Mathematics 30–2

Released Items

2016 Released Diploma Examination Items

Alberta Government

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Distribution: This document is posted on the Alberta Education website.

Contents

Introduction

The questions in this booklet are from the August 2013 Mathematics 30–2 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*. This material, along with the *Program of Studies*, *Information Bulletin*, and the *Assessment Standards and Exemplars*, can provide insights that assist with decisions about instructional planning.

These questions are released in both English and French by the Provincial Assessment Sector.

Additional Documents

The Provincial Assessment Sector supports the instruction of Mathematics 30–2 with the following documents available online.

- *Mathematics 30–2 Information Bulletin* and *Mathematics 30–2 Assessment Standards and Exemplars*

- *Mathematics 30–2 Practice Questions*
  Some practice questions have been released for Mathematics 30–2.

- *School Reports and Instructional Group Reports*
  Detailed statistical information on provincial, group, and individual student performance on the entire examination.

Mathematics 30–2 Diploma Examination
August 2013 – Blueprint Summary

The following table gives results for the machine-scored questions released from the examination and shows the percentage of students that answered each question correctly. For each question, the table also gives the correct response, the topic, the outcome, the standard, and the cognitive levels.

Topics
LR Logical Reasoning
PR Probability
RF Relations and Functions

Standards
Acceptable
Excellence
Cognitive Level
Conceptual
Procedural
Problem Solving

Question	Diff.*	Key	Topic	Outcome	Cognitive Level	Standard
MC1	82.3%	B	LR	1	Problem Solving	Acceptable
MC2	98.2%	C	LR	1	Problem Solving	Acceptable
NR1	74.1%	1531	LR	1	Problem Solving	Acceptable
MC3	97.8%	C	LR	2	Conceptual	Acceptable
MC4	45.9%	D	LR	2	Conceptual	Acceptable
NR2	69.0%	413	LR	2	Conceptual	Acceptable
MC5	81.6%	B	LR	2	Problem Solving	Excellence
MC6	85.8%	D	LR	2	Conceptual	Acceptable
NR3	80.9%	80	PR	4	Procedural	Acceptable
MC7	71.8%	B	PR	4	Problem Solving	Acceptable
NR4	66.1%	6720	PR	5	Problem Solving	Acceptable
MC8	31.3%	A	PR	5	Conceptual	Acceptable
MC9	65.0%	B	PR	6	Problem Solving	Excellence
MC10	45.9%	D	PR	6	Conceptual	Excellence
NR5	52.5%	3360	PR	5	Problem Solving	Acceptable
MC11	54.3%	A	PR	1	Conceptual	Acceptable
MC12	53.7%	C	PR	1	Conceptual	Acceptable
MC13	59.2%	B	PR	2	Procedural	Excellence
MC14	50.8%	A	PR	3	Procedural	Acceptable

Question	Diff.*	Key	Topic	Outcome	Cognitive Level	Standard
NR6	27.3%	0.21	PR	3	Problem Solving	Acceptable
MC15	45.0%	D	RF	6	Conceptual	Acceptable
MC16	65.2%	B	RF	5	Conceptual	Acceptable
MC17	61.9%	D	RF	6	Conceptual	Excellence
MC18	75.4%	C	RF	6	Problem Solving	Acceptable
MC19	84.3%	A	RF	5	Procedural	Acceptable
NR7	48.8%	255	RF	6	Procedural	Acceptable
MC20	30.4%	B	RF	4	Conceptual	Acceptable
MC21	70.1%	C	RF	4	Procedural	Acceptable
NR8	35.9%	5	RF	4	Procedural	Acceptable
MC22	56.8%	D	RF	1	Procedural	Acceptable
NR9	37.9%	586	RF	2	Procedural	Acceptable
MC23	64.3%	A	RF	1	Problem Solving	Excellence
MC24	70.3%	A	RF	1, 2	Problem Solving	Acceptable
NR10	62.7%	4.3	RF	7	Problem Solving	Acceptable
MC25	51.4%	D	RF	3	Problem Solving	Excellence
NR11	14.9%	8192	RF	7	Problem Solving	Acceptable
MC26	55.7%	C	RF	7	Conceptual	Acceptable
MC27	68.1%	B	RF	8	Conceptual	Acceptable
NR12	43.7%	5.85	RF	8	Procedural	Acceptable
MC28	83.8%	A	RF	8	Conceptual	Acceptable

*Difficulty—proportion of students answering the question correctly

Mathematics 30–2 Diploma Examination
August 2013 – Released Items

*Use the following information to answer the first question.*

Sarah's parents promise to pay her $1.00 for doing her Monday chores. For the remainder of the week, they promise to double her previous day's pay if she continues doing her chores.

