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

ALGEBRA II

Thursday, January 24, 2019 — 1:15 to 4:15 p.m., only

Student Name: _____

School Name: _____

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

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

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

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

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

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

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

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

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

Part I

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

Use this space for computations.

1 Suppose two sets of test scores have the same mean, but different standard deviations, σ_1 and σ_2, with $\sigma_2 > \sigma_1$. Which statement best describes the variability of these data sets?

(1) Data set one has the greater variability.

(2) Data set two has the greater variability.

(3) The variability will be the same for each data set.

(4) No conclusion can be made regarding the variability of either set.

2 If $f(x) = \log_3 x$ and $g(x)$ is the image of $f(x)$ after a translation five units to the left, which equation represents $g(x)$?

(1) $g(x) = \log_3 (x + 5)$ (3) $g(x) = \log_3 (x - 5)$

(2) $g(x) = \log_3 x + 5$ (4) $g(x) = \log_3 x - 5$

3 When factoring to reveal the roots of the equation $x^3 + 2x^2 - 9x - 18 = 0$, which equations can be used?

$$\text{I.} \quad x^2(x + 2) - 9(x + 2) = 0$$
$$\text{II.} \quad x(x^2 - 9) + 2(x^2 - 9) = 0$$
$$\text{III.} \quad (x - 2)(x^2 - 9) = 0$$

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

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

4 When a ball bounces, the heights of consecutive bounces form a geometric sequence. The height of the first bounce is 121 centimeters and the height of the third bounce is 64 centimeters. To the *nearest centimeter*, what is the height of the fifth bounce?

(1) 25 (3) 36

(2) 34 (4) 42

5 The solutions to the equation $5x^2 - 2x + 13 = 9$ are

(1) $\dfrac{1}{5} \pm \dfrac{\sqrt{21}}{5}$

(2) $\dfrac{1}{5} \pm \dfrac{\sqrt{19}}{5}i$

(3) $\dfrac{1}{5} \pm \dfrac{\sqrt{66}}{5}i$

(4) $\dfrac{1}{5} \pm \dfrac{\sqrt{66}}{5}$

6 Julia deposits $2000 into a savings account that earns 4% interest per year. The exponential function that models this savings account is $y = 2000(1.04)^t$, where t is the time in years. Which equation correctly represents the amount of money in her savings account in terms of the monthly growth rate?

(1) $y = 166.67(1.04)^{0.12t}$

(2) $y = 2000(1.01)^t$

(3) $y = 2000(1.0032737)^{12t}$

(4) $y = 166.67(1.0032737)^t$

7 Tides are a periodic rise and fall of ocean water. On a typical day at a seaport, to predict the time of the next high tide, the most important value to have would be the

(1) time between consecutive low tides

(2) time when the tide height is 20 feet

(3) average depth of water over a 24-hour period

(4) difference between the water heights at low and high tide

8 An estimate of the number of milligrams of a medication in the bloodstream t hours after 400 mg has been taken can be modeled by the function below.

$$I(t) = 0.5t^4 + 3.45t^3 - 96.65t^2 + 347.7t, \text{ where } 0 \le t \le 6$$
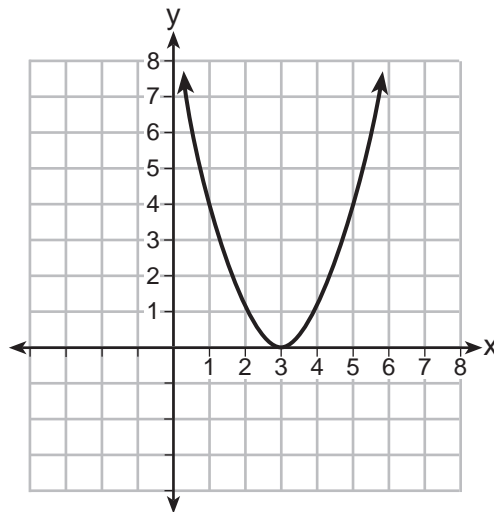
Over what time interval does the amount of medication in the bloodstream strictly increase?

(1) 0 to 2 hours   (3) 2 to 6 hours

(2) 0 to 3 hours   (4) 3 to 6 hours

9 Which representation of a quadratic has imaginary roots?

x	y
−2.5	2
−2.0	0
−1.5	−1
−1.0	−1
−0.5	0
0.0	2

(1)

(3)

$2(x + 3)^2 = 64$

(2)

$2x^2 + 32 = 0$

(4)

10 A random sample of 100 people that would best estimate the proportion of all registered voters in a district who support improvements to the high school football field should be drawn from registered voters in the district at a

(1) football game   (3) school fund-raiser

(2) supermarket   (4) high school band concert

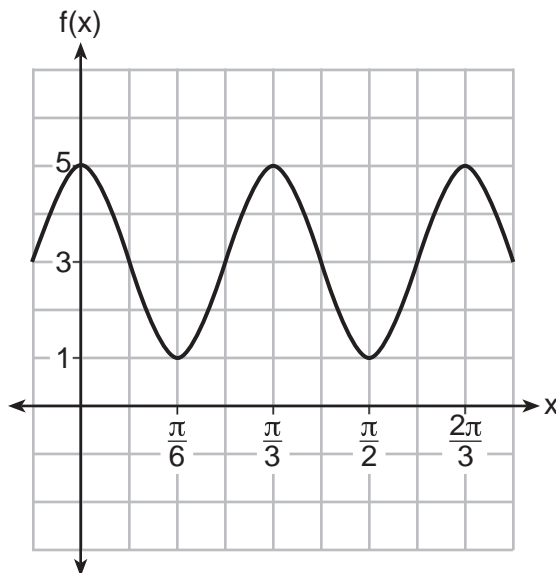**11** Which expression is equivalent to $(2x - i)^2 - (2x - i)(2x + 3i)$ where i is the imaginary unit and x is a real number?

(1) $-4 - 8xi$ (3) 2

(2) $-4 - 4xi$ (4) $8x - 4i$

12 Suppose events A and B are independent and $P(A \text{ and } B)$ is 0.2. Which statement could be true?

(1) $P(A) = 0.4, P(B) = 0.3, P(A \text{ or } B) = 0.5$

(2) $P(A) = 0.8, P(B) = 0.25$

(3) $P(A|B) = 0.2, P(B) = 0.2$

(4) $P(A) = 0.15, P(B) = 0.05$

13 The function $f(x) = a \cos bx + c$ is plotted on the graph shown below.

f(x)

What are the values of a, b, and c?

(1) $a = 2$, $b = 6$, $c = 3$ (3) $a = 4$, $b = 6$, $c = 5$

(2) $a = 2$, $b = 3$, $c = 1$ (4) $a = 4$, $b = \frac{\pi}{3}$, $c = 3$

14 Which equation represents the equation of the parabola with focus $(-3,3)$ and directrix $y = 7$?

(1) $y = \frac{1}{8}(x + 3)^2 - 5$ (3) $y = -\frac{1}{8}(x + 3)^2 + 5$

(2) $y = \frac{1}{8}(x - 3)^2 + 5$ (4) $y = -\frac{1}{8}(x - 3)^2 + 5$

15 What is the solution set of the equation $\dfrac{2}{3x+1} = \dfrac{1}{x} - \dfrac{6x}{3x+1}$?

(1) $\left\{ -\dfrac{1}{3}, \dfrac{1}{2} \right\}$

(3) $\left\{ \dfrac{1}{2} \right\}$

(2) $\left\{ -\dfrac{1}{3} \right\}$

(4) $\left\{ \dfrac{1}{3}, -2 \right\}$

16 Savannah just got contact lenses. Her doctor said she can wear them 2 hours the first day, and can then increase the length of time by 30 minutes each day. If this pattern continues, which formula would *not* be appropriate to determine the length of time, in either minutes or hours, she could wear her contact lenses on the *n*th day?

(1) $a_1 = 120$
$a_n = a_{n-1} + 30$

(3) $a_1 = 2$
$a_n = a_{n-1} + 0.5$

(2) $a_n = 90 + 30n$

(4) $a_n = 2.5 + 0.5n$

17 If $f(x) = a^x$ where $a > 1$, then the inverse of the function is

(1) $f^{-1}(x) = \log_x a$
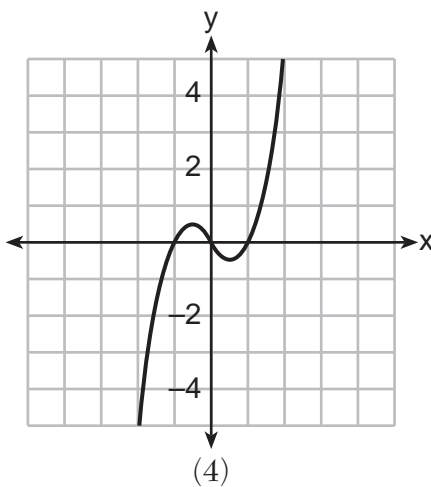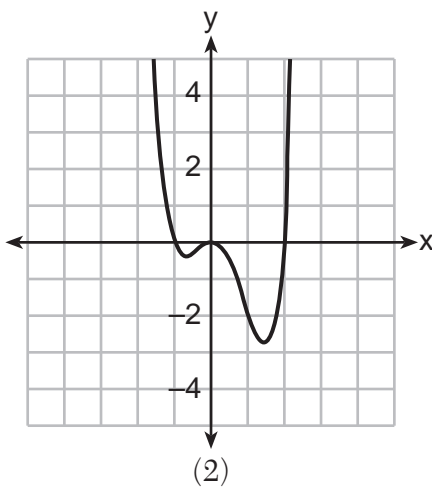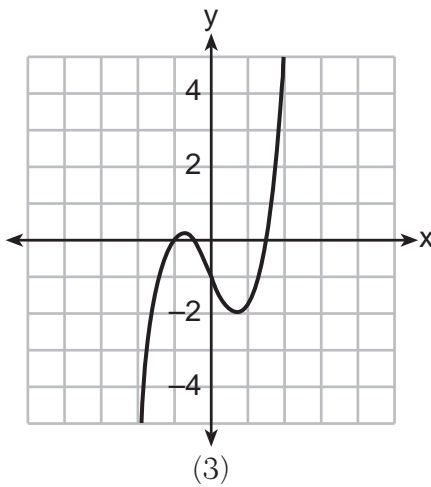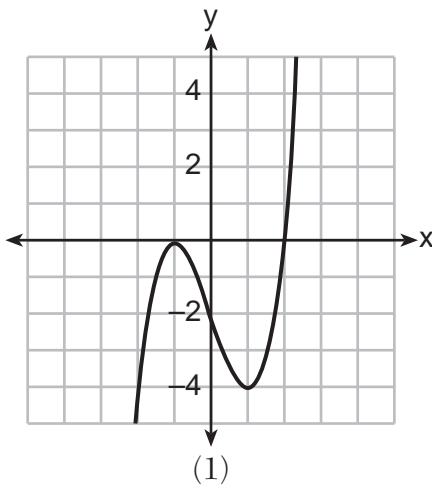
(3) $f^{-1}(x) = \log_a x$

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

(4) $f^{-1}(x) = x\log a$

18 Kelly-Ann has \$20,000 to invest. She puts half of the money into an account that grows at an annual rate of 0.9% compounded monthly. At the same time, she puts the other half of the money into an account that grows continuously at an annual rate of 0.8%. Which function represents the value of Kelly-Ann's investments after t years?
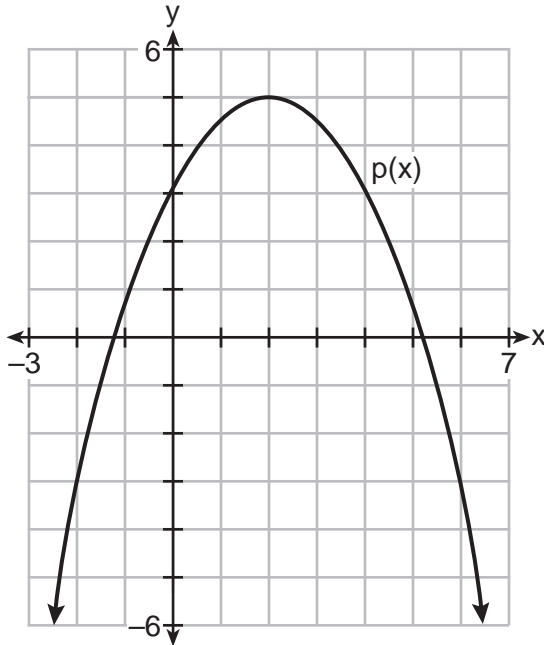
(1) $f(t) = 10{,}000(1.9)^t + 10{,}000e^{0.8t}$

(2) $f(t) = 10{,}000(1.009)^t + 10{,}000e^{0.008t}$

(3) $f(t) = 10{,}000(1.075)^{12t} + 10{,}000e^{0.8t}$

(4) $f(t) = 10{,}000(1.00075)^{12t} + 10{,}000e^{0.008t}$

19 Which graph represents a polynomial function that contains $x^2 + 2x + 1$ as a factor?

(1)

(3)

(2)

(4)

20 Sodium iodide-131, used to treat certain medical conditions, has a half-life of 1.8 hours. The data table below shows the amount of sodium iodide-131, rounded to the nearest thousandth, as the dose fades over time.

Number of Half Lives	1	2	3	4	5
Amount of Sodium Iodide-131	139.000	69.500	34.750	17.375	8.688

What approximate amount of sodium iodide-131 will remain in the body after 18 hours?

(1) 0.001   (3) 0.271

(2) 0.136   (4) 0.543

21 Which expression(s) are equivalent to $\dfrac{x^2 - 4x}{2x}$, where $x \neq 0$?

$$\text{I. } \frac{x}{2} - 2 \qquad \text{II. } \frac{x-4}{2} \qquad \text{III. } \frac{x-1}{2} - \frac{3}{2}$$

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

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

22 Consider $f(x) = 4x^2 + 6x - 3$, and $p(x)$ defined by the graph below.

The difference between the values of the maximum of p and minimum of f is

(1) 0.25   (3) 3.25

(2) 1.25   (4) 10.25

23 The scores on a mathematics college-entry exam are normally distributed with a mean of 68 and standard deviation 7.2. Students scoring higher than one standard deviation above the mean will not be enrolled in the mathematics tutoring program. How many of the 750 incoming students can be expected to be enrolled in the tutoring program?

(1) 631   (3) 238

(2) 512   (4) 119

**24** How many solutions exist for $\dfrac{1}{1 - x^2} = -|3x - 2| + 5$?

(1) 1   (3) 3

(2) 2   (4) 4

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

25 Justify why $\dfrac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}}$ is equivalent to $x^{\frac{-1}{12}} y^{\frac{2}{3}}$ using properties of rational exponents,

where $x \neq 0$ and $y \neq 0$.

26 The zeros of a quartic polynomial function are 2, −2, 4, and −4. Use the zeros to construct a
possible sketch of the function, on the set of axes below.
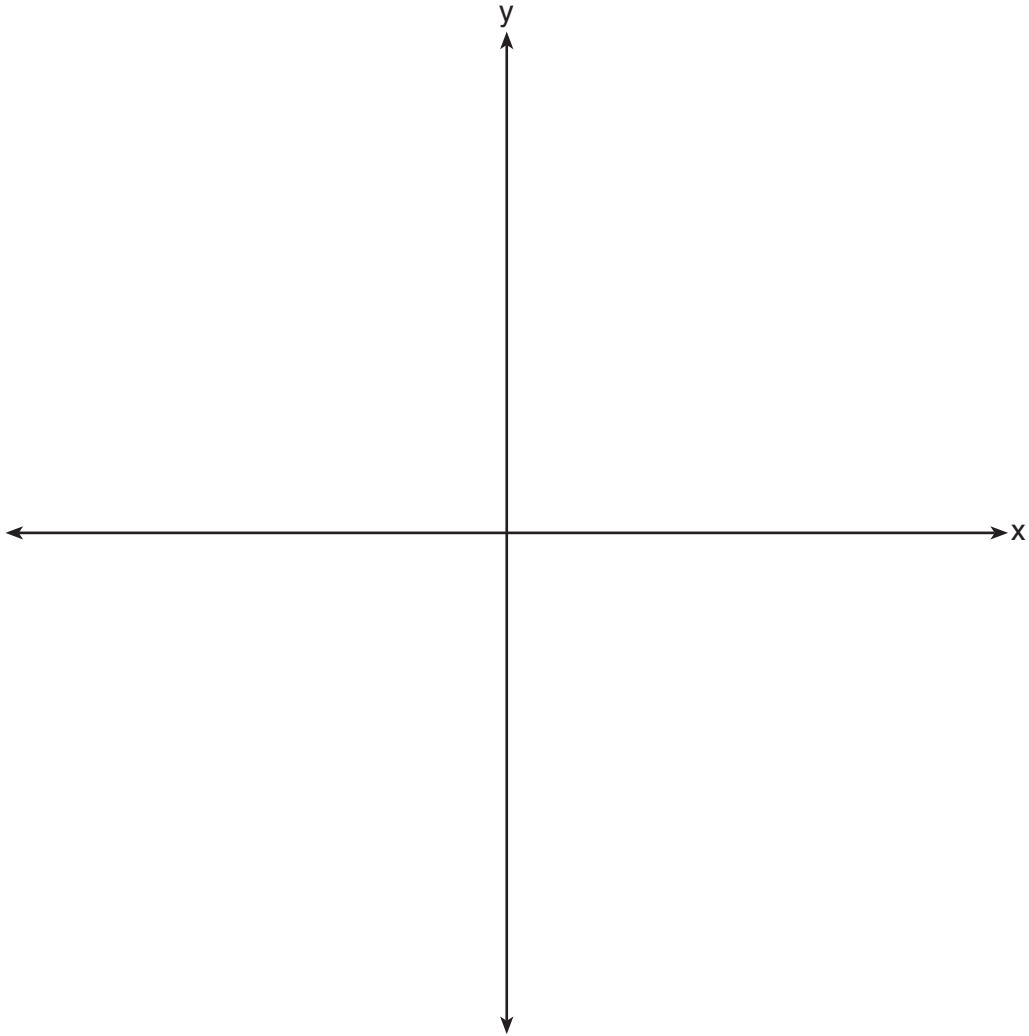
27 Erin and Christa were working on cubing binomials for math homework. Erin believed they could save time with a shortcut. She wrote down the rule below for Christa to follow.

$$(a + b)^3 = a^3 + b^3$$

Does Erin's shortcut always work? Justify your result algebraically.

