ALGEBRA

II

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

ALGEBRA II

Wednesday, August 14, 2019 — 12:30 to 3:30 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]

Use this space for computations.

1 When the expression $(x + 2)^2 + 4(x + 2) + 3$ is rewritten as the product of two binomials, the result is

(1) $(x + 3)(x + 1)$
(2) $(x + 5)(x + 3)$
(3) $(x + 2)(x + 2)$
(4) $(x + 6)(x + 1)$

2 The first term of a geometric sequence is 8 and the fourth term is 216. What is the sum of the first 12 terms of the corresponding series?

(1) 236,192
(2) 708,584
(3) 2,125,760
(4) 6,377,288

3 Perry invested in property that cost him \$1500. Five years later it was worth \$3000, and 10 years from his original purchase, it was worth \$6000. Assuming the growth rate remains the same, which type of function could he create to find the value of his investment 30 years from his original purchase?

(1) exponential function
(2) linear function
(3) quadratic function
(4) trigonometric function

4 If $(a^3 + 27) = (a + 3)(a^2 + ma + 9)$, then m equals

(1) -9
(2) -3
(3) 3
(4) 6

Use this space for computations.

5 If $\cos \theta = -\frac{3}{4}$ and θ is in Quadrant III, then $\sin \theta$ is equivalent to

(1) $-\frac{\sqrt{7}}{4}$ (3) $-\frac{5}{4}$

(2) $\frac{\sqrt{7}}{4}$ (4) $\frac{5}{4}$

6 A veterinary pharmaceutical company plans to test a new drug to treat a common intestinal infection among puppies. The puppies are randomly assigned to two equal groups. Half of the puppies will receive the drug, and the other half will receive a placebo. The veterinarians monitor the puppies.

This is an example of which study method?

(1) census (3) survey

(2) observational study (4) controlled experiment

7 The expression $2 - \frac{x-1}{x+2}$ is equivalent to

(1) $1 - \frac{3}{x+2}$ (3) $1 - \frac{1}{x+2}$

(2) $1 + \frac{3}{x+2}$ (4) $1 + \frac{1}{x+2}$

8 Which description could represent the graph of $f(x) = 4x^2(x + a) - x - a$, if a is an integer?

(1) As $x \to -\infty$, $f(x) \to \infty$, as $x \to \infty$, $f(x) \to \infty$, and the graph has 3 x-intercepts.

(2) As $x \to -\infty$, $f(x) \to -\infty$, as $x \to \infty$, $f(x) \to \infty$, and the graph has 3 x-intercepts.

(3) As $x \to -\infty$, $f(x) \to \infty$, as $x \to \infty$, $f(x) \to -\infty$, and the graph has 4 x-intercepts.

(4) As $x \to -\infty$, $f(x) \to -\infty$, as $x \to \infty$, $f(x) \to \infty$, and the graph has 4 x-intercepts.

Use this space for computations.

9 After Roger's surgery, his doctor administered pain medication in the following amounts in milligrams over four days.

Day (n)	1	2	3	4
Dosage (m)	2000	1680	1411.2	1185.4

How can this sequence best be modeled recursively?

(1) $m_1 = 2000$
$m_n = m_{n-1} - 320$

(2) $m_n = 2000(0.84)^{n-1}$

(3) $m_1 = 2000$
$m_n = (0.84)m_{n-1}$

(4) $m_n = 2000(0.84)^{n+1}$

10 The expression $\frac{9x^2 - 2}{3x + 1}$ is equivalent to

(1) $3x - 1 - \frac{1}{3x + 1}$

(2) $3x - 1 + \frac{1}{3x + 1}$

(3) $3x + 1 - \frac{1}{3x + 1}$

(4) $3x + 1 + \frac{1}{3x + 1}$

11 If $f(x)$ is an even function, which function must also be even?

(1) $f(x - 2)$

(2) $f(x) + 3$

(3) $f(x + 1)$

(4) $f(x + 1) + 3$

12 The average monthly temperature of a city can be modeled by a cosine graph. Melissa has been living in Phoenix, Arizona, where the average annual temperature is 75°F. She would like to move, and live in a location where the average annual temperature is 62°F. When examining the graphs of the average monthly temperatures for various locations, Melissa should focus on the

(1) amplitude

(2) horizontal shift

(3) period

(4) midline

Use this space for computations.

13 Consider the probability statements regarding events A and B below.

$$P(A \text{ or } B) = 0.3;$$
$$P(A \text{ and } B) = 0.2, \text{ and}$$
$$P(A \mid B) = 0.8$$

What is $P(B)$?

(1) 0.1
(2) 0.25
(3) 0.375
(4) 0.667

14 Given $y > 0$, the expression $\sqrt{3x^2y} \bullet \sqrt[3]{27x^3y^2}$ is equivalent to

(1) $81x^5y^3$
(2) $3^{1.5}x^2y$
(3) $3^{\frac{5}{2}}x^2y^{\frac{5}{3}}$
(4) $3^{\frac{3}{2}}x^2y^{\frac{7}{6}}$

15 What is the solution set of the equation $\frac{10}{x^2 - 2x} + \frac{4}{x} = \frac{5}{x - 2}$?

(1) $\{0,2\}$
(2) $\{0\}$
(3) $\{2\}$
(4) $\{\ \}$

Use this space for computations.

16 What are the solution(s) to the system of equations shown below?

$$x^2 + y^2 = 5$$
$$y = 2x$$

(1) $x = 1$ and $x = -1$

(2) $x = 1$

(3) (1, 2) and (−1, −2)

(4) (1, 2), only

17 If \$5000 is put into a savings account that pays 3.5% interest compounded monthly, how much money, to the *nearest ten cents*, would be in that account after 6 years, assuming no money was added or withdrawn?

(1) \$5177.80

(2) \$5941.30

(3) \$6146.30

(4) \$6166.50

18 The Fahrenheit temperature, $F(t)$, of a heated object at time t, in minutes, can be modeled by the function below. F_s is the surrounding temperature, F_0 is the initial temperature of the object, and k is a constant.

$$F(t) = F_s + (F_0 - F_s)e^{-kt}$$

Coffee at a temperature of 195°F is poured into a container. The room temperature is kept at a constant 68°F and $k = 0.05$. Coffee is safe to drink when its temperature is, at most, 120°F. To the *nearest minute*, how long will it take until the coffee is safe to drink?

(1) 7

(2) 10

(3) 11

(4) 18

Use this space for computations.

19 The mean intelligence quotient (IQ) score is 100, with a standard deviation of 15, and the scores are normally distributed. Given this information, the approximate percentage of the population with an IQ greater than 130 is closest to

(1) 2% (3) 48%

(2) 31% (4) 95%

20 After examining the functions $f(x) = \ln(x + 2)$ and $g(x) = e^{x-1}$ over the interval $(-2,3]$, Lexi determined that the correct number of solutions to the equation $f(x) = g(x)$ is

(1) 1 (3) 3

(2) 2 (4) 0

21 Evan graphed a cubic function, $f(x) = ax^3 + bx^2 + cx + d$, and determined the roots of $f(x)$ to be ± 1 and 2. What is the value of b, if $a = 1$?

(1) 1 (3) -1

(2) 2 (4) -2

Use this space for computations.

22 The equation $t = \frac{1}{0.0105}\ln\left(\frac{A}{5000}\right)$ relates time, t, in years, to the amount of money, A, earned by a \$5000 investment. Which statement accurately describes the relationship between the average rates of change of t on the intervals [6000, 8000] and [9000, 12,000]?

(1) A comparison cannot be made because the intervals are different sizes.

(2) The average rate of change is equal for both intervals.

(3) The average rate of change is larger for the interval [6000, 8000].

(4) The average rate of change is larger for the interval [9000, 12,000].

23 What is the inverse of $f(x) = \frac{x}{x+2}$, where $x \neq -2$?

(1) $f^{-1}(x) = \frac{2x}{x-1}$

(2) $f^{-1}(x) = \frac{-2x}{x-1}$

(3) $f^{-1}(x) = \frac{x}{x-2}$

(4) $f^{-1}(x) = \frac{-x}{x-2}$

24 A study of black bears in the Adirondacks reveals that their population can be represented by the function $P(t) = 3500(1.025)^t$, where t is the number of years since the study began. Which function is correctly rewritten to reveal the monthly growth rate of the black bear population?

(1) $P(t) = 3500(1.00206)^{12t}$

(2) $P(t) = 3500(1.00206)^{\frac{t}{12}}$

(3) $P(t) = 3500(1.34489)^{12t}$

(4) $P(t) = 3500(1.34489)^{\frac{t}{12}}$

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 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.

26 Explain what a rational exponent, such as $\frac{5}{2}$ means. Use this explanation to evaluate $9^{\frac{5}{2}}$.

27 Write $-\frac{1}{2}i^3\left(\sqrt{-9} - 4\right) - 3i^2$ in simplest $a + bi$ form.

28 A person's lung capacity can be modeled by the function $C(t) = 250\sin\left(\frac{2\pi}{5}t\right) + 2450$, where $C(t)$ represents the volume in mL present in the lungs after t seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

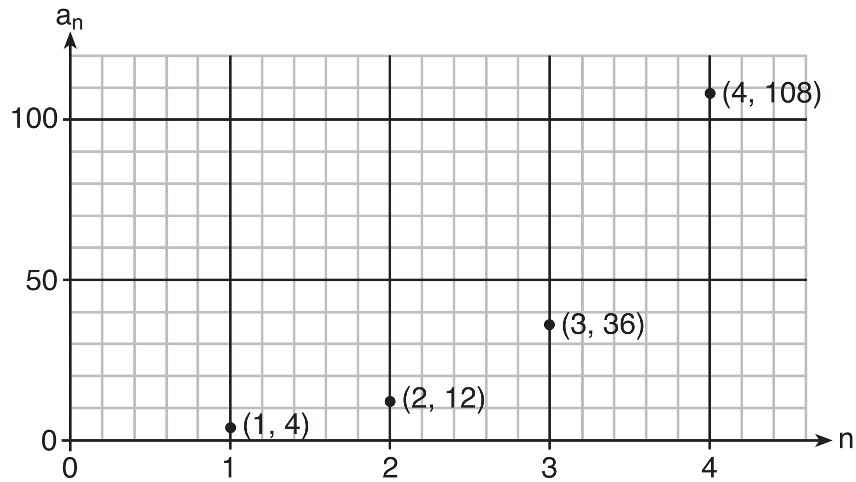
29 Determine for which polynomial(s) $(x + 2)$ is a factor. Explain your answer.

$$P(x) = x^4 - 3x^3 - 16x - 12$$
$$Q(x) = x^3 - 3x^2 - 16x - 12$$

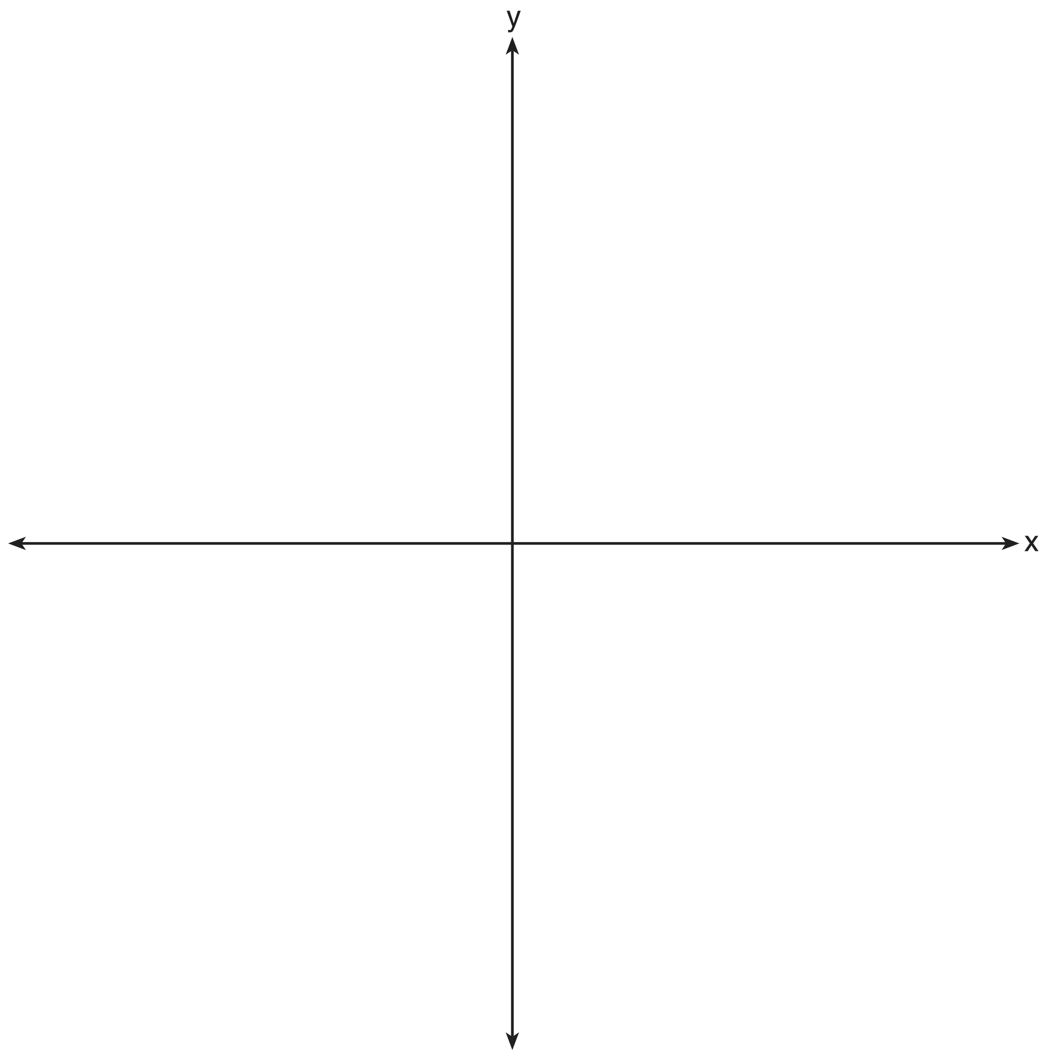
30 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of -2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of -0.1 ft at 5:31 a.m.

The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

31 Write a recursive formula, a_n, to describe the sequence graphed below.



32 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.



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. 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]

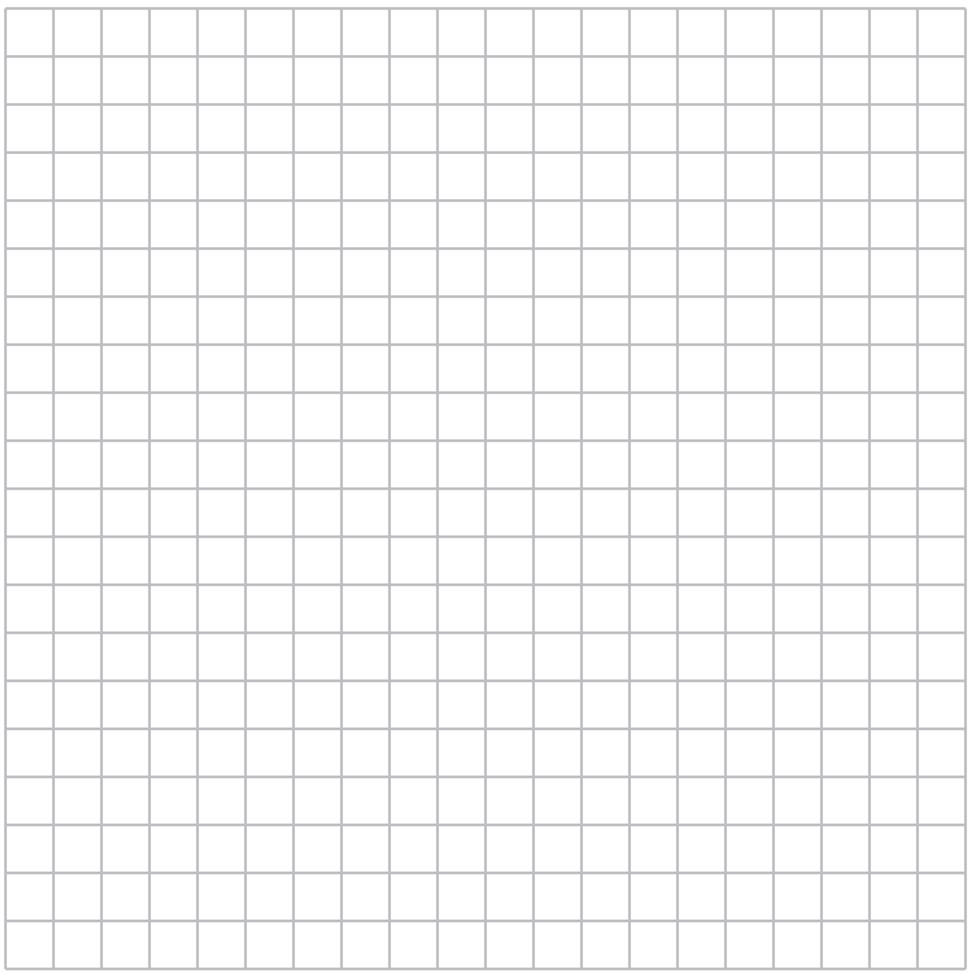
33 A population of 950 bacteria grows continuously at a rate of 4.75% per day.

