Name: _____ Date: _____

MathLinks 9 Option 1
Final Exam Multiple Choice and
Numerical Response

*Record your answers on the answer sheet provided.*

Sports Events

Sports events, such as the Olympic Summer and Winter Games, make use of mathematics. Apply your knowledge and skills of mathematics to solve problems related to sports events.

Use this information to answer #1–3.

The Olympic Village houses athletes, as well as officials and trainers. A railing at the Olympic Village had this design.
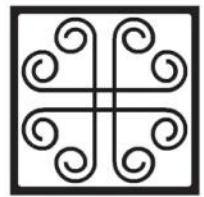
1. What is the order of rotation of the design?

   A 1   **B** 2   **C** 3   **D** 4

2. What is the angle of rotation of the design?

   A 45°   **B** 90°   **C** 180°   **D** 360°

Numerical Response

3. How many lines of symmetry does the design have?

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Use this information to answer #4.

Juan will win a free ticket to a sporting event if he answers this skill-testing question correctly.

$(10 - 4)^3 \div 9 \times 3 \div 6 + 10$

4. What is the answer to the skill-testing question?

    A 13   **B** 14   **C** 22   **D** 24

Use this diagram to answer #5.

The diagram shows a metal sculpture in the Olympic Village.
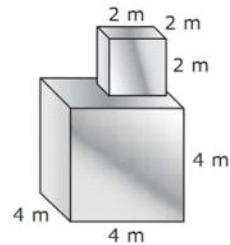
5. How much paint is needed to cover the exposed surface area of the sculpture?

    A 120 m²   **B** 100 m²   **C** 96 m²   **D** 80 m²

6. A food services company at the Olympic Games wants to know if their employees prefer working four 10-h shifts or five 8-h shifts. They plan to survey the first hundred employees who enter the workplace. These employees represent a

    A population   **B** proportion   **C** ratio   **D** sample

Use this information to answer #7–8.

Terri attended the Olympic Games. During her four-night stay, her share of the hotel was $79 per night. She spent $350 for food and the flight cost $612. She was repaid $20 in shared taxi costs. Before paying for these expenses, the balance in Terri's account is $1542.12.

7. Which expression represents the transactions?

    A $(4 \times -79) - 350 - 612 + 20$ **B** $(4 \times 79) - (350 - 612) + 20$

   **C** $4 \times (79 - 350 - 612) + 20$ **D** $4 \times 79 - 350 - 612 + 20$

Numerical Response

8. Determine Terri's new bank balance, to the nearest dollar.

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Use this diagram to answer #9.

The diagram shows the floor plan of a cabin for officials at a sports event.
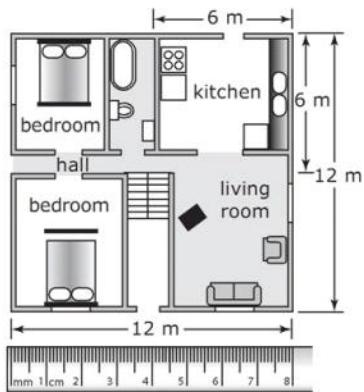
9. What is the most appropriate scale for the drawing?

    A 1 cm = 0.5 m   **B** 1 mm = 1 m   **C** 1 cm = 1.5 m   **D** 1 mm = 2 m

Use this information to answer #10–11.

A plane begins its descent to an airport. The table shows the altitude of the plane after each minute.

Time (min)	Altitude (m)
0	12 000
1	11 600
2	11 200
3	10 800

10. An expression for the altitude of the plane after t minutes is

    A $a = -12\,000t + 400$ **B** $a = 12\,000 + 400t$

    C $a = 12\,000 - 400$ **D** $a = 12\,000 - 400t$

Numerical Response

**11.** What is the plane's altitude after 28 min?

Numerical Response

12. Dale estimates that he spends 20¢ in fuel to warm up his car and 8¢ per kilometre to drive it. He travels 692 km to watch a hockey game. What did Dale spend on fuel, to the nearest dollar?

