

ALGEBRA  
**II**

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

# ALGEBRA II

Thursday, January 25, 2024 — 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

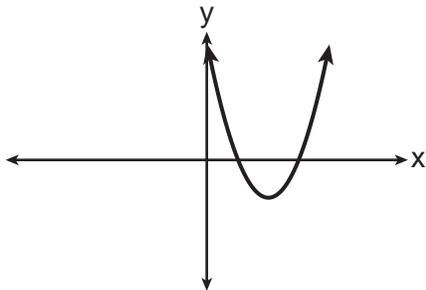
Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression 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.

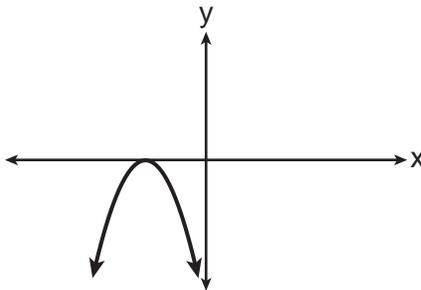
- 1 A cafeteria food manager studied the lunchtime eating habits of a group of employees in their office building. The purpose of the study was to determine the proportion of employees who purchased lunch in the cafeteria, brought their lunch from home, or purchased lunch from an outside vendor. This collection of data would best be classified as

- (1) a census  
(2) an experiment  
(3) an observational study  
(4) a simulation

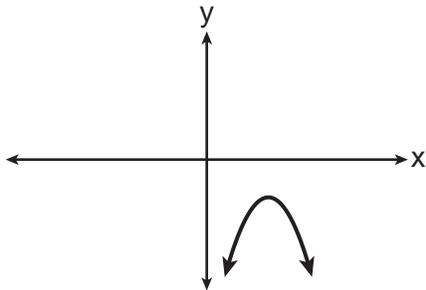
- 2 Which graph has imaginary roots?



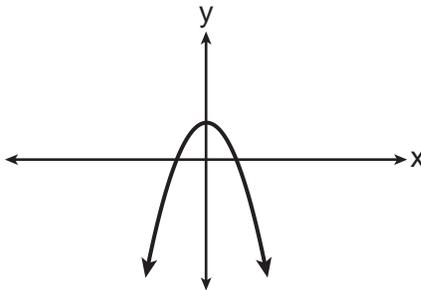
(1)



(3)



(2)



(4)





**Use this space for  
computations.**

**9** The equation of the parabola that has its focus at the point  $(-3, 2)$  and directrix at  $y = 0$  is

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

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

**10** The seventh term of the geometric sequence

$\sqrt{6}, -2\sqrt{3}, 2\sqrt{6}, -4\sqrt{3} \dots$  is

(1)  $6\sqrt{6}$     (3)  $8\sqrt{6}$

(2)  $-6\sqrt{3}$     (4)  $-8\sqrt{3}$

**11** A company wishes to determine the cooking time for one pound of spaghetti. The company's technicians cooked one pound of spaghetti and recorded the time needed for the spaghetti to be ready to eat. Repeating this process 35 times resulted in an approximately normal distribution, with a mean of 9.82 minutes and a standard deviation of 1.4 minutes. In which interval should the middle 95% of cooking times fall?

(1) (8.42, 11.22)                                      (3) (9.35, 10.29)

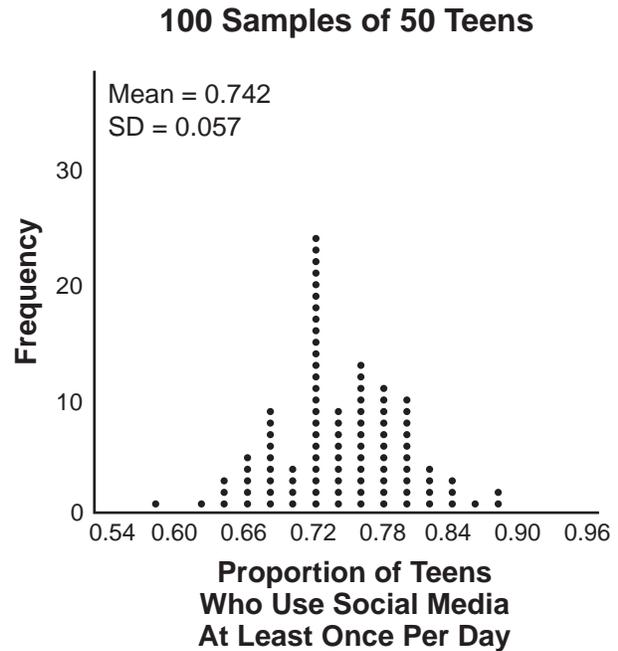
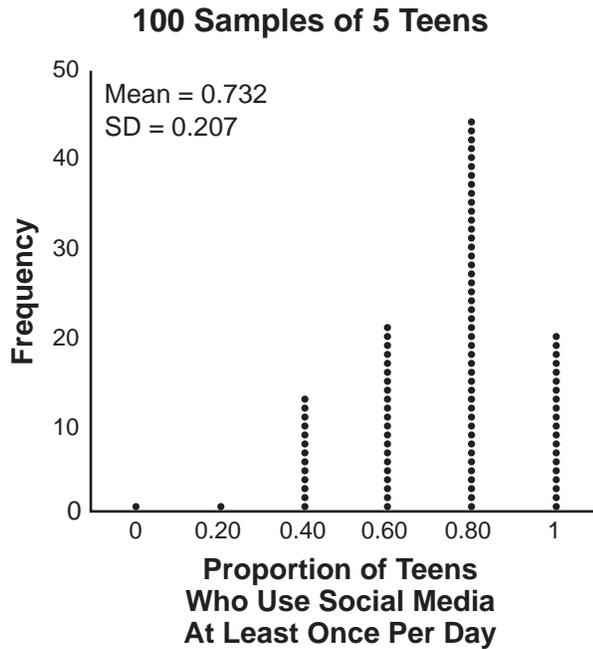
(2) (7.02, 12.62)                                      (4) (6.82, 11.32)





Use this space for computations.

18 Two surveys were conducted to estimate the proportion of teens who use social media at least once per day.



Based on these results, it was determined that approximately 75% of teens use social media at least once per day. What is the best explanation of the difference in the results between the two surveys?

- (1) The smaller sample size of five teens resulted in a smaller margin of error and should provide a more accurate estimate.
- (2) The smaller sample size of five teens resulted in a bigger margin of error and should provide a more accurate estimate.
- (3) The larger sample size of 50 teens resulted in a smaller margin of error and should provide a more accurate estimate.
- (4) The larger sample size of 50 teens resulted in a bigger margin of error and should provide a more accurate estimate.

19 Given  $f(x) = x^3 - 3$  and  $f^{-1}(x) = \sqrt[3]{x - 3b}$ , the value of  $b$  is

- (1) 1
- (2) -1
- (3) 3
- (4) -3

Use this space for  
computations.

- 20** Robert is buying a car that costs \$22,000. After a down payment of \$4000, he borrows the remainder from a bank, a six year loan at 6.24% annual interest rate. The following formula can be used to calculate his monthly loan payment.

$$R = \frac{(P)(i)}{1 - (1 + i)^{-t}}$$

$R$  = monthly payment

$P$  = loan amount

$i$  = monthly interest rate

$t$  = time, in months

Robert's monthly payment will be

- (1) \$298.31                      (3) \$307.35  
(2) \$300.36                      (4) \$367.10
- 21** Given  $\tan \theta = -\frac{4}{3}$  where  $\frac{\pi}{2} < \theta < \pi$ , what is the value of  $\sec \theta$ ?
- (1)  $-\frac{5}{3}$                               (3)  $\frac{4}{5}$   
(2)  $-\frac{3}{5}$                               (4)  $\frac{5}{3}$
- 22** To solve the equation  $\frac{7}{x+7} + \frac{4x}{x-7} = \frac{3x+7}{x-7}$ , Joan's first step is to multiply both sides by the least common denominator. Which statement is true?
- (1)  $-14$  is an extraneous solution.  
(2)  $7$  and  $-7$  are extraneous solutions.  
(3)  $7$  is an extraneous solution.  
(4) There are no extraneous solutions.

**Use this space for  
computations.**

**23** Beginning July 1, 2019, Michelle deposited \$250 into an account that yields 0.15% each month. She continued to make \$250 deposits into this account on the first of each month for 3 years. Which expression represents the amount of money that was in the account after her last deposit was made on June 1, 2022?

(1)  $250(1.0015)^3$

(3)  $\frac{250 - 250(1.0015)^3}{1 - 1.0015}$

(2)  $250(1.0015)^{36}$

(4)  $\frac{250 - 250(1.0015)^{36}}{1 - 1.0015}$

**24** A study of the red tailed hawk population in a given area shows the population,  $H(t)$ , can be represented by the function  $H(t) = 50(1.19)^t$  where  $t$  represents the number of years since the study began. In terms of the monthly rate of growth, the population can be best approximated by the function

(1)  $H(t) = 50(1.015)^{12t}$

(3)  $H(t) = 50(1.19)^{12t}$

(2)  $H(t) = 50(1.15)^{\frac{t}{12}}$

(4)  $H(t) = 50(1.19)^{\frac{t}{12}}$

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## Part II

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

25 Factor  $x^3 + 4x^2 - 9x - 36$ , completely.

**26** Determine if  $x + 4$  is a factor of  $2x^3 + 10x^2 + 4x - 16$ . Explain your answer.

**27** An initial investment of \$1000 reaches a value,  $V(t)$ , according to the model  $V(t) = 1000(1.01)^{4t}$ , where  $t$  is the time in years.

Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.

**28** When  $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$  is written in the form  $y^n$ , what is the value of  $n$ ? Justify your answer.

**29** The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the *nearest percent*, who are between 67 inches and 72 inches tall.

**30** The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

**31** Express  $(2xi^3 - 3y)^2$  in simplest form.

**32** A survey was given to 1250 randomly selected high school students at the end of their junior year. The survey offered four post-graduation options: two-year college, four-year college, military, or work. Of the 1250 responses, 475 chose a four-year college. State *one* possible conclusion that can be made about the population of high school juniors, based on this survey.

### Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

**33** A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts
Allergic to Milk	3	42
Not Allergic to Milk	12	1443

Determine the probability that a randomly selected survey respondent is allergic to milk.

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

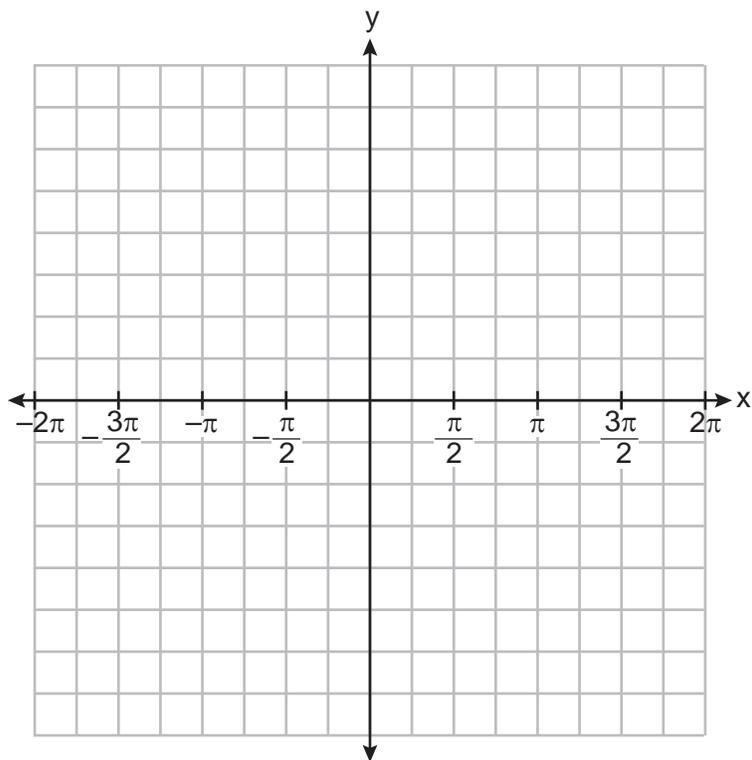
Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

**34** Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x - 1}$

**35** During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank *A* at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank *B* at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ .

Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.

36 On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .



Based on your graph, state an interval in which the graph is increasing.

