

The University of the State of New York  
REGENTS HIGH SCHOOL EXAMINATION

# ALGEBRA I (Common Core)

Tuesday, June 3, 2014 — 9:15 a.m. to 12:15 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. 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. 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]

Use this space for  
computations.

1 When solving the equation  $4(3x^2 + 2) - 9 = 8x^2 + 7$ , Emily wrote  $4(3x^2 + 2) = 8x^2 + 16$  as her first step. Which property justifies Emily's first step?

- (1) addition property of equality
- (2) commutative property of addition
- (3) multiplication property of equality
- (4) distributive property of multiplication over addition

2 Officials in a town use a function,  $C$ , to analyze traffic patterns.  $C(n)$  represents the rate of traffic through an intersection where  $n$  is the number of observed vehicles in a specified time interval. What would be the most appropriate domain for the function?

- (1)  $\{\dots -2, -1, 0, 1, 2, 3, \dots\}$
- (2)  $\{-2, -1, 0, 1, 2, 3\}$
- (3)  $\left\{0, \frac{1}{2}, 1, 1\frac{1}{2}, 2, 2\frac{1}{2}\right\}$
- (4)  $\{0, 1, 2, 3, \dots\}$

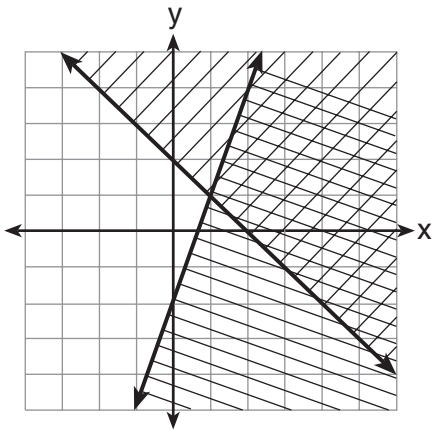
3 If  $A = 3x^2 + 5x - 6$  and  $B = -2x^2 - 6x + 7$ , then  $A - B$  equals

- (1)  $-5x^2 - 11x + 13$
- (2)  $5x^2 + 11x - 13$
- (3)  $-5x^2 - x + 1$
- (4)  $5x^2 - x + 1$

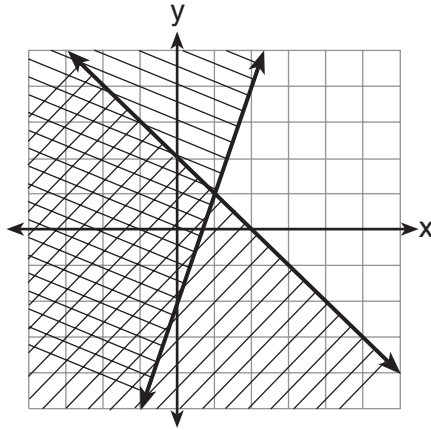
Use this space for computations.

4 Given:  $y + x > 2$   
 $y \leq 3x - 2$

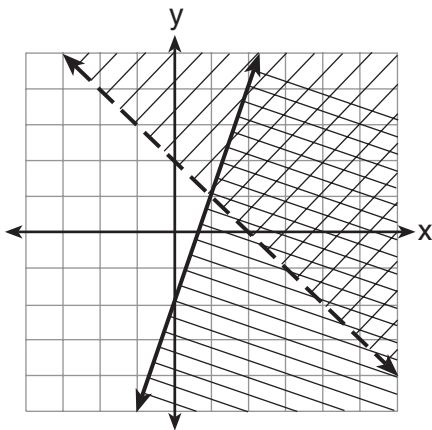
Which graph shows the solution of the given set of inequalities?



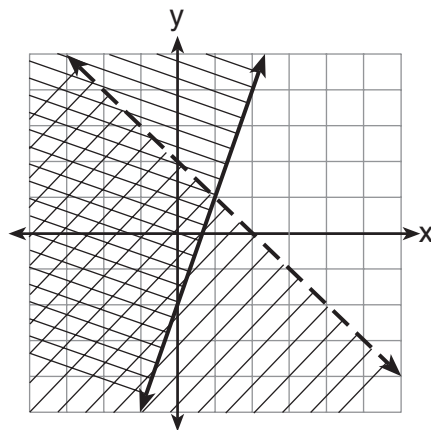
(1)



(3)



(2)



(4)

5 Which value of  $x$  satisfies the equation  $\frac{7}{3}\left(x + \frac{9}{28}\right) = 20$ ?

(1) 8.25

(3) 19.25

(2) 8.89

(4) 44.92

**Use this space for  
computations.**

- 6 The table below shows the average yearly balance in a savings account where interest is compounded annually. No money is deposited or withdrawn after the initial amount is deposited.

Year	Balance, in Dollars
0	380.00
10	562.49
20	832.63
30	1232.49
40	1824.39
50	2700.54

Which type of function best models the given data?