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

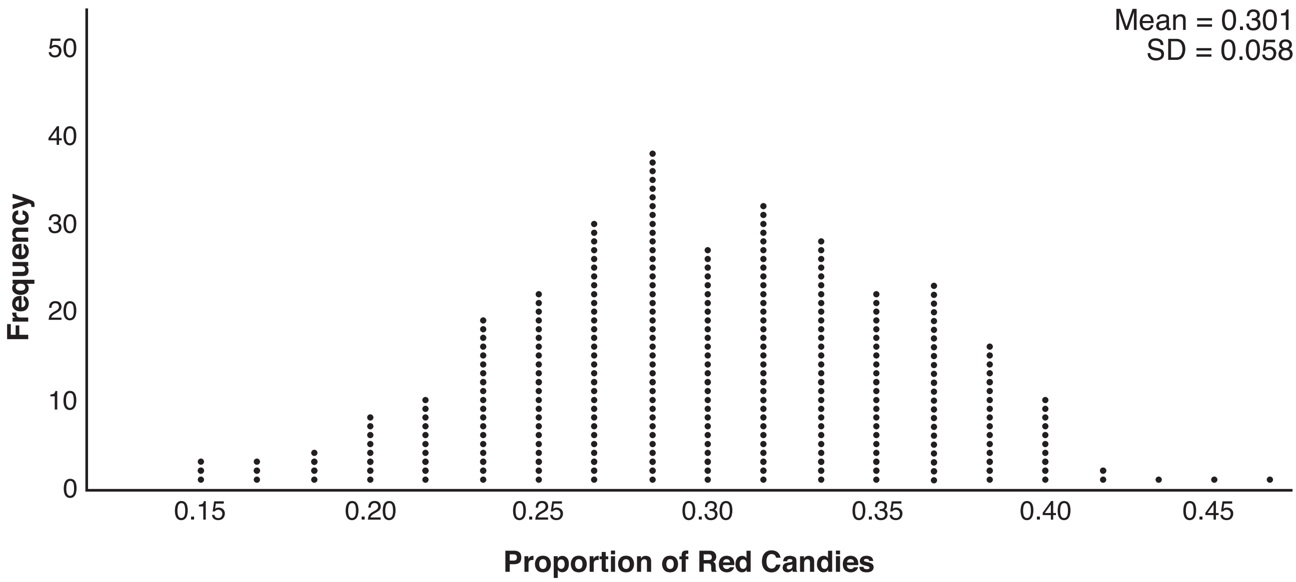
Determine the bacterial population after 36 hours, to the *nearest bacterium*.

34 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$.

On the grid below, sketch the graph of the equation in the interval 0 to 2π.



35 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within.

Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

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 done in pencil. [6]

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

Question 37 is continued on the next page.

Question 37 continued

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

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Scrap Graph Paper — This sheet will *not* be scored.

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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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The State Education Department / The University of the State of New York

Regents Examination in Algebra II – August 2019

Scoring Key: Part I (Multiple-Choice Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Algebra II	August '19	**1**	2	MC	2	1
Algebra II	August '19	**2**	3	MC	2	1
Algebra II	August '19	**3**	1	MC	2	1
Algebra II	August '19	**4**	2	MC	2	1
Algebra II	August '19	**5**	1	MC	2	1
Algebra II	August '19	**6**	4	MC	2	1
Algebra II	August '19	**7**	2	MC	2	1
Algebra II	August '19	**8**	2	MC	2	1
Algebra II	August '19	**9**	3	MC	2	1
Algebra II	August '19	**10**	1	MC	2	1
Algebra II	August '19	**11**	2	MC	2	1
Algebra II	August '19	**12**	4	MC	2	1
Algebra II	August '19	**13**	2	MC	2	1
Algebra II	August '19	**14**	4	MC	2	1
Algebra II	August '19	**15**	4	MC	2	1
Algebra II	August '19	**16**	3	MC	2	1
Algebra II	August '19	**17**	4	MC	2	1
Algebra II	August '19	**18**	4	MC	2	1
Algebra II	August '19	**19**	1	MC	2	1
Algebra II	August '19	**20**	2	MC	2	1
Algebra II	August '19	**21**	4	MC	2	1
Algebra II	August '19	**22**	3	MC	2	1
Algebra II	August '19	**23**	2	MC	2	1
Algebra II	August '19	**24**	1	MC	2	1

Regents Examination in Algebra II – August 2019

Scoring Key: Parts II, III, and IV (Constructed-Response Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Algebra II	August '19	**25**	-	CR	2	1
Algebra II	August '19	**26**	-	CR	2	1
Algebra II	August '19	**27**	-	CR	2	1
Algebra II	August '19	**28**	-	CR	2	1
Algebra II	August '19	**29**	-	CR	2	1
Algebra II	August '19	**30**	-	CR	2	1
Algebra II	August '19	**31**	-	CR	2	1
Algebra II	August '19	**32**	-	CR	2	1
Algebra II	August '19	**33**	-	CR	4	1
Algebra II	August '19	**34**	-	CR	4	1
Algebra II	August '19	**35**	-	CR	4	1
Algebra II	August '19	**36**	-	CR	4	1
Algebra II	August '19	**37**	-	CR	6	1

Key
MC = Multiple-choice question
CR = Constructed-response question

The chart for determining students' final examination scores for the **August 2019 Regents Examination in Algebra II** will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on the day of the examination. Conversion charts provided for the previous administrations of the Regents Examination in Algebra II must NOT be used to determine students' final scores for this administration.

FOR TEACHERS ONLY

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

ALGEBRA II

Wednesday, August 14, 2019 — 12:30 to 3:30 p.m., only

RATING GUIDE

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: http://www.p12.nysed.gov/assessment/ and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

The Department is providing supplemental scoring guidance, the "Model Response Set," for the Regents Examination in Algebra II. This guidance is intended to be part of the scorer training. Schools are encouraged to incorporate the Model Response Sets into the scorer training or to use them as additional information during scoring. While not reflective of all scenarios, the model responses selected for the Model Response Set illustrate how less common student responses to constructed-response questions may be scored. The Model Response Set will be available on the Department's web site at http://www.nysedregents.org/algebratwo/.

Mechanics of Rating

The following procedures are to be followed for scoring student answer papers for the Regents Examination in Algebra II. More detailed information about scoring is provided in the publication *Information Booklet for Scoring the Regents Examination in Algebra II*.

Do *not* attempt to correct the student's work by making insertions or changes of any kind. In scoring the constructed-response questions, use check marks to indicate student errors. Unless otherwise specified, mathematically correct variations in the answers will be allowed. Units need not be given when the wording of the questions allows such omissions.

Each student's answer paper is to be scored by a minimum of three mathematics teachers. No one teacher is to score more than approximately one-third of the constructed-response questions on a student's paper. Teachers may not score their own students' answer papers. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Schools are not permitted to rescore any of the constructed-response questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Raters should record the student's scores for all questions and the total raw score on the student's separate answer sheet. Then the student's total raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ by Wednesday, August 14, 2019. Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score. The student's scale score should be entered in the box provided on the student's separate answer sheet. The scale score is the student's final examination score.

General Rules for Applying Mathematics Rubrics

I. General Principles for Rating

The rubrics for the constructed-response questions on the Regents Examination in Algebra II are designed to provide a systematic, consistent method for awarding credit. The rubrics are not to be considered all-inclusive; it is impossible to anticipate all the different methods that students might use to solve a given problem. Each response must be rated carefully using the teacher's professional judgment and knowledge of mathematics; all calculations must be checked. The specific rubrics for each question must be applied consistently to all responses. In cases that are not specifically addressed in the rubrics, raters must follow the general rating guidelines in the publication *Information Booklet for Scoring the Regents Examination in Algebra II*, use their own professional judgment, confer with other mathematics teachers, and/or contact the State Education Department for guidance. During each Regents Examination administration period, rating questions may be referred directly to the Education Department. The contact numbers are sent to all schools before each administration period.

II. Full-Credit Responses

A full-credit response provides a complete and correct answer to all parts of the question. Sufficient work is shown to enable the rater to determine how the student arrived at the correct answer.

When the rubric for the full-credit response includes one or more examples of an acceptable method for solving the question (usually introduced by the phrase "such as"), it does not mean that there are no additional acceptable methods of arriving at the correct answer. Unless otherwise specified, mathematically correct alternative solutions should be awarded credit. The only exceptions are those questions that specify the type of solution that must be used; e.g., an algebraic solution or a graphic solution. A correct solution using a method other than the one specified is awarded half the credit of a correct solution using the specified method.

III. Appropriate Work

Full-Credit Responses: The directions in the examination booklet for all the constructed-response questions state: "Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc." The student has the responsibility of providing the correct answer ***and*** showing how that answer was obtained. The student must "construct" the response; the teacher should not have to search through a group of seemingly random calculations scribbled on the student paper to ascertain what method the student may have used.

Responses With Errors: Rubrics that state "Appropriate work is shown, but…" are intended to be used with solutions that show an essentially complete response to the question but contain certain types of errors, whether computational, rounding, graphing, or conceptual. If the response is incomplete; i.e., an equation is written but not solved or an equation is solved but not all of the parts of the question are answered, appropriate work has ***not*** been shown. Other rubrics address incomplete responses.

IV. Multiple Errors

Computational Errors, Graphing Errors, and Rounding Errors: Each of these types of errors results in a 1-credit deduction. Any combination of two of these types of errors results in a 2-credit deduction. No more than 2 credits should be deducted for such mechanical errors in a 4-credit question and no more than 3 credits should be deducted in a 6-credit question. The teacher must carefully review the student's work to determine what errors were made and what type of errors they were.

Conceptual Errors: A conceptual error involves a more serious lack of knowledge or procedure. Examples of conceptual errors include using the incorrect formula for the area of a figure, choosing the incorrect trigonometric function, or multiplying the exponents instead of adding them when multiplying terms with exponents.

If a response shows repeated occurrences of the same conceptual error, the student should not be penalized twice. If the same conceptual error is repeated in responses to other questions, credit should be deducted in each response.

For 4- and 6-credit questions, if a response shows one conceptual error and one computational, graphing, or rounding error, the teacher must award credit that takes into account both errors. Refer to the rubric for specific scoring guidelines.

Part II

For each question, use the specific criteria to award a maximum of 2 credits. Unless otherwise specified, mathematically correct alternative solutions should be awarded appropriate credit.

(25) **[2]** 0.24 or equivalent and correct work is shown.

[1] Appropriate work is shown, but one computational error is made.

or

[1] Appropriate work is shown, but one conceptual error is made.

or

[1] 0.24, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(26) **[2]** A correct explanation is written, such as 2 is the root and 5 is the power, and 243.

[1] Appropriate work is shown, but one computational error is made.

or

[1] Appropriate work is shown, but one conceptual error is made.

or

[1] A correct explanation is written or 243.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(27) **[2]** $\frac{3}{2} - 2i$, and correct work is shown.

[1] Appropriate work is shown, but one computational or simplification error is made.

or

[1] Appropriate work is shown, but one conceptual error is made.

or

[1] $\frac{3}{2} - 2i$, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(28) **[2]** 2700, and a correct explanation is written, such as the number of mL when the lungs are full.

[1] Appropriate work is shown, but one computational error is made.

or

[1] Appropriate work is shown, but one conceptual error is made.

or

[1] 2700, but the explanation is incomplete, incorrect, or missing.

or

[1] A correct explanation is written, but no further correct work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(29) **[2]** $Q(x)$, and correct work is shown, and a correct explanation is written.

[1] Appropriate work is shown, but one computational error is made.

or

[1] Appropriate work is shown, but one conceptual error is made.

or

[1] $Q(x)$, and correct work is shown, but the explanation is incomplete, incorrect, or missing.

or

[1] A correct explanation is written, but $Q(x)$ is not determined.

[0] $Q(x)$, but no work is shown.

or

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(30) **[2]** 4.75 or −4.75, and correct work is shown.

[1] Appropriate work is shown, but one computational error is made.

or

[1] Appropriate work is shown, but one conceptual error is made.

or

[1] 4.75 or −4.75, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(31) **[2]** A correct recursive formula is written, such as $a_1 = 4$ and $a_n = 3a_{n-1}$.

[1] One computational or notation error is made.

or

[1] One conceptual error is made.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(32) **[2]** Correct sketches are drawn and 3.3.

[1] Appropriate work is shown, but one graphing error is made.

or

[1] Appropriate work is shown, but one conceptual error is made.

or

[1] Correct graphs are sketched or 3.3.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Part III

For each question, use the specific criteria to award a maximum of 4 credits. Unless otherwise specified, mathematically correct alternative solutions should be awarded appropriate credit.

(33) **[4]** $N(t) = 950e^{0.0475t}$, a correct explanation is written, 1020 and correct work is shown.

[3] Appropriate work is shown, but one computational, notation, or rounding error is made.

or

[3] Appropriate work is shown, but the explanation is incomplete, incorrect, or missing.

[2] Appropriate work is shown, but two or more computational, notation, or rounding errors are made.

or

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] $N(t) = 950e^{0.0475t}$ and a correct explanation is written, but no further correct work is shown.

or

[2] Appropriate work is shown to find 1020, but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual error and one computational, notation, or rounding error are made.

or

[1] $N(t) = 950e^{0.0475t}$ or a correct explanation is written, but no further correct work is shown.

or

[1] 1020, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(34) **[4]** A correct equation, such as $y = 2 \sin 4x$, and a correct sketch is drawn.

[3] Appropriate work is shown, but one computational, graphing, notation, or labeling error is made.

[2] Appropriate work is shown, but two or more computational, graphing, notation, or labeling errors are made.

or

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] $y = 2 \sin 4x$ is written or a correct sketch is drawn.

[1] Appropriate work is shown, but one conceptual error and one computational, graphing, notation, or labeling error are made.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(35) **[4]** A correct interval is determined, such as (0.185, 0.417) or equivalent notation, No is indicated, and a correct explanation is written.

[3] Appropriate work is shown, but one computational error is made.

[2] Appropriate work is shown, but two or more computational errors are made.

or

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] Appropriate work is shown to find (0.185, 0.417), but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual error and one computational error are made.

or

[1] A correct explanation is written, but no further correct work is shown.

or

[1] 23% or equivalent is written, but no further correct work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

(36) **[4]** $3 \pm \left(2\sqrt{2}\right)i$ or $3 \pm 2i\sqrt{2}$ and correct algebraic work is shown, and a correct explanation is written.

