The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I (Common Core)

Thursday, January 28, 2016 — 1:15 to 4:15 p.m., only

Student Name:_____

School Name: _____

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Print your name and the name of your school on the lines above.

A separate answer sheet for Part I has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 37 questions. You must answer all questions in this examination. Record your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in Parts II, III, and IV directly in this booklet. All work should be written in pen, except graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. This sheet is perforated so you may remove it from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice…

A graphing calculator and a straightedge (ruler) must be available for you to use while taking this examination.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [48]

1 In the function $f(x) = (x - 2)^2 + 4$, the minimum value occurs when x is

(1) -2 (3) -4

(2) 2 (4) 4

2 The graph below was created by an employee at a gas station.

Gas Sales
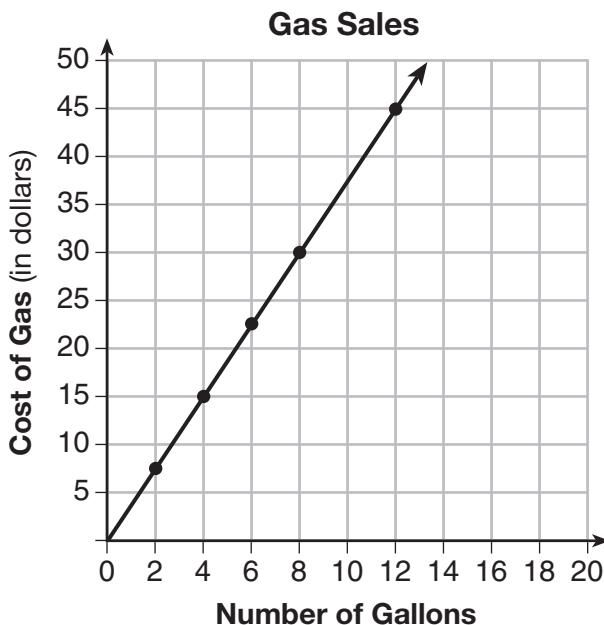
Which statement can be justified by using the graph?

(1) If 10 gallons of gas was purchased, $35 was paid.

(2) For every gallon of gas purchased, $3.75 was paid.

(3) For every 2 gallons of gas purchased, $5.00 was paid.

(4) If zero gallons of gas were purchased, zero miles were driven.

3 For a recently released movie, the function $y = 119.67(0.61)^x$ models the revenue earned, y, in millions of dollars each week, x, for several weeks after its release.

Based on the equation, how much more money, in millions of dollars, was earned in revenue for week 3 than for week 5?

(1) 37.27

(3) 17.06

(2) 27.16

(4) 10.11

4 Given the following expressions:

I. $-\dfrac{5}{8} + \dfrac{3}{5}$

III. $\left(\sqrt{5}\right) \cdot \left(\sqrt{5}\right)$

II. $\dfrac{1}{2} + \sqrt{2}$

IV. $3 \cdot \left(\sqrt{49}\right)$

Which expression(s) result in an irrational number?

(1) II, only

(3) I, III, IV

(2) III, only

(4) II, III, IV

5 Which inequality is represented by the graph below?
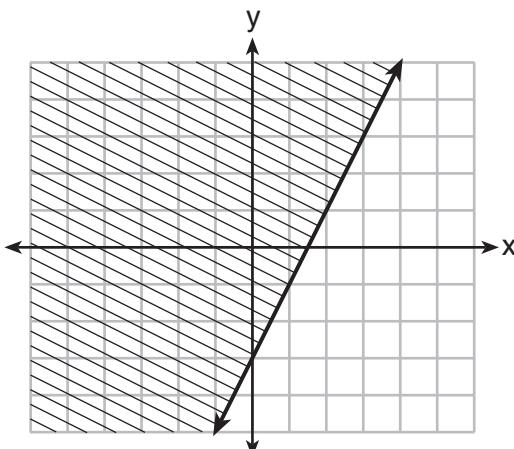
(1) $y \le 2x - 3$

(3) $y \le -3x + 2$

(2) $y \ge 2x - 3$

(4) $y \ge -3x + 2$

6 Michael borrows money from his uncle, who is charging him simple interest using the formula $I = Prt$. To figure out what the interest rate, r, is, Michael rearranges the formula to find r. His new formula is r equals