Use this information to answer #13.

> The organizers of a sports event plan to offer a dinner in the arena. The rental cost of the arena is $800. The food has been donated by local sponsors. The organizers plan to charge $16 per person for dinner.

13. Which graph best represents the profit?
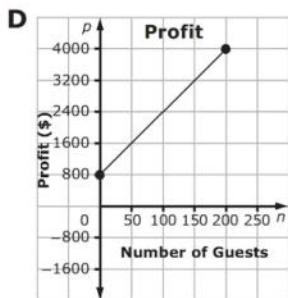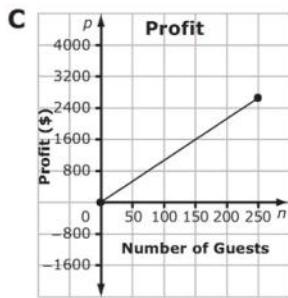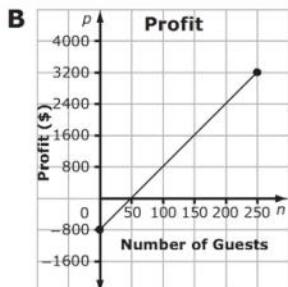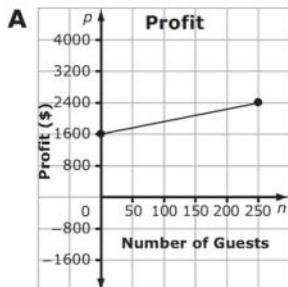
Use this information to answer #14.

> A plane carrying several sports teams approaches the runway for a landing.
>
>
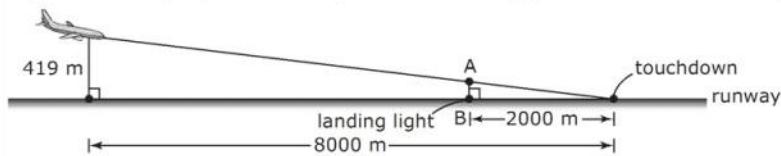
14. When the plane flies over the landing light located at point B, what is the vertical height of AB? Express the answer to the nearest metre.

   A 101 m   **B** 105 m   **C** 119 m   **D** 127 m

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Use this information to answer #15–17.

A runner gets a 4-m head start and then maintains a constant pace of 3 m/s.

15. The table of values that represents the distance travelled after 5 s is

A

Time, t	1	2	3	4	5
Distance, d	5	10	15	20	25

B

Time, t	1	2	3	4	5
Distance, d	7	10	13	16	19

C

Time, t	1	2	3	4	5
Distance, d	8	16	24	32	40

D

| Time, t	1	2	3	4	5
Distance, d	8	16	32	64	128

16. If the coach decided to determine the runner's distance at 10 s, she could use
    A estimation   **B** extrapolation   **C** interpolation   **D** interpretation

17. In the equation that represents the distance, d, at any time, t, the value 3 in 3 m/s is the
    A constant   **B** linear equation   **C** numerical coefficient   **D** variable

Use this information to answer #18.

A model of an arena set up for an awards ceremony consists of two squares. The audience will be seated in the large square, which has an area of 324 cm². The square stage located in the middle of the audience has an area of 16 cm².
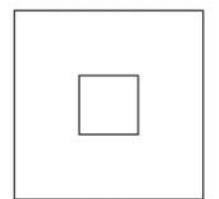
18. In the model, how far is the edge of the stage from the extreme edge of the audience area?
    A 4 cm   **B** 7 cm   **C** 14 cm   **D** 18 cm

Use this information to answer #19.

The chairs on a ski chairlift are carried by a cable loop that is strung between two end terminals. The cable adjusts for the load on the chairs. The amount that a cable extends (*e*) depends on the load (*k*) that it supports.