[3] Appropriate work is shown, but one computational or simplification error is made.

or

[3] Appropriate work is shown, but the explanation is incomplete.

[2] Appropriate work is shown, but two or more computational or factoring errors are made.

or

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] Appropriate work is shown to find $3 \pm \left(2\sqrt{2}\right)i$, but no further correct work is shown.

or

[2] A correct explanation is written, but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual error and one computational or factoring error are made.

or

[1] $3 \pm \left(2\sqrt{2}\right)i$, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Part IV

For each question, use the specific criteria to award a maximum of 6 credits. Unless otherwise specified, mathematically correct alternative solutions should be awarded appropriate credit.

(37) **[6]** Steady breeze and a correct justification is given, 115 and correct work is shown, and 55-64 is stated.

[5] Appropriate work is shown, but one computational, graphing, or rounding error is made.

[4] Appropriate work is shown, but two computational, graphing, or rounding errors are made.

or

[4] Appropriate work is shown, but one conceptual error is made.

[3] Appropriate work is shown, but three or more computational, graphing, or rounding errors are made.

or

[3] Appropriate work is shown, but one conceptual error and one computational, graphing or rounding error are made.

[2] Appropriate work is shown, but two conceptual errors are made.

or

[2] Steady breeze and a correct justification is given, but no further correct work is shown.

or

[2] Appropriate work is shown to find 115, but no further correct work is shown.

or

[2] 55–64 is stated, but no further correct work is shown.

or

[2] Steady breeze and 115, but no work is shown.

[1] Appropriate work is shown, but two conceptual errors and one computational, graphing or rounding error are made.

or

[1] Appropriate work is shown to find 6, but no further correct work is shown.

or

[1] Steady breeze or 115, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Map to the Learning Standards
Algebra II
August 2019

Question	Type	Credits	Cluster
1	Multiple Choice	2	A-SSE.A
2	Multiple Choice	2	A-SSE.B
3	Multiple Choice	2	S-ID.B
4	Multiple Choice	2	A-APR.C
5	Multiple Choice	2	F-TF.A
6	Multiple Choice	2	S-IC.B
7	Multiple Choice	2	A-SSE.A
8	Multiple Choice	2	F-IF.C
9	Multiple Choice	2	F-BF.A
10	Multiple Choice	2	A-APR.D
11	Multiple Choice	2	F-BF.B
12	Multiple Choice	2	N-Q.A
13	Multiple Choice	2	S-CP.A
14	Multiple Choice	2	N-RN.A
15	Multiple Choice	2	A-REI.A
16	Multiple Choice	2	A-REI.C
17	Multiple Choice	2	A-CED.A
18	Multiple Choice	2	F-LE.A
19	Multiple Choice	2	S-ID.A
20	Multiple Choice	2	A-REI.D

21	Multiple Choice	2	A-APR.B
22	Multiple Choice	2	F-IF.B
23	Multiple Choice	2	F-BF.B
24	Multiple Choice	2	A-SSE.B
25	Constructed Response	2	S-CP.B
26	Constructed Response	2	N-RN.A
27	Constructed Response	2	N-CN.A
28	Constructed Response	2	F-IF.B
29	Constructed Response	2	A-APR.B
30	Constructed Response	2	F-TF.B
31	Constructed Response	2	F-LE.A
32	Constructed Response	2	A-REI.D
33	Constructed Response	4	F-BF.A
34	Constructed Response	4	F-IF.C
35	Constructed Response	4	S-IC.B
36	Constructed Response	4	A-REI.B
37	Constructed Response	6	A-REI.A

Regents Examination in Algebra II
August 2019
Chart for Converting Total Test Raw Scores to Final Examination Scores (Scale Scores)

The *Chart for Determining the Final Examination Score for the August 2019 Regents Examination in Algebra II* will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ by Wednesday, August 14, 2019. Conversion charts provided for previous administrations of the Regents Examination in Algebra II must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.cfm.

2. Select the test title.

3. Complete the required demographic fields.

4. Complete each evaluation question and provide comments in the space provided.

5. Click the SUBMIT button at the bottom of the page to submit the completed form.

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA II

Wednesday, August 14, 2019 — 12:30 to 3:30 p.m., only

MODEL RESPONSE SET

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Question 25

25 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.

$$\frac{165}{825} + \frac{66}{825} - \frac{33}{825} = \frac{198}{825}$$

Score 2: The student gave a complete and correct response.

Question 25

25 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.

$\frac{165}{825}$ = AP World , A = AP World students

$\frac{66}{825}$ = AP Euro , B = AP Euro students

$\frac{33}{825}$ = World + Euro

$$P(A \text{ or } B) = P(A) + P(B) - P(A+B)$$

$$\frac{165}{825} + \frac{66}{825} - \frac{33}{825}$$

$$P(A \text{ or } B) = \frac{231}{825} - \frac{33}{825}$$

$$P(A \text{ or } B) = \frac{198}{825}$$

$= \boxed{.24 \text{ or } 24\% \text{ will be allowed to enroll in AP U.S. History}}$

Score 2: The student gave a complete and correct response.

Question 25

25 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.

$$\frac{33}{825} + \frac{165}{825} + \frac{66}{825}$$

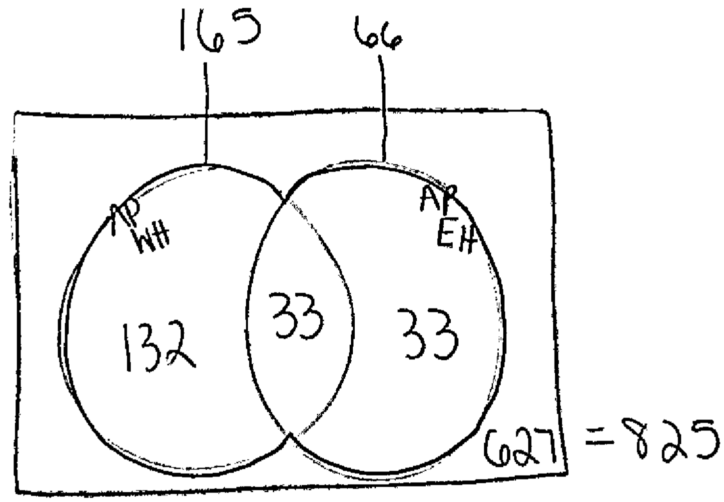
$$= \frac{264}{825} = \boxed{\frac{8}{25}}$$

Score 1: The student misapplied the addition rule.

Question 25

25 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.

seniors = 825
AP WH = 165
AP EH = 66
both = 33



132 + 33 + 33

$\boxed{\text{198 Students}}$

Score 1: The student did not divide by 825.

Question 25

25 At Andrew Jackson High School, students are only allowed to enroll in AP U.S. History if they have already taken AP World History or AP European History. Out of 825 incoming seniors, 165 took AP World History, 66 took AP European History, and 33 took both. Given this information, determine the probability a randomly selected incoming senior is allowed to enroll in AP U.S. History.

825 in total
165 took AP WH
66 took AP EH
33 took both

$\boxed{33/825}$

Score 0: The student did not show enough correct work to receive any credit.

Question 26

26 Explain what a rational exponent, such as $\frac{5}{2}$ means. Use this explanation to evaluate $9^{\frac{5}{2}}$.

The numerator is the power which the base is raised to and the denominator is the root

$\sqrt{9^5} = \boxed{243}$

Score 2: The student gave a complete and correct response.

Question 26

26 Explain what a rational exponent, such as $\frac{5}{2}$ means. Use this explanation to evaluate $9^{\frac{5}{2}}$.

A Fraction

represents $\frac{5}{2}$ ← power ← root

$\left(\sqrt[2]{9}\right)^5$

3^5

$\boxed{243}$

Score 2: The student gave a complete and correct response.

Question 26

26 Explain what a rational exponent, such as $\frac{5}{2}$ means. Use this explanation to evaluate $9^{\frac{5}{2}}$.

$\frac{5}{2}$, as a rational exponent means 5 halves. This can be rationalized to 2.5, by dividing 5 and 2. $9^{\frac{5}{2}}$, can be evaluated by multiplying 9 by itself 2.5 times, to which you arrive at an answer of $\boxed{243}$

Score 1: The student gave an incomplete explanation.

Question 26

26 Explain what a rational exponent, such as $\frac{5}{2}$ means. Use this explanation to evaluate $9^{\frac{5}{2}}$.

It is bigger than 1, so it will
produce a higher nember than
it is raising. It is also 2.5.

Score 0: The student did not provide a correct explanation.

Question 27

27 Write $-\frac{1}{2}i^3(\sqrt{-9} - 4) - 3i^2$ in simplest $a + bi$ form.

$\frac{1}{2}i(\sqrt{-9} - 4) + 3$

$\frac{1}{2}i(3i - 4) + 3$

$1.5i^2 - 2i + 3$

$-1.5 - 2i + 3$

$\boxed{1.5 - 2i}$

Score 2: The student gave a complete and correct response.

Question 27

27 Write $-\frac{1}{2}i^3(\sqrt{-9} - 4) - 3i^2$ in simplest $a + bi$ form.

$$-\frac{1}{2}i^3\left(\sqrt{-9} - 4\right) - 3i^2$$

$$\frac{1}{2}i\,(3i - 4) + 3$$

$i = i$
$i^2 = -1$
$i^3 = -i$
$i^4 = 1$

$$-\frac{3}{2} - 2i + 3$$

$$\boxed{-2i + \frac{3}{2}}$$

Score 2: The student gave a complete and correct response.

Question 27

27 Write $-\frac{1}{2}i^3(\sqrt{-9} - 4) - 3i^2$ in simplest $a + bi$ form.

$\frac{1}{2}i(\sqrt{-9}-4) - 3(1)$

$-1 \quad i \quad 1 \quad -i$

$\frac{1}{2}i(3i-4) - 3$

$1.5i^2 - 2i - 3$

$1.5 - 2i - 3$

$-1.5 - 2i$

Score 1: The student incorrectly substituted for i^2.

Question 27

27 Write $-\frac{1}{2}i^3(\sqrt{-9} - 4) - 3i^2$ in simplest $a + bi$ form.

$.5i(3i-4)+3$

$-1.5-2i+3$

$-\frac{3}{2}$

-3

$\boxed{\frac{-9}{2}-2i}$

Score 1: The student made one computational error.

Question 27

27 Write $-\frac{1}{2}i^3\left(\sqrt{-9} - 4\right) - 3i^2$ in simplest $a + bi$ form.

$-\frac{1}{2}i^3\left(\sqrt{-9} - 4\right) - 3i^2$

$.5i(-3-4)+3$

$.5i(-7)+3$

$.5i-4$

$\boxed{-4+.5i}$

Score 0: The student made multiple computational errors.

28 A person's lung capacity can be modeled by the function $C(t) = 250\sin\left(\frac{2\pi}{5}t\right) + 2450$, where $C(t)$ represents the volume in mL present in the lungs after t seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

max value = M+A

M = 2450 = midline

A = 250 = amplitude

max = 2450+250

max = 2700

2700 represents the maximum amount of air a person's lungs can hold in milliliters.

Score 2: The student gave a complete and correct response.

Question 28

28 A person's lung capacity can be modeled by the function $C(t) = 250\sin\left(\frac{2\pi}{5}t\right) + 2450$, where $C(t)$ represents the volume in mL present in the lungs after t seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

on calculator

$Y_1 = 250\sin\left(\frac{2\pi}{5}t\right) + 2450$

2nd calc 4: maximum (-498.75, 2700)

max = 2700

After 2700 seconds a person's lung capacity has expanded completely.

Score 1: The student gave an incorrect explanation.

Question 28

28 A person's lung capacity can be modeled by the function $C(t) = 250\sin\left(\frac{2\pi}{5}t\right) + 2450$, where $C(t)$ represents the volume in mL present in the lungs after t seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

the Maximum value of this function over one full cycle is ~~two~~ 2450

Score 0: The student did not show enough correct work to receive any credit.

Question 29

29 Determine for which polynomial(s) $(x + 2)$ is a factor. Explain your answer.

$$P(x) = x^4 - 3x^3 - 16x - 12$$
$$Q(x) = x^3 - 3x^2 - 16x - 12$$

$P(-2) = 60$

$Q(-2) = 0$

$Q(x)$ since $Q(-2) = 0$
$(x+2)$ must be a factor

Score 2: The student gave a complete and correct response.

Question 29

29 Determine for which polynomial(s) $(x + 2)$ is a factor. Explain your answer.

$$P(x) = x^4 - 3x^3 - 16x - 12$$
$$Q(x) = x^3 - 3x^2 - 16x - 12$$

$P(-2) = (-2)^4 - 3(-2)^3 - 16(-2) - 12$
$= 16 + 24 + 32 - 12$
$= 60$

$Q(-2) = (-2)^3 - 3(-2)^2 - 16(-2) - 12$
$= -8 - 12 + 32 - 12$
$= 0$

$(x+2)$ is a factor of $Q(x) = x^3 - 3x^2 - 16x - 12$ because -2 equals zero.

Score 1: The student gave an incomplete explanation.

Question 29

29 Determine for which polynomial(s) $(x + 2)$ is a factor. Explain your answer.

$$P(x) = x^4 - 3x^3 - 16x - 12$$
$$Q(x) = x^3 - 3x^2 - 16x - 12$$

$x + 2 = 0$
$-2 \quad -2$
$x = -2$

	1	-3	-16	-12
-2	1	-2	10	12
	1	-5	-6	0

	1	-3	0	-16	-12
-2	1	-2	10	-20	72
	1	-5	10	-36	60

×

$(x+2)(x^2-5x-6) = Q(x)$

Q(x).

Score 1: The student gave no explanation.

29 Determine for which polynomial(s) $(x + 2)$ is a factor. Explain your answer.

$$P(x) = x^4 - 3x^3 - 16x - 12$$
$$Q(x) = x^3 - 3x^2 - 16x - 12$$

$x^3(x-3\ )-4(4x-3)$

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

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

$(x+2)(x-2)$

$Q(x) = x^3-3x^2-16x-12$

when factored it leaves you with a solution of $(x+2)$

Score 0: The student made multiple errors.

Question 30

30 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of −2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of −0.1 ft at 5:31 a.m.

The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

Puget Sound

$10.1 - -2 = 12.1$ 4.05 ft normal water level

$\frac{12.1}{2} = 6.05$ amp water level

$\boxed{\text{Puget Sounds amplitude is greater by 4.75 feet}}$

Long Island

$2.5 - -0.1 = 2.6$ 1.2 ft normal water level

$\frac{2.6}{2} = 1.3$ amp

$6.05 - 1.3 = 4.75$ ft

Score 2: The student gave a complete and correct response.

Question 30

30 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of −2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of −0.1 ft at 5:31 a.m.

The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

— 10.1

— 4.05 6.05

— −2

— 2.5

— 1.2 1.3

— .1

6.05
−1.3

4.75ft

Score 2: The student gave a complete and correct response.

Question 30

30 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of −2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of −0.1 ft at 5:31 a.m.

The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

Puget Sound, Wa

high 10.1 ft.

low −2ft

amp - 12.1

Long Island, Ny

high 2.5 ft

low −0.1

amp - 2.6

difference = 12.1 − 2.6

$\boxed{9.5}$

Score 1: The student made an error finding the amplitudes.

Question 30

30 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of −2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of −0.1 ft at 5:31 a.m.

The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

6.05

1.3

Score 1: The student did not determine the difference in amplitudes.

Question 30

30 On July 21, 2016, the water level in Puget Sound, WA reached a high of 10.1 ft at 6 a.m. and a low of −2 ft at 12:30 p.m. Across the country in Long Island, NY, Shinnecock Bay's water level reached a high of 2.5 ft at 10:42 p.m. and a low of −0.1 ft at 5:31 a.m.

