Released 2010 Achievement Test

Mathematics





Government of Alberta ■



This document contains a release of selected test items from the 2010 Mathematics Achievement Test in Grade 9.

A test blueprint and an answer key are included in this document. These materials, along with the <u>program of studies</u> and <u>subject bulletin</u>, provide information that can be used to inform instructional practice.

Assessment Highlights reports for all achievement test subjects and grades will be posted on the Alberta Education website every year in the fall. Assessment Highlights provide information about the overall test, the test blueprints, and student performance on the 2010 Mathematics Achievement Test in Grade 9. Also provided is commentary on student performance at the acceptable standard and the standard of excellence on selected items from the 2010 Achievement test. This information is intended for teachers and is best used in conjunction with the multi-year and detailed school reports that are available to schools via the extranet.

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The Alberta Education website: education.alberta.ca.

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2010 Grade 9 PILOT Mathematics Achievement Test Blueprint (2007 Program of Studies)

	Reporting	NIII		
Program of Study Strands	Low Complexity Items	Moderate Complexity Items	High Complexity Items	Number (Percentage) of items
Number	1, 7, 14, 22	4, 5, 28, 31, 32, 39, 40	15	12 (24%)
Patterns and Relations	11, 12, 18, 19, 24	2, 6, 9, 21, 23, 27, 35, 36, NR8	8, 17, 29, NR1, NR7	19 (38%)
Shape and Space	3, 16, 38, NR5, NR9	10, 13, 20, 25, NR3, NR4, NR10	NR2, NR6	14 (28%)
Statistics and Probability		26, 30, 34, 37	33	5 (10%)
Number (Percentage) of Questions	14 (28%)	27 (54%)	9 (18%)	50 (100%)

Additional Information

The table below provides additional information about 49 of the 50 items that appeared on the 2010 Grade 9 Pilot Mathematics Achievement Test.

Itom	K ov	Correct	Item Complexity	Strand	Specific	Itam Decorintian
Item	Key	Response %	Complexity	Strand	Outcome	Item Description
MC 1	С	85.1	L	N	6	Determine the approximate square root of a rational number that is not a perfect square.
MC 2	В	18.2	M	PR	3	Represent a word problem as a single-variable linear equation.
MC 3	В	71.1	L	SS	5	Determine the resulting coordinates of an image that undergoes a translation on the Cartesian plane.
MC 4	D	43.2	M	N	4	Apply knowledge of order of operations to determine which expressions are equivalent.
MC 5	D	71.0	М	N	2	Perform operations on expressions containing powers with integral bases and whole number exponents.
MC 6	A	38.3	M	PR	4	Solve a single-variable linear inequality with rational coefficients.
MC 7	С	69.8	L	N	2	Determine the sum, difference, product, and quotient of given powers with integral bases and whole number exponents.
MC 8	D	42.5	Н	PR	4	Solve a single-variable linear inequality with rational coefficients and represent the solution on a number line.
MC 9	D	65.3	M	PR	7	Represent the product of a monomial and a binomial with an algebra tile model.
MC 10	A	47.5	M	SS	2	Determine the equation that represents the height of a rectangular prism when given the surface area of the prism.
MC 11	В	59.5	L	PR	1	Represent a pattern shown in a table of values as a single-variable linear equation.
MC 12	D	70.3	L	PR	4	Represent a given context as a single-variable linear inequality with a rational coefficient.
MC 13	В	50.0	M	SS	2	Determine the change in surface area of a rectangular prism after one of its dimensions is increased by a certain factor.
MC 14	D	53.2	L	N	2	Simplify a two-term expression contained within parentheses by applying the exponent laws of powers with integral bases and whole number exponents.
MC 15	D	48.9	Н	N	4	Determine the equation that represents the solution to a word problem involving the order of operations.