1. If Sarah does her chores for all seven days that week, her parents will pay her

    A. $190

    B. $127

    C. $43

    D. $28

Use the following information to answer the next question.

In a particular game, drawings consist of circles or squares. Different letters are used to describe the type of shape, the number of shapes, and the arrangement of the shapes in the drawing. Five drawings from a particular game are shown below.

CDE **ACF** **BDF**

ABE **ACE**
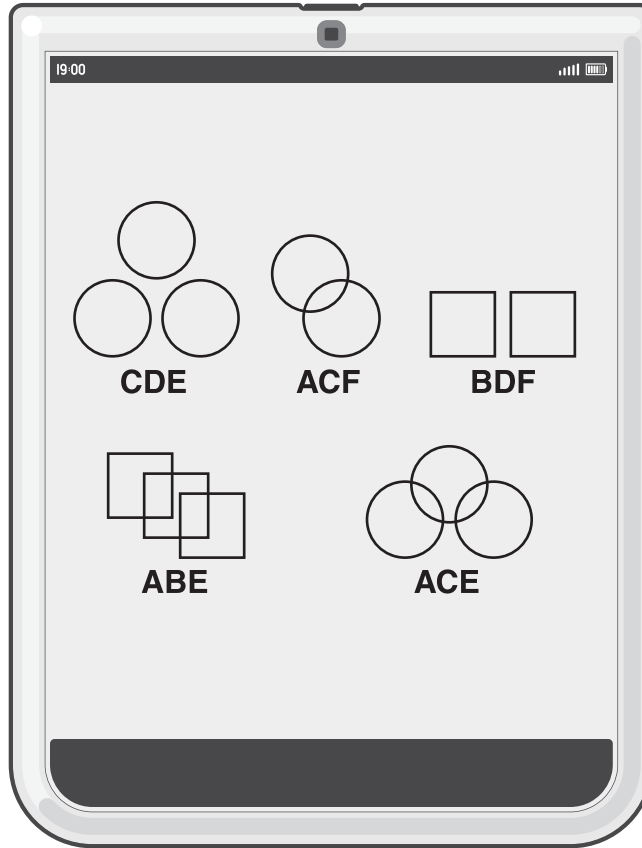
2. Based on the drawings above, which of the following statements about the letter *A* is true?

A. The letter *A* represents circles.

B. The letter *A* represents squares.

C. The letter *A* represents overlapping shapes.

D. The letter *A* represents the number of shapes in the drawing.

The puzzle below requires a player to fill all the squares with the digits 1 through 9 inclusive so that the digits add up to the numbers shown in the triangles. For example, in the 2nd column, the entries are 8 and 5, which have a sum of 13.

	13	9	17			7	5
13	8	A	4	10	5 / 4	2	3
32	5	6	8	7	C	1	2
	15	2	B	3	D	4	

Numerical Response

1. In the completed puzzle, 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.)

Two Sets

$A = \{a, b, e, i, k, l, r\}$
$B = \{a, c, e, k, l, m, o, p\}$

3. Which of the following words can be formed from the elements in the intersection of sets A and B?

    A. bake

    B. cake

    C. lake

    D. rake

Sets S and T are represented by the Venn diagram shown below.
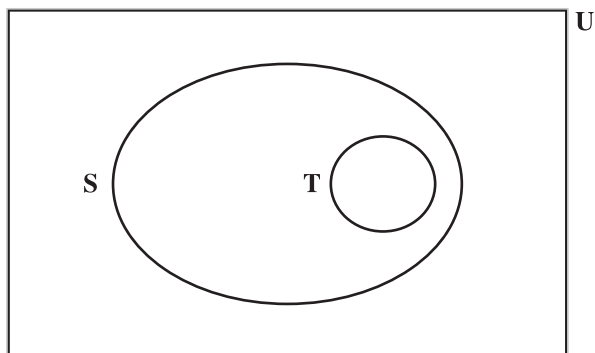
4. Which of the following statements is true for sets S and T?

    A. $S \subset T$

    B. $T \subset S'$

    C. $S \cap T = \varnothing$

    D. $S \cup T = S$

Use the following information to answer the next question.