28 The probability that a resident of a housing community opposes spending money for community improvement on plumbing issues is 0.8. The probability that a resident favors spending money on improving walkways given that the resident opposes spending money on plumbing issues is 0.85. Determine the probability that a randomly selected resident opposes spending money on plumbing issues and favors spending money on walkways.

29 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

30 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function $B(t) = 25.29\sin(0.4895t - 1.9752) + 55.2877$, where t is the month number (January = 1). State, to the *nearest tenth*, the average monthly rate of temperature change between August and November.

Explain its meaning in the given context.

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.

32 On the grid below, graph the function $y = \log_2(x - 3) + 1$
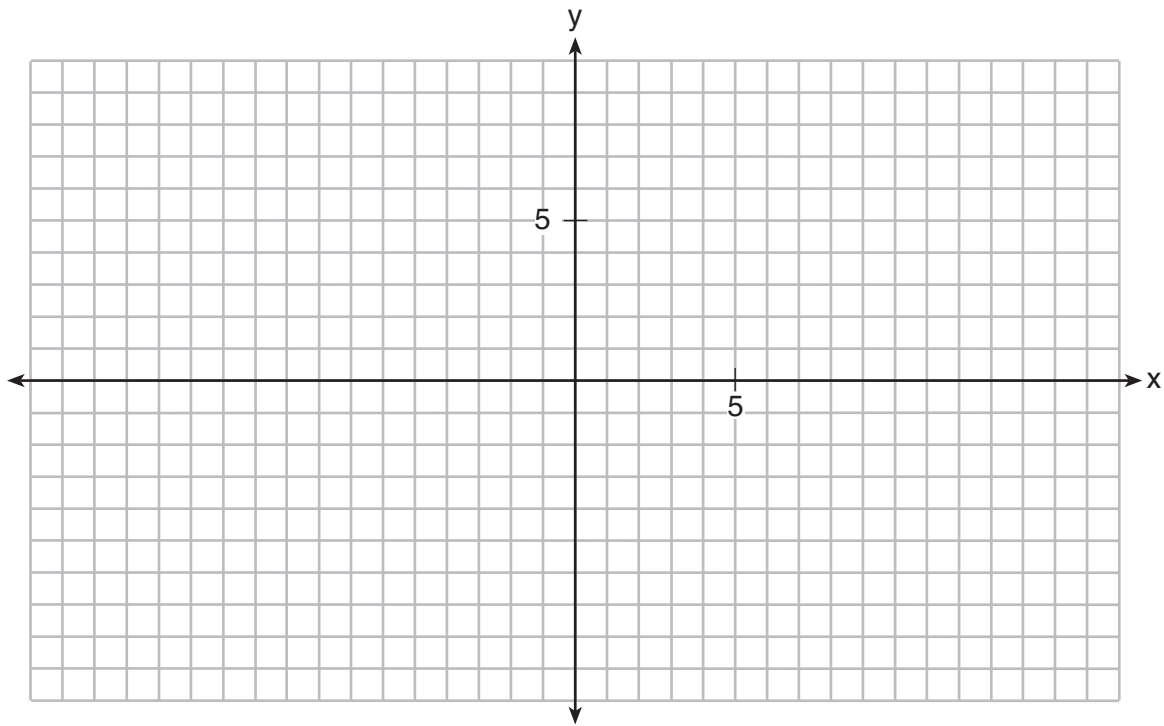
Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily 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 Solve the following system of equations algebraically for all values of a, b, and c.

$$a + 4b + 6c = 23$$
$$a + 2b + c = 2$$
$$6b + 2c = a + 14$$

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

Is $b(x)$ a factor of $a(x)$? Explain.

35 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

$\overline{x}$	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.

samples = 1000
mean = 29.101
SD = 0.934
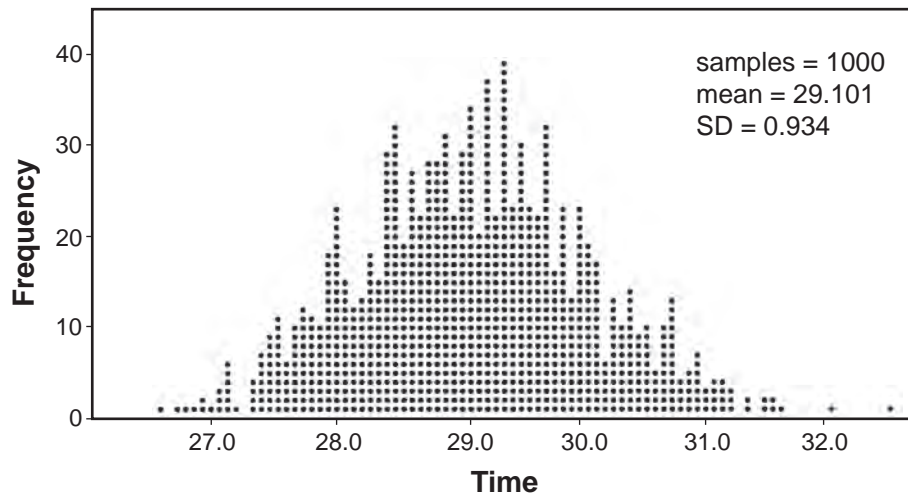
Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

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 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

Graph $A(t)$ where $0 \leq t \leq 20$ on the set of axes below.

A(t)
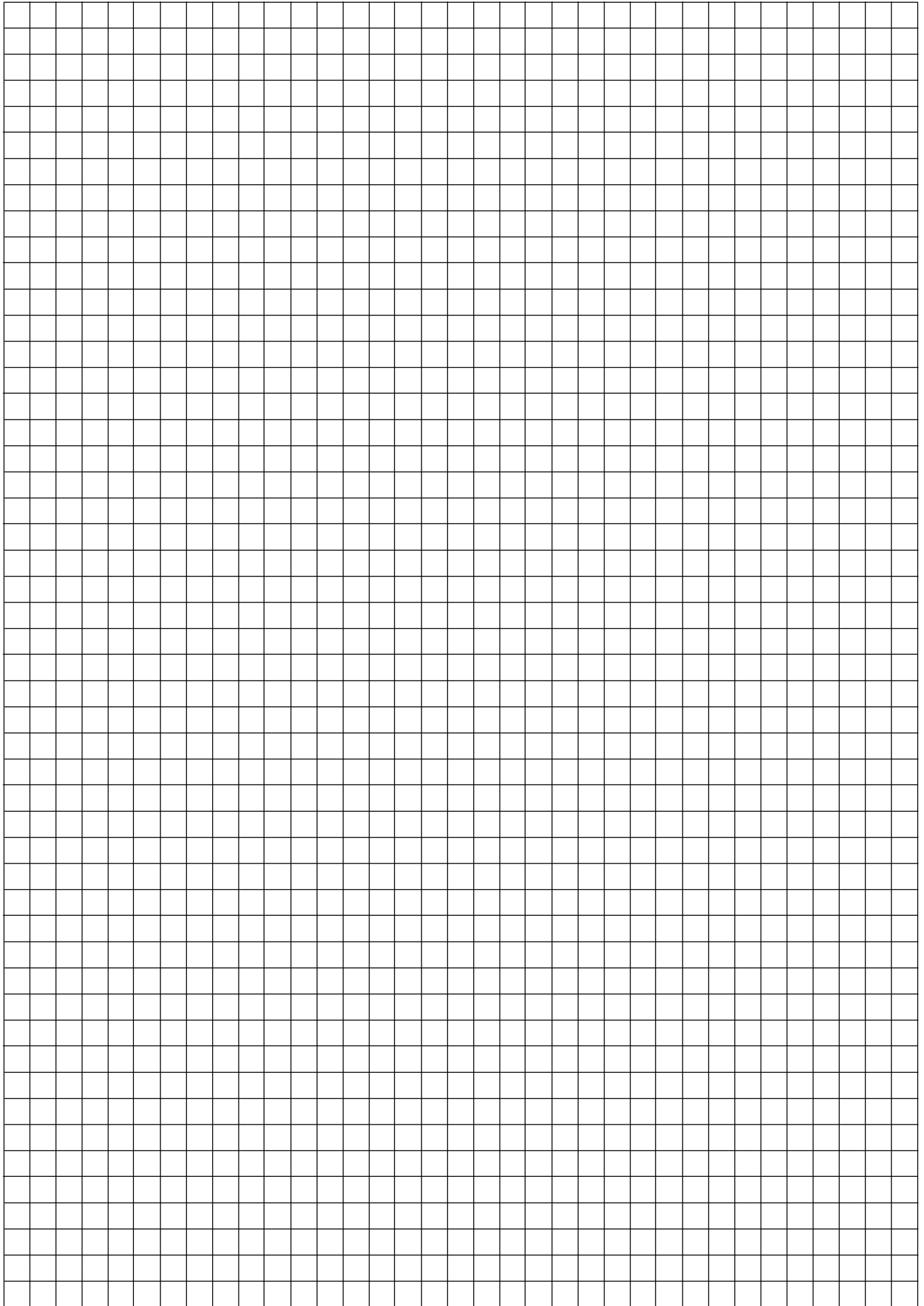
t
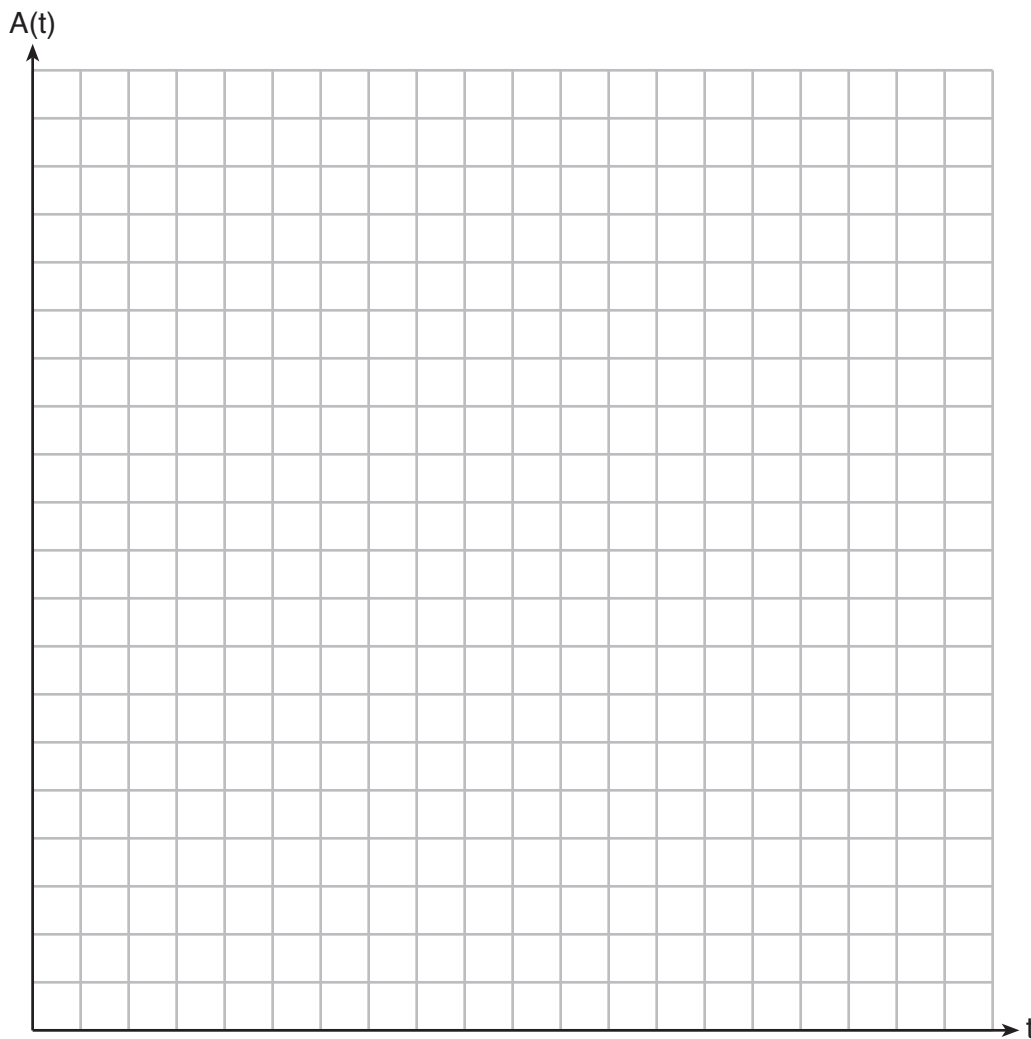
Question 37 is continued on the next page.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

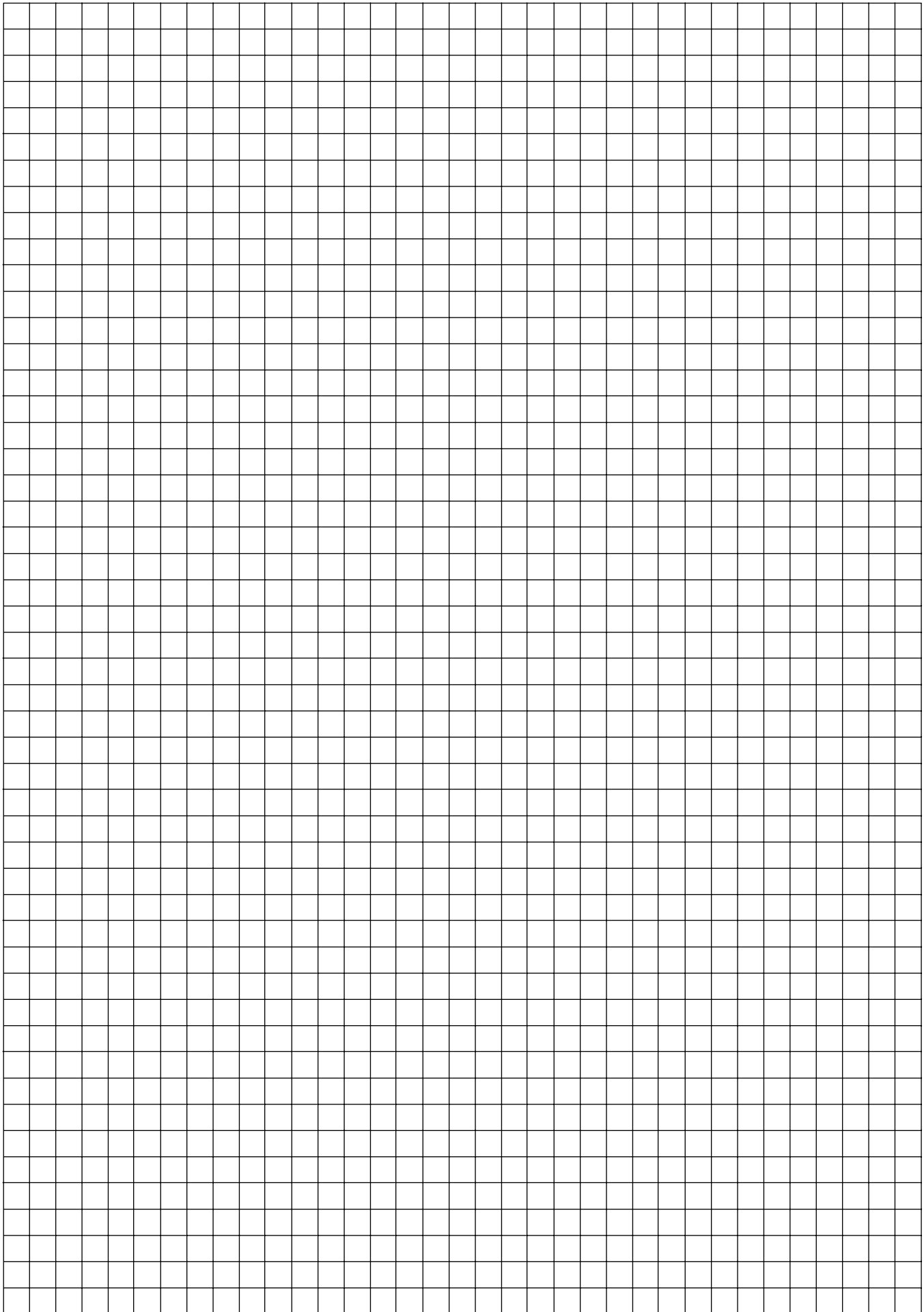Explain how your graph of $A(t)$ confirms your answer.

High School Math Reference Sheet

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

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

ALGEBRA II

Printed on Recycled Paper

ALGEBRA II

FOR TEACHERS ONLY

ALGEBRA II

SCORING KEY AND RATING GUIDE

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 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.

Raters should record the student's scores for all questions and the total raw score on the student's separate answer sheet. Then the student's total raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ by Thursday, January 24, 2019. Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score. The student's scale score should be entered in the box provided on the student's separate answer sheet. The scale score is the student's final examination score.

If the student's responses for the multiple-choice questions are being hand scored prior to being scanned, the scorer must be careful not to make any marks on the answer sheet except to record the scores in the designated score boxes. Marks elsewhere on the answer sheet will interfere with the accuracy of the scanning.

Part I

Allow a total of 48 credits, 2 credits for each of the following.