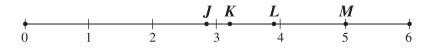
Item	Key	Correct Response %	Item Complexity	Strand	Specific Outcome	Item Description
MC 16	В	59.2	L	SS	5	Determine the resulting coordinates of an image after a 2-D shape undergoes a rotation about a given point on the Cartesian plane.
MC 17	С	64.1	Н	PR	3	Verify by substitution the rational number that is a solution to a problem that can be modelled by a linear equation and/or concrete or pictorial representations.
MC 18	A	60.1	L	PR	3	Represent a context involving money with an expression containing two variables.
MC 19	A	74.4	L	PR	5	Identify the degree, coefficient, and constant term of a given polynomial expression.
MC 20	С	52.7	М	SS	5	Perform a 90 degree rotation on a 2-D shape about a given point on the Cartesian plane.
MC 21	С	52.7	М	PR	6	Perform the operations of addition and subtraction on three polynomial expressions.
MC 22	D	70.3	L	N	6	Estimate the square root of a given rational number that is not a perfect square using the roots of perfect squares as benchmarks.
MC 23	A	56.2	M	PR	5	Determine the expression that represents a given model of a polynomial.
MC 24	A	64.5	L	PR	3	Compare given single-variable equations to determine which two equations are equivalent.
MC 25	С	49.9	М	SS	4	Interpret a scale diagram of a 2-D shape to determine the dimensions of the original 2-D shape.
MC 26	С	62.7	М	SP	1	Determine the effect of bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity on the collection of data for a given survey.
MC 27	A	49.2	М	PR	6	Identify the step in which an error is made in simplifying a polynomial expression.
MC 28	A	75.9	М	N	3	Solve a given problem involving arithmetic operations on rational numbers in decimal form.
MC 29	В	69.0	Н	PR	4	Represent the solution to a word problem with a single-variable linear inequality.
MC 30	В	57.6	М	SP	3	Determine the measure of a sector angle in a circle graph that represents data from a survey.
MC 31	С	60.6	М	N	3	Solve a word problem involving operations on rational numbers expressed as percentages.

Item	Key	Correct Response %	Item Complexity	Strand	Specific Outcome	Item Description
MC 32	A	57.2	M	N	4	Solve a word problem by applying knowledge of order of operations on rational numbers expressed as percentages.
MC 33	С	89.0	Н	SP	3	Identify the statement that represents a possible interpretation for a given graph.
						Represent the solution to a given problem
MC 35	A	67.0	M	PR	2	with a linear equation.
MC 36	A	53.4	M	PR	2	Match a given linear equation to its corresponding graph.
MC 37	С	79.0	M	SP	2	Determine whether or not a sample of a population or a population was used to answer a question and how that decision may have influenced the results.
MC 38	D	55.4	L	SS	1	Use properties of circles to determine the measure of an angle in a triangle that is inscribed in a circle.
MC 39	A	68.4	M	N	4	Determine the expression that represents the solution to a word problem involving order of operations.
MC 40	D	66.8	M	N	3	Solve a word problem involving arithmetic operations on rational numbers.
NR 1	22	38.5	Н	PR	3	Represent and solve a given money problem using a linear equation.
NR 2	8	44.4	Н	SS	1	Solve a problem involving a circle property whereby the perpendicular from the centre of a circle to a chord bisects the chord.
NR 3	2.5	51.2	M	SS	3	Use the properties of similar polygons to solve a word problem.
NR 4	64	16.1	M	SS	3	Solve a word problem involving perimeter and area of similar polygons.
NR 5	35	71.2	L	SS	1	Solve a problem involving a circle property whereby the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc.
NR 6	24	20.0	Н	SS	2	Create a composite 3-D object with the largest surface area possible by joining together two identical 3-D objects and find the shared area that is common to both 3-D objects.
NR 7	85	37.6	Н	PR	3	Represent and solve a given problem using single-variable linear equations.
NR 8	11	74.0	M	PR	4	Represent and solve a given problem using a single-variable linear equation.
NR 9	3	63.1	L	SS	4	Determine the scale factor used to create an image of a 2-D shape on the Cartesian plane.
NR 10	80	66.2	M	SS	4	Use the properties of similar triangles to solve a word problem.

Grade 9 Mathematics Pilot Achievement Test

Use the following information to answer question 1.

The letters on the number line below represent rational numbers.



- 1. The approximate value of $\sqrt{15}$ is represented by the letter
 - **A.** J
 - **B.** K
 - C. L
 - **D.** M

Use the following information to answer question 2.

A truck heads north at a constant speed of 80 km/h. A car leaves 20 minutes later heading north along the same road and travelling at a constant speed of 90 km/h.

2. Which of the following equations could be used to determine how much time in hours, t, the car travels until it catches up to the truck?