Tim was given three Venn diagrams with shading to represent a set operation. These diagrams are followed by four possible set operations.
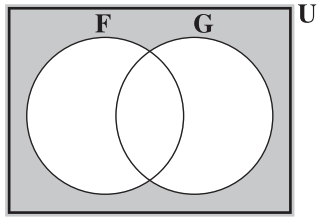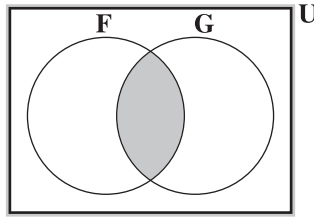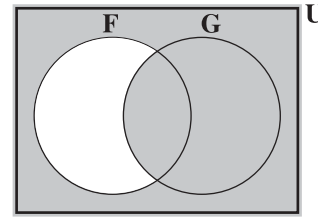

| Diagram **A** | Diagram **B** | Diagram **C** |

Set Operation	Reference Number
$F \cap G$	1
$F \cap G'$	2
$F' \cup G$	3
$(F \cup G)'$	4

Numerical Response

2. Match each Venn diagram shown above with the reference number of the set operation that produces that diagram's shaded region. (Use any reference number only once.)

Reference Number: _____ _____ _____
       Diagram: **A**   **B**   **C**
                 (Record in the   (Record in the   (Record in the
                 first column)   second column)   third column)

(Record all **three digits** of your answer in the numerical-response section on the answer sheet.)

A particular junior high school offers cooking, drama, and computer courses as options. Students at the school were surveyed to determine which options they are enrolled in. The Venn diagram below represents the data that were collected.
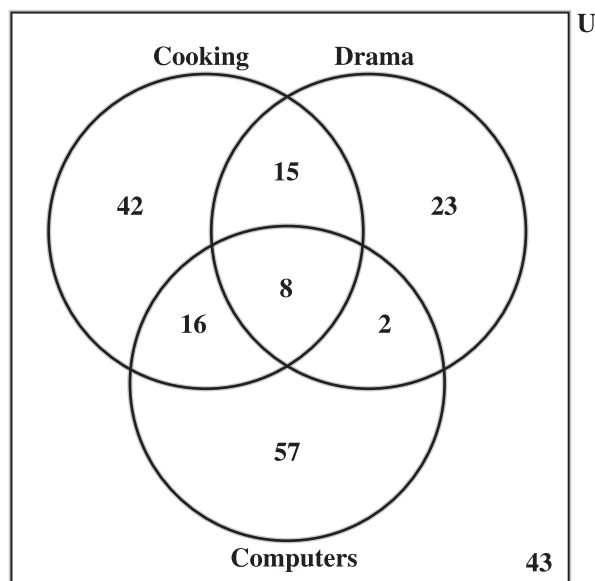

5. The number of students enrolled in cooking or drama but **not** computers is

A. 15

B. 80

C. 106

D. 123

Man-Wai surveyed residents of a retirement home to determine what languages other than English they spoke. She reported that the residents who were surveyed spoke German (G), French (F), or both German and French. In total, 45 people spoke French.

6. Which of the following Venn diagrams could model the results of Man-Wai's survey?

A.

B.

C.

D.
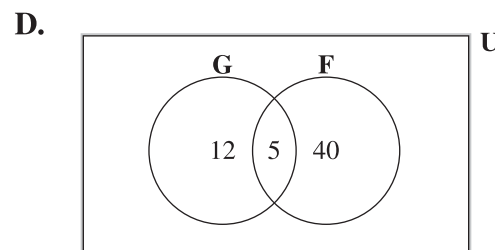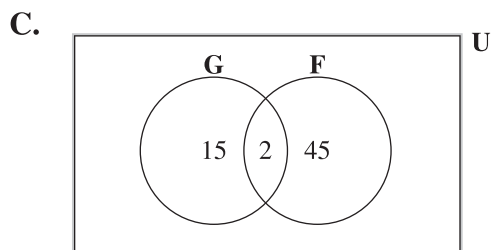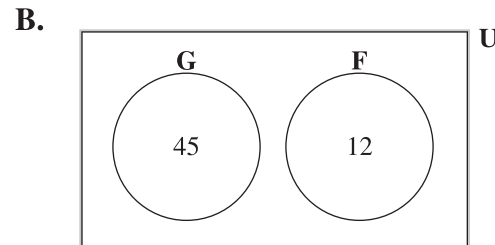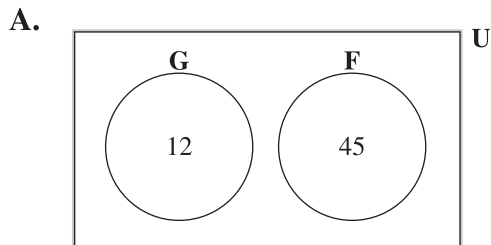
Simon has the following options to choose from for the new car he plans to purchase.