Load, *k*, (kg)	0	1.2	2.0	3.2	4.8
Extension, *e*, (cm)	0	0.9	1.5	2.4	3.6

19. Which equation shows the relationship between extension and load?

A $e = \frac{4}{3}k$ **B** $e = k - 1.2$ **C** $e = k - 0.3$ **D** $e = \frac{3}{4}k$

Use this information to answer #20–21.

To calculate the number of hits a baseball player needs to get in order to attain a certain batting average, statisticians use $n = [a \times (b + c)] - h$. In the equation,
n = the number of hits needed to get a certain batting average
a = the desired batting average
b = the present number of times at bat
c = the number of times at bat to come
h = present number of hits

20. Maylin has 30 hits in a total of 70 times at bat. She still has 38 times to bat. Assuming she makes 19 more hits, what is Maylin's batting average, to the nearest thousandth?

$19 = [a(70 + 38)] - 30$

**A** 0.505   **B** 0.454   **C** 0.246   **D** 0.157

Numerical Response

21. If all the values in #20 remained the same, except that Maylin's batting average was 0.5, how many hits would she need?

Use this information to answer #22.

Two cyclists leave the centre of a circular area and ride along separate straight paths.

25 km

12 km

O

12 km

T

1 km A

B
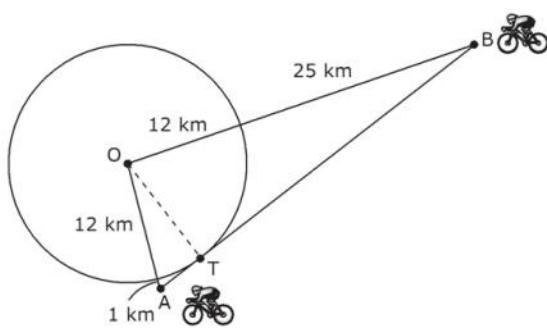
22. If AB joins the cyclists and is tangent to the circle, how far apart are the cyclists?

   A 50 km   **B** 40 km   **C** 37 km   **D** 35 km

Use this information to answer #23–25.

A Vancouver radio station took a poll at 11:00 p.m. about attendance at the Olympic Games. The poll asked people to call in their response to the following question: "How many outdoor events did you attend at the Olympics this week?"

After tallying and averaging the responses, the radio announcer reported, "Most Canadians do not attend the Olympics!"

23. Which survey question would collect more accurate data about attendance at Olympic Games events?

   A How many events did you attend at the Olympic Games this week?

   B What is your favorite outdoor event?

   C How much time did you spend at events during the Olympic Games?

   D What mode of transportation did you use to get to the Olympic Games?

24. A possible influencing factor in the poll conducted by the radio station is

   A cost   **B** cultural sensitivity   **C** ethics   **D** timing

25. What type of sample did the radio station use?

   A convenience sample   **B** random sample

   C stratified sample   **D** voluntary response sample

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Use this information to answer #26.

A souvenir stand at the Olympics has glass plates for sale.
A chain is attached at points A and B such that the segments
AD and BD are tangent to the circle.
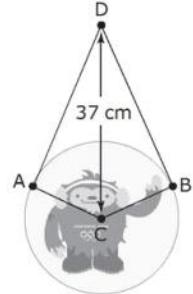
26. If the diameter of the plate is 24 cm, what is the total length of chain
needed to hang the plate on a nail at point D? The chain connects to the
plate at points A and B.

   A 70 cm   **B** 50 cm   **C** 35 cm   **D** 25 cm

Use this information to answer #27–28.

A shop selling souvenir water bottles at a sports event has
four colours available: red, blue, green, and yellow.

27. The bottles are displayed in a large bin with the same number of bottles of
each colour. What is the theoretical probability that the first shopper
randomly picks a green water bottle from the bin?

   A 25%   **B** 50%   **C** 75%   **D** 100%

28. After one day of sales, the owner determined that 42% of shoppers
purchased red water bottles. If 3200 people visited the shop, how many
people bought a red water bottle?