(1) $\dfrac{I - P}{t}$

(3) $\dfrac{I}{Pt}$

(2) $\dfrac{P - I}{t}$

(4) $\dfrac{Pt}{I}$

7 Which equation is equivalent to $y - 34 = x(x - 12)$?

(1) $y = (x - 17)(x + 2)$

(3) $y = (x - 6)^2 + 2$

(2) $y = (x - 17)(x - 2)$

(4) $y = (x - 6)^2 - 2$

8 The equation $A = 1300(1.02)^7$ is being used to calculate the amount of money in a savings account. What does 1.02 represent in this equation?

(1) 0.02% decay

(3) 2% decay

(2) 0.02% growth

(4) 2% growth

9 The zeros of the function $f(x) = 2x^2 - 4x - 6$ are

(1) 3 and -1

(3) -3 and 1

(2) 3 and 1

(4) -3 and -1

10 When $(2x - 3)^2$ is subtracted from $5x^2$, the result is

(1) $x^2 - 12x - 9$

(3) $x^2 + 12x - 9$

(2) $x^2 - 12x + 9$

(4) $x^2 + 12x + 9$

11 Joe has a rectangular patio that measures 10 feet by 12 feet. He wants to increase the area by 50% and plans to increase each dimension by equal lengths, x. Which equation could be used to determine x?

(1) $(10 + x)(12 + x) = 120$ (3) $(15 + x)(18 + x) = 180$

(2) $(10 + x)(12 + x) = 180$ (4) $(15)(18) = 120 + x^2$

12 When factored completely, $x^3 - 13x^2 - 30x$ is

(1) $x(x + 3)(x - 10)$ (3) $x(x + 2)(x - 15)$

(2) $x(x - 3)(x - 10)$ (4) $x(x - 2)(x + 15)$

13 The table below shows the cost of mailing a postcard in different years. During which time interval did the cost increase at the greatest average rate?

Year	1898	1971	1985	2006	2012
Cost (¢)	1	6	14	24	35

(1) 1898–1971   (3) 1985–2006

(2) 1971–1985   (4) 2006–2012

14 When solving the equation $x^2 - 8x - 7 = 0$ by completing the square, which equation is a step in the process?

(1) $(x - 4)^2 = 9$ (3) $(x - 8)^2 = 9$

(2) $(x - 4)^2 = 23$ (4) $(x - 8)^2 = 23$

15 A construction company uses the function $f(p)$, where p is the number of people working on a project, to model the amount of money it spends to complete a project. A reasonable domain for this function would be