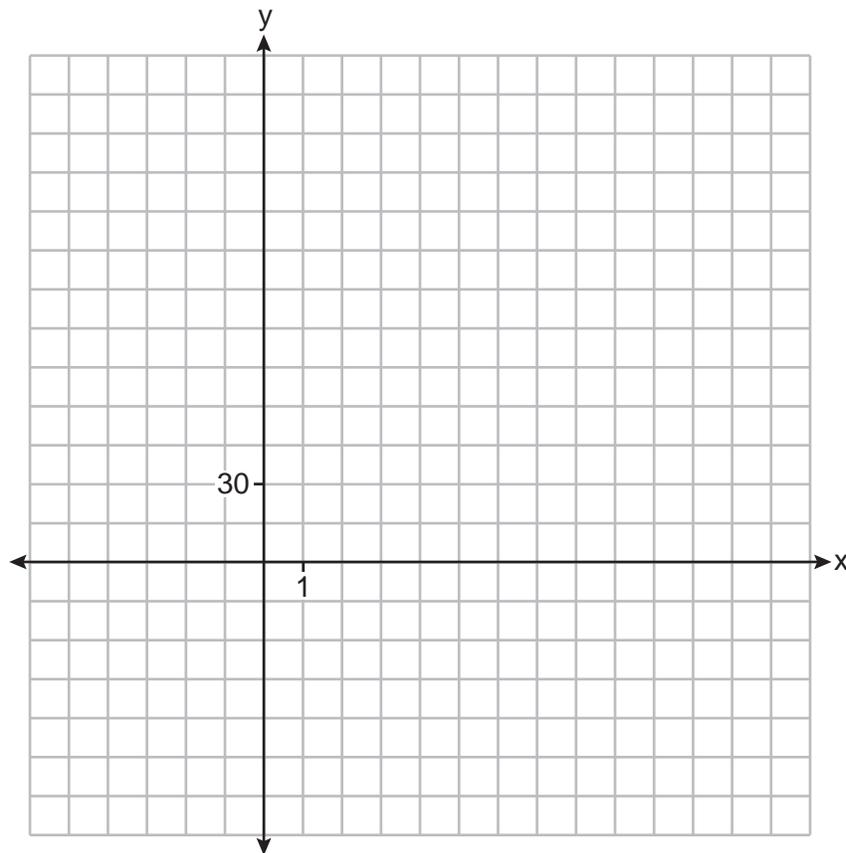
### Part IV

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 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



Question 37 is continued on the next page.

**Question 37 continued**

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

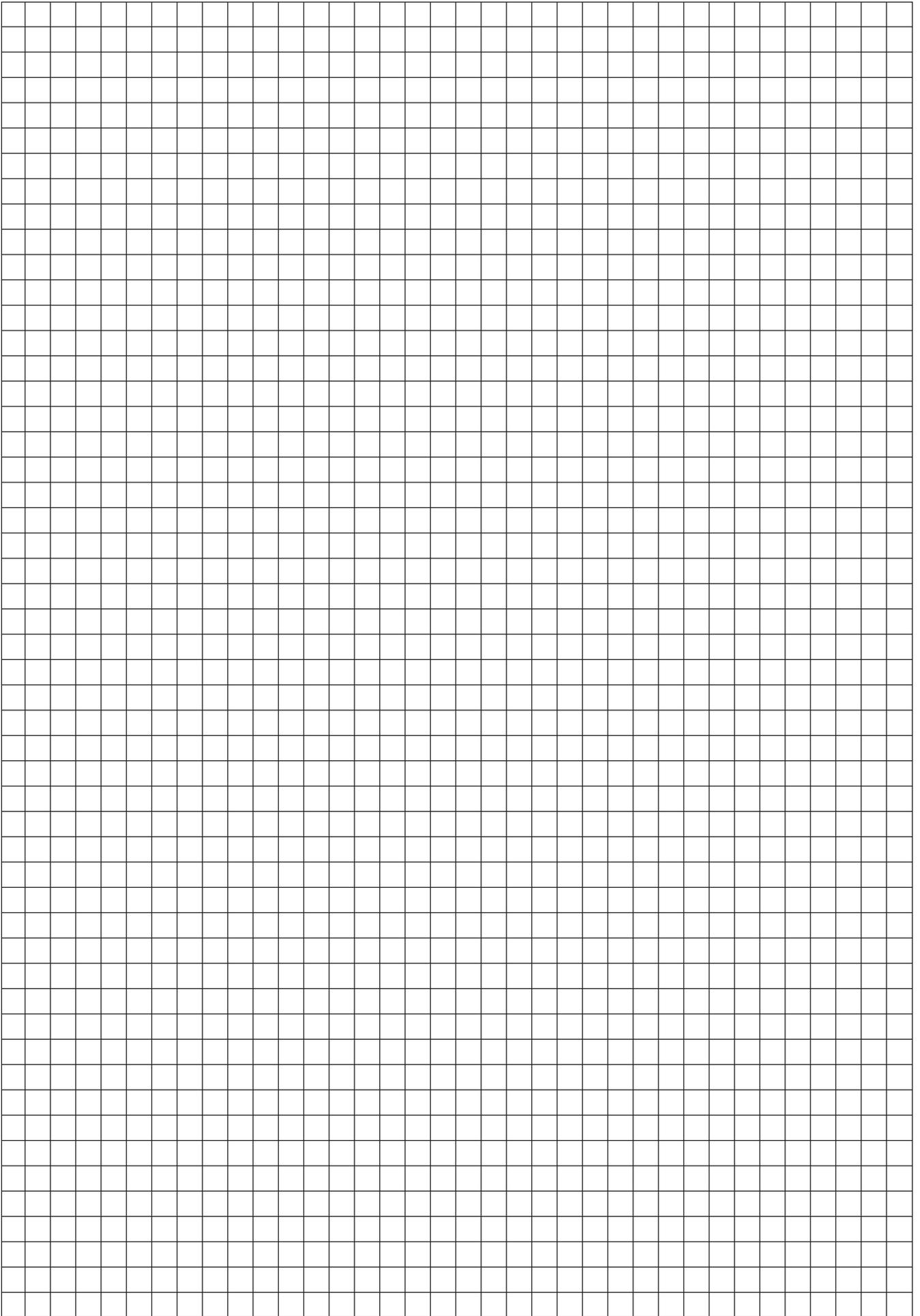
Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.



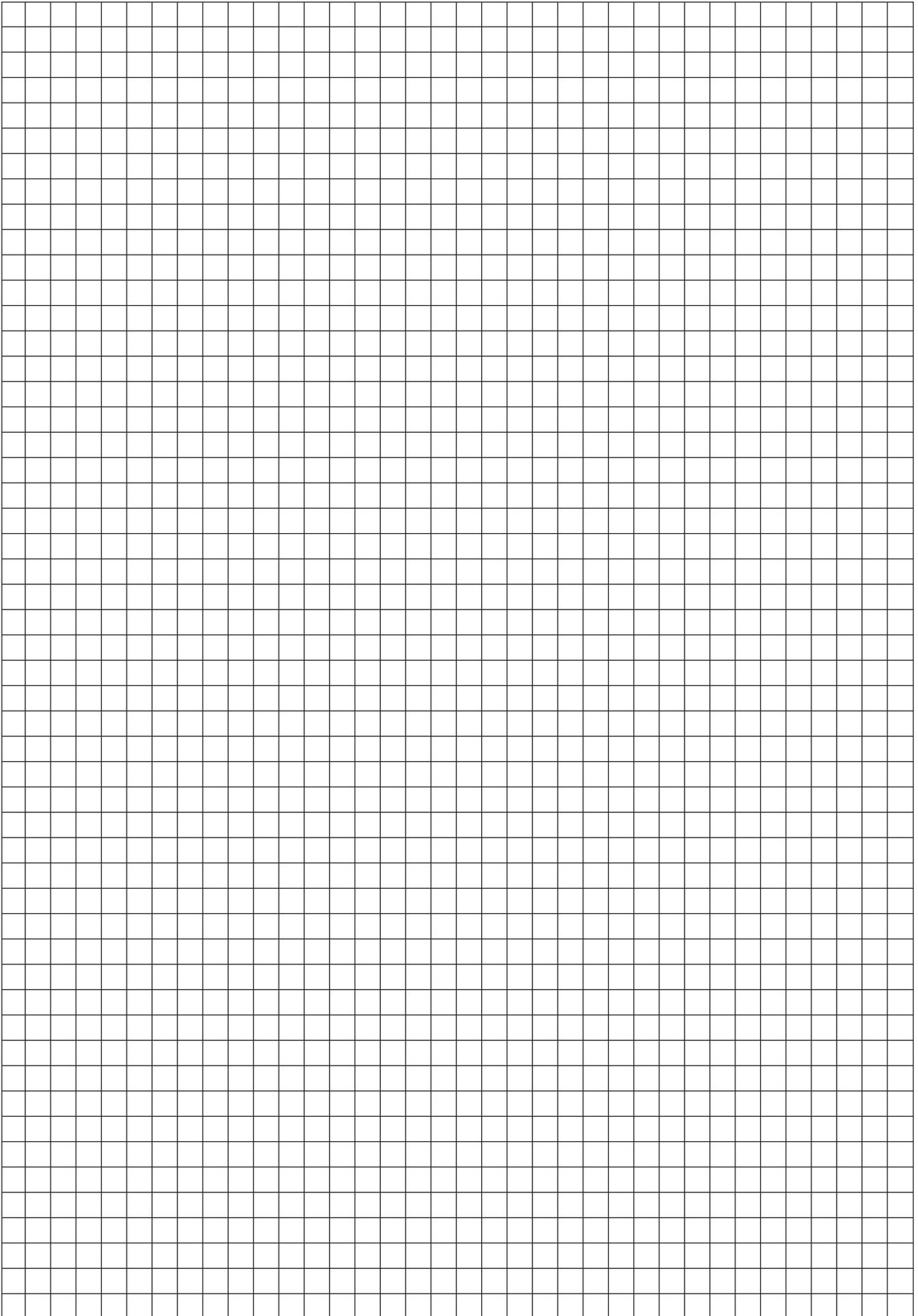
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## High School Math Reference Sheet

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

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

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

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

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

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

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

**Key**

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

The chart for determining students' final examination scores for the **January 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

Thursday, January 25, 2024 — 1:15 to 4:15 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 Thursday, January 25, 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]  $(x + 3)(x - 3)(x + 4)$ , and correct work is shown.
- [1] Appropriate work is shown, but one computational or factoring error is made.
- or*
- [1] Appropriate work is shown, but one conceptual error is made.
- or*
- [1]  $(x + 3)(x - 3)(x + 4)$ , 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.
- (26) [2] Correct work is shown, and a correct explanation is written.
- [1] Appropriate work is shown, but one computational error is made.
- or*
- [1] Appropriate work is shown, but one conceptual error is made.
- or*
- [1] Correct work is shown, but the explanation is incomplete, incorrect, or missing.
- or*
- [1] A correct explanation is written, but  $(x + 4)$  is not determined to be a factor.
- [0] Yes, but no explanation is written.
- 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] 48, 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] 48, 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]  $\frac{10}{3}$  or equivalent, 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]  $\frac{10}{3}$ , but the justification is incomplete, incorrect, or missing.
- [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] 25, 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] 25, 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.

- (30) [2]  $a_1 = 12$  and  $a_n = a_{n-1} + 6$ , or an equivalent recursive form is stated.
- [1] Appropriate work is shown, but one computational or notation error is made.
- or**
- [1] Appropriate work is shown, but one conceptual or notation error is made.
- or**
- [1]  $a_1 = 12$  or  $a_n = a_{n-1} + 6$  or an equivalent recursive form is stated.
- [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]  $-4x^2 + 12xyi + 9y^2$  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]  $-4x^2 + 12xyi + 9y^2$ , 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.
- (32) [2] A correct conclusion is written.
- [1] Appropriate work is shown, but one computational error is made.
- or**
- [1] Appropriate work is shown, but one conceptual error is made.
- or**
- [1] An incomplete or partially correct conclusion is written.
- [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] 0.03 or equivalent, 0.2 or equivalent, a negative response, and a correct justification is given.

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

*or*

[3] 0.03 or equivalent, 0.2 or equivalent, and no, but the justification is incomplete.

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

*or*

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

*or*

[2] 0.03 or equivalent and 0.2 or equivalent, but no further correct work is shown.

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

*or*

[1] 0.03 or 0.2, and no further correct work is shown.

[0] A negative response is indicated, but no further correct 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] 5, and correct algebraic work is shown.
- [3] Appropriate work is shown, but one computational or factoring error is made.
- or*
- [3] Appropriate work is shown, but 2 is not rejected.
- [2] Appropriate work is shown, but two computational or factoring errors are made.
- or*
- [2] Appropriate work is shown, but one conceptual error is made.
- or*
- [2] Appropriate work is shown to find 5, but a method other than algebraic is used.
- or*
- [2] A correct quadratic equation in standard form is written.
- [1] Appropriate work is shown, but one conceptual error and one computational or factoring error are made.
- or*
- [1] 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.

(35) [4]  $A(t) = 4000\left(1 + \frac{0.024}{12}\right)^{12t}$  and  $B(t) = 3500\left(1 + \frac{0.04}{4}\right)^{4t}$  or equivalent, 8.4, and a correct justification is given.

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

**or**

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

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

**or**

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

**or**

[2] 8.4 and a correct justification is given, but no further correct work is shown.

**or**

[2]  $A(t) = 4000\left(1 + \frac{0.024}{12}\right)^{12t}$  and  $B(t) = 3500\left(1 + \frac{0.04}{4}\right)^{4t}$ , but no further correct work is shown.

[1]  $A(t) = 4000\left(1 + \frac{0.024}{12}\right)^{12t}$  or  $B(t) = 3500\left(1 + \frac{0.04}{4}\right)^{4t}$ , but no further correct work is shown.

**or**

[1] 8.4, 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.

- (36) [4] A correct graph is drawn and a correct interval is stated.
- [3] Appropriate work is shown, but one graphing error is made.
- or*
- [3] A correct graph is drawn, but an incorrect interval or no interval is stated.
- [2] Appropriate work is shown, but two graphing errors are made.
- or*
- [2] Appropriate work is shown, but one conceptual error is made.
- [1] Appropriate work is shown but one conceptual and one graphing 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.
-

## 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 correct graph is drawn, (7,78) and a correct explanation is written, 3549 and a correct justification is given.
- [5] Appropriate work is shown, but one computational, graphing, or rounding error is made.
- [4] Appropriate work is shown, but two computational, graphing, or rounding errors are made.
- or*
- [4] Appropriate work is shown, but one conceptual error is made.
- [3] Appropriate work is shown, but three or more computational, graphing, or rounding errors are made.
- or*
- [3] Appropriate work is shown, but one conceptual error and one computational, graphing, or rounding error are made.
- [2] Appropriate work is shown, but two conceptual errors are made.
- or*
- [2] A correct graph is drawn, but no further correct work is shown.
- or*
- [2] (7,78), and a correct explanation is written, but no further correct work is shown.
- or*
- [2] 3549 and a correct justification is given, but no further correct work is shown.
- or*
- [2] (7,78) and 3549, but no work is shown.
- [1] Appropriate work is shown, but two conceptual errors and one computational, graphing, or rounding error are made.
- or*
- [1] (7,78) or 3549, 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.

**Map to the Learning Standards  
Algebra II  
January 2024**

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

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

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

**The *Chart for Determining the Final Examination Score for the January 2024 Regents Examination in Algebra II* will be posted on the Department’s web site at: <https://www.nysed.gov/state-assessment/> by Thursday, January 25, 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.surveymonkey.com/r/8LNLLDW>.
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 25, 2024 — 1:15 to 4:15 p.m., only

## MODEL RESPONSE SET

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**Question 25**

25 Factor  $x^3 + 4x^2 - 9x - 36$ , completely.

$$x^3 + 4x^2 - 9(x+4)$$
$$x(x^2 + 4x) - 9(x+4)$$

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

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

**Question 25**

25 Factor  $x^3 + 4x^2 - 9x - 36$ , completely.

$$x^3 + 4x^2 - 9x - 36$$
$$x = -4, -3, 3$$
$$(x+4)(x+3)(x-3)$$

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

**Question 25**

25 Factor  $x^3 + 4x^2 - 9x - 36$ , completely.

$$x^2(x+4) - 9(x+4)$$

$$(x+4)(x^2 - 9)$$

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

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

**Question 25**

25 Factor  $x^3 + 4x^2 - 9x - 36$ , completely.

$$x^2(x+4) - 9(x+4)$$

$$(x^2 - 9)(x+4)$$

$$\begin{array}{l} (x+3)(x-3)(x+4) \\ x = -3 \quad | \quad x = 3 \quad | \quad x = -4 \end{array}$$

**Score 1:** The student made a conceptual error by solving for  $x$ .

Question 25

25 Factor  $x^3 + 4x^2 - 9x - 36$ , completely.

$$(x^3 + 4x^2) - (9x + 36)$$

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

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

$$(x + 3)(x - 3)(x + 4)(x - 6)$$

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

**Question 25**

25 Factor  $x^3 + 4x^2 - 9x - 36$ , completely.

$$x(x^2 + 4x - 9) - 36$$

$$x^2(x+4) - 9(x+4)$$

$$(x^2 - 9) = 0 \quad (x+4) = 0$$

$$\begin{array}{r} x^2 - 9 = 0 \\ +4 \quad +4 \\ \hline x^2 = 9 \end{array}$$

$$x = 3$$

$$\begin{array}{r} x + 4 = 0 \\ -4 \quad -4 \\ \hline x = -4 \end{array}$$

**Score 0:** The student did not write the expression in factored form and made a conceptual error by solving for  $x$ .

**Question 26**

26 Determine if  $x + 4$  is a factor of  $2x^3 + 10x^2 + 4x - 16$ . Explain your answer.

$$\begin{aligned}x + 4 &= 0 \\ -x &= -4 \\ x &= -4\end{aligned}\quad \begin{aligned}f(-4) &= 2(-4)^3 + 10(-4)^2 + 4(-4) - 16 \\ &= 2(-64) + 10(16) + 4(-4) - 16 \\ &= \underbrace{-128 + 160} - \underbrace{16 - 16} \\ &= 32 - 32 \\ f(-4) &= 0 \rightarrow \text{it is a factor}\end{aligned}$$

By using the remainder Theorem, I can conclude that if I plugged in  $-4$  for  $x$ , then if the answer is  $0$  then  $x+4$  is a factor of  $2x^3+10x^2+4x-16$ .

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

**Question 26**

26 Determine if  $x + 4$  is a factor of  $2x^3 + 10x^2 + 4x - 16$ . Explain your answer.

$$\begin{array}{r|rrrr} -4 & 2 & 10 & 4 & -16 \\ & \downarrow & & & \\ & & -8 & -8 & 16 \\ \hline & 2 & 2 & -4 & 0 \end{array}$$

Yes because there is a 0 remainder.

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

**Question 26**

**26** Determine if  $x + 4$  is a factor of  $2x^3 + 10x^2 + 4x - 16$ . Explain your answer.

$$2(x^3 + 5x^2 + 2x - 8)$$

$$2(x^3 - x^2 + 6x^2 + 2x - 8)$$

$$2(x - 1)(x^2 + 7x + 8)$$

$$(4x + 2x)$$

$$2(x - 1)(x + 4)(x + 2)$$

**Score 1:** The student did not provide an explanation.

Question 26

26 Determine if  $x + 4$  is a factor of  $2x^3 + 10x^2 + 4x - 16$ . Explain your answer.

$$\begin{array}{r}
 x + 4 \\
 \overline{) 2x^3 + 10x^2 + 4x - 16} \\
 \underline{2x^3 + 8x^2 + 4x + 16} \phantom{-16} \\
 2x^4 + 10x^3 + 4x^2 - 16x \\
 + \phantom{2x^4 +} 8x^3 + 40x^2 + 16x + 64 \\
 \hline
 2x^4 + 18x^3 + 44x^2 + 64 \\
 \underline{2x^4 + 44x^2} \\
 18x^3 + 64 \\
 \underline{2(9x^2 + 32)} \\
 2x^2(x^2 + 22)
 \end{array}$$

\*No, it does not since it does not factor out completely leaving both numbers to be negative

Score 0: The student made multiple errors.

Question 26

26 Determine if  $x + 4$  is a factor of  $2x^3 + 10x^2 + 4x - 16$ . Explain your answer.

	$2x^3$	$10$	$4x$	$-16$
$2x$				
$10$				
$4x$				

Yes because using the factor graph you can multiply it

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

**Question 27**

27 An initial investment of \$1000 reaches a value,  $V(t)$ , according to the model  $V(t) = 1000(1.01)^{4t}$ , where  $t$  is the time in years.

Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.

$$V(t) = 1000(1.01)^{4t}$$

$t$	$V(t)$
2	1083
3	1127
4	1173
5	1220
6	1270
7	1321

$$\frac{y^2 - y^1}{x^2 - x^1} = \frac{1321 - 1083}{7 - 2} = \frac{238}{5} = 47.6 \approx \$48$$

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

**Question 27**

**27** An initial investment of \$1000 reaches a value,  $V(t)$ , according to the model  $V(t) = 1000(1.01)^{4t}$ , where  $t$  is the time in years.

Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.

$$\frac{1082.4567 - 1321.29096}{2 - 7}$$

\$ 48.. per year

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

**Question 27**

27 An initial investment of \$1000 reaches a value,  $V(t)$ , according to the model  $V(t) = 1000(1.01)^{4t}$ , where  $t$  is the time in years.

Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.

$$\begin{aligned}V(2) &= 1000(1.01)^{4(2)} \\ &= 1082.856706 \\ V(7) &= 1000(1.01)^{4(7)} \\ &= 1321.920967 \\ &\quad 1082.856706\end{aligned}$$

$$\begin{aligned}\text{Aroc: } &\frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{1321.920967 - 1082.856706}{7 - 2} \\ &= 47.8128522\end{aligned}$$

$$\boxed{\approx \$48}$$

**Score 1:** The student made an error evaluating  $V(7)$ .

**Question 27**

27 An initial investment of \$1000 reaches a value,  $V(t)$ , according to the model  $V(t) = 1000(1.01)^{4t}$ , where  $t$  is the time in years.

Determine the average rate of change, to the *nearest dollar per year*, of this investment from year 2 to year 7.

$$\begin{array}{r} 2 \text{ years} = 1082.4 \\ 7 \text{ years} = 1321.3 \\ \hline \end{array} \quad \begin{array}{r} 1321.3 \\ - 1082.4 \\ \hline 238.9 \\ \hline 5 \end{array}$$

average rate of change =  $\$47.68$  per year

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

**Question 27**

27 An initial investment of \$1000 reaches a value,  $V(t)$ , according to the model  $V(t) = 1000(1.01)^{4t}$ , where  $t$  is the time in years.

Determine the average rate of change, to the nearest dollar per year, of this investment from year 2 to year 7.

$$\begin{aligned} V(2) &= 1000(1.01)^{4(2)} \rightarrow 108.29 \\ V(7) &= 114.95 \\ &\quad \underline{114.95} \\ &\quad - 108.29 \\ &\quad \hline &\quad 6.66 \\ &\quad \boxed{6.66} \end{aligned}$$

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

Question 28

28 When  $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$  is written in the form  $y^n$ , what is the value of  $n$ ? Justify your answer.

$$\left(\frac{1}{y^{2/3}}\right)y^4$$

$$\frac{y^4}{y^{2/3}}$$

$$y^{10/3} = y^n$$
$$n = 10/3$$

$n = \frac{10}{3}$  because when solving for  $n$ , fractions can be multiplied to values, but then exponents in a fraction are subtracted from one another ( $4 - \frac{2}{3}$ ). Which resulted in the answer of  $\frac{10}{3}$ .

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

**Question 28**

28 When  $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$  is written in the form  $y^n$ , what is the value of  $n$ ? Justify your answer.

$$y^{-2/3} \cdot y^4$$

$$y^{3.\bar{3}}$$

$$n = 3.\bar{3}$$

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

**Question 28**

28 When  $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$  is written in the form  $y^n$ , what is the value of  $n$ ? Justify your answer.

$$\left(x^{-\frac{2}{3}}\right) \sqrt[4]{4}$$
$$\sqrt[3]{\frac{10}{3}}$$

**Score 1:** The student did not state the value of  $n$ .

Question 28

28 When  $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$  is written in the form  $y^n$ , what is the value of  $n$ ? Justify your answer.

$$\left(\frac{1}{y^{\frac{2}{3}}}\right)y^4$$
$$y^{4 \times \frac{3}{2}}$$
$$y^{4\cancel{3}} \times y^{\cancel{3}/2}$$
$$y^{6/2} \times y^{3/2} = y^{11/2}$$

$$n = \frac{11}{2}$$

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

**Question 28**

28 When  $\left(\frac{1}{\sqrt[3]{y^2}}\right)y^4$  is written in the form  $y^n$ , what is the value of  $n$ ? Justify your answer.

$$y^{\frac{2}{3}} \times y^4 = y^{\frac{14}{3}}$$

**Score 0:** The student made a conceptual error and did not state the value of  $n$ .

**Question 29**

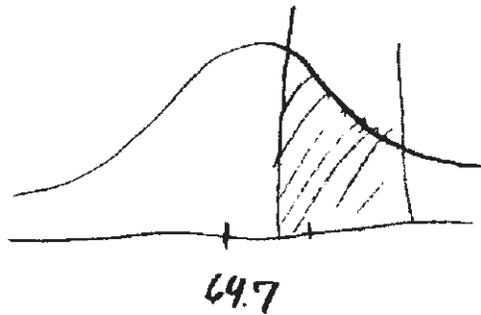
29 The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the nearest percent, who are between 67 inches and 72 inches tall.

$$\text{normal cdf}(67, 72, 64.7, 4.3) = \boxed{25\%}$$

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

**Question 29**

**29** The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the nearest percent, who are between 67 inches and 72 inches tall.



$$\sigma = 4.3$$
$$\mu = 64.7$$

$$0.251580524289$$

$$25\%$$

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

---

**Question 29**

---

**29** The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the *nearest percent*, who are between 67 inches and 72 inches tall.

25%  
using graphing calculator

---

**Score 1:** The student did not show work.

**Question 29**

29 The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the *nearest percent*, who are between 67 inches and 72 inches tall.

$$64.7 \text{ mean}$$

$$z = \frac{67 - 64.7}{4.3}$$

$$z = .628$$

$$z = \frac{72 - 64.7}{4.3}$$

$$z = 1.698$$

$$.628 < z < 1.698$$

.220

22%

**Score 1:** The student made a computational error finding the first z-score.

Question 29

29 The heights of the members of a ski club are normally distributed. The average height is 64.7 inches with a standard deviation of 4.3 inches. Determine the percentage of club members, to the nearest percent, who are between 67 inches and 72 inches tall.

Mean  $\mu$  64.7  
Standard deviation  $\sigma$  4.3  
lower bound  $\mu$  67  
upper bound  $\mu$  72

$$\text{Normalcdf}(67, 72, 4.3, 64.7)$$

$$= 0.0185549731$$

$$1.85549731\%$$

1.8%

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

**Question 30**

**30** The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

$$\begin{aligned} a_1 &= 12 \\ a_2 &= 18 \\ a_3 &= 24 \\ a_4 &= 30 \end{aligned}$$

$$\begin{aligned} a_1 &= 12 \\ a_n &= a_{n-1} + 6 \end{aligned}$$

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

**Question 30**

30 The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

$$n = 0$$
$$a_0 = 6$$
$$a_n = a_{n-1} + 6$$

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

**Question 30**

30 The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

$$a_1 = 12$$

$$a_2 = 18$$

$$a_3 = 24$$

$$a_4 = 30$$

$$a_n = a_{n-1} + 6$$

**Score 1:** The student did not state  $a_1$ , in the answer.

**Question 30**

30 The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

$$a_1 = 6 + 6(1)$$
$$a_1 = 6 + 6 = 12$$

$$a_1 = 12$$

$$a_n = a_1$$

**Score 1:** The student only stated  $a_1$ , correctly.

**Question 30**

30 The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

$$a_n = 6 + 6n$$

$$a_n = a_1 + 6n$$

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

**Question 30**

**30** The explicit formula  $a_n = 6 + 6n$  represents the number of seats in each row in a movie theater, where  $n$  represents the row number. Rewrite this formula in recursive form.

$$a_n = 6 + 6n$$

$$a_n = 6 + (a_{n-1})6$$

Answer

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

**Question 31**

31 Express  $(2xi^3 - 3y)^2$  in simplest form.

~~ans~~

$$(2xi^3 - 3y)(2xi^3 - 3y)$$

$$4x^2i^6 - 6xyi^3 - 6xyi^3 + 9y^2$$

$$4x^2i^6 - 12xyi^3 + 9y^2$$

$$9y^2 + 4x^2(-1) - 12xyi^3$$

$$9y^2 - 4x^2 - 12xyi^3$$

$$9y^2 - 4x^2 + 12xyi$$

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

Question 31

31 Express  $(2xi^3 - 3y)^2$  in simplest form.

$$\begin{array}{r} 2xi^3 \quad -3y \\ \begin{array}{|c|c|} \hline 4xi^{2 \cdot 6} & -6xyi^3 \\ \hline -6xi^3 & 9y^2 \\ \hline \end{array} \end{array}$$

$$4xi^{2 \cdot 6} - 12xyi^3 + 9y^2$$

$$-4x^2 + 12xyi + 9y^2$$

$$9y^2 - 4x^2 + 12xyi$$

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

Question 31

31 Express  $(2xi^3 - 3y)^2$  in simplest form.

$$\begin{array}{cc} & 2xi^3 & -3y \\ \begin{array}{c} 2xi^3 \\ -3y \end{array} & \begin{array}{|c|c|} \hline 4x^2i^6 & -6yxi^3 \\ \hline -6yxi^3 & 9y^2 \\ \hline \end{array} & \end{array}$$

$$-12yxi^3 + 4x^2i^6 + 9y^2$$

**Score 1:** The student did not write the answer in simplest form.

Question 31

31 Express  $(2xi^3 - 3y)^2$  in simplest form.

- 0 1
- 1 i
- 2 -i
- 3 i

$$\begin{array}{r}
 2xi^3 \quad -3y \\
 \begin{array}{|c|c|}
 \hline
 4x^2i^6 & -6xyi^3 \\
 \hline
 -6xyi^3 & 9y^2 \\
 \hline
 \end{array}
 \end{array}$$

$$\begin{aligned}
 &4x^2i^6 - 12xyi^3 + 9y^2 \\
 &4x^2(-1) - 12xy(-i) + 9y^2 \\
 &-4x^2 + 12xyi + 9y^2
 \end{aligned}$$

$$\frac{-12 \pm \sqrt{12^2 - 4(-4)(9)}}{2(-4)} = \frac{-12 \pm \sqrt{288}}{-8}$$

$$= \frac{-12 \pm \sqrt{36} \sqrt{8}}{-8} = \frac{-12 \pm \sqrt{36} \sqrt{4} \sqrt{2}}{-8}$$

$$= \frac{-12 \pm 6 \cdot 2 \sqrt{2}}{-8} = \frac{-12 \pm 12\sqrt{2}}{-8}$$

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

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

**Score 1:** The student made a conceptual error by solving the expression as an equation.

Question 31

31 Express  $(2xi^3 - 3y)^2$  in simplest form.

$$\begin{aligned} & \overbrace{(2xi^3 - 3y)(2xi^3 - 3y)} \\ & 4xi^6 - 6xi^3y - 6xi^3y + 9y^2 \\ & 4xi^6 - 12xi^3y + 9y^2 \\ & \downarrow \\ & -4x \quad -12x \quad 9y \\ & \downarrow \\ & \textcircled{-16x + 4y} \end{aligned}$$

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

**Question 31**

31 Express  $(2xi^3 - 3y)^2$  in simplest form.

$$(2xi^3 - 3y)(2xi^3 - 3y)$$

$$4x^2i^9 - 6xi^3y - 6xi^3y + 9y^2$$

$$(4x^2i^9 - 12xiy + 9y^2)$$

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

**Question 32**

- 32 A survey was given to 1250 randomly selected high school students at the end of their junior year. The survey offered four post-graduation options: two-year college, four-year college, military, or work. Of the 1250 responses, 475 chose a four-year college. State *one* possible conclusion that can be made about the population of high school juniors, based on this survey.

$$\frac{475}{1250} = 38\%$$

The population of high school juniors that would choose a four-year college would probably be about 38% who would choose a 4-year college whereas 62% would choose a different option based on the survey

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

Question 32

- 32 A survey was given to 1250 randomly selected high school students at the end of their junior year. The survey offered four post-graduation options: two-year college, four-year college, military, or work. Of the 1250 responses, 475 chose a four-year college. State *one* possible conclusion that can be made about the population of high school juniors, based on this survey.

$$\frac{475}{1250} = \frac{236}{625} = 37\%$$

37% will go onto 4 yr college /  
less than half will go to  
4 yr college

**Score 1:** The student gave a correct conclusion based on incorrect work.

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**Question 32**

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**32** A survey was given to 1250 randomly selected high school students at the end of their junior year. The survey offered four post-graduation options: two-year college, four-year college, military, or work. Of the 1250 responses, 475 chose a four-year college. State *one* possible conclusion that can be made about the population of high school juniors, based on this survey.

One possible conclusion is that the juniors are looking for more education to get better jobs.

---

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

**Question 33**

33 A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts	
Allergic to Milk	3	42	45
Not Allergic to Milk	12	1443	1455
	15		1500

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$\frac{45}{1500}$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

$$\frac{3}{15}$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

$$\begin{aligned} \therefore P(a) &= P(a|b) \\ \frac{45}{1500} &= \frac{3}{15} \\ 0.03 &\neq 0.2 \\ \text{Not independent} \end{aligned}$$

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

**Question 33**

33 A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts	
Allergic to Milk	3	42	45
Not Allergic to Milk	12	1443	1455
	15	1485	1500

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$\frac{45}{1500} \text{ or } \frac{3}{100} \text{ or } 3\%$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

$$\frac{3}{15} \text{ or } \frac{1}{5} \text{ or } 20\%$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

No b/c someone is more likely to be allergic to milk if they are allergic to nuts

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

**Question 33**

33 A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed ~~1500~~ people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts	
Allergic to Milk	3	42	total 45
Not Allergic to Milk	12	1443	1455
	total 15	1485	1500

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$\frac{45}{1500} = 0.03$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

A given B → denom  
15-peanuts

$$\frac{3}{15} = 0.2$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

NO

equal  
each other

**Score 3:** The student did not justify the answer.

**Question 33**

**33** A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts	
Allergic to Milk	3	42	45
Not Allergic to Milk	12	1443	1455
	15	1485	1500

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$\frac{45}{1500} = .03 \quad 3\%$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

$$\frac{3}{15} = .002 \quad .2\%$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

$$P(N \cap M) = P(N) \cdot P(M)$$

$$\frac{3}{1500} = \frac{15}{1500} \cdot \frac{45}{1500}$$

$$.002 \neq .01 \cdot .03$$

$$.002 \neq$$

They are dependent

**Score 3:** The student made a computational error.

**Question 33**

33 A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts	
Allergic to Milk	3	42	45
Not Allergic to Milk	12	1443	1455
	15	1485	1500

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$\frac{45}{1500}$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

$$\frac{3}{15} \text{ or } \frac{1}{5}$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

Nut Allergy:  $\frac{15}{1500}$      
 Milk Allergy:  $\frac{45}{1500}$      
 Both allergies:  $\frac{3}{1500}$      
 No allergy:  $\frac{1443}{1500}$

An allergy:  $\frac{60}{1500}$

They are independent since there is such a difference in the # of people allergic to nuts & milk. 45 is more than 15.

**Score 2:** The student incorrectly determined independence and gave an incorrect justification.

**Question 33**

**33** A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts
Allergic to Milk	3	42
Not Allergic to Milk	12	1443

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$P = \frac{45}{1500} = \frac{9}{300} = \frac{3}{100}$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

$$P = \frac{3}{1500}$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

*nut allergies and milk allergies are not independent events.*

**Score 1:** The student received one point for the first part.

**Question 33**

**33** A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts	
Allergic to Milk	3	42	45
Not Allergic to Milk	12	1443	1455
	15	1485	1500

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$\frac{45}{1500}$$

$$= .03$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

$$\frac{3}{1500}$$

$$= .002$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

The are dependent  
b/c they are the  
same.

**Score 1:** The student received one point for the first part.

**Question 33**

33 A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts
Allergic to Milk	3	42
Not Allergic to Milk	12	1443

Determine the probability that a randomly selected survey respondent is allergic to milk.

$$\frac{42}{1500} = \frac{21}{750} = \frac{7}{250}$$

$$\frac{7}{250}$$

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

$$\frac{3}{1500} = \frac{1}{500}$$

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

it's not because most people are not allergic to milk and nut

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

**Question 33**

**33** A researcher wants to determine if nut allergies and milk allergies are related to each other. The researcher surveyed 1500 people and asked them if they are allergic to nuts or milk. The survey results are summarized in the table below.

	Allergic to Nuts	Not Allergic to Nuts
Allergic to Milk	3	42
Not Allergic to Milk	12	1443

Determine the probability that a randomly selected survey respondent is allergic to milk.

12 out of 1443      1 out of 1500

$$\frac{12}{1443} = .08$$

percent chance

Determine the probability that a randomly selected survey respondent is allergic to milk, given that the person is allergic to nuts.

3 out of 1500      1 out of 500

$$\frac{3}{1500} = .02$$

percent chance

Based on the survey data, determine whether nut allergies and milk allergies are independent events. Justify your answer.

No they are not because there is a outside event so it dependent.

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

Question 34

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$\frac{2x = 6 + 2\sqrt{x-1}}{-6 \quad -6}$$

$$\frac{2x-6}{2} = \frac{2\sqrt{x-1}}{2}$$

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

$$(x-3)(x-3) = x-1$$

$$\begin{array}{r} x^2 - 3x - 3x + 9 = x - 1 \\ -x \quad +1 \quad -x + 1 \end{array}$$

$$x^2 - 7x + 10 = 0$$

$$a=1 \quad b=-7 \quad c=10$$

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

$$x = \frac{7 \pm \sqrt{49 - 4(1)(10)}}{2}$$

$$x = \frac{7 \pm \sqrt{9}}{2}$$

$$x = \frac{7 \pm 3}{2}$$

check

$$2(5) = 6 + 2\sqrt{5-1}$$

$$10 = 10 \quad \checkmark$$

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

$$4 \neq 8$$

$$\boxed{\begin{array}{l} x=5 \\ x=2 \\ \text{extraneous} \end{array}}$$

$$x = \frac{7+3}{2} = \frac{10}{2} = 5$$

$$x = \frac{7-3}{2} = \frac{4}{2} = 2 \text{ extraneous}$$

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

Question 34

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$\begin{aligned} & \begin{array}{r} 2x = 6 + 2\sqrt{x-1} \\ -6 \quad -6 \end{array} \\ & \frac{2x-6}{2} = \frac{2\sqrt{x-1}}{2} \\ & (x-3)^2 = \sqrt{x-1}^2 \\ & x^2 - 6x + 9 = x - 1 \\ & x^2 - 7x + 10 = 0 \\ & (x-2)(x-5) \\ & \cancel{x=2} \quad \boxed{x=5} \checkmark \\ & \text{reject} \end{aligned}$$

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

Question 34

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$\frac{2x-6}{2} = \frac{2\sqrt{x-1}}{2}$$

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

$$x^2 - 6x + 9 = x - 1$$

$$x^2 - 7x + 10 = 0$$

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

$$x = \frac{7 \pm \sqrt{49 - 40}}{2}$$

$$x = \frac{7 \pm 3}{2} \begin{cases} \frac{7+3}{2} = 5 \\ \frac{7-3}{2} = 2 \end{cases}$$

**Score 3:** The student did not reject  $x = 2$ .

**Question 34**

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$\begin{aligned}2x &= 6 + 2\sqrt{x-1} \\ \frac{2x-6}{2} &= \frac{2\sqrt{x-1}}{2} \\ (x-3)^2 &= (\sqrt{x-1})^2 \\ (x-3)(x-3) &= x-1 \\ x^2 - 3x - 3x + 9 &= x-1 \\ x^2 - 6x + 9 &= x-1 \\ x^2 - 6x + 10 &= x \\ x^2 - 7x + 10 & \\ (x-5)(x+2) &= 0 \\ x=5 \quad x=-2 \\ \cdot x &= -2, 5\end{aligned}$$

**Score 2:** The student made a factoring error and did not reject  $x = -2$ .

**Question 34**

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$2x - 6 = 2\sqrt{x-1}$$

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

$$x^2 - 6x + 9 = x - 1$$

$$x^2 - 7x + 10 = 0$$

$$x = \frac{7 \pm \sqrt{(-7)^2 - 4(10)}}{2}$$

$$x = \frac{7 \pm 3}{2}$$

$$x = 4 \quad x = 5$$

**Score 2:** The student made a computational error and did not reject  $x = 4$ .

**Question 34**

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$\begin{aligned}2x-6 &= 2(\sqrt{x}-1) \\2x-6 &= 2\sqrt{x}-2 \\(2x-4)^2 &= (2\sqrt{x})^2 \\4x^2-16x+16 &= 4x \\4x^2-20x+16 &= 0 \\x^2-5x+4 &= 0 \\(x-4)(x-1) &= 0 \\x=4 \quad x=1\end{aligned}$$

**Score 1:** The student made multiple errors and did not reject their solutions.

Question 34

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$\frac{2x}{2} = \frac{6}{2} + \frac{2\sqrt{x-1}}{2}$$

$$x = 3 + \sqrt{x-1}$$

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

$$x^2 = 2 + x$$

$$x^2 - x - 2 = 0$$

$$(x-2)(x+1)$$

$$x-2=0 \quad | \quad x+1=0$$

$$x=2 \quad | \quad x=-1$$

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

Question 34

34 Algebraically solve for  $x$ :  $2x = 6 + 2\sqrt{x-1}$

$$\begin{aligned} (2x-6) &= 2(\sqrt{x-1}) \\ &= 2(x-2) \end{aligned}$$

$$(2x-6)(2x-6) = 2x-4$$

$$4x^2 - 12x + 36 = 2x - 4$$

$$4x^2 - 24x + 36 =$$

$$4x^2 - 26x + 40 = 0$$

$$40 \times 4 = 160$$



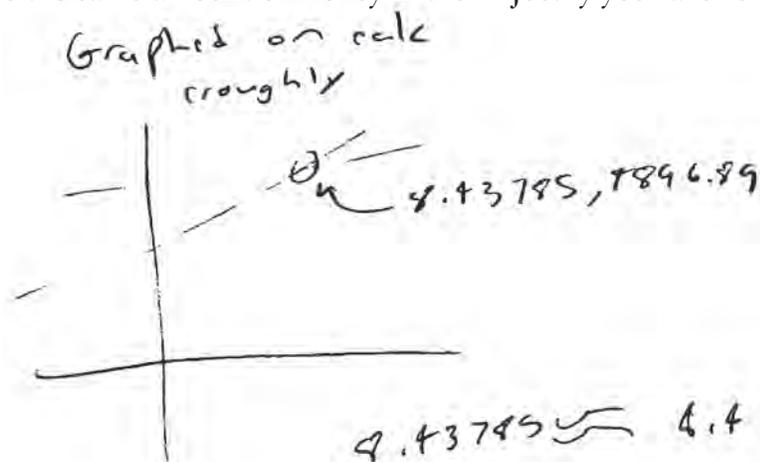
**Score 0:** The student did not show enough correct work to receive any credit.

**Question 35**

- 35 During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank A at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank B at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ .

$$\begin{aligned} A(t) &= 4000(1 + 0.002)^{12t} \\ B(t) &= 3500(1 + 0.02)^{4t} \end{aligned}$$

Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.



It will take 4.4 years for the two accounts to have the same amount of money in them

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

**Question 35**

**35** During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank *A* at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank *B* at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ .

$$A(t) = 4000 \left( 1 + \frac{0.024}{12} \right)^{12t}$$
$$B(t) = 3500 \left( 1 + \frac{0.04}{4} \right)^{4t}$$

Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.

It will take about 8.4 years for the two accounts to have the same amount of money

**Score 3:** The student gave an incomplete justification.

**Question 35**

35 During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank A at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank B at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ .

Adam

$$A(t) = 4000 \left( 1 + \frac{0.024}{12} \right)^{12t}$$

0 002

Betty

$$B(t) = 3500 \left( 1 + \frac{0.04}{4} \right)^{4t}$$

0 01

Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.

8 years for both  
accounts to have the  
same amount of  
money

**Score 2:** The student made a rounding error and gave an incomplete justification.

**Question 35**

**35** During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank A at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank B at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ .

$$A(t) = 4000(1.024)^{\frac{1}{12}t} \quad B(t) = 3500(1.04)^{\frac{1}{4}t}$$

Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.

17.1 years

$$4000(1.024)^{\frac{1}{12}t} = 3500(1.04)^{\frac{1}{4}t}$$

**Score 2:** The student gave the correct number of years based on their incorrect equations.

**Question 35**

**35** During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank *A* at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank *B* at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ .

$$A(t) = 4000 \left(1 + \frac{0.024}{12}\right)^{12t}$$

$$B(t) = 3500 \left(1 + \frac{0.04}{4}\right)^{4t}$$

Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.

$$4008^{12t} = 3511.666667^{12t}$$

**Score 1:** The student stated  $A(t)$  correctly.

**Question 35**

**35** During the summer, Adam saved \$4000 and Betty saved \$3500. Adam deposited his money in Bank *A* at an annual rate of 2.4% compounded monthly. Betty deposited her money in Bank *B* at an annual rate of 4% compounded quarterly. Write two functions that represent the value of each account after  $t$  years if no other deposits or withdrawals are made, where Adam's account value is represented by  $A(t)$ , and Betty's by  $B(t)$ .

$$A = 4000 \left( \frac{0.024}{12} \right)^{12(t)}$$
$$B = 3500 \left( \frac{0.04}{4} \right)^{4(t)}$$

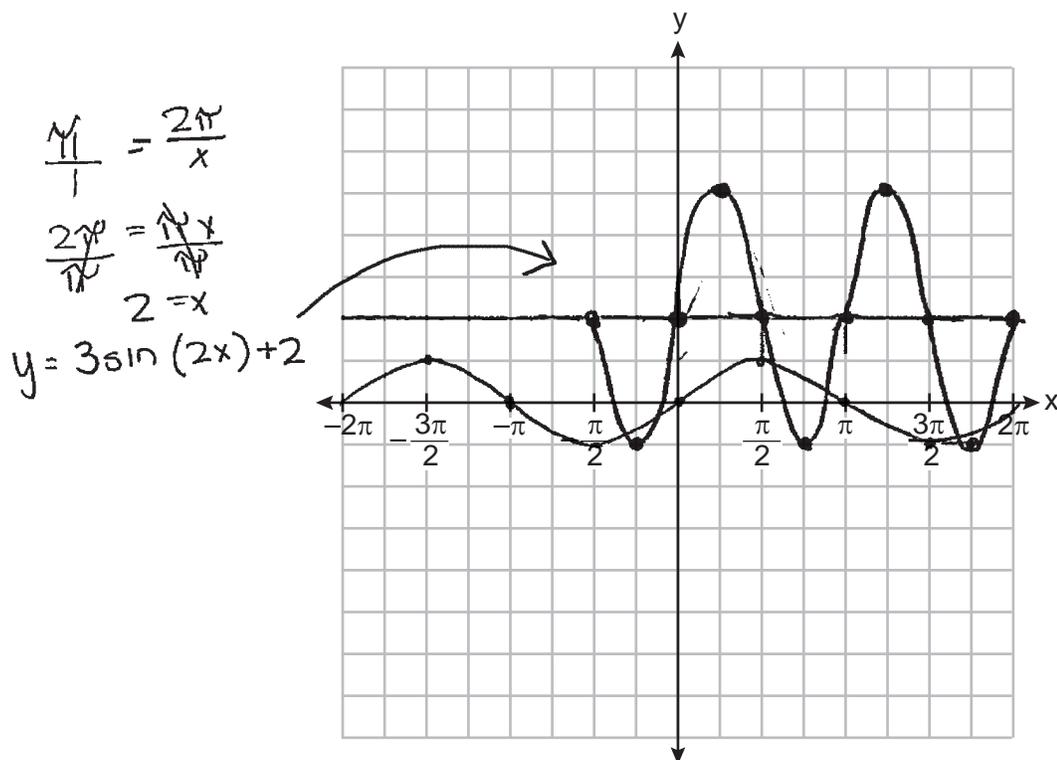
Using technology, determine, to the *nearest tenth of a year*, how long it will take for the two accounts to have the same amount of money in them. Justify your answer.

5 years

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

**Question 36**

36 On the graph below, draw *at least one* complete cycle of a sine graph passing through point (0,2) that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .



Based on your graph, state an interval in which the graph is increasing.

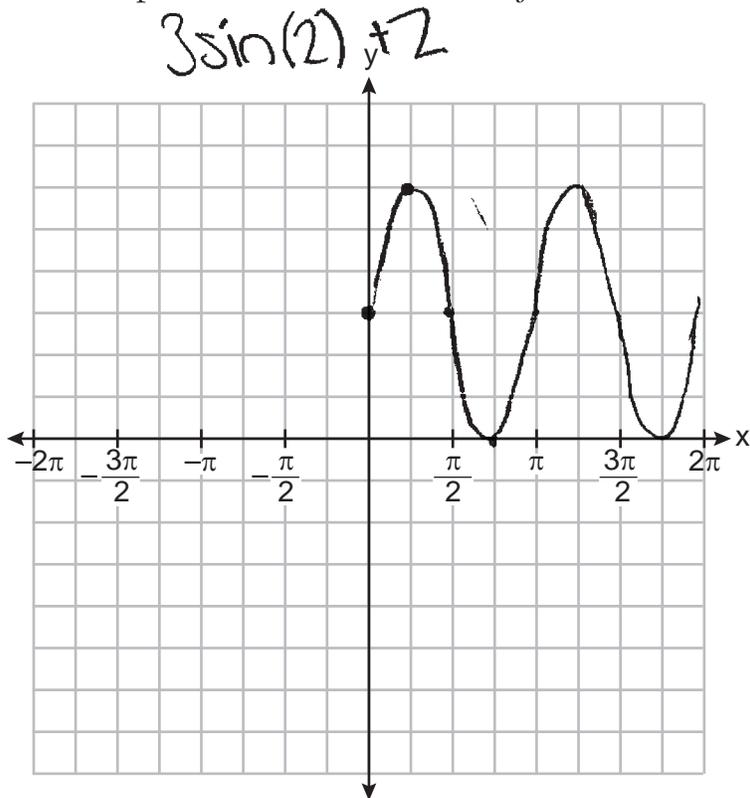
$$-\frac{\pi}{4} \text{ to } \frac{\pi}{4}$$

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

Question 36

36 On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .

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



Based on your graph, state an interval in which the graph is increasing.

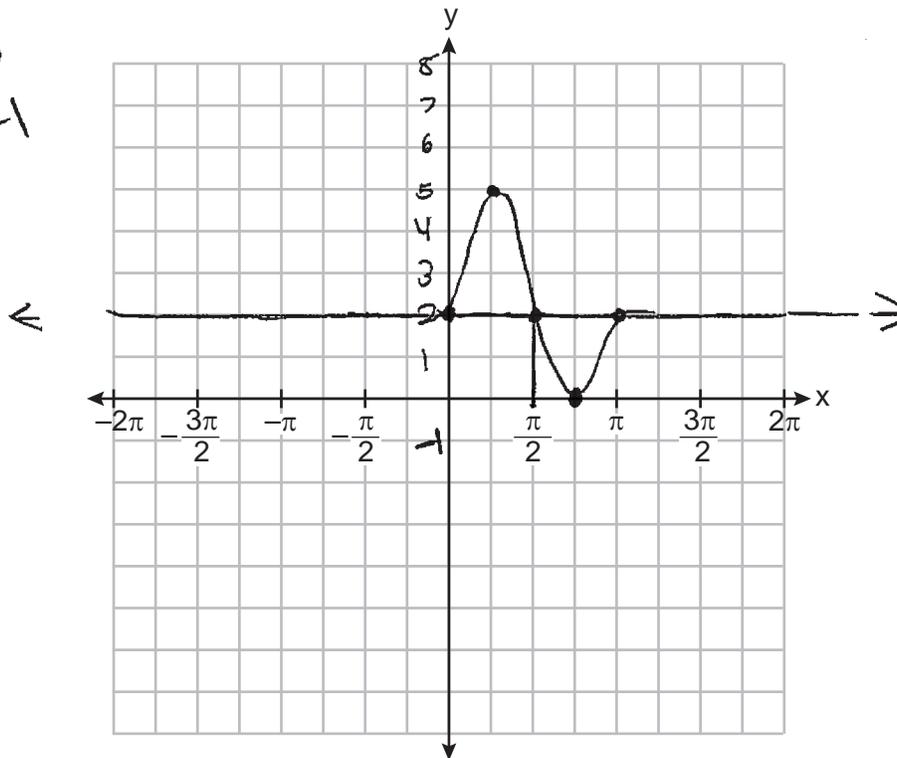
$$0 - \frac{\pi}{4}$$

**Score 3:** The student made one graphing error.

Question 36

36 On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .

max = 5  
min = -1



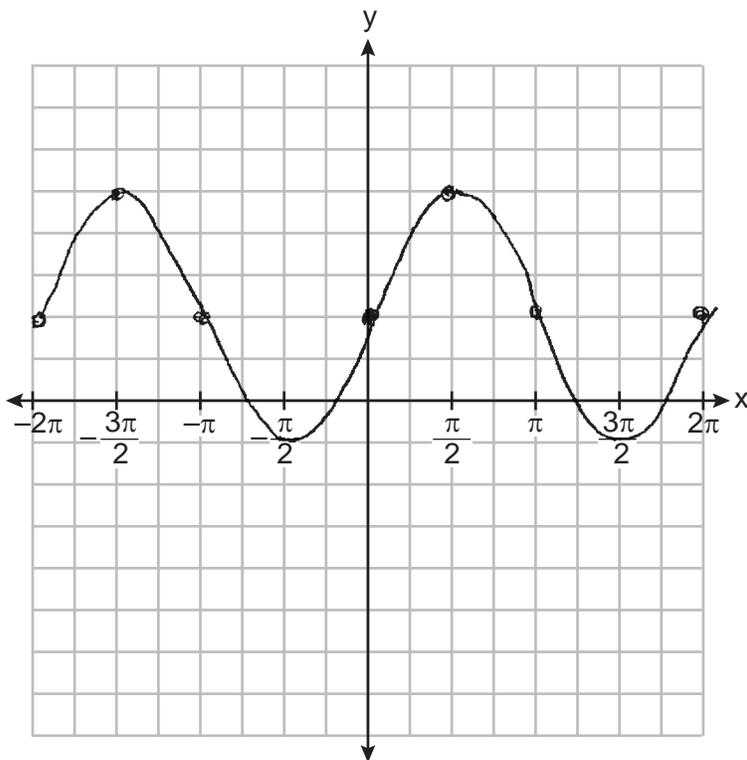
Based on your graph, state an interval in which the graph is increasing.

Interval =  $0 \rightarrow \frac{\pi}{4}$

**Score 3:** The student made one graphing error.

**Question 36**

36 On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .



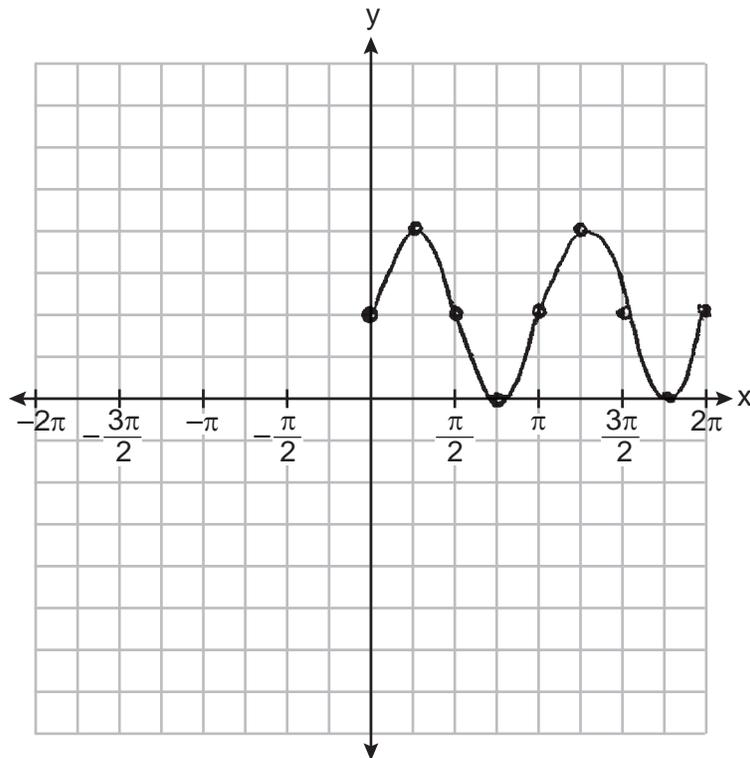
Based on your graph, state an interval in which the graph is increasing.

The graph is increasing from  
 $-2\pi$  to  $-\frac{3\pi}{2}$ ,  $-\frac{\pi}{2}$  to  $\frac{\pi}{2}$ ,  
 and  $\frac{3\pi}{2}$  to  $2\pi$ .

**Score 3:** The student made one graphing error.

**Question 36**

**36** On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .



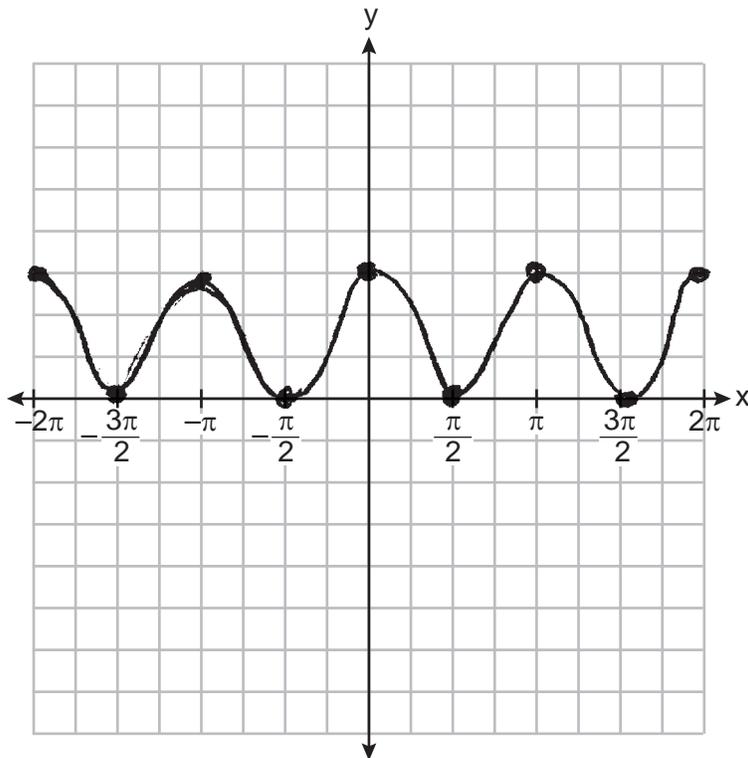
Based on your graph, state an interval in which the graph is increasing.

$$\{x \mid 0 \leq x \leq \pi\}$$

**Score 2:** The student made one graphing error and stated an incorrect interval.

**Question 36**

**36** On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .



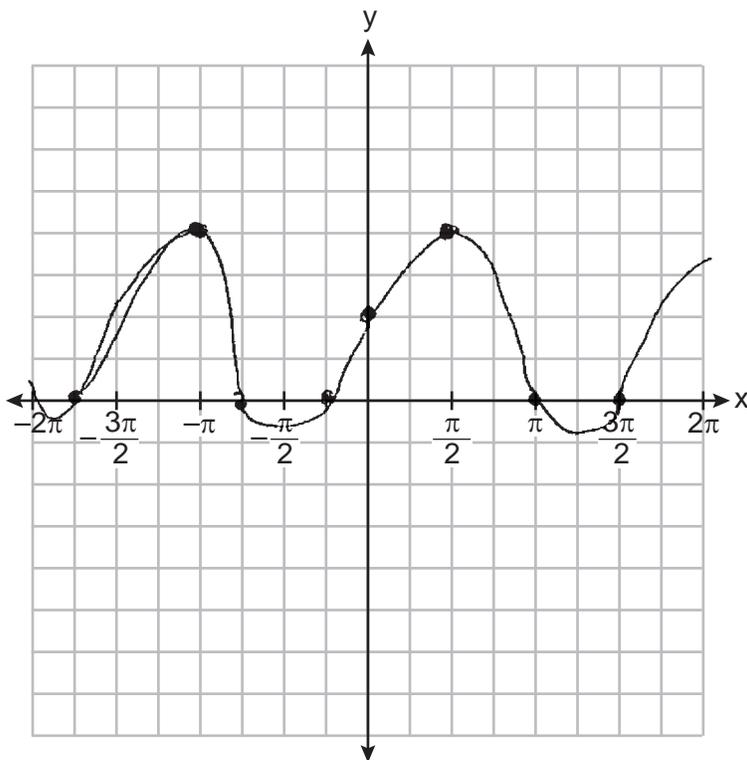
Based on your graph, state an interval in which the graph is increasing.

$(\pi/2 \text{ to } \pi)$

**Score 1:** The student stated a correct interval only.

Question 36

36 On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .



Based on your graph, state an interval in which the graph is increasing.

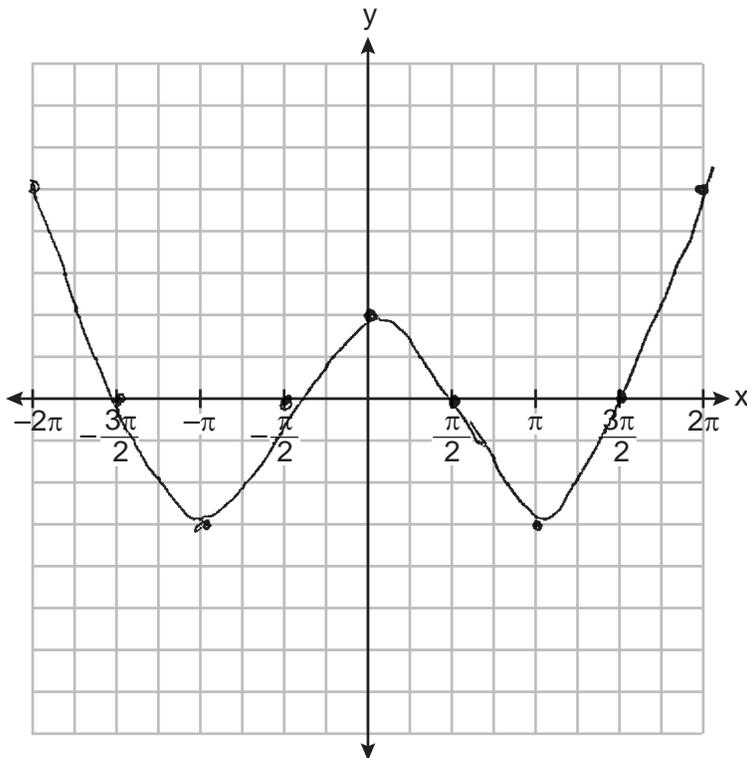
The graph is increasing in interval 1.

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

Question 36

36 On the graph below, draw *at least one* complete cycle of a sine graph passing through point  $(0,2)$  that has an amplitude of 3, a period of  $\pi$ , and a midline at  $y = 2$ .

$A=3$   
 $D=2$



Based on your graph, state an interval in which the graph is increasing.

$(-\pi, \infty)$

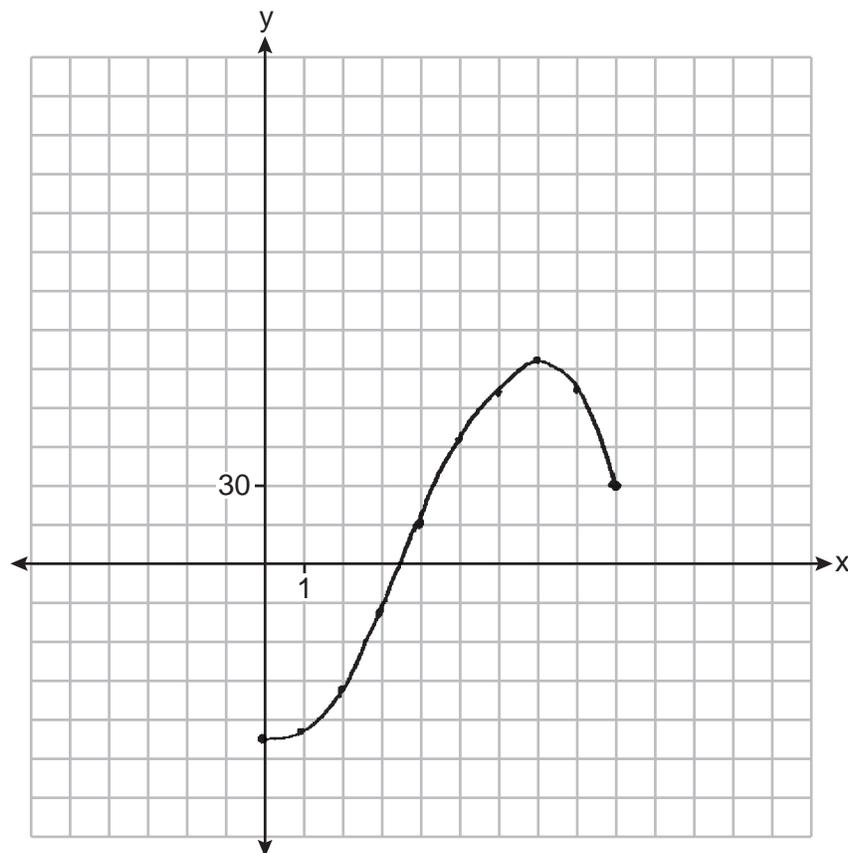
**Score 0:** The student did not show enough correct work to receive any credit.

**Question 37**

**37** A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



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

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

### Question 37

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$(7, 78)$  if 7,000 sweatshirts are sold, then profit is maximized at \$78,000.

Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

3,549 sweatshirts.

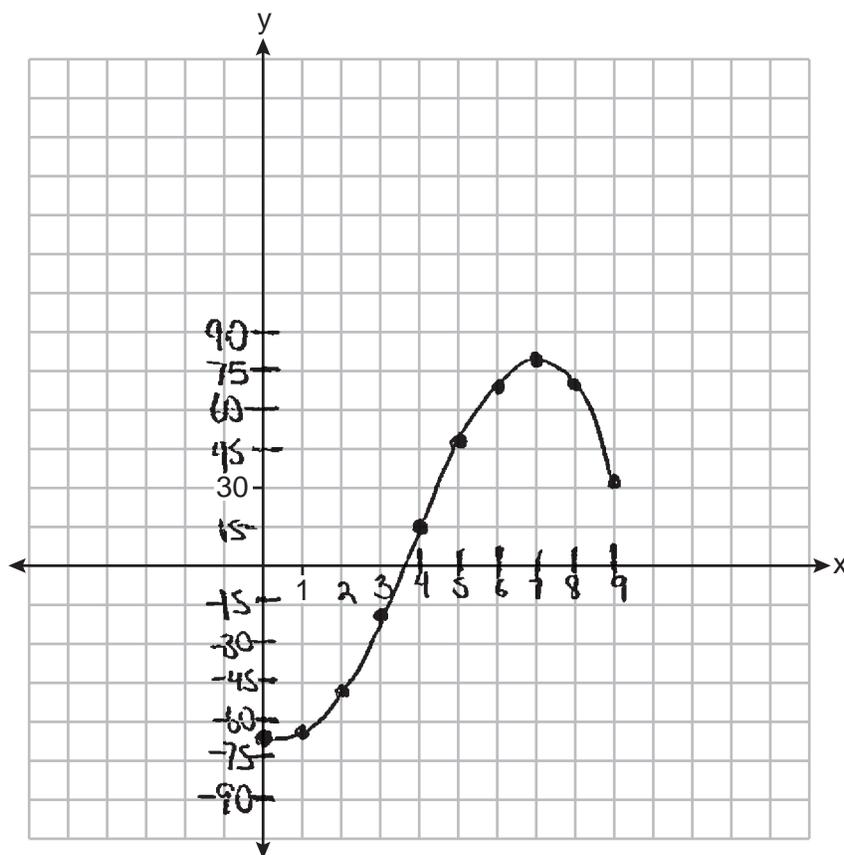
When  $x = 3,548$ ,  $p(x)$  is negative, meaning that a positive profit is not made when 3,548 sweatshirts are produced. 3,549 is the first  $x$  value where  $p(x)$  is positive, making the minimum amount produced for a profit needs to be 3,549 whole sweatshirts.

**Question 37**

37 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



x	y
0	-69
1	-66
2	-47
3	-18
4	15
5	46
6	69
7	78
8	67
9	30

Question 37 is continued on the next page.

**Score 5:** The student made an error in units in the last part.

### Question 37

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$$\text{2nd calc max} \\ (6.969697, 77.990845)$$

$(7, 78)$  is the local maximum of  $p$ .  
If 7000 hooded sweatshirts are sold, the manufacturer will profit with 78,000 dollars.

Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

$$y=0 \quad p(x) \\ \text{2nd calc intersect } (3.5488398, 0)$$

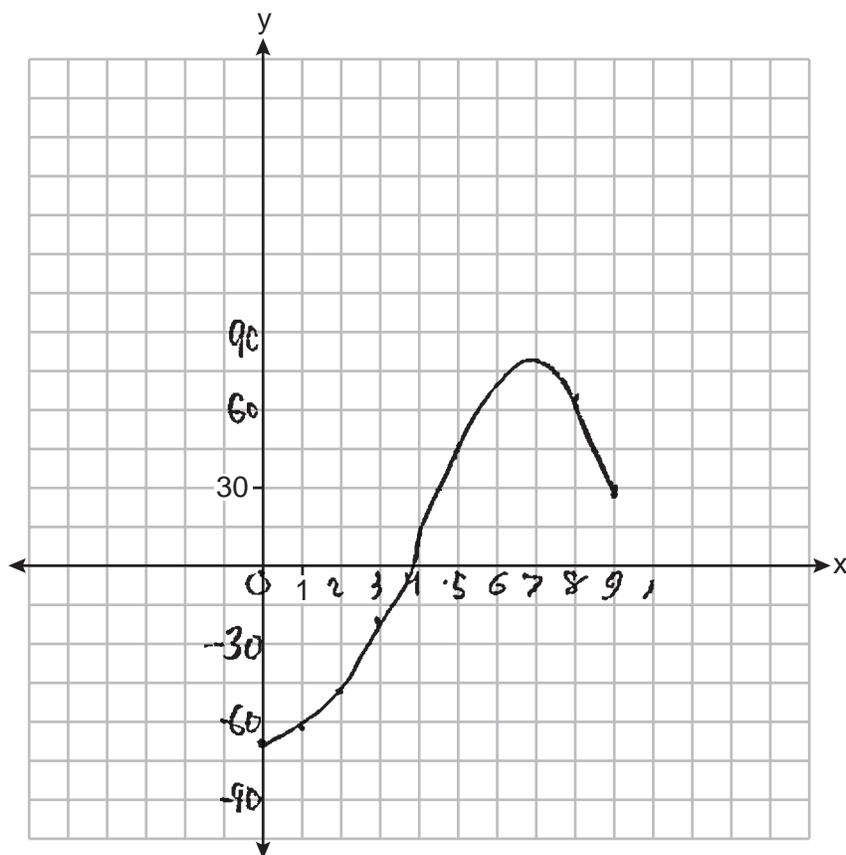
4 sweatshirts

**Question 37**

37 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



Question 37 is continued on the next page.

**Score 5:** The student made an error in units throughout the problem.

### Question 37

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$(7, 78)$  for every 7 sweatshirts sold, the profit is \$78

Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

4 Sweatshirts.  $P(x) = -x^3 + 11x^2 - 7x - 69$

$$P(3) = -(3)^3 + 11(3)^2 - 7(3) - 69$$

$$P(3) = -27 + 99 - 21 - 69$$

$$P(3) = -18$$

$$P(4) = -(4)^3 + 11(4)^2 - 7(4) - 69$$

$$P(4) = 15$$

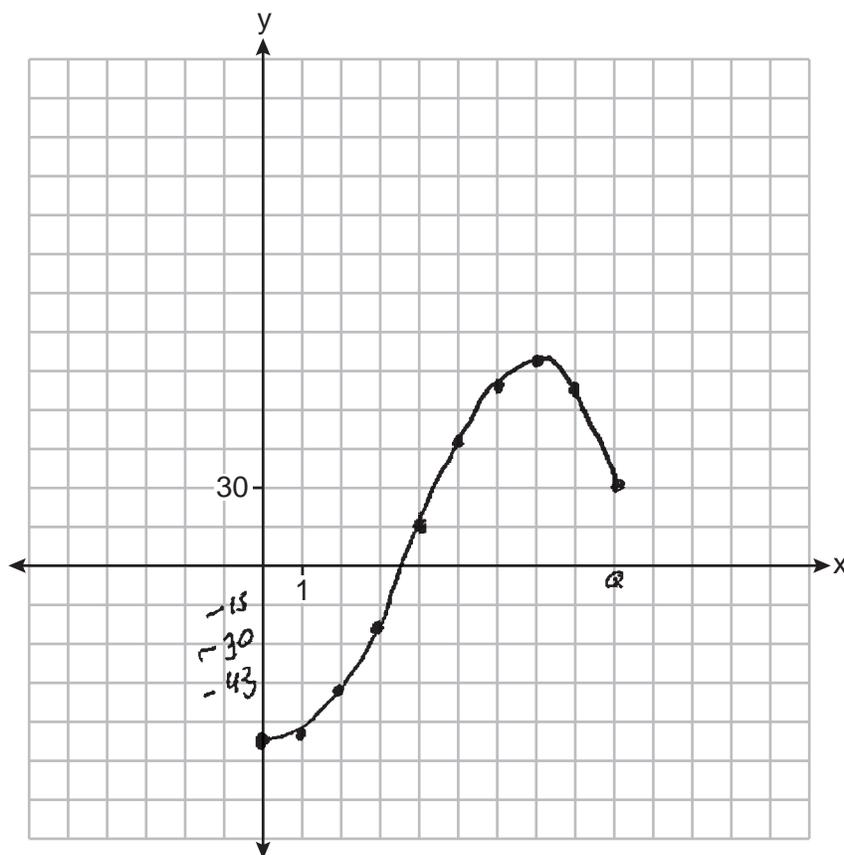
4 is the lowest whole integer that makes profit since 3 is negative, but 4 is positive.

**Question 37**

37 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



Question 37 is continued on the next page.

**Score 4:** The student stated the wrong coordinates and did not justify their answer to the last question.

### Question 37

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$(78, 7)$

If 7,000 sweatshirts are made and sold, there will be \$78,000 made at most.

Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

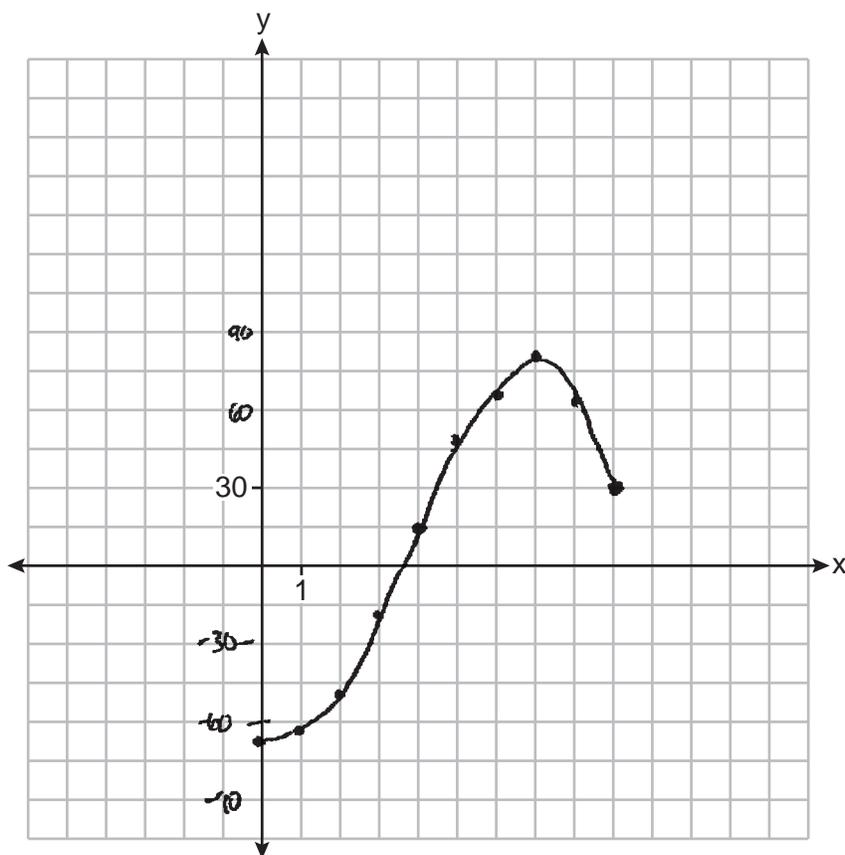
3,549 sweatshirts

**Question 37**

37 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



Question 37 is continued on the next page.

**Score 3:** The student received credit for the graph and stating the coordinates of the point.

### Question 37

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$(7, 78)$ , this point represents that producing 7,000 sweatshirts is most profitable for the manufacturer.

Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

$$-x^3 + 11x^2 - 7x - 69 > 0$$

$$x^3 - 11x^2 + 7x + 69 < 0$$

$$x^3 - 11x^2 + 7x < -69$$

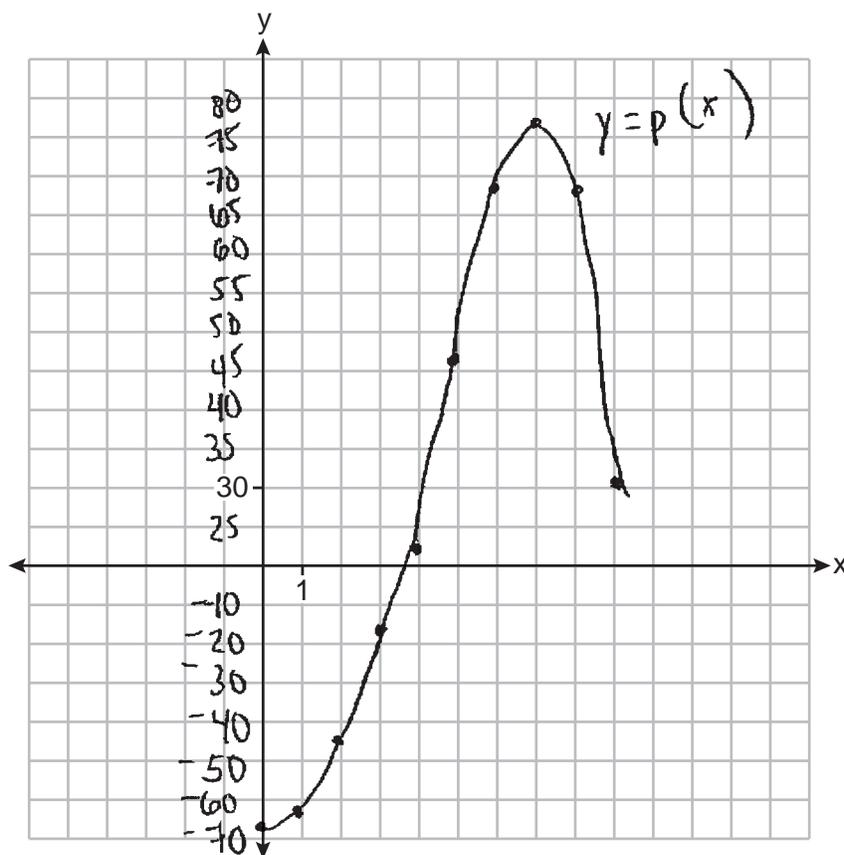
$$x(x^2 - 11x + 7) < -69$$

**Question 37**

37 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



Question 37 is continued on the next page.

**Score 3:** The student made one graphing error and received no credit for the last part.

**Question 37**

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$$(7, 78)$$

When there are 7,000 sweatshirts sold,  
\$78,000 are made in profit

Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

4000 sweatshirts

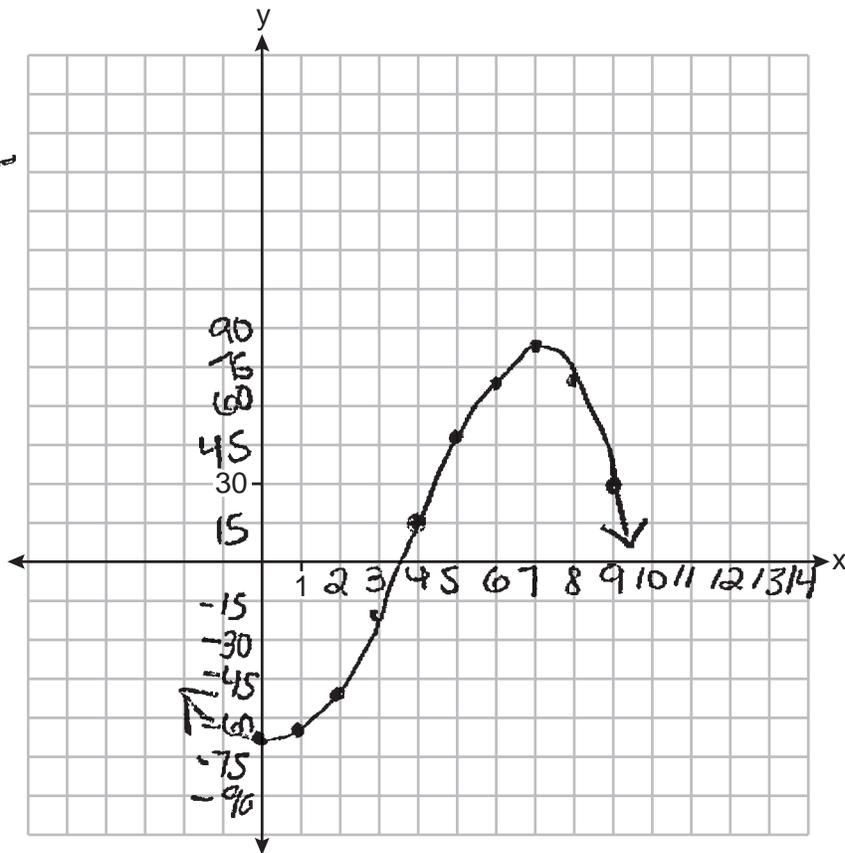
**Question 37**

37 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.

X	Y
0	-69
1	-66
2	-47
3	-18
4	15
5	46
6	69
7	78
8	67
9	30



Question 37 is continued on the next page.

**Score 2:** The student received one point for the graph and one for stating the coordinates.

### Question 37

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the nearest integer. Explain what this point represents in terms of the number of sweatshirts sold and profit.

Max = (7, 78) every 7 sweatshirts  
has a 78%  
profit

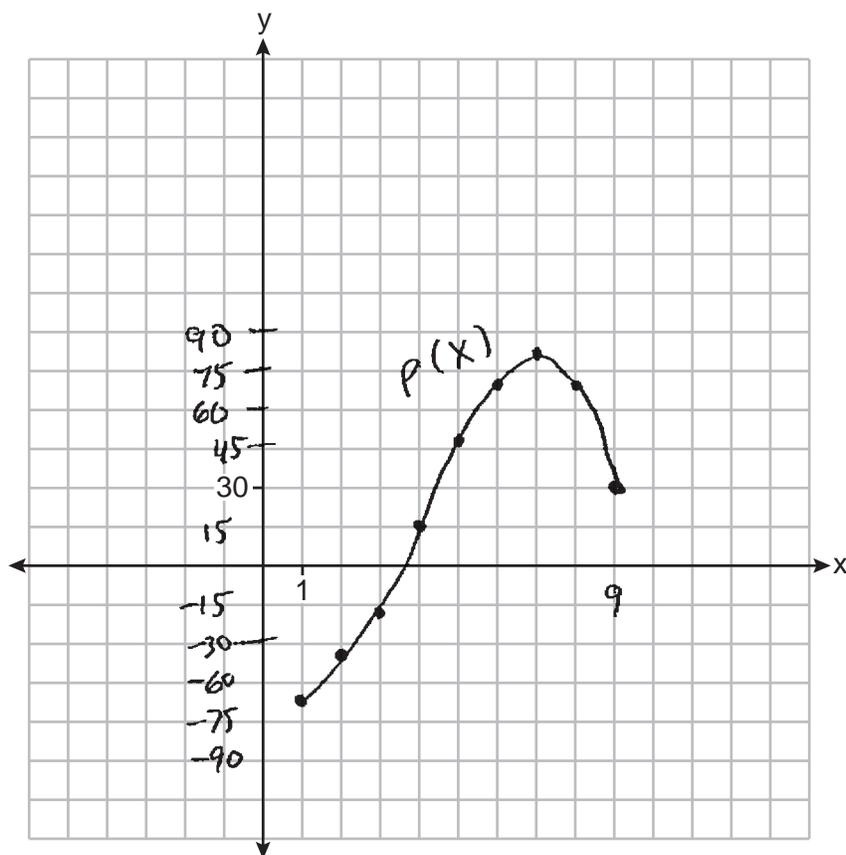
Determine how many sweatshirts, to the nearest whole sweatshirt, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

### Question 37

37 A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



Question 37 is continued on the next page.

**Score 1:** The student received one point for stating the coordinates.

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**Question 37**

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Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$$(7, 78)$$

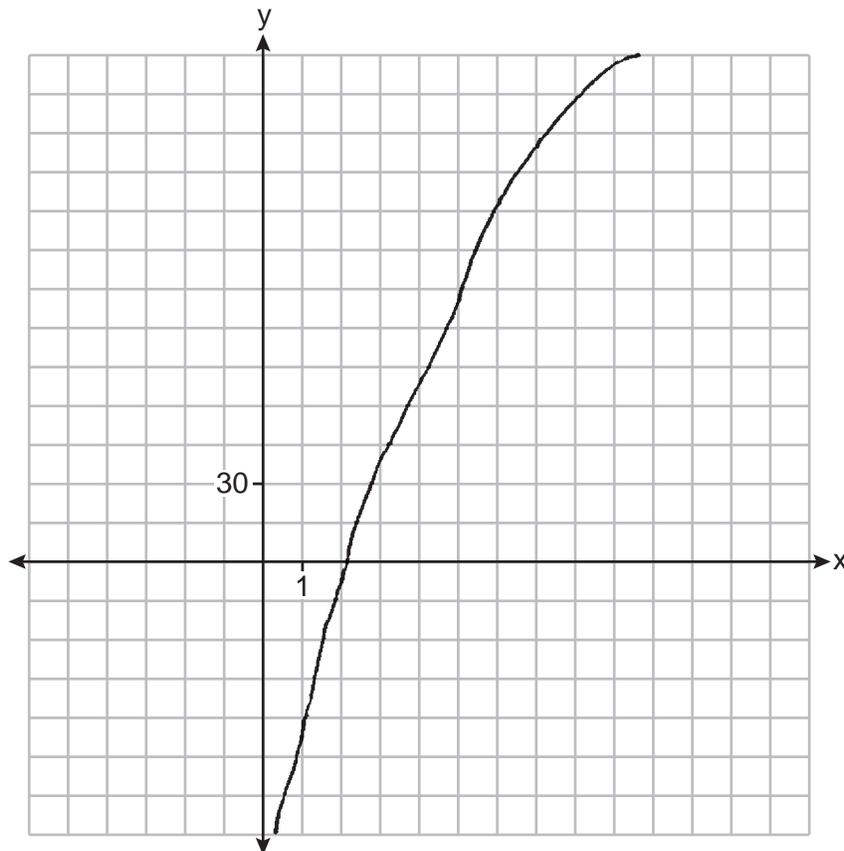
Determine how many sweatshirts, to the nearest whole sweatshirt, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

**Question 37**

**37** A manufacturer of sweatshirts finds that profits and costs fluctuate depending on the number of products created. Creating more products doesn't always increase profits because it requires additional costs, such as building a larger facility or hiring more workers. The manufacturer determines the profit,  $p(x)$ , in thousands of dollars, as a function of the number of sweatshirts sold,  $x$ , in thousands. This function,  $p$ , is given below.

$$p(x) = -x^3 + 11x^2 - 7x - 69$$

Graph  $y = p(x)$ , over the interval  $0 \leq x \leq 9$ , on the set of axes below.



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

**Score 0:** The student showed no correct work.

### Question 37

Over the given interval, state the coordinates of the maximum of  $p$  and round all values to the *nearest integer*. Explain what this point represents in terms of the number of sweatshirts sold and profit.

$(9, 1488)$

All values = 4155

The number of sweatshirts  
sold made a window profit.

-69      1091  
-64      1488  
-31  
36  
143  
296  
501  
764

Determine how many sweatshirts, to the *nearest whole sweatshirt*, the manufacturer would need to produce in order to first make a positive profit. Justify your answer.

36 sweatshirts

## Regents Examination in Algebra II – January 2024

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

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