Released Items
Mathematics 30–2

April 2019 Diploma Exam

Diploma Examinations Program

Alberta

This document was primarily written for:

Students	✓
Teachers	✓ of Mathematics 30–2
Administrators	✓
Parents	
General Audiences	
Others	

2025–2026 Mathematics 30–2 Released Item

Contents

Please note that if you cannot access one of the direct website links referred to in this document, you can find diploma examination-related materials on the Alberta Education and Childcare website.

Introduction

The questions in this document are from the *Mathematics 30–2 April 2019 Diploma Examination*. Teachers may wish to use these questions in a variety of ways to help students develop and demonstrate an understanding of the concepts described in the Mathematics 30–2 Program of Studies. The content in this document, along with the program of studies, the *Mathematics 30-2 Information Bulletin*, and the *Mathematics 30-2 Assessment Standards and Exemplars*, can provide insights that assist you with decisions about instructional planning.

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Documents

The Provincial Assessment Sector supports the instruction of Mathematics 30–2 with the following documents available online on the Writing diploma exams web page.

- *Mathematics 30-2 Information Bulletin*
- *Mathematics 30-2 Assessment Standards and Exemplars*
- *Mathematics 30-2 Released Items*
- *Mathematics 30-2 Written-Response Information*

Mathematics 30–2 Diploma Examination
April 2019 — Item Information

The following tables give the results for the machine-scored and written-response questions released from the examination. For each question, the table also gives the correct response, the topic, the outcome, the cognitive level, and the assessment standard.

Topics		Cognitive Levels		Standards
LR	Logical Reasoning	C	Conceptual	Acceptable
PR	Probability	P	Procedural	Excellence
RF	Relations and Functions	PS	Problem Solving	

Question	Diff.*	Key	Topic	Outcome	Cognitive Level	Standard
1	76.4%	D	LR	1	PS	Acceptable
NR1	85.2%	4286	LR	1	PS	Acceptable
2	42.8%	A	LR	1	PS	Acceptable
3	64.4%	D	LR	2	C	Acceptable
4	42.0%	B	LR	2	PS	Acceptable
NR2	75.6%	7528	LR	2	C	Excellence
5	77.2%	D	LR	2	C	Acceptable
6	68.4%	A	PR	2	PS	Excellence
7	40.8%	C	PR	2	C	Excellence
8	82.4%	D	PR	1	PS	Acceptable
9	70.8%	A	PR	1	C	Excellence
10	50.8%	C	PR	3	P	Acceptable
11	59.6%	C	PR	6	PS	Acceptable
12	70.4%	B	PR	6	PS	Acceptable
13	70.0%	D	PR	5	C	Acceptable
NR3	40.0%	10	PR	5	PS	Acceptable
14	51.2%	C	PR	4	PS	Acceptable

| Question	Diff.*	Key	Topic	Outcome	Cognitive Level	Standard
NR4	53.2%	64	PR	4	PS	Excellence
15	70.0%	D	RF	1	C	Acceptable
NR5	30.4%	299	RF	2	P	Acceptable
16	69.2%	B	RF	1	P	Acceptable
17	41.6%	C	RF	2	C	Acceptable
18	69.6%	A	RF	7	PS	Acceptable
NR6	67.2%	1334	RF	7	P	Acceptable
19	53.2%	B	RF	7	C	Acceptable
20	62.0%	B	RF	4	P	Acceptable
21	51.2%	A	RF	4	C	Excellence
22	52.4%	C	RF	5	P	Acceptable
NR7	53.6%	22.6	RF	6	P	Acceptable
23	64.0%	A	RF	5	C	Excellence
24	49.6%	B	RF	6	C	Acceptable
NR8	62.0%	12	RF	6	P	Acceptable

*Difficulty—percentage of students answering the question correctly

Question	Average Raw Score	Key	Topic	Outcome	Cognitive Level	Standard
WR1	3.37/7	See Sample Solution	RF, PR	8, 3	P, C, PS	Acceptable, Excellence
WR2	2.15/7	See Sample Solution	RF, PR	2, 3, 6	P, C, PS	Acceptable, Excellence

Mathematics 30–2 Diploma Examination
April 2019 — Released Items

Use the following information to answer question 1.

In a particular game, two players take turns removing 1, 2, or 3 pegs on their turn. The player who can remove the last remaining peg wins the game.
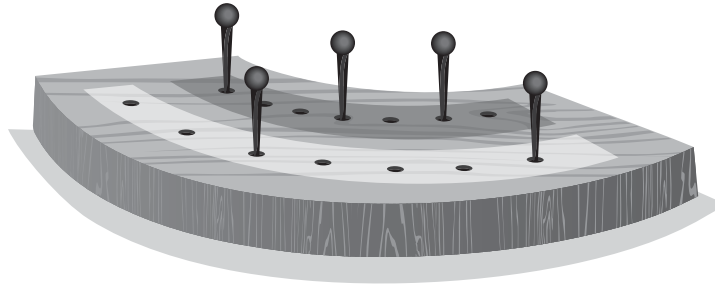
Wei and Denis are playing the game, and there are five pegs remaining. Wei has the next turn.