   A 1856   **B** 1344   **C** 420   **D** 42

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Connections

Many concepts and skills that you learn in mathematics can be applied to new situations. Connect the concepts and skills you have learned in *MathLinks 9* to solve problems.

*Use this information to answer #29.*

Point O is the centre of the circle.
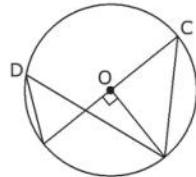
29. What are the measures of ∠C and ∠D?

  A ∠C = 50° and ∠D = 45°   B ∠C = 45° and ∠D = 50°
  C ∠C = 45° and ∠D = 45°   D ∠C = 50° and ∠D = 50°

Use this information to answer #30.

Point O is the centre of the circle. AB is the diameter.
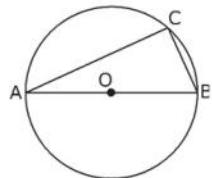

30. What is the measure of ∠C?

  A 70°   B 80°   C 90°   D 110°

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Use this information to answer #31.

Chord DE is parallel to chord FG. The diameter of the circle is 20 cm long.
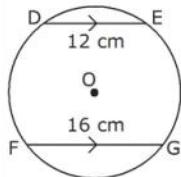
31. What is the shortest distance between DE and FG?

    A 4 cm   **B** 8 cm   **C** 10 cm   **D** 14 cm

Use this diagram to answer #32–33.

The two hexagons are regular.

$5(x + 1)$

$3(x + 1)$
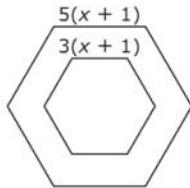
32. Which expression represents the difference in the perimeter between the two hexagons?

    A $6(x + 1) - 6(3x + 1)$ **B** $(30x - 18x) - (30 - 18)$

    C $(30x + 6) - (18x + 6)$ **D** $(30x + 30) - (18x + 18)$

Numerical Response

33. The ratio of the small hexagon to the large hexagon is $3:5$. To the nearest tenth of a unit, what scale factor was used to reduce the large hexagon?

Use this information to answer #34.

Rose solved the expression $(4 + 5)^2(4 - 6)^3$. Her work was as follows:
$(4 + 5)^2(4 - 6)^3$
$= (4^2 + 5^2)(-2)^3$ Step 1
$= (9 + 25)(-2)^3$ Step 2
$= (34)(-8)$ Step 3
$= -272$ Step 4

34. Rose made her first mistake in

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

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35. In the expression $2x^3$, the 2 is the

    A base   **B** coefficient   **C** exponent   **D** power

36. When simplified, the expression $\left(\dfrac{x}{y^9}\right)^3$ is

    A $\dfrac{x^3}{y^{12}}$ **B** $\dfrac{x^4}{y^{12}}$ **C** $\dfrac{x}{y^{27}}$ **D** $\dfrac{x^3}{y^{27}}$

37. Which value falls between $\dfrac{1}{2}$ and 1?

    A $\sqrt{\dfrac{1}{49}}$ **B** $\sqrt{\dfrac{9}{16}}$ **C** $\sqrt{\dfrac{9}{4}}$ **D** $\sqrt{\dfrac{81}{25}}$

Use this information to answer #38.

Compare the following rational numbers.			
$\dfrac{2}{5}$	-0.777	0.25	$-\dfrac{5}{8}$
1	**2**	**3**	**4**

Numerical Response

**38.** Using the numerals 1, 2, 3, and 4, list the rational numbers in ascending order.

39. Which expression is equivalent to $\dfrac{(n \times n \times n \times n \times n) \times (n \times n \times n)}{n \times n \times n}$?

    A $\dfrac{n^{15}}{n^3}$ **B** $\dfrac{n^8}{n^3}$ **C** n^6 **D** n^3

40. In the expression "three squared," what is the base?

    A 2   **B** 3   **C** 6   **D** 9

41. If $2304 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3$, which expression is equal to $\sqrt{2304}$?

    A $2 \times 2 \times 3$ **B** $2^4 \times 3$ **C** $3 \times 3 \times 2 \times 2 \times 2 \times 2$ **D** $2^8 \times 3^2$

Use this diagram to answer #42.