A.
$$90t = 80\left(t - \frac{1}{3}\right)$$

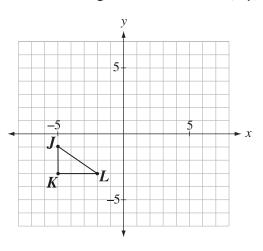
B.
$$90t = 80\left(t + \frac{1}{3}\right)$$

C.
$$90t = 80(t - 20)$$

D.
$$90t = 80(t + 20)$$

Use the following diagram to answer question 3.

The triangle *JKL* shown below undergoes the translation $(x, y) \rightarrow (x + 3, y - 2)$.



3. Which of the following rows represents the coordinates of the resulting image?

Row	\mathbf{J}'	K'	L'
A.	(-2, -3)	(-2, -5)	(-1, 5)
В.	(-2, -3)	(-2, -5)	(1, -5)
C.	(-8, -3)	(-8, -1)	(-5, 1)
D.	(-8, -3)	(-8, -1)	(5, -1)

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

A piggy bank contains only quarters and nickels, and there is a total of 60 coins. The total value of the coins in the bank is \$7.40.

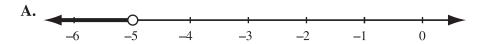
Numerical Response

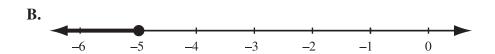
1. How many quarters are in the piggy bank?

Answer: _____

- **4.** Which of the following expressions is equivalent to $\frac{40+10}{5\times(6-4)}$?
 - **A.** $40 + 10 \div 5 \times 6 4$
 - **B.** $(40 + 10) \div 5 \times (6 4)$
 - C. $40 + 10 \div (5 \times (6 4))$
 - **D.** $(40 + 10) \div (5 \times (6 4))$
- 5. If n = 2, then which of the following expressions yields the largest result?
 - $\mathbf{A.} \quad \frac{n^5 \times n^2}{n^4}$
 - **B.** $\frac{n^2 \times n^3}{n}$
 - **C.** $\frac{(n^2)^3}{n}$
 - **D.** $\frac{(n^5)^2}{n^4}$
- **6.** The solution to the inequality 6 x > -1 is
 - **A.** x < 7
 - **B.** x > 7
 - **C.** x < -7
 - **D.** x > -7
- 7. Which one of the following statements is correct?
 - **A.** $4^5 + 4^7 = 4^{12}$
 - **B.** $4^{12} 4^4 = 4^8$
 - **C.** $4^2 \times 4^5 = 4^7$
 - **D.** $4^6 \div 4^3 = 4^2$

8. Which of the following number lines represents the solution to the inequality $5x - 3 \le 7x + 7$?

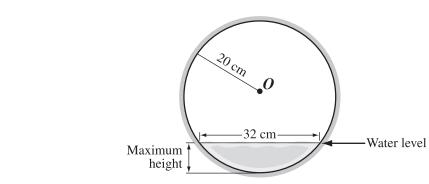






Use the following information to answer numerical-response question 2.

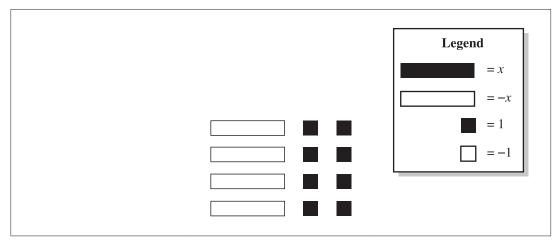
The diagram below shows a circular pipe that has ${\cal O}$ as its centre. The radius of the pipe is 20 cm.



Numerical Response

2. The maximum depth of the water in the pipe is _____ cm.

Use the following algebra-tile diagram to answer question 9.



- **9.** The algebra tile model above could represent the product of
 - **A.** 2 and (2x + 4)
 - **B.** 2 and (2x 4)
 - **C.** 4 and (-x 2)
 - **D.** 4 and (-x + 2)
- 10. If a cube has a surface area of 2.16 m^2 , then which of the following equations represents the height, h, of the cube?
 - **A.** $h = \sqrt{\frac{2.16}{6}} \text{ m}$
 - **B.** $h = \sqrt{\frac{6}{2.16}}$ m
 - **C.** $h = \frac{2.16}{6}$ m
 - **D.** $h = 2.16 \times 6 \text{ m}$

Use the following information to answer question 11.

An art store is having a sale. The table below shows the regular price, r, and the sale price, s, of several items.