- 4 different models
- 2 different transmissions
- 2 different interior colours
- 5 different exterior colours

Simon must select one item from each option.

Numerical Response

3. The number of different cars that Simon can choose from is _____.

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

Logging-truck licence plates in British Columbia begin with a T followed by 5 digits, as shown below. The first digit must be a 0, 1, 2, or 3. The remaining digits can be any digit from 0 to 9 inclusive.

7. The total number of possible logging-truck licence plates in British Columbia is

    A.   20 160

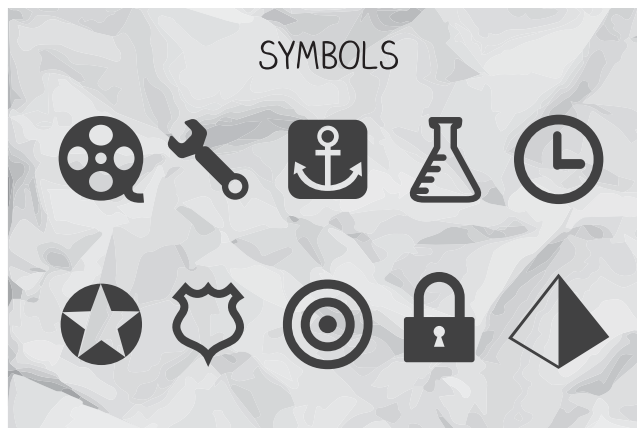   **B.**   40 000

    C.   786 240

    D.   1 040 000

Numerical Response

4. The number of distinguishable arrangements of all the letters in the word **BOOKWORM** is _____.

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

The following symbols are selected and arranged to create various code "words." No symbol can be repeated in a code word.

SYMBOLS

8. Which of the following calculations could be used to determine the number of possible code words that can be created when **at least** 8 symbols are selected and arranged?

A. $_{10}P_8 + {}_{10}P_9 + {}_{10}P_{10}$

B. $_{10}P_8 \cdot {}_{10}P_9 \cdot {}_{10}P_{10}$

C. $_{10}C_8 + {}_{10}C_9 + {}_{10}C_{10}$

D. $_{10}C_8 \cdot {}_{10}C_9 \cdot {}_{10}C_{10}$

Use the following information to answer the next question.

A high-school volleyball coach is selecting members for the volleyball team, and there are 7 power players, 6 middle players, 3 right sides, and 4 setters trying out for the team. The coach must select the following players:

- 4 power players
- 3 middle players
- 2 right sides
- 2 setters

9. The number of different teams that the coach can select is

A. 504

B. 12 600

C. 167 960

D. 7 257 600

Stéphane is going to randomly select 10 songs from the list shown below to create a playlist.

Category	Number of Songs
Rock 'n' Roll	6
Classical	5
Jazz	8
Country	10

10. Which of the following calculations could be used to determine the number of 10-song playlists that contain two or three country songs?

A. $_{10}C_2 \cdot {_{10}C_3}$

B. $_{10}C_2 + {_{10}C_3}$

C. $_{10}C_2 \cdot {_{19}C_8} \cdot {_{10}C_3} \cdot {_{19}C_7}$

D. $_{10}C_2 \cdot {_{19}C_8} + {_{10}C_3} \cdot {_{19}C_7}$

An executive committee consisting of a president, a secretary, and a treasurer is to be formed from a group of 16 students.

Numerical Response

5. The number of different executive committees that can be formed is _____.

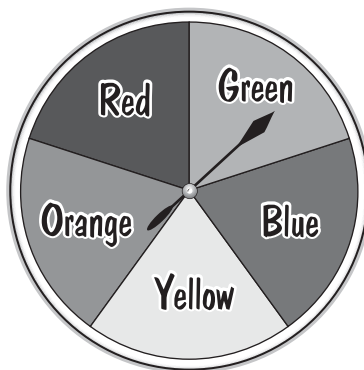(Record your answer in the numerical-response section on the answer sheet.)

A recent survey of 100 students found that 25 own both a smartphone and a tablet.