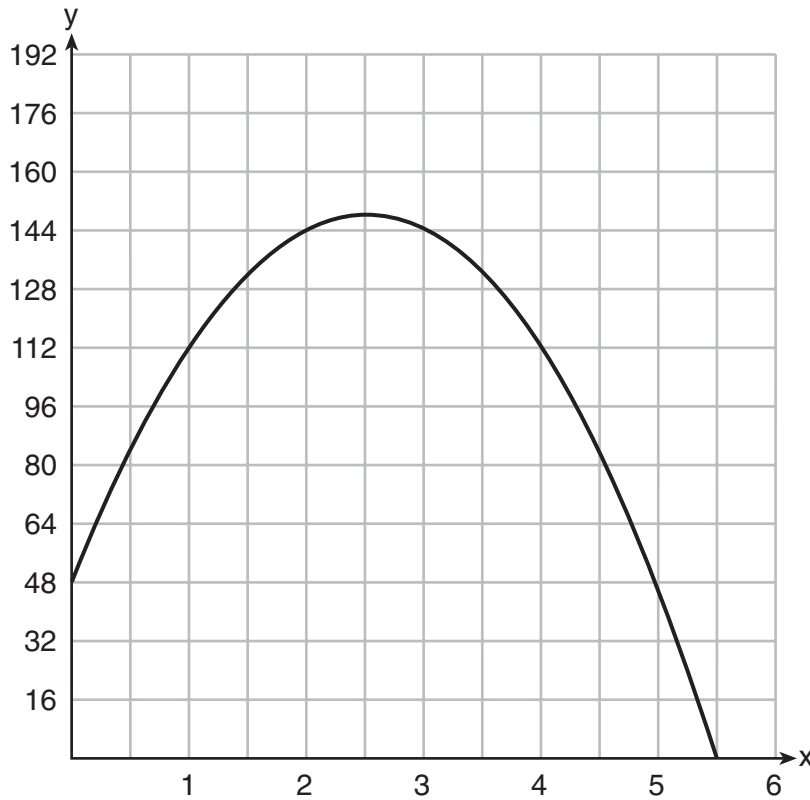
- (1) linear function with a negative rate of change
  - (2) linear function with a positive rate of change
  - (3) exponential decay function
  - (4) exponential growth function
- 7 A company that manufactures radios first pays a start-up cost, and then spends a certain amount of money to manufacture each radio. If the cost of manufacturing  $r$  radios is given by the function  $c(r) = 5.25r + 125$ , then the value 5.25 best represents
- (1) the start-up cost
  - (2) the profit earned from the sale of one radio
  - (3) the amount spent to manufacture each radio
  - (4) the average number of radios manufactured

- 8 Which equation has the same solution as  $x^2 - 6x - 12 = 0$ ?

- (1)  $(x + 3)^2 = 21$
- (2)  $(x - 3)^2 = 21$
- (3)  $(x + 3)^2 = 3$
- (4)  $(x - 3)^2 = 3$

Use this space for computations.

- 9 A ball is thrown into the air from the edge of a 48-foot-high cliff so that it eventually lands on the ground. The graph below shows the height,  $y$ , of the ball from the ground after  $x$  seconds.

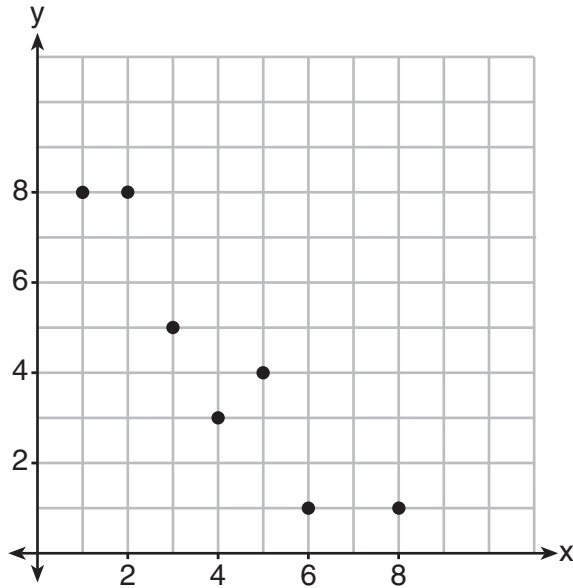


For which interval is the ball's height always *decreasing*?

- (1)  $0 \leq x \leq 2.5$                       (3)  $2.5 < x < 5.5$   
(2)  $0 < x < 5.5$                       (4)  $x \geq 2$
- 10 What are the roots of the equation  $x^2 + 4x - 16 = 0$ ?
- (1)  $2 \pm 2\sqrt{5}$                       (3)  $2 \pm 4\sqrt{5}$   
(2)  $-2 \pm 2\sqrt{5}$                       (4)  $-2 \pm 4\sqrt{5}$

Use this space for  
computations.

- 11 What is the correlation coefficient of the linear fit of the data shown below, to the nearest hundredth?



- (1) 1.00  
(2) 0.93  
(3) -0.93  
(4) -1.00
- 12 Keith determines the zeros of the function  $f(x)$  to be  $-6$  and  $5$ . What could be Keith's function?

- (1)  $f(x) = (x + 5)(x + 6)$   
(2)  $f(x) = (x + 5)(x - 6)$   
(3)  $f(x) = (x - 5)(x + 6)$   
(4)  $f(x) = (x - 5)(x - 6)$

- 13 Given:  $L = \sqrt{2}$   
 $M = 3\sqrt{3}$   
 $N = \sqrt{16}$   
 $P = \sqrt{9}$

Which expression results in a rational number?

