ALGEBRA
# II

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

# ALGEBRA II

**Monday,** August 19, 2024 — 12:30 p.m. 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.**

ALGEBRA II

## 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 A grocery store owner wonders how many customers bring reusable bags to the store. An employee stands at the store entrance for two hours and counts the number of people bringing in reusable bags. This type of study is best classified as

(1) a census

(2) an experiment

(3) an observational study

(4) a survey

2 The graph of $y = 2^x - 4$ is positive on which interval?

(1) $(-\infty,\infty)$

(2) $(2,\infty)$

(3) $(0,\infty)$

(4) $(-4,\infty)$

3 Tim deposits \$300 into a savings account. The annual interest rate is 2.7% and compounds monthly. He uses the equation $A = 300\left(1 + \dfrac{0.027}{12}\right)^{12t}$ to determine how much money, $A$, he will have after $t$ years. Which equation is equivalent to Tim's equation?

(1) $A = 300\left[(1.00225)^{12}\right]^{t}$

(2) $A = 300(0.08558)^{12t}$

(3) $A = 300\left[1 + \left(\dfrac{0.027}{12}\right)^{12t}\right]$

(4) $A = (300)^{12t}(1)^{12t} + \left(\dfrac{0.027}{12}\right)^{12t}$

**4** Which equation is true for all real values of $x$?

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

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

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

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

**5** The solution of $\dfrac{x}{x + 3} + \dfrac{2}{x - 4} = \dfrac{2x + 27}{x^2 - x - 12}$ is

(1) $-3$             (3) 3

(2) $-7$             (4) 7

**6** The cost, in dollars, of a single-ride fare in the New York City subway in the years since 1904 is listed in the table below.

| Years since 1904 (x) | 0 | 49 | 72 | 91 | 99 | 111 |
|---|---|---|---|---|---|---|
| Fare (y) | $0.05 | $0.15 | $0.50 | $1.50 | $2.00 | $2.75 |

Which equation best models the cost of a single-ride fare based on these data?

(1) $y = 0.0375(1.0392)^x$      (3) $y = 0.0234x - 0.487$

(2) $y = 1.0392(0.0375)^x$      (4) $y = -0.179 + 0.356 \ln(x)$

**7** Which expression is equivalent to $\dfrac{6x^4 + 4x^3 + x + 200}{x + 2}$?

(1) $6x^2 - 8x + 17 + \dfrac{166}{x + 2}$

(2) $6x^2 + 16x + 33 + \dfrac{266}{x + 2}$

(3) $6x^3 + 16x^2 + 32x + 65 + \dfrac{330}{x + 2}$

(4) $6x^3 - 8x^2 + 16x - 31 + \dfrac{262}{x + 2}$

**8** The solution to the equation $6\left(2^{x + 4}\right) = 36$ is

(1) $-1$

(3) $\ln(3) - 4$

(2) $\dfrac{\ln 36}{\ln 12} - 4$

(4) $\dfrac{\ln 6}{\ln 2} - 4$

**9** The asymptote of the graph of $f(x) = 5 \log(x + 4)$ is

(1) $y = 6$

(3) $x = 4$

(2) $x = -4$

(4) $y = 5$

**10** The probability of having math homework is $\frac{1}{3}$ and the probability of having English homework is $\frac{1}{7}$. The probability of having math homework or having English homework is $\frac{9}{21}$. What is the probability of having math homework and having English homework?

(1) $\frac{19}{21}$                    (3) $\frac{1}{21}$

(2) $\frac{1}{5}$                    (4) $\frac{10}{21}$

**11** The solution set of the equation $x - 1 = \sqrt{2x + 6}$ is

(1) $\{5, -1\}$                    (3) $\{-1\}$

(2) $\{5\}$                    (4) $\{\ \}$

**12** Given $x > 0$, the expression $\left(\dfrac{1}{x^{-2}}\right)^{-\frac{3}{4}}$ is equivalent to

(1) $x\sqrt{x}$                    (3) $\sqrt[3]{x^2}$

(2) $\dfrac{1}{x\sqrt{x}}$                    (4) $\dfrac{1}{\sqrt[3]{x^2}}$

**13** The graph of which function has a period of 3?

(1) $y = -7\sin\left(\dfrac{2\pi}{3}x\right) - 5$    (3) $y = -7\sin(3x) - 5$

(2) $y = -7\sin\left(\dfrac{3\pi}{2}x\right) + 9$    (4) $y = 3\sin(\pi x) + 9$

**14** Which graph could represent a $4^{\text{th}}$ degree polynomial function with a positive leading coefficient, 2 real zeros, and 2 imaginary zeros?



( 1 )



( 3 )



( 2 )



( 4 )
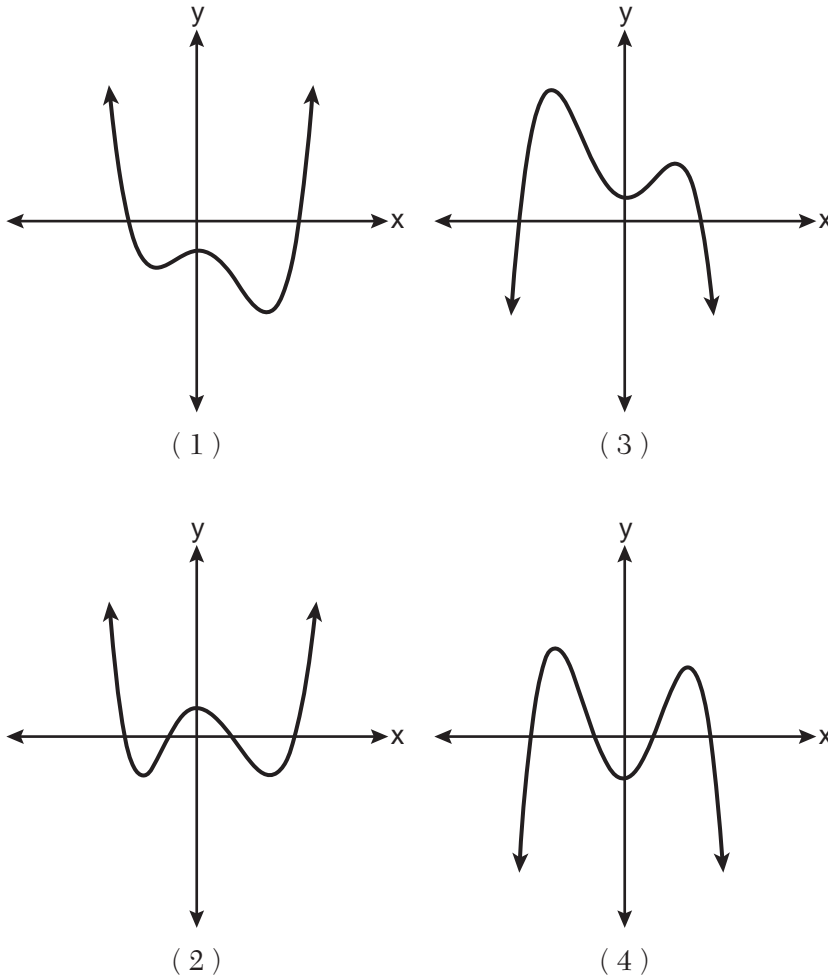
**15** Given $i$ is the imaginary unit, which expression is equivalent to $5i(2x + 3i) - x\sqrt{-9}$ ?

(1) $15 + 13xi$                    (3) $15 + 7xi$

(2) $-15 + 13xi$                   (4) $-15 + 7xi$

**16** What is the focus of the parabola $8(y + 2) = (x + 5)^2$?

(1) $(-5,0)$                        (3) $(5,0)$

(2) $(-5,-4)$                       (4) $(5,4)$

**17** Given $q(x) = 2\log(x)$ and $r(x) = (x - 2)^3 - 4$, what is a solution of $q(x) = r(x)$ to the *nearest tenth*?

(1) 1.1                             (3) 3.9

(2) 3.7                             (4) 4.3

**18** The volume of a cardboard box can be modeled by $V(x)$, which is the product of the length, width, and height, $x$. If the length can be represented by $L(x) = 18 - 2x$ and the width can be represented by $W(x) = 18 - 2x$, then which function represents $V(x)$?

(1) $V(x) = 4x^2 - 72x + 324$

(2) $V(x) = 4x^3 - 72x^2 + 324x$

(3) $V(x) = -3x + 36$

(4) $V(x) = 4x^3 + 324x$

**19** The expression $8^{\frac{x}{2}} \cdot 8^{\frac{x}{3}}$ is equivalent to

(1) $\sqrt[6]{8^{5x}}$                         (3) $\sqrt[5]{8^{2x}}$

(2) $64^{\frac{5x}{6}}$                         (4) $64^{\frac{x^2}{6}}$

**20** If $\theta$ is an angle in standard position whose terminal side passes through the point $(-3,-4)$, which statement is true?

(1) $\sec \theta > 0$ and $\tan \theta > 0$

(2) $\sec \theta < 0$ and $\tan \theta < 0$

(3) $\sec \theta > 0$ and $\tan \theta < 0$

(4) $\sec \theta < 0$ and $\tan \theta > 0$

**21** What is the value of $y$ for the system shown below?

$$3x + 4y - 5z = -27$$
$$2x + 3y - z = -3$$
$$6x - y + 4z = 3$$

(1) $-27$ \qquad\qquad (3) 3

(2) 6 \qquad\qquad\qquad (4) $-3$

**22** The number of employees who work nights and weekends at a department store is summarized in the table below.

| | Works Nights | Doesn't Work Nights |
|---|---|---|
| **Works Weekends** | 8 | 40 |
| **Doesn't Work Weekends** | 12 | 60 |

Let $N$ represent the event "works nights" and let $W$ represent the event "works weekends." Based on the table, are $N$ and $W$ independent events?

(1) Yes, because $P(N) \cdot P(W) = P(N \cap W)$.

(2) Yes, because $P(N) \cdot P(W) \neq P(N \cap W)$.

(3) No, because $P(N) \cdot P(W) = P(N \cap W)$.

(4) No, because $P(N) \cdot P(W) \neq P(N \cap W)$.

**23** Which expression is equivalent to $x^8 - y^8$?

(1) $(x - y)^8$

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

(2) $(x^2 + y^2)^2 (x^2 - y^2)^2$

(4) $(x + y)^4 (x - y)^4$

**24** A research assistant receives a first year salary of $90,000 and a 2% annual raise throughout the first ten years of employment. In total, how much money will be earned over the first ten years, to the *nearest dollar*?

(1) $91,837

(3) $877,917

(2) $109,709

(4) $985,475

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** On the axes below, graph $y = 3.2(1.8)^x$.
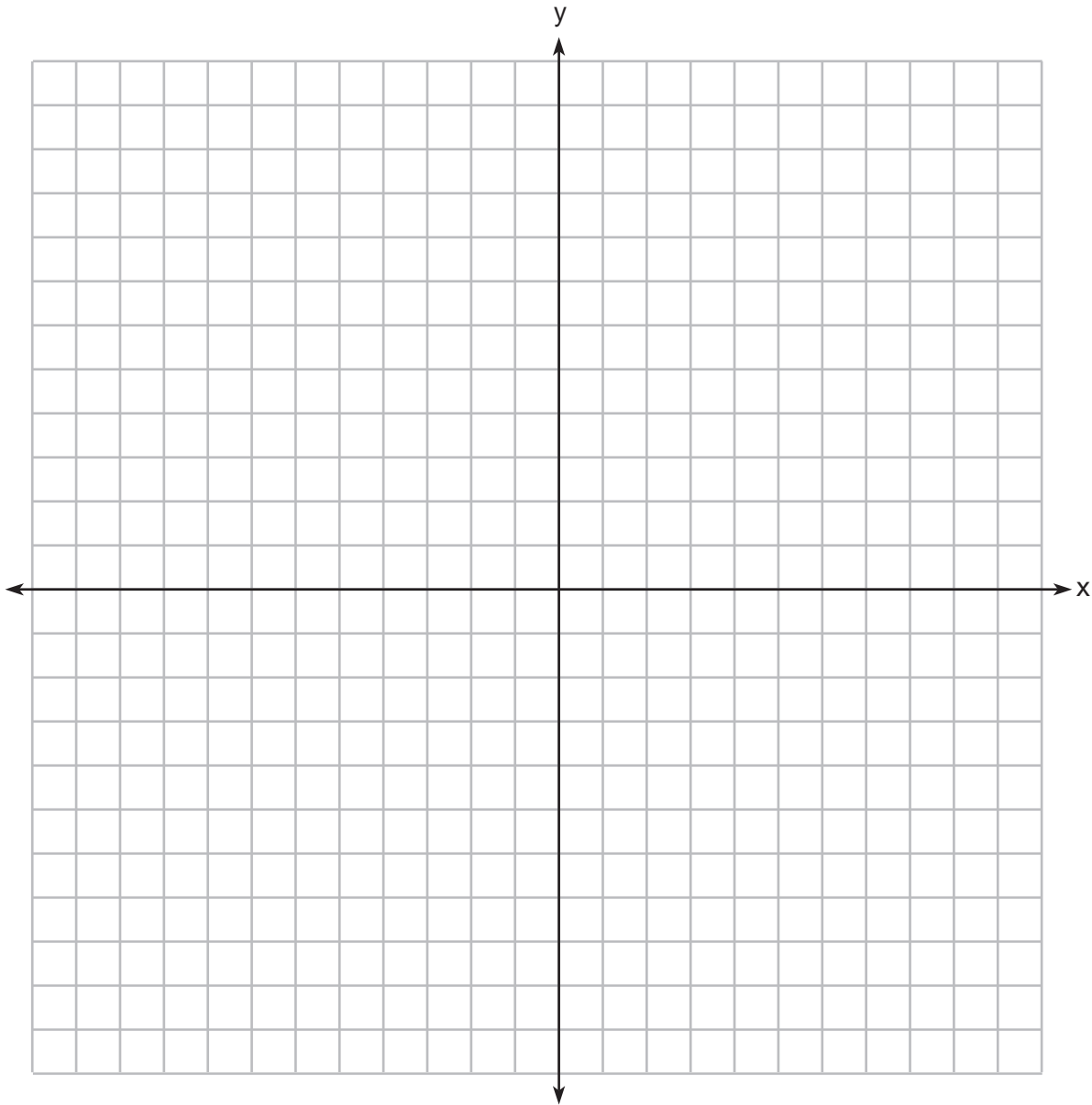
**26** Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
  Justify your answer.