(1). 2	(9). 4	(17). . . . . 3 . . . . .
(2). 1	(10). 2	(18). . . . . 4 . . . . .
(3). 1	(11). 1	(19). . . . . 1 . . . . .
(4). 2	(12). 2	(20). . . . . 3 . . . . .
(5). 2	(13). 1	(21). . . . . 4 . . . . .
(6). 3	(14). 3	(22). . . . . 4 . . . . .
(7). 1	(15). 3	(23). . . . . 1 . . . . .
(8). 1	(16). 4	(24). . . . . 4 . . . . .

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

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

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 justification is given.

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

<div align="center">*or*</div>

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

<div align="center">*or*</div>

       [1] Appropriate work is shown, but the justification is incomplete.

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

(26)   **[2]** A correct sketch is drawn.

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

<div align="center">*or*</div>

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

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

(27)   **[2]** No, and a correct algebraic justification is given.

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

<div align="center">*or*</div>

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

<div align="center">*or*</div>

       [1] No, but an incomplete justification is given.

<div align="center">*or*</div>

       [1] No, but a justification other than algebraic is given.

       [0] No, but no further correct work is shown.

<div align="center">*or*</div>

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

(28)   **[2]** 0.68 and correct work is shown.

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

or

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

or

[1] 0.68, but no work is shown.

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

(29)   **[2]** 171.958, 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, such as finding only the number of miles run in the tenth week.

or

[1] $\dfrac{15 - 15(1.03)^{10}}{1 - 1.03}$ is written, but no further correct work is shown.

or

[1] 171.958, but a geometric series formula is not used.

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

(30) **[2]** -10.1, and a correct explanation is written.

[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] -10.1, but the explanation is incomplete, incorrect, or missing.

or

[1] An appropriate explanation is written based on an incorrect value.

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

(31) **[2]** $-\dfrac{\sqrt{33}}{7}$ or equivalent, and correct work is shown.

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

or

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

or

[1] Appropriate work is shown, but the answer is expressed as a decimal.

or

[1] $-\dfrac{\sqrt{33}}{7}$, but no work is shown.

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

(32)   **[2]** A correct graph is drawn.

       [1] One graphing error is made.

<div align="center">*or*</div>

       [1] One conceptual error is made.

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

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]** $a = -3, b = \frac{1}{2}, c = 4$, and correct algebraic work is shown.

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

    [3] Appropriate work is shown to find two solutions, but no further correct work is shown.

or

    [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 one solution, but no further correct work is shown.

or

    [2] $a = -3, b = \frac{1}{2}, c = 4$, but a method other than algebraic is used.

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

or

    [1] Appropriate work is shown to eliminate one variable to create a system of two equations with two unknowns, but no further correct work is shown.

or

    [1] $a = -3, b = \frac{1}{2}, c = 4$, but no work is shown.

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

(34) **[4]** $x^3 + 4 + \dfrac{-18}{x+2}$, and correct work is shown, and no and a correct explanation is written.

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

or

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

[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 $x^3 + 4 + \dfrac{-18}{x+2}$, but no further correct work is shown.

or

[2] No, and a correct explanation is written, but no further correct work is shown.

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

[0] No, but no work is shown.

or

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

(35)   **[4]** Yes, a correct interval such as (27.23, 30.97) and correct work is shown, and a correct explanation is written.

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

or

[3] Yes, a correct interval and correct work is shown, but the explanation is incomplete.

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

or

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

or

[2] A correct interval and correct work is shown, but no further correct work is shown.

or

[2] Yes, and a correct explanation is written, but no further correct work is shown.

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

or

[1] A correct interval is stated, but no work is shown.

[0] Yes, but no work is shown.

or

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

(36)   **[4]** 6.25 or equivalent and correct algebraic work is shown.

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

or

   [3] 6.25 and appropriate work is shown, but 1 is not rejected.

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

or

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

or

   [2] A correct quadratic equation in standard form is written, but no further correct work is shown.

or

   [2] 6.25, but a method other than algebraic is used.

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

or

   [1] 6.25, but no work is shown.

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

———————————————————————

Part IV

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

(37) **[6]** $A(t) = 318{,}000(1.07)^t$, a correct graph is drawn, 17 and correct algebraic work is shown, and a correct explanation is written.

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

or

[5] Appropriate work is shown, but the explanation based on the graph is incomplete, incorrect, or missing.

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

or

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

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

or

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

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

or

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

or

[2] A correct graph is drawn, but no further correct work is shown.

or

[2] Appropriate work is shown to find 17, but no further correct work is shown.

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

or

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

or

[1] $A(t) = 318{,}000(1.07)^t$, but no further correct work is shown.

or

[1] 17, but a method other than algebraic is used.

or

[1] 17, but no work is shown.

[0] The expression $318{,}000(1.07)^t$, is written, but no further correct work is shown.

or

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

Map to the Learning Standards
Algebra II
January 2019

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

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

Regents Examination in Algebra II

January 2019

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

> **The *Chart for Determining the Final Examination Score for the January 2019 Regents Examination in Algebra II* will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ by Thursday, January 24, 2019. Conversion charts provided for previous administrations of the Regents Examination in Algebra II must NOT be used to determine students' final scores for this administration.**

Online Submission of Teacher Evaluations of the Test to the Department

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

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

2. Select the test title.

3. Complete the required demographic fields.

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

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

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

ALGEBRA II

Thursday, January 24, 2019 — 1:15 to 4:15 p.m., only

MODEL RESPONSE SET

Table of Contents

25 Justify why $\dfrac{\sqrt[3]{x^2y^5}}{\sqrt[4]{x^3y^4}}$ is equivalent to $x^{\frac{-1}{12}}y^{\frac{2}{3}}$ using properties of rational exponents, where $x \neq 0$ and $y \neq 0$.

$$\sqrt[3]{x^2y^5} = \sqrt[3]{x^2} \cdot \sqrt[3]{y^5}$$

$$x^{\frac{2}{3}} \qquad y^{\frac{5}{3}}$$

$$\sqrt[4]{x^3y^4} = \sqrt[4]{x^3} \cdot \sqrt[4]{y^4}$$

$$x^{\frac{3}{4}} \qquad y^1$$

$$\frac{x^{\frac{2}{3}}}{x^{\frac{3}{4}}} = x^{-\frac{1}{12}} \qquad\qquad \frac{y^{\frac{5}{3}}}{y^{\frac{3}{3}}} = y^{\frac{2}{3}}$$

$$x^{-\frac{1}{12}} \cdot y^{\frac{2}{3}}$$

$$x^{-\frac{1}{12}} y^{\frac{2}{3}}$$

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

25 Justify why $\dfrac{\sqrt[3]{x^2y^5}}{\sqrt[4]{x^3y^4}}$ is equivalent to $x^{\frac{-1}{12}}y^{\frac{2}{3}}$ using properties of rational exponents,

where $x \neq 0$ and $y \neq 0$.

$$\frac{\sqrt[3]{x^2y^5}}{\sqrt[4]{x^3y^4}} = \frac{x^{\frac{2}{3}}y^{\frac{5}{3}}}{x^{\frac{3}{4}}y}$$

$$= x^{-\frac{1}{12}}y^{\frac{2}{3}}$$

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

25 Justify why $\dfrac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}}$ is equivalent to $x^{\frac{-1}{12}} y^{\frac{2}{3}}$ using properties of rational exponents,

where $x \neq 0$ and $y \neq 0$.

$$\frac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}} = \frac{\left(x^2 y^5\right)^{1/3}}{\left(x^3 y^4\right)^{1/4}}$$

Score 1: The student only rewrote the radicals with rational exponents.

25 Justify why $\dfrac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}}$ is equivalent to $x^{\frac{-1}{12}} y^{\frac{2}{3}}$ using properties of rational exponents, where $x \neq 0$ and $y \neq 0$.

$$X = 4$$
$$y = 3$$

$$\dfrac{\sqrt[3]{4^2 3^5}}{\sqrt[4]{4^3 3^4}} = 1.853144012$$

$$\left.\begin{array}{c} \\ \\ \end{array}\right\} \text{equivalet}$$

$$4^{\frac{-1}{12}} 3^{\frac{2}{3}} = 1.853144012$$

Score 1:   The student gave an incomplete justification by only evaluating $x = 4$ and $y = 3$.

25 Justify why $\dfrac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}}$ is equivalent to $x^{\frac{-1}{12}} y^{\frac{2}{3}}$ using properties of rational exponents,

where $x \neq 0$ and $y \neq 0$.

$$\frac{\sqrt[3]{x^2 y^5}}{\sqrt[4]{x^3 y^4}} \; : \; x^{\frac{-1}{12}} y^{\frac{2}{3}}$$

let $x = 4$
let $y = 2$

$$\frac{\sqrt[3]{4^2 2^5}}{\sqrt[4]{4^3 2^4}}$$

$$4^{\frac{-1}{12}} \cdot 2^{\frac{2}{3}}$$

$$\frac{\sqrt[3]{32}}{\sqrt[4]{16}} \qquad \frac{\sqrt[3]{32}}{2} \quad \frac{\sqrt[8]{4}}{2}$$

$-\dfrac{1}{12} \cdot 1,58740052$

$= -,13228342\overline{1}$

$\sqrt[4]{4} = 8$

Score 0: The student gave a completely incoherent response.

26 The zeros of a quartic polynomial function are 2, −2, 4, and −4. Use the zeros to construct a possible sketch of the function, on the set of axes below.

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

26 The zeros of a quartic polynomial function are 2, −2, 4, and −4. Use the zeros to construct a possible sketch of the function, on the set of axes below.

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

26 The zeros of a quartic polynomial function are 2, −2, 4, and −4. Use the zeros to construct a possible sketch of the function, on the set of axes below.

Score 1:   The student incorrectly graphed the end behavior.

26 The zeros of a quartic polynomial function are 2, −2, 4, and −4. Use the zeros to construct a possible sketch of the function, on the set of axes below.
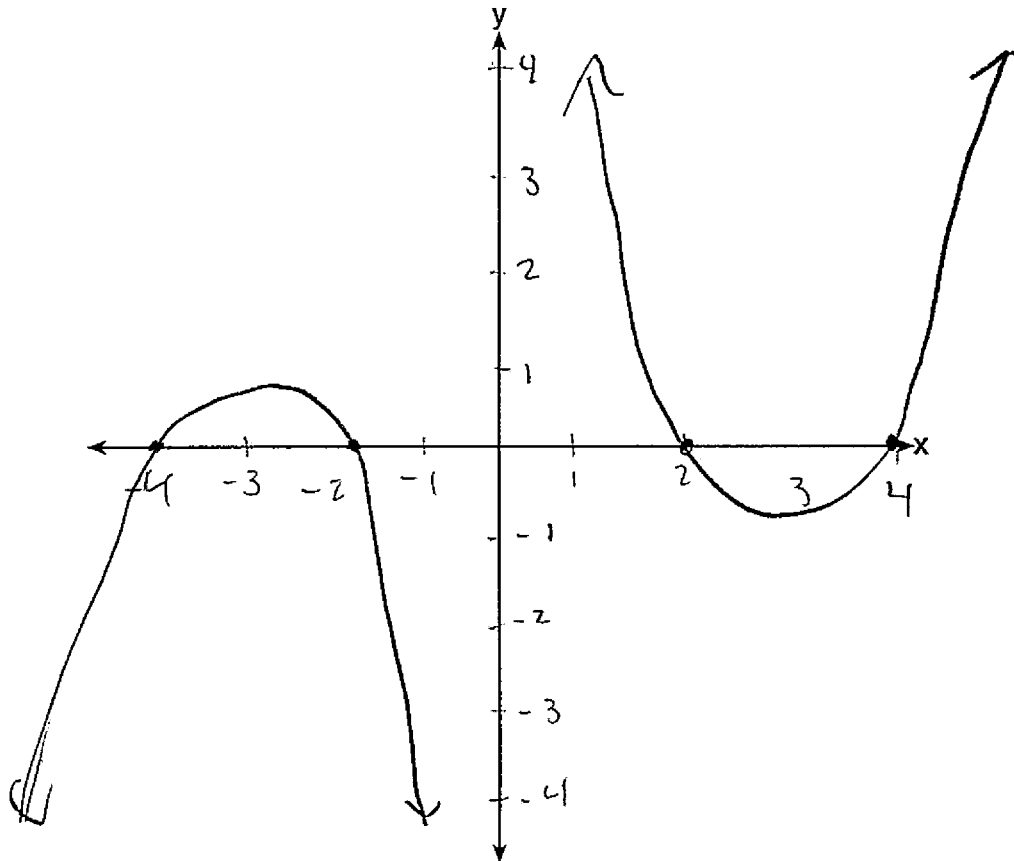
Score 1: The student did not graph a quartic polynomial function.

26 The zeros of a quartic polynomial function are 2, −2, 4, and −4. Use the zeros to construct a possible sketch of the function, on the set of axes below.
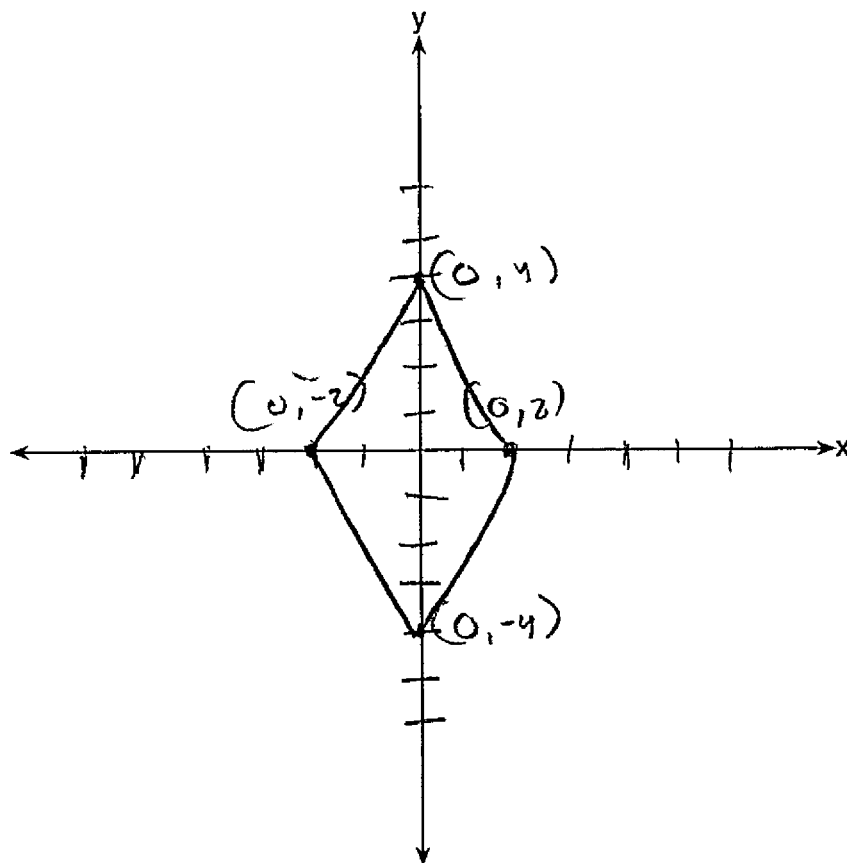
Score 0: The student's sketch is completely incorrect.

27 Erin and Christa were working on cubing binomials for math homework. Erin believed they could save time with a shortcut. She wrote down the rule below for Christa to follow.

$$(a + b)^3 = a^3 + b^3$$

Does Erin's shortcut always work? Justify your result algebraically.

$$(a+b)(a+b)(a+b) = a^3 + b^3$$

$$(a^2 + 2ab + b^2)(a+b) = a^3 + b^3$$

$$a^3 + a^2b + 2a^2b + 2ab^2 + ab^2 + b^3$$

$$a^3 + 3a^2b + 3ab^2 + b3$$

No   Erin's shortcut does not work.

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

27 Erin and Christa were working on cubing binomials for math homework. Erin believed they could save time with a shortcut. She wrote down the rule below for Christa to follow.

$$(a + b)^3 = a^3 + b^3$$

Does Erin's shortcut always work? Justify your result algebraically.

$$(a+b)(a+b)(a+b) = a^3 + b^3$$

$$(a^2 + 2ab + b^2)(a+b) = a^3 + b^3$$

$$a^3 + 2a^2b + ab^2 + a^2b + 2ab^2 + b^3 = a^3 + b^3$$

No

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

27 Erin and Christa were working on cubing binomials for math homework. Erin believed they could save time with a shortcut. She wrote down the rule below for Christa to follow.

$$(a + b)^3 = a^3 + b^3$$

Does Erin's shortcut always work? Justify your result algebraically.

No

$$(A+B)^3 \neq a^3 + B^3$$

$$(A+B)^3 = (A+B)(A+B)(A+B)$$

$$= A^2 + AB + BA + B^2 + A^2 + 2AB + BA + B^2$$

$$= 2A^2 + 2AB + 2BA + 2B^2$$

Score 1: The student incorrectly distributed.

27 Erin and Christa were working on cubing binomials for math homework. Erin believed they could save time with a shortcut. She wrote down the rule below for Christa to follow.

$$(a + b)^3 = a^3 + b^3$$

Does Erin's shortcut always work? Justify your result algebraically.

No, it does not always work

$$(9+19)^3 = 9^3 + 19^3$$

$$(28)^3 = 729 + 6859$$

$$21952 = 7588$$

Score 1: The student used a method other than algebraic to justify.

27 Erin and Christa were working on cubing binomials for math homework. Erin believed they could save time with a shortcut. She wrote down the rule below for Christa to follow.

$$(a + b)^3 = a^3 + b^3$$

Does Erin's shortcut always work? Justify your result algebraically.

$$\sqrt{(a+b)^3} = \sqrt{a^3+b^3}$$

$$a+b = \sqrt{a^3+b^3}$$

No because you will not get the exact value.

Score 0: The student stated No, but showed no further correct work.