(1) positive integers

(2) positive real numbers

(3) both positive and negative integers

(4) both positive and negative real numbers

16 Which function is shown in the table below?

x	f(x)
–2	$\frac{1}{9}$
–1	$\frac{1}{3}$
0	1
1	3
2	9
3	27

(1) $f(x) = 3x$

(2) $f(x) = x + 3$

(3) $f(x) = -x^3$

(4) $f(x) = 3^x$

17 Given the functions $h(x) = \frac{1}{2}x + 3$ and $j(x) = |x|$, which value of x makes $h(x) = j(x)$?

(1) -2

(2) 2

(3) 3

(4) -6

**18** Which recursively defined function represents the sequence 3, 7, 15, 31, …?

(1) $f(1) = 3, \ f(n + 1) = 2^{f(n)} + 3$

(2) $f(1) = 3, \ f(n + 1) = 2^{f(n)} - 1$

(3) $f(1) = 3, \ f(n + 1) = 2f(n) + 1$

(4) $f(1) = 3, \ f(n + 1) = 3f(n) - 2$

19 The range of the function defined as $y = 5^x$ is

(1) $y < 0$

(2) $y > 0$

(3) $y \leq 0$

(4) $y \geq 0$

20 The graph of $y = f(x)$ is shown below.
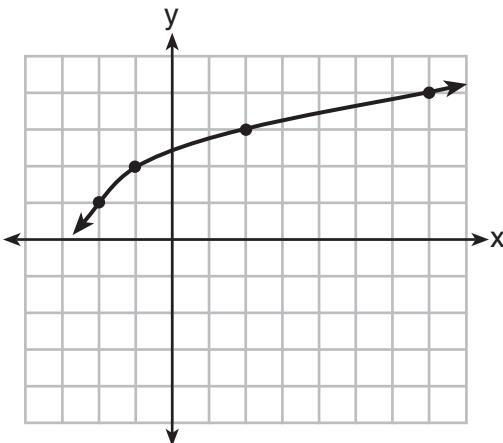
What is the graph of $y = f(x + 1) - 2$?

(1)

(3)

(2)

(4)
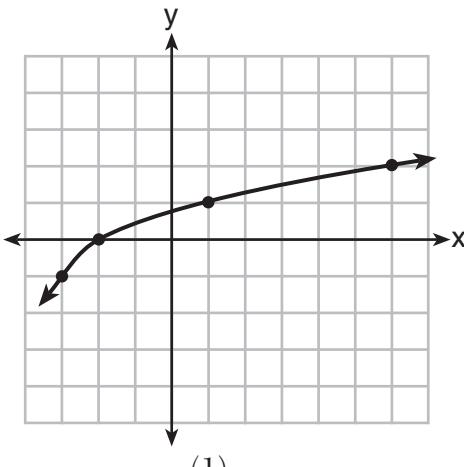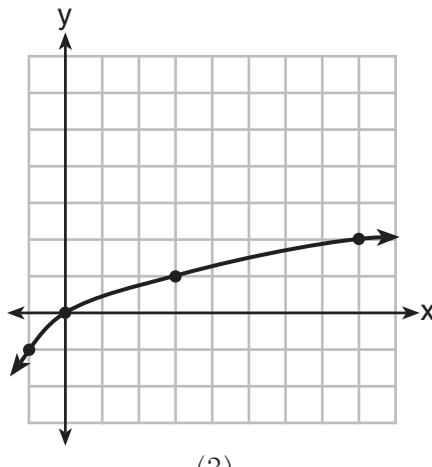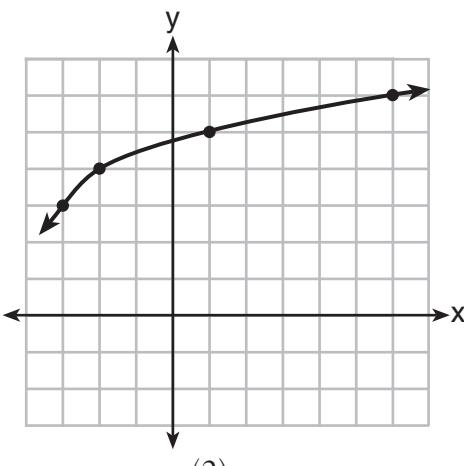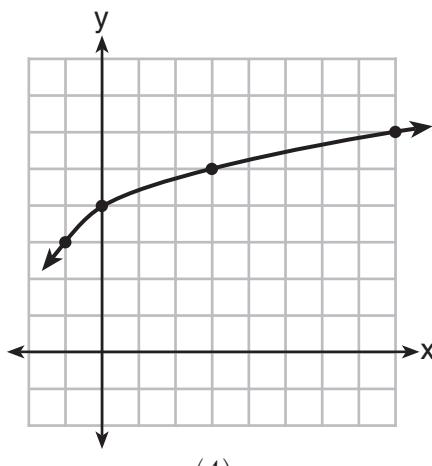
21 Which pair of equations could *not* be used to solve the following equations for x and y?