1. Which statement below **correctly** describes the outcome of the game after Wei's next turn?

   A. No matter how many pegs Wei removes, she cannot win.

   B. If Wei removes 3 pegs, she can win no matter how many pegs Denis removes on his next turn.

   C. If Wei removes 2 pegs, she can win no matter how many pegs Denis removes on his next turn.

   D. If Wei removes 1 peg, she can win no matter how many pegs Denis removes on his next turn.

A 3 × 3 puzzle is filled with the digits 1 through 9, without repetition, so that every row, column, and diagonal adds up to the same value. A partially completed 3 × 3 puzzle is shown below.

A	9	B
3	5	7
C	1	D

Numerical Response

1. When the puzzle is correctly completed, the value of

A is _____ (Record in the **first** column)

B is _____ (Record in the **second** column)

C is _____ (Record in the **third** column)

D is _____ (Record in the **fourth** column)

(Record your answer in the numerical-response section on the answer sheet.)

On an upcoming Thursday, Friday, and Saturday, Tom plans to have his camp group play a different outdoor sport each day. The sport he will choose for each day depends on the weather, as listed below.

- Soccer can be played in any weather.
- Tennis can be played in the wind but not the rain.
- Badminton cannot be played in the rain or the wind.

The weather is forecast to be different each day.

- One day will be windy with no rain.
- One day will be rainy with no wind.
- One day will have sunshine with neither wind nor rain.

2. *If it will **not** be raining on Thursday, then Tom should plan to play ____i____ .*

   *If it will **not** be windy on Friday, then Tom should plan to play ____ii____ .*

   If it will be windy on Saturday, then Tom should plan to play ____iii____ .

   Which row below shows the sports that Tom should plan to play on each day?

Row	Thursday (*i*)	Friday (*ii*)	Saturday (*iii*)
A.	badminton	soccer	tennis
B.	badminton	tennis	soccer
C.	tennis	badminton	soccer
D.	tennis	soccer	badminton

Use the following information to answer question 3.

Three Sets

$A = \{$multiples of 3 between 0 and 40$\}$
$B = \{$odd numbers$\}$
$C = \{9, 21, 36, 39\}$

3. Which of the following statements is true for the sets A, B, and C?

   A. $A \subset B$
   B. $A \subset C$
   C. $B \subset A$
   D. $C \subset A$

Use the following information to answer question 4.

The bouquets that were sold on one particular day at Mary's Flower Store are described below.

- 23 bouquets of daisies or roses

- 4 bouquets of both daisies and roses

- 5 more rose bouquets than daisy bouquets

4. The number of bouquets of roses only that were sold on this day is
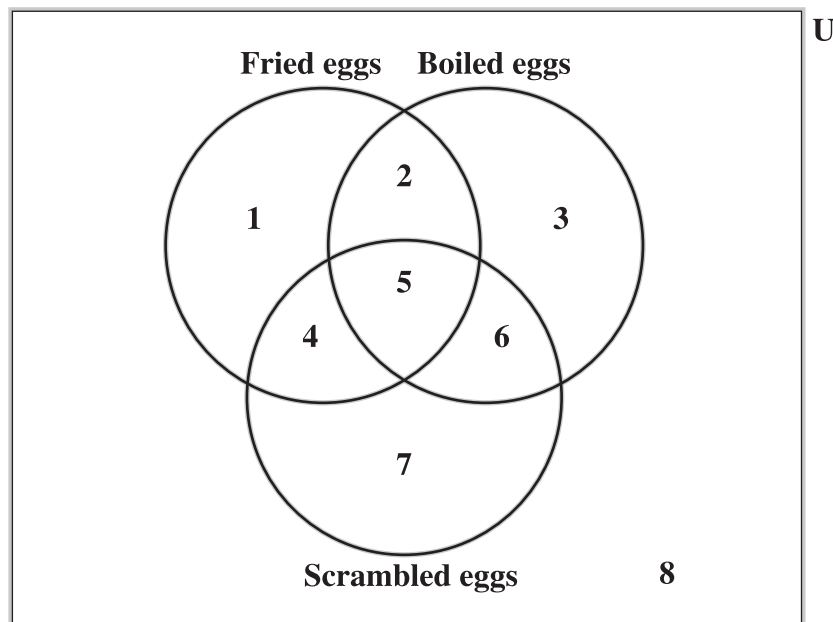
   A. 7
   B. 12
   C. 14
   D. 16

Use the following information to answer numerical-response question 2.

A class of students was surveyed and asked whether they like fried eggs, boiled eggs, or scrambled eggs. The results of the survey were organized into a Venn diagram using the regions numbered 1 through 8 below.