28 The probability that a resident of a housing community opposes spending money for community improvement on plumbing issues is 0.8. The probability that a resident favors spending money on improving walkways given that the resident opposes spending money on plumbing issues is 0.85. Determine the probability that a randomly selected resident opposes spending money on plumbing issues and favors spending money on walkways.

$$\boxed{P(FW \cap NP) = .68}$$

$$P(NP) = .8$$
$$P(FW|NP) = .85$$

$$P(FW|NP) = \frac{P(FW \cap NP)}{P(NP)} = .85$$

$$\frac{P(FW \cap NP)}{.8} = .85$$
$$\times .8 \qquad \times .8$$
$$P(FW \cap NP) = .68$$

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

28 The probability that a resident of a housing community opposes spending money for community improvement on plumbing issues is 0.8. The probability that a resident favors spending money on improving walkways given that the resident opposes spending money on plumbing issues is 0.85. Determine the probability that a randomly selected resident opposes spending money on plumbing issues and favors spending money on walkways.

$$\frac{8}{10} \cdot \frac{85}{100}$$

$$\boxed{\frac{680}{1000}}$$

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

28 The probability that a resident of a housing community opposes spending money for community improvement on plumbing issues is 0.8. The probability that a resident favors spending money on improving walkways given that the resident opposes spending money on plumbing issues is 0.85. Determine the probability that a randomly selected resident opposes spending money on plumbing issues and favors spending money on walkways.

$$\frac{0.8}{0.85} \longrightarrow$$

Prob = 0.9411764706

Score 1: The student divided rather than multiplied to determine the probability.

28 The probability that a resident of a housing community opposes spending money for community improvement on plumbing issues is 0.8. The probability that a resident favors spending money on improving walkways given that the resident opposes spending money on plumbing issues is 0.85. Determine the probability that a randomly selected resident opposes spending money on plumbing issues and favors spending money on walkways.

$$0.8 + 0.85 = 1.65$$

$$\frac{0.8}{1.65} + \frac{0.85}{1.65}$$

Score 0: The student made multiple errors.

29 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

$$S_n = \frac{a_1 - a_1 r^n}{1 - r}$$

$$S_{10} = \frac{15 - 15(1.03)^{10}}{1 - 1.03} = \boxed{171.958 \text{ miles}}$$

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

29 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

$$15(1.03)^{x-1} \qquad x = \# \text{ of weeks trained after week 1}$$

$$m = \sum_{x=1}^{10} 15(1.03)^{x-1} \implies \underline{171.958 \text{ miles}}$$

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

29 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

0.03

Week 1 – 15
Week 2 – 15.45
Week 3 – 15.9135
Week 4 – 16.390905
Week 5 – 16.88263215
Week 6 – 17.38911111
Week 7 – 17.91078444
Week 8 – 18.44810797
Week 9 – 19.00155121
+ Week 10 – 19.57159775
_____

171.9581896
  tenth \\ \\
    hund.   thous.

The total number of miles Rowan runs over the first ten weeks of training is 171.958 miles.

Score 1: The student used expansion rather than a geometric series formula.

29 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

$$S_n = \frac{a_1 - a_1 r^n}{1 - r}$$

$$\frac{15 - 15(.03)^{10}}{1 - .03} = \frac{.15}{.97} = \boxed{15.464}$$

Score 1:   The student incorrectly substituted for the ratio.

29 Rowan is training to run in a race. He runs 15 miles in the first week, and each week following, he runs 3% more than the week before. Using a geometric series formula, find the total number of miles Rowan runs over the first ten weeks of training, rounded to the *nearest thousandth*.

$$S_n = \frac{a_1 - a_1 r^n}{1-r}$$

$$S_n = \frac{15 - 15(0.03)^n}{1 - 0.03}$$

$$S_{10} = \frac{15 - 15(0.03)^{10}}{1 - 0.03}$$

$$S_{10} = \boxed{172.220} \text{ miles}$$

15.
15.45
15.91
16.39
16.48
16.97
17.48

18.00
18.54
19.00

Score 0: The student made multiple errors.

30 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function $B(t) = 25.29\sin(0.4895t - 1.9752) + 55.2877$, where t is the month number (January = 1). State, to the *nearest tenth*, the average monthly rate of temperature change between August and November.

August = 8

$B(8) = 25.29\sin(0.4895 \cdot 8 - 1.9752) + 55.2877$

$B(8) = 78.86622498$

November = 11

$B(11) = 25.29\sin(0.4895 \cdot 11 - 1.9752) + 55.2877$

$B(11) = 48.59746025$

$$\frac{B(8) - B(11)}{8 - 11} = \frac{78.86622498 - 48.59746025}{8 - 11}$$

$$= \frac{30.26876473}{-3}$$

$$\approx -10.1°$$

Explain its meaning in the given context.

$-10.1°$ This means that through August to November, the temperature drops down an average of 10.1° per month.

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

30 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function $B(t) = 25.29\sin(0.4895t - 1.9752) + 55.2877$, where t is the month number (January = 1). State, to the *nearest tenth,* the average monthly rate of temperature change between August and November.

8

11

$B(8) = 25.29\sin(.4895(8) - 1.9752) + 55.2877$

$B(8) = 78.9°$

$B(11) = 25.29\sin(.4895(11) - 1.9752) + 55.2877$

$B(11) = 48.6°$ $\dfrac{48.6 - 78.9}{11 - 8} = \dfrac{-30.3}{3} = -10.3$

Explain its meaning in the given context.

The average monthly rate of temperature change between August and November is -10.3°. Given the context, this means the average monthly high temperature in Buffalo changes by an average of -10.3° each month between August and November.

Score 1: The student made a division error.

30 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function $B(t) = 25.29\sin(0.4895t - 1.9752) + 55.2877$, where t is the month number (January = 1). State, to the *nearest tenth*, the average monthly rate of temperature change between August and November.

$8 + 3 = 11$

$(8\text{th month}) \text{August} = 25.29 \sin(0.4895(8) - 1.9752) + 55.2877$

$(11\text{th month}) \text{November} = 25.29 \sin(0.4895(11) - 1.9752) + 55.2877$

$(\text{august}) \quad B(8) = 56.14 \quad \text{september} \quad B(9) = 56.36$

$\text{november} \quad B(11) = 56.79 \quad \text{October} \quad B(10) = 56.58$

Explain its meaning in the given context.

$\begin{array}{r} 56.79 \\ -56.14 \\ \hline 0.65 \end{array}$

$\dfrac{0.65}{3 \text{ (months)}}$

$\boxed{0.2}$

R

* between each month from August to November (3 months) the temperature changed about $\boxed{.2 \text{ degrees}}$

Score 1: The student was incorrectly in degree mode.

30 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function $B(t) = 25.29\sin(0.4895t - 1.9752) + 55.2877$, where t is the month number (January = 1). State, to the *nearest tenth*, the average monthly rate of temperature change between August and November.

August

$25.79\sin(0.4895(8) - 1.9752) + 55.2877$

78.8668779498

November

$25.29\sin(0.4895(11) - 1.9752) + 55.2877$

48.59796025

$$\frac{11 - 8}{48.6 - 78.9} = -.099009901$$

Explain its meaning in the given context.

Score 0: The student used an incorrect formula and gave no explanation.

30 The average monthly high temperature in Buffalo, in degrees Fahrenheit, can be modeled by the function $B(t) = 25.29\sin(0.4895t - 1.9752) + 55.2877$, where t is the month number (January = 1). State, to the *nearest tenth*, the average monthly rate of temperature change between August and November.

8

11

$$B(8) = 25.29\sin(0.4895(8) - 1.9752) + 55.2877$$
$$= 25.29\sin(1.9408) + 55.2877$$
$$= 23.57852498 + 55.2877$$
$$= 78.86622498$$

$$B(11) = 25.29\sin(.4895(11) - 1.9752) + 55.2877$$
$$= 25.29\sin(3.4093) + 55.2877$$
$$= -6.689739702 + 55.2877$$
$$= 48.5976025$$

$$= \frac{48.5976025 + 78.86622498}{2}$$

$$= 63.73209261$$

Explain its meaning in the given context.

63.7 is the average monthly rate, this means the temperature will change 63.7 degrees between these months

Score 0: The student incorrectly calculated the rate of change and gave an incorrect explanation.

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.

$$1^2 - \left(\frac{4}{7}\right)^2 = t^2$$

$$1 - \frac{16}{49} = t^2$$

$$\sqrt{\frac{33}{49}} = \sqrt{t^2}$$
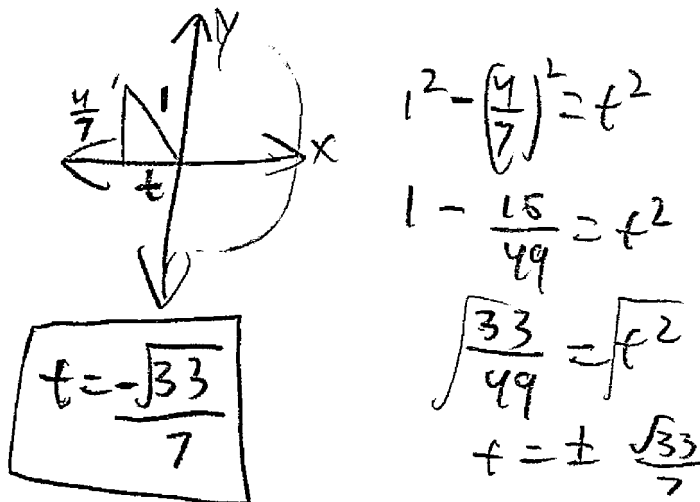
$$t = \pm \frac{\sqrt{33}}{7}$$

$$\boxed{t = \frac{-\sqrt{33}}{7}}$$

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

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.

$t = \cos\theta$

$$t = -\frac{\sqrt{33}}{7}$$
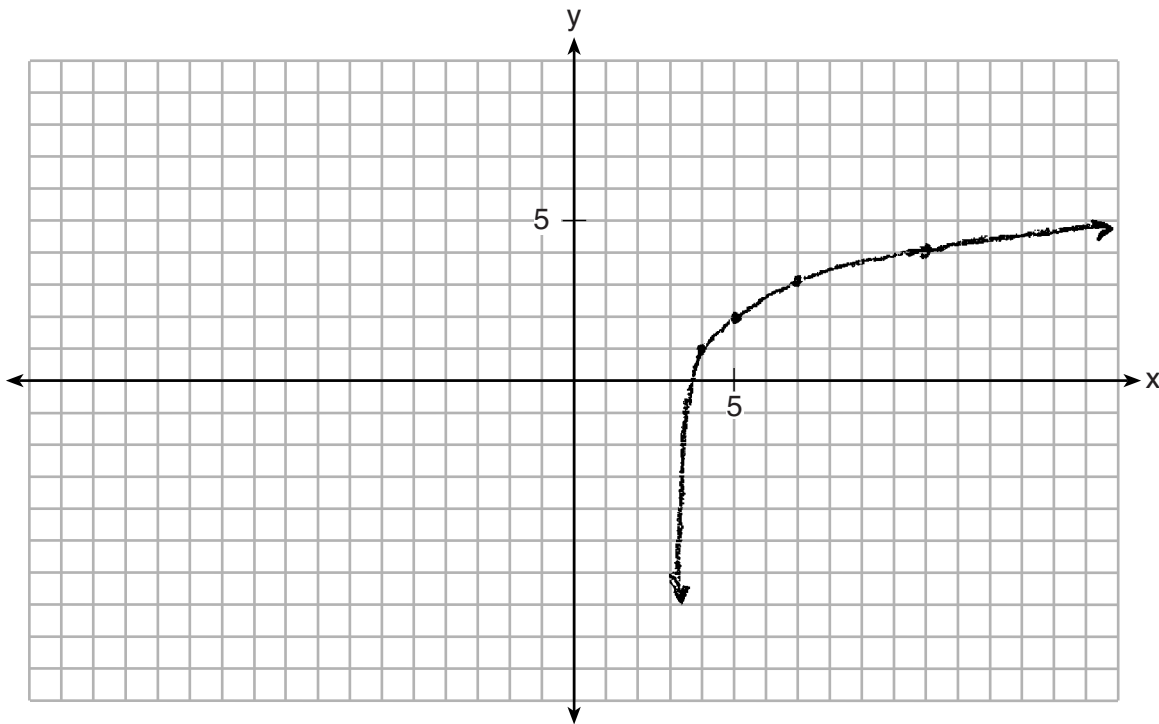
Score 2: The student gave a complete and correct response.

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.

$$\left(\frac{4}{7}\right)^2 + \left(t\right)^2 = 1^?$$

$$\frac{16}{49} + \left(t\right)^2 = 1$$

$$\frac{-16}{49} \qquad \frac{-16}{49}$$

$$\sqrt{t^2} = \sqrt{\frac{33}{49}}$$

$$t = \sqrt{\frac{33}{49}} \qquad \frac{\sqrt{33}}{\sqrt{49}} \qquad \frac{\sqrt{33}}{7}$$
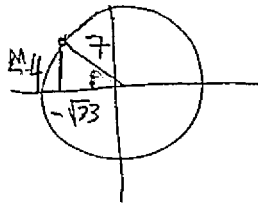
$$t = \frac{\sqrt{33}}{7}$$

Score 1: The student did not determine the correct sign of the value.

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.
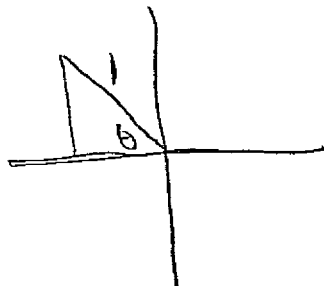
$$\left(\cos\theta, \sin\theta\right) = \left(t, \frac{4}{7}\right)$$

$$\sin\theta = \frac{4}{7}$$

$$\theta = 34.85°$$

$$\cos 34.85' = t$$

$$t = -.82$$
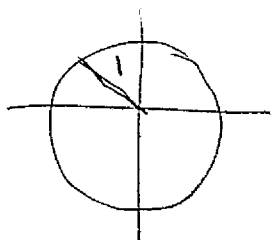
Score 1: The student did not determine the exact value.

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.
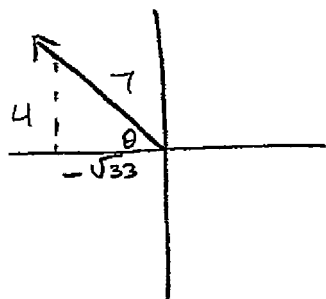
$$4^2 + b^2 = 7^2$$

$$16 + b^2 = 49$$

$$b^2 = 33$$

$$b = \sqrt{33}$$

$$t = -\sqrt{33}$$

Score 1: The student made made an error by not considering the unit circle.

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.

$\text{Cos}(M) = t$
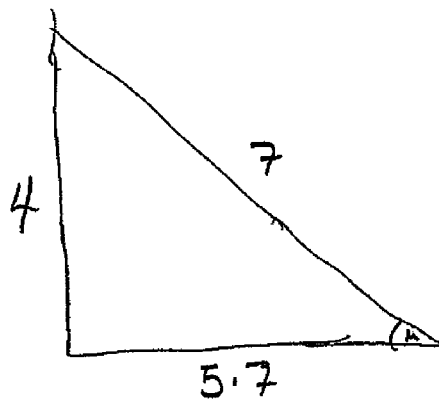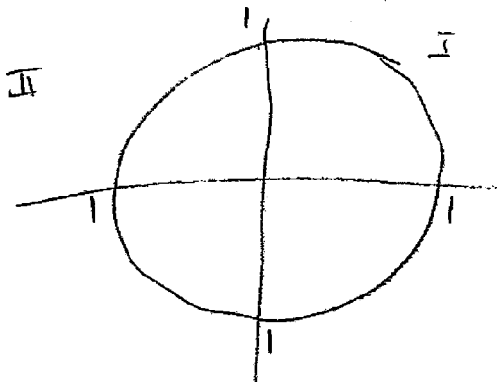
$\text{Sin}(M) = \frac{4}{7}$

$7^2 = 4^2 + b^2$

$49 = 16 + b^2$

$\sqrt{33} = \sqrt{b^2}$

$5.744562647 = b$

$\text{Cos}(M) = \frac{5.7}{7}$

$T = \frac{5.7}{7}$

Score 0: The student made multiple errors.

31 Point $M\left(t, \frac{4}{7}\right)$ is located in the second quadrant on the unit circle. Determine the exact value of t.

$\overset{x}{} \overset{y}{} \rightarrow 0.57\ldots$

- t must be negative

$(-x, y)$

$(-x, \frac{4}{7})$

II I

$(0,1)$

$\rightarrow y = 0.57\ldots$

$(-1,0)$ 0.5 $(1,0)$

$(0,-1)$

III IV
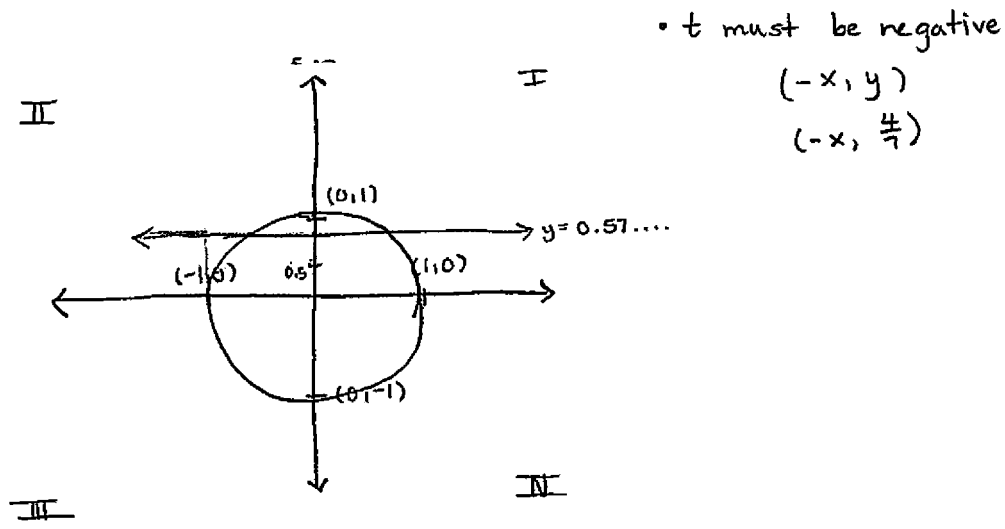
Score 0: The student gave a completely irrelevant response.