- (1)  $L + M$   
(2)  $M + N$   
(3)  $N + P$   
(4)  $P + L$

14 Which system of equations has the same solution as the system below?

$$\begin{aligned}2x + 2y &= 16 \\3x - y &= 4\end{aligned}$$

- (1)  $2x + 2y = 16$   
 $6x - 2y = 4$
- (2)  $2x + 2y = 16$   
 $6x - 2y = 8$
- (3)  $x + y = 16$   
 $3x - y = 4$
- (4)  $6x + 6y = 48$   
 $6x + 2y = 8$

15 The table below represents the function  $F$ .

$x$	3	4	6	7	8
$F(x)$	9	17	65	129	257

The equation that represents this function is

- (1)  $F(x) = 3^x$
- (2)  $F(x) = 3x$
- (3)  $F(x) = 2^x + 1$
- (4)  $F(x) = 2x + 3$

16 John has four more nickels than dimes in his pocket, for a total of \$1.25. Which equation could be used to determine the number of dimes,  $x$ , in his pocket?

- (1)  $0.10(x + 4) + 0.05(x) = \$1.25$
- (2)  $0.05(x + 4) + 0.10(x) = \$1.25$
- (3)  $0.10(4x) + 0.05(x) = \$1.25$
- (4)  $0.05(4x) + 0.10(x) = \$1.25$

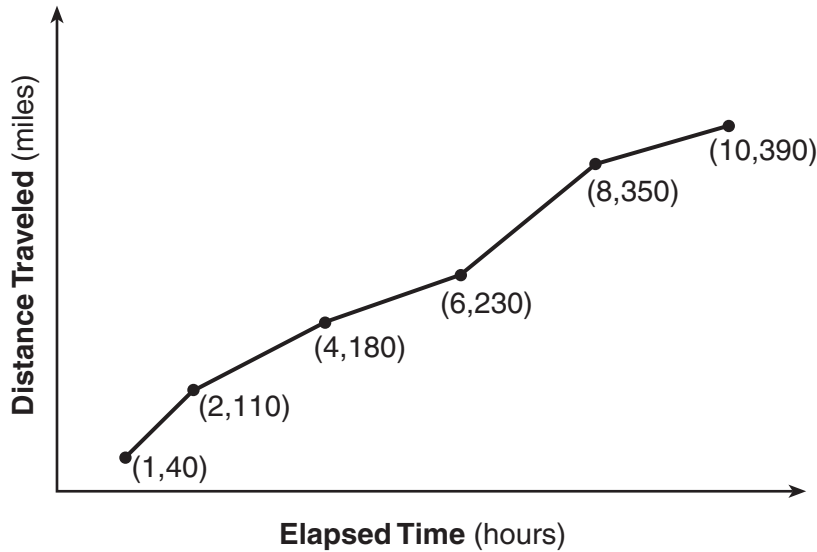
17 If  $f(x) = \frac{1}{3}x + 9$ , which statement is always true?

- (1)  $f(x) < 0$
- (2)  $f(x) > 0$
- (3) If  $x < 0$ , then  $f(x) < 0$ .
- (4) If  $x > 0$ , then  $f(x) > 0$ .



Use this space for  
computations.

- 18 The Jamison family kept a log of the distance they traveled during a trip, as represented by the graph below.



During which interval was their average speed the greatest?

- (1) the first hour to the second hour
  - (2) the second hour to the fourth hour
  - (3) the sixth hour to the eighth hour
  - (4) the eighth hour to the tenth hour
- 19 Christopher looked at his quiz scores shown below for the first and second semester of his Algebra class.

Semester 1: 78, 91, 88, 83, 94

Semester 2: 91, 96, 80, 77, 88, 85, 92

Which statement about Christopher's performance is correct?

- (1) The interquartile range for semester 1 is greater than the interquartile range for semester 2.
- (2) The median score for semester 1 is greater than the median score for semester 2.
- (3) The mean score for semester 2 is greater than the mean score for semester 1.
- (4) The third quartile for semester 2 is greater than the third quartile for semester 1.



Use this space for  
computations.

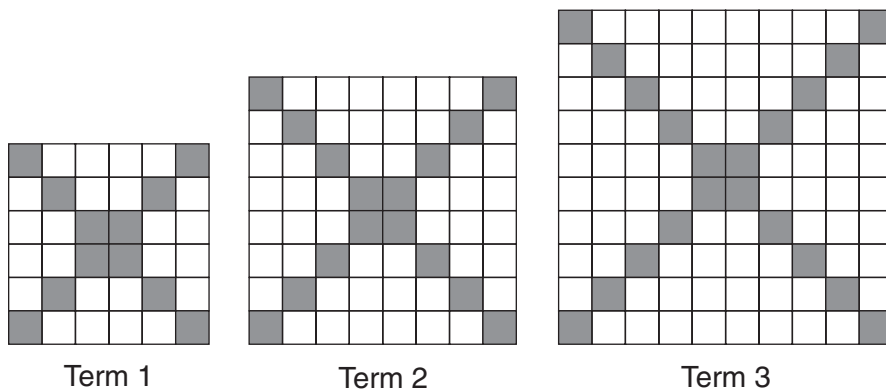
22 A cell phone company charges \$60.00 a month for up to 1 gigabyte of data. The cost of additional data is \$0.05 per megabyte. If  $d$  represents the number of additional megabytes used and  $c$  represents the total charges at the end of the month, which linear equation can be used to determine a user's monthly bill?