$$4x + 2y = 22$$
$$-2x + 2y = -8$$

(1) $4x + 2y = 22$
     $2x - 2y = 8$

(3) $12x + 6y = 66$
     $6x - 6y = 24$

(2) $4x + 2y = 22$
     $-4x + 4y = -16$

(4) $8x + 4y = 44$
     $-8x + 8y = -8$

22 The graph representing a function is shown below.
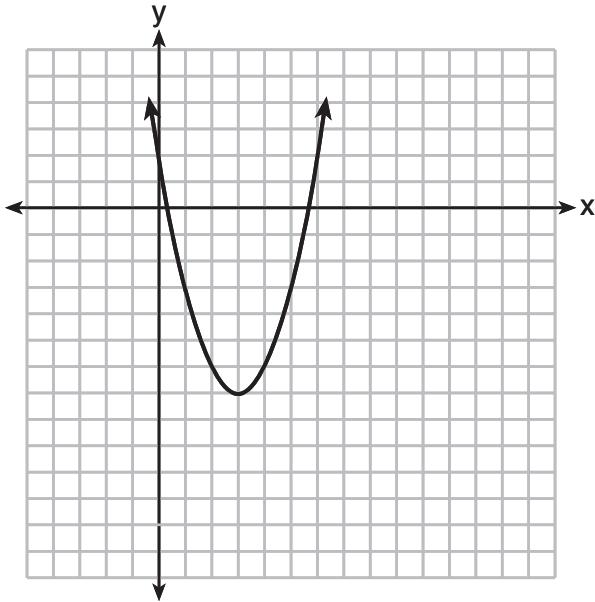
Which function has a minimum that is *less* than the one shown in the graph?

(1) $y = x^2 - 6x + 7$

(3) $y = x^2 - 2x - 10$

(2) $y = |x + 3| - 6$

(4) $y = |x - 8| + 2$

23 Grisham is considering the three situations below.

I. For the first 28 days, a sunflower grows at a rate of 3.5 cm per day.

II. The value of a car depreciates at a rate of 15% per year after it is purchased.

III. The amount of bacteria in a culture triples every two days during an experiment.

Which of the statements describes a situation with an equal difference over an equal interval?

(1) I, only   (3) I and III

(2) II, only   (4) II and III

24 After performing analyses on a set of data, Jackie examined the scatter plot of the residual values for each analysis. Which scatter plot indicates the best linear fit for the data?


(1)

(3)

(2)

(4)
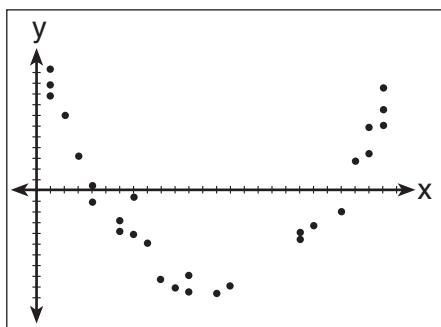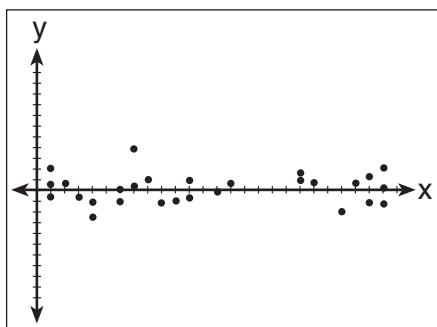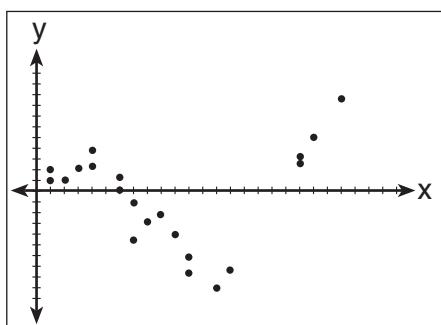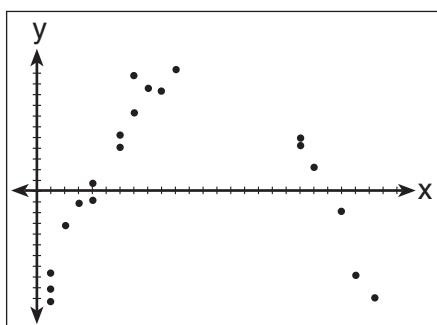
Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

25 The function, $t(x)$, is shown in the table below.

x	t(x)
−3	10
−1	7.5
1	5
3	2.5
5	0

Determine whether $t(x)$ is linear or exponential. Explain your answer.