Item	Regular Price (r)	Sale Price (s)
Glue	\$5.00	\$4.25
Brushes	\$7.00	\$5.95
Paper	\$10.00	\$8.50
Crayons	\$12.00	\$10.20

- 11. Which of the following equations was used to calculate the sale prices?
 - **A.** s = 0.15r
 - **B.** s = 0.85r
 - **C.** s = r 0.75
 - **D.** s = r 0.85

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

Sam draws two polygons that are similar. The first polygon has a perimeter of 16 cm and the second polygon has a perimeter of 10 cm.

Numerical Response

3. If the shortest side of the first polygon has a length of 4 cm, then the corresponding side of the second polygon has a length of _____ cm.

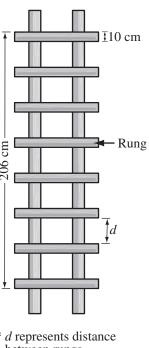
Kristy received a speeding ticket for travelling above the posted limit.



- **12.** The inequality that shows the speed, s, that Kristy was travelling at is
 - **A.** $s \le 100 \text{ km/h}$
 - **B.** s < 100 km/h
 - **C.** $s \ge 100 \text{ km/h}$
 - **D.** s > 100 km/h
- **13.** If the side length of a cube is tripled, then the surface area of the cube will increase by a factor of
 - **A.** 6
 - **B.** 9
 - **C.** 12
 - **D.** 27
- **14.** The expression $(3^2 \times 2)^3$ can be simplified to
 - **A.** $3^2 \times 2^3$
 - **B.** $3^6 \times 2$
 - **C.** $3^5 \times 2^3$
 - **D.** $3^6 \times 2^3$

Use the following diagram to answer question 15.

A ladder with equally spaced rungs is shown below.



- * *d* represents distance between rungs
- Which of the following equations can be used to calculate the distance, d, between each ladder rung?

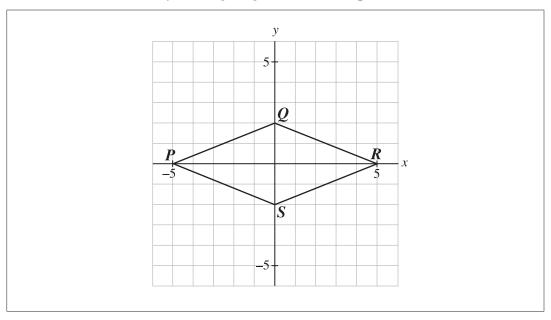
A.
$$d = 206 - 8(10) \div 7$$

B.
$$d = 206 - 8(10) \times 7$$

$$\mathbf{C.} \quad d = \frac{7}{206 - 8(10)}$$

D.
$$d = \frac{206 - 8(10)}{7}$$

Use the following diagram to answer question 16.



- 16. If the shape shown above is rotated 90 degrees clockwise about the origin to form the quadrilateral P'Q'R'S', then P' would be located at
 - **A.** (5, 0)
 - **B.** (0, 5)
 - C. (0, -5)
 - **D.** (-5, 0)

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

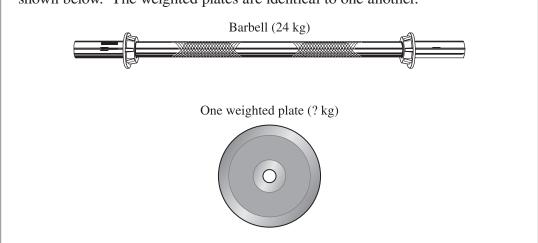
When a square piece of paper is folded in half, the resulting figure has a perimeter of 24 cm.

Numerical Response

4. The area of the square piece of paper before it is folded is _____ cm².

Use the following information to answer question 17.

A weight-lifter adds a certain number of equally weighted plates to the barbell shown below. The weighted plates are identical to one another.



- 17. If the total mass of the barbell and plates equals 60 kg, and if each side of the barbell has the same number of plates, then one weighted plate could have a mass of
 - **A.** 36 kg
 - **B.** 12 kg
 - **C.** 6 kg
 - **D.** 4 kg

18. Marc has a certain number of coins that are dimes, d, and quarters, q. Which of the following expressions represents the value of Marc's money in cents?