- (1)  $c = 60 - 0.05d$                       (3)  $c = 60d - 0.05$   
 (2)  $c = 60.05d$                          (4)  $c = 60 + 0.05d$

23 The formula for the volume of a cone is  $V = \frac{1}{3}\pi r^2 h$ . The radius,  $r$ , of the cone may be expressed as

- (1)  $\sqrt{\frac{3V}{\pi h}}$                                       (3)  $3\sqrt{\frac{V}{\pi h}}$   
 (2)  $\sqrt{\frac{V}{3\pi h}}$                                       (4)  $\frac{1}{3}\sqrt{\frac{V}{\pi h}}$

24 The diagrams below represent the first three terms of a sequence.



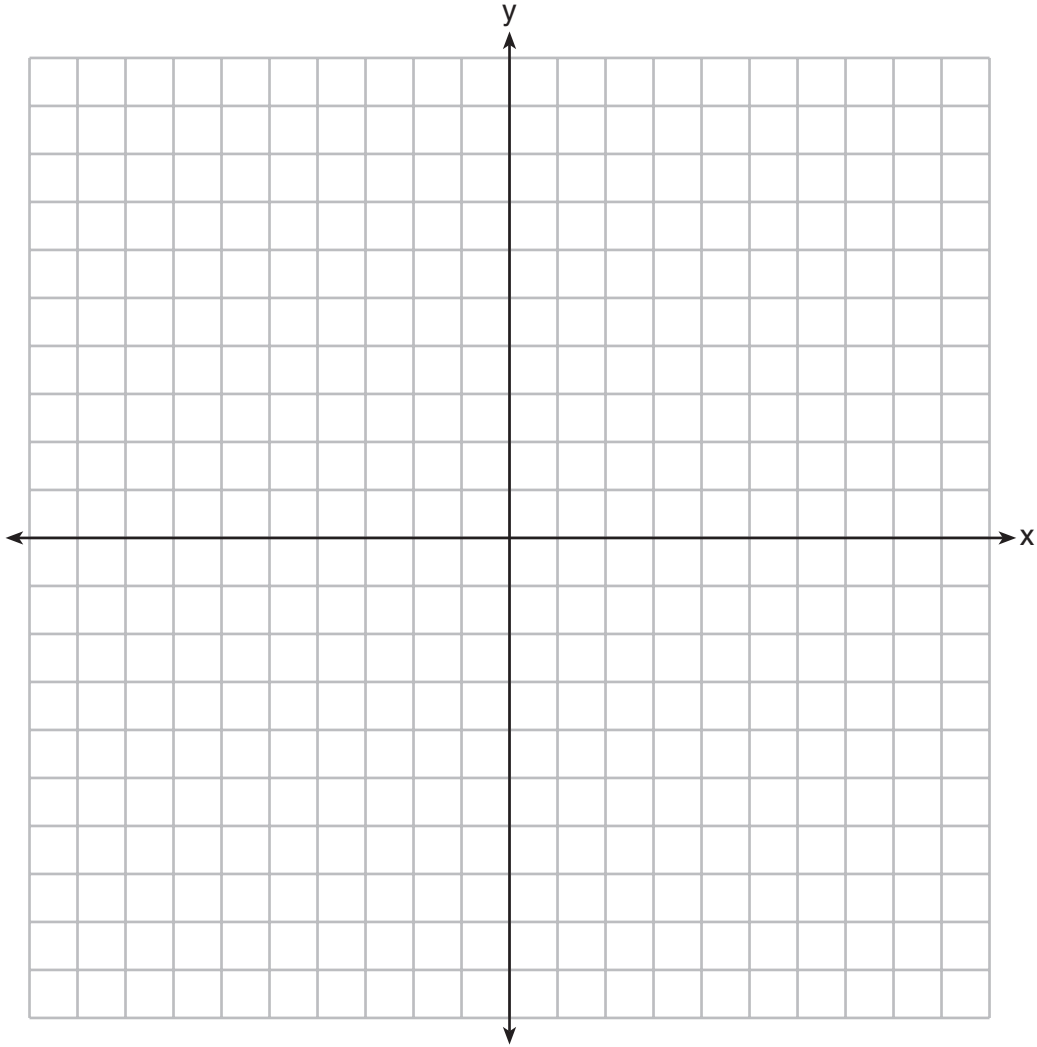
Assuming the pattern continues, which formula determines  $a_n$ , the number of shaded squares in the  $n$ th term?

- (1)  $a_n = 4n + 12$                               (3)  $a_n = 4n + 4$   
 (2)  $a_n = 4n + 8$                               (4)  $a_n = 4n + 2$

Part II

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. 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 Draw the graph of  $y = \sqrt{x} - 1$  on the set of axes below.

