The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I (Common Core)

Wednesday, August 12, 2015 — 8:30 to 11:30 a.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.

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]

Use this space for computations.

1 Given the graph of the line represented by the equation $f(x) = -2x + b$, if b is increased by 4 units, the graph of the new line would be shifted 4 units

(1) right (3) left

(2) up (4) down

2 Rowan has $50 in a savings jar and is putting in $5 every week. Jonah has $10 in his own jar and is putting in $15 every week. Each of them plots his progress on a graph with time on the horizontal axis and amount in the jar on the vertical axis. Which statement about their graphs is true?

(1) Rowan's graph has a steeper slope than Jonah's.

(2) Rowan's graph always lies above Jonah's.

(3) Jonah's graph has a steeper slope than Rowan's.

(4) Jonah's graph always lies above Rowan's.

3 To watch a varsity basketball game, spectators must buy a ticket at the door. The cost of an adult ticket is $3.00 and the cost of a student ticket is $1.50. If the number of adult tickets sold is represented by a and student tickets sold by s, which expression represents the amount of money collected at the door from the ticket sales?

(1) $4.50as$ (3) $(3.00a)(1.50s)$

(2) $4.50(a + s)$ (4) $3.00a + 1.50s$

4 The graph of $f(x)$ is shown below.
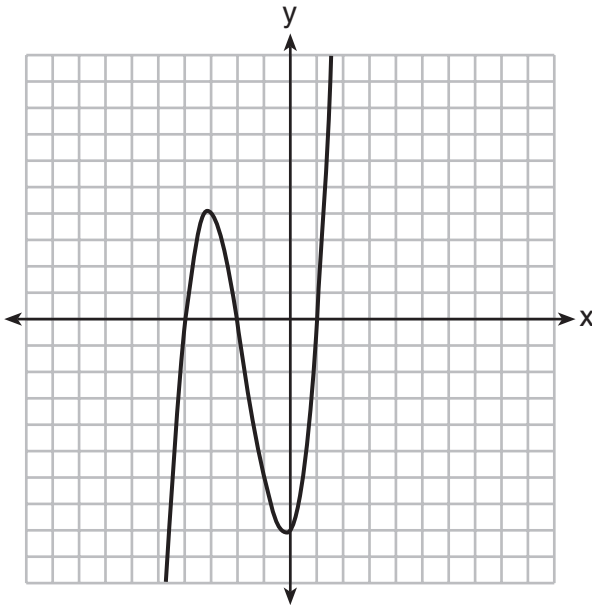

Which function could represent the graph of $f(x)$?

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

(2) $f(x) = (x - 2)(x^2 + 3x - 4)$

(3) $f(x) = (x + 2)(x^2 + 3x + 4)$

(4) $f(x) = (x - 2)(x^2 + 3x + 4)$

5 The cost of a pack of chewing gum in a vending machine is \$0.75. The cost of a bottle of juice in the same machine is \$1.25. Julia has \$22.00 to spend on chewing gum and bottles of juice for her team and she must buy seven packs of chewing gum. If b represents the number of bottles of juice, which inequality represents the maximum number of bottles she can buy?

(1) $0.75b + 1.25(7) \geq 22$ (3) $0.75(7) + 1.25b \geq 22$

(2) $0.75b + 1.25(7) \leq 22$ (4) $0.75(7) + 1.25b \leq 22$

6 Which graph represents the solution of $y \leq x + 3$ and $y \geq -2x - 2$?

(1)

(3)

(2)