The water levels of both locations are affected by the tides and can be modeled by sinusoidal functions. Determine the difference in amplitudes, in feet, for these two locations.

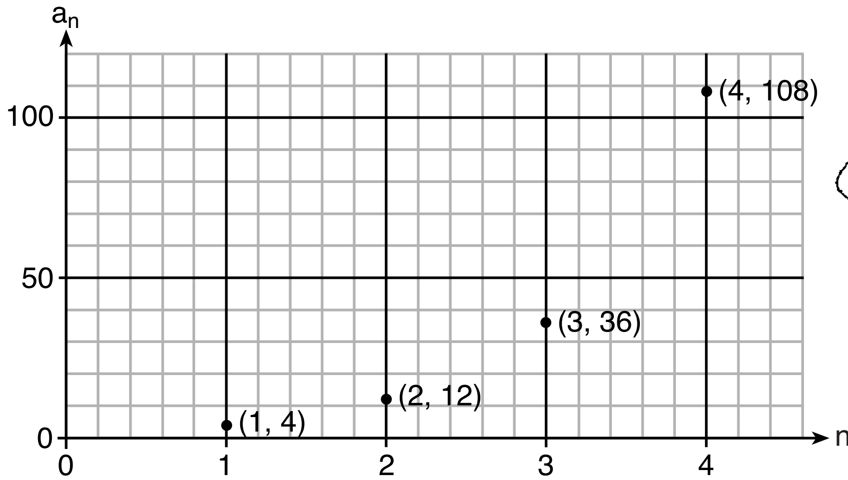
$Amp = max - min$

$A_1 = 10.1ft - (-2ft)$ $\quad A_1 = 12$ $\quad 12 - 2.51 = \boxed{9.49}$

$A_2 = 2.5ft - (-.01ft)$ $\quad A_2 = 2.51$

Score 0: The student made multiple errors.

31 Write a recursive formula, a_n, to describe the sequence graphed below.



Geometric

not ~~Arithmetic~~

$a_1 =$

a_n

	x	y	
+1	1	4	×3
+1	2	12	×3
+1	3	36	×3
+1	4	108	×3

x↑1 y*4

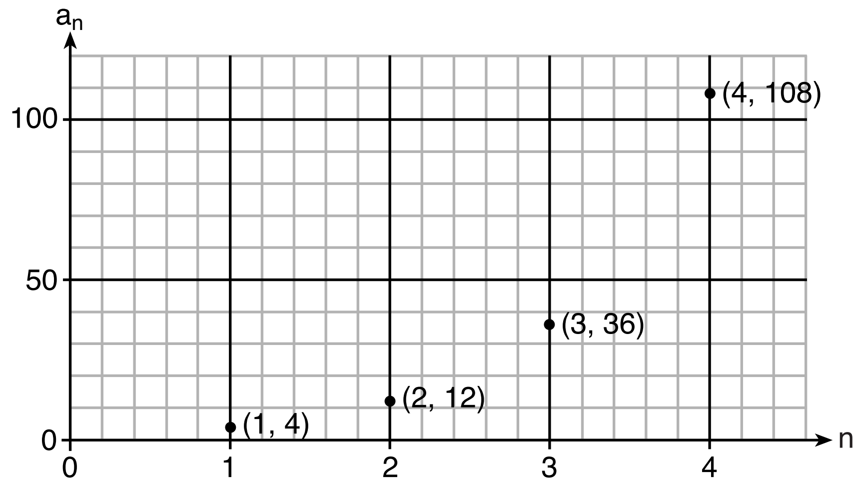
$$\boxed{\begin{array}{l} a_1 = 4 \\ a_n = 3a_{n-1} \end{array}}$$

answer

Score 2: The student gave a complete and correct response.

Question 31

31 Write a recursive formula, a_n, to describe the sequence graphed below.



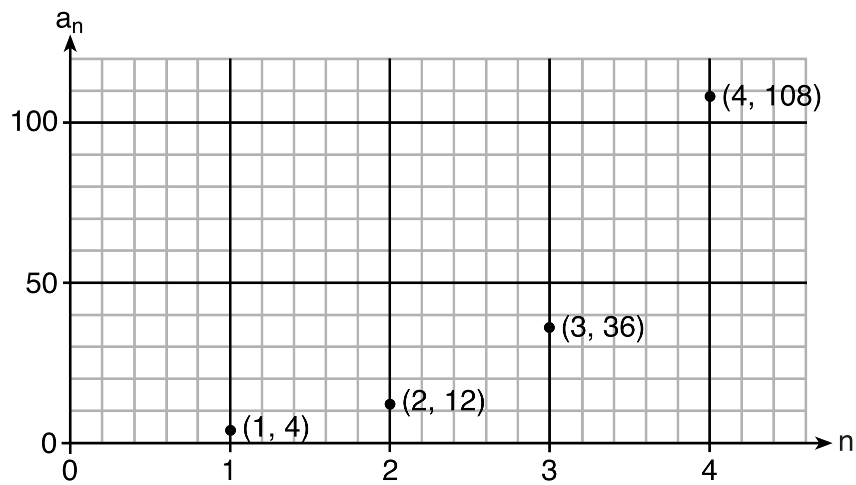
$a_1 = 4$

$a_n = 4(3)^{n-1}$

Score 1: The student wrote an explicit formula.

Question 31

31 Write a recursive formula, a_n, to describe the sequence graphed below.



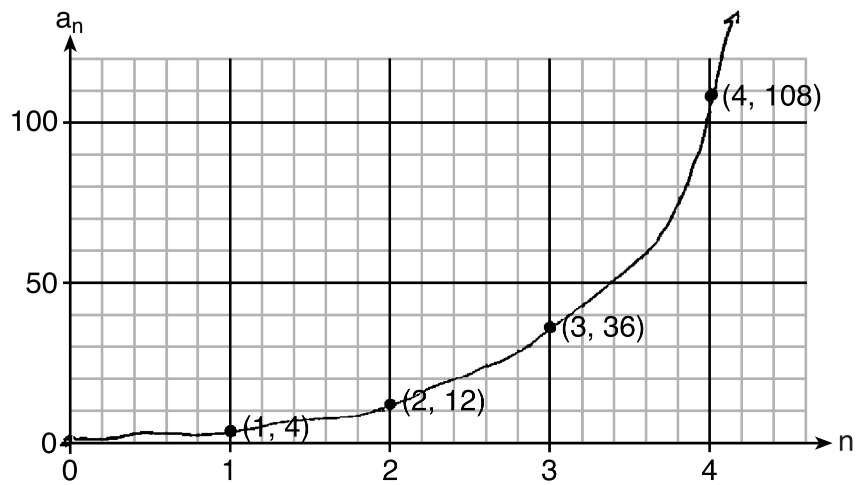
$a_1 = 4$

$a_n = 3 \quad n-1$

Score 1: The student made a notation error.

Question 31

31 Write a recursive formula, a_n, to describe the sequence graphed below.



(1, 4)
↓ ×3
(2, 12)

$y = x + 3$

Score 0: The student did not show enough correct work to receive any credit.

Question 32

32 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.

$y^2+3y-1=0$

$y=\frac{1}{y}-3$ $\frac{-3\pm\sqrt{9+4}}{2}$

$y=\frac{1}{x}$

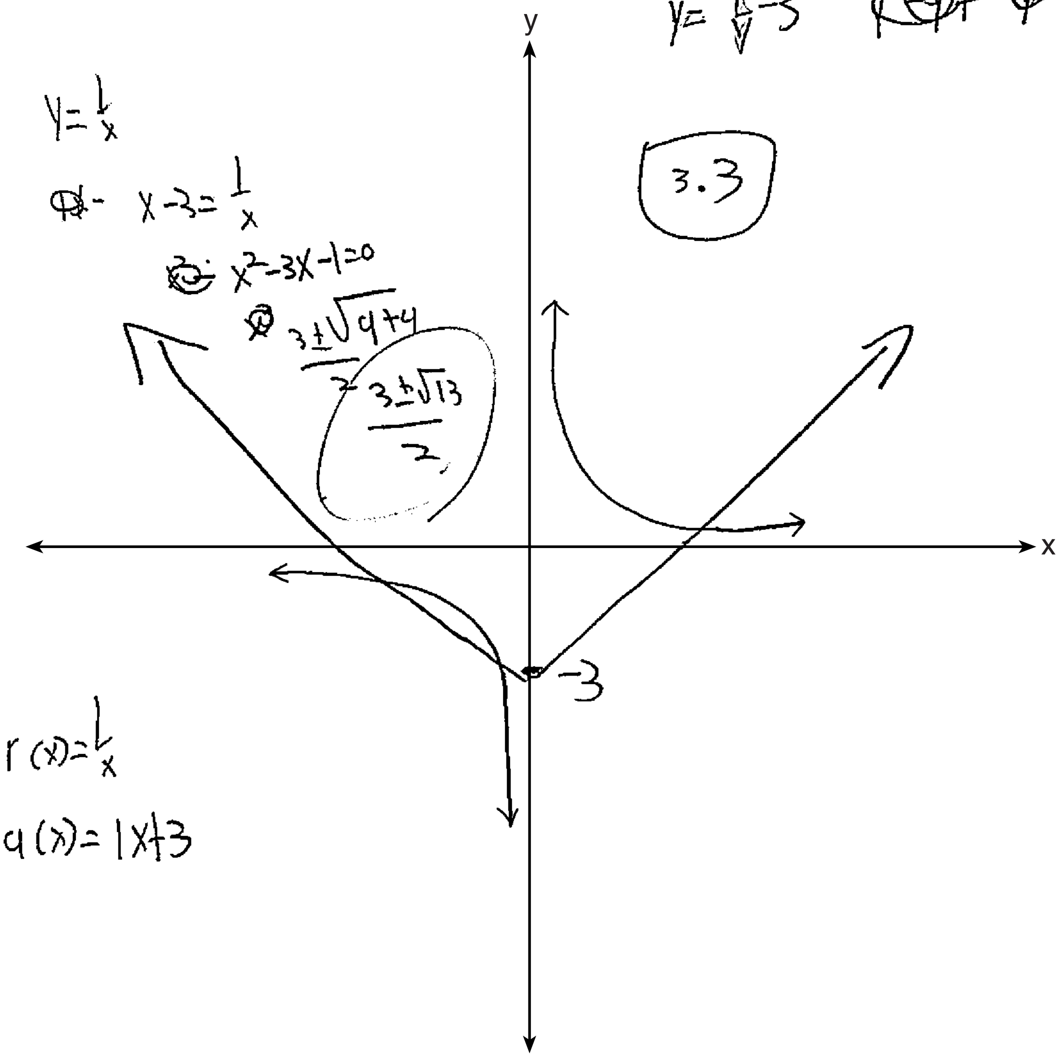
$x-3=\frac{1}{x}$

$x^2-3x-1=0$

$\frac{3\pm\sqrt{9+4}}{2}$

$\frac{3\pm\sqrt{13}}{2}$

$\boxed{3.3}$



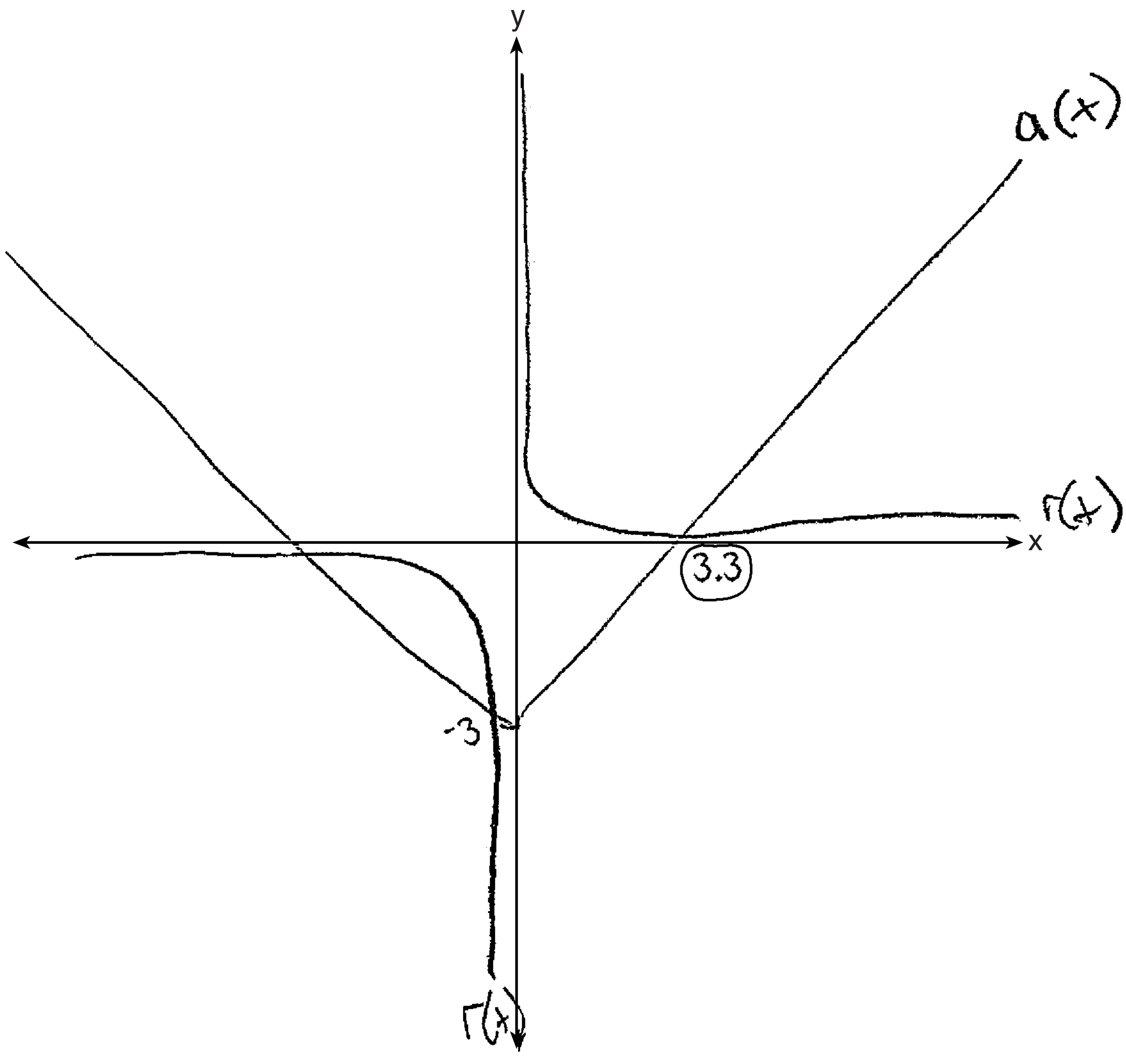
$r(x)=\frac{1}{x}$

$a(x)=|x|+3$

Score 2: The student gave a complete and correct response.