32 On the grid below, graph the function $y = \log_2(x - 3) + 1$

x	y
4	1
5	2
7	3
11	4

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

32 On the grid below, graph the function $y = \log_2(x - 3) + 1$

x	y
4	1
5	2
7	3
11	4

Score 1: The student made an error graphing the end behavior as $x \to 3$.

Question 32

32 On the grid below, graph the function $y = \log_2(x - 3) + 1$
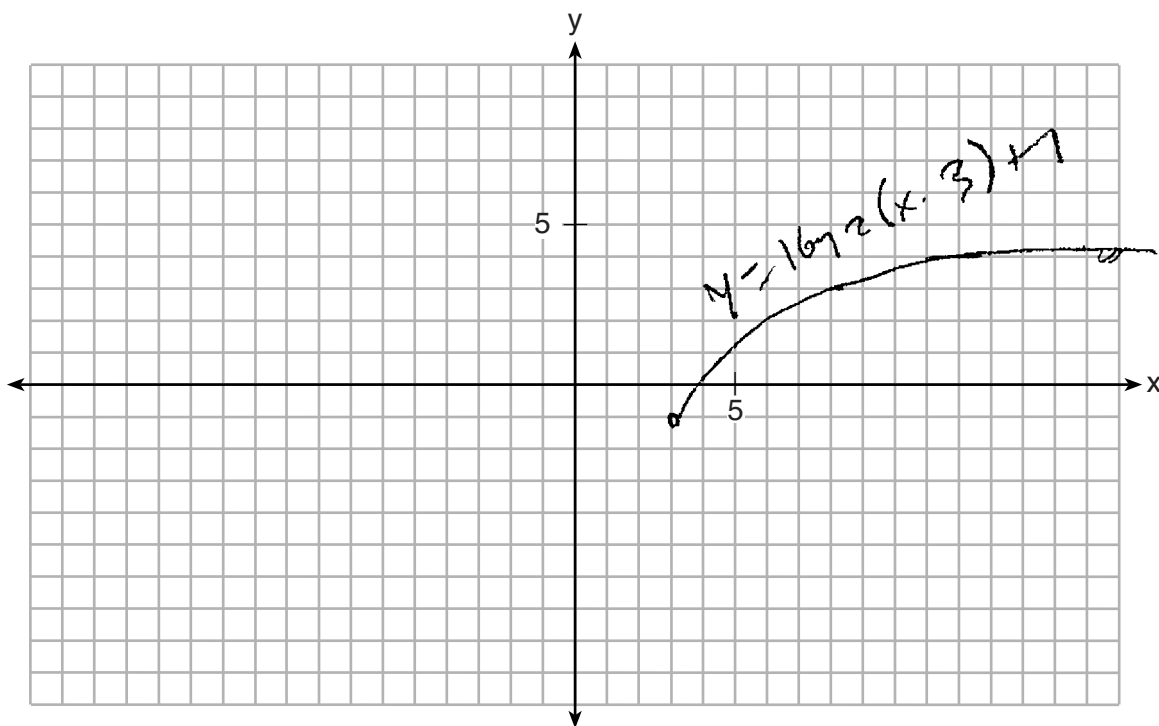
Score 0: The student made multiple graphing errors.

32 On the grid below, graph the function $y = \log_2(x - 3) + 1$

Score 0: The student made multiple graphing errors.

33 Solve the following system of equations algebraically for all values of a, b, and c.

$$a + 4b + 6c = 23$$
$$a + 2b + c = 2$$
$$6b + 2c = a + 14 \quad \rightarrow \quad -a + 6b + 2c = 14$$

$6b + 2c = a + 14$

$a + 4b + 6c = 23$

$-a + 6b + 2c = 14$

$10b + 8c = 37$

$3(10b + 8c = 37)$
$-8(8b + 3c = 16)$

$30b + 24c = 111$
$-64b + 24c = -128$

$\dfrac{-34b}{-34} = \dfrac{-17}{-34}$

$b = 0.5$

$6b + 2c = a + 14$
$a + 2b + c = 2$
$-a + 6b + 2c = 14$

$8b + 3c = 16$

$8b + 3c = 16$
$8(0.5) + 3c = 16$
$\dfrac{4 + 3c = 16}{-4 \quad -4}$
$\dfrac{3c}{3} = \dfrac{12}{3}$
$c = 4$

$a + 2b + c = 2$
$a + 2(0.5) + 4 = 2$
$a + 1 + 4 = 2$
$\dfrac{a + 5 = 2}{-5 \quad -5}$
$a = -3$

$a + 4b + 6c = 23$
$-3 + 4(0.5) + 6(4) = 23$
$-3 + 2 + 24 = 23$

$6b + 2c = a + 14$
$6(0.5) + 2(4) = -3 + 14$
$3 + 8 = 11$

$a = -3$
$b = 0.5$
$c = 4$

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

33 Solve the following system of equations algebraically for all values of a, b, and c.

$$-a + 4b + 6c = 23$$
$$-a + 2b + c = 2$$
$$-a + 6b + 2c = a + 14$$

$a = -3$

$b = 0.5$

$c = 4$

Check

$a + 2b + c = 2$

$-3 + 2(.5) + 4 = 2$

$2 = 2$

$-8b - 12c = -84$
$5(8b + 3c = 16)$
$3(-2b - 5c = -21)$

$-17c = \dfrac{-68}{-17}$

$c = 4$

$40b + 15c = 80$
$-6b - 15c = -63$
$\overline{34b = \dfrac{17}{34}} =$

$b = 0.5$

$a + 2(.5) + 4 = 2$

$a = -3$

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

33 Solve the following system of equations algebraically for all values of a, b, and c.

1) $a + 4b + 6c = 23$
2) $a + 2b + c = 2$
   $6b + 2c = a + 14$
3) $-a + 6b + 2c = 14$

$-a + 6b + 2c = 14$
$a + 2b + c = 2$
_____
5) $8b + 3c = 16$

$a + 4b + 6c = 23$
$-a - 2b - c = -2$
_____
6) $2b + 5c = 21$

$8b + 3c = 16$
$-8b - 20c = -84$
_____
$-17c = -68$
$\overline{-17}$ $\overline{-17}$
$\boxed{c = 4}$

$-4(2b + 5c = 21)$
$-8b - 20c = -84$

$2b + 5c = 21$
$2b + 5(4) = 21$
$2b + 20 = 21$
$2b = 1$
$\boxed{b = 2}$

$a + 2b + c = 2$
$a + 2(2) + 4 = 2$
$a + 4 + 4 = 2$
$a + 8 = 2$
$\underline{-8 \quad -8}$
$\boxed{a = -6}$

Score 3: The student made a mistake when evaluating b.

33 Solve the following system of equations algebraically for all values of a, b, and c.

$$a + 4b + 6c = 23$$
$$-a + 2b + c = 2$$
$$-a + 6b + 2c = a + 14$$

$$-5(2b + 5c = 21)$$
$$10b + 8c = 36$$

$$-10b - 25c = -105$$
$$10b + 8c = 36$$

$$-17c = -69$$

$$\boxed{c = 4}$$

$$10b + 8(4) = 36$$

$$10b = 4$$

$$\boxed{b = \frac{2}{5}}$$

$$a + 4\left(\frac{2}{5}\right) + 6(4) = 23$$

$$a + 4\left(\frac{2}{5}\right) = -1$$

$$\boxed{a = -2.6}$$

Score 2: The student made two computational errors.

33 Solve the following system of equations algebraically for all values of a, b, and c.

$$① \quad a + 4b + 6c = 23$$
$$② \quad a + 2b + c = 2$$
$$③ \quad 6b + 2c = a + 14 \quad → \quad -a + 6b + 2c = 14$$

① add eqn 1 and eqn 3

$$\not a + 4b + 6c = 23$$
$$-\not a + 6b + 2c = 14$$
$$\overline{10b + 8c = 37}$$

② add eqn 3 and eqn 2

$$-\not a + 6b + 2c = 14$$
$$\not a + 2b + c = 2$$
$$\overline{8b + 3c = 16}$$

$$(10b + 8c = 37)·8 \quad → \quad -80b - 64c = 296$$
$$(8b + 3c = 16)·10 \quad → \quad 80b + 30c = 160$$

$$-80\not b + 64c = 296$$
$$80b + 30c = 160$$
$$\overline{\frac{-34c}{-34} = \frac{456}{-34}}$$
$$C = -13.4$$

$$10b + 8(-13.4) = 37$$
$$10b + 107.2$$
$$10b = 144.2$$
$$b = 14.42$$

$$a + 2b + c = 2$$
$$a + 2(14.42) - 13.4 = 2$$
$$a + 15.44 = 2$$
$$a = -13.44$$

Score 2:   The student made one computational error and one rounding error.

33 Solve the following system of equations algebraically for all values of a, b, and c.

$$L_1 \quad a + 4b + 6c = 23$$
$$L_2 \quad a + 2b + c = 2$$
$$L_3 \quad 6b + 2c = a + 14$$
$$-a + 6b + 2c = 14$$

① $L_1 + (L_2) - 1$

$$+ \quad \begin{array}{l} a + 4b + 6c = 23 \\ -1(a + 2b + c = 2) \end{array}$$

$$\begin{array}{l} a + 4b + 6c = 23 \\ -a - 2b - c = -2 \end{array}$$

$$L_4 : 2b + 5c = 21$$

② $L_1 + L_3$

$$+ \quad \begin{array}{l} a + 4b + 6c = 23 \\ -a + 6b + 2c = 14 \end{array}$$

$$L_5 : 10b + 8c = 37$$

③ $5(L_4) + L_5$

Score 1: The student showed correct work to eliminate one variable.

33 Solve the following system of equations algebraically for all values of a, b, and c.

$$a + 4b + 6c = 23$$
$$a + 2b + c = 2$$
$$6b + 2c = a + 14$$

① $-\dfrac{a + 4b + 6c = 23}{a + 2b + c = 2}$

$2b + 5c = 21$

② $\dfrac{a + 2b + c = 2}{-a + 6b + 2c = 14}$

$8b + 3c = 16$

③ $2b + 5c = 21 \,(4)$

$8b + 3c = 16$

$-\dfrac{8b + 20c = 84}{8b + 3c = 16}$

$17c = 100$

$6b + 2c = a + 14$
$\quad\; -a$
$-a + 6b + 2c = 14$

33 Solve the following system of equations algebraically for all values of a, b, and c.

$$a + 4b + 6c = 23$$
$$a + 2b + c = 2$$
$$6b + 2c = a + 14$$

$-1 (a+4b+6c =23)$
$1 (a+2b+c=2)$

$-\cancel{a}-4b-6c = -23$
$+\cancel{a} +2b+c = 2$

$\boxed{-2b -5c = -21}$

$-6(a+4b+6c=23)$
$1 (6b+2c =a+14)$

$-6\cancel{a} -24b-36c = -183$
$6b+2c = a+14$

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$
\begin{array}{r}
x^3+4 \\
x+2\,\overline{)\,x^4+2x^3+4x-10} \\
x^4 \mp 2x^3 \\
\hline
0+4x-10 \\
-4x \mp 8 \\
\hline
-18
\end{array}
$$

$$\boxed{x^3 + 4 + \frac{-18}{x+2}}$$

Is $b(x)$ a factor of $a(x)$? Explain.

no, because when I divided it, the remainder was −18, not 0.

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

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$a(x) = x^4 + 2x^3 + 4x - 10 \Rightarrow \frac{a(x)}{b(x)}$$
$$b(x) = x + 2$$

$$
\begin{array}{r}
x^3 + 4 + \frac{-2}{x+2} \\
x+2 \overline{\smash{)}\, x^4 + 2x^3 + 4x - 10} \\
-\ x^4 + 2x^3 \\
\hline
0 + 4x \\
-\ 4x + 8 \\
\hline
8 - 10 \Rightarrow
\end{array}
$$

remainder
-2

$$\boxed{x^3 + 4 + \frac{-2}{x+2}}$$

Is $b(x)$ a factor of $a(x)$? Explain.

(bx) is not a factor of a(x) because when a(x) is divided by ~~a~~ b(x) a ~~factors~~ remainder is present.

Score 3: The student made an error in calculating the remainder.

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$
\begin{array}{r}
x^3 \qquad\qquad +4 \\
x+2 \overline{\smash{\big)}\, x^4 + 2x^3 + 0x^2 + 4x - 10} \\
-(x^4 + 2x^3) \quad -(4x + 8) \\
\overline{0 \quad 0} \\
-18
\end{array}
$$

$$\frac{a(x)}{b(x)} = x^3 + 4 + \frac{-18}{x+2}$$

Is $b(x)$ a factor of $a(x)$? Explain.

The remainder is not 0

Score 3: The student did not indicate that $b(x)$ is not a factor.

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$
\begin{array}{r}
x^3 + 4 \\
x+2 \overline{\smash{\big)}\, x^4 + 2x^3 + 4x - 10} \\
\underline{x^4 + 2x^3} \\
+4x - 10 \\
\underline{-\ 4x + 8} \\
-18
\end{array}
$$

$$\frac{(x+2)(x^3+4) - 18}{x+2}$$

$$= x^3 + 4 - \frac{18}{x+2}.$$

Is $b(x)$ a factor of $a(x)$? Explain.

$$\underline{N_0}$$

because $\left(\dfrac{-18}{x+2}\right)$

Score 3: The student provided an incomplete explanation.

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$\frac{x^4 + 2x^3 + 4x - 10}{x + 2}$$

$$\frac{x^3(x + 2) + 2(2x - 5)}{x + 2}$$

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

$$\boxed{x^3 + 4x - 10}$$

Is $b(x)$ a factor of $a(x)$? Explain.

b(x) isn't a factor because when you graph a(x), the zeros aren't at -2. x+2 means that a zero would go through the x-axis at -2.

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

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$
\begin{array}{r}
x^3 \qquad 0x + 4 \\
x+2 \overline{)\; x^4 + 2x^3 + 0x^2 + 4x - 10} \\
-\; x^4 + 2x^3 \qquad \downarrow \\
\hline
0x^2 + 4x \\
-\; 0x^2 + 0x \quad \downarrow \\
\hline
4x - 10 \\
-\; 4x + 8 \\
\hline
-16
\end{array}
$$

Is $b(x)$ a factor of $a(x)$? Explain.

no, because the remainder is not 0.

Score 2: The student made a computational error and did not state the answer in the correct form.

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$\frac{X^4 + 2x^3 + 4x - 10}{X + 2}$$

$$\begin{array}{r|rrrrr} -2 & 1 & 2 & 0 & 4 & -10 \\ \hline & 1 & 0 & 0 & 4 & \underline{-18} \end{array}$$

$$X^3 + 4 \quad \longrightarrow \quad \boxed{X^3 + 4 + \frac{-18}{2}}$$

$$\text{Remainder} : -18$$

Is $b(x)$ a factor of $a(x)$? Explain.

Score 1: The student did not state $b(x)$ correctly.

34 Given $a(x) = x^4 + 2x^3 + 4x - 10$ and $b(x) = x + 2$, determine $\dfrac{a(x)}{b(x)}$ in the form $q(x) + \dfrac{r(x)}{b(x)}$.

$$\frac{x^4 + 2x^3 + 4x - 10}{x + 2}$$

$$\frac{x^3(x+2) + 2(x-5)}{x+2}$$

$$x^3 + 2(x-5)$$
$$x^3 + 2x - 10$$

Is $b(x)$ a factor of $a(x)$? Explain.

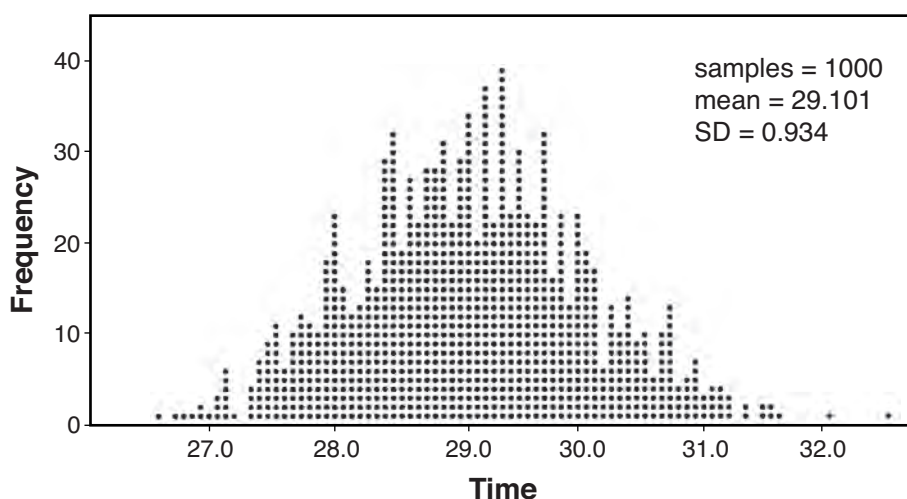Yes it is because when $x^4 + 2x^3$ is factored the result is $x^3(x+2)$ and $b(x) = x+2$.