- **A.** 10d + 25q
- **B.** 35(d+q)
- **C.** 35d + q
- **D.** d+q

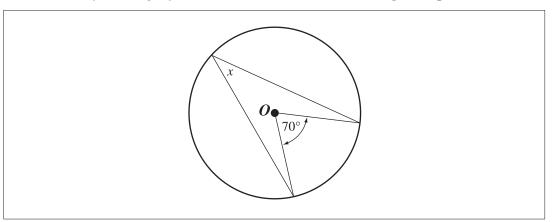
Use the following information to answer question 19.

$$3x^2 - 4$$

19. Which row correctly shows the degree, the coefficient, and the constant term in the expression shown above?

Row	Degree	Coefficient	Constant Term
Α.	2	3	-4
В.	3	2	4
C.	2	-4	3
D.	3	4	2

Use the following information to answer numerical-response question 5.

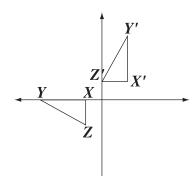


Numerical Response

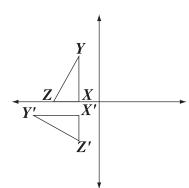
5. If O is the centre of the circle, the measure of x is $_$.

20. Which of the following diagrams illustrates a 90° rotation of triangle *XYZ* counter-clockwise about the origin?

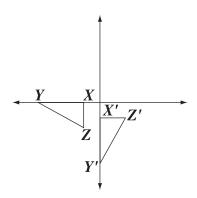
A.



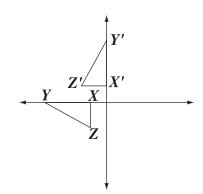
B.



C.



D.



21. When $x^2 - 9x - 4$ is subtracted from the sum of $5x^2 - 8x + 2$ and $2x^2 - 3x - 7$, the result is

A.
$$x^2 - 20x - 9$$

B.
$$2x^2 + 4x + 13$$

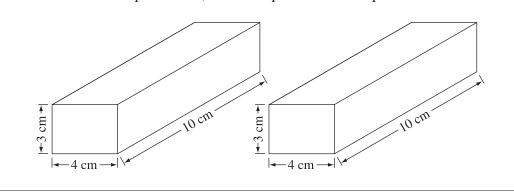
C.
$$6x^2 - 2x - 1$$

D.
$$8x^2 - 20x - 9$$

- 22. In estimating $\sqrt{70}$, which two perfect square numbers provide the **best** two benchmarks to estimate your answer?
 - **A.** 49 and 64
 - **B.** 64 and 100
 - **C.** 49 and 81
 - **D.** 64 and 81

Use the following information to answer numerical-response question 6.

Darren joins the rectangular prisms shown below to create a new rectangular prism that has the greatest possible surface area. He then paints all visible surfaces. After the paint dries, Darren separates the two prisms.



Numerical Response

6. The total area of both prisms that has **not** been painted is _____ cm².

Use the following information to answer question 23.

The following diagram represents a balanced mobile.

3x

- 23. The sum of all parts of the mobile is
 - **A.** $2x^2 + 12x$
 - **B.** $2x^2 + 9x$
 - **C.** $x^2 + 6x$
 - **D.** $x^2 + 3x$

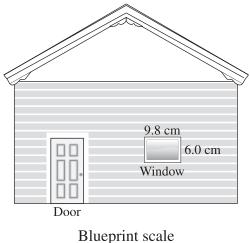
Use the following equation to answer question 24.

2.15x + 7.8 = 25

- **24.** Which of the following equations is equivalent to the equation shown above?
 - **A.** 215x + 780 = 2500
 - **B.** 215x + 780 = 250
 - **C.** 215x + 78 = 2500
 - **D.** 215x + 78 = 25

Use the following information to answer question 25.

The diagram below shows the front elevation of a building on a blueprint.



1:18

- Based on the dimensions shown on the blueprint, the actual dimensions of the window, to the nearest tenth of a metre, will be
 - A. $0.5 \text{ m} \times 0.3 \text{ m}$
 - В. $1.0 \text{ m} \times 0.6 \text{ m}$
 - C. $1.8 \text{ m} \times 1.1 \text{ m}$
 - D. $1.8 \text{ m} \times 3.0 \text{ m}$

Use the following information to answer question 26.

The following survey question was given to a sample of Grade 9 students:

Do you prefer to use your television to play childish video games or to watch educational programs?

- Data collected by this survey may be **most** influenced by a problem related to
 - ethics A.
 - В. privacy
 - C. use of language
 - D. cultural sensitivity

Use the following information to answer question 27.

Jim simplifies the expression $\frac{5(x+2)-(8-x)}{2}$ as shown below.