**27** Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

**28** The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

**29** The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, $t$ hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

**30** A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream $t$ hours after drinking one cup of coffee.

**31** Markus is a long-distance walker. In one race, he walked 55 miles in $t$ hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, $r$, for each race. Determine the number of hours that *each* of the two races took.

**32** Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

## 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 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

**34** In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.



Mean = 42.029
SD = 3.105
n = 10

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

Write an equation for $h(x)$, the inverse of $g(x)$.

**36** Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

**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** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

**Question 37 is continued on the next page.**

**Question 37 continued**

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.
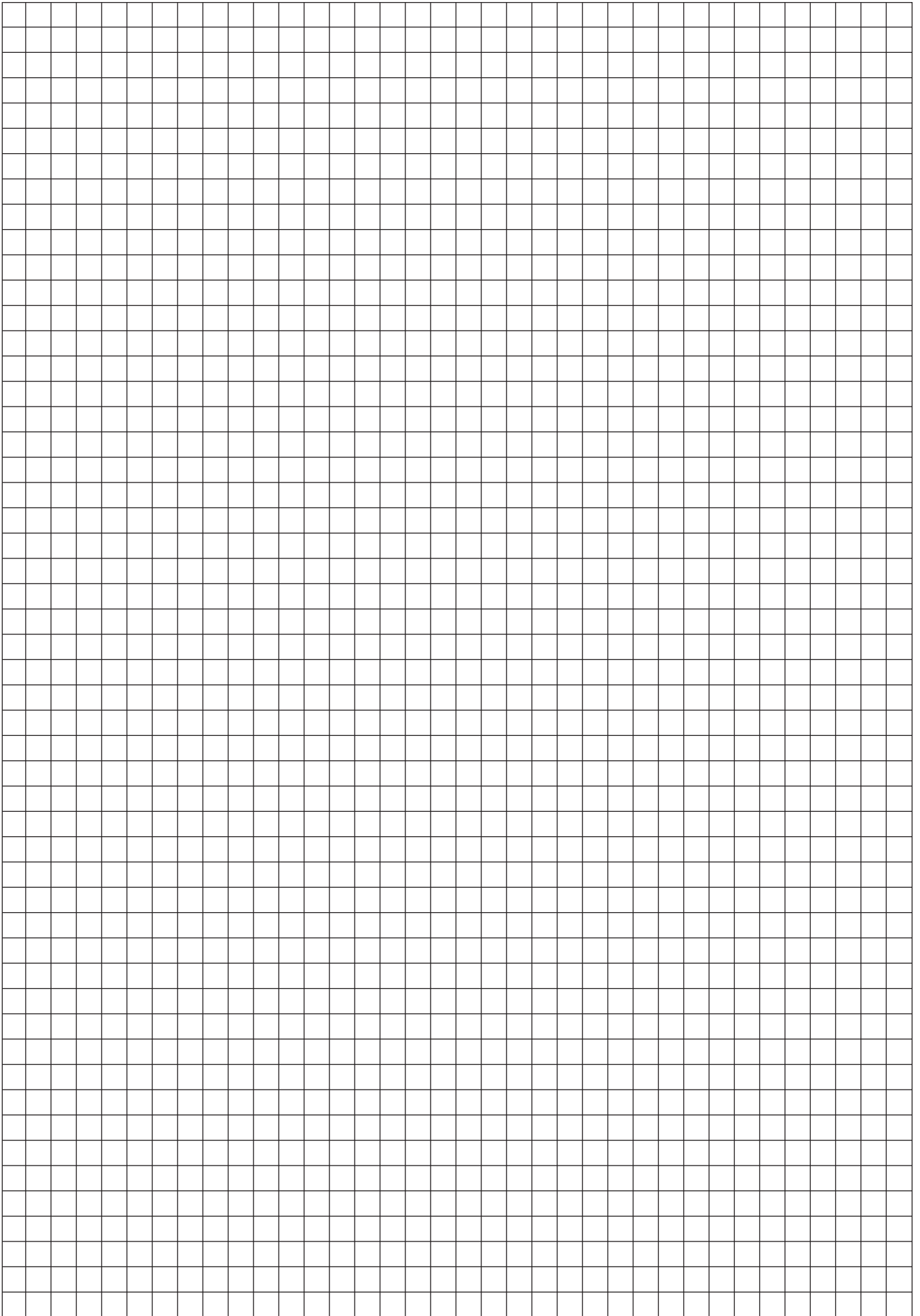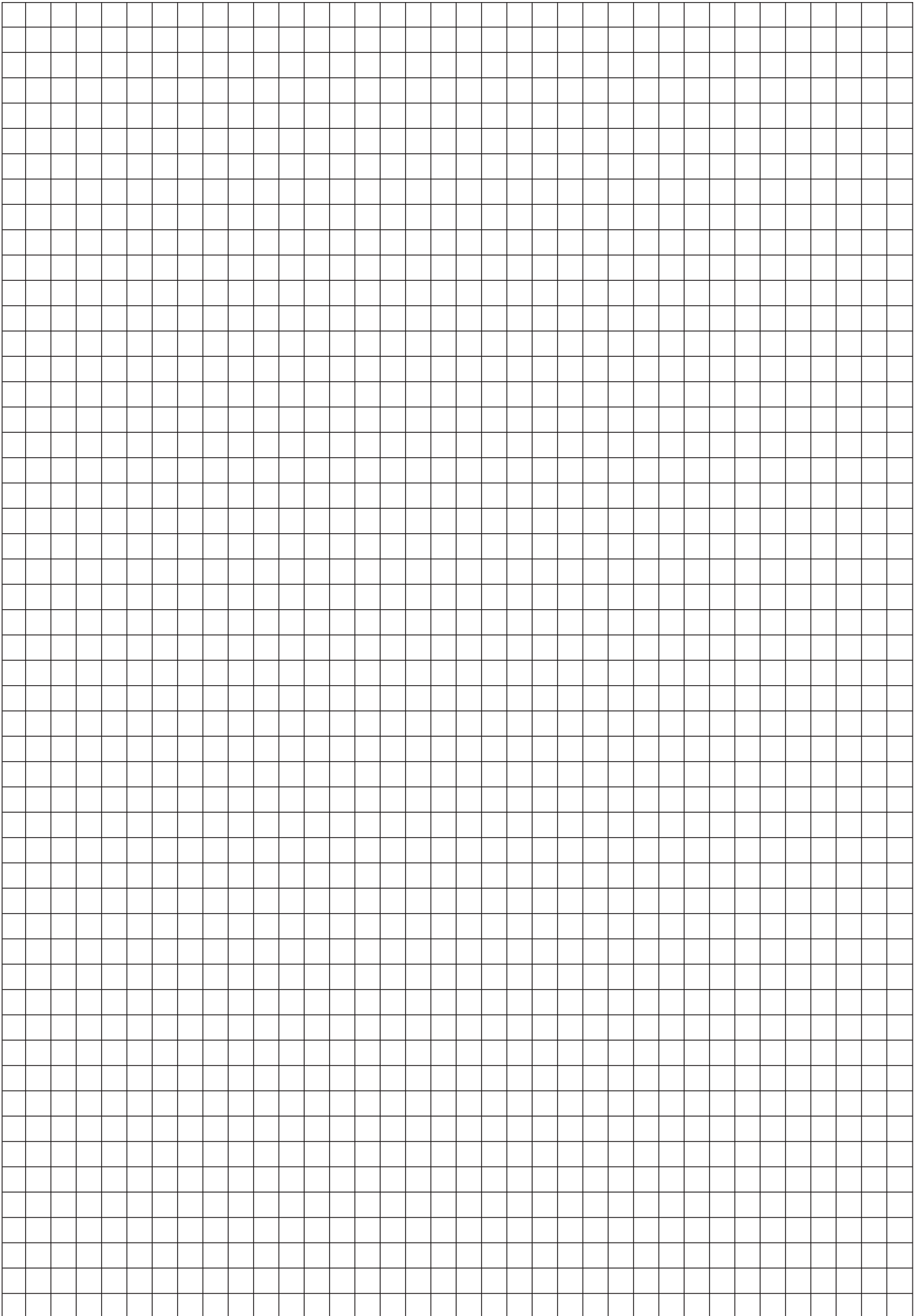
# High School Math Reference Sheet

1 inch = 2.54 centimeters

1 meter = 39.37 inches

1 mile = 5280 feet

1 mile = 1760 yards

1 mile = 1.609 kilometers

1 kilometer = 0.62 mile

1 pound = 16 ounces

1 pound = 0.454 kilogram

1 kilogram = 2.2 pounds

1 ton = 2000 pounds

1 cup = 8 fluid ounces

1 pint = 2 cups

1 quart = 2 pints

1 gallon = 4 quarts

1 gallon = 3.785 liters

1 liter = 0.264 gallon

1 liter = 1000 cubic centimeters

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

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Tear Here

ALGEBRA II

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

## Regents Examination in Algebra II – August 2024
### Scoring Key: Part I (Multiple-Choice Questions)

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

## Regents Examination in Algebra II – August 2024
### Scoring Key: Parts II, III, and IV (Constructed-Response Questions)

| Examination | Date | Question Number | Scoring Key | Question Type | Credit |
|---|---|---|---|---|---|
| Algebra II | August '24 | 25 | - | CR | 2 |
| Algebra II | August '24 | 26 | - | CR | 2 |
| Algebra II | August '24 | 27 | - | CR | 2 |
| Algebra II | August '24 | 28 | - | CR | 2 |
| Algebra II | August '24 | 29 | - | CR | 2 |
| Algebra II | August '24 | 30 | - | CR | 2 |
| Algebra II | August '24 | 31 | - | CR | 2 |
| Algebra II | August '24 | 32 | - | CR | 2 |
| Algebra II | August '24 | 33 | - | CR | 4 |
| Algebra II | August '24 | 34 | - | CR | 4 |
| Algebra II | August '24 | 35 | - | CR | 4 |
| Algebra II | August '24 | 36 | - | CR | 4 |
| Algebra II | August '24 | 37 | - | CR | 6 |

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

The chart for determining students' final examination scores for the **August 2024 Regents Examination in Algebra II** will be posted on the Department's web site at: https://www.nysedregents.org/algebratwo/ 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

**Monday,** August 19, 2024 — 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: https://www.nysed.gov/state-assessment/high-school-regents-examinations 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 https://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: https://www.nysed.gov/state-assessment/ by Monday, August 19, 2024. 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]** A correct graph is drawn.

   **[1]** One graphing error is made.

*or*

   **[1]** One conceptual error is made.

   **[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(26)    **[2]** A positive response is indicated, and a correct justification is given.

   **[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]** Yes, but an incomplete justification is given.

   **[0]** Yes, but the justification is incorrect or missing.

*or*

   **[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(27)    **[2]** $x(2x^2 + 3)(x - 5)$ or equivalent, and correct work is shown.

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

*or*

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

*or*

   **[1]** $x(2x^2 + 3)(x - 5)$, but no work is shown.

   **[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(28)    **[2]** 31, and correct work is shown.

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

*or*

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

*or*

**[1]** 31, but no work is shown.

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.


(29)    **[2]** 3, and a correct justification is given.

**[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]** 3, but no justification is given.

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.


(30)    **[2]** $C(t) = 130\left(\dfrac{1}{2}\right)^{\frac{t}{5.5}}$ or equivalent.

**[1]** One computational or notation error is made.

*or*

**[1]** One conceptual error is made.

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(31)　　**[2]** 16.5 and 19.5, 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]** Correct work is shown to find 16.5 or 19.5, but no further correct work is shown.

*or*

　　　　**[1]** 16.5 and 19.5, but no work is shown.

　　　　**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(32)　　**[2]** $-\dfrac{3}{2} \pm \dfrac{\sqrt{35}}{2}i$ or equivalent $a + bi$ form, and correct algebraic 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]** Appropriate work is shown to find $\dfrac{-3 \pm i\sqrt{35}}{2}$, but no further correct work is shown.

*or*

　　　　**[1]** Appropriate work is shown, but a method other than algebraic is used.

*or*

　　　　**[1]** $-\dfrac{3}{2} \pm \dfrac{\sqrt{35}}{2}i$, but no work is shown.

　　　　**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, 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]** India, and a correct justification is given.