(4)
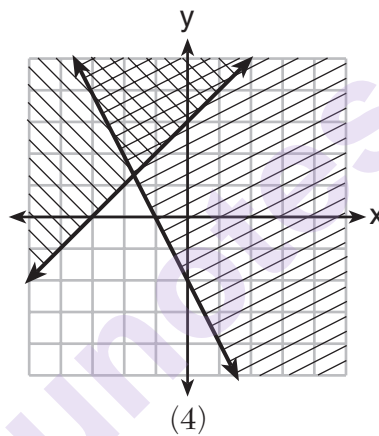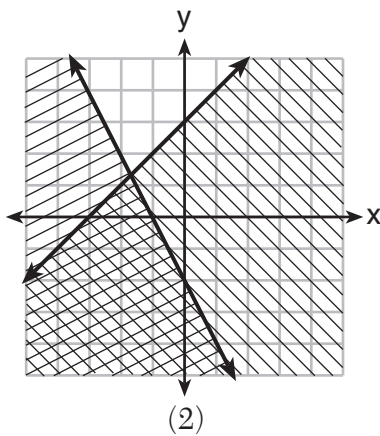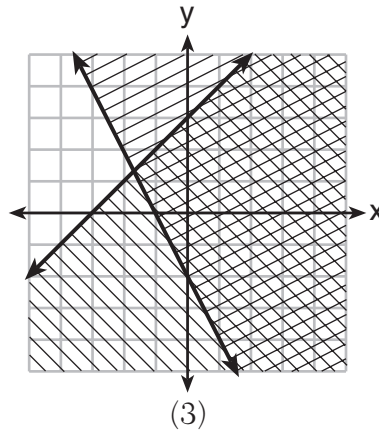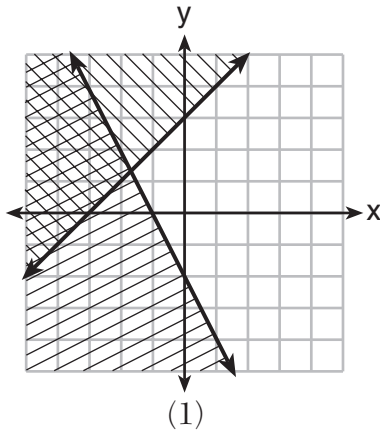
7 The country of Benin in West Africa has a population of 9.05 million people. The population is growing at a rate of 3.1% each year. Which function can be used to find the population 7 years from now?

(1) $f(t) = (9.05 \times 10^6)(1 - 0.31)^7$

(2) $f(t) = (9.05 \times 10^6)(1 + 0.31)^7$

(3) $f(t) = (9.05 \times 10^6)(1 + 0.031)^7$

(4) $f(t) = (9.05 \times 10^6)(1 - 0.031)^7$

8 A typical cell phone plan has a fixed base fee that includes a certain amount of data and an overage charge for data use beyond the plan. A cell phone plan charges a base fee of \$62 and an overage charge of \$30 per gigabyte of data that exceed 2 gigabytes. If C represents the cost and g represents the total number of gigabytes of data, which equation could represent this plan when more than 2 gigabytes are used?

(1) $C = 30 + 62(2 - g)$ (3) $C = 62 + 30(2 - g)$

(2) $C = 30 + 62(g - 2)$ (4) $C = 62 + 30(g - 2)$

9 Four expressions are shown below.

$$\text{I} \qquad 2(2x^2 - 2x - 60)$$
$$\text{II} \qquad 4(x^2 - x - 30)$$
$$\text{III} \qquad 4(x + 6)(x - 5)$$
$$\text{IV} \qquad 4x(x - 1) - 120$$

The expression $4x^2 - 4x - 120$ is equivalent to

(1) I and II, only   (3) I, II, and IV

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

10 Last week, a candle store received \$355.60 for selling 20 candles. Small candles sell for \$10.98 and large candles sell for \$27.98. How many large candles did the store sell?
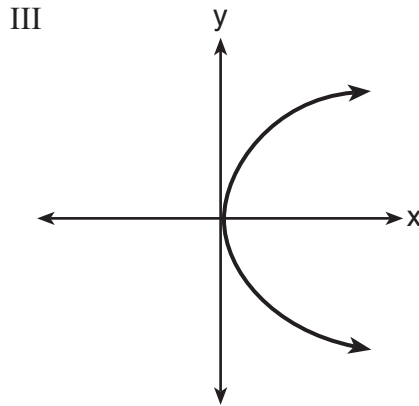
(1) 6   (3) 10