**26** Marcel claims that the graph below represents a function.
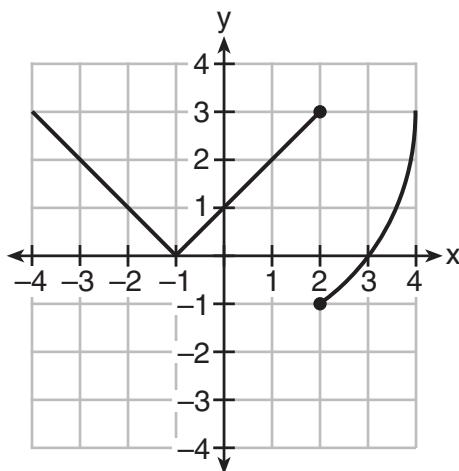
State whether Marcel is correct. Justify your answer.

27 Solve the equation for y.

$$(y - 3)^2 = 4y - 12$$

28 The graph below shows the variation in the average temperature of Earth's surface from 1950–2000, according to one source.

Variation of Earth's Surface Temperature Over 50 Years
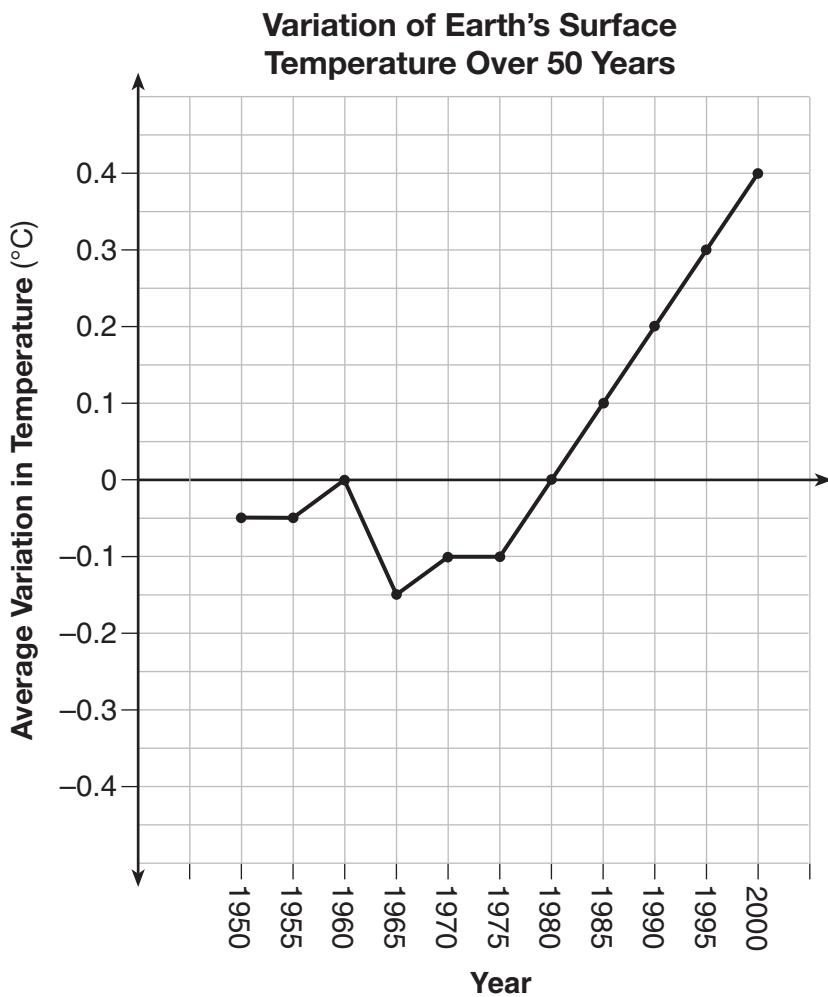
During which years did the temperature variation change the most per unit time? Explain how you determined your answer.

29 The cost of belonging to a gym can be modeled by $C(m) = 50m + 79.50$, where $C(m)$ is the total cost for m months of membership.