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

*or*

**[3]** Appropriate work is shown, but India is not stated.

**[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 the average rate of change for China.

*or*

**[2]** The average rate of change for India and China are stated, but no work is shown.

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

*or*

**[1]** Appropriate work is shown to find the average rate of change for India.

*or*

**[1]** The average rate of change for India or the average rate of change for China is stated, but no work is shown.

**[0]** India, but no work is shown.

*or*

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(34)    **[4]** A correct interval is stated, such as (35.82, 48.24) and correct work is shown, a positive response is indicated, and a correct justification is given.

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

*or*

**[3]** Appropriate work is shown, but an incomplete justification is given.

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

*or*

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

*or*

**[2]** Correct work is shown to find (35.82, 48.24), but no further correct work is shown.

*or*

**[2]** A correct justification is given, but no further correct work is shown.

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

**[0]** Yes, but no justification is given.

*or*

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(35) **[4]** A negative response is indicated and a correct justification is given, $g(x) = 2^x + 5$ and $h(x) = \log_2(x - 5)$ or equivalent.

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

*or*

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

*or*

**[3]** $g(x) = 2^x + 5$ and $h(x) = \log_2(x - 5)$, but no further correct work is shown.

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

*or*

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

*or*

**[2]** $g(x) = 2^x + 5$, a negative response is indicated, and a correct justification is given, but no further correct work is shown.

**[1]** $g(x) = 2^x + 5$ or a negative response is indicated with a correct justification, but no further correct work is shown.

*or*

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

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(36)   **[4]** $(7,1)$ and $(4,-2)$ or equivalent solutions, and correct algebraic work is shown.

**[3]** Appropriate work is shown, but one computational, factoring, or substitution error is made.

*or*

**[3]** Appropriate work is shown, but only one correct solution is found or only the $x$-values or $y$-values are found.

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

*or*

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

*or*

**[2]** $(7,1)$ and $(4,-2)$, but a method other than algebraic is used.

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

*or*

**[1]** A correct quadratic equation in one variable is written, but no further correct work is shown.

*or*

**[1]** $(7,1)$ and $(4,-2)$, but no work is shown.

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

_____

# Part IV

For this 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]** $A(t) = 1200\left(1 + \dfrac{0.064}{4}\right)^{4t}$ or equivalent, $B(t) = 1200e^{0.0635t}$ or equivalent, Barnyard Bank and correct work is shown, 17.3 and correct algebraic work is shown.

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

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

*or*

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

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

**[2]** Appropriate work is shown, but one conceptual error and two or more computational, notation, or rounding errors are made.

*or*

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

*or*

**[2]** $A(t)$ and $B(t)$ are correct, but no further correct work is shown.

*or*

**[2]** A correct justification is given for choosing a bank, but no further correct work is shown.

*or*

**[2]** Correct algebraic work is shown to find 17.3, but no further correct work is shown.

**[1]** Appropriate work is shown, but one conceptual and three or more computational or rounding errors are made.

*or*

**[1]** 17.3, but no work is shown.

*or*

**[1]** $A(t)$ or $B(t)$ is correct, but no further correct work is shown.

**[0]** Barnyard Bank is stated, but no work is shown.

*or*

**[0]** A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

# Map to the Learning Standards
## Algebra II
## August 2024

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

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

# Regents Examination in Algebra II
## August 2024
## Chart for Converting Total Test Raw Scores to
## Final Examination Scores (Scale Scores)

The *Chart for Determining the Final Examination Score for the August 2024 Regents Examination in Algebra II* will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations by Monday, August 19, 2024. 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 https://www.nysed.gov/state-assessment/teacher-feedback-state-assessments.

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.