Numerical Response

2. Identify the region of the Venn diagram that represents each statement below.

Students who like scrambled
eggs only are represented by region _____ . (Record in the **first** column)

Students who like all three types
of eggs are represented by region _____ . (Record in the **second** column)

Students who like fried eggs and
boiled eggs but **not** scrambled
eggs are represented by region _____ . (Record in the **third** column)

The complement of students
who like **at least** one type of
egg is represented by region _____ . (Record in the **fourth** column)

(Record your answer in the numerical-response section on the answer sheet.)

A restaurant is running a contest where each drink purchased has a printed message on the bottom of the cup indicating if a prize has been won. There are 500 cash prizes, 100 prizes of big-screen televisions, and 1 prize of a car. The remaining drinks have no prize. For every drink that is purchased, Event A is winning the car.

5. The set A' can be described as

    A. not winning a prize

    B. not purchasing a drink

    C. winning a television or cash

    D. winning a television, or cash, or no prize

A group of students were surveyed at a particular high school. Of those surveyed, a total of 82 students took Mathematics 30–2, and a total of 60 students took Chemistry 30. There were 24 students who took both courses. All of the students surveyed took at least one of these courses.

6. To the nearest hundredth, the probability that a randomly selected student from this group took Chemistry 30 but **not** Mathematics 30–2 is

    A. 0.31

    B. 0.49

    C. 0.51

    D. 0.69

The results of a 2010 survey indicate that 82% of Canadians have a home phone, 78% of Canadians have a cellphone, and 13% of Canadians have only a cellphone.

7. *Having a home phone and having a cellphone are ____i____ events. The probability that a randomly selected Canadian has a cellphone or a home phone is ____ii____ .*

The statements above are completed by the information in row

Row	i	ii
A.	mutually exclusive	0.95
B.	mutually exclusive	0.65
C.	non-mutually exclusive	0.95
D.	non-mutually exclusive	0.65

The digits 1 to 9 inclusive are written on individual slips of paper, placed in a box, and then randomly selected. The digits 2, 3, 5, and 8 have already been selected, as shown below.
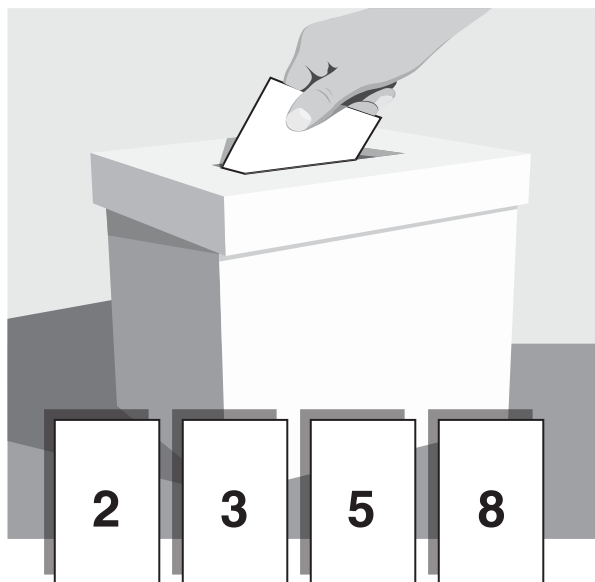
8. The odds in favour of the next randomly selected digit being an even number are

  A. 5 : 4
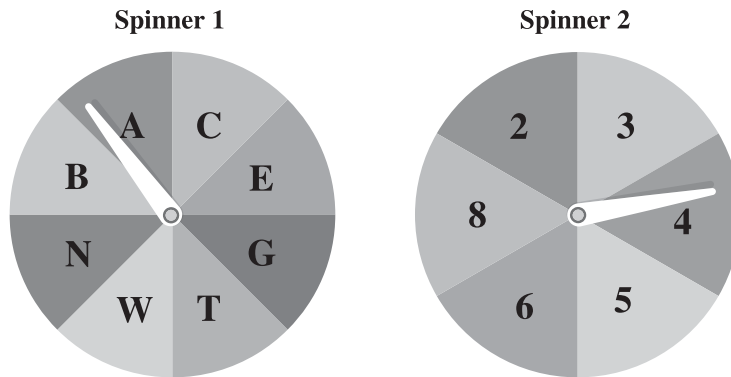 **B.** 3 : 2
  C. 4 : 5
  D. 2 : 3

9. The probability of Scott winning a particular competition is $\frac{6}{11}$. The odds against Scott winning the competition are

  A. 5 : 6
  B. 6 : 5
  C. 5 : 11
  D. 6 : 11

Ben spins each of the spinners below once.

Spinner 1

Spinner 2

10. The probability that the needle on Spinner 1 stops on a letter that is in Ben's name and the needle on Spinner 2 stops on a prime number is

A. $\dfrac{1}{8}$

B. $\dfrac{7}{8}$

C. $\dfrac{3}{16}$

D. $\dfrac{17}{24}$

Use the following information to answer question 11.