State the meaning of the slope and y-intercept of this function with respect to the costs associated with the gym membership.

30 A statistics class surveyed some students during one lunch period to obtain opinions about television programming preferences. The results of the survey are summarized in the table below.

Programming Preferences

	Comedy	Drama
Male	70	35
Female	48	42

Based on the sample, predict how many of the school's 351 males would prefer comedy. Justify your answer.

31 Given that $a > b$, solve for x in terms of a and b:

$$b(x - 3) \geq ax + 7b$$

32 Jacob and Jessica are studying the spread of dandelions. Jacob discovers that the growth over t weeks can be defined by the function $f(t) = (8) \cdot 2^t$. Jessica finds that the growth function over t weeks is $g(t) = 2^{t+3}$.

Calculate the number of dandelions that Jacob and Jessica will each have after 5 weeks.

Based on the growth from both functions, explain the relationship between $f(t)$ and $g(t)$.

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33 Let $h(t) = -16t^2 + 64t + 80$ represent the height of an object above the ground after t seconds. Determine the number of seconds it takes to achieve its maximum height. Justify your answer.

State the time interval, in seconds, during which the height of the object *decreases*. Explain your reasoning.

34 Fred's teacher gave the class the quadratic function $f(x) = 4x^2 + 16x + 9$.

   a) State two different methods Fred could use to solve the equation $f(x) = 0$.

   b) Using one of the methods stated in part a, solve $f(x) = 0$ for x, to the *nearest tenth*.

35 Erica, the manager at Stellarbeans, collected data on the daily high temperature and revenue from coffee sales. Data from nine days this past fall are shown in the table below.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
High Temperature, t	54	50	62	67	70	58	52	46	48
Coffee Sales, f(t)	$2900	$3080	$2500	$2380	$2200	$2700	$3000	$3620	$3720

State the linear regression function, $f(t)$, that estimates the day's coffee sales with a high temperature of t. Round all values to the *nearest integer*.

State the correlation coefficient, r, of the data to the *nearest hundredth.* Does r indicate a strong linear relationship between the variables? Explain your reasoning.

36 A contractor has 48 meters of fencing that he is going to use as the perimeter of a rectangular garden. The length of one side of the garden is represented by x, and the area of the garden is 108 square meters.

Determine, algebraically, the dimensions of the garden in meters.

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. A correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [6]

37 The Reel Good Cinema is conducting a mathematical study. In its theater, there are 200 seats. Adult tickets cost $12.50 and child tickets cost $6.25. The cinema's goal is to sell at least $1500 worth of tickets for the theater.

Write a system of linear inequalities that can be used to find the possible combinations of adult tickets, x, and child tickets, y, that would satisfy the cinema's goal.

Graph the solution to this system of inequalities on the set of axes on the next page. Label the solution with an S.