# ALGEBRA II

**Monday,** August 19, 2024 — 12:30 to 3:30 p.m., only

## MODEL RESPONSE SET

### Table of Contents
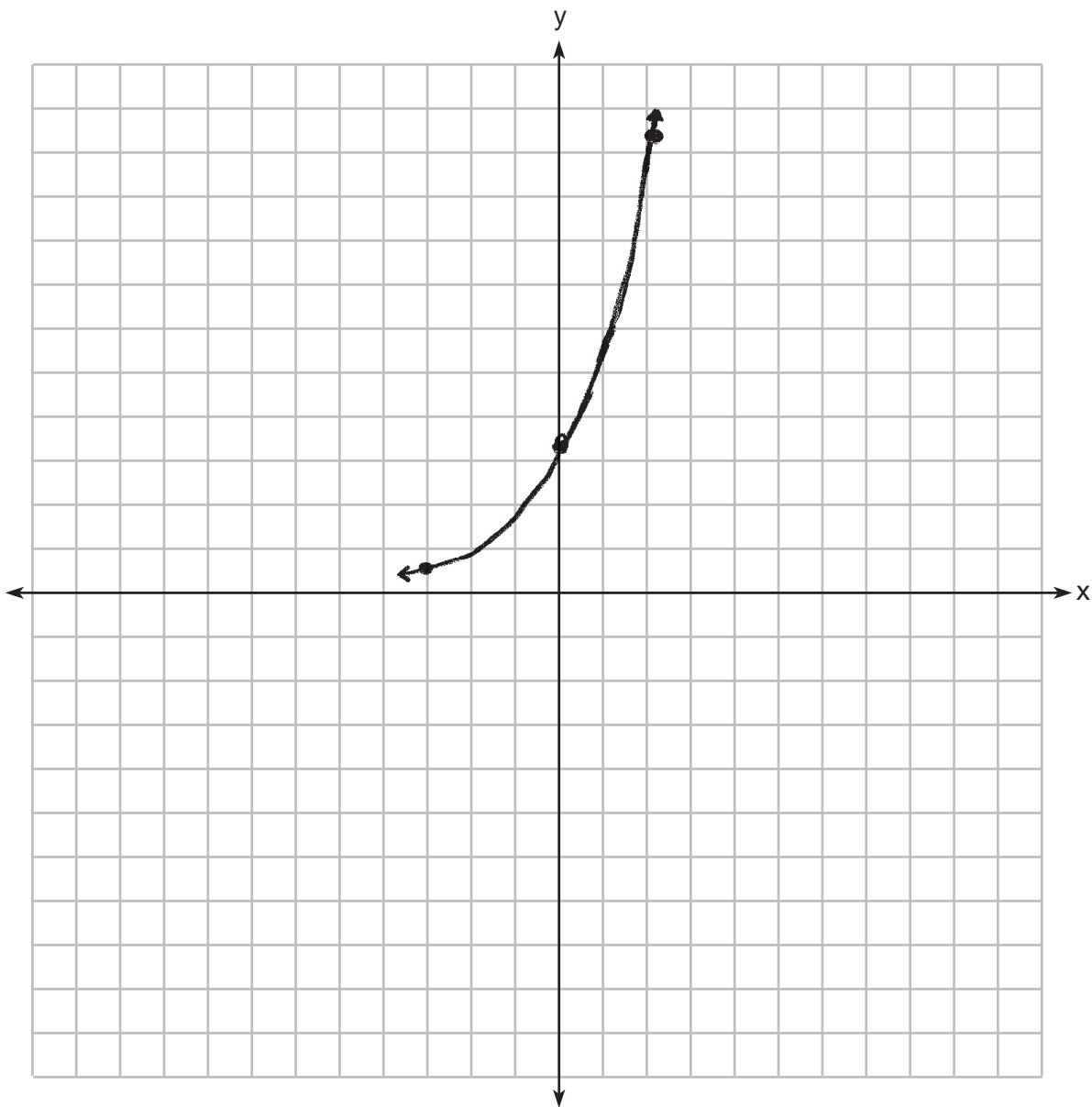
**25** On the axes below, graph $y = 3.2(1.8)^x$.



**Score 2:**   The student gave a complete and correct response.
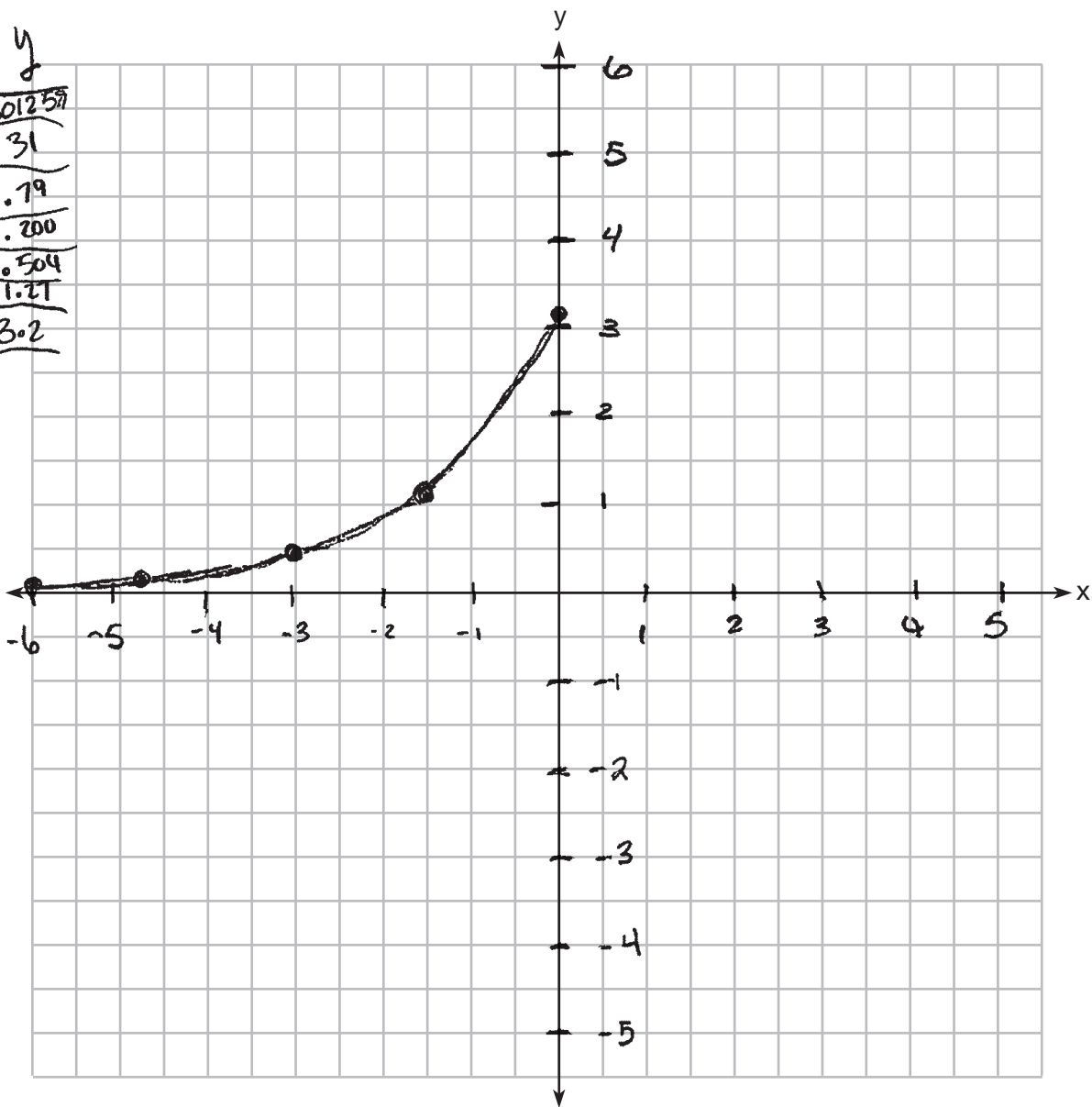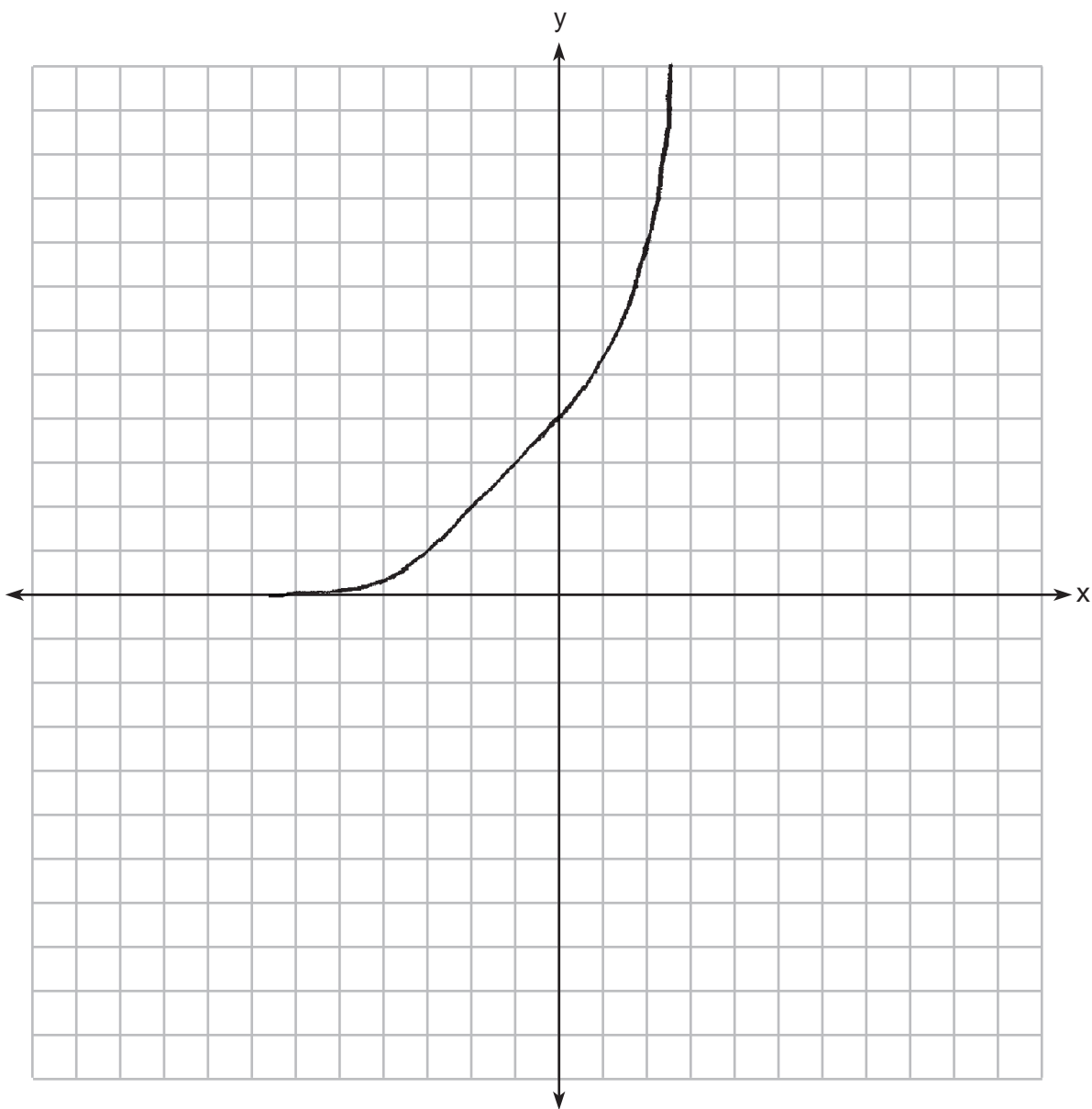
**25** On the axes below, graph $y = 3.2(1.8)^x$.
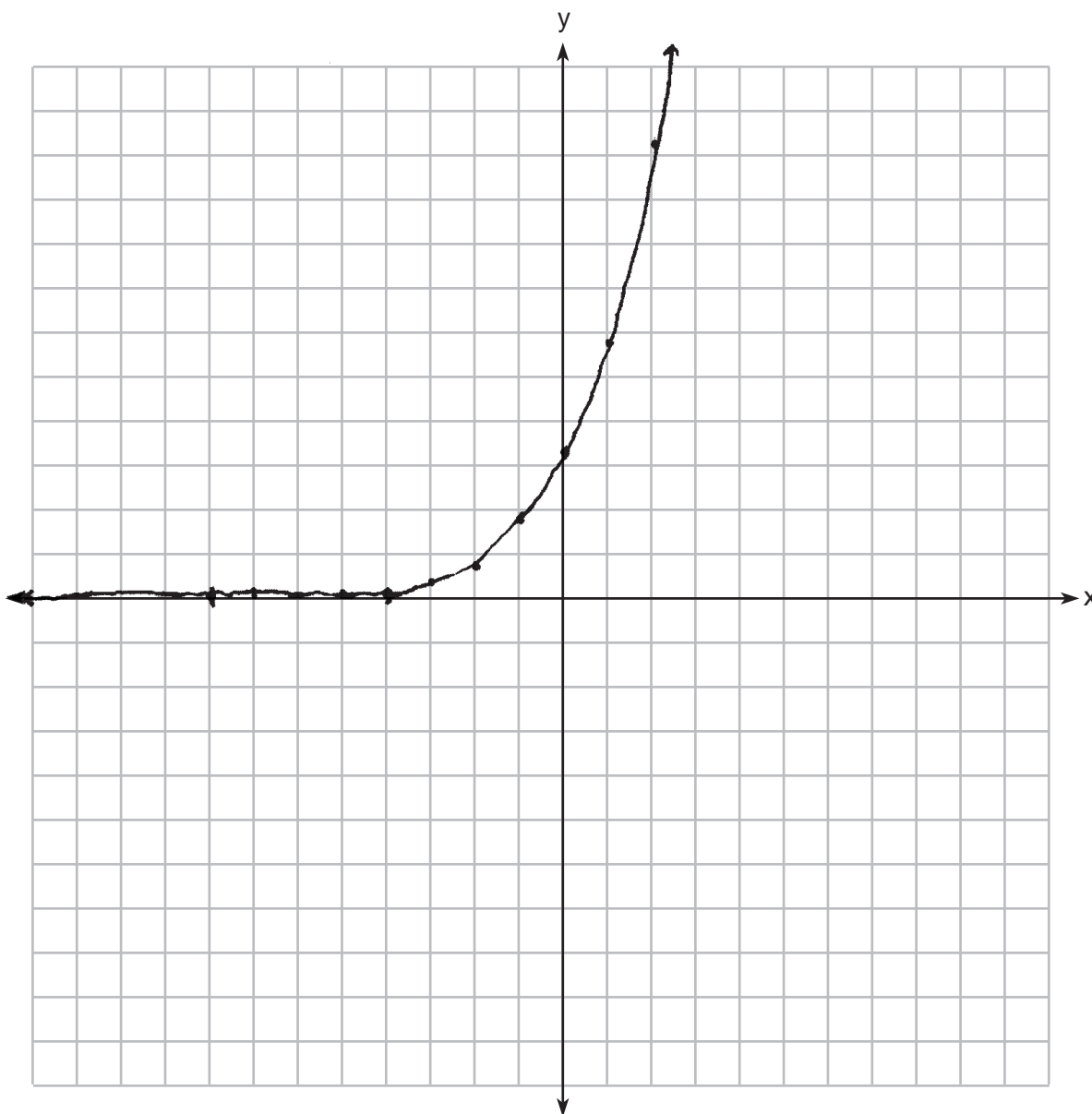


**Score 2:** The student gave a complete and correct response.

**25** On the axes below, graph $y = 3.2(1.8)^x$.

| X | y |
|---|---|
| -9.4 | .01257 |
| -7.8 | .31 |
| -6.2 | .79 |
| -4.7 | .200 |
| -3.1 | .504 |
| -1.5 | 1.27 |
| 0 | 3.2 |



**Score 1:** The student made an error by terminating the graph at the *y*-intercept.

**25** On the axes below, graph $y = 3.2(1.8)^x$.



**Score 0:**  The student made multiple graphing errors.

**25** On the axes below, graph $y = 3.2(1.8)^x$.
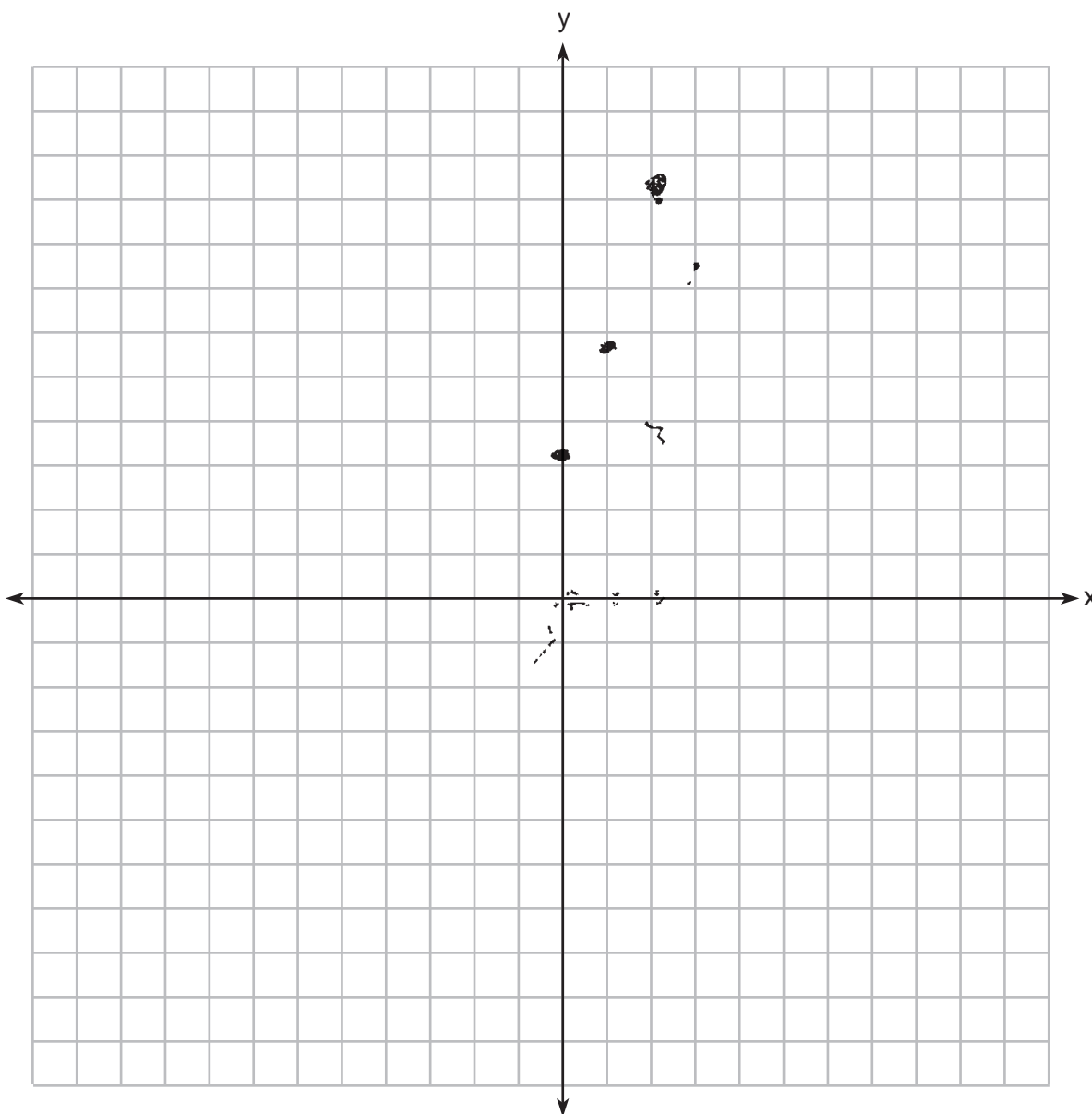


**Score 0:** The student correctly plotted two points, but did not show enough relevant course-level work to receive any credit.

**26** Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
    Justify your answer.

$$
\begin{array}{r}
7x^2 + 6x - 9 \\
x+3 \overline{\smash)\ 7x^3 + 27x^2 + 9x - 27} \\
-(7x^3 + 21x^2) \downarrow \\
6x^2 + 9x \\
-(6x^2 + 17x) \downarrow \\
-9x - 27 \\
-(-9x - 27) \\
\hline
0
\end{array}
$$

$x+3$ is a factor of $7x^3 + 27x^2 + 9x - 27$ because there's no remainder when you divide them together.

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

**26** Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$7(-3)^3 + 27(-3)^2 + 9(-3) - 27$$

$$-189 + 243 + 27 - 27$$

$$= 0$$

$x + 3$ is a factor of $7x^3 + 27x^2 + 9x - 27$

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

**26** Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$7(3)^3 + 27(3)^2 + 9(3) - 27 = 0$$
$$189 + 243 + \cancel{27 - 27} = 0$$
$$432 \neq 0$$
$$x + 3 \; \exists \; 1 + 1s \; \text{not a factor}$$

**Score 1:** The student incorrectly evaluated 3 instead of $-3$.

**26** Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$x + 3 \overline{)\phantom{ }}$$

$$
\begin{array}{r|rrrr}
-3 & 7 & 27 & 9 & -27 \\
& \downarrow & -21 & -24 & 45 \\
\hline
& 7 & 8 & -15 & 18
\end{array}
$$

$$7x^2 + 8x - 15 + \dfrac{18}{x + 3}$$

x+3 is not a factor of
7x³ + 2x² + 9y -27 becaus
there is a remainder

**Score 1:** The student made a computational error.

**26** Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$\boxed{-3}$$

$$7x^3 \quad 27x^2 \quad 9x \quad -27$$
$$\downarrow \quad -21 \quad -18 \quad +27$$
$$7x^3 \quad 6 \quad 27 \quad \text{or}$$

$$7x^2 + 6x + 27$$

yes because when preforming division, x-3 goes into $7x^3 + 27x^2 + 9x - 27$ perfectly.