The number line shows points Q and S.
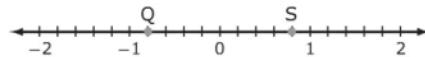
42. Which rational number correctly matches each point?

    A $Q = -1.2$ and $S = 0.8$ **B** $Q = -1.2$ and $S = 1.2$

    C $Q = -0.8$ and $S = 0.8$ **D** $Q = -0.4$ and $S = 0.4$

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Use this diagram to answer #43.

Each graph shows a linear relation between distance and time.
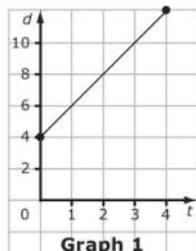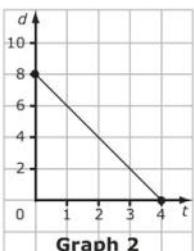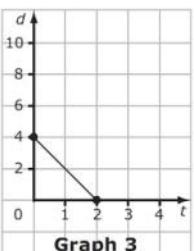
Graph 1   Graph 2   Graph 3   Graph 4
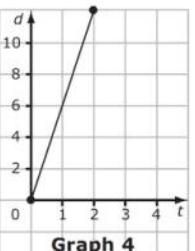
Numerical Response

43. Choose the graph number that matches each linear equation shown below. Write the graph numbers in the same order as the equations.

$d = 2t + 4$
$d = 6t$
$d = 8 - 2t$
$d = -2t + 4$

**44.** The solution to $5 + \frac{1}{3}r \le 2 + \frac{2}{3}r$ is

A $r \ge 9$ **B** $r \le 9$ **C** $r \ge -3$ **D** $r \le -3$

Use this figure to answer #45.
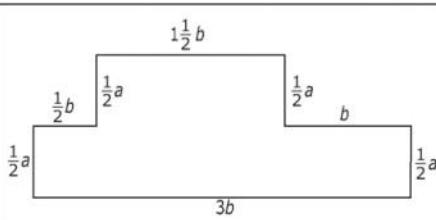
45. What is the expression for the perimeter of the figure?

     A $7a$ units   **B** $7b$ units   **C** $2a + 5b$ units   **D** $2a + 6b$ units

46. Which expression is equivalent to $\frac{6x^2 + 8x - 4}{2}$?

     A $5x^2$ **B** $7x - 2$ **C** $3x^2 + 4x - 2$ **D** $3x^2 + 8x - 4$

47. Which table of values could represent $y = 3x + 3$?

A

x	y
1	6
2	
3	
4	
5	18
6	21
7	
8	

B

x	y
1	6
2	9
3	
4	
5	11
6	
7	
8	

C

x	y
1	
2	
3	
4	15
5	
6	
7	13
8	14

D

x	y
1	
2	
3	36
4	37
5	
6	
7	40
8	

48. The simplified form of $-3(p + 6) + 2(2p - 5)$ is

    A $p - 28$ **B** $p - 18$ **C** $p + 1$ **D** $p + 8$

Use this information to answer #49.

Rick used algebra tiles to model an expression.