Marta claims that selling 30 adult tickets and 80 child tickets will result in meeting the cinema's goal. Explain whether she is correct or incorrect, based on the graph drawn.
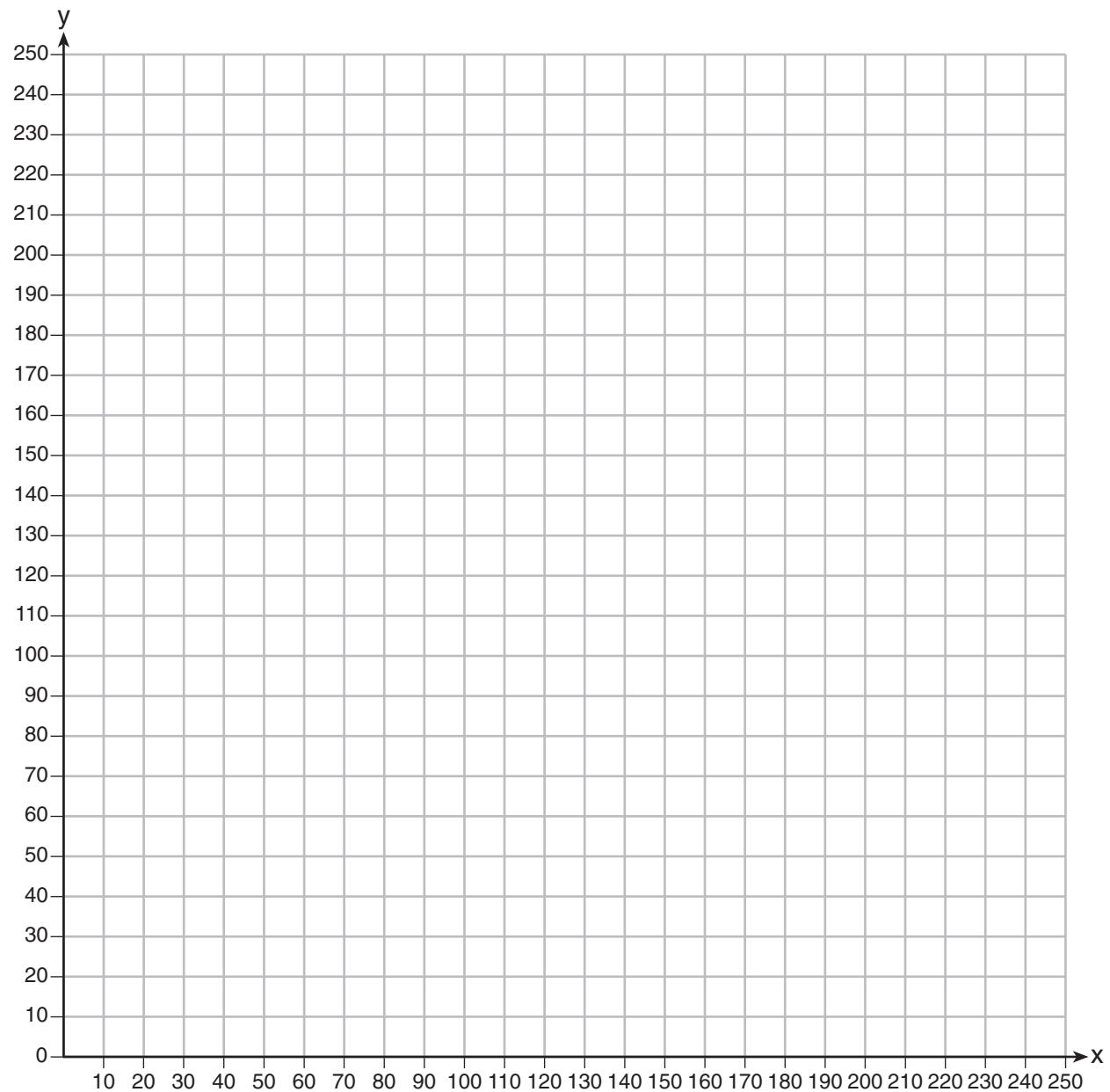
Scrap Graph Paper — This sheet will *not* be scored.
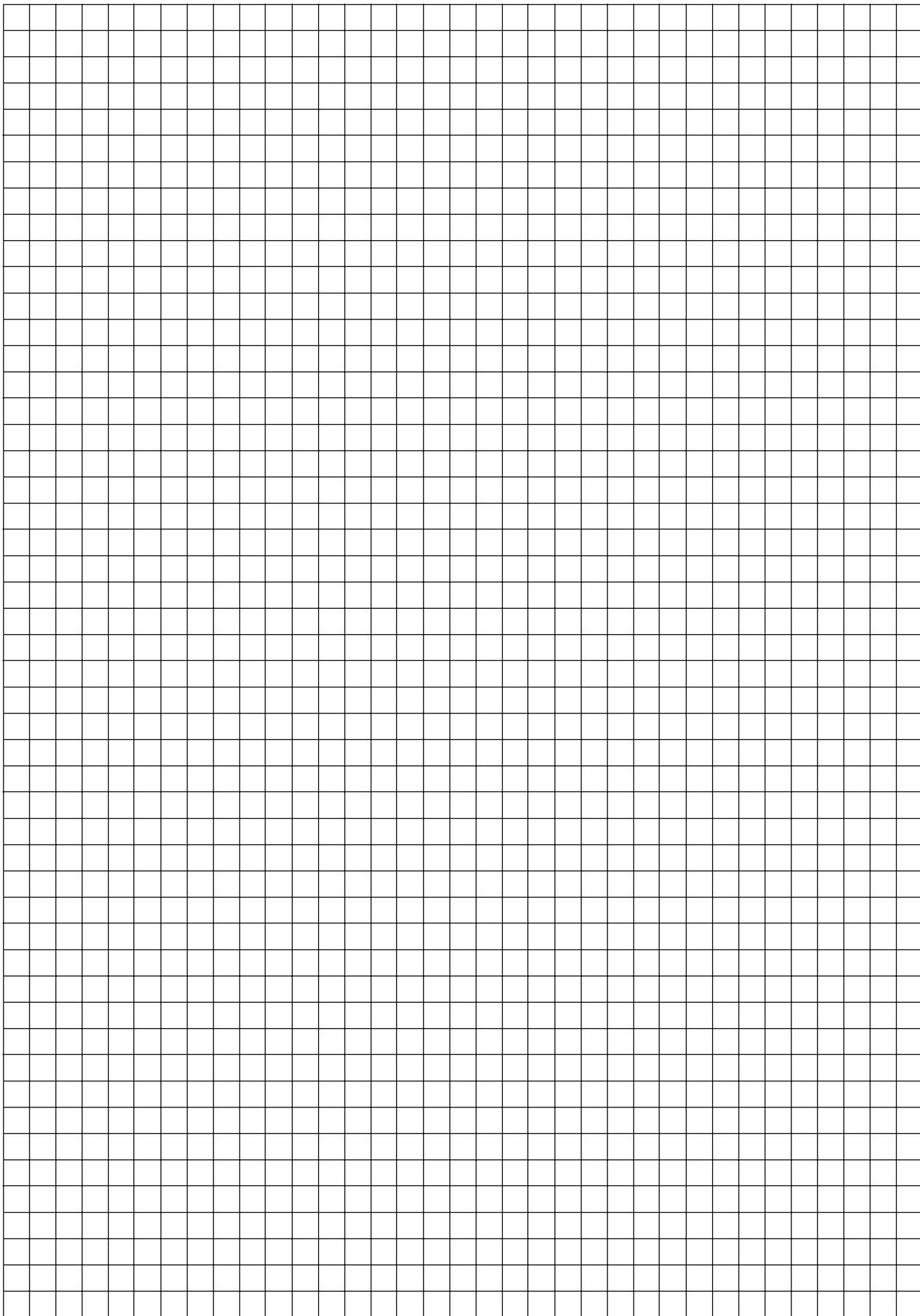
High School Math Reference Sheet