**Score 0:** The student made multiple errors.

**26** Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$7(3)^3 + 27(3)^2 + 9(3) - 27$$

$$7(27) +$$
$$1189 + 243$$

$$= 432$$

**Score 0:** The student incorrectly substituted 3 and did not indicate no/yes.

27 Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^3(x-5) + 3x(x-5)$$

$$(2x^3 + 3x)(x-5)$$

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

$$x(2x^2 + 3)(x-5)$$

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

**27** Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^4 - 10x^3 + 3x^2 - 15x$$

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

$$x(2x^2 + 3)(x = 5)$$

$$x(2x^2 + 3)(x - 5)$$

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

**27** Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$\left(2x^4 - 10x^3\right)\left(+3x^2 - 15x\right)$$

$$2x^3\left(x-5\right) + 3x\left(x-5\right)$$

$$\left(2x^3 + 3x\right)\left(x-5\right)$$

**Score 1:** The student did not factor out the greatest common factor.

**27** Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^3(x-5) + 3x(x-5)$$
$$(2x^3 + 3x)(x-5)^2$$
$$x(2x^2+3)(x-5)^2$$

**Score 1:** The student incorrectly squared $(x - 5)$.

**27** Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^3(x-5) \ 3x(x-5)$$

$$2 \frac{\cancel{2}^3}{\cancel{2}} \Big\backslash 1 \qquad (2x^3 + 3x)(x-5)$$

$$\cancel{x(2x+3)}$$

$$(2x^3 + 1x)(x-5)$$

**Score 0:** The student did not factor out the GCF and made a transcription error.

28 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

31%

normal cdf(6, 100, 5.2, 1.6)

.308

.31

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

**28** The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

$\mu = .052$

$\sigma = .016$

low: .06

up: $\infty$

normCdf
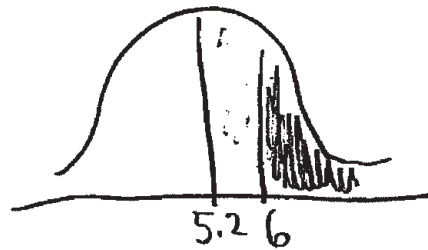
31% of towns

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

28 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

normal CDF(0.06, aaaaa, 0.052, 0.016)

= 0.309

30.9

**Score 1:** The student made a rounding error.

**28** The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

normCdf(7,100,5.2,1.6)=0.13029...

13%

**Score 1:** The student used 7 as the lower value in the distribution.

**28** The monthly unemployment rate of towns in the United States is approximately <u>normally distributed</u> with a <u>mean rate of 5.2%</u> and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate <u>greater than 6%</u>.

normal cdf $(6, 100, 1.6, 5.2)$

0.2

**Score 0:** The student made multiple errors.

**29** The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, $t$ hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.
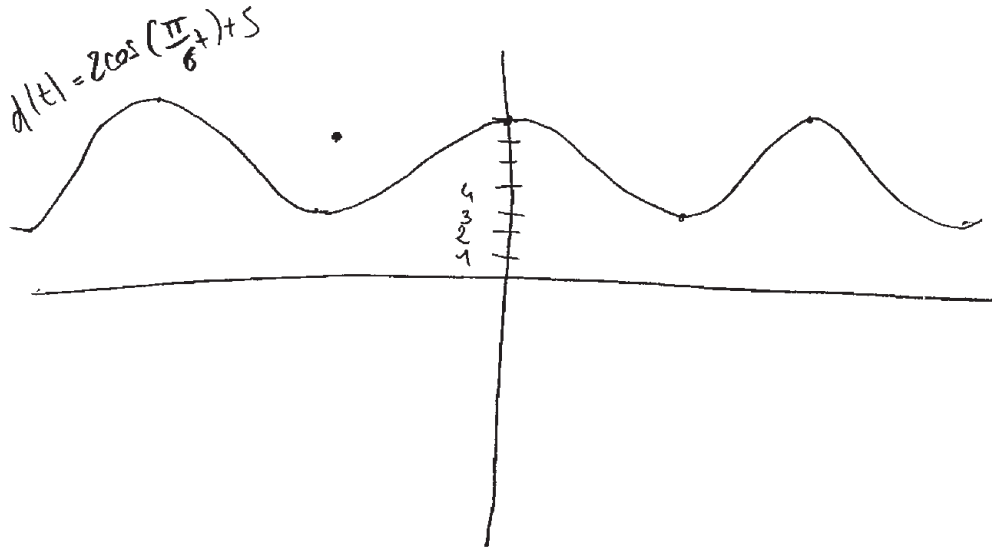
$d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$



When graphing the depth we see that it's

at    3 feet    where   is   the   minimum depth of

the spot.

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

**29** The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, $t$ hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

$$d(t) = 2\ \cos\left(\frac{\pi}{6}t\right) + 5$$

$a$

midline

$$5 - 2 = 3$$

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

**29** The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, $t$ hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

$$d(0) = 2\cos\left(\frac{\pi}{6}0\right) + 5 = 7$$

$$d(1) = 6.73$$

$$d(2) = 6$$

$$d(5) = 3.27$$

$$d(10) = 6$$

$$d(7) = 3.27$$

$$d(6) = 3$$

$$\boxed{6 \text{ hours}}$$

**Score 1:** The student found the time at which the tide reached its minimum.

29 The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, $t$ hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

7 because the midline is
at 5 and the amplitude
is 2.

**Score 1:** The student stated the maximum instead of the minimum.

**29** The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, $t$ hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

-5 ft, because it is
the minimum altitude

**Score 0:** The student did not show enough relevant course-level work to receive any credit.

**30** A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream $t$ hours after drinking one cup of coffee.

$$C(t) = 130 \left(\tfrac{1}{2}\right)^{t/5.5}$$

$$C(t) = 130 \left(\tfrac{1}{2}\right)^{t/5.5}$$

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

**30** A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream $t$ hours after drinking one cup of coffee.

$$\frac{65 = 130 e^{r \cdot 5.5}}{\frac{65}{130}} \quad \frac{}{130}$$

$$.5 = e^{r \cdot 5.5}$$

$$\frac{\ln .5}{5.5} = \frac{r \cdot 5.5}{5.5}$$

$$C(t) = 130 \, e^{-.126t}$$

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

30 A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream $t$ hours after drinking one cup of coffee.

$$C(t) = 130(0.5)^{5.5t}$$

**Score 1:** The student incorrectly expressed the exponent as a product.

**30** A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream $t$ hours after drinking one cup of coffee.

$$130\left(\frac{1}{2}\right)^{\frac{t}{5.5}}$$

**Score 1:** The student wrote an expression, not an equation.

**30** A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream $t$ hours after drinking one cup of coffee.

$$C(t) = 130 e^{(5.5)t}$$

**Score 0:** The student did not satisfy the criteria for one or more credits.

**31** Markus is a long-distance walker. In one race, he walked 55 miles in $t$ hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, $r$, for each race. Determine the number of hours that *each* of the two races took.

$$55t + 165 = 65t$$

$$\frac{165}{10} = \frac{10t}{10}$$

16.5 hours

19.5 hours

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

31 Markus is a long-distance walker. In one race, he walked 55 miles in $t$ hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, $r$, for each race. Determine the number of hours that *each* of the two races took.

$$\frac{10}{3}$$

$$3.33 \text{ mpH}$$

$$\frac{55}{t} = \frac{65}{t+3}$$

$$\frac{55}{t} \times \frac{t+3}{65}$$

$$3575 = t^2 + 3$$

$$\frac{55}{3.33} \qquad\qquad \frac{65}{3.33}$$

race 1   16.5 h

race 2   19.5 h

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

**31** Markus is a long-distance walker. In one race, he walked 55 miles in $t$ hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, $r$, for each race. Determine the number of hours that *each* of the two races took.

$$\frac{55}{t} = \frac{65}{t+3}$$

$$55(t+3) = 65t$$

$$55t + 160 = 65t$$

$$\frac{10t}{10} = \frac{160}{10}$$

$$t = \underline{16}$$

$$t + 3 = \underline{19}$$

**Score 1:** The student made one computational error.

31 Markus is a long-distance walker. In one race, he walked 55 miles in $t$ hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, $r$, for each race. Determine the number of hours that *each* of the two races took.

$$t \cdot \frac{55}{t} = \frac{65}{t+3}, t+3$$

$$55t = 65(t+3)$$

$$55t = 65t + 195$$

$$19.5$$

$$19.5 + 3$$

$$= 22.5$$

**Score 0:** The student made multiple errors.

**32** Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$a = 1$$
$$b = 3$$
$$c = 11$$

$$x = \frac{-3 \pm \sqrt{9 - 4(1)(11)}}{2}$$

$$x = \frac{-3 \pm \sqrt{-35}}{2}$$

$$\sqrt{-35} = \sqrt{-1 \cdot 35} = i\sqrt{35}$$

$$x = -\frac{3}{2} \pm \frac{i\sqrt{35}}{2}$$

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

**32** Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$x^2 + 3x + \_\_ = -11 + \_\_$$

$$x^2 + 3x + \frac{9}{4} = -11 + \frac{9}{4}$$

$$\sqrt{\left(x + \frac{3}{2}\right)^2} = \pm\sqrt{\frac{-35}{4}}$$

$$x + \frac{3}{2} = \pm\frac{i\sqrt{35}}{2}$$

$$x = -\frac{3}{2} \pm \frac{i\sqrt{35}}{2}$$

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

**32** Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$x^2 + 3x + 11 = 0$$

$$a = 1$$
$$b = 3$$
$$c = 11$$

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

$$x = -3 \pm \frac{\sqrt{(3)^2 - 4(1)(11)}}{2(1)}$$

$$x = \frac{-3 \pm \sqrt{-35}}{2} \qquad \frac{\sqrt{-1} \to i}{\sqrt{35}}$$

$$x = \frac{-3 \pm \sqrt{35}\,i}{2}$$

**Score 1:** The student did not write the answer in $a + bi$ form.

**32** Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$a = 1$$
$$b = 3$$
$$c = 11$$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(11)}}{2(1)}$$

$$x = \frac{-3 \pm \sqrt{9 - 44}}{2}$$

$$x = \frac{-3 \pm \sqrt{-35}}{2}$$

$$x = \frac{-3 \pm 35i}{2}$$

$$x = \frac{-3}{2} \pm \frac{35i}{2}i$$

**Score 1:** The student incorrectly removed the radical when simplifying.

**32** Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$\underset{a}{} \quad \underset{b}{} \quad \underset{c}{}$$

$$a + bi$$

$$\frac{-3 \pm \sqrt{3^2 - 4(1)(11)}}{2(1)}$$

$$\frac{-3 \pm \sqrt{-35}}{2}$$

$$-3 \pm 7\sqrt{5}$$

$$\sqrt{35}$$
$$\sqrt{7} \quad \sqrt{5}$$
$$1$$

$$-15 \pm 5.9i$$

**Score 0:** The student made multiple errors simplifying.

**32** Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$x = \frac{-b \pm \sqrt{b^2 + 2c}}{2a}$$

$$x = \frac{-3 \pm \sqrt{-3^2 \cdot 1(11)}}{2(1)}$$

$$x = -3 \pm \sqrt{9 - 11}$$

$$x = \frac{-3 \pm \sqrt{-2}}{2}$$

$$x = \sqrt{3} \pm \sqrt{2}\sqrt{-1} \cdot i \cdot 5$$

$$x = \frac{-3 \pm i\sqrt{2}}{2}$$

**Score 0:** The student did not satisfy the criteria for one or more credits.

**33** The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

$2020 - 1950 = 70$

India:
$1380 - 376.3 = 1003.7$

China:
$P(50) = 316.93e^{.0133(50)} =$
$P(50) = 616.267$
$P(120) = 316.93e^{.0133(120)}$
$P(120) = 1563.498$

$1563.498 - 616.267 = 947.231$

$\dfrac{1003.7}{70} > \dfrac{947.231}{70}$

↓

India had a greater average rate of change

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

**33** The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

China

$(50, 616.27)$
$(120, 1563.50)$

$\dfrac{1563.50 - 616.27}{120 - 50} = \dfrac{947.23}{70} = 13.5$

India

$(50, 376.3)$

$\dfrac{1380 - 376.3}{120 - 50} = \dfrac{1003.7}{70} = 14.3$

India population had a greater average rate of change between 1950 and 2020.

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

**33** The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

$$\underline{India:} \quad \frac{120-50}{1380-376.3} = 0.0697419548$$

$$\underline{China:} \quad P(120) = 1563.498 \qquad \frac{120-50}{1563.5-616.3} = 0.0739$$
$$P(50) = 616.27$$

China had a
greater average
rate of change

**Score 3:** The student calculated $\frac{\Delta x}{\Delta y}$ for the average rate of change.

**Algebra II – Aug. '24** [45]

**33** The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

$$\frac{1380 - 376.3}{80} = 14.3$$

$$\frac{1563 - 16.27}{80} = 13.5$$

China is greater avery of change since it ha a average of 14.3 > 13a

**Score 3:** The student stated an incorrect conclusion.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

70 yrs

India

$$\frac{1380 - 376.3}{120 - 50} = \frac{1003.7}{70} = 14.3385$$

China

$$\frac{70}{316.93} = \frac{316.93 e^{0.0133x}}{316.93}$$

$$\frac{70}{316.93} = e^{0.013x}$$

$$\frac{\ln \frac{70}{316.93}}{0.0133} = \frac{e^{0.0133x}}{0.0133}$$

$$x = -113.54$$

India had the greatest rate of Change. from 1950 to 2020

**Score 2:** The student correctly calculated the average rate of change for India, incorrectly calculated China's average rate of change, and wrote a correct conclusion.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

$$\frac{15635 - 616.267}{2} = 1254.86 \qquad \frac{1380 - 376.3}{2} = 1151$$

China

**Score 1:** The student showed correct differences in the numerators.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

China: $316.93e^{0.0133(70)} = 804$

India: $\dfrac{120 - 50}{1380 - 376.3} = \dfrac{70}{1003.7} \dfrac{(70)}{1} = 100.37$  Not Correct

India has a greater rate of change between 1950 - 2020

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

**33** The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where $x$ is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

| Years since 1900 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 243 | 254 | 268 | 285 | 324 | 376.3 | 450.6 | 555.1 | 699 | 873.3 | 1056.6 | 1234.3 | 1380 |

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

chart $\dfrac{y_2 - y_1}{x_2 - x_1}$ $\dfrac{20-10}{268-254} = \dfrac{5}{7} = 0.7142857143$

$P(x)$ $\dfrac{y_2 - y_1}{x_2 - x_1}$ $\dfrac{20-10}{413.51-364.43}$ $\dfrac{250}{1227} = 0.2037489813$

China's average rate of change between 1950 and 2020 is greater than India's average rate of change because China's average rate of change is 0.7142857143 while India's is 0.2037489813.