    ■ = positive 1-tile   □ = negative 1-tile

    ▬ = positive x-tile   ▭ = negative x-tile

    ■ = positive x^2-tile   □ = negative x^2-tile
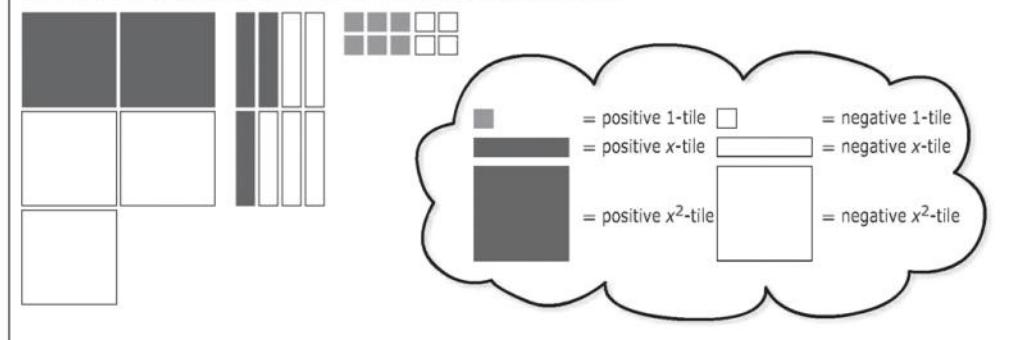
49. Which algebraic expression do the algebra tiles represent?

    A $x^2 + 2x - 2$ **B** $x^2 - 2x + 2$ **C** $-x^2 + 2x - 2$ **D** $-x^2 - 2x + 2$

50. Which number line expresses the solution to $-3x + 2 < 5$?

A
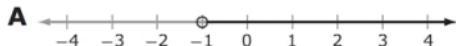
B
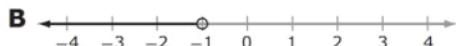
C

D
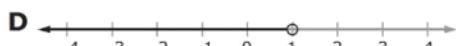
51. Which polynomial does *not* have a degree of 2?

A $p(p + 5)$ **B** $2 + 4x^2 + 6x$ **C** $xy + 3$ **D** $2x - 1$

52. What is the constant term in $6y^2 - 3 - 4y$?

A 6   **B** 2   **C** -3 **D** -4

Use these algebra tiles to answer #53.
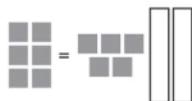
Shaded tiles are positive and white tiles are negative.

53. Which equation is represented by the algebra tiles?

A $6x = 5x - 2$ **B** $6 = 5 - 2x$ **C** $11x = -2$ **D** $-x = 11$

Use these algebra tiles to answer #54.
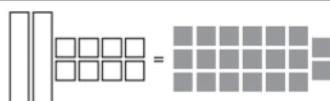
Shaded tiles are positive and white tiles are negative.

54. What is the last step in solving the equation represented by the algebra tiles?

A Multiply both sides by -2.   **B** Divide both sides by -2.

C Add 8 to both sides.   **D** Subtract 8 from both sides.

55. Which equation does *not* have $x = 3$ as a solution?

A $7x - 5 \leq -2x + 22$ **B** $2x + 1 = x + 4$

C $2x - 21 = 9x$ **D** $\dfrac{x + 7}{2} = 5$

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Numerical Response

56. What is the value of a in $\frac{a}{2} + \frac{a}{3} = 2$, to the nearest tenth?

57. Which equation has the largest value for x in the solution?

 A $\frac{4}{5}x = 12$ **B** $\frac{x+1}{3} = 7$

 C $2(2x - 5) = 5(2 - 6)$ **D** $3(2x - 5) = 2(x + 3)$

58. If n is a negative integer, the value of $-\frac{3}{4} \div n$ is a

 A positive value greater than n **B** positive value less than n
 C negative value greater than n **D** negative value less than n

59. Which type of sample gives every individual an equal chance of being chosen to participate in a survey?

 A clustered sample   **B** convenience sample
 C population sample   **D** random sample

Numerical Response

60. What is the value of $\left(\frac{3}{2}\right)^2$, to the nearest hundredth?

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MathLinks 9 Option 1
Final Exam Written Response

*Write your response in the space provided. Present your response in
a well-organized way, using complete sentences and correct units.*

Use this information to answer #1.

The volume of the rectangular glass prism is 288 cm³.