Question 32

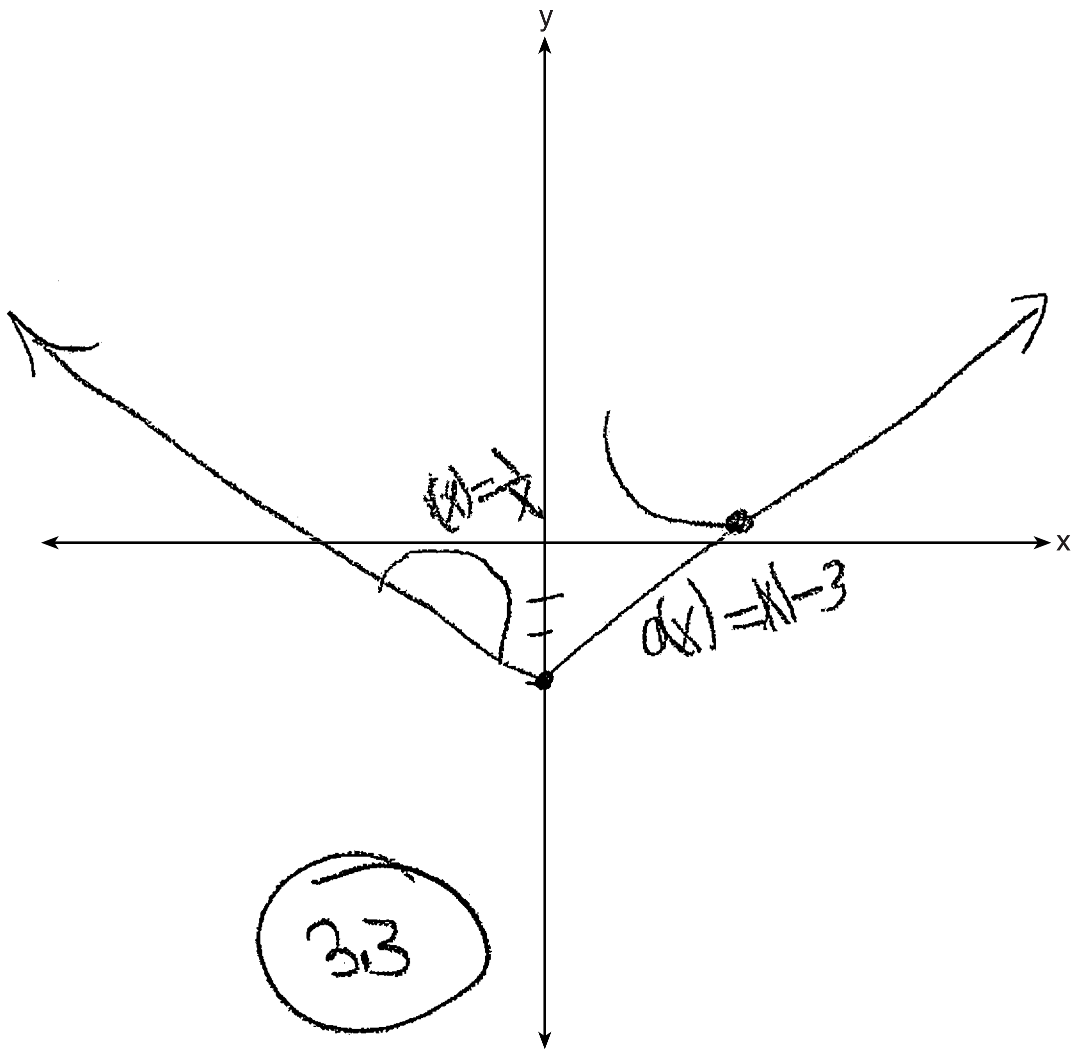
32 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.



Score 2: The student gave a complete and correct response.

Question 32

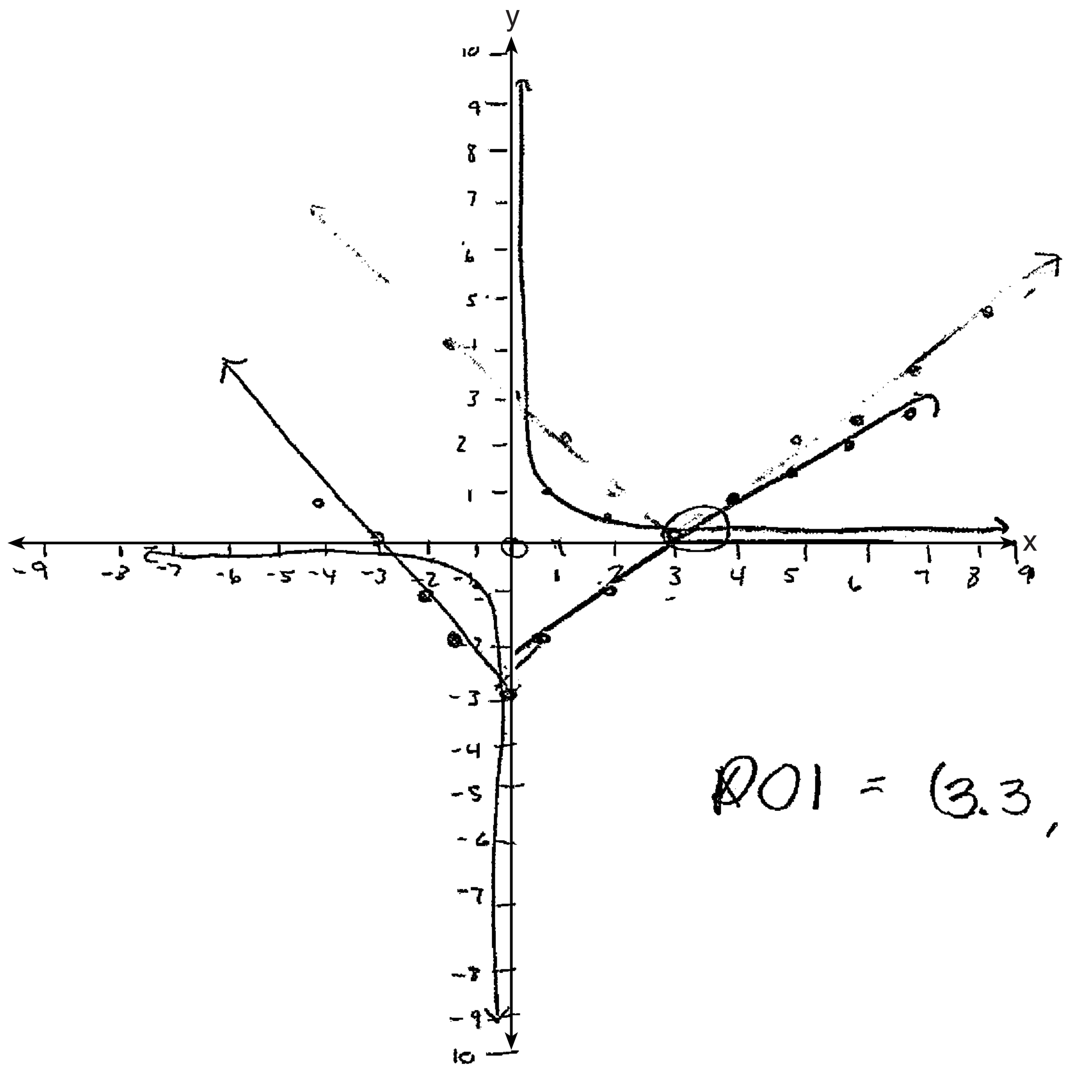
32 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.



Score 1: The student made an error when sketching $r(x)$.

Question 32

32 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.

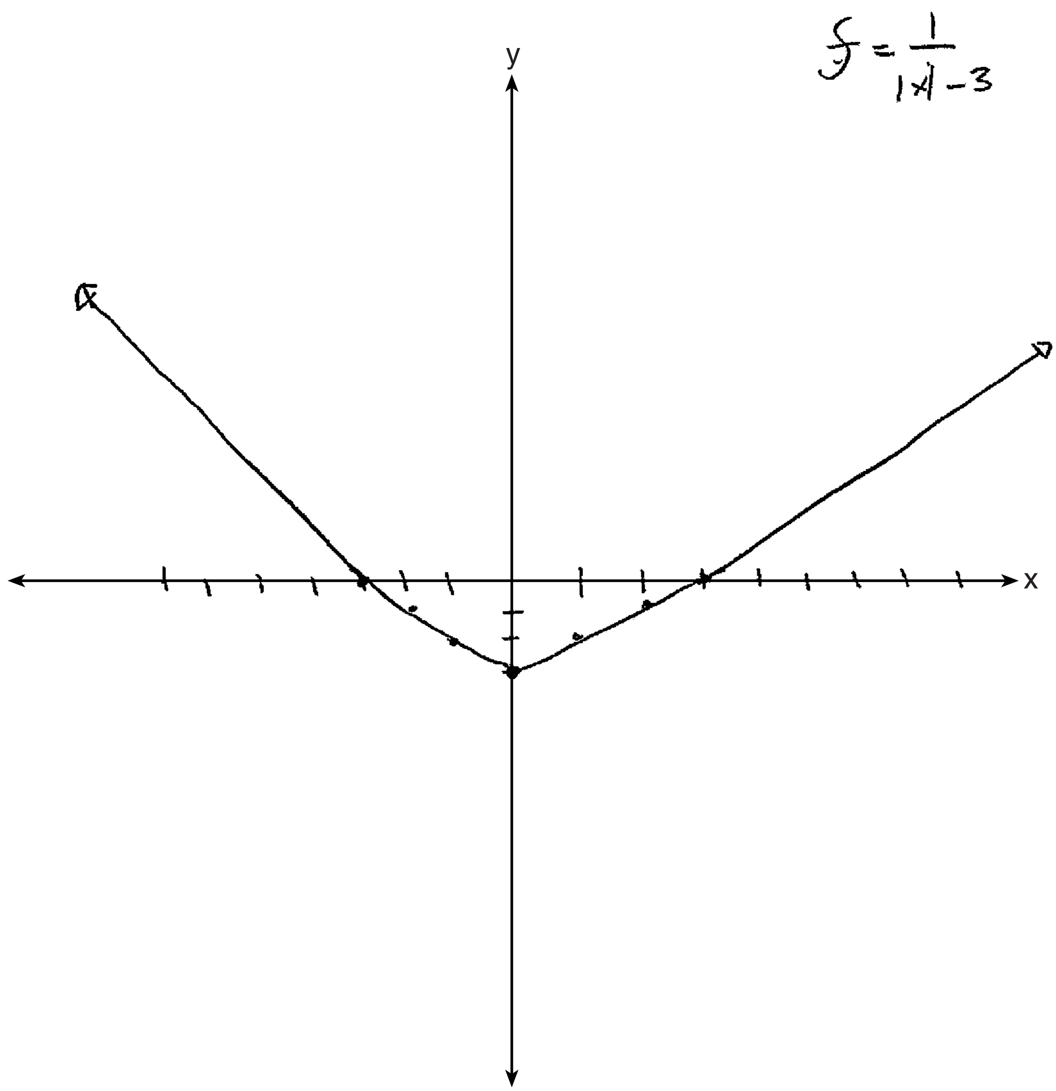


POI = (3.3, .3)

Score 1: The student did not state the solution of $r(x) = a(x)$.

Question 32

32 Sketch the graphs of $r(x) = \frac{1}{x}$ and $a(x) = |x| - 3$ on the set of axes below. Determine, to the *nearest tenth*, the positive solution of $r(x) = a(x)$.



Score 0: The student did not show enough correct work to receive any credit.

33 A population of 950 bacteria grows continuously at a rate of 4.75% per day.

Pe^{rt}

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

$N(t) = 950e^{.0475 \cdot t}$

The ~~cs~~ bacteria grows continously

Determine the bacterial population after 36 hours, to the *nearest bacterium*.

$N(t) = 950e^{.0475\left(\frac{36}{24}\right)}$

$N(t) = 1020$

Score 4: The student gave a complete and correct response.

Question 33

33 A population of 950 bacteria grows continuously at a rate of 4.75% per day.

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

$A = 950e^{.0475t}$

I chose this because it best explains exponential growth how the bacterium grows 4.75% over t-days.

Determine the bacterial population after 36 hours, to the *nearest bacterium*.

$A = 950e^{.0475(1.5)} = 950e\wedge .07125$

$A = 950(1.073849655) = \boxed{1020 \text{ bacterium}}$

Score 3: The student gave an incomplete explanation for the choice of the base.

Question 33

33 A population of 950 bacteria grows continuously at a rate of 4.75% per day.

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

P

$$N(t) = 950e^{0.0475t}$$

$\boxed{\text{e because continuously}}$

Determine the bacterial population after 36 hours, to the *nearest bacterium*.

5225.513404

~~5225.~~

≈ 5226 bacterium

Score 2: The student received full credit for the first part.

Question 33

33 A population of 950 bacteria grows continuously at a rate of 4.75% per day.

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

$$A = Pe^{rt}$$

$$N(t) = (950)e^{.0475t}$$

Determine the bacterial population after 36 hours, to the *nearest bacterium*.

$$N(t) = 950e^{.0475(1.5)}$$

$$N(t) = 950e^{.07125}$$

$$N(t) = 1020.157172$$

Score 2: The student gave no explanation and made a rounding error in the second part.

Question 33

33 A population of 950 bacteria grows continuously at a rate of 4.75% per day.

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

$N(t) = 950\, e^{0.475t}$

950 → initial.

e → function increases continuously, (e) must be used

Determine the bacterial population after 36 hours, to the *nearest bacterium*.

$N(36) = 950(e)^{0.475(36)}$

$N(36) = 5252.5$

$N(36) = 5253$

Score 1: The student gave a correct explanation for the choice of base.

Question 33

33 A population of 950 bacteria grows continuously at a rate of 4.75% per day. $.02$

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

D ← P   ~~4.75~~ .04.75 Pe^{rt}

$$N(t) = 950(e)^{.0475t}$$

Determine the bacterial population after 36 hours, to the *nearest bacterium*.

$$N(t) = 950(e)^{475.0(36)}$$

$$N(t) = 950(5.528961478)$$

$$N(t) = 5252.513404$$

$$N(t) \approx 5253$$

Score 1: The student created a correct equation.

Question 33

33 A population of 950 bacteria grows continuously at a rate of 4.75% per day.

Write an exponential function, $N(t)$, that represents the bacterial population after t days and explain the reason for your choice of base.

$N(t) = 950(.0475)^t$

The starting value of the strain is 950 bacteria, the rate is 4.75% growth/day.

Determine the bacterial population after 36 hours, to the *nearest bacterium*.

$N(36) = 950(.0475)^{36}$

$= 950(.0475)^{36}$

$= 45.125^{36}$

$= 3E59$

Score 0: The student did not show enough correct work to receive any credit.

Question 34

34 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$.

$y = 2\sin 4x$

$\frac{2\pi}{4} = \frac{2\pi}{1} \cdot \frac{1}{4} = \frac{2\pi}{4} = \frac{\pi}{2}$

On the grid below, sketch the graph of the equation in the interval 0 to 2π.