A fingerprint scanner is used to unlock an electronic safe. It is programmed to accept the fingerprints of 10 different people, but only requires the fingerprints of any 4 of these people to unlock. The fingerprints of the 4 people unlocking the safe can be placed on the scanner in any order.

11. The number of different groups of 4 people that can unlock the safe is

A. 24

B. 40

C. 210

D. 5 040

A students' council has 3 executive members and 7 general members. A subcommittee is to be selected that includes 1 executive member and 4 general members.

12. The number of possible subcommittees is

    A. 35

    B. 105

    C. 210

    D. 252

The bar codes on the library books at a particular college have 14 digits. The first 8 digits are always 3 1847 000, as shown below. The remaining 6 spaces are filled with the digits 0 through 9 inclusive, but these digits cannot repeat.
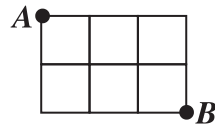

3 1847 000 564132

13. An expression that could be used to determine the number of different bar codes available for books at this library is

    A. $6!$

    B. $10!$

    C. 10^6

    D. $_{10}P_6$

Use the following information to answer numerical-response question 3.

A student must draw a path from Point *A* to Point *B* in the diagram below by moving only down and to the right along the grid lines.

Numerical Response

3. The number of different paths that the student can draw is _____.

(Record your answer in the numerical-response section on the answer sheet.)

Use the following information to answer question 14.

From 1975 to 2009, the format of Alberta license plates consisted of 3 letters followed by 3 digits. In 2010, a new format was introduced, consisting of 3 letters followed by 4 digits. At no time could the letters I or O be used. Letters and digits may be repeated.

14. How many more license plates are available using the new format than were available using the old format?

    A. 13 824 000

    B. 52 462 080

    C. 124 416 000

    D. 138 240 000

Use the following information to answer numerical-response question 4.

A school cafeteria offers the following choices for a meal special.

Main Course	Side Dish	Dessert
Ribs	Salad	Pie
Wings	Noodles	Ice Cream
Veggie Burger	French Fries	Fruit Salad
Chicken Burger	Mashed Potatoes	

For $4.99, a student can select a main course and a side dish. For $6.99, a student can select a main course, a side dish, and a dessert.

Numerical Response

4. If Alvin has enough money to purchase either the $4.99 special or the $6.99 special, the number of possible meal specials he can select from is _____.

(Record your answer in the numerical-response section on the answer sheet.)

Two students know that the expression $\dfrac{x^2 + x}{x + 1}$ can be simplified as follows.

$$= \dfrac{x(x + 1)}{x + 1}$$

$$= x$$

Amin states that the expression has no non-permissible values.

Qi states that the expression has a non-permissible value of $x = -1$.

15. *The student who is correct is ____i____ because he determined his non-permissible values ____ii____ simplification.*

The statement above is completed by the information in row

Row	*i*	*ii*
A.	Amin	after
B.	Amin	before
C.	Qi	after
D.	Qi	before

The product of $\dfrac{4x + 6}{x + 7} \cdot \dfrac{x + 3}{2x}$, $x \neq -7, 0,$ can be expressed in the form $\dfrac{Ax^2 + Bx + C}{x(x + 7)}$, where A, B, and C are single-digit whole numbers.

Numerical Response

5. In the product $\dfrac{Ax^2 + Bx + C}{x(x + 7)}$, the value of

A is _____ (Record in the **first** column)

B is _____ (Record in the **second** column)

C is _____ (Record in the **third** column)

(Record your answer in the numerical-response section on the answer sheet.)

16. An expression equivalent to $\dfrac{x^2 - 6x}{x^2 - 36}$, $x \neq -6, 6$, is

A. $\dfrac{x}{x - 6}$

B. $\dfrac{x}{x + 6}$

C. $\dfrac{x}{-6}$

D. $\dfrac{x}{6}$

Use the following information to answer question 17.

Alejandro simplified the expression $\dfrac{(x - 5)}{x(x + 3)} - \dfrac{(x + 4)}{x}$, $x \neq -3, 0$. His work is shown below.

$$\dfrac{(x - 5)}{x(x + 3)} - \dfrac{(x + 4)}{x}$$

Step 1 $= \dfrac{(x - 5)}{x(x + 3)} - \dfrac{(x + 4)(x + 3)}{x(x + 3)}$

Step 2 $= \dfrac{(x - 5) - (x^2 + 7x + 12)}{x(x + 3)}$

Step 3 $= \dfrac{x^2 + 8x + 7}{x(x + 3)}$

Step 4 $= \dfrac{(x + 1)(x + 7)}{x(x + 3)}$

17. In which step did Alejandro record his **first** error?

A. Step 1
B. Step 2
C. Step 3
D. Step 4

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Use the following information to answer question 18.