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

35 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

$\overline{x}$	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.

samples = 1000
mean = 29.101
SD = 0.934

Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

$$29.101 \pm 2(.934)$$

$$(27.23, 30.97)$$

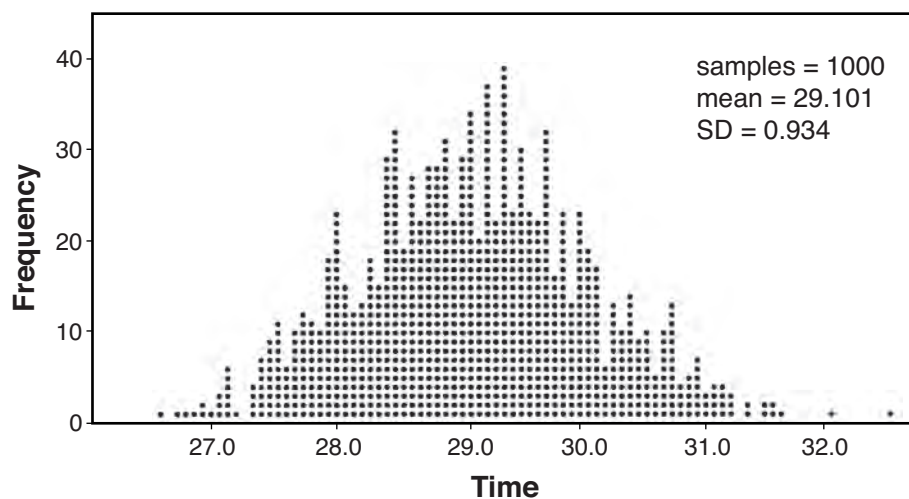Yes, 30 falls within the interval, so the claim is plausible.

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

35 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

$\bar{x}$	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.

Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

27.233 28.167 29.101 30.035 30.969

.934 .934 .934 .934

30.0

30 minutes is plausible because it falls withing the interval 27.233 – 30.969.

Score 3: The student made a rounding error.

35 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

$\overline{x}$	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.

samples = 1000
mean = 29.101
SD = 0.934
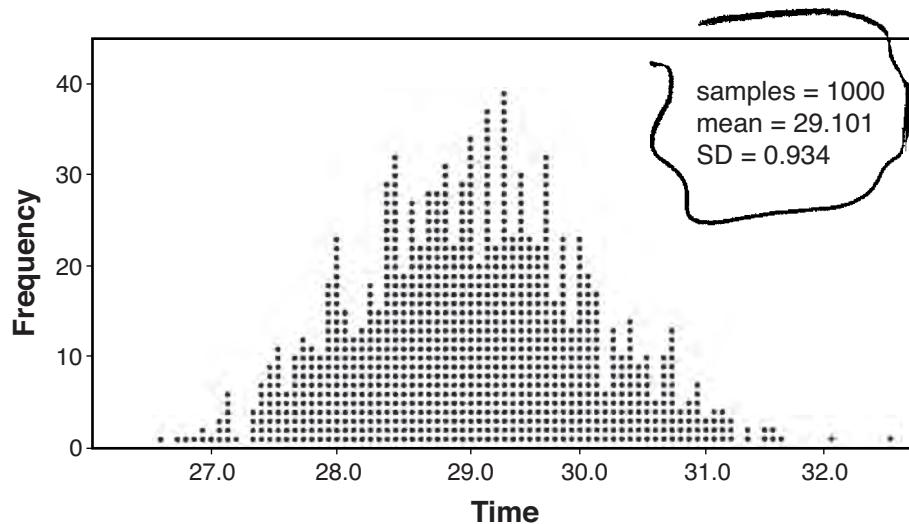
Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

To say the average is 30 would be appropriate because the margin of error is 1.87 and the mean is 29.101 therefore 30 is not inappropriate and it could be possible. (29.101 + 1.868 = 30.969)

M.O. : 2 = 2σ
↓
1.868
could occur

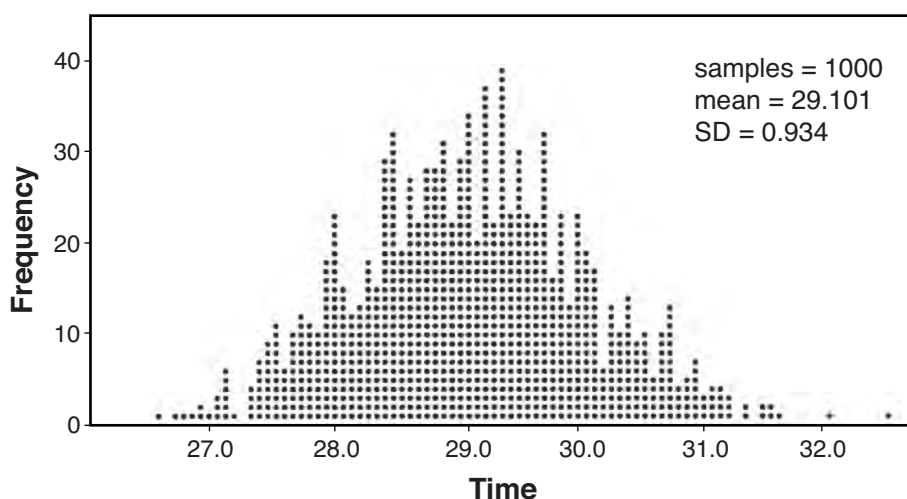**Score 2:** The student did not round correctly and provided an incomplete interval.

35 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

$\overline{x}$	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.

samples = 1000
mean = 29.101
SD = 0.934

Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

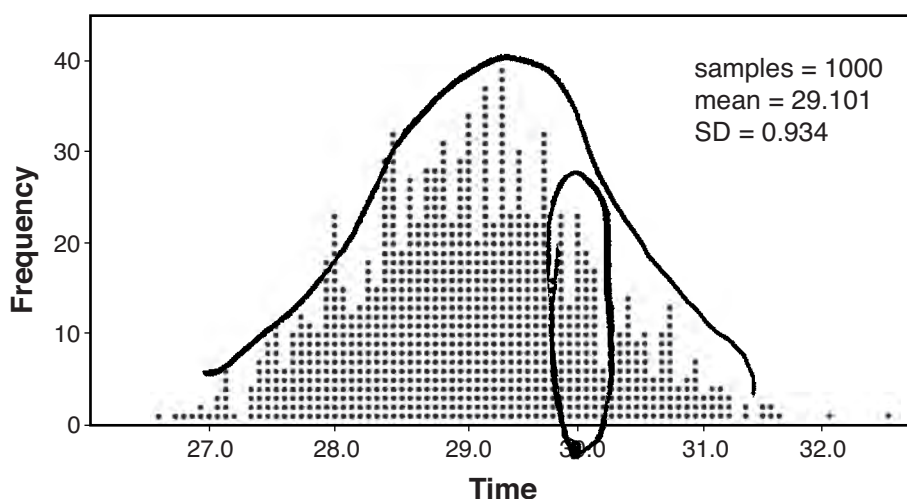$$27.233 \xleftarrow{-2\sigma} 29.101 \xrightarrow{+2\sigma} 30.969$$

Score 1: The student didn't round the interval correctly.

35 A radio station claims to its advertisers that the mean number of minutes commuters listen to the station is 30. The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

$\overline{x}$	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.

Based on the simulation results, is the claim that commuters listen to the station on average 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

I+ is because its within the interval 95% percentile.

Score 0: The student did not provide an interval and provided an irrelevant explanation.

35 A radio station claims to its advertisers that the <u>mean number</u> of minutes commuters listen to the station <u>is 30.</u> The station conducted a survey of 500 of their listeners who commute. The sample statistics are shown below.

Mean = 30

$\bar{x}$	29.11
s_x	20.718

A simulation was run 1000 times based upon the results of the survey. The results of the simulation appear below.

samples = 1000
mean = 29.101
SD = 0.934
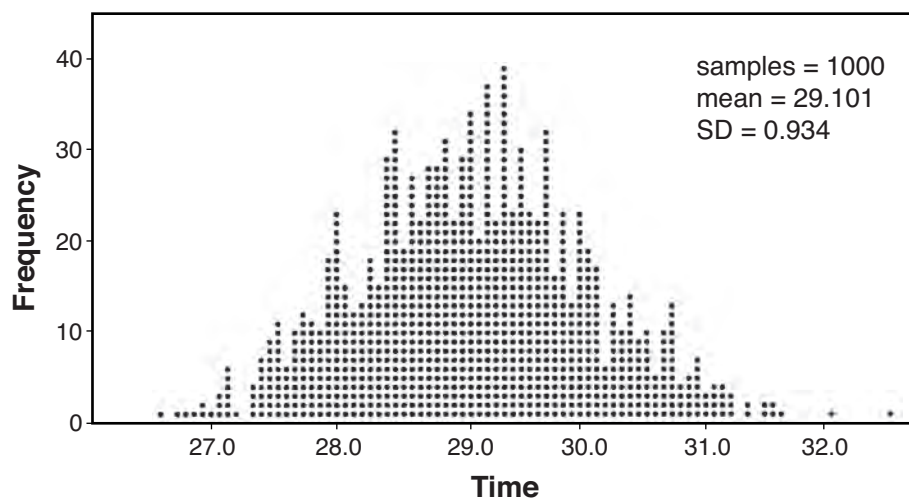
Mean = 29.1

Based on the simulation results, is the claim that commuters listen to the station on <u>average</u> 30 minutes plausible? Explain your response including an interval containing the middle 95% of the data, rounded to the *nearest hundredth*.

NO, the middle number is 30/29.1 so there for there is no majority listening over 30 minutes. Most listened for under 30.

Score 0: The student provided a completely incoherent response.

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

$3\sqrt{x} = -5 + 2x$

$9x = (-5 + 2x)^2$

$9x = 25 - 20x + 4x^2$

$9x - 25 + 20x - 4x^2 = 0$

$29x - 25 - 4x^2 = 0$

$-4x^2 + 29x - 25 = 0$

$4x^2 - 29x + 25 = 0$

$x = \dfrac{-(-29) \pm \sqrt{(-29)^2 - 4 \times 4 \times 25}}{2 \times 4}$

$x = \dfrac{29 \pm \sqrt{841 - 400}}{8}$

$x = \dfrac{29 \pm \sqrt{441}}{8}$

$x = \dfrac{29 \pm 21}{8}$

$x = \dfrac{25}{4} \qquad x = 1$

$3\sqrt{\dfrac{25}{4}} - 2 \times \dfrac{25}{4} = -5$

$3\sqrt{1} - 2 \times 1 = -5$

$-5 = -5$

$1 = -5$

$x = \dfrac{25}{4}$

$x \neq 1$

$\boxed{X = 6.25}$

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

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

$4x - 25 = 0$
$+25 +25$

$\dfrac{4x}{4} = \dfrac{25}{4}$

$\boxed{x = 6.25}$

$x - 1 = 0$
$+1 +1$

$\boxed{x = 1}$ reject

$\sqrt{9x} - 2x = -5 + 2x$
$\phantom{\sqrt{9x}} +2x$

$\left(\sqrt{9x}\right)^2 \left(-5 + 2x\right)^2$

$9x = (-5 + 2x)(-5 + 2x)$

$9x = 25 - 10x + 4x^2$
$ -10x$

$9x = 4x^2 - 20x + 25$
$-9x -9x$

$0 = 4x^2 - 29x + 25$

$0 = 4x^2 - 4x - 25x + 25$

$0 = 4x(x - 1) - 25(x - 1)$

$0 = (4x - 25)(x - 1)$

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

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

$$3\sqrt{x} = 2x - 5$$

$$\sqrt{x} = \frac{2x - 5}{3}$$

$$x = \frac{4x^2 - 20x + 25}{9}$$

$$9x = 4x^2 - 20x + 25$$

$$0 = 4x^2 - 29x + 25$$

$$\begin{array}{cc} 4 & -1 \\ 4 & -25 \end{array}$$

$$(x - 1)(4x - 25)$$

$$x_1 = 1 \qquad x_2 = \frac{25}{4}$$

$$x_1 = 1 \qquad x_2 = 6.25$$

Score 3: The student did not reject one solution.

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

$$3\sqrt{x} - 2x = -5$$

$$\sqrt{x} = \frac{-5+2x}{3}$$

$$x = \left(\frac{-5+2x}{3}\right)^2$$

$$x = \frac{25+4x^2}{9}$$

$$9x = 25 + 4x^2$$

$$0 = 4x^2 - 9x + 25$$

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

$$x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(4)(25)}}{2(4)}$$

$$= \frac{9 \pm \sqrt{81 - 400}}{8}$$

$$= \frac{9 \pm \sqrt{-319}}{8}$$

No solution

Score 2: The student did not correctly square the binomial $-5 + 2x$.

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

$(2x-5)(2x-5)$

$4x^2-10x-10x+25$

$(3\sqrt{x})^2=(2x-5)^2$

$9x = 4x^2-20x+25$

$0 = 4x^2-29x+25$

$x = \dfrac{-(-29)\pm\sqrt{-29^2-4(4(25))}}{2(4)}$

$x = \dfrac{29\pm\sqrt{441}}{4}$

$x = \dfrac{29\pm21}{4}$

$x = 12.5$

$x = 2$

Score 2:   The student correctly stated the quadratic equation, but made multiple errors after that.

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

$$\phantom{3\sqrt{x}}\underset{+5}{}\underset{+5}{}$$

$$\left(\sqrt{9x} - 2x + 5 = 0\right)^2$$

$$9x - 4x^2 + 25 = 0$$

$$-4x^2 + 9x + 25 = 0$$

$$4x^2 - 9x - 25 = 0$$

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

$$\frac{9 \pm \sqrt{81 - 4(4)(-25)}}{8}$$

$$\frac{9 \pm \sqrt{81 - 400}}{8}$$

$$\frac{9 \pm \sqrt{481}}{8}$$

$$\frac{9 \pm \sqrt{481}}{8}$$

or

$$\frac{9 - \sqrt{481}}{8}$$

Score 1: The student incorrectly squared a trinomial and didn't reject the answers.

36 Solve the given equation algebraically for all values of x.

$$3\sqrt{x} - 2x = -5$$

$$3\sqrt{x} - 2x = -5$$
$$+2x \quad +2x$$
$$\overline{}$$
$$(3\sqrt{x}) = (-5 + 2x)$$
$$\frac{3x}{3} = \frac{-5 + 2x}{3}$$

$$\boxed{X = \frac{-5 + 2X}{3}}$$

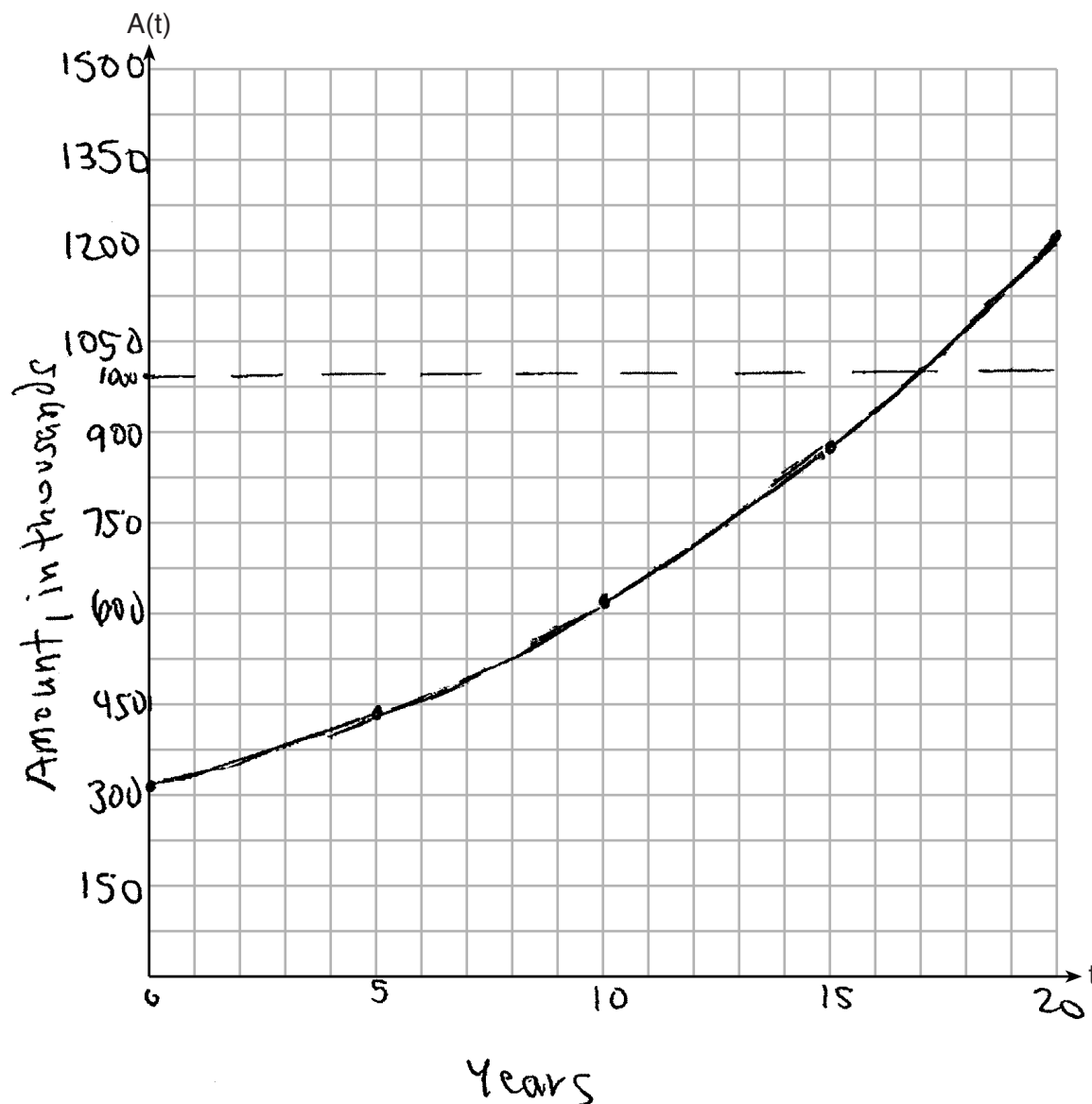**Score 0:** The student did not show enough correct work to receive any credit.

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$A(t) = 318000(1.07)^t$$

Graph $A(t)$ where $0 \le t \le 20$ on the set of axes below.