11. The odds in favour of a randomly selected student owning both a smartphone and a tablet are

    A.   1 : 3
    B.   3 : 1
    C.   1 : 4
    D.   4 : 1

The odds in favour of the spinner landing on the region labelled red on the spinner shown below are 1 : 4.

12. A new spinner is being developed. The red region will be twice as large as the red region shown above, the green region will be eliminated, and the blue, yellow, and orange regions will stay the same. The odds in favour of the spinner landing on the red region in this new spinner are

    A.   1 : 3
    B.   1 : 4
    C.   2 : 3
    D.   2 : 5

A survey of students was used to estimate the percentage of students who do homework in the evenings and the percentage who watch television. The survey found that

- 52% did homework
- 45% did homework and watched television
- 75% did homework or watched television

13. The probability that a randomly selected student watched television only is

    A. 0.07

    B. 0.23

    C. 0.25

    D. 0.68

A candy dish contains 2 blue candies, 1 red candy, 3 white candies, and 2 green candies. Two candies will be randomly selected from the dish, one after the other, without replacement.

14. The probability of selecting a blue candy and then a candy that is **not** blue is

    A. $\dfrac{3}{14}$

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

    C. $\dfrac{1}{16}$

    D. $\dfrac{1}{28}$

Use the following information to answer the next question.

A box contains 6 red balls, 2 green balls, and 5 blue balls. Renée randomly selects 2 balls, one after the other, with replacement.

Numerical Response

6. To the nearest hundredth, the probability that both balls that Renée selects from the box are red is _____.

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

———————————————————————————

Use the following information to answer the next question.

Amin is determining how many ancestors he had from the past 10 generations. He notes that 1 generation ago he had 2 ancestors, 2 generations ago he had 4 ancestors, 3 generations ago he had 8 ancestors, and so on.
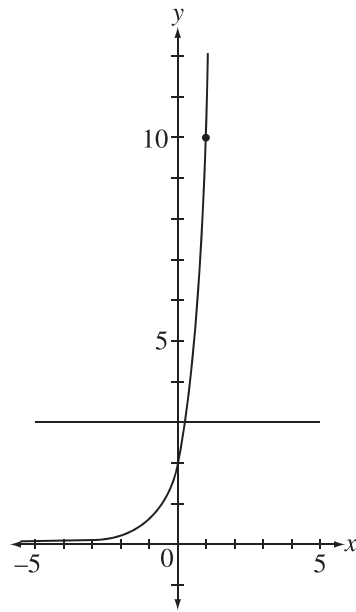
15. These data could **most appropriately** be modelled using

    A.   linear regression
    B.   quadratic regression
    C.   sinusoidal regression
    D.   exponential regression

16. Which of the following graphs could be used to determine the solution to the equation $3 = 2 \cdot 5^x$?
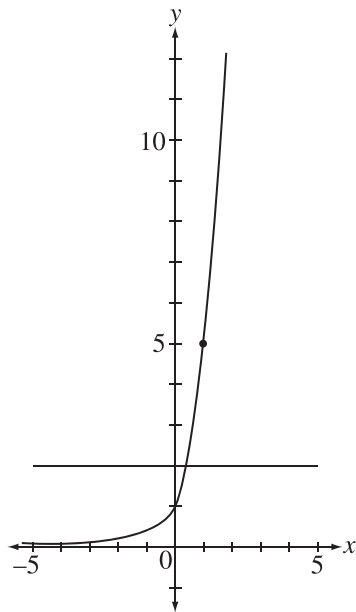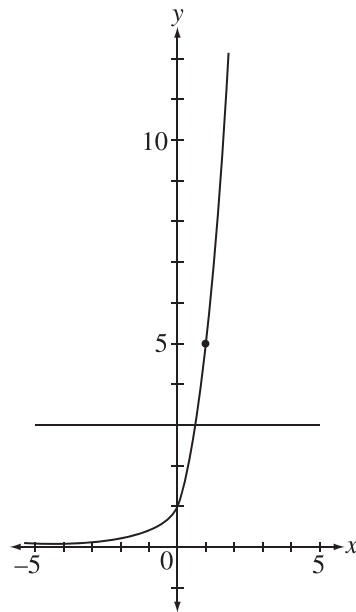
A.
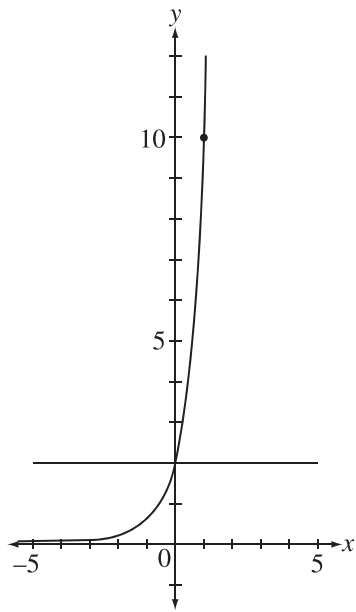
B.