**Score 0:** The student did not satisfy the criteria for one or more credits.

**34** In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.



Mean = 42.029
SD = 3.105
n = 10

**Time** (seconds)

2 sd

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

42.029
+ 6.21
‾‾‾‾‾‾‾‾
48.239

42.029
− 6.21
‾‾‾‾‾‾‾
35.819

35.82 to 48.24

Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

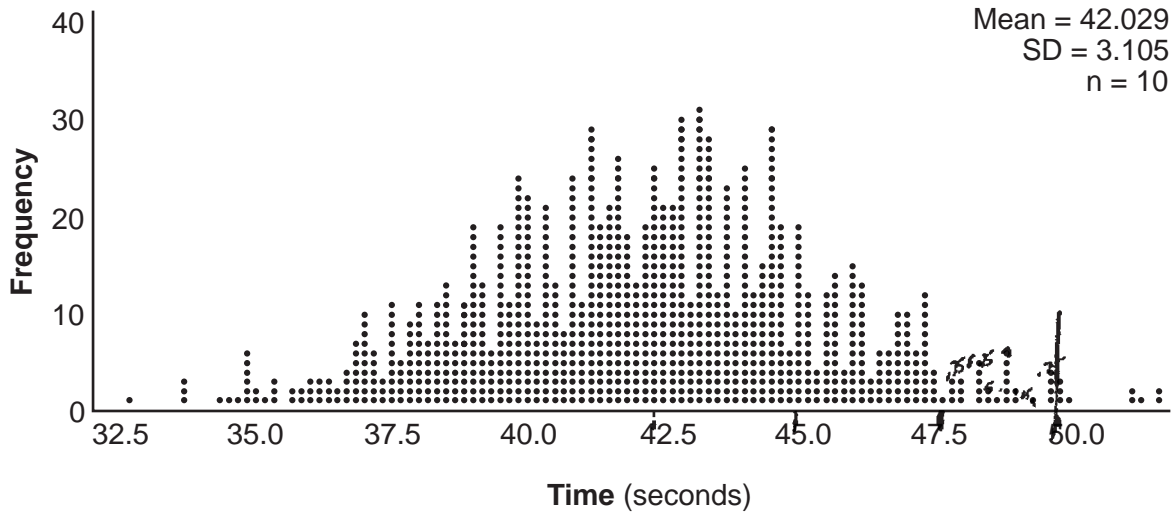Yes because it falls out
of the range in which
we could be 95% Sure.

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

**34** In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.



Mean = 42.029
SD = 3.105
n = 10

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

M.o.c = 2(3.105)
M.oc = 6.21

(35.82, 48.24)

42.029 + 6.21 = 48.239
42.029 - 6.21 = 35.819

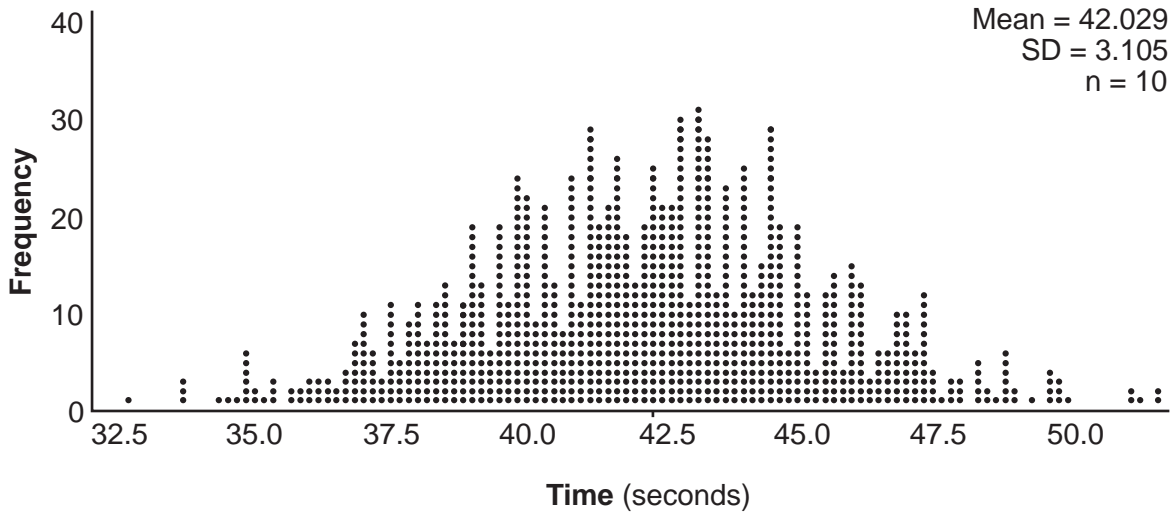Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

$\frac{9}{1000}$ = .009  .9%

Yes very unusual,
it is not within the 95%
confidence interval and
49.8 seconds or greater
only happens .9% of
the time which is statistically
significant, so much so that
is very small r

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

**34** In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.



Mean = 42.029
SD = 3.105
n = 10

**Time** (seconds)

−2 to 2

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

mean + 2(SD)          (35.819, 48.239)
mean − 2(SD)

42.029 + 2(3.105) = 48.239
42.029 − 2(3.105) = 35.819

Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.
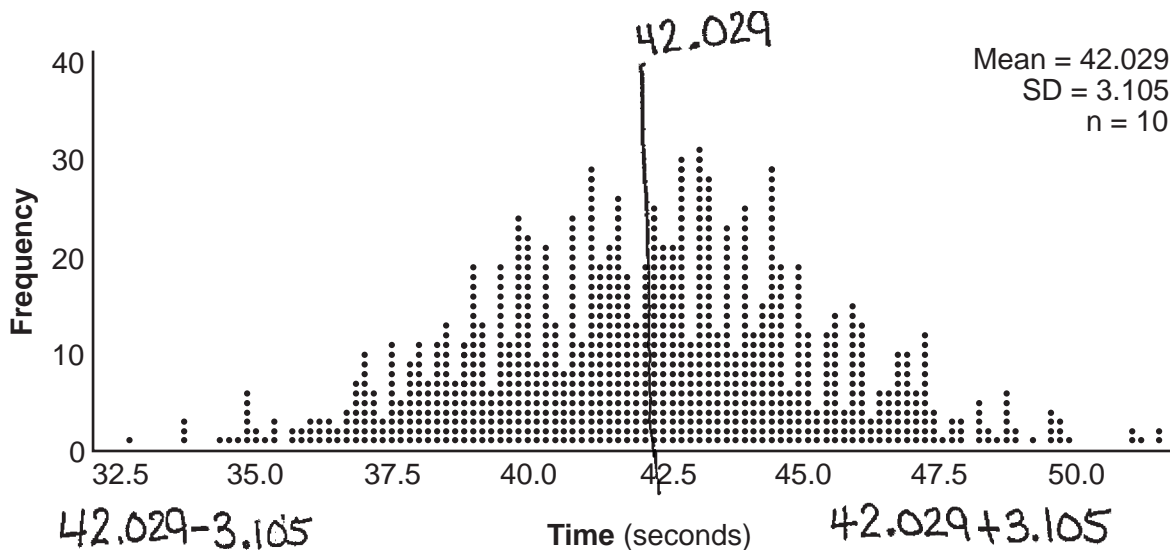
yes because 49.8 falls
outside the (35.819, 48.239)
interval

**Score 3:**    The student did not round to the nearest hundredth.

**34** In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.



*42.029*

Mean = 42.029
SD = 3.105
n = 10

*42.029−3.105*

**Time** (seconds)

*42.029+3.105*

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

*38.92 to 45.134*

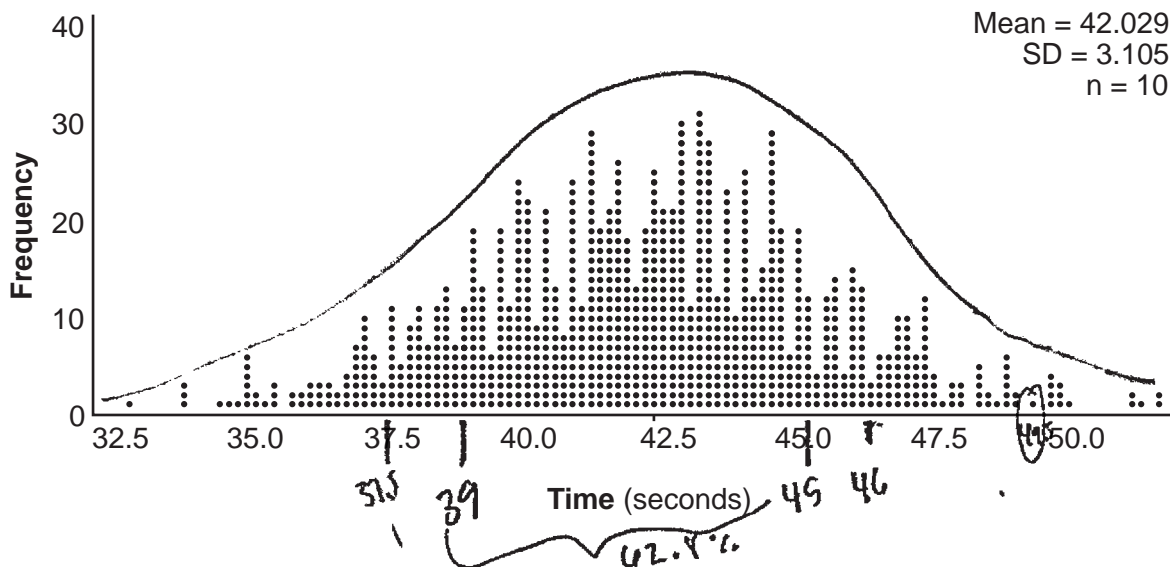Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

*Yes, 49.8 sec. is unusal because it does not fall between the intervals.*

**Score 2:** The student provided a complete justification.

**Question 34**

34 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.



Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

$$(37.50, 46.00)$$

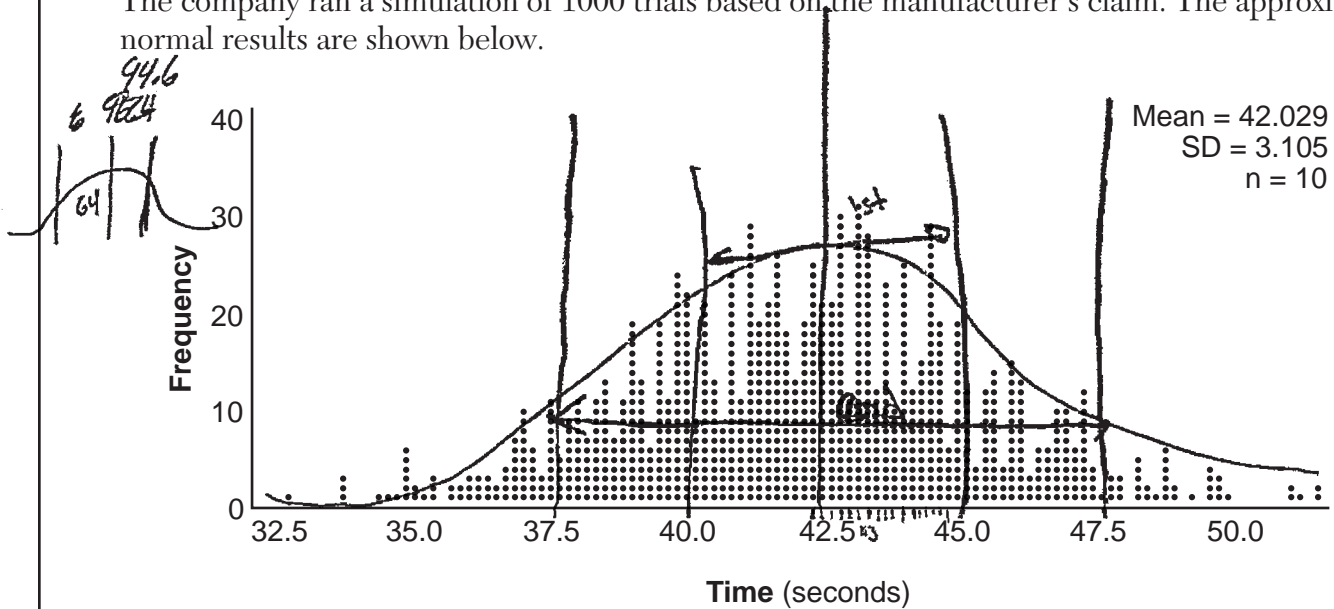Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

yes, 49.8 very rarely occurs

**Score 1:** The student provided an incomplete justification.

**Question 34**

**34** In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.

94.6
ɫ 9ɛ4
64

Mean = 42.029
SD = 3.105
n = 10

Frequency

40
30
20
10
0

32.5    35.0    37.5    40.0    42.5ᵏ₃    45.0    47.5    50.0

**Time** (seconds)

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

37.5 ⟶ 47.5

10 secounds

47.5
-37.5
─────
10

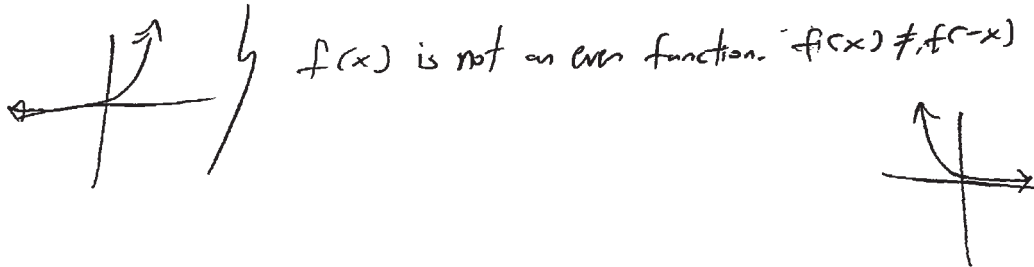Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