Brooke and Sally are launching rockets that they made in science class. The paths of their rockets can be modelled by the following functions

Brooke $\quad h = -0.01d^2 + 2.5d$

Sally $\quad\quad h = -0.02d^2 + 4d$

where h is the height above ground, in feet, and d is the distance travelled horizontally, in feet.

18. *The rocket that reached the greater maximum height was launched by* ____*i*____ *, and the rocket that travelled the further distance horizontally was launched by* ____*ii*____ *.*

The statement above is completed by the information in row

Row	*i*	*ii*
A.	Sally	Brooke
B.	Sally	Sally
C.	Brooke	Brooke
D.	Brooke	Sally

The height of a stunt airplane above the ground during an aerial dive was measured at regular intervals, as shown in the table below.

Time (s)	0	1	2	3	4	5
Height (ft)	1 700	870	368	200	360	625

These data can be modelled by a quadratic regression function in the form

$$y = ax^2 + bx + c$$

where x is the elapsed time, in seconds, and y is the height of the stunt airplane above the ground, in feet.
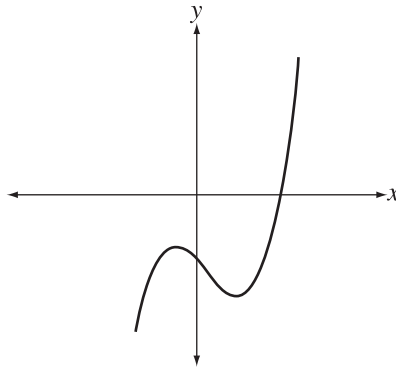
Numerical Response

6. According to the regression function, the height of the stunt airplane above the ground at a time of 6 s, to the nearest foot, was _____ ft.

(Record your answer in the numerical-response section on the answer sheet.)

The graph of a polynomial function of the form $y = ax^3 + bx^2 + cx + d$ is shown below.

19. Which of the following statements about a and d is true?

    A. $a > 0$ and $d > 0$

    B. $a > 0$ and $d < 0$

    C. $a < 0$ and $d > 0$

    D. $a < 0$ and $d < 0$

20. The expression $\log_5 x + \log_5(x - 7)$, $x > 7$, is equivalent to

    A. $\log_5(2x - 7)$

    B. $\log_5(x^2 - 7x)$

    C. $2 \log_5(2x - 7)$

    D. $2 \log_5(x^2 - 7x)$

21. Which of the following expressions is equivalent to $\log_b(mn)^a$, where $b > 1$, $m > 0$, and $n > 0$?

A. $a \log_b m + a \log_b n$

B. $a \log_b m + \log_b n$

C. $(a \log_b m)(a \log_b n)$

D. $(a \log_b m)(\log_b n)$

22. Which of the following equations could be used to algebraically solve $4^{(2x-1)} = 2^{\frac{1}{4}}$?

A. $2x - 1 = \dfrac{1}{4}$

B. $2x - 1 = \dfrac{1}{2}$

C. $4x - 2 = \dfrac{1}{4}$

D. $4x - 2 = \dfrac{1}{2}$

The loudness of a sound can be measured in sones or decibels. The table below shows a comparison between sone level and decibel level.

Sone Level	0.5	1	2	4
Decibel Level (dB)	30	40	50	60

These data can be modelled by a logarithmic regression function of the form

$$y = a + b \cdot \ln x$$

where x represents the sone level and y represents the decibel level.

Numerical Response

7. Based on the logarithmic regression function, a sound that has a decibel level of 85 dB would have a sone level, to the nearest tenth of a sone, of _____ sones.

(Record your answer in the numerical-response section on the answer sheet.)

_____

23. A student is asked to solve the exponential equation $7 = 3^{(5x - 2)}$. A correct first step could be

A. $5x - 2 = \log_3(7)$

B. $(5x - 2)\log 3 = 7$

C. $5x - 2 = \dfrac{7}{3}$

D. $5x - 2 = 3^7$

24. *A student is given the exponential function $y = a \cdot b^x$, where $a > 0$ and $0 < b < 1$. The graph of this function has a y-intercept of ____i____ , and it ____ii____ as you move from left to right.*

The statement above is completed by the information in row

Row	*i*	*ii*
A.	*a*	increases
B.	*a*	decreases
C.	*b*	increases
D.	*b*	decreases

Use the following information to answer numerical-response question 8.

Tatjana consumes a particular energy drink that contains caffeine. The mass of caffeine remaining in her bloodstream, *M*, in mg, can be modelled by the exponential function

$$M = 400(0.5)^{\frac{t}{6}}$$

where *t* is the number of hours after she consumed the energy drink.

Numerical Response

8. To the nearest hour, the length of time that elapses until 100 mg of caffeine remains in Tatjana's bloodstream is _____ h.

(Record your answer in the numerical-response section on the answer sheet.)

Written-response question 1 begins on the next page.

Use the following information to answer written-response question 1.