C.

D.

Use the following information to answer the next question.

Since 2007, Alberta has had an average annual population growth rate of 2.1%/a. The population of Alberta in 2007 was approximately 3 490 000.

17. Assuming the average annual population growth rate remains constant, which of the following equations could be used to determine the number of years, n, required for the population to increase to 6 000 000?

   A. $3\,490\,000 = 6\,000\,000\,(0.021)^n$

   B. $3\,490\,000 = 6\,000\,000\,(1.021)^n$

   C. $6\,000\,000 = 3\,490\,000\,(0.021)^n$

   D. $6\,000\,000 = 3\,490\,000\,(1.021)^n$

Use the following information to answer the next question.

Every year Jodi determines the average height of the trees in her backyard, as shown in the table below.

Year Since Planting	Average Height (ft)
1	4.2
2	6.2
3	7.8
4	9.1
5	10.0
6	10.3
7	10.5

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

$$h = a + b \cdot \ln t$$

where h is the average height of the trees after t years.

18. According to this regression function, the average height of these trees 12 years after Jodi planted them, to the nearest tenth of a foot, will be

   A.   7.5 ft

   B.   9.9 ft

   C.   12.7 ft

   D.   16.7 ft

19. The value of x in the equation $729^{(x-1)} = 9^{(2x-1)}$ is

    A. 2

    B. 0

    C. −2

    D. −4

Use the following information to answer the next question.

Once growing conditions are ideal, the population of a certain bacteria doubles every 20 minutes. Starting from a single bacterium, the number of bacteria, E, present after m minutes can be modelled by the formula

$$E = 2^{\frac{m}{20}}$$

Numerical Response

7. To the nearest minute, the time it will take for there to be at **least** 6 800 bacteria is _____ min.

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

_____

20. Given $\log_b c = a, b \neq 1,$ which of the following statements must be true?

    A. $b > 0$ and $a > 0$

    B. $b > 0$ and $c > 0$

    C. $b > c$ and $a > 0$

    D. $a > b$ and $c > 0$

21. Which of the following expressions is equivalent to $3^x = y$?

    A. $\log_x y = 3$

    B. $\log_y 3 = x$

    C. $\log_3 y = x$

    D. $\log_3 x = y$

8. When $\log_6 40 - 3\log_6 2$ is simplified and written in the form $\log_6 a$, the value of a is _____.

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

22. Which of the following expressions is equivalent to $\dfrac{2x^2 - 4x}{x^2 - 4}$, $x \neq -2, 2$?

A. $2x$

B. $2 - x$

C. $\dfrac{2x}{x - 2}$

D. $\dfrac{2x}{x + 2}$

The simplified sum of $\dfrac{x+4}{3x} + \dfrac{1}{2}$, $x \neq 0$, can be written in the form

$$\dfrac{\boxed{A}x + \boxed{B}}{\boxed{C}x}$$

where A, B, and C represent single-digit numbers.

Numerical Response

9. In the simplified sum $\dfrac{\boxed{A}x + \boxed{B}}{\boxed{C}x}$, 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.)

_____

23. Which of the following expressions is equivalent to $\dfrac{5}{3x+5}$, $x \neq \dfrac{-5}{3}, 0, \dfrac{5}{3}$?

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

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

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

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

Jenny was asked to simplify

$$\frac{x+1}{x^2-1} \div \frac{x+1}{x-1}, x \neq -1, 1$$

24. Which of the following is a correct simplification of this expression?

A. $\dfrac{{}^{1}\!\!\!\not{x+1}}{{}^{1}\!(\not{x-1})(x+1)} \cdot \dfrac{{}^{1}\!\!\!\not{x-1}}{{}^{1}\!\!\!\not{x+1}} = \dfrac{1}{x+1}$