No it is above the 2nd notation and is greater than the 94.6 percent in the standard deviation

**Score 0:**   The student did not satisfy the criteria for one or more credits.

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$f(x)$ is not an even function. $f(x) \neq f(-x)$

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2^x + 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$x = 2^y + 5$$

$$x - 5 = 2^y$$
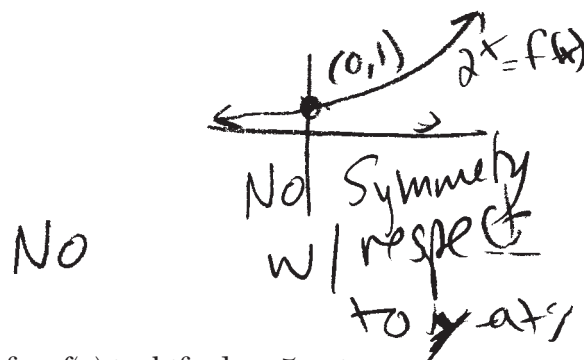
$$\log_2(x-5) = \log_2(2^y)$$

$$\log_2(x-5) = y$$

$$h(x) = \log_2(x-5)$$

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

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$(0,1)$ $2^x = f(x)$

No

No Symmetry w/ respect to y at y

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$f(x) + 5 = g(x)$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$x = 2^y + 5$$

$$x - 5 = 2^y$$

$$\log(x-5) = y \log 2$$

$$h(x) = \frac{\log(x-5)}{\log 2}$$

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

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$$f(-x) = 2^{-x}$$
$$-f(x) = -2^x$$

$\boxed{No}$

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$f(x) = 2^x$$
$$\boxed{g(x) = 2^x + 5}$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$y = 2^x + 5$$

$$\boxed{h(x) = \log(x-5) - .3010}$$

$$\begin{array}{cc} x = 2^y + 5 \\ -5 \qquad -5 \end{array}$$

$$\log(x-5) - \log(2)$$

$$x - 5 = 2^y$$

$$\frac{\log(x-5)}{\log(2)} = \frac{y \log 2}{\log 2}$$

$$H(x) = \frac{\log(x-5)}{\log(2)}$$

**Score 3:** The student did not provide a sufficient justification.

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$f(x)$ is not an even function,
It's exponential meaning there's
no reflection or rotation on the graph.

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2^x + 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$y = 2^x + 5$$
$$x = 2^y + 5$$
$$x - 5 = 2^y$$
$$2^y = x - 5$$
$$\log_2 x - 5 = y$$
$$\boxed{h(x) = \log_2 x - 5}$$

**Score 2:** The student did not provide a sufficient justification and is missing parentheses when expressing $h(x)$.

---

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

No, it's not symmetrical/equal when mirrored across the y-axis

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2^{x+5}$$

Write an equation for $h(x)$, the inverse of $g(x)$.
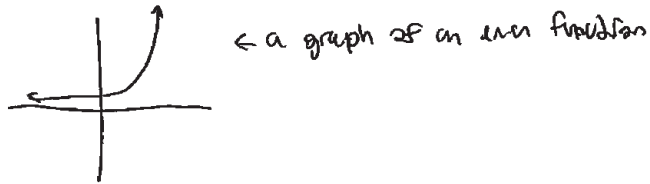
$$h(x) = -2^{x-5}$$

---

**Score 1:** The student provided a correct justification.

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$F(x)$ is an even Function because when observing the graph

 ← a graph of an even function

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2^x + 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$h(x) = 2^x + 5$$
$$y = 2^x \,{\scriptstyle +5 \atop -5}$$
$$y - 5 = 2^x$$
$$\log_2 y - 5 = x$$

**Score 1:** The student correctly stated an equation for $g(x)$.

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

Yes- slope is going up to the right which makes it even.

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2 \cdot x - 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$x = 2^y - 5$$

$$x + 5 = 2^y$$

$$\log_2 x+5 = y$$

$$h(x)^{-1} = \log_2 x + 5$$

**Score 0:** The student did not satisfy the criteria for one or more credits.

**35** Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

f(x) is an even function because it is positive and it contains a coefficient and exponent

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$f(x) = 2^x + 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$-2x - 5$

**Score 0:** The student did not satisfy the criteria for one or more credits.

**36** Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$$\underline{+y}$$

$$x = \boxed{6+y}$$

$$\left(6+y-4\right)^2 + (y-1)^2 = 9$$

$$(2+y)^2 + (y-1)^2 = 9$$

$$(2+y)(2+y) + (y-1)(y-1) = 9$$

$$4 + 4y + y^2 + y^2 - 2y + 1 = 9$$

$$2y^2 + 2y + 5 = 9$$

$$2y^2 + 2y - 4 = 0$$

$$2(y^2 + y - 2) = 0$$

$$\frac{2(y+2)(y-1) = 0}{2 \neq 0 \quad | \quad y = -2 \quad | \quad y = 1}$$

$$\boxed{-2}$$

$$x - y = 6$$
$$x - (-2) = 6$$
$$x + 2 = 6$$
$$\boxed{x = 4}$$

$$\boxed{y = 1}$$

$$x - y = 6$$
$$x - 1 = 6$$
$$\boxed{x = 7}$$

$$\boxed{(4, -2)}$$
$$\boxed{(7, 1)}$$

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

36 Solve the system of equations shown below algebraically:

$(x - 4)^2 + (y - 1)^2 = 9$

$x - y = 6$

$(x-4)(x-4)$

$-y = -x + 6$

$y = x - 6$

$(x-4)^2 + ((x-6)-1)^2 = 9$

$(x-7)^2$

$x^2 - 8x + 16 + x^2 - 14x + 49 = 9$

$2x^2 - 22x + 56 = 0$

$2(x^2 - 11x + 28) = 0$

$(x-7)(x-4) = 0$

$x = 7 \quad | \quad x = 4$

$(7) - y = 6$      $4 - y = 6$

$-y = -1$      $-y = 2$

$\boxed{y = 1}$      $\boxed{y = -2}$

$(7, 1)$      $(4, -2)$

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

**36** Solve the system of equations shown below algebraically:

$$(x-4)^2 + (y-1)^2 = 9$$
$$x - y = 6$$

$$-x \quad\quad -x$$

$$\frac{-y = -x + 6}{-1}$$

$$y = x - 6$$

$$(x-4)^2 + (x-6-1)^2 = 9$$

$$x^2 - 4x - 4x + 16 + (x-7)^2 = 9$$

$$x^2 - 8x + 16 + x^2 - 7x - 7x + 49 = 9$$

$$x^2 - 8x + 16 + x^2 - 14x + 49 = 9$$
$$-49 \quad -49$$

$$2x^2 - 22x + 16 = -40$$
$$-16 \quad\quad -16$$

$$\frac{2x^2 - 22x = -56}{2}$$

$$x^2 - 11x = -28$$
$$+28 \quad +28$$

$$x^2 - 11x + 28 = 0$$

$$(x-7)(x-4) = 0$$

$$\boxed{\begin{array}{l} x = 7 \\ x = 4 \end{array}}$$

**Score 3:** The student correctly found both values of $x$.

**36** Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$x - y = 6$

$+y \quad +y$

$x = 6 + y$

$x - y = 6$

$x - 1 = 6$

$+1 \quad +1$

$x = 7$

$x = 7$

$y = 1$

or

$y = 2$

$(x-4)(x-4) + (y-1)(y-1) = 9$

$x^2 - 4x - 4x + 16 + y^2 - y - y + 1 = 9$

$x^2 - 8x + 16 + y^2 - 2y + 1 = 9$

$\phantom{x^2 - 8x + 16} -17 \qquad -17$

$x^2 - 8x + y^2 - 2y = -8$

$(y+6)(y+6) - 8(6+y) + y^2 - 2y = -8$

$y^2 + 6y + 6y + 36 - 48 - 8y + y^2 - 2y = -8$

$2y^2 + 2y - 12 = -8$
$\phantom{2y^2 + 2y} +8 \quad +8$

$2y^2 + 2y - 4 = 0$

$2(y^2 + 1y - 2) = 0$

$\dfrac{2(y+2)(y-1)}{2} = \dfrac{6}{2}$

$(y+2)(y-1) = 0$

$y + 2 = 0 \qquad y - 1 = 0$
$-2 \ -2 \qquad +1 \ +1$

$y = 2 \qquad y = 1$

**Score 3:** The student found one correct solution.

## Question 36

**36** Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$x - y = 6$
$\phantom{x}+y \phantom{=} -6$
_____
$x - 6 = y$

$(x-4)(x-4) + (y-1)(y-1) = 9$
$x^2 - 4x - 4x + 16 + y^2 - y - y + 1 = 9$
$x^2 - 8x + 16 + y^2 - 2y + 1 = 9$
$\phantom{x^2} -16 \phantom{+ y^2 - 2y} = 1 \quad -1$
_____
$\phantom{xxxxxxxx} 16$
$x^2 - 8x - y^2 - y = -8$
$xy(x - 8) + (y - 2) = -8$

$(x-4)^2 + ((x-6) - 1)^2 = 9$
$(x-4)^2 + (x-7)^2 = 9$

$x^2 - 4x - 4x + 16 + (x-7)(x-7) = 9$
$x^2 - 8x + 16 + x^2 - 7x - 7x + 49 = 9$
$x^2 - 8x + 16 + x^2 - 14x + 49 = 9$

$2x^2 - 22x + 69 = 9$
$\phantom{2x^2 - 22x + 6} -9 \quad -9$
_____
$2x^2 - 22x + 60 = 0$
$(2x - 10)(x - 6) = 0$

$\{5, 6\}$

$2x = 10 \cdot 0$
$\phantom{2x} -10 \quad -10$
$\frac{2x}{2} = \frac{10}{2}$
$\boxed{x = 5}$

$x - 6 = 0$
$x = 6$

$x = 6$

---

**Score 2:**    The student made a computational error solving for *x* and didn't find either *y*-value.

## Question 36

**36** Solve the system of equations shown below algebraically:

$(x+4)(x+4)$

$(x-4)^2 + (y-1)^2 = 9$

$x - y = 6$

$(x-6-1)(x-6-1)$

$x^2 + 4x + 4x + 16$

$x^2 + 8x + 16$

$\dfrac{-x \quad -x}{}$

$\dfrac{-y}{-1} = \dfrac{-x}{-1} + \dfrac{6}{-1}$

$x^2 - 6x - x - 6x + 36 + 6 - x + 6 + 1$

$x^2 - 12x - 2x + 49$

$y = x - 6$

$x^2 - 14 + 49$

$(x-4)^2 + (x-6-1)^2 = 9$

$x^2 + 8x + 16 + x^2 - 14x + 49 = 9$

$2x^2 - 6x + 65 = 9$

$\dfrac{\qquad -9 \quad -9}{}$

$X - 7 = 0 \qquad X + 4 = 0$

$+7 +7 \qquad -4 -4$

$\dfrac{2x^2 - 6x + 56 = 0}{}$

$X = 7 \qquad X = -4$

$\dfrac{2x^2}{2} - \dfrac{6x}{2} + \dfrac{56}{2} = 0$

$x^2 - 3x + 28$

$X = \{7, -4\}$

$\dfrac{28}{-7 \cdot 4} \Big| \dfrac{-3}{-7+4} \quad (x-7)(x+4)$

$X = 7 \qquad X = -4$

$Y = 1 \qquad Y = -10$

**Score 2:** The student made one computational and one factoring error.

**36** Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$$x - y = 6$$
$$\underline{-x \qquad -x}$$

$$\frac{-y}{-1} = \frac{6-x}{-1}$$

$$y = -6 + x$$

$$(x-4)^2 + (y-1)^2 = 9$$

$$(x-4)(x-4) + (-6+x-1)(-6+x-1) = 9$$

$$x^2 - 4x - 4x \boxed{+16} \boxed{+36} - 6x \boxed{+6} - 6x + x^2 - x \boxed{\phantom{x}}$$