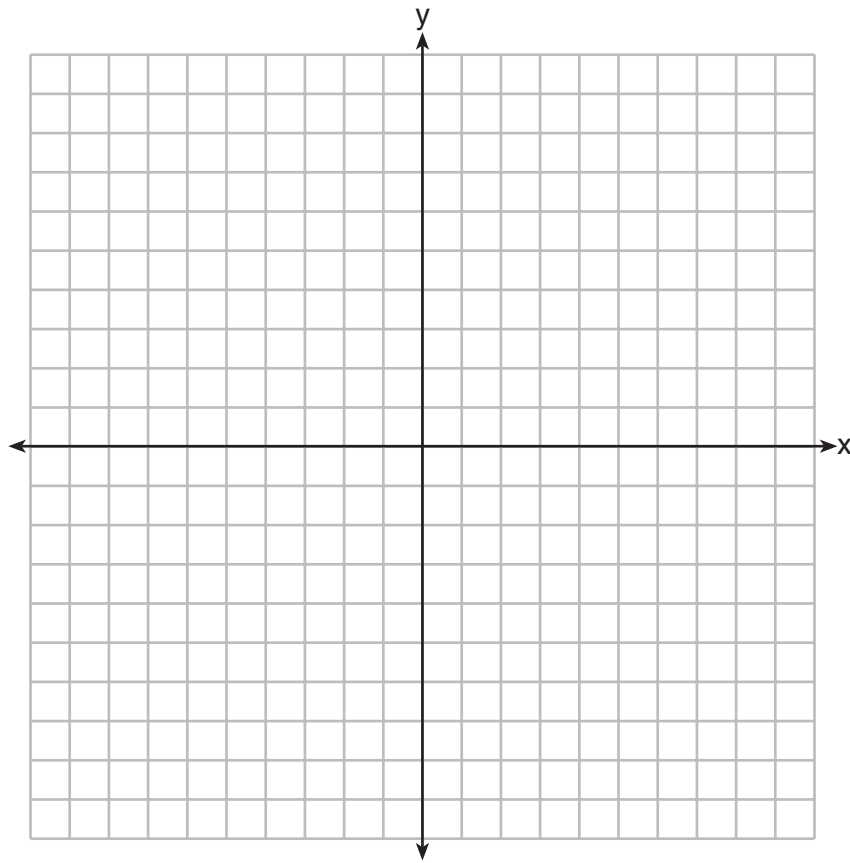


**26** The breakdown of a sample of a chemical compound is represented by the function  $p(t) = 300(0.5)^t$ , where  $p(t)$  represents the number of milligrams of the substance and  $t$  represents the time, in years. In the function  $p(t)$ , explain what 0.5 and 300 represent.

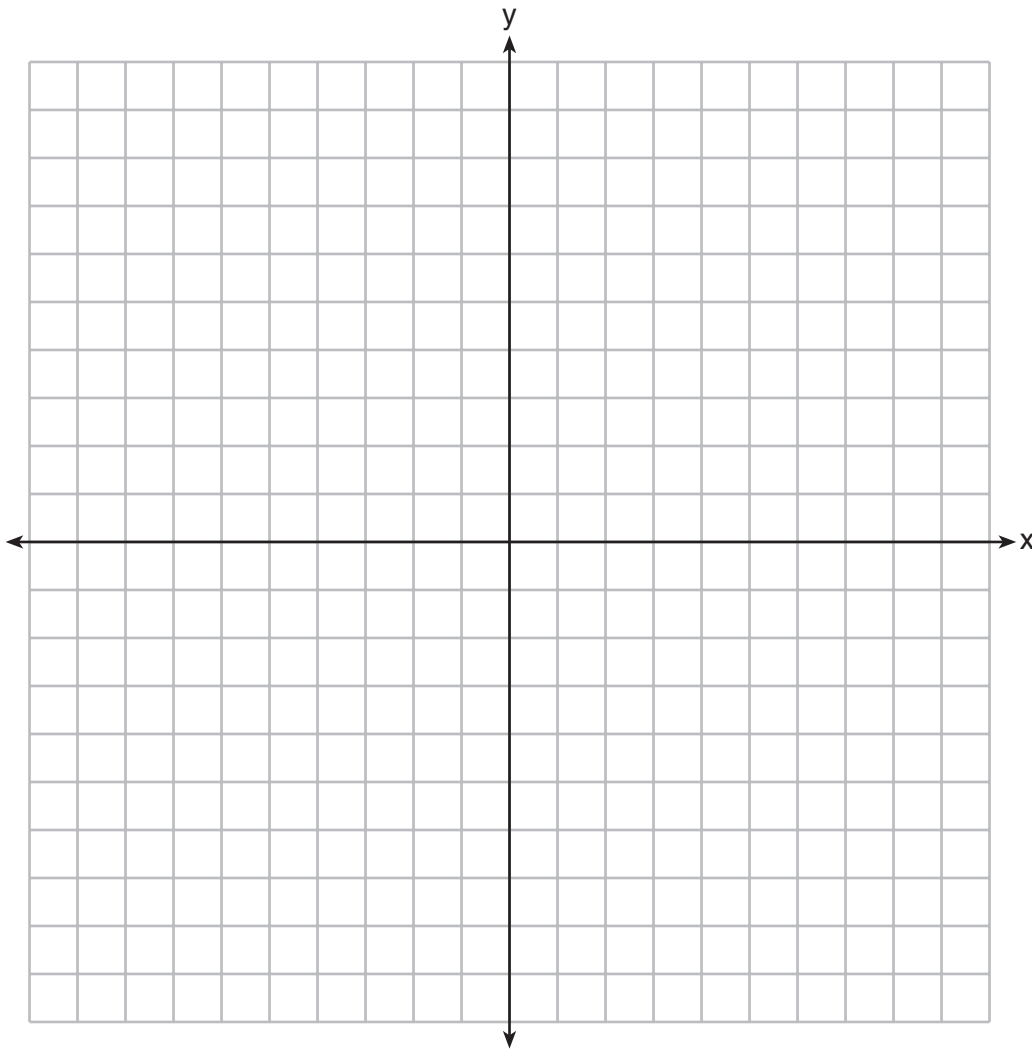
**27** Given  $2x + ax - 7 > -12$ , determine the largest integer value of  $a$  when  $x = -1$ .

**28** The vertex of the parabola represented by  $f(x) = x^2 - 4x + 3$  has coordinates  $(2, -1)$ . Find the coordinates of the vertex of the parabola defined by  $g(x) = f(x - 2)$ . Explain how you arrived at your answer.

