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

ALGEBRA II

Thursday, January 26, 2023 — 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 Which expression is equivalent to $(x + 2)^2 - 5(x + 2) + 6$?

(1) $x(x - 1)$

(2) $(x - 3)(x - 2)$

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

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

2 To the *nearest tenth*, the solution to the equation $4300e^{0.07x} - 123 = 5000$ is

(1) 1.1

(2) 2.5

(3) 6.3

(4) 68.5

3 The value of an automobile t years after it was purchased is given by the function $V = 38{,}000(0.84)^t$. Which statement is true?

(1) The value of the car increases 84% each year.

(2) The value of the car decreases 84% each year.

(3) The value of the car increases 16% each year.

(4) The value of the car decreases 16% each year.

4 Which function represents exponential decay?

(1) $p(x) = \left(\frac{1}{4}\right)^{-x}$

(2) $q(x) = 1.8^{-x}$

(3) $r(x) = 2.3^{2x}$

(4) $s(x) = 4^{\frac{x}{2}}$

Use this space for computations.

5 The expression $\frac{x^4 - 5x^2 + 4x + 14}{x + 2}$ is equivalent to

(1) $x^3 - 2x^2 - x + 6 + \frac{2}{x + 2}$

(2) $x^3 - 5x + 4 - \frac{14}{x + 2}$

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

(4) $x^3 + 2x^2 - 9x + 22 - \frac{30}{x + 2}$

6 The sum of the first 20 terms of the series $-2 + 6 - 18 + 54 - \ldots$ is

(1) -610

(2) -59

(3) 1,743,392,200

(4) 2,324,522,934

7 If $f(x) = 2x^4 - x^3 - 16x + 8$, then $f\left(\frac{1}{2}\right)$

(1) equals 0 and $2x + 1$ is a factor of $f(x)$

(2) equals 0 and $2x - 1$ is a factor of $f(x)$

(3) does not equal 0 and $2x + 1$ is not a factor of $f(x)$

(4) does not equal 0 and $2x - 1$ is a factor of $f(x)$

8 If $(6 - ki)^2 = 27 - 36i$, the value of k is

(1) -36

(2) -3

(3) 3

(4) 6

Use this space for computations.

9 What is the solution set of the equation $\frac{x+2}{x} + \frac{x}{3} = \frac{2x^2+6}{3x}$?

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

10 How many real solutions exist for the system of equations below?

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

(1) 1
(2) 2
(3) 3
(4) 0

11 Which equation represents a polynomial identity?

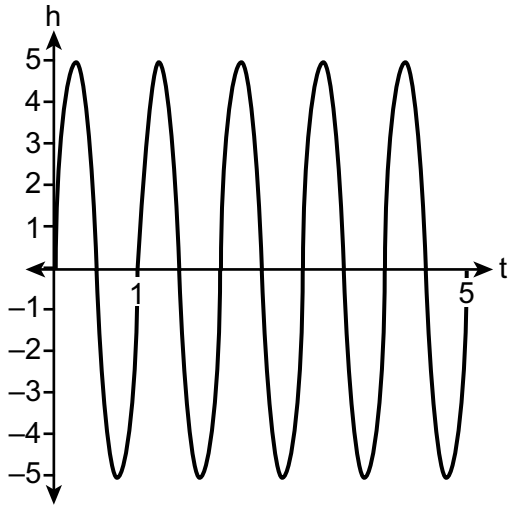
(1) $x^3 + y^3 = (x + y)^3$
(2) $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$
(3) $x^3 + y^3 = (x + y)(x^2 - xy - y^2)$
(4) $x^3 + y^3 = (x - y)(x^2 + xy + y^2)$

12 Given $x > 0$, the expression $\frac{x^{\frac{1}{5}}}{x^{\frac{1}{2}}}$ can be rewritten as

(1) $\sqrt[3]{x}$
(2) $-\sqrt[10]{x^3}$
(3) $\frac{1}{\sqrt[10]{x^3}}$
(4) $\sqrt[3]{x^{10}}$

Use this space for computations.