0,1,0-1,0

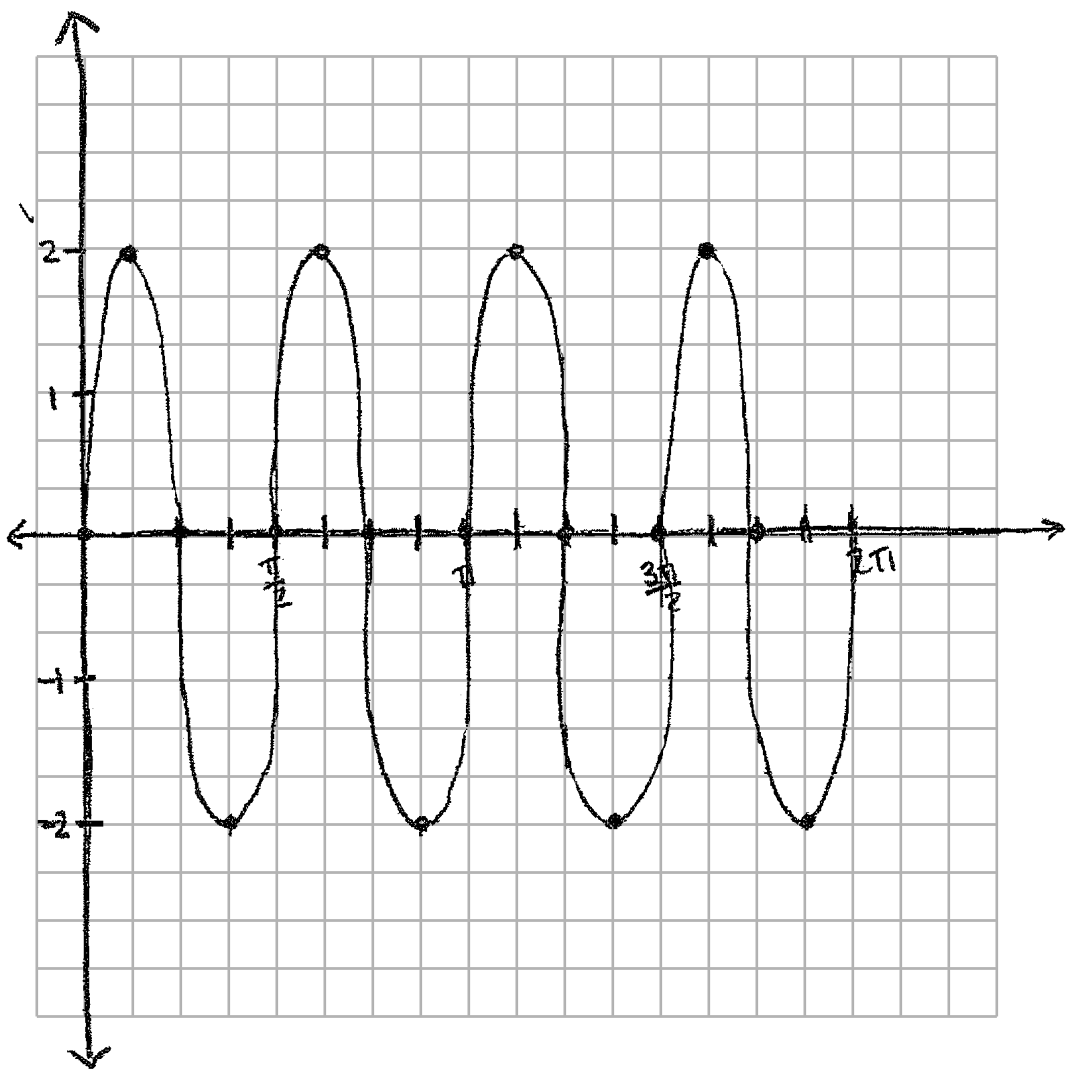
0,2,0,-2,0

$\frac{\pi}{2}$

$\frac{\pi}{2} \cdot \frac{2}{1} = \frac{2\pi}{2}$

2π

$\frac{\pi}{2} \cdot \frac{3}{1} = \frac{3\pi}{2}$



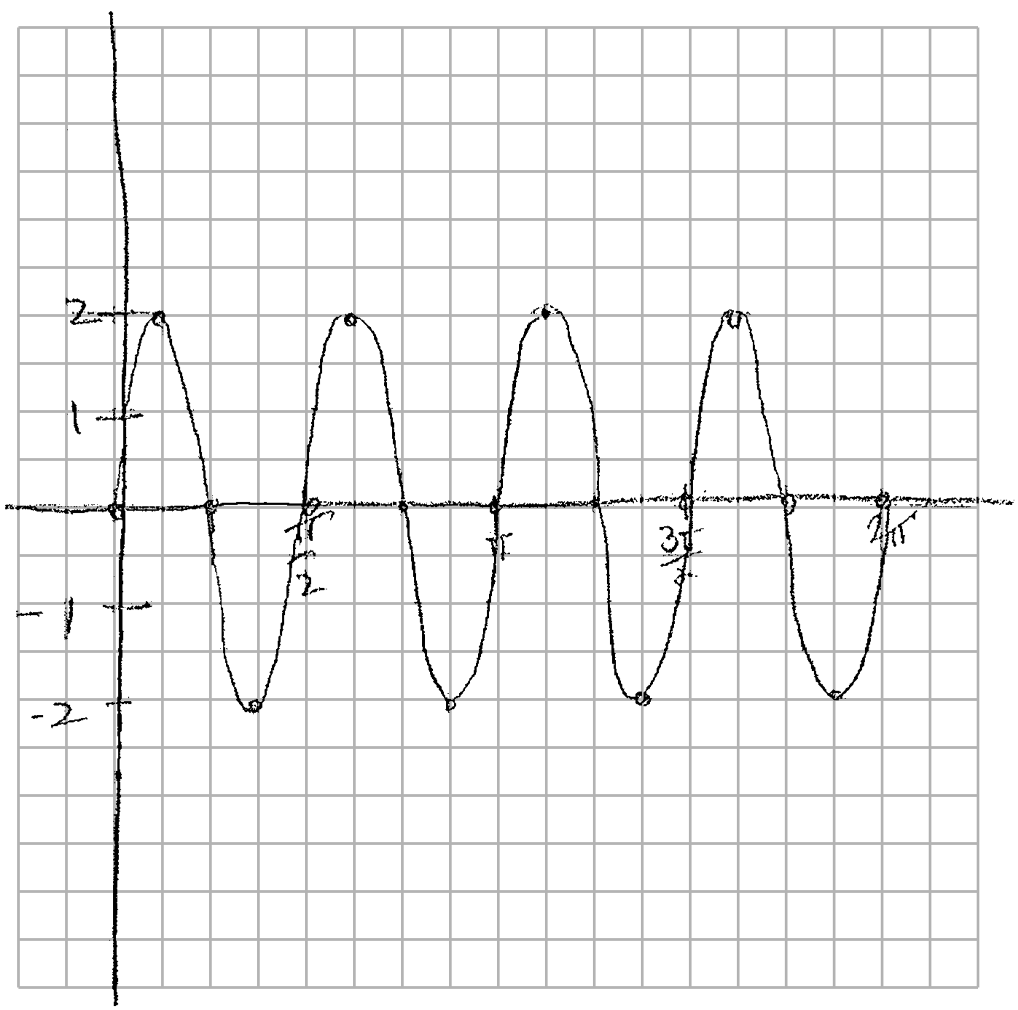
Score 4: The student gave a complete and correct response.

Question 34

34 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$.

2sin4x

On the grid below, sketch the graph of the equation in the interval 0 to 2π.



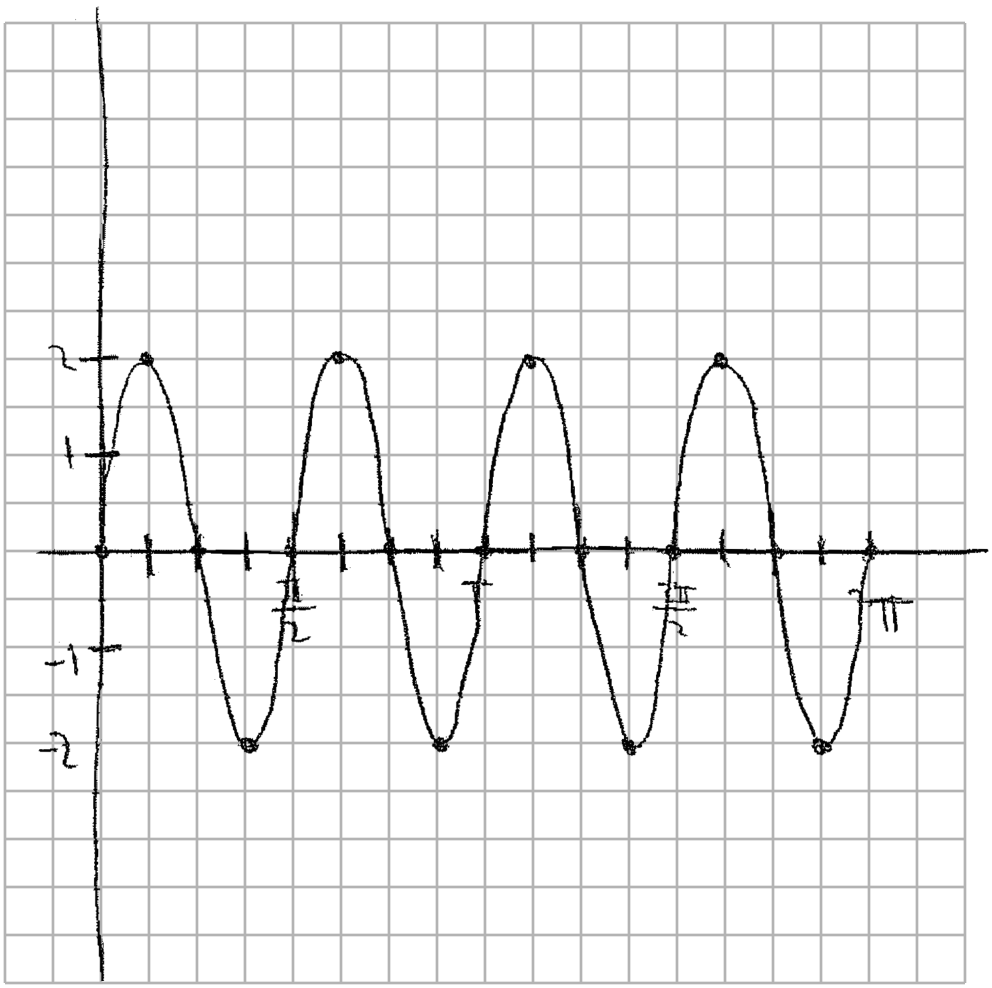
Score 3: The student made a notation error writing the equation.

Question 34

34 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$.

0,1,0,-1,0   0,2,0,-2,0 $\frac{\pi}{2}$

On the grid below, sketch the graph of the equation in the interval 0 to 2π.



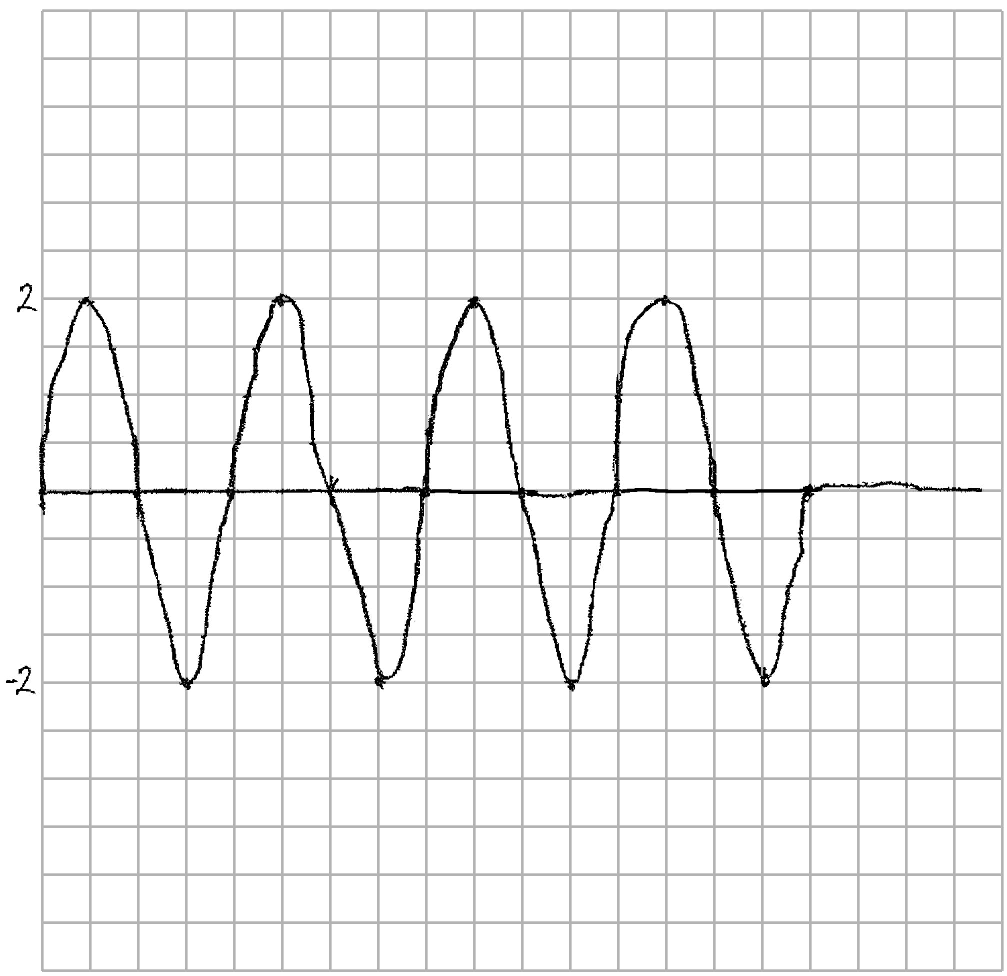
Score 2: The student sketched a correct graph.

Question 34

34 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$.

$y = 2\sin\left(\frac{\pi}{2}\right)$

On the grid below, sketch the graph of the equation in the interval 0 to 2π.

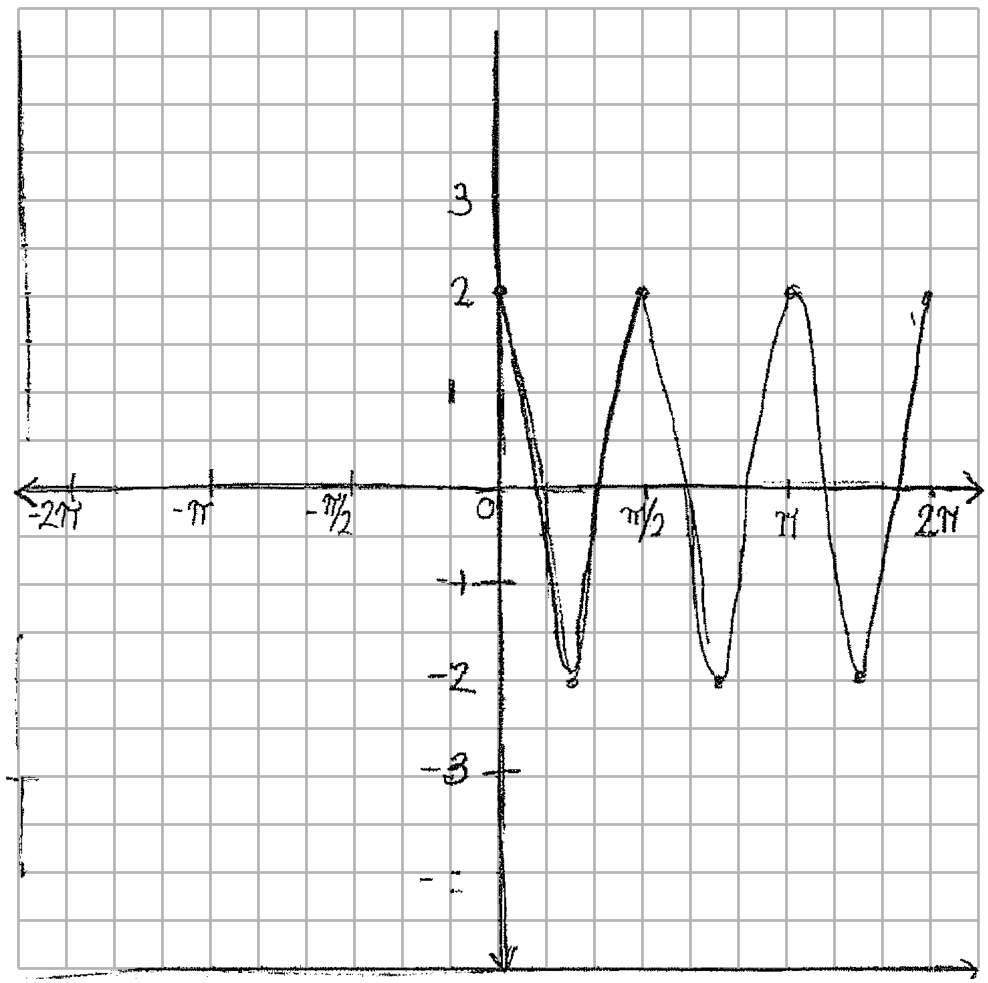


Score 1: The student received one credit for the sketch.