The motion of a horse on a carousel as it rises and falls is periodic. The blue horse on the carousel shown below starts at its lowest position, 72 cm above the carousel's platform. It takes the blue horse 3.50 s to rise 36 cm to its maximum height and return to its starting position.
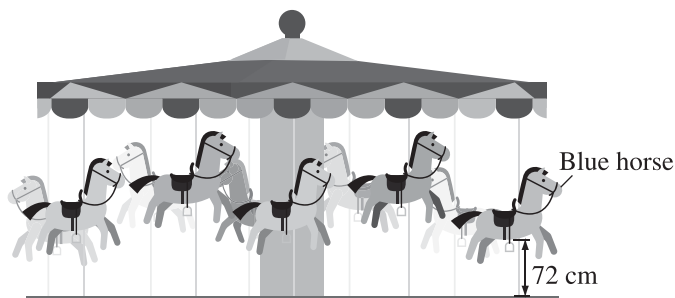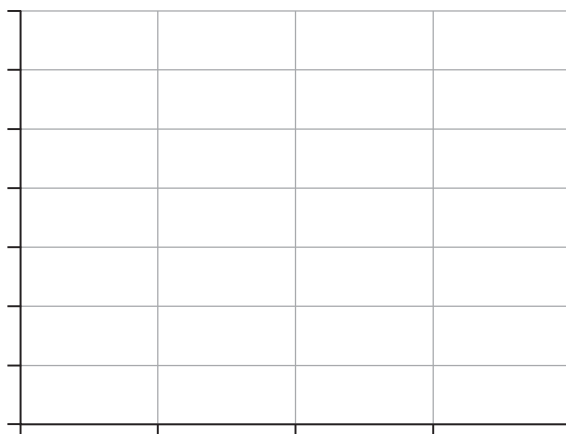

The height of the blue horse over time is recorded in the table below.

Time (s)	Height Above Platform (cm)
0.00	72
1.75	108
3.50	72
5.25	108
7.00	72

Written Response—7 marks

1. a. **Sketch** a sinusoidal graph that models the height of the blue horse above the carousel's platform during the first 7 s of the ride. Label each axis accordingly.

b. State the values of the amplitude, period, and median of the sinusoidal function that models the height of the blue horse above the carousel's platform. Include units of measurement.

       Amplitude:

       Period:

       Median:

c. If the blue horse is lowered 7 cm on its pole, **describe** how the amplitude, period, and median would be affected on the graph of the sinusoidal function.

d. There are exactly 10 horses on the ride; 4 are red, 3 are green, and 3 are blue. If each horse is equally likely to be chosen, **determine** the probability that the first two children in line both select a blue horse. Round to the nearest hundredth if necessary.

Written-response question 2 begins on the next page.

Use the following information to answer written-response question 2.

Chad and Renaud are preparing for a math competition. In order to help them prepare, their teacher has provided a review package.

Written Response—7 marks

2. **a.** Complete the first question from the package, shown below.

Name: _____Chad and Renaud_____

Math Competition - Review Problems

State all the non-permissible values for the rational expression below.

$$\frac{x^2 - 4}{x - 2} \div \frac{2x}{x + 3}$$

b. Complete the second question from the package, shown below.

> *Algebraically determine* the solution to the rational equation shown below.
>
> $$\frac{4x + 3}{x} + \frac{1}{2} = 4$$

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Chad drives the 255 km to the city where the math competition is being held and Renaud drives the 255 km home. On the way to the competition, Chad drives at an average speed of x km/h. On the way home from the competition, Renaud drives at an average speed that is 11 km/h faster than Chad's average speed. Compared to Chad's trip to the competition, Renaud's trip home takes 0.25 h less time.

This information can be represented in a table, as outlined below.

	Distance (km)	Average Speed (km/h)	Time (h)
Chad	255		
Renaud	255		

c. Write a rational equation that represents the relationship between Chad's and Renaud's driving times for the trip to the competition and the trip home.

d. Before the competition begins, three door prizes of $50 will be given to 3 different participants. Chad would like to calculate the total number of different possible prize-winning groups that consist of 3 different participants. Identify whether his calculation should be completed using permutations or combinations. **Justify** your answer.

Written-response Question 1 Sample Solution

Use the following information to answer written-response question 1.