(2) 8   (4) 12

11 Which representations are functions?

I

x	y
2	6
3	−12
4	7
5	5
2	−6

III

II $\{ (1,1), (2,1), (3,2), (4,3), (5,5), (6,8), (7,13) \}$ IV $y = 2x + 1$

(1) I and II

(2) II and IV

(3) III, only

(4) IV, only

12 If $f(x) = \dfrac{\sqrt{2x+3}}{6x-5}$, then $f\left(\dfrac{1}{2}\right) =$

(1) 1

(2) −2

(3) −1

(4) $-\dfrac{13}{3}$

13 The zeros of the function $f(x) = 3x^2 - 3x - 6$ are

(1) −1 and −2

(2) 1 and −2

(3) 1 and 2

(4) −1 and 2

14 Which recursively defined function has a first term equal to 10 and a common difference of 4?

(1) $f(1) = 10$
$f(x) = f(x - 1) + 4$

(3) $f(1) = 10$
$f(x) = 4f(x - 1)$

(2) $f(1) = 4$
$f(x) = f(x - 1) + 10$

(4) $f(1) = 4$
$f(x) = 10f(x - 1)$

15 Firing a piece of pottery in a kiln takes place at different temperatures for different amounts of time. The graph below shows the temperatures in a kiln while firing a piece of pottery after the kiln is preheated to 200°F.
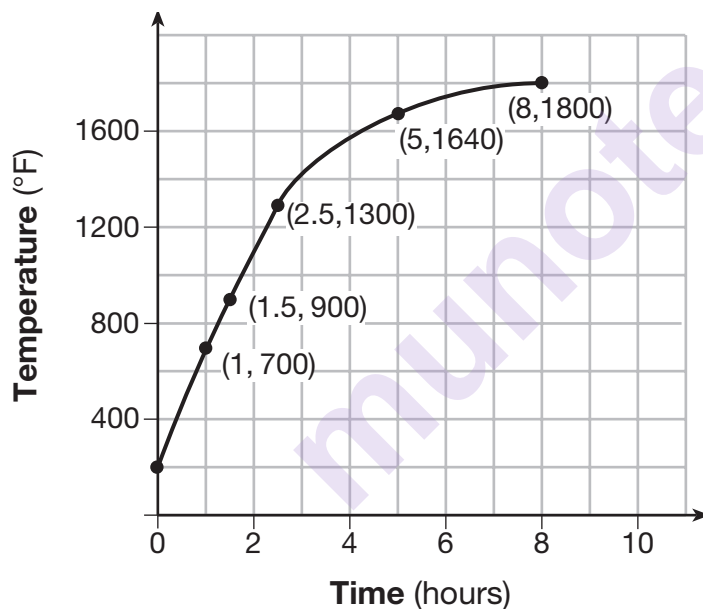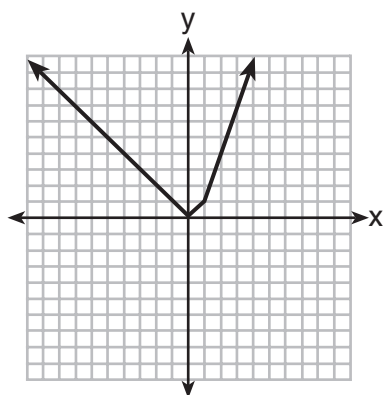

During which time interval did the temperature in the kiln show the greatest average rate of change?

(1) 0 to 1 hour

(3) 2.5 hours to 5 hours

(2) 1 hour to 1.5 hours

(4) 5 hours to 8 hours

16 Which graph represents $f(x) = \begin{cases} |x| & x < 1 \\ \sqrt{x} & x \geq 1 \end{cases}$?

(1)
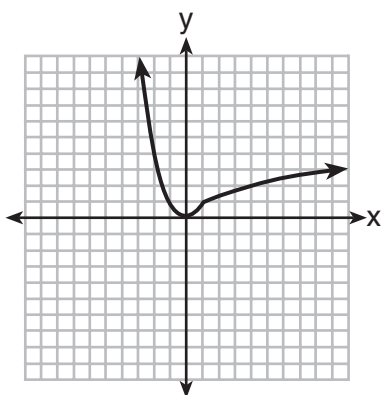
(3)
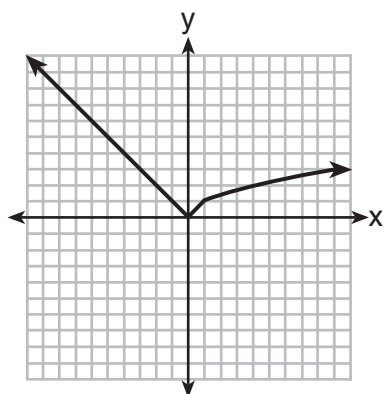
(2)

(4)

17 If $f(x) = x^2 - 2x - 8$ and $g(x) = \frac{1}{4}x - 1$, for which values of x is $f(x) = g(x)$?

(1) -1.75 and -1.438 (3) -1.438 and 0

(2) -1.75 and 4 (4) 4 and 0

18 Alicia has invented a new app for smart phones that two companies are interested in purchasing for a 2-year contract.

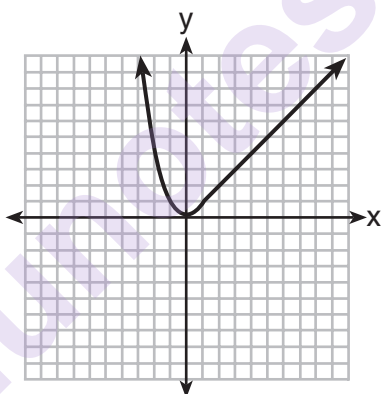Company *A* is offering her $10,000 for the first month and will increase the amount each month by $5000.