Step 1
$$\frac{5x + 10 - 8 - x}{2}$$

Step 2
$$\frac{4x+2}{2}$$

Step 3
$$\frac{4x}{2} + \frac{2}{2}$$

Step 4
$$2x + 1$$

- 27. In which step did Jim make an error when simplifying the expression?
 - A. Step 1
 - **B.** Step 2
 - C. Step 3
 - **D.** Step 4
- **28.** Tim buys 2 kg of almonds at \$5.49/kg and 4 kg of cashews at a store that includes GST in its prices. If the cost of his purchase is \$25.50, then the price of 1 kg of cashews is
 - **A.** \$3.63
 - **B.** \$7.26
 - **C.** \$10.98
 - **D.** \$14.52

Use the following information to answer question 29.

Sandy has a budget of \$100 to spend on back-to-school clothes. The shirts she wants to buy are \$12 each, and the pants she wants to buy are \$25 each. All prices include tax.

- **29.** Which of the following inequalities could be used to determine the maximum number of shirts, *n*, Sandy can buy if she also buys 2 pairs of pants?
 - **A.** $12n 2(25) \le 100$
 - **B.** $12n + 2(25) \le 100$
 - C. $2(25) 12n \ge 100$
 - **D.** $2(25) + 12n \ge 100$

Use the following information to answer numerical-response question 7.

Alan, Bob, and Charles worked together on a job and earned a combined total of \$380. Alan earned \$40 less than Bob. Charles earned twice as much as Alan.

Numerical Response

7. How much did Alan earn?

Answer: \$ _____

In a survey, 500 people were asked to name their favourite sport. The results of the survey are shown below.



- **30.** If the data results were displayed on a circle graph, then the measure of the angle that would represent how many people selected football would be approximately
 - **A.** 33°
 - **B.** 88°
 - **C.** 122°
 - **D.** 244°

Use the following information to answer question 31.

Ben was earning a monthly salary of \$5 000 before he changed jobs. At his new job he earns 10% less than he did at his old job.

31.		after one year at his new job Ben receives a pay increase of then be earning per month?	of 15%, how	much	will
	A.	\$4 725			

C. \$5 175

\$4 750

B.

D. \$5 250

32. Jenny notices that a music store is having a "No GST and 40% off the regular price" sale. If the regular price of a CD is \$15.99, then what is the maximum number of sale-priced CDs that Jenny can buy with her \$80 gift card?

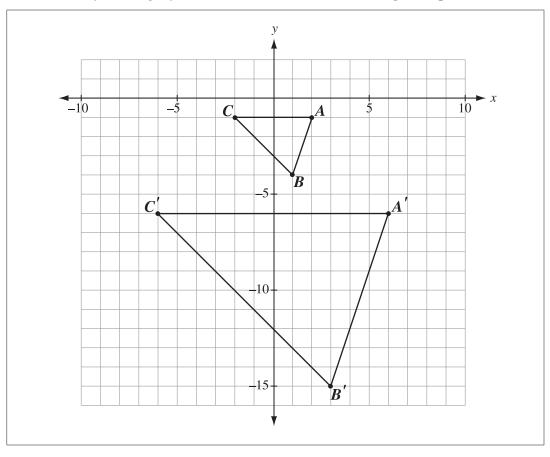
- **A.** 8
- **B.** 9
- **C.** 11
- **D.** 13

Numerical Response

8. At a picnic for 49 people, 4 families each brought an equal number of lawn chairs. If 5 more lawn chairs were still needed, then how many chairs did each family bring?

Answer: _____

Use the following information to answer numerical-response question 9.



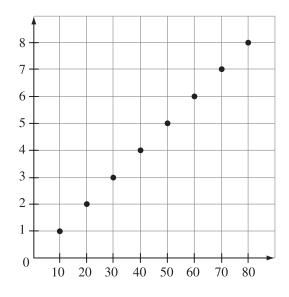
Numerical Response

9. What is the scale factor of the enlargement	9.	What is the	scale factor	of the enla	rgement?
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Answer: _____

Use the following information to answer question 33.

Various points have been plotted on the graph below. The title of the graph and the labels of the axes have been omitted.