[The use of the set of axes below is optional.]



29 On the set of axes below, draw the graph of the equation  $y = -\frac{3}{4}x + 3$ .



Is the point (3,2) a solution to the equation? Explain your answer based on the graph drawn.

**30** The function  $f$  has a domain of  $\{1, 3, 5, 7\}$  and a range of  $\{2, 4, 6\}$ .

Could  $f$  be represented by  $\{(1,2), (3,4), (5,6), (7,2)\}$ ?

Justify your answer.

**31** Factor the expression  $x^4 + 6x^2 - 7$  completely.



**32** Robin collected data on the number of hours she watched television on Sunday through Thursday nights for a period of 3 weeks. The data are shown in the table below.

	Sun	Mon	Tues	Wed	Thurs
Week 1	4	3	3.5	2	2
Week 2	4.5	5	2.5	3	1.5
Week 3	4	3	1	1.5	2.5

Using an appropriate scale on the number line below, construct a box plot for the 15 values.



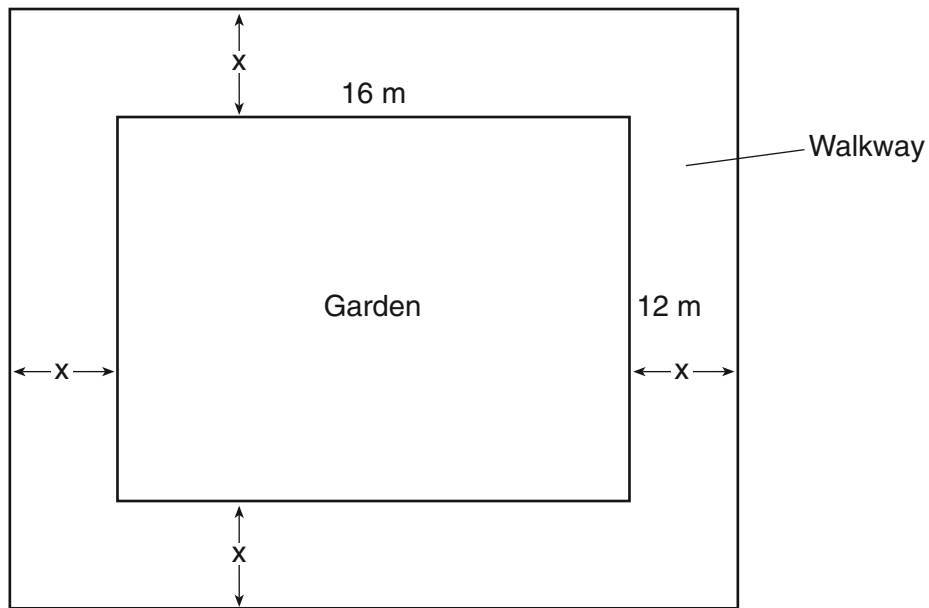
### Part III

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. 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 Write an equation that defines  $m(x)$  as a trinomial where  $m(x) = (3x - 1)(3 - x) + 4x^2 + 19$ .

Solve for  $x$  when  $m(x) = 0$ .

- 34 A rectangular garden measuring 12 meters by 16 meters is to have a walkway installed around it with a width of  $x$  meters, as shown in the diagram below. Together, the walkway and the garden have an area of 396 square meters.



Write an equation that can be used to find  $x$ , the width of the walkway.

Describe how your equation models the situation.

Determine and state the width of the walkway, in meters.

**35** Caitlin has a movie rental card worth \$175. After she rents the first movie, the card's value is \$172.25. After she rents the second movie, its value is \$169.50. After she rents the third movie, the card is worth \$166.75.

Assuming the pattern continues, write an equation to define  $A(n)$ , the amount of money on the rental card after  $n$  rentals.

Caitlin rents a movie every Friday night. How many weeks in a row can she afford to rent a movie, using her rental card only? Explain how you arrived at your answer.

**36** An animal shelter spends \$2.35 per day to care for each cat and \$5.50 per day to care for each dog. Pat noticed that the shelter spent \$89.50 caring for cats and dogs on Wednesday.

Write an equation to represent the possible numbers of cats and dogs that could have been at the shelter on Wednesday.

Pat said that there might have been 8 cats and 14 dogs at the shelter on Wednesday. Are Pat's numbers possible? Use your equation to justify your answer.