13 A cyclist pedals a bike at a rate of 60 revolutions per minute. The height, h, of a pedal at time t, in seconds, is plotted below.



The graph can be modeled by the function $h(t) = 5\sin(kt)$, where k is equal to

(1) 1

(2) 2π

(3) 60

(4) $\frac{\pi}{30}$

14 Which statement about data collection is most accurate?

(1) A survey about parenting styles given to every tenth student entering the library will provide unbiased results.

(2) An observational study allows a researcher to determine the cause of an outcome.

(3) Margin of error increases as sample size increases.

(4) A survey collected from a random sample of students in a school can be used to represent the opinions of the school population.

Use this space for computations.

15 If $f(x) = \frac{1}{2}x + 2$, then the inverse function is

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

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

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

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

16 Given $f(x) = x^4 - x^3 - 6x^2$, for what values of x will $f(x) > 0$?

(1) $x < -2$, only

(2) $x < -2$ or $x > 3$

(3) $x < -2$ or $0 \leq x \leq 3$

(4) $x > 3$, only

17 For which approximate value(s) of x will $\log(x + 5) = |x - 1| - 3$?

(1) 5, 1

(2) -2.41, 0.41

(3) -2.41, 5

(4) 5, only

18 Consider a cubic polynomial with the characteristics below.

- exactly one real root
- as $x \to \infty, f(x) \to -\infty$

Given $a > 0$ and $b > 0$, which equation represents a cubic polynomial with these characteristics?

(1) $f(x) = (x - a)(x^2 + b)$

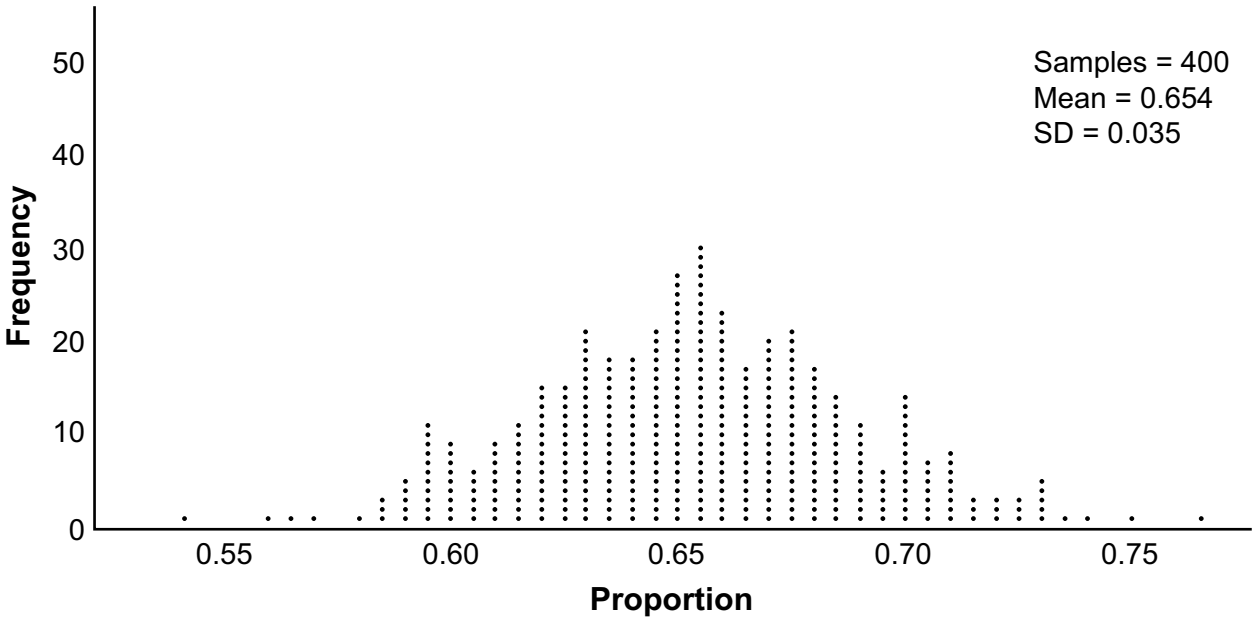
(2) $f(x) = (a - x)(x^2 + b)$

(3) $f(x) = (a - x^2)(x^2 + b)$

(4) $f(x) = (x - a)(b - x^2)$

Use this space for computations.