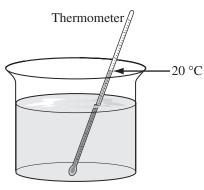


- **33.** Which of the following statements is a possible interpretation of the graph above?
 - **A.** Nicole earns \$20 for each hour she works.
 - **B.** For every 10 swimmers, 2 lifeguards are needed.
 - C. For every 10 pieces of candy Simone buys, she pays \$1.
 - **D.** A runner runs at a constant speed of 2 km every 30 minutes.

Multiple-choice question 34 is not being released at this time.

Use the following information to answer question 35.

In a science experiment, a solution has an initial temperature of 20 °C, as shown below.



- **35.** If the temperature, *T*, of the solution drops 2.8 °C/h, then which of the following equations can be used to calculate the temperature of the solution after 4 hours?
 - **A.** $T = 20 \, ^{\circ}\text{C} (2.8 \, ^{\circ}\text{C/h} \times 4 \, \text{h})$
 - **B.** $T = 20 \, ^{\circ}\text{C} + (2.8 \, ^{\circ}\text{C/h} \times 4 \, \text{h})$
 - C. $T = (20 \, ^{\circ}\text{C} 2.8 \, ^{\circ}\text{C/h}) \times 4 \, \text{h}$
 - **D.** $T = (20 \text{ }^{\circ}\text{C} + 2.8 \text{ }^{\circ}\text{C/h}) \times 4 \text{ h}$

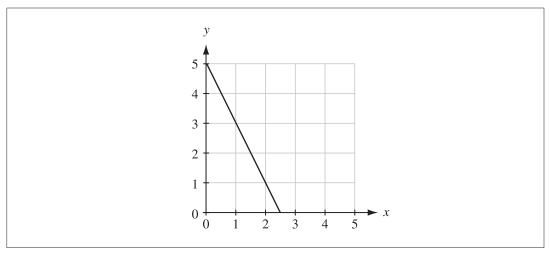
Use the following information to answer numerical-response question 10.

A person who is 200 cm tall casts a shadow that is 40 cm long. At the same time of day, a nearby post casts a shadow that is 16 cm long.

Numerical Response

10. The height of the post is _____ cm.

Use the following information to answer question 36.



- **36.** Which of the following equations represents the relationship between the variables *x* and *y* in the graph shown above?
 - **A.** y = 5 2x
 - **B.** y = 2x 5
 - **C.** y = 5 x
 - **D.** y = x 5

Use the following information to answer question 37.

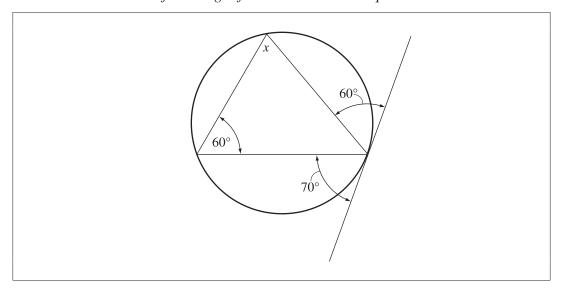
A school principal asks every student and staff member in the school if they like the idea of school uniforms. The school has 450 students and 30 staff members.

37. The survey above uses a \underline{i} , and \underline{ii} would have the most influence on the data.

The statement above is completed by the information in row

Row	i	ii
Α.	sample	students
В.	sample	staff
C.	population	students
D.	population	staff

Use the following information to answer question 38.



- **38.** The measure of x in the diagram above is
 - **A.** 50°
 - **B.** 60°
 - **C.** 65°
 - **D.** 70°

Jennifer wants to buy a computer that costs \$2 000, including all taxes. She will make a down payment of \$500 and arrange to make 5 equal payments for the balance owing.

- **39.** Which of the following expressions can Jennifer use to determine the amount of each of the 5 equal payments?
 - **A.** $(\$2\ 000 500) \div 5$
 - **B.** $($2\ 000 500) \times 5$
 - **C.** $(\$2\ 000 \times 5) 500$
 - **D.** $(\$2\ 000 \div 5) 500$

Use the following information to answer question 40.

The following list shows Rick's yearly vehicle expenses.

- Insurance: \$1 200
- Gasoline: \$1 300
- Repairs: \$850
- **40.** If Rick works 8 hours/day, 5 days/week, and takes home \$10/hour, then what is the **least** number of complete weeks he must work in order to pay for all his yearly vehicle expenses?
 - **A.** 6 weeks
 - **B.** 7 weeks
 - C. 8 weeks
 - **D.** 9 weeks

You have now completed the test. If you have time, you may wish to check your answers.