8 cm

2x cm

2x cm
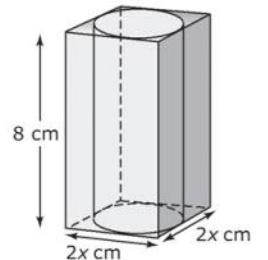
1. a) Write an expression for the volume of the rectangular box in terms of x.
   Show your thinking. **Hint:** $V = lwh$.

   b) Use the given volume of the prism to determine the value of x and the
   dimensions of the rectangular right prism.

   c) Calculate the surface area of the right cylinder. Justify your work
   mathematically. Express your answer to the nearest tenth of a
   centimetre. **Hint:** $SA = 2\pi r^2 + 2\pi rh$.

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Use this information to answer #2.

Jeanine is training for her first 10-km run. The graph shows her times after two weeks of training.
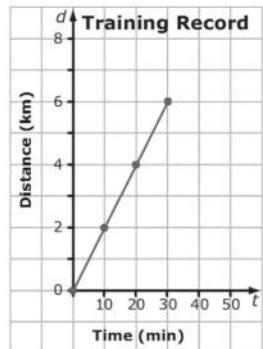
2. a) Jeanine tells Max that she can extrapolate to determine the time it would take to run 5 km. Is she correct? Explain.

b) Determine the time it would take for Jeanine to run 5 km.

c) Write an equation to represent her distance at any time, *t*.

d) Jeanine's goal is to complete the 10-km run in less than 50 min. At her current rate, will she achieve her goal? Justify your work mathematically.

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Use this information to answer #3.

A card game that you are playing with a partner involves drawing cards containing a mathematical expression or an equation from a deck of cards. The object of the game is to solve the expressions or equations on your cards before your partner does.

Your draw the cards shown.
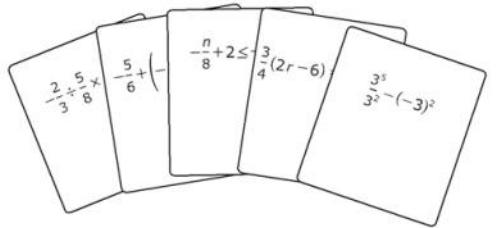
3. a) Describe the order for solving $-\frac{2}{3} \div \frac{5}{8} \times \left(-\frac{4}{5}\right)$.

b) Determine the solution for $-\frac{5}{6} + \left(-\frac{2}{3}\right) \div \frac{3}{4}$. Show your work.

**c)** Graph the solution to $-\frac{n}{8} + 2 \le -7$.

d) Solve $\frac{3}{4}(2r - 6) = \frac{1}{5}(36 + r)$.

e) Simplify and evaluate $\frac{3^5}{3^2} - (-3)^2$.

Name: _____   Date: _____

Use this information to answer #4.

The image shows data about a gathering area for spectators at a local sporting event. This area was created to accommodate 195 people comfortably. It is important to the event planners that there is enough space for the spectators to spread out. The planners photographed the area periodically during the day of an event in order to monitor the volume of spectators. They divided the images into 15 equal squares. Each dot on the image represents a spectator.
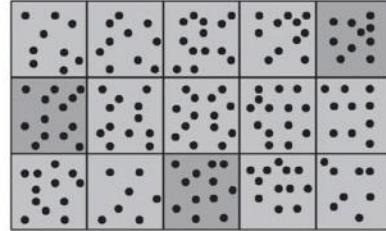
4. a) If a spectator can go to any square in the gathering area, what is the theoretical probability of a spectator choosing any square? Explain your thinking.

b) The event planners want to know if the spectators are overcrowding any part of the gathering area. **Hint:** A square that has more than the average number of people on a square is overcrowded.
- Using the image provided, describe the method you will use to collect the necessary data.
- Identify any samples or population you will use.
- Carry out your method.
- Analyze your results and draw conclusions.