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

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

$$1000000 = 318000(1.07)^t$$

$$\frac{500}{159} = 1.07^t$$

$$\ln\left(\frac{500}{159}\right) = \ln 1.07^t$$

$$\frac{\ln\left(\frac{500}{159}\right)}{\ln 1.07} = \frac{t \ln 1.07}{\ln 1.07}$$

$$16:93\ldots = t$$

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

Explain how your graph of $A(t)$ confirms your answer.

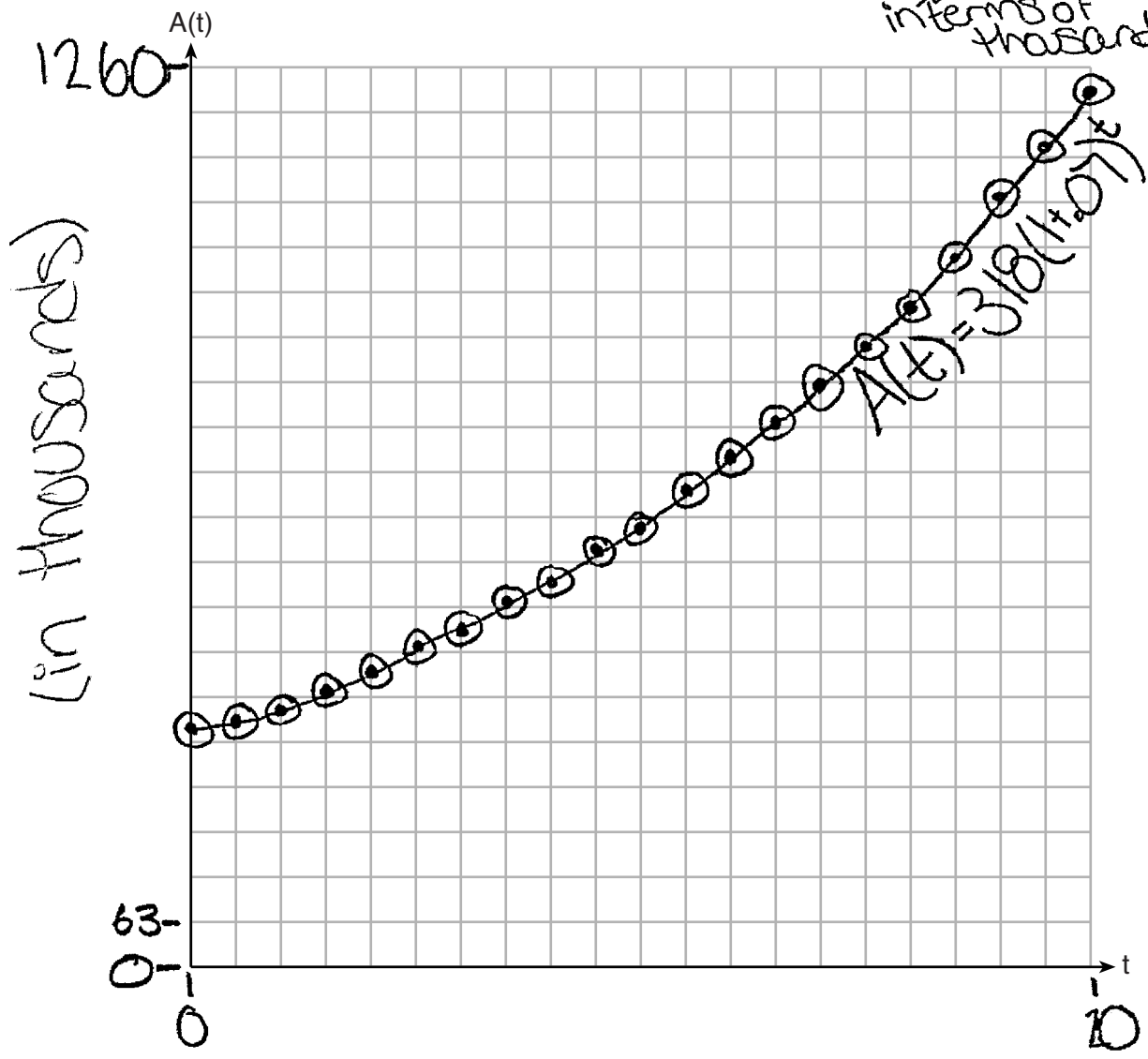The graph of $A(t)$ crosses the line $y = 1000$ (really $1,000,000$) where $X \approx 17$.

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$A(t) = 318,000(1.07)^t$

$A(t) = 318(1+.07)^t$

Graph $A(t)$ where $0 \leq t \leq 20$ on the set of axes below.

in terms of thousands

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

Tony's goal is to save \$1,000,000. Determine algebraically, to the *nearest year,* how many years it will take for him to achieve his goal.

$$1,000 = 318(1+.07)^t$$

$$\frac{1000}{318} = (1.07)^t$$

$$\log\left(\frac{1000}{318}\right) = \log\left((1.07)^t\right)$$

$$\log\left(\frac{1000}{318}\right) = t\log(1.07)$$

$$\frac{}{\log(1.07)}$$

$$16.93\ldots = t \qquad \boxed{17\,years}$$

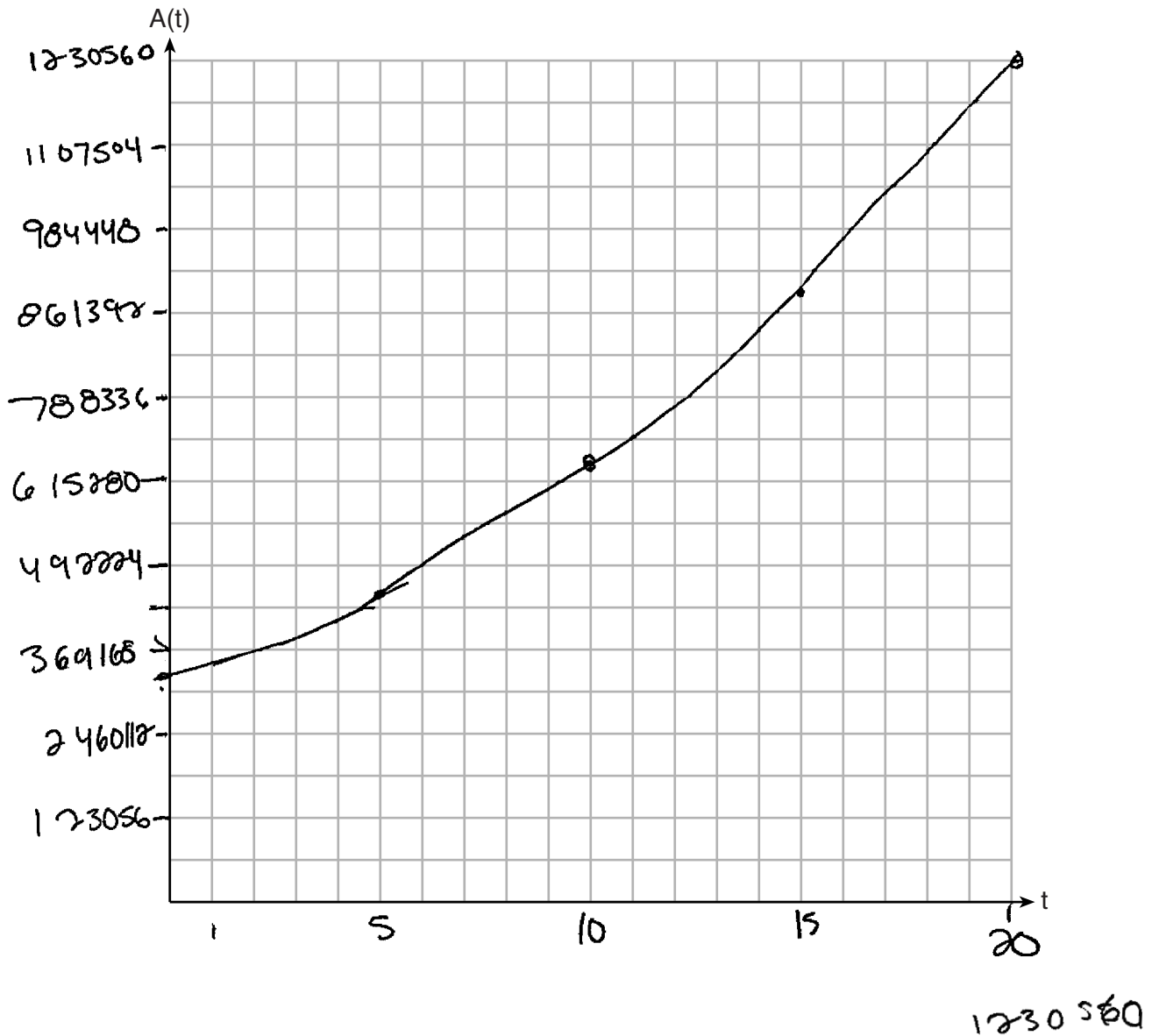Explain how your graph of *A(t)* confirms your answer.

It is about
1,000 at 17 years

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$A(t) = 318\,000(1.07)^t$$

Graph $A(t)$ where $0 \le t \le 20$ on the set of axes below.

A(t)
1230560
1107504
984448
861398
788336
615280
492224
369168
246012
123056

5   10   15   20   t

1230 560

Score 5: The student made a scaling error on the vertical axis.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

$$1\,000\,000 = 318000(1.07)^t$$
$$\overline{318000}$$

$$\frac{1000\,000}{318\,000} = 1.07^t$$

$$\log_{1.07}\frac{1000000}{318000} = t$$

$$17 \approx t$$

Explain how your graph of $A(t)$ confirms your answer.
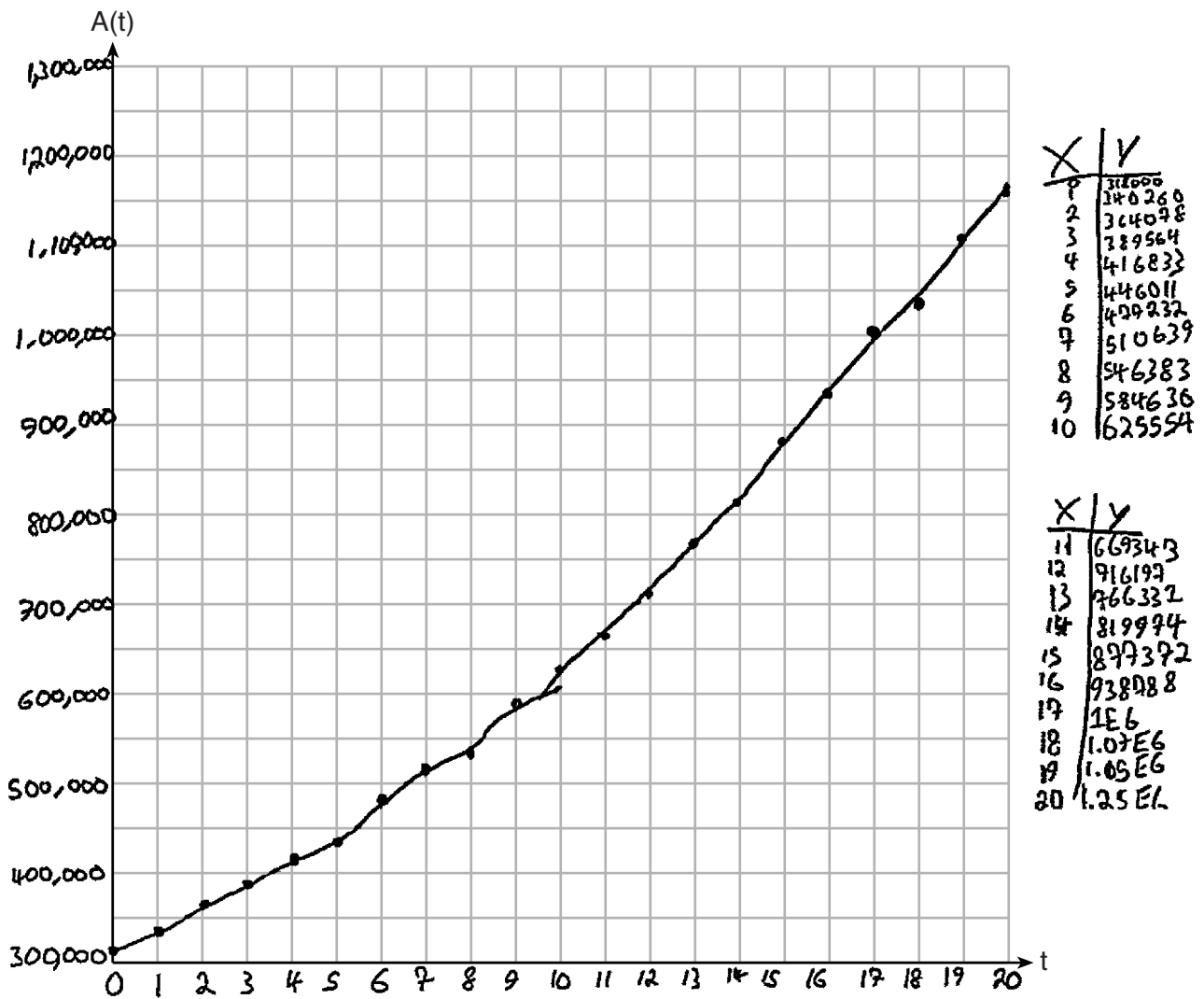
$$\text{At } t=17, \ A(t) \text{ is } \sim 1,000,000.$$

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$A(t) = 318,000(1.07)^t$$

Graph $A(t)$ where $0 \le t \le 20$ on the set of axes below.

X	Y
0	318000
1	340260
2	364078
3	389564
4	416833
5	446011
6	477232
7	510639
8	546383
9	584636
10	625554

X	Y
11	669343
12	716197
13	766332
14	819974
15	877372
16	938088
17	1E6
18	1.07E6
19	1.05E6
20	1.25EL

Score 4: The student made a scaling error on the vertical axis and a graphing error at $t = 20$.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

$$1,000,000 = 318000(1.07)^t$$

$$\log\left(\frac{1,000,000}{318,000}\right) = t\log(1.07)$$

$$\frac{\log\left(\frac{1,000,000}{318,000}\right)}{\log(1.07)} = t$$

$$t \approx 17 \text{ years}$$

Explain how your graph of $A(t)$ confirms your answer.

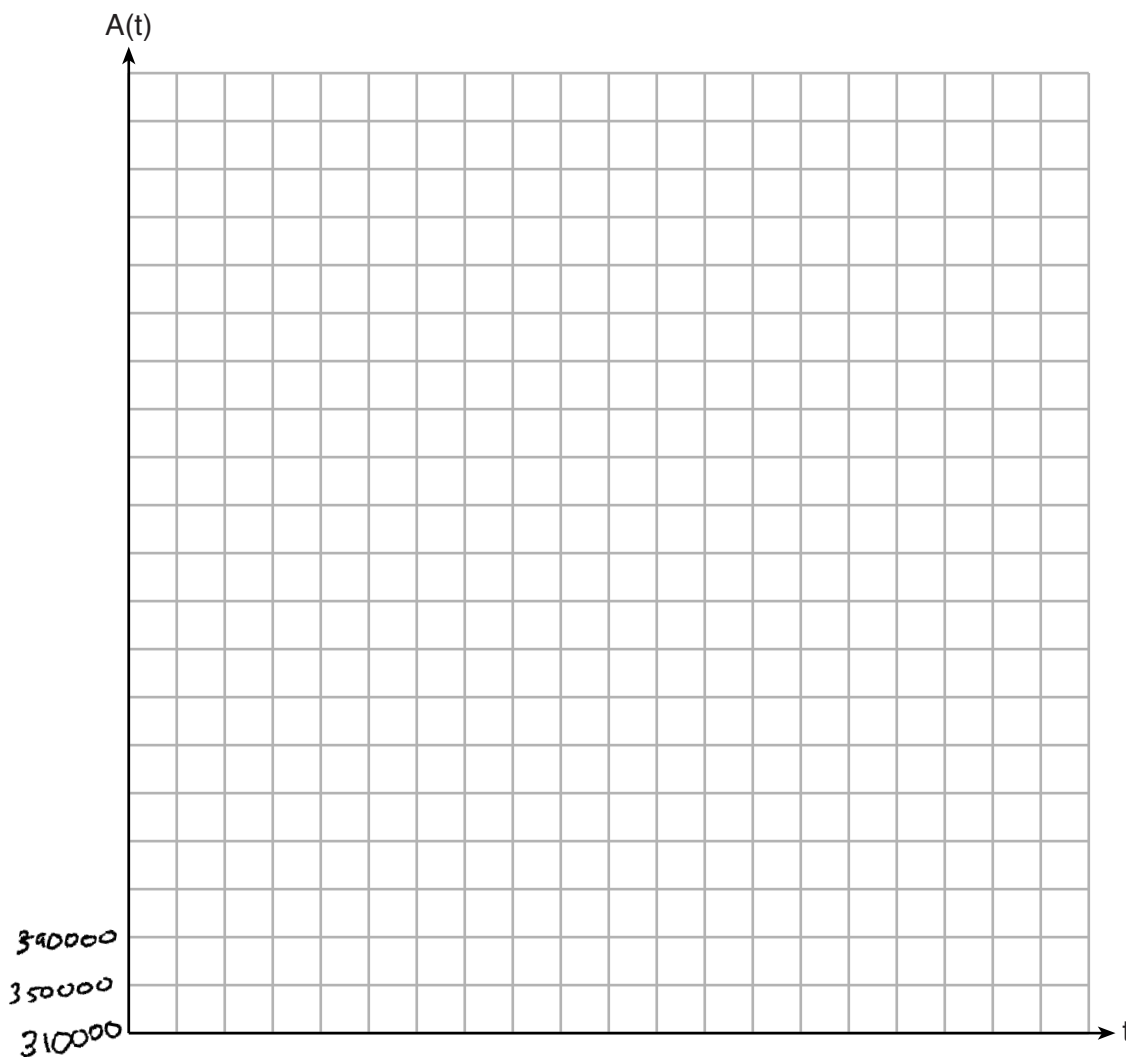At $x = 17$ the graph very closely reaches $y = 1,000,000$.