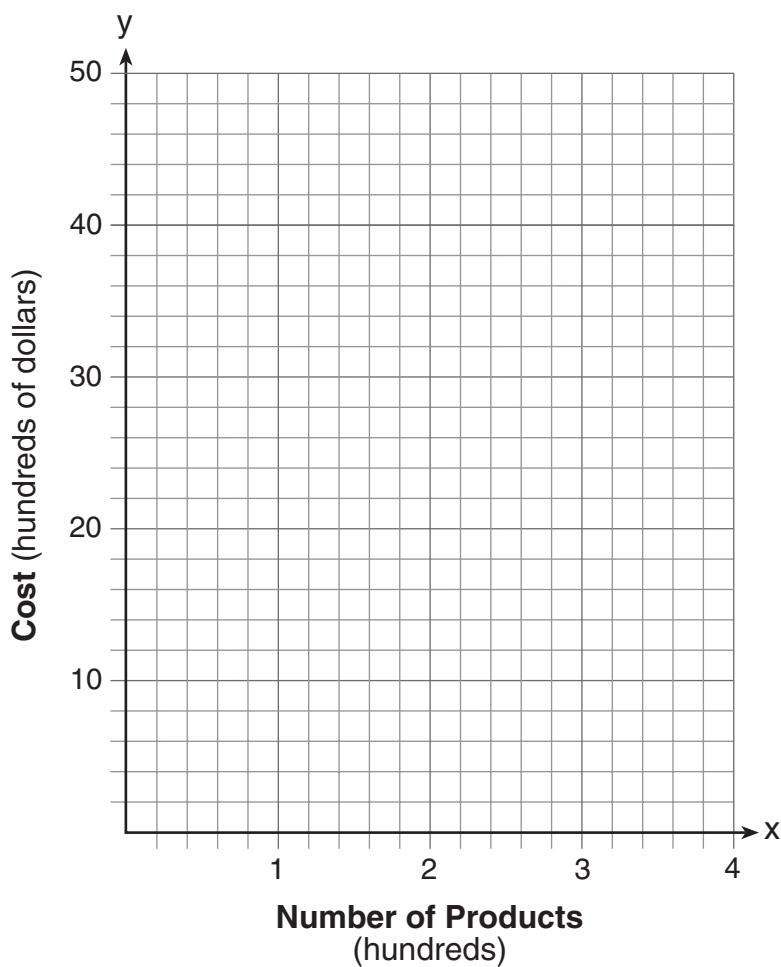
Later, Pat found a record showing that there were a total of 22 cats and dogs at the shelter on Wednesday. How many cats were at the shelter on Wednesday?

Part IV

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. A correct numerical answer with no work shown will receive only 1 credit. The answer should be written in pen. [6]

37 A company is considering building a manufacturing plant. They determine the weekly production cost at site A to be  $A(x) = 3x^2$  while the production cost at site B is  $B(x) = 8x + 3$ , where  $x$  represents the number of products, *in hundreds*, and  $A(x)$  and  $B(x)$  are the production costs, *in hundreds of dollars*.

Graph the production cost functions on the set of axes below and label them site A and site B.



Question 37 is continued on the next page.

**Question 37 continued**

State the positive value(s) of  $x$  for which the production costs at the two sites are equal.  
Explain how you determined your answer.

If the company plans on manufacturing 200 products per week, which site should they use?  
Justify your answer.