Company *B* is offering $500 for the first month and will double their payment each month from the previous month.

Monthly payments are made at the end of each month. For which monthly payment will company *B*'s payment first exceed company *A*'s payment?

(1) 6   (3) 8

(2) 7   (4) 9

19 The two sets of data below represent the number of runs scored by two different youth baseball teams over the course of a season.

> Team *A*:   4, 8, 5, 12, 3, 9, 5, 2
> Team *B*:   5, 9, 11, 4, 6, 11, 2, 7

Which set of statements about the mean and standard deviation is true?

(1) mean *A* < mean *B*
    standard deviation *A* > standard deviation *B*

(2) mean *A* > mean *B*
    standard deviation *A* < standard deviation *B*

(3) mean *A* < mean *B*
    standard deviation *A* < standard deviation *B*

(4) mean *A* > mean *B*
    standard deviation *A* > standard deviation *B*

20 If Lylah completes the square for $f(x) = x^2 - 12x + 7$ in order to find the minimum, she must write $f(x)$ in the general form $f(x) = (x - a)^2 + b$. What is the value of a for $f(x)$?

(1) 6   (3) 12

(2) −6   (4) −12

21 Given the following quadratic functions:

$$g(x) = -x^2 - x + 6$$

and

x	−3	−2	−1	0	1	2	3	4	5
n(x)	−7	0	5	8	9	8	5	0	−7

Which statement about these functions is true?

(1) Over the interval $-1 \leq x \leq 1$, the average rate of change for $n(x)$ is less than that for $g(x)$.

(2) The y-intercept of $g(x)$ is greater than the y-intercept for $n(x)$.

(3) The function $g(x)$ has a greater maximum value than $n(x)$.

(4) The sum of the roots of $n(x) = 0$ is greater than the sum of the roots of $g(x) = 0$.

22 For which value of P and W is $P + W$ a rational number?

(1) $P = \dfrac{1}{\sqrt{3}}$ and $W = \dfrac{1}{\sqrt{6}}$

(2) $P = \dfrac{1}{\sqrt{4}}$ and $W = \dfrac{1}{\sqrt{9}}$

(3) $P = \dfrac{1}{\sqrt{6}}$ and $W = \dfrac{1}{\sqrt{10}}$

(4) $P = \dfrac{1}{\sqrt{25}}$ and $W = \dfrac{1}{\sqrt{2}}$

23 The solution of the equation $(x + 3)^2 = 7$ is

(1) $3 \pm \sqrt{7}$ (3) $-3 \pm \sqrt{7}$

(2) $7 \pm \sqrt{3}$ (4) $-7 \pm \sqrt{3}$

24 Which trinomial is equivalent to $3(x - 2)^2 - 2(x - 1)$?

(1) $3x^2 - 2x - 10$ (3) $3x^2 - 14x + 10$

(2) $3x^2 - 2x - 14$ (4) $3x^2 - 14x + 14$

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. 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 Each day Toni records the height of a plant for her science lab. Her data are shown in the table below.

Day (n)	1	2	3	4	5
Height (cm)	3.0	4.5	6.0	7.5	9.0

The plant continues to grow at a constant daily rate. Write an equation to represent $h(n)$, the height of the plant on the nth day.