The motion of a horse on a carousel as it rises and falls is periodic. The blue horse on the carousel shown below starts at its lowest position, 72 cm above the carousel's platform. It takes the blue horse 3.50 s to rise 36 cm to its maximum height and return to its starting position.
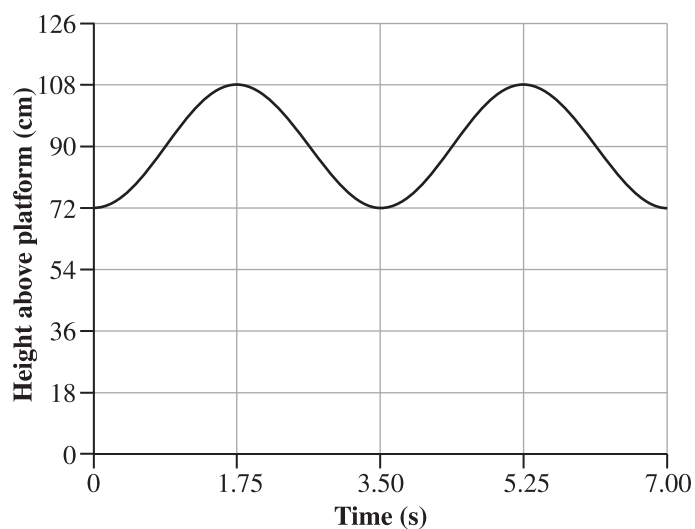

Blue horse

72 cm
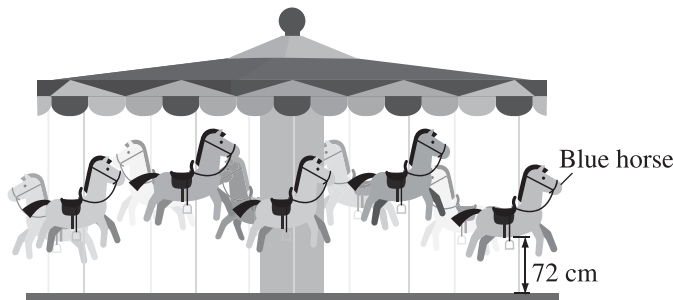
The height of the blue horse over time is recorded in the table below.

Time (s)	Height Above Platform (cm)
0.00	72
1.75	108
3.50	72
5.25	108
7.00	72

1. **a.** **Sketch** a sinusoidal graph that models the height of the blue horse above the carousel's platform during the first 7 s of the ride. Label each axis accordingly.

A possible solution to WR 1 Part a

b. State the values of the amplitude, period, and median of the sinusoidal function that models the height of the blue horse above the carousel's platform. Include units of measurement.

A possible solution to WR 1 Part b

Amplitude	18 cm
Period	3.5 s
Median	90 cm

c. If the blue horse is lowered 7 cm on its pole, **describe** how the amplitude, period, and median would be affected on the graph of the sinusoidal function.

A possible solution to WR 1 Part c

All the points of the graph of the sinusoidal function will move down 7 cm; therefore, the value of the

- amplitude would remain the same (i.e., 18 cm)
- period would remain the same (i.e., 3.5 s)
- median would decrease 7 cm (i.e., 83 cm).

d. There are exactly 10 horses on the ride; 4 are red, 3 are green, and 3 are blue. If each horse is equally likely to be chosen, **determine** the probability that the first two children in line both select a blue horse. Round to the nearest hundredth if necessary.

A possible solution to WR 1 Part d

$$P \text{ (blue and blue)} = \frac{3}{10} \cdot \frac{2}{9}$$

$$= \frac{6}{90}$$

$$= \frac{1}{15}$$

$$= 0.066\ 666$$

The probability that the first two children in line both select a blue horse is 0.07.

Written Response Question 2 Sample Solution

Use the following information to answer written-response question 2.

Chad and Renaud are preparing for a math competition. In order to help them prepare, their teacher has provided a review package.

Written Response—7 marks

2. **a.** Complete the first question from the package, shown below.

Name: _____ Chad and Renaud _____

Math Competition - Review Problems

State all the non-permissible values for the rational expression below.

$$\frac{x^2 - 4}{x - 2} \div \frac{2x}{x + 3}$$

A possible solution to WR 2 Part a

$x \neq -3,\ 0,\ 2$

b. Complete the second question from the package, shown below.

> *Algebraically determine* the solution to the rational equation shown below.
>
> $$\frac{4x + 3}{x} + \frac{1}{2} = 4$$

A possible solution to WR 2 Part b

$$\frac{4x + 3}{x} + \frac{1}{2} = 4$$

$$2(4x + 3) + x = 8x$$

$$8x + 6 + x = 8x$$

$$x = -6$$

Use the following information to answer the next part of the question.

Chad drives the 255 km to the city where the math competition is being held and Renaud drives the 255 km home. On the way to the competition, Chad drives at an average speed of *x* km/h. On the way home from the competition, Renaud drives at an average speed that is 11 km/h faster than Chad's average speed. Compared to Chad's trip to the competition, Renaud's trip home takes 0.25 h less time.

This information can be represented in a table, as outlined below.

	Distance (km)	Average Speed (km/h)	Time (h)
Chad	255		
Renaud	255		

c. Write a rational equation that represents the relationship between Chad's and Renaud's driving times for the trip to the competition and the trip home.