Final Exam Option 1 Answers
Multiple Choice and Numerical Response Answers

1. D		31. D	
2. B		32. D	
3. 4		33. 0.6	
4. C		34. A	
5. C		35. B	
6. D		36. D	
7. A		37. B	
8. $284		38. 2431	
9. C		39. B	
10. D		40. B	
11. 800 m		41. B	
12. $56		42. C	
13. B		43. 1423	
14. B		44. A	
15. B		45. D	
16. B		46. C	
17. C		47. A	
18. C		48. A	
19. D		49. D	
20. B		50. A	
21. 24		51. D	
22. B		52. C	
23. A		53. B	
24. D		54. B	
25. D		55. C	
26. A		56. 2.4	
27. A		57. B	
28. B		58. A	
29. C		59. D	
30. C		60. 2.25	

Written Response Answers

1. a) $l = 2x$; $w = 2x$; $h = 8$
$V = (2x)(2x)(8)$
$V = 32x^2$

b) $288 = 32x^2$
$\dfrac{288}{32} = \dfrac{32}{32}x^2$
$9 = x^2$
$\sqrt{9} = \sqrt{x}$
$x = 3$

The dimensions of the right prism are 8 cm by 6 cm by 6 cm.

c) Since $2x$ represents the diameter and if $x = 3$, then the diameter $= 2(3) = 6$ cm. One half the diameter $=$ radius. The radius $= 3$ cm; the height $= 8$ cm.

$SA = 2(3.14)(3)^2 + 2(3.14)(3)(8)$
$= 207.2$ cm^2

The surface area of the right cylinder is approximately 207.2 cm².

2. a) She is correct. However, Jeanine assumes that she runs at a steady pace. Many trained athletes are able to predict their speed but people just starting to train are less likely to run at a consistent rate.

b) approximately 25 min

c) $d = \frac{1}{5}t$ or $d = \frac{t}{5}$

d)
$$d = \frac{1}{5}t$$
$$10 = \frac{1}{5}t$$
$$5 \times 10 = 5 \times \frac{1}{5}t$$
$$50 = t$$

At Jeanine's current rate, she will complete the run in exactly 50 min; in theory, she will therefore not achieve her goal. Students may present arguments such as the following:

- She is unlikely to maintain a consistent pace and slow down at times. Therefore, she will not achieve her goal.
- She may run at a slightly faster pace to achieve her goal, since she is so close to reaching it.

Students should support their argument mathematically.

3. a) First, multiply by the reciprocal: $-\frac{2}{3} \times \frac{8}{5}$. Next, multiply the answer by $-\frac{4}{5}$. The final solution will be positive.

b)
$$-\frac{2}{3} \times \frac{4}{3} = -\frac{8}{9}$$
$$-\frac{5}{6} + -\frac{8}{9} = \frac{-5 \times 3}{6 \times 3} + \frac{-8 \times 2}{9 \times 2}$$
$$\frac{-15}{18} + \frac{-16}{18} = \frac{-31}{18} \text{ or } -1\frac{13}{18}$$

c)

72
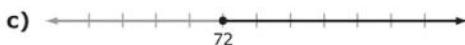
d)
$$20\frac{3}{4}(2r - 6) = 20\frac{1}{5}(36 + r)$$
$$15(2r - 6) = 4(36 + r)$$
$$30r - 90 = 144 + 4r$$
$$30r - 4r - 90 = 144 + 4r - 4r$$
$$26r - 90 + 90 = 144 + 90$$
$$26r = 234$$
$$r = 9$$

e) $3^3 - 9 = 27 - 9 = 18$

4. a) A spectator has an equal chance of choosing any one of 15 squares. The theoretical probability is $\frac{1}{15}$ or 6.67%.

b) Divide the total people by the number of squares: $\frac{195}{15} = 13$. A square that has more than 13 people on it is overcrowded. Students might use the population, count the people on each square, determine which squares are overcrowded, and determine the percent this represents of the total area. Alternatively, they might take a random sample of 5 squares to determine overcrowding and then extrapolate to the population.

Example: Using a random sample of 5 squares, such as the top row of the image, moving from left to right, the number of spectators is: 9, 10, 14, 11, and 10. Only one square is overcrowded. In conclusion, in general, there is no problem with overcrowding. The area seems to accommodate the spectators comfortably.