1 inch = 2.54 centimeters   1 kilometer = 0.62 mile   1 cup = 8 fluid ounces
1 meter = 39.37 inches   1 pound = 16 ounces   1 pint = 2 cups
1 mile = 5280 feet   1 pound = 0.454 kilogram   1 quart = 2 pints
1 mile = 1760 yards   1 kilogram = 2.2 pounds   1 gallon = 4 quarts
1 mile = 1.609 kilometers   1 ton = 2000 pounds   1 gallon = 3.785 liters
                                                          1 liter = 0.264 gallon
                                                          1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$		Pythagorean Theorem	$a^2 + b^2 = c^2$
Parallelogram	$A = bh$		Quadratic Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Circle	$A = \pi r^2$		Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Circle	$C = \pi d$ or $C = 2\pi r$		Geometric Sequence	$a_n = a_1 r^{n-1}$
General Prisms	$V = Bh$		Geometric Series	$S_n = \dfrac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Cylinder	$V = \pi r^2 h$		Radians	1 radian = $\dfrac{180}{\pi}$ degrees
Sphere	$V = \frac{4}{3}\pi r^3$		Degrees	1 degree = $\dfrac{\pi}{180}$ radians
Cone	$V = \frac{1}{3}\pi r^2 h$		Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$
Pyramid	$V = \frac{1}{3}Bh$			

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