26 On the set of axes below, graph the inequality $2x + y > 1$.
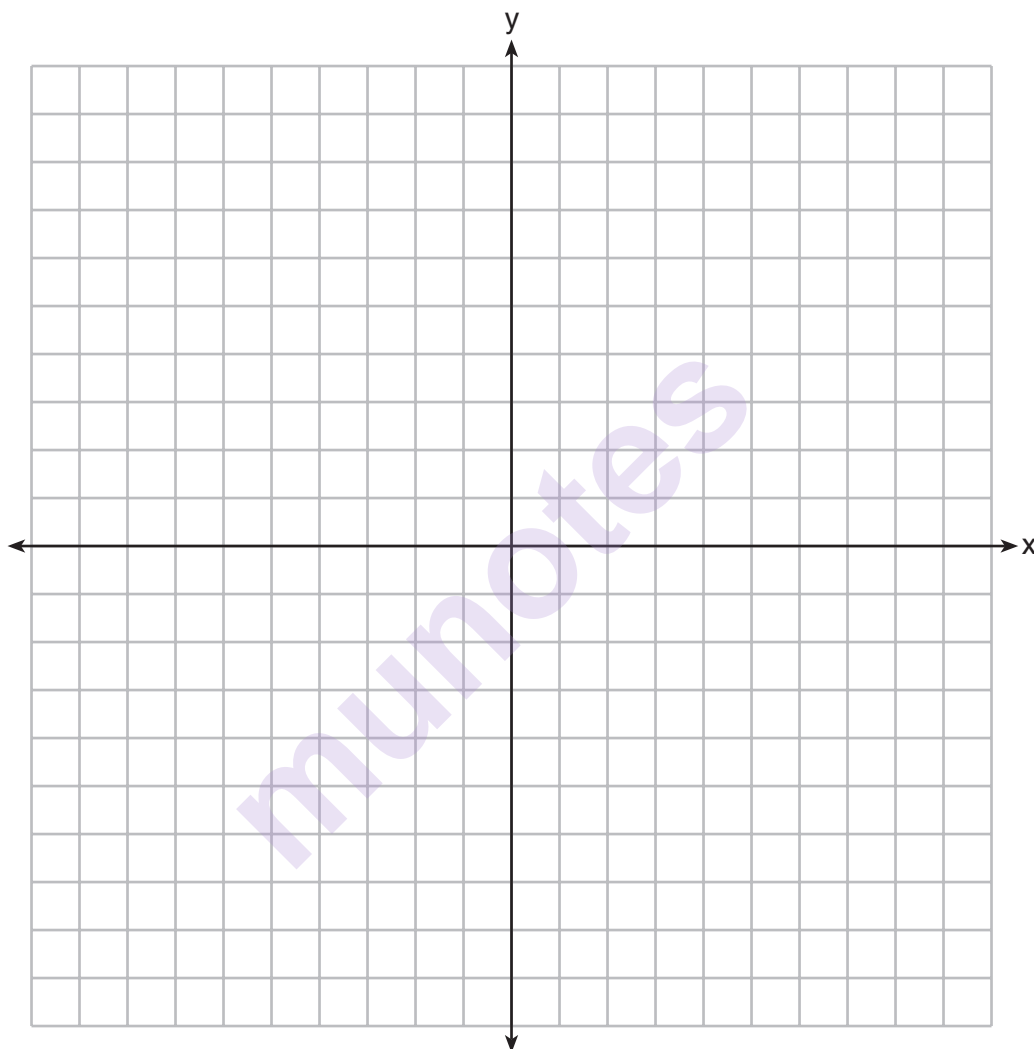
27 Rachel and Marc were given the information shown below about the bacteria growing in a Petri dish in their biology class.

Number of Hours, x	1	2	3	4	5	6	7	8	9	10
Number of Bacteria, B(x)	220	280	350	440	550	690	860	1070	1340	1680

Rachel wants to model this information with a linear function. Marc wants to use an exponential function. Which model is the better choice? Explain why you chose this model.

28 A driver leaves home for a business trip and drives at a constant speed of 60 miles per hour for 2 hours. Her car gets a flat tire, and she spends 30 minutes changing the tire. She resumes driving and drives at 30 miles per hour for the remaining one hour until she reaches her destination.