B. $\dfrac{{}^{1}\!\!\!\not{x+1}}{(x-1)(\not{x+1})^{1}} \cdot \dfrac{x+1}{x-1} = \dfrac{x+1}{(x-1)^2}$

C. $\dfrac{{}^{1}\!\!\!\not{x+1}}{{}^{1}(\not{x-1})(x-1)} \cdot \dfrac{{}^{1}\!\!\!\not{x-1}}{{}^{1}\!\!\!\not{x+1}} = \dfrac{1}{x-1}$

D. $\dfrac{x+1}{(x-1)(x-1)} \cdot \dfrac{x+1}{x-1} = \dfrac{(x+1)^2}{(x-1)^3}$

The height, h, in metres, of an object in free fall after t seconds can be modelled by the quadratic function

$$h = -4.9t^2 + 100, t > 0$$

Numerical Response

10. To the nearest tenth of a second, the object will reach a height of 10 m after _____ s.

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

When there is no wind, a runner is able to run 10 000 m at an average speed of x m/s. When he runs with a tailwind, his average speed increases by 0.05 m/s and it takes him 15 s less to run the 10 000 m.

The equation shown below represents this relationship.

$$\frac{10\ 000}{x} - \frac{10\ 000}{x + 0.05} = 15, x > 0$$

25. When there is no wind, the runner's average speed, to the nearest hundredth of a metre per second, is

    A.   33.33 m/s

    B.   25.79 m/s

    C.   5.80 m/s

    D.   5.75 m/s

Use the following information to answer the next question.

The volume, V, in cubic inches, of a fish tank can be modelled by the function

$$V = h(48 - 2h)^2$$

where h is the height of the fish tank in inches and $0 < h < 24$.

Numerical Response

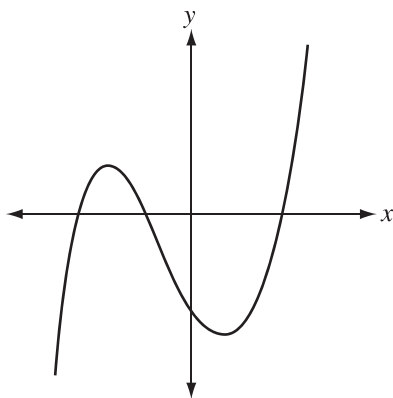**11.** To the nearest cubic inch, the maximum volume of this fish tank is _____ in^3.

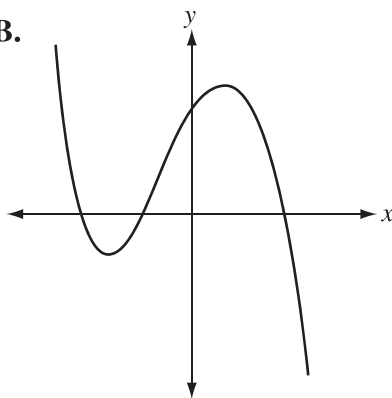(Record your answer in the numerical-response section on the answer sheet.)

An equation of a particular cubic function is $y = (x - m)(x - n)(x + p)$, where m, n, and p are different whole numbers.

26. Which of the following could be the graph of this polynomial function?
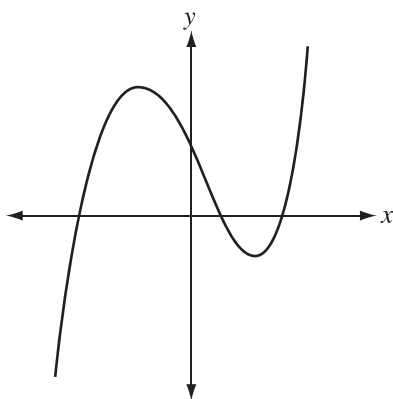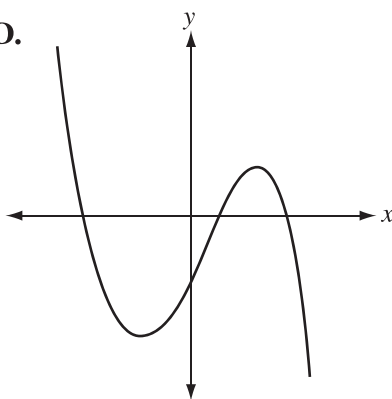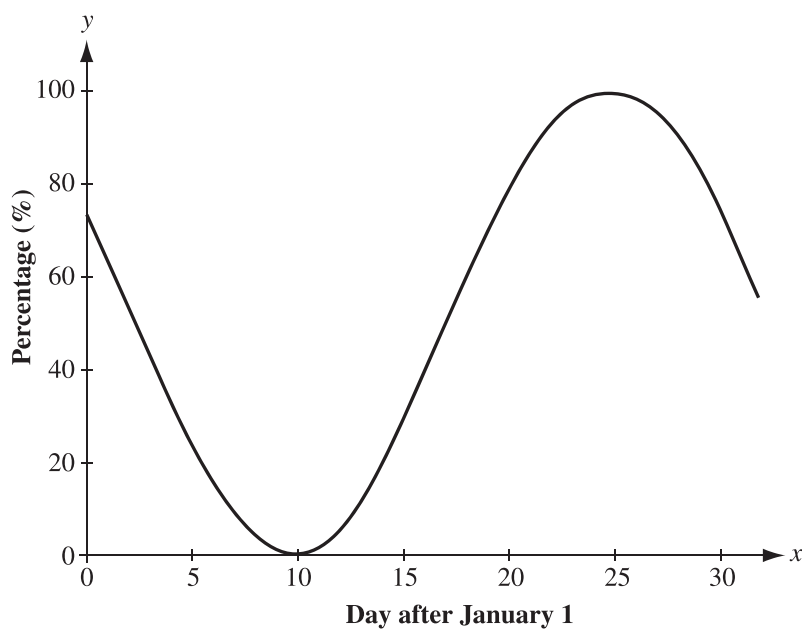
A.