A possible solution to WR 2 Part c

Let x represent Chad's average speed in km/h.

$$\frac{255}{x} = \frac{255}{x+11} + \frac{1}{4}$$

d. Before the competition begins, three door prizes of $50 will be given to 3 different participants. Chad would like to calculate the total number of different possible prize-winning groups that consist of 3 different participants. Identify whether his calculation should be completed using permutations or combinations. **Justify** your answer.

A possible solution to WR 2 Part d

Chad should use combinations to calculate the number of prize-winning groups possible. Since the 3 participants will each receive the same $50 prize, the order in which the participants are selected does not need to be considered.

Scoring Guide for Written-response Question 1

WR 1 Part a

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • incorrectly sketches a graph
0.5		For example, the student could • accurately sketch the sinusoidal graph, but does not label the axes or shows an inconsistent scale OR • accurately plot the points and labels the axes, but does not correctly draw the sinusoidal curve
1	In the response, the student applies appropriate mathematical knowledge to find a complete and correct solution.	In the response, the student • accurately sketches the sinusoidal graph and labels the axes correctly, with an appropriate scale

WR 1 Part b

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • does not correctly identify any of the characteristics
0.5		For example, the student could • correctly identify one characteristic, with or without the unit of measurement
1	In the response, the student demonstrates basic mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.	In the response, the student • correctly identifies two characteristics, with or without units of measurement
1.5		For example, the student could • correctly identify all three characteristics, but does not include units of measurement or uses incorrect units of measurement
2	In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.	In the response, the student • correctly identifies all three characteristics, with the correct units of measurement

Note: Students can still receive partial marks if they use an incorrectly drawn sinusoidal graph from part a.

WR 1 Part c

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • provides an incorrect description of the characteristics
0.5		For example the student could • state that all the points on the graph moves down 7 units OR • only state that the median decreases without including numerical values
1	In the response, the student demonstrates basic mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.	In the response, the student • provides a complete and correct description of one characteristic
1.5		For example the student could • provide a complete and correct description of two of the characteristics OR • state the new value of all three characteristics and does not provide any descriptions
2	In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.	In the response, the student • provides a complete and correct description of all three characteristics

WR 1 Part d

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • determines the probability of one event only
0.5		For example, the student could • incorrectly determine the probability of independent events and then add the probabilities
1	In the response, the student demonstrates basic mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.	In the response, the student • correctly determines the probability of each event, but does not combine them or incorrectly combines them OR • determines the correct probability of one of the events, but continues with a correct process using the correct and incorrect probabilities to provide a solution

1.5		For example, the student could
		• correctly determine the probability of each event, but
		  - makes a minor calculation error in the final probability
		  or
		  - expresses the final probability as a percent without the percent symbol

2	In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.	In the response, the student • determines the correct probability of the dependent events

Note: Any equivalent probability can receive full marks.

Scoring Guide for Written-response Question 2

WR 2 Part a

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • states any additional incorrect non-permissible values
0.5		For example, the student could • state two of the three correct non-permissible values
1	In the response, the student applies appropriate mathematical knowledge to find a complete and correct solution.	In the response, the student • correctly states all three non-permissible values

WR 2 Part b

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • states the correct answer with no supporting work
0.5		For example, the student could • correctly identify a common denominator and attempt to eliminate the denominators OR • correctly apply a common denominator to the left side only, and continues to solve for x, $\left(\text{e.g., } x = -\dfrac{2}{9}\right)$
1	In the response, the student demonstrates basic mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.	In the response, the student • identifies a common denominator, eliminates the denominators correctly, and obtains a linear equation
1.5		For example, the student could • obtain a correct linear equation, but makes a minor algebraic error in solving for x
2	In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.	In the response, the student • correctly determines the solution to the equation algebraically

WR 2 Part c

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • incorrectly completes the table and/or writes incorrect expressions
0.5		For example the student could • write correct expressions representing Chad and Renaud's time only OR • write the correct expression representing Chad's time and attempts to write an appropriate time equation
1	In the response, the student demonstrates basic mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.	In the response, the student • writes the correct expressions for Chad's and Renaud's times, and attempts to write an appropriate time equation
1.5		For example the student could • write an incorrect speed expression for Renaud but in an appropriate time equation
2	In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.	In the response, the student • writes a correct equation that represents the relationship between the driving times

Note: The table does not have to be completed for a student to receive full marks.

WR 2 Part d

Score	General Description	Specific Description
NR	No response is provided.	
0	In the response, the student does not address the question or provides a solution that is invalid.	In the response, the student • incorrectly states that permutations should be used, with or without justification

0.5		For example, the student could
		• correctly state that combinations should be used:
		
		  - with no justification
		
		  or
		
		  - with the definition of a combination only

1	In the response, the student demonstrates basic mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.	In the response, the student • correctly states that combinations should be used, but provides an incomplete justification
1.5		For example, the student could • correctly state that combinations should be used, but provides a justification that lacks clarity OR • provide a clear and complete justification, but does not clearly state their position
2	In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.	In the response, the student • correctly states that combinations should be used, and provides a clear and complete justification