19 Betty conducted a survey of her class to see if they like pizza. She gathered 200 responses and 65% of the voters said they did like pizza. Betty then ran a simulation of 400 more surveys, each with 200 responses, assuming that 65% of the voters would like pizza. The output of the simulation is shown below.



Considering the middle 95% of the data, what is the margin of error for the simulation?

(1) 0.01
(2) 0.02
(3) 0.05
(4) 0.07

20 If $\cos A = \frac{\sqrt{5}}{3}$ and $\tan A < 0$, what is the value of $\sin A$?

(1) $\frac{2}{3}$
(2) $-\frac{\sqrt{5}}{3}$
(3) $-\frac{2}{3}$
(4) $\frac{3}{\sqrt{5}}$

Use this space for computations.

21 A tree farm initially has 150 trees. Each year, 20% of the trees are cut down and 80 seedlings are planted. Which recursive formula models the number of trees, a_n, after n years?

(1) $a_1 = 150$
$a_n = a_{n-1}(0.2) + 80$

(2) $a_1 = 150$
$a_n = a_{n-1}(0.8) + 80$

(3) $a_n = 150(0.2)^n + 80$

(4) $a_n = 150(0.8)^n + 80$

22 Which equation represents a parabola with a focus of $(4,-3)$ and directrix of $y = 1$?

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

(2) $(x - 1)^2 = -8(y - 3)$

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

(4) $(x - 4)^2 = -8(y + 1)$

23 Mia has a student loan that is in deferment, meaning that she does not need to make payments right now. The balance of her loan account during her deferment can be represented by the function $f(x) = 35{,}000(1.0325)^x$, where x is the number of years since the deferment began. If the bank decides to calculate her balance showing a monthly growth rate, an approximately equivalent function would be

(1) $f(x) = 35{,}000(1.0027)^{12x}$

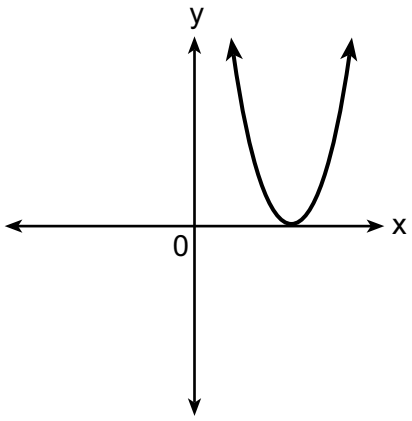
(2) $f(x) = 35{,}000(1.0027)^{\frac{x}{12}}$

(3) $f(x) = 35{,}000(1.0325)^{12x}$

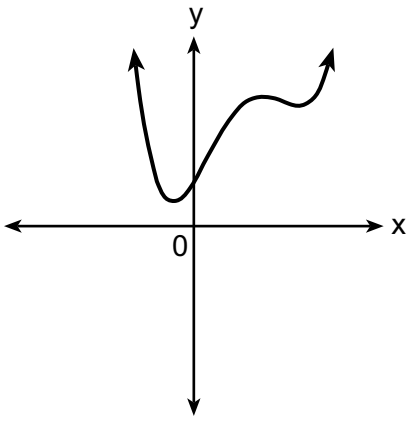
(4) $f(x) = 35{,}000(1.0325)^{\frac{x}{12}}$

24 Which graph shows a quadratic function with two imaginary zeros?

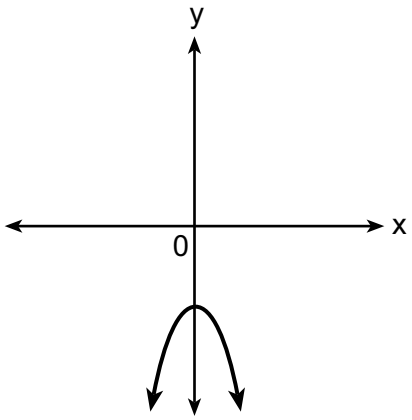
Use this space for computations.