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$A = 318000 \, (1 + .07)^t$$

Graph $A(t)$ where $0 \leq t \leq 20$ on the set of axes below.

A(t)

390000
350000
310000

t

Score 3: The student did not graph the function and provided an incorrect explanation.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

$$1000000 = 318000 (1+.07)^t$$

$$3.144654 = 1.07^t$$

$$\frac{\log 3.144654}{\log 1.07} = \frac{t \log 1.07}{\log 1.07}$$

$$16.93359123 = t$$

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

Explain how your graph of $A(t)$ confirms your answer.
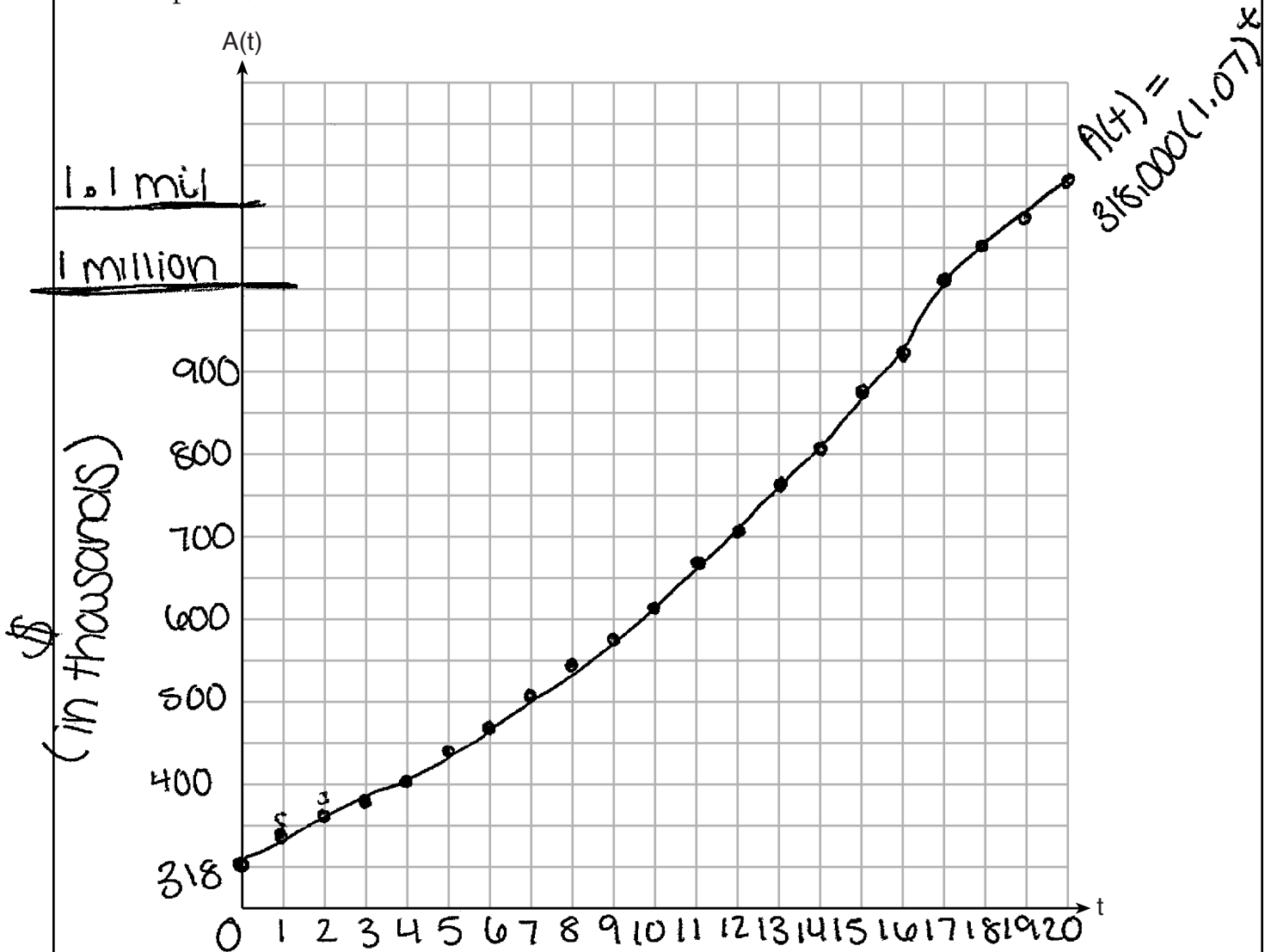
when the x value is at 17 the y value is at 1000000.

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$A(t) = 318,000(1 + 0.07)^t$$

Graph $A(t)$ where $0 \leq t \leq 20$ on the set of axes below.

Score 2: The student provided a correct function but made one graphing error scaling the vertical axis and provided no further correct work.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

$$A(t) = 318(1.07)^t$$

$$\frac{1,000,000}{1.07} = 318,000\frac{(1.07)^t}{1.07}$$

$$934579.4393 = 318,000^t$$
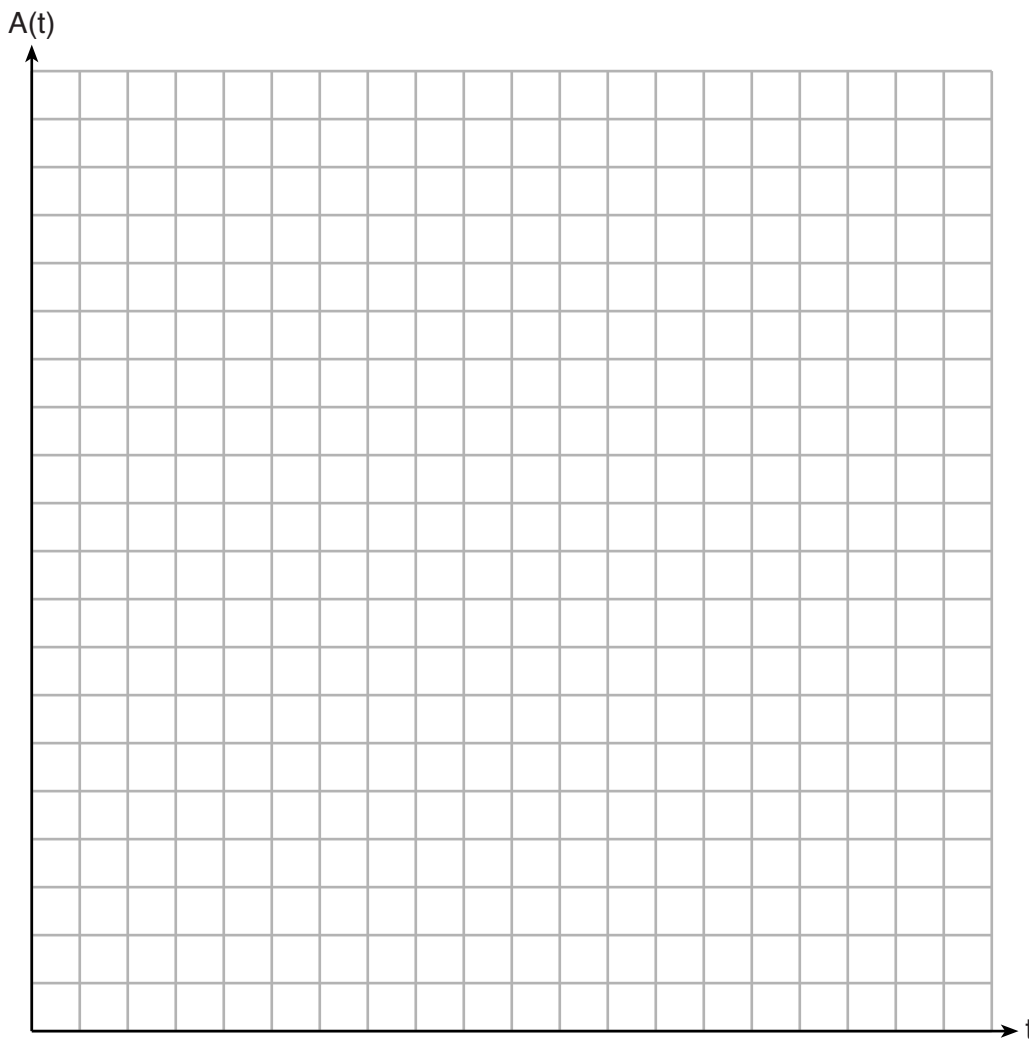
Explain how your graph of $A(t)$ confirms your answer.

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$A(t) = 318000(1 + 0.07)^t$$

Graph $A(t)$ where $0 \leq t \leq 20$ on the set of axes below.

A(t)

Score 2: The student provided a correct function and found 17 using a method other than algebraic.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

$$318000(1+0.07)^{17} = 1004503.237$$

$$\approx 1,000000$$

Tony will make 1000000 in approximately 17 years

Explain how your graph of $A(t)$ confirms your answer.

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$A(t) = 318,000\,(1 + .07)^t$$

Graph $A(t)$ where $0 \le t \le 20$ on the set of axes below.

Score 1: The student only provided a correct function.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

$$318,000 \left(1 + .07\right)^{18}$$

$$107\,4818 = 18 \text{ yrs.}$$

Explain how your graph of $A(t)$ confirms your answer.
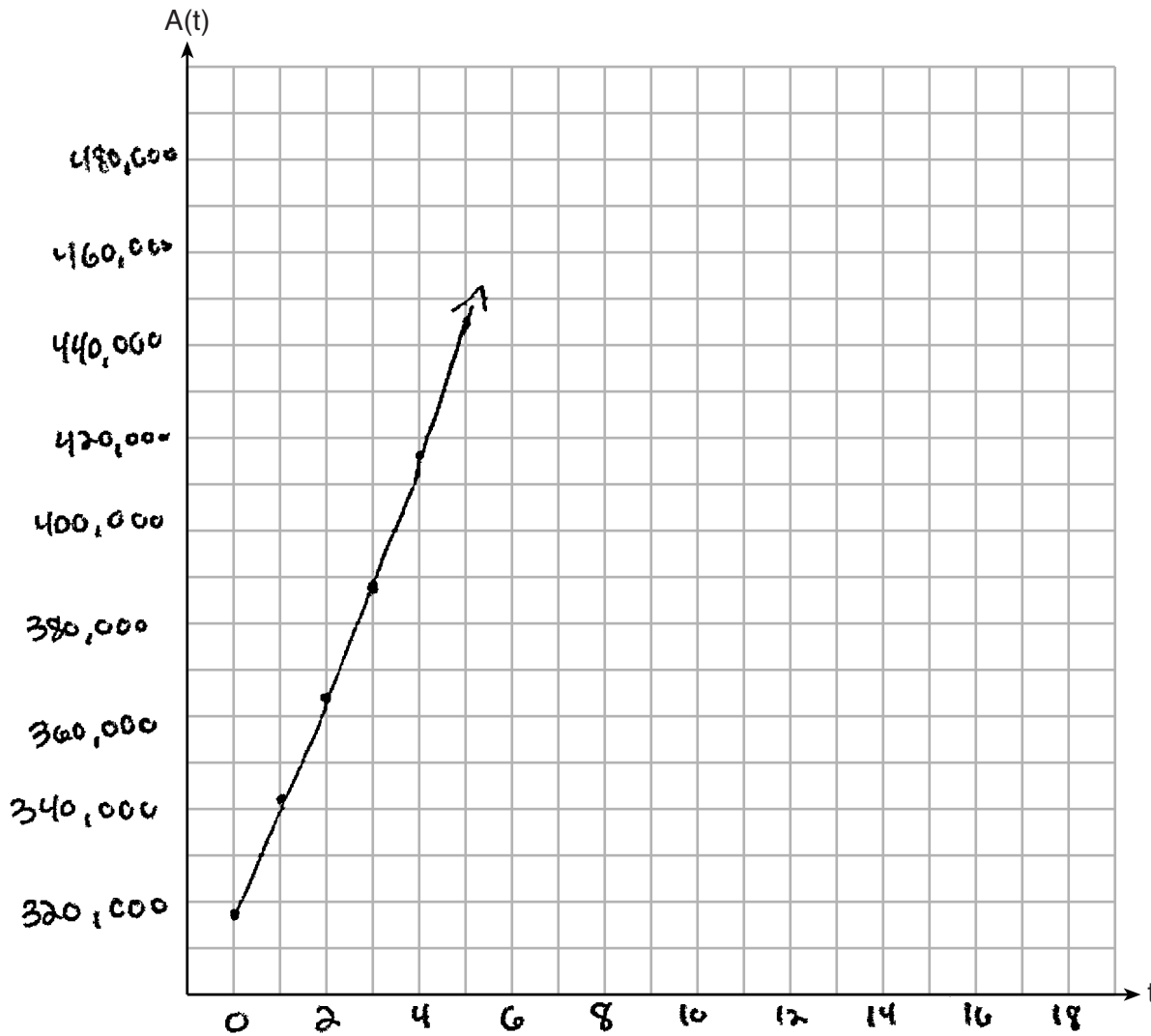
By the 18th yr. it reaches past 1 million
& by 17th not.

37 Tony is evaluating his retirement savings. He currently has $318,000 in his account, which earns an interest rate of 7% compounded annually. He wants to determine how much he will have in the account in the future, even if he makes no additional contributions to the account.

Write a function, $A(t)$, to represent the amount of money that will be in his account in t years.

$$318,000\,(1.07^{t})$$

Graph $A(t)$ where $0 \le t \le 20$ on the set of axes below.

A(t)

35000
348000
346000
344000
342000
340000
338000
336000
334000
332000
33000
328000
326000
324000
322000
320000
318000

10   20   t
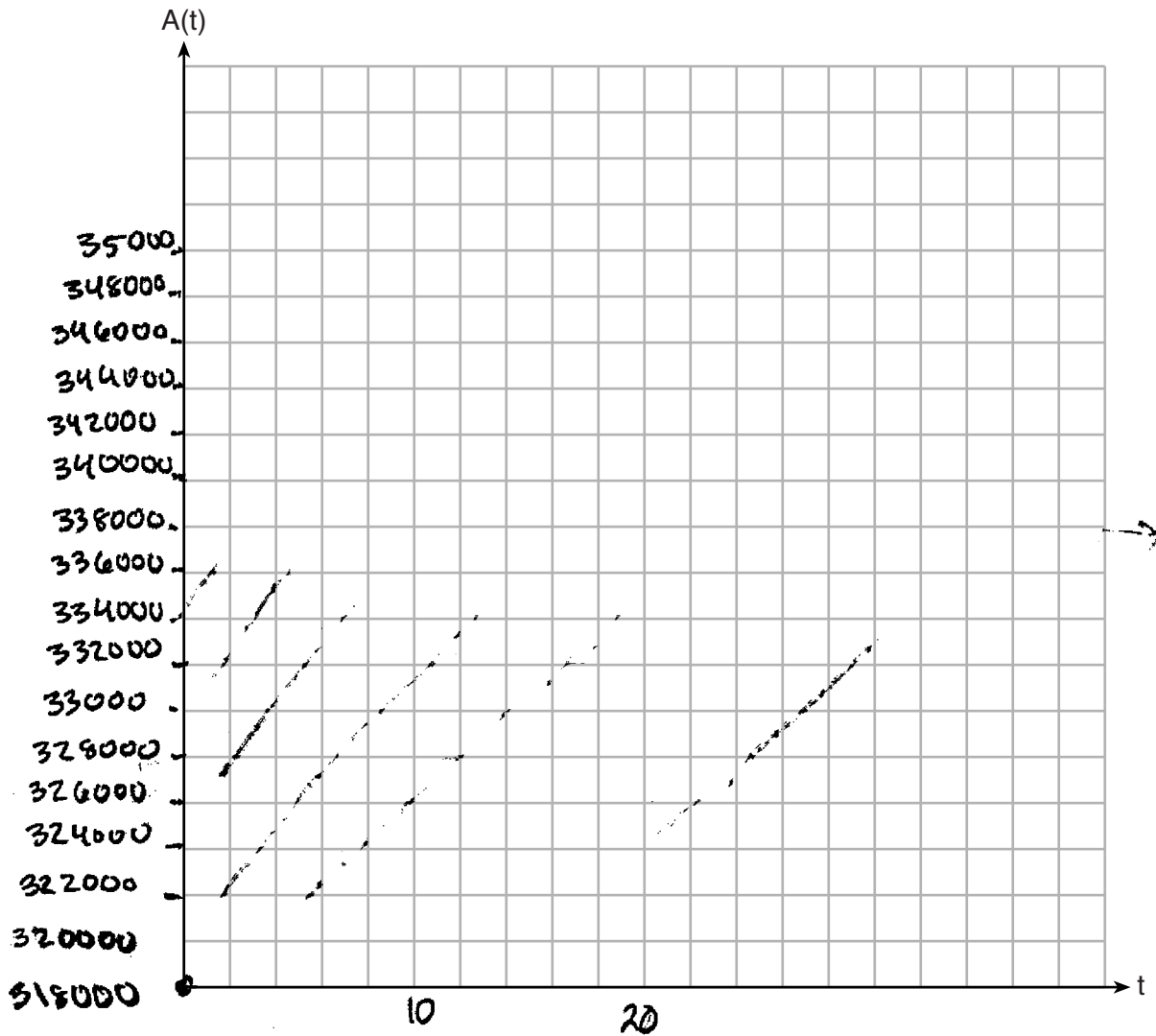
Score 0: The student wrote an expression, not a function.

Tony's goal is to save $1,000,000. Determine algebraically, to the *nearest year*, how many years it will take for him to achieve his goal.

Explain how your graph of $A(t)$ confirms your answer.

Regents Examination in Algebra II – January 2019

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

(Use for the January 2019 exam only.)

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

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

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

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