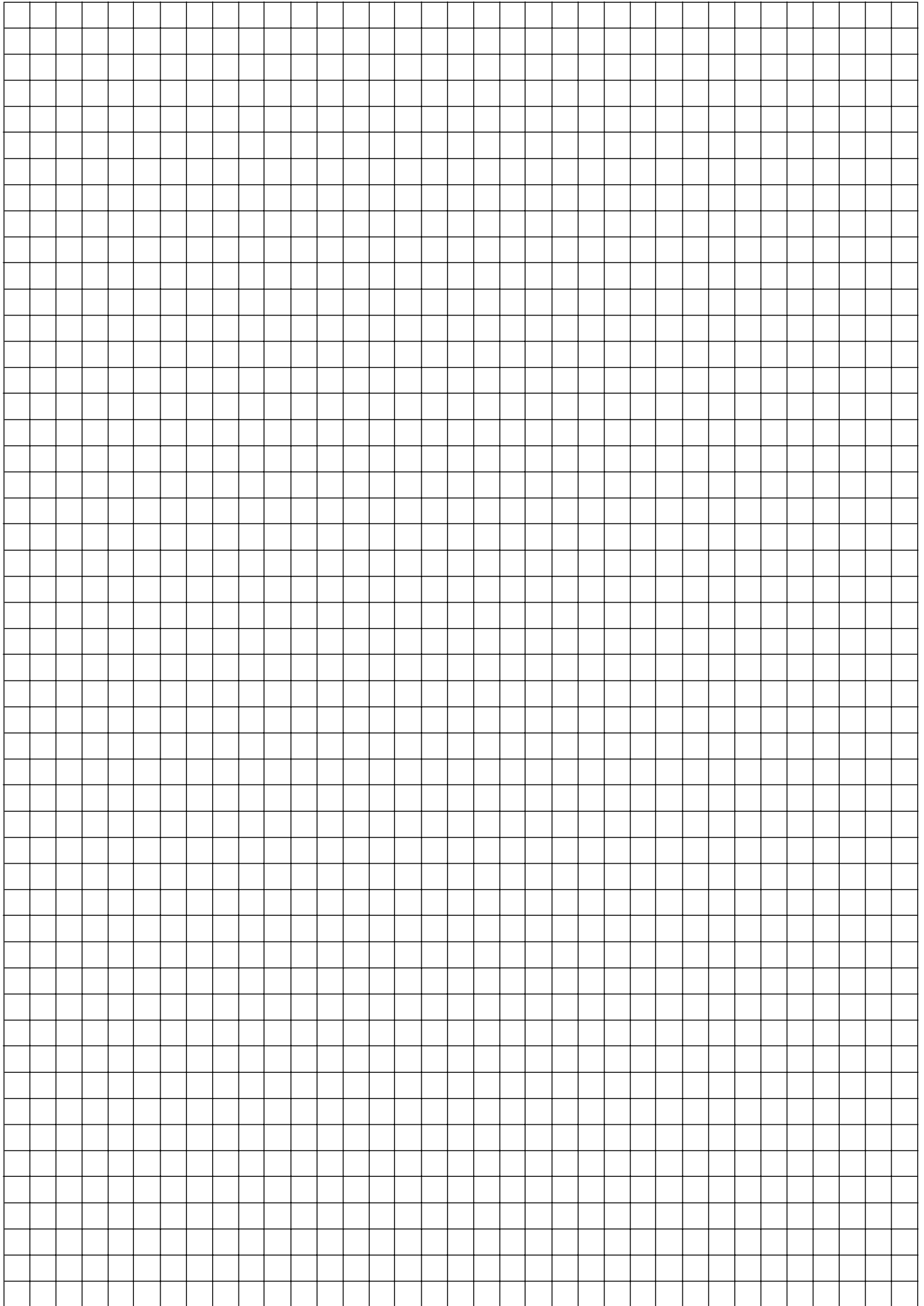




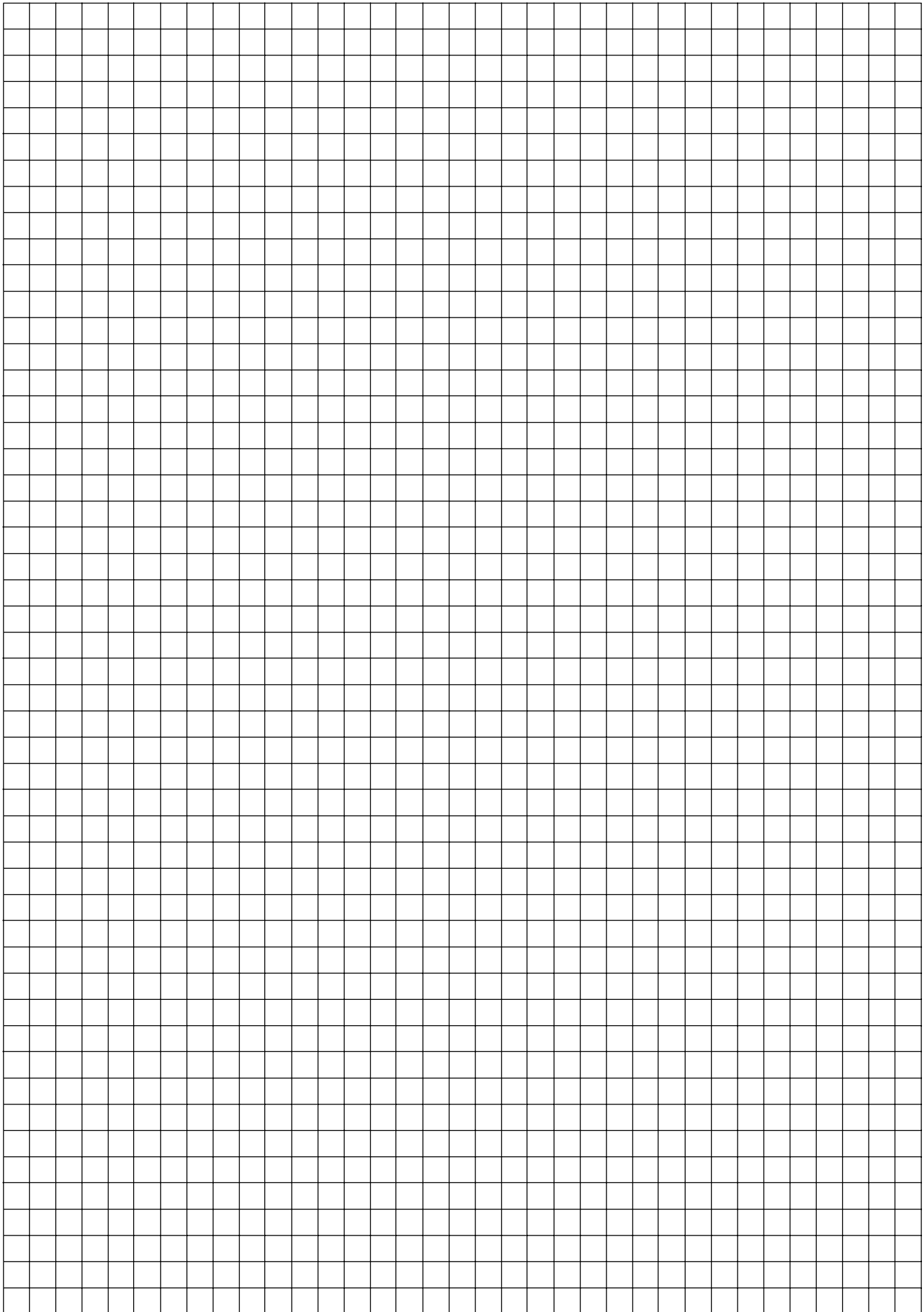
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## High School Math Reference Sheet

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	$A = \frac{1}{2}bh$
Parallelogram	$A = bh$
Circle	$A = \pi r^2$
Circle	$C = \pi d$ or $C = 2\pi r$
General Prisms	$V = Bh$
Cylinder	$V = \pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$
Cone	$V = \frac{1}{3}\pi r^2 h$
Pyramid	$V = \frac{1}{3}Bh$

Pythagorean Theorem	$a^2 + b^2 = c^2$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Geometric Sequence	$a_n = a_1 r^{n-1}$
Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Radians	1 radian = $\frac{180}{\pi}$ degrees
Degrees	1 degree = $\frac{\pi}{180}$ radians
Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$

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