Test **Question 5 Page 96**

a)



b) **i)** $P(\text{He takes the sports car then his helicopter}) = \frac{1}{6}$

ii) $P(\text{He does not take his limousine}) = \frac{4}{6}$

$= \frac{2}{3}$

iii) $P(\text{He takes the sports car or motorcycle and the jet}) = \frac{2}{6}$

$= \frac{1}{3}$

Chapter 2 Practice Test **Question 6 Page 96**

a) Of the 256 246 new immigrants in 2005, 256 246 × 0.61 = 156 310 were in the "economic" category. Therefore, 256 246 – 156 310 = 99 936 were in the "family" or "protected" categories.

b) Since 25% of new immigrants were in the "family" category and 61% in the "economic" category,

$$P(\text{an immigrant not in the "protected" category will be in the "economic" category}) = \frac{61}{86} \times 100\% \approx 71\%$$

Chapter 2 Practice Test **Question 7 Page 97**

a) The spinner will have to have 50% of the area representing a gain of $10 000, and 10% of the area representing a loss of $30 000. The rest of the area, 40% will be neutral. Therefore form a sector of 180° for the gain, a sector of 36° for the loss, and a sector of 144° for the neutral part.

b) Answers may vary. For example:
The simulation can be set up using the **rand** command as follows:
Any number between 0 and 0.5 will represent a gain of $10 000.
Any number between 0.9 and 1.0 will represent a loss of $30 000.
Numbers between 0.5 and 0.9 are ignored.

c) Answers may vary. For example:
Using the graphing calculator for one set of 25 trials gave an average gain of $5200.

Chapter 2 Practice Test **Question 8 Page 97**

a) The red sector should be one ninth of 360° = 40°.
The blue sector will be two ninths of 360° = 80°.
The yellow sector will be six ninths of 360° = 240°.

b) **i)** Theoretical: P(Theoretical probability of landing on red) = $\frac{1}{9}$

ii) Theoretical: P(Theoretical probability of not landing on red) = $\frac{8}{9}$.

c) Answers may vary. For example:
Using the **randInt** command (1,9,1), let a 1 represent red, a 2 or 3 represent blue, and 4 to 9 represent a yellow.

d) Answers may vary. For example:
In 20 trials "Red + Red" occurred once and "Yellow + Yellow" occurred ten times.

e) There are nine possible outcomes and the probability of yellow occurring is $\frac{6}{9} = \frac{2}{3}$.

$$P(\text{consecutive yellows}) = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$$

This is quite close to the experimental result of 50% in part d).