On the set of axes below, draw a graph that models the driver's distance from home.
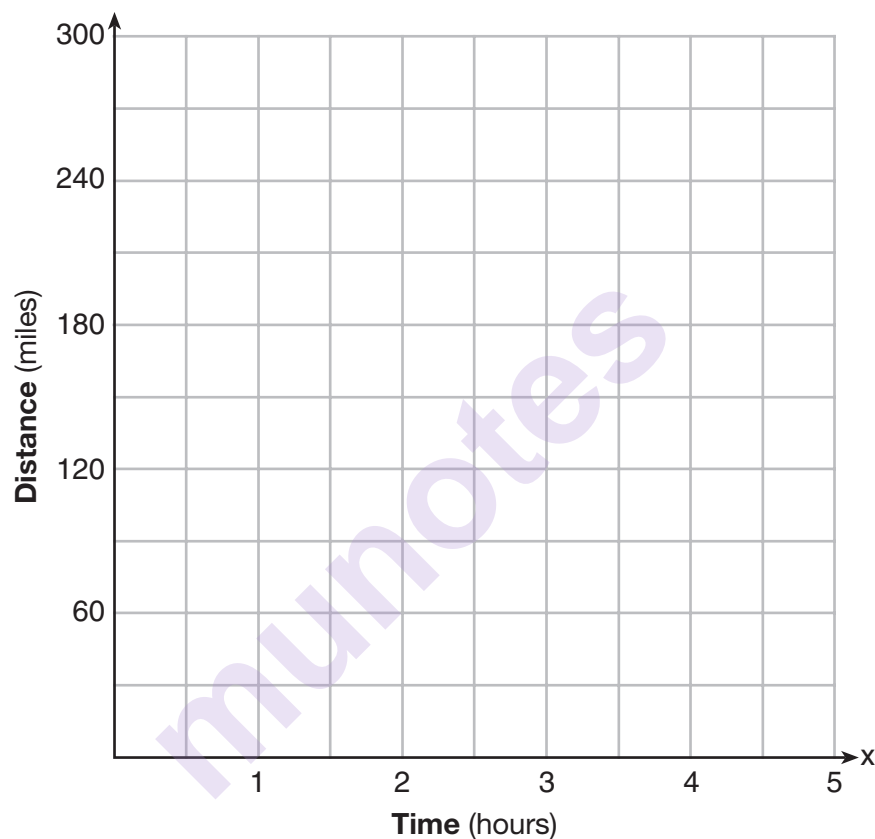
29 How many real solutions does the equation $x^2 - 2x + 5 = 0$ have? Justify your answer.

30 The number of carbon atoms in a fossil is given by the function $y = 5100(0.95)^x$, where x represents the number of years since being discovered.

What is the percent of change each year? Explain how you arrived at your answer.

31 A toy rocket is launched from the ground straight upward. The height of the rocket above the ground, in feet, is given by the equation $h(t) = -16t^2 + 64t$, where t is the time in seconds. Determine the domain for this function in the given context. Explain your reasoning.

32 Jackson is starting an exercise program. The first day he will spend 30 minutes on a treadmill. He will increase his time on the treadmill by 2 minutes each day. Write an equation for $T(d)$, the time, in minutes, on the treadmill on day d.

Find $T(6)$, the minutes he will spend on the treadmill on day 6.

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 Graph $f(x) = x^2$ and $g(x) = 2^x$ for $x \geq 0$ on the set of axes below.
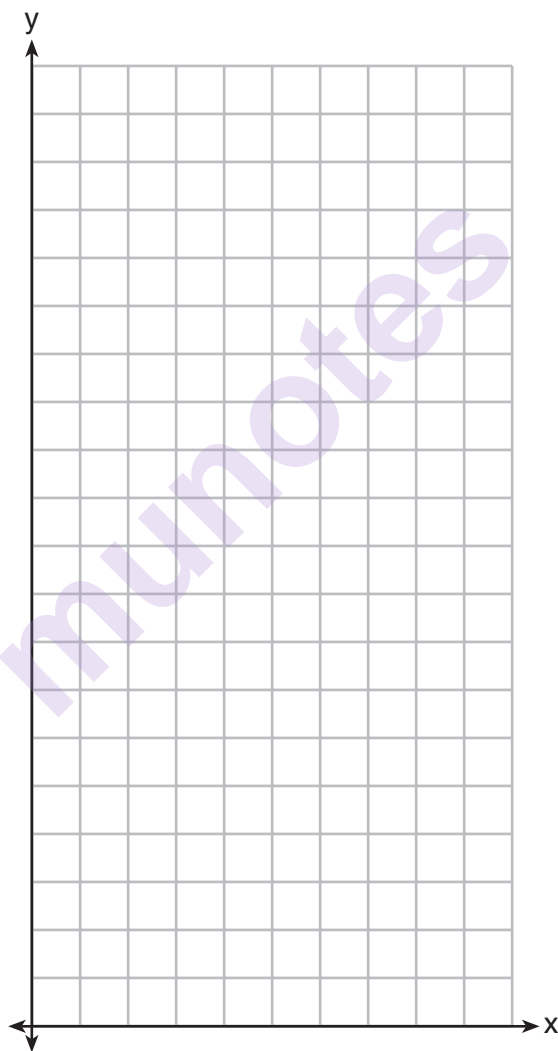
State which function, $f(x)$ or $g(x)$, has a greater value when $x = 20$. Justify your reasoning.

34 Solve for x algebraically: $7x - 3(4x - 8) \le 6x + 12 - 9x$

If x is a number in the interval [4,8], state all integers that satisfy the given inequality. Explain how you determined these values.

35 The volume of a large can of tuna fish can be calculated using the formula $V = \pi r^2 h$. Write an equation to find the radius, r, in terms of V and h.