Question 34

34 Write an equation for a sine function with an amplitude of 2 and a period of $\frac{\pi}{2}$.

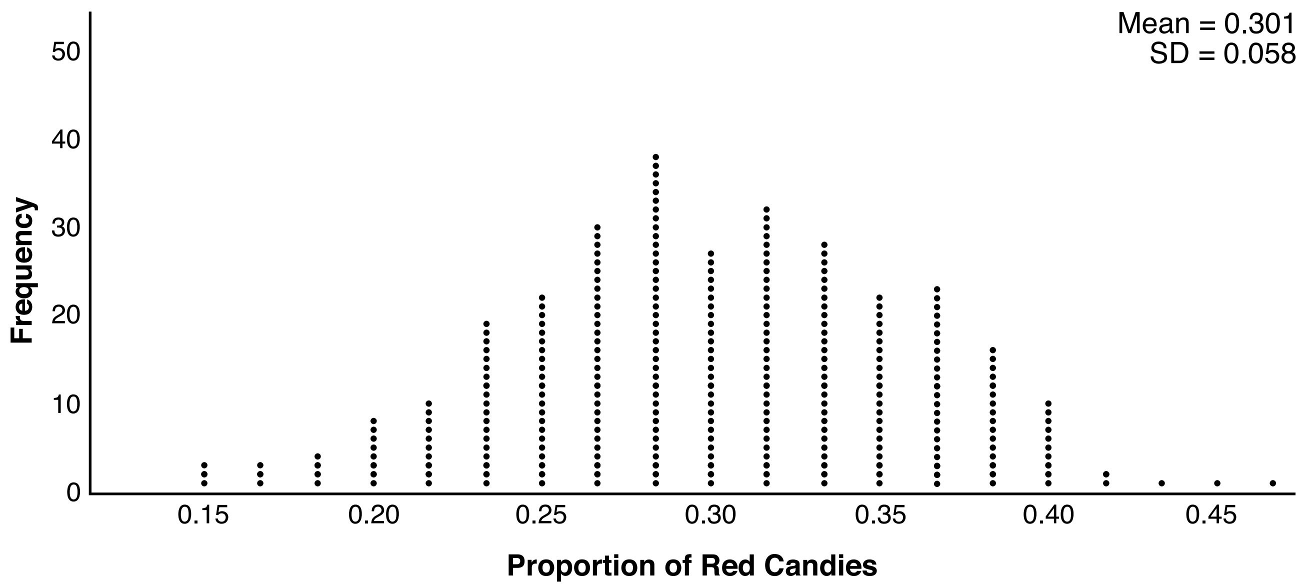
On the grid below, sketch the graph of the equation in the interval 0 to 2π.



Score 0: The student did not show enough correct work to receive any credit.

Question 35

35 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within.

$$0.301 - 2(.058) < M < 0.301 + 2(.058)$$

$$.185 < M < .417$$

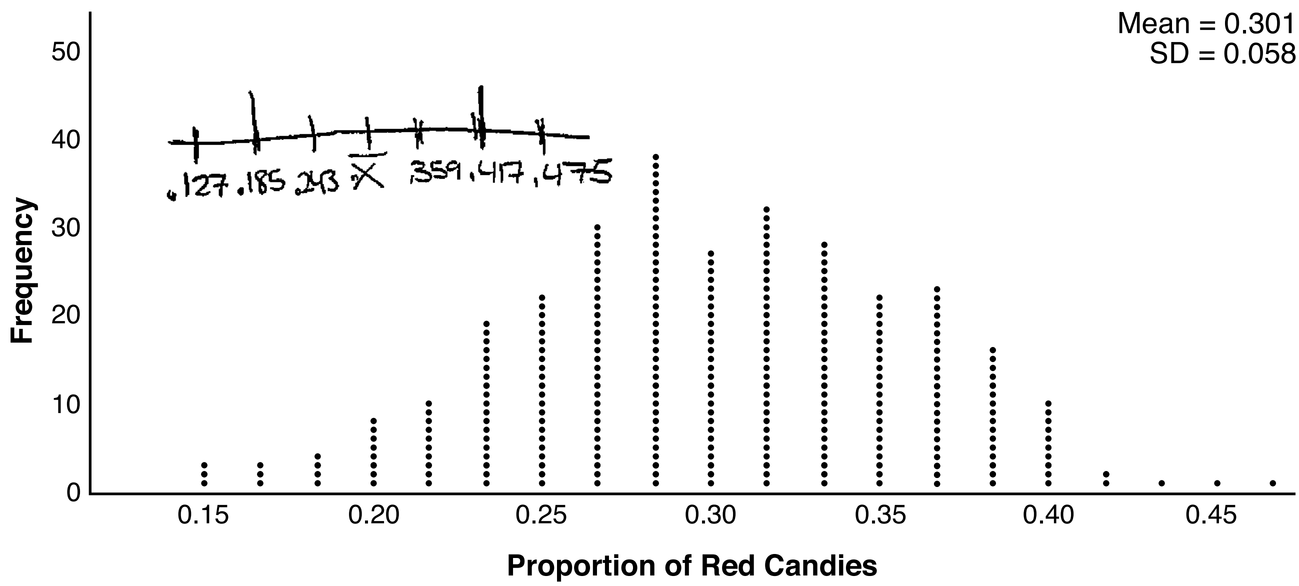
Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

$$\frac{14}{60} = 0.2\overline{3}$$

No, it is not unusual that Marys pack had 14 out of 60 because that proportion lies with the middle 95% plausible values.

Score 4: The student gave a complete and correct response.

35 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within.

$.185 \leq x \leq .417$

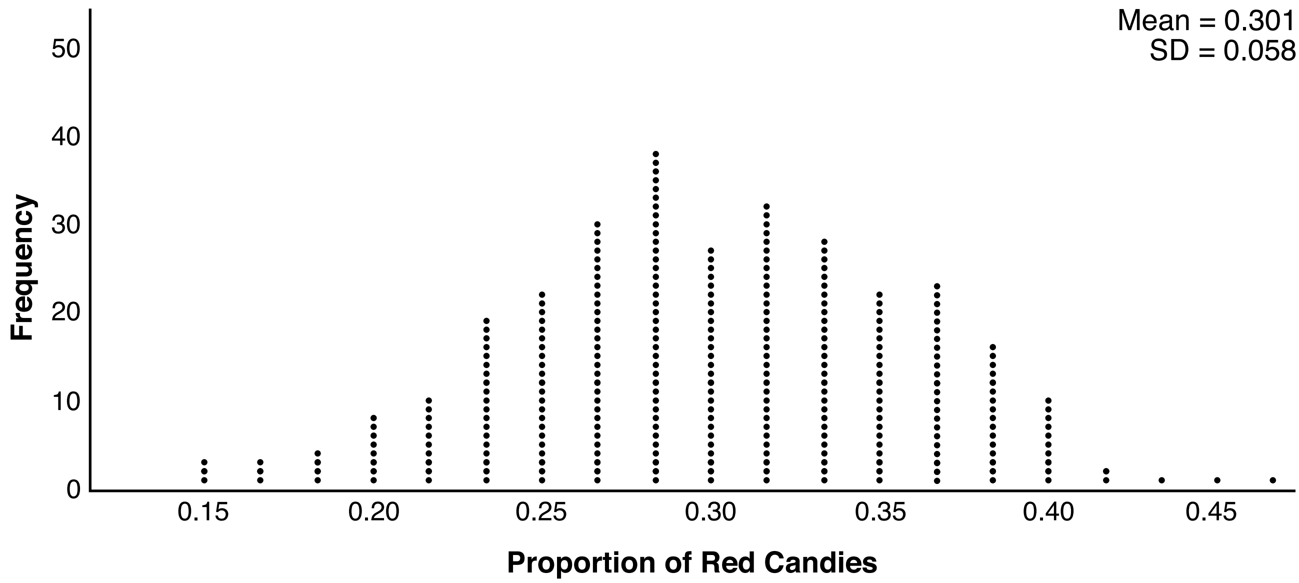
Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

No because the proportion of red candies to the total would equal .233 which falls in the 99% range of plausible values.

Score 3: The student made a transcription error.

Question 35

35 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within.

.185 .243 .301 .359 .417

291 candies

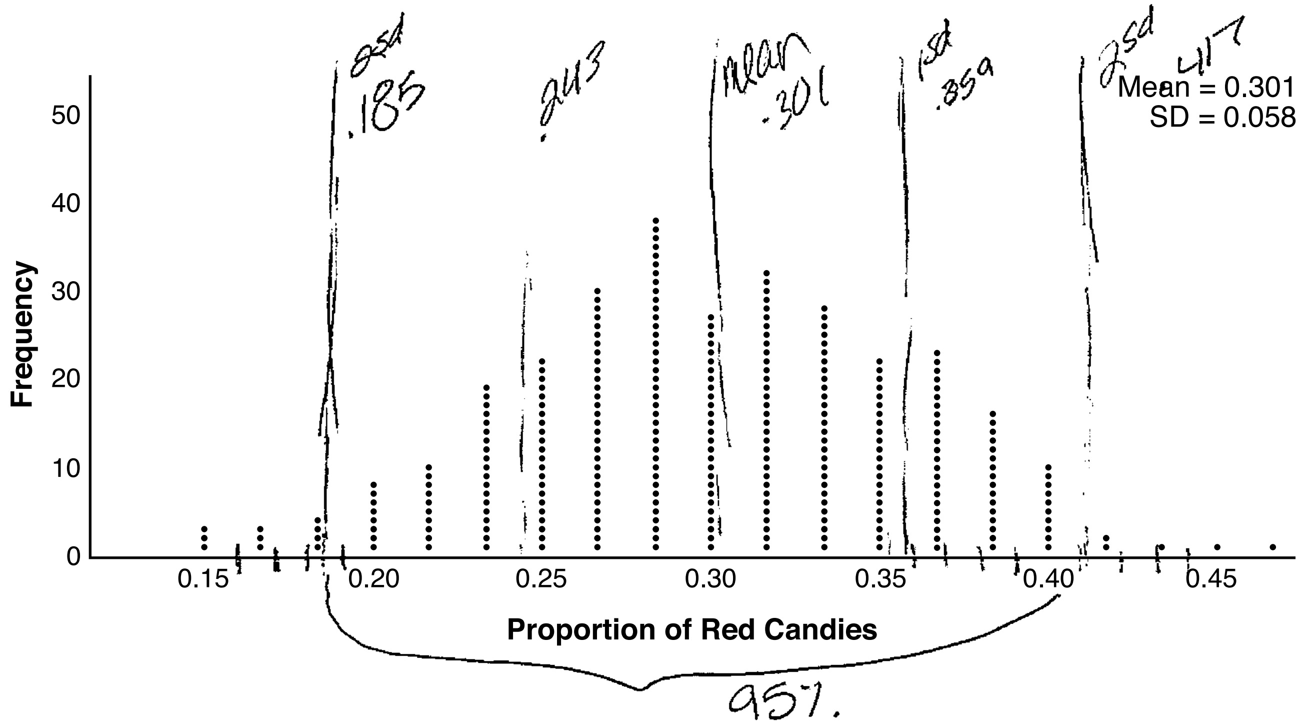
Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

No it isn't because .233 falls in the 95% of plausible values.

Score 3: The student did not explicitly state an interval.

Question 35

35 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within.

within .185 to .417
95%

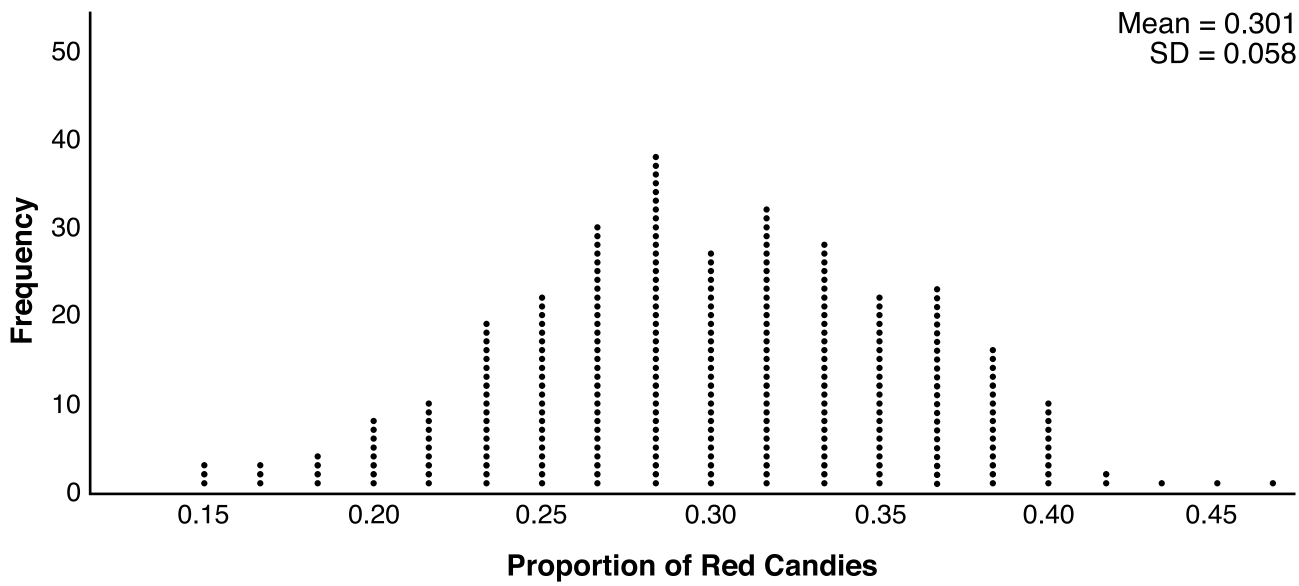
Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

Yes, it is within the 95%.

Score 2: The student answered the first part correctly.

Question 35

35 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within.

$\frac{14}{60} = 0.233$

$0.301 + 0.058 = 0.089$

$0.301 - 0.058 = 0.243$

$\boxed{0.243 - 0.089}$

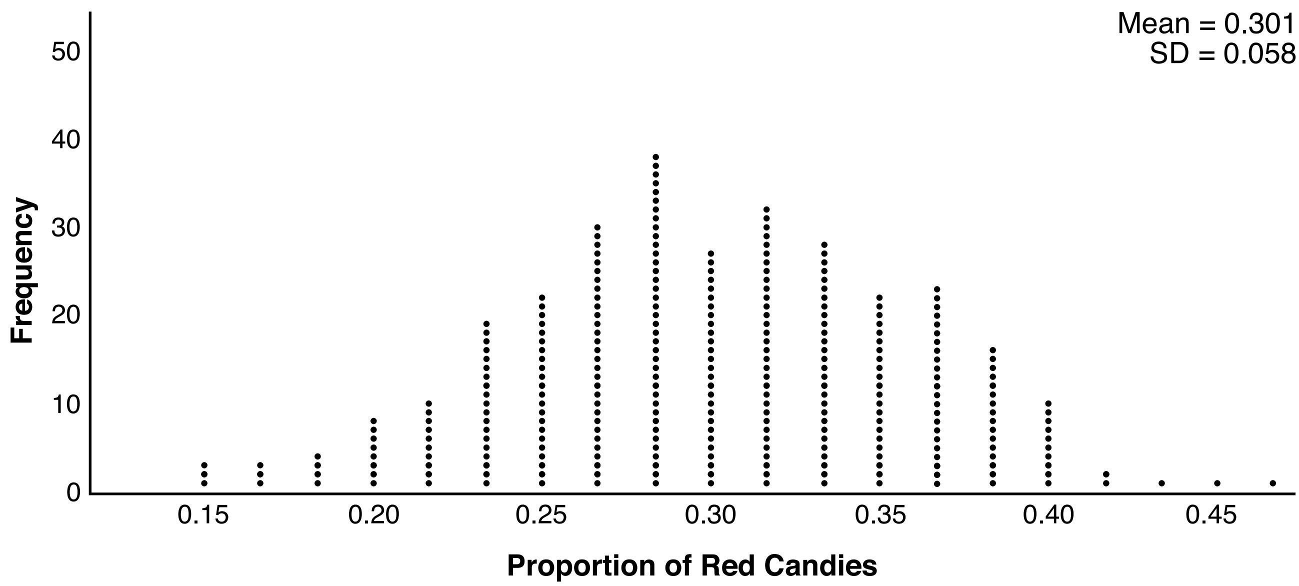
Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

NO it is not unusual because around 0.23 was recorded many times

Score 1: The student found the correct proportion.