B.

C.

D.

To model the percentage of the surface of the moon that will be visible from Alberta in January 2016, a student graphed the regression function shown below.

27. To predict when the surface of the moon will **not** be visible, the student used the graph shown above and determined

  A. a y-intercept
  B. an x-intercept
  C. a maximum value
  D. a point on the midline

Use the following information to answer the next question.

The sunrise time for a particular Alberta city can be modelled by the sinusoidal regression function

$$S = 1.51 \sin(0.0172d + 1.51) + 7.00$$

where S is the sunrise time in hours after midnight, and d is the number of days since the beginning of the year (January 1 = 1, January 2 = 2, etc.).
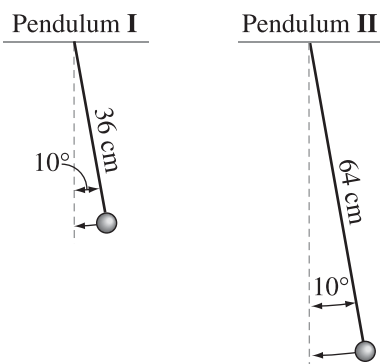
Numerical Response

12. According to the sinusoidal regression function, the sunrise time on August 15 (Day 227), to the nearest hundredth of an hour, is _____ h after midnight.

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

The two pendulums shown below are allowed to complete one swing.

Pendulum **I**   Pendulum **II**

10°   36 cm

64 cm

10°

The number of degrees the pendulum swings from vertical is measured at regular time intervals and recorded. The number of degrees to the right of vertical is recorded as positive, and the number of degrees to the left of vertical is recorded as negative. The graphs representing the degrees from vertical as a function of time, in seconds, for each pendulum are shown below.
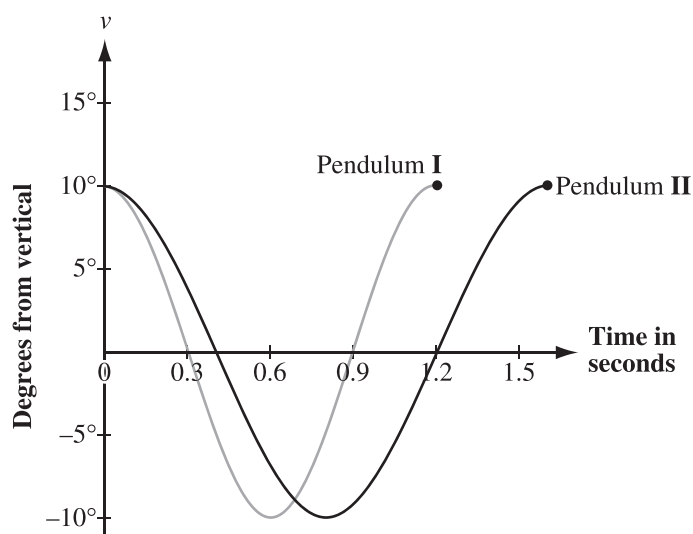
28. The sinusoidal function representing pendulum I differs from the sinusoidal function representing pendulum II in its

   A. period
   B. amplitude
   C. median value
   D. maximum value