Determine the diameter, to the *nearest inch*, of a large can of tuna fish that has a volume of 66 cubic inches and a height of 3.3 inches.

36 The table below shows the attendance at a museum in select years from 2007 to 2013.

Attendance at Museum

Year	2007	2008	2009	2011	2013
Attendance (millions)	8.3	8.5	8.5	8.8	9.3

State the linear regression equation represented by the data table when $x = 0$ is used to represent the year 2007 and y is used to represent the attendance. Round all values to the *nearest hundredth*.

State the correlation coefficient to the *nearest hundredth* and determine whether the data suggest a strong or weak association.

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. 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 written in pencil.   [6]

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37 A rectangular picture measures 6 inches by 8 inches. Simon wants to build a wooden frame for the picture so that the framed picture takes up a maximum area of 100 square inches on his wall. The pieces of wood that he uses to build the frame all have the same width.

Write an equation or inequality that could be used to determine the maximum width of the pieces of wood for the frame Simon could create.
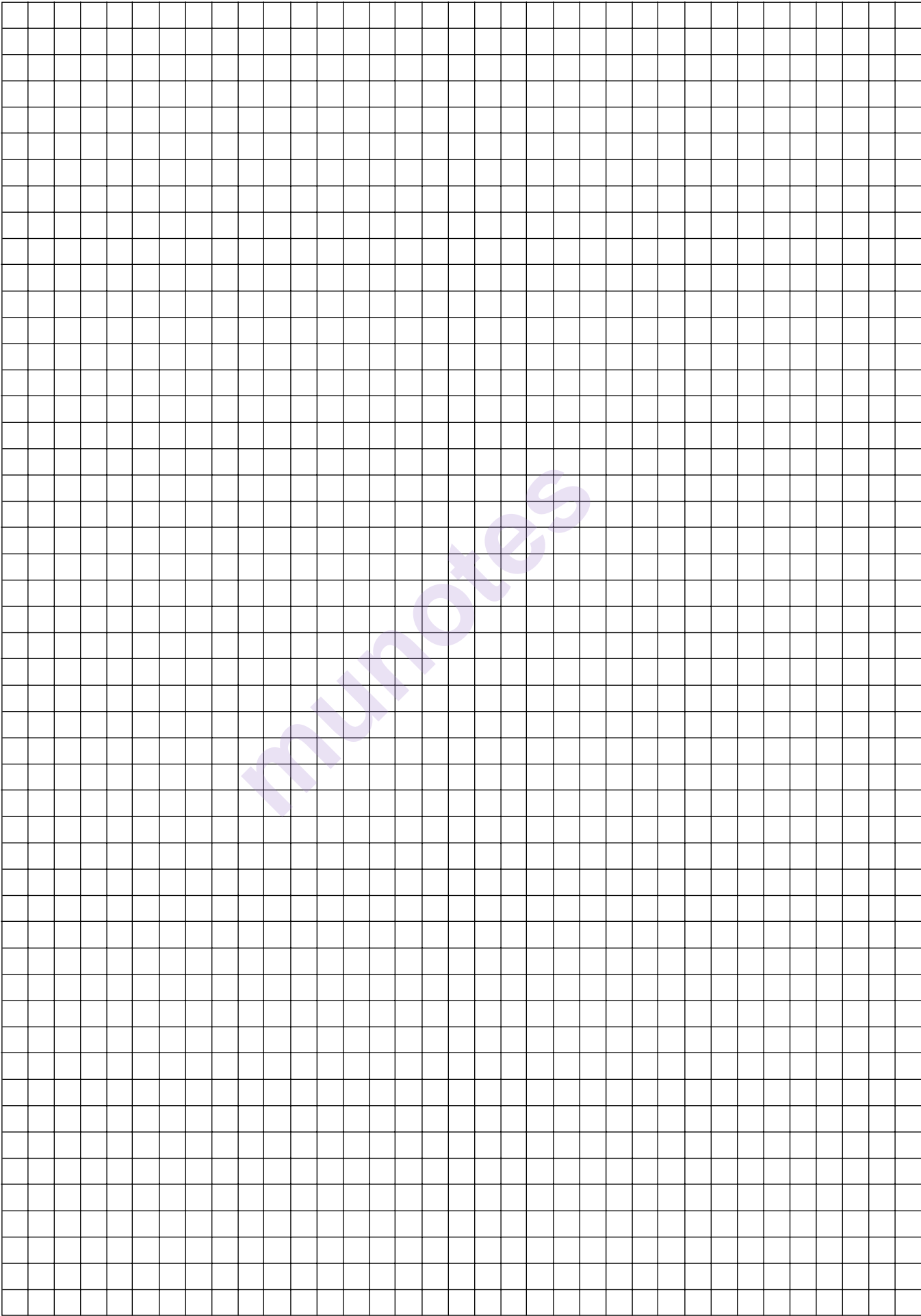
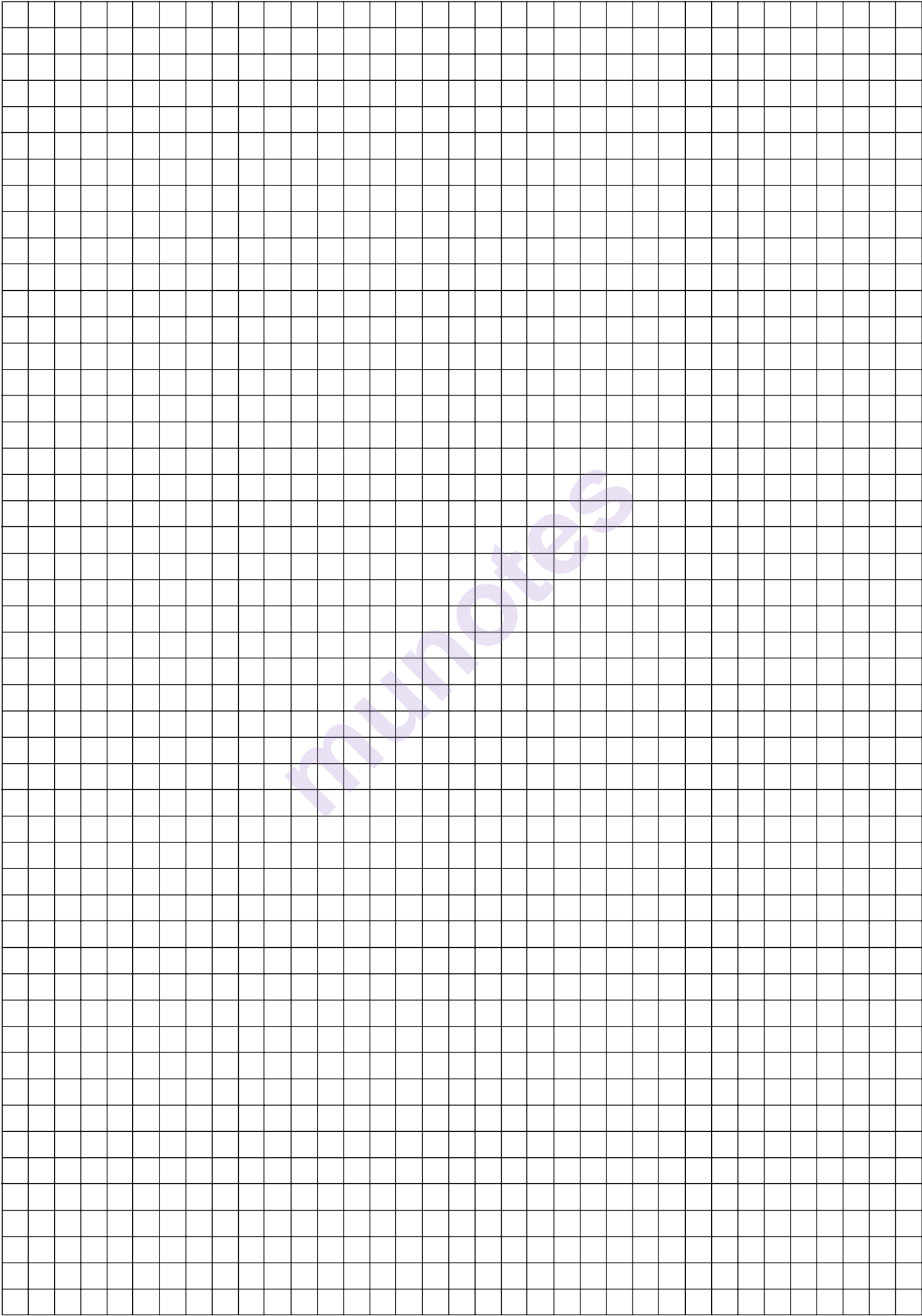Explain how your equation or inequality models the situation.

Solve the equation or inequality to determine the maximum width of the pieces of wood used for the frame to the *nearest tenth of an inch*.

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

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