Question 35

35 Mary bought a pack of candy. The manufacturer claims that 30% of the candies manufactured are red. In her pack, 14 of the 60 candies are red. She ran a simulation of 300 samples, assuming the manufacturer is correct. The results are shown below.



Based on the simulation, determine the middle 95% of plausible values that the proportion of red candies in a pack is within.

0.26 - 0.32

Based on the simulation, is it unusual that Mary's pack had 14 red candies out of a total of 60? Explain.

yes because according to the graph the mean is 0.301.

Score 0: The student did not show enough correct work to receive any credit.

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

$x^2 - 6x + 17 = 0$

$\frac{6 \pm \sqrt{36-4(1)(17)}}{2(1)}$

$\frac{6 \pm \sqrt{-32}}{2}$ → $\frac{6 \pm \sqrt{16} \cdot \sqrt{2} \cdot \sqrt{-1}}{2}$

$\frac{6 \pm 4i\sqrt{2}}{2}$ → $\boxed{3 \pm 2i\sqrt{2}}$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

The equation can be concluded to have imaginary roots based on observing the graph because the system does not have any solutions; rather, the equations do not intersect. Because the system of the two equations has no solution, we can conclude that setting the two equations equal to each other will not yield any real roots.

Score 4: The student gave a complete and correct response.

Question 36

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

$x^2-2x+7=4x-10$

$-4x+10$

$x^2-6x+17$

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$x=\frac{6\pm\sqrt{6^2-4(1)(17)}}{2}$

$x=\frac{6\pm\sqrt{-32}}{2}$

$x=6\pm\frac{\sqrt{-16}\sqrt{2}}{2}$

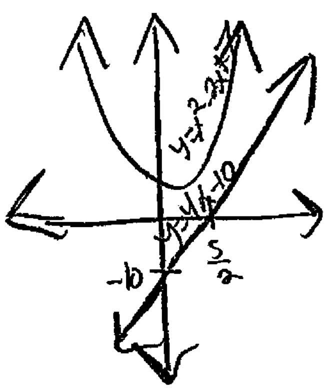
$x=\frac{6\pm4i\sqrt{2}}{2}$

$x=3\pm2i\sqrt{2}$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.



Not one value of x satisfies the equations because they do not intercept at a given point.

Score 4: The student gave a complete and correct response.

Question 36

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

$x^2 - 6x + 17$

$\frac{6 \pm \sqrt{36 - 4(17)(1)}}{2}$

$\frac{6 \pm \sqrt{-32}}{2}$

$\frac{6 \pm 4i\sqrt{2}}{2}$

$3 \pm 2i\frac{\sqrt{2}}{2}$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

Because when graphed, the parabola never crosses the line so it doesn't have any roots that are real, just imaginary.

Score 3: The student made a computational error.

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

$x^2 - 6x + 17 = 0$

$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(17)}}{2(1)}$

$x = \frac{6 \pm \sqrt{-32}}{2}$

$x = \frac{6 \pm 4i\sqrt{2}}{2}$

$\boxed{x = 3 \pm 2i\sqrt{2}}$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

If the system does not intersect.

Score 3: The student gave an incomplete explanation.

Question 36

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4\cancel{x} - 1\cancel{0}$$

$$-4x + 10 \quad 4x + 10$$

$$x^2 - 6x + 17 = 0$$

$x = ?$

$x =$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

It has imaginary roots because the graph shows a parabola and then a straight line for the linear equation, and at no point do they intersect, therefore, it has imaginary roots.

Score 2: The student gave a correct explanation.

Question 36

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - 2x + 7 = 4x - 10$$

$$\underline{-4x+10 \quad -4x+10}$$

$$x^2 - 6x + 17 = 0$$

$$\underline{-17 \quad -17}$$

$$x^2 \underbrace{-6x}_{(-3)^2} + 9 = -17$$

$$\underline{\qquad + 9}$$

$$\pm\sqrt{(x-3)^2} = \pm\sqrt{-8}$$

$$x - 3 = \pm\sqrt{-8}$$

$$+3$$

$$x = 3 \pm \sqrt{-8}$$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

The equation from part a has imaginary roots because $\pm\sqrt{-8}$ is a non-real number, so it is imaginary making the equation have imaginary roots.

Score 1: The student completed the square correctly.

Question 36

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

x intercepts, zeros

$$x^2 - 2x + 7 = 4x - 10$$

$x^2 - 6x + 17 = 0$

quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{6 \pm \sqrt{6^2 - 4(17)}}{2} \qquad x = \frac{6 \pm \sqrt{-32}}{2}$$

$$\boxed{x = \frac{6 \pm 4i\sqrt{2}}{2}}$$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

Because i is an imaginary # and it has i in it's solutions

Score 1: The student solved the quadratic equation, but did not simplify completely.

Question 36

36 a) Algebraically determine the roots, in simplest $a + bi$ form, to the equation below.

$$x^2 - \cancel{2}x + 7 = 4x - 10$$

$+\cancel{2}x \quad +2x$

$x^2+7 = 6x - 1\cancel{0}$

$+10 \quad \cancel{+10}$

$\sqrt{x^2+17} = 6x$

$\frac{17}{6} \quad \frac{6}{6}$

$\boxed{x^2+2.8 = x}$

b) Consider the system of equations below.

$$y = x^2 - 2x + 7$$
$$y = 4x - 10$$

The graph of this system confirms the solution from part *a* is imaginary. Explain why.

Score 0: The student did not show enough correct work to receive any credit.

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

$B = 1.69\sqrt{30 + 4.45} - 3.49$

$B = 6.429306679 \approx 6$

$\boxed{\text{Steady breeze}}$

Question 37 is continued on the next page.

Score 6: The student gave a complete and correct response.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$15 = 1.69\sqrt{s+4.45} - 3.49$

$\boxed{\approx 115\text{mph}}$

$\frac{18.49}{1.69} = \frac{1.69\sqrt{s+4.45}}{1.69}$

$\left(\frac{18.49}{1.69}\right)^2 = \left(\sqrt{s+4.45}\right)^2$

$\left(\frac{18.49}{1.69}\right)^2 = s+4.45$
$-4.45 \qquad -4.45$

$s = 115.2517261$

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

$10 = 1.69\sqrt{s+4.45} - 3.49$

$\frac{13.49}{1.69} = \frac{1.69\sqrt{s+4.45}}{1.69}$

$\left(\frac{13.49}{1.69}\right)^2 = \left(\sqrt{s+4.45}\right)^2$

$\left(\frac{13.49}{1.69}\right)^2 = s+4.45$
$-4.45 \qquad -4.45$

$s \approx 59.26629145$

$\boxed{55 \leq s \leq 64}$

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

6.429

Question 37 is continued on the next page.

Score 5: The student did not classify the force of wind.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$15 = 1.69\sqrt{s+4.45} - 3.49$

$18.49 = 1.69\sqrt{s+4.45}$

$10.94 = \sqrt{s+4.45}$

$119.702 = s+4.45$

~~115 mph~~

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

$9.5 \leq X < 10.5$

55 mph to 64 mph

$9.5 = 1.69\sqrt{s+4.45} - 3.49$

$12.99 = 1.69\sqrt{s+4.45}$

$7.686 = \sqrt{s+4.45}$

$59.08 = s+4.45$

54.6 mph

$10.49 = 1.69\sqrt{s+4.45}$

$13.98 = 1.69\sqrt{s+4.45}$

$8.272 = \sqrt{s+4.45}$

$68.429 = s+4.45$

64 mph

Question 37

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

$B = 1.69\sqrt{(30)+4.45} - 3.49$

$B = 6.429$ $\boxed{\text{Steady breeze}}$

Question 37 is continued on the next page.

Score 5: The student made an error when finding the interval.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$$15 = 1.69\sqrt{s+4.45} - 3.49$$
$$+3.49 \qquad +3.49$$
$$\frac{18.49}{1.69} = \frac{1.69\sqrt{s+4.45}}{1.69}$$
$$(10.9408284)^2 = (\sqrt{s+4.45})^2$$
$$119.7017261 = s+4.45$$
$$-4.45 \qquad -4.45$$
$$115.2517261 = s$$
$$\boxed{s = 115}$$

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

$$B = 1.69\sqrt{55+4.45} - 3.49 \qquad B = 1.69\sqrt{63+4.45} - 3.49$$
$$B = 9.54 \qquad B = 10.389$$
$$B = 10 \qquad B = 10$$
$$\boxed{55 - 63 \text{ mph}}$$

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

Steady breeze

Question 37 is continued on the next page.

Score 4: The student did not justify "steady breeze" and made an error when finding the interval.

Question 37 continued.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$15 = 1.69\sqrt{s+4.45} - 3.49$
$\quad +3.49$

$18.49 = 1.69\sqrt{s+4.45}$
$\quad 1.69$

$\frac{18.49}{1.69} = \sqrt{s+4.45}$

$\left(\frac{18.49}{1.69}\right)^2 = s + 4.45$
$\quad -4.45$

$\left(\frac{18.49}{1.69}\right)^2 - 4.45 = s$

$s = 115$ mph

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

$9.5 = 1.69\sqrt{s+4.45} - 3.49$

$\left(\frac{12.99}{1.69}\right)^2 = s + 4.45$

$s = \left(\frac{12.99}{1.69}\right)^2 - 4.45$

$s = 55$ mph

$10.4 = 1.69\sqrt{s+4.45} - 3.49$

$\left(\frac{13.89}{1.69}\right)^2 - 4.45 = s$

$s = 63$ mph

55 mph – 63 mph

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

$B = 1.69\sqrt{30+4.45} - 3.49 =$

$B = 6.4$ Steady Breeze

Question 37 is continued on the next page.

Score 4: The student made a computational error and did not state an interval.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$15 = 1.69\sqrt{s+4.45} - 3.49$

$+3.49 \qquad +3.49$

$\frac{18.49}{1.69} = \frac{1.69\sqrt{s+4.45}}{1.69}$

$(10.941)^2 = (\sqrt{s+4.45})^2$

$119.702 = s + 4.45$

$-4.45 \qquad -4.45$

115.252

115 mph

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

$10 = 1.69\sqrt{s+4.45} - 3.49$

$-3.49 \qquad +3.49$

$\frac{6.51}{1.69} = \frac{1.69\sqrt{s+4.45}}{1.69}$

$(3.852)^2 = (\sqrt{s+4.45})^2$

$14.838 = s + 4.45$

$-4.45 \qquad -4.45$

$10.388 = s$

$10 \approx s$

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

$B = 1.69\sqrt{s+4.45} - 3.49$ $\quad s = 30$

$1.69\sqrt{s+4.45} - 3.49 \rightarrow 6.42$ $\quad B = 6$ $\quad$ moderate breeze

Question 37 is continued on the next page.

Score 3: The student gave an incorrect classification and did not state the correct interval.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$$15 = 1.69\sqrt{s+4.45} - 3.49$$

$$\left(\frac{18.49}{1.69}\right)^2 - 4.45 = \cancel{s}\ s = 115\text{mph}$$

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

$$10 = 1.69\sqrt{s+4.45} - 3.49$$

$$\left(\frac{13.49}{1.69}\right)^2 - 4.45 \rightarrow 59\text{ mph}$$

(59.26..)

59 - 60 : range

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

calm

Question 37 is continued on the next page.

Score 2: The student received credit for the second part.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$13.49 = 1.69\sqrt{s+4.45}$

$10.9408^2 = \sqrt{s+4.45}^2$

$119.7017 = s+4$

$\boxed{115\text{mph}}$

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

10 13.49 = 7.98 63.71 =

$\boxed{59\text{mph} - 69\text{mph}}$

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

steady breeze

Question 37 is continued on the next page.

Score 2: The student received credit for "steady breeze" and 115 with no work shown.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

115 mph

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

59 to 69

Question 37

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

$B = 1.69\sqrt{30+4.45} - 3.49$

$B = 6.43$

Question 37 is continued on the next page.

Score 1: The student calculated an approximation of the Beaufort number correctly.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$$15 = 1.69\sqrt{s+4.45} - 3.49$$

$$11.51 = 1.69\sqrt{s+4.45}$$

$$9.82 = \sqrt{s+4.45}$$

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

$1.69\sqrt{30+4.45-3.49}$

$1.69\sqrt{30.96}$

Strong gale

Question 37 is continued on the next page.

Score 1: The student selected the correct category for a miscalculation of the Beaufort number.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

37 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B, are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale

Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer.

$1.69\sqrt{30+4.45} - 3.49$

$9.4 \rightarrow 10$ whole gale

Question 37 is continued on the next page.

Score 0: The student did not show enough correct work to receive any credit.

In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s, to the *nearest mph*.

$15 = 1.69\sqrt{s+4.45} - 3.49$

$11.51 = 1.69\sqrt{s+4.45}$

$10.767 = \sqrt{s+4.45}$

$115.9398 = s + 4.45$

$s = 120$ mph

Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

$10 = 1.69\sqrt{s+4.45} - 3.49$

$s = 59$ mph

59 - 60

The State Education Department / The University of the State of New York

Regents Examination in Algebra II – August 2019

Chart for Converting Total Test Raw Scores to Final Exam Scores (Scale Scores)

(Use for the August 2019 exam only.)

Raw Score	Scale Score	Performance Level	Raw Score	Scale Score	Performance Level	Raw Score	Scale Score	Performance Level
86	**100**	5	57	**81**	4	28	**67**	3
85	**99**	5	56	**81**	4	27	**66**	3
84	**98**	5	55	**81**	4	26	**65**	3
83	**97**	5	54	**80**	4	25	**64**	2
82	**96**	5	53	**80**	4	24	**62**	2
81	**95**	5	52	**80**	4	23	**61**	2
80	**95**	5	51	**79**	4	22	**60**	2
79	**94**	5	50	**79**	4	21	**58**	2
78	**93**	5	49	**79**	4	20	**55**	2
77	**92**	5	48	**78**	4	19	**54**	1
76	**91**	5	47	**78**	4	18	**53**	1
75	**91**	5	46	**77**	3	17	**51**	1
74	**90**	5	45	**77**	3	16	**49**	1
73	**89**	5	44	**77**	3	15	**47**	1
72	**89**	5	43	**76**	3	14	**44**	1
71	**88**	5	42	**76**	3	13	**42**	1
70	**87**	5	41	**76**	3	12	**39**	1
69	**87**	5	40	**75**	3	11	**36**	1
68	**86**	5	39	**75**	3	10	**34**	1
67	**86**	5	38	**74**	3	9	**31**	1
66	**86**	5	37	**74**	3	8	**27**	1
65	**85**	5	36	**73**	3	7	**24**	1
64	**84**	4	35	**72**	3	6	**21**	1
63	**84**	4	34	**72**	3	5	**17**	1
62	**83**	4	33	**71**	3	4	**14**	1
61	**83**	4	32	**70**	3	3	**11**	1
60	**82**	4	31	**70**	3	2	**7**	1
59	**82**	4	30	**69**	3	1	**3**	1
58	**82**	4	29	**68**	3	0	**0**	1

To determine the student's final examination score (scale score), find the student's total test raw score in the column labeled "Raw Score" and then locate the scale score that corresponds to that raw score. The scale score is the student's final examination score. Enter this score in the space labeled "Scale Score" on the student's answer sheet.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart change from one administration to another, it is crucial that for each administration the conversion chart provided for that administration be used to determine the student's final score. The chart above is usable only for this administration of the Regents Examination in Algebra II.