$$2x^2 - 20x + 59 = 9$$
$$\qquad\qquad -9 \quad -9$$

$$2x^2 - 20x - 50$$

$$2x^2 - 10y - 10x - 50$$
$$-10 \bigtimes^{100}_{-10}{}_{-20} \quad 2x(x-5) \mid -10(x-5)$$

$$\frac{(2x-10)(x-5)}{2x = 10 \qquad x = 5}$$

$$x = 5$$

---

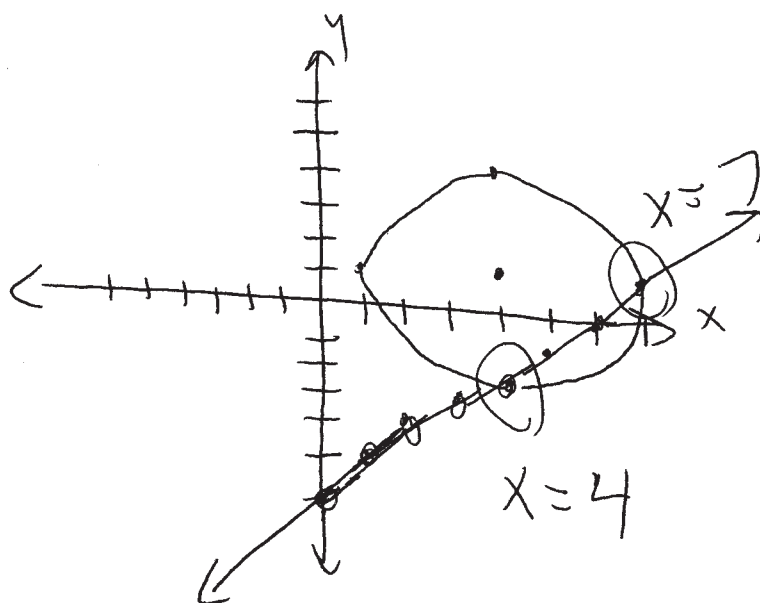**Score 1:** The student wrote a correct quadratic equation in one variable.

**36** Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$(h,k) = (4,1)$

$r = 3$

$$\frac{-6 + y \quad -6 + y}{x - 6 = y}$$



$X = 7$

$X = 4$

**Score 1:** The student solved graphically and only stated the *x*-values.

36 Solve the system of equations shown below algebraically:

$$(x+2)(x-2) + (y+1)(y-1) = 9$$
$$(x-4)^2 + (y-1)^2 = 9$$
$$x - y = 6$$
$$x = y + 6 \qquad y = x - 6$$

(grid/box multiplication work)

| $y$ | $+8$ |
|-----|------|
| $y^2$ | $8y$ |
| $4y$ | $32$ |

(with $y$ and $4$ on left side)

$$(y+8)(y+4) + (y+1)(y-1) = 9$$
$$y^2 + 12y + 32 + y^2 - 1 = 9$$
$$2y^2 + 12y + 31 = 9$$
$$\phantom{2y^2 + 12y + 31} -9 \quad -9$$

(second grid)

| $y$ | $+1$ |
|-----|------|
| $y^2$ | $y$ |
| $-y$ | $-1$ |

(with $y$ and $-1$ on left)

$$2y^2 + 12y + 22 = 0$$

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

$$x = \frac{-(12) \pm \sqrt{(12)^2 - 4(2)(22)}}{2(2)}$$

$$x = \frac{-12 \pm \sqrt{-32}}{4}$$

$$x = -3 \pm \sqrt{\frac{-32}{4}}$$

$$x = -3 \pm 32i$$

$$y = (-3 \pm 32i) - 6$$

**Score 0:**  The student did not satisfy the criteria for one or more credits.

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

$$1200 \cdot 1200 \left(1 + \frac{r}{t}\right)^{xt}$$

$$A(t) = 1200 \left(1 + \frac{0.064}{4}\right)^{4t} \quad \rightarrow \quad A(t) = 1200(1.016)^{4t}$$

$$B(t) = 1200 (e)^{0.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200(1.016)^{40} = 2264.28$$

$$B(t) = 1200 e^{0.0635(10)} = \boxed{2264.43}$$

She should choose bank B (Barnyard Bank)

**Question 37 is continued on the next page.**

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

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$3600 = 1200 \, e^{0.0635t}$$
$$\overline{1200} \qquad \overline{1200}$$

$$3 = e^{0.0635t}$$

$$\log_e 3 = 0.0635t$$

$$\boxed{17.3} = \frac{1.098612289}{0.0635} = \frac{0.0635t}{0.0635}$$

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

$$A(t) = 1200 \left(1 + \frac{.064}{4}\right)^{4t}$$

$$B(t) = 1200 \left(1 + .0635\right)^{t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200 \left(1 + \frac{.064}{4}\right)^{4t}$$

$$A(t) = 1200 \left(1.016\right)^{4(10)}$$

$$A(t) = \$2264.28$$

↑
America's Bank
will earn the most
money.

$$B(t) = 1200 \left(1 + .0635\right)^{10}$$

$$B(t) \approx \$2221.04$$

**Question 37 is continued on the next page.**

**Score 5:** The student wrote the incorrect equation for $B(t)$.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600}{120e} = 1200 \frac{(1.0635)^t}{1200}$$

$$3 = (1.0635)^t$$

$$\frac{\log 3}{\log 1.0635} = \frac{t \log 1.0635}{\log 1.0635}$$

$$\boxed{17.8 = t \atop years}$$

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

$$A(t) = 1200\left(1 + \frac{0.064}{4}\right)^{4t}$$

$$B(t) = 1200e^{0.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200\left(1 + \frac{0.064}{4}\right)^{40}$$

$$A(t) = 2264.28$$

America's Bank
$$2264.28 > 1547.01$$

$$B(t) = 1200e^{0.2540}$$

$$B(t) = 1547.01$$

$$\begin{array}{c} .635 \\ \quad 4 \\ \hline 2540 \end{array}$$

**Score 5:**    The student incorrectly evaluated $B(4)$ rather than $B(10)$.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$3600 = 1200e^{0.0635t}$$

$$3 = e^{0.0635t}$$

$$\ln(3) = 0.0635t$$

$$\boxed{t = 17.3 \text{ years}}$$

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

$$A(t) = 1200(.064)^{4t}$$

$$B(t) = 1200e^{.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200(.064)^{4(10)} = 2.8120216477773$$

$$B(t) = 1200e^{.0635(10)} = 2264.42656975$$

Taylor should choose Barnyard Bank.

**Score 4:** The student wrote an incorrect equation for $A(t)$ and incorrectly evaluated $A(10)$.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600}{1200} = \frac{1200e^{.0635t}}{1200}$$

$$3 = e^{.0635t}$$

$$\ln 3 = \ln e^{.0635t}$$

$$\frac{\ln 3}{.0635} = \frac{.0635t}{.0635}$$

$$t \approx 17.3009809239$$

It will take 17.3 years.

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

$$A(T) = 1200\left(1+\frac{0.064t}{4}\right)^{4t}$$
America

$$B(T) = 1200e^{0.0635t}$$
Barnyard

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$1200\left(1+\frac{0.064}{4}\right)^{4(10)} \quad \$2264.277$$

$$1200e^{0.0635(10)} = \$2264.426 \quad \text{Bank of America}$$

$$\text{(Barnyard)}$$

**Score 4:** The student incorrectly solved for the time it takes for the deposit to triple.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600 = 1200e^{0.0635t}}{1200e}$$

$$\frac{8.154 = 0.0635t}{0.0635}$$

128.4 years

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

$$A(t) = 1200(1+.064)^{.4t}$$

$$B(t) = 1200c^{.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$1200(1+.064)^{4(10)} = \boxed{14399.82}$$   She should choose America's loank.

$$(1200)^{.0635(10)} = 762 \quad \sqrt{\text{greater than}}$$

**Score 3:**   The student wrote an incorrect equation for $A(t)$, incorrectly evaluated $B(10)$, and made a rounding error.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\boxed{17 \text{ years}}$$

$$\frac{3600}{1200} = \frac{1200e^{.0635t}}{1200}$$

$$(\ln) \quad 3 = e^{.0635t} \quad (\ln)$$

$$\ln 3 = .0635t$$

$$P = 1\left(\frac{a}{a}\right)^{\frac{t}{h}}$$

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

America Bank

$$A(t) = P\left(1 + \frac{}{n}\right)^{\frac{t}{n}}$$

$$A(t) = 1200\left(1 + \frac{.064}{4}\right)^{\frac{t}{4}}$$

Barnyard

$$B(t) = 1200 e^{(.0635)(t)}$$

Taylor would like to invest the $1200 into one bank for (ten) years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200\left(1 + \frac{.064}{4}\right)^{\frac{10}{4}}$$

$$A(t) = 1,248.58$$

$$B(t) = 1200 e^{(.0635)(10)}$$

$$B(t) \approx 2,264.43$$

∴ taylor Should use Barnyard Bank

**Score 3:** The student wrote an incorrect equation for $A(t)$, but provided a correct justification.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600}{1200} = \frac{\cancel{1200}e^{(.0635)(t)}}{\cancel{1200}}$$

$$3 = e^{(.0635)(t)}$$

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

A

$$1200\left(1+.064\right)^{(t)}$$

B    Pert

$$1200\, e^{(.0635)(t)}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

2231.50

2264.43

Barnyard because she will get mon mon

**Score 2:**    The student provided an appropriate justification for choosing Barnyard Bank.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

Around 17 years

$$\frac{3600 \quad 1200\,e^{(.0675)(t)}}{1200}$$

$$3$$

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has
narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded
quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.
Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank
and Barnyard Bank as a function of time, $t$, in years.

*Annotations:* 4 (next to 37), 0.0635, 0.064, 365

$$A(t) = 1200\left(\frac{0.064}{4}\right)^{\frac{t}{12}}$$

$$B(t) = 1200\left(\frac{0.0635}{365}\right)^{\frac{t}{12}}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits
and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

America's Bank, recieves
more interest in 10
year period .

$A(10) = 38.25$

$B(10) = .884$

**Question 37 is continued on the next page.**

**Score 1:** The student correctly evaluated their incorrect equations at 10 years.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\overline{3}$$

$$B(t) = 1200 \left( \frac{0.0635}{365} \right) \div \frac{.10}{12}$$

**37** Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, $t$, in years.

$$A(t) = 1200(1 + 0.064)^{\frac{t}{4}}$$

$$B(t) = 1200(1 + 0.0635)^{t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

she should close America's bank.

**Score 0:** The student did not satisfy the criteria for one or more credits.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

23.6 years

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

# Regents Examination in Algebra II – August 2024

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

(Use for the August 2024 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 | 66 | 3 |
| 85 | 99 | 5 | 56 | 80 | 4 | 27 | 65 | 3 |
| 84 | 98 | 5 | 55 | 80 | 4 | 26 | 64 | 2 |
| 83 | 97 | 5 | 54 | 80 | 4 | 25 | 63 | 2 |
| 82 | 96 | 5 | 53 | 79 | 4 | 24 | 61 | 2 |
| 81 | 95 | 5 | 52 | 79 | 4 | 23 | 60 | 2 |
| 80 | 94 | 5 | 51 | 79 | 4 | 22 | 59 | 2 |
| 79 | 93 | 5 | 50 | 78 | 4 | 21 | 56 | 2 |
| 78 | 92 | 5 | 49 | 78 | 4 | 20 | 55 | 2 |
| 77 | 91 | 5 | 48 | 78 | 4 | 19 | 53 | 1 |
| 76 | 90 | 5 | 47 | 77 | 3 | 18 | 52 | 1 |
| 75 | 90 | 5 | 46 | 77 | 3 | 17 | 50 | 1 |
| 74 | 89 | 5 | 45 | 77 | 3 | 16 | 48 | 1 |
| 73 | 88 | 5 | 44 | 76 | 3 | 15 | 46 | 1 |
| 72 | 88 | 5 | 43 | 76 | 3 | 14 | 44 | 1 |
| 71 | 87 | 5 | 42 | 75 | 3 | 13 | 41 | 1 |
| 70 | 86 | 5 | 41 | 75 | 3 | 12 | 39 | 1 |
| 69 | 86 | 5 | 40 | 75 | 3 | 11 | 36 | 1 |
| 68 | 86 | 5 | 39 | 74 | 3 | 10 | 33 | 1 |
| 67 | 85 | 5 | 38 | 74 | 3 | 9 | 31 | 1 |
| 66 | 84 | 4 | 37 | 73 | 3 | 8 | 28 | 1 |
| 65 | 84 | 4 | 36 | 72 | 3 | 7 | 24 | 1 |
| 64 | 83 | 4 | 35 | 72 | 3 | 6 | 21 | 1 |
| 63 | 83 | 4 | 34 | 71 | 3 | 5 | 18 | 1 |
| 62 | 83 | 4 | 33 | 70 | 3 | 4 | 15 | 1 |
| 61 | 82 | 4 | 32 | 70 | 3 | 3 | 11 | 1 |
| 60 | 82 | 4 | 31 | 69 | 3 | 2 | 8 | 1 |
| 59 | 81 | 4 | 30 | 68 | 3 | 1 | 4 | 1 |
| 58 | 81 | 4 | 29 | 67 | 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.