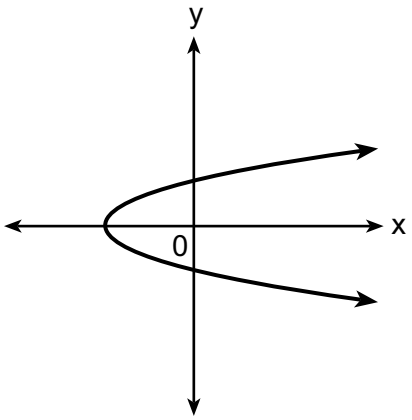
(1)



(3)



(2)



(4)

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 Algebraically determine the zeros of the function below.

$$r(x) = 3x^3 + 12x^2 - 3x - 12$$

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

27 Given $P(A) = \frac{1}{3}$ and $P(B) = \frac{5}{12}$, where A and B are independent events, determine $P(A \cap B)$.

28 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120.

Determine the percentage of scores between 690 and 900, to the *nearest percent*.

29 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth*.

30 Write the expression $A(x) \bullet B(x) - 3C(x)$ as a polynomial in standard form.

$$A(x) = x^3 + 2x - 1$$
$$B(x) = x^2 + 7$$
$$C(x) = x^4 - 5x$$

31 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.

32 Natalia's teacher has given her the following information about angle θ.

- $\pi < \theta < 2\pi$
- $\cos\theta = \frac{\sqrt{3}}{4}$

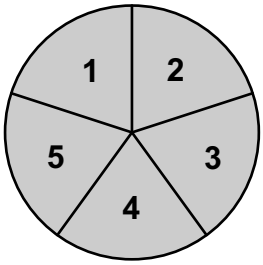
Explain how Natalia can determine if the value of $\tan\theta$ is positive or negative.

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 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

34 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.



She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game.

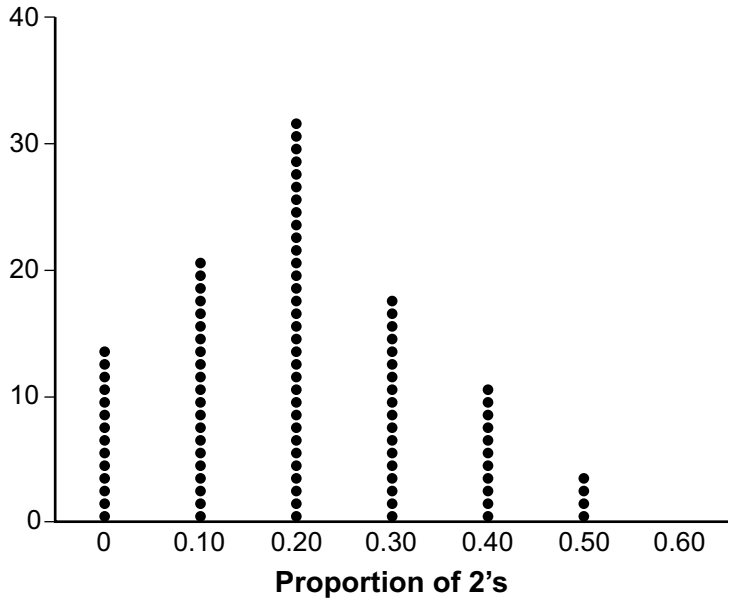
State the proportion of 2's that were spun.

State the theoretical probability of spinning a 2.

Question 34 is continued on the next page.

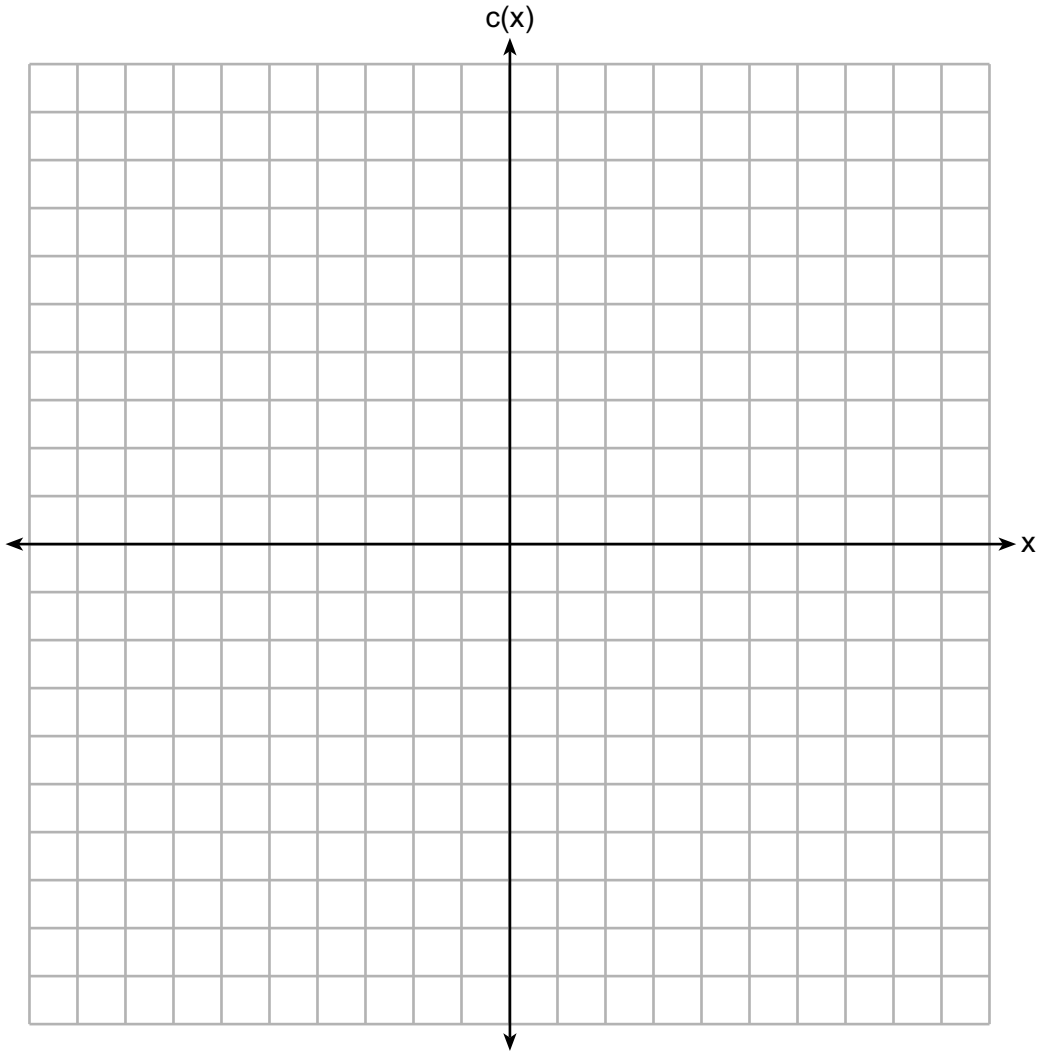
Question 34 is continued

The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.



Does the output indicate that the carnival game was unfair? Explain your answer.

35 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.



Describe the end behavior of $c(x)$ as x approaches positive infinity.

Describe the end behavior of $c(x)$ as x approaches negative infinity.

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

Explain what this value represents in the given context.

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 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

Question 37 is continued on the next page.

Question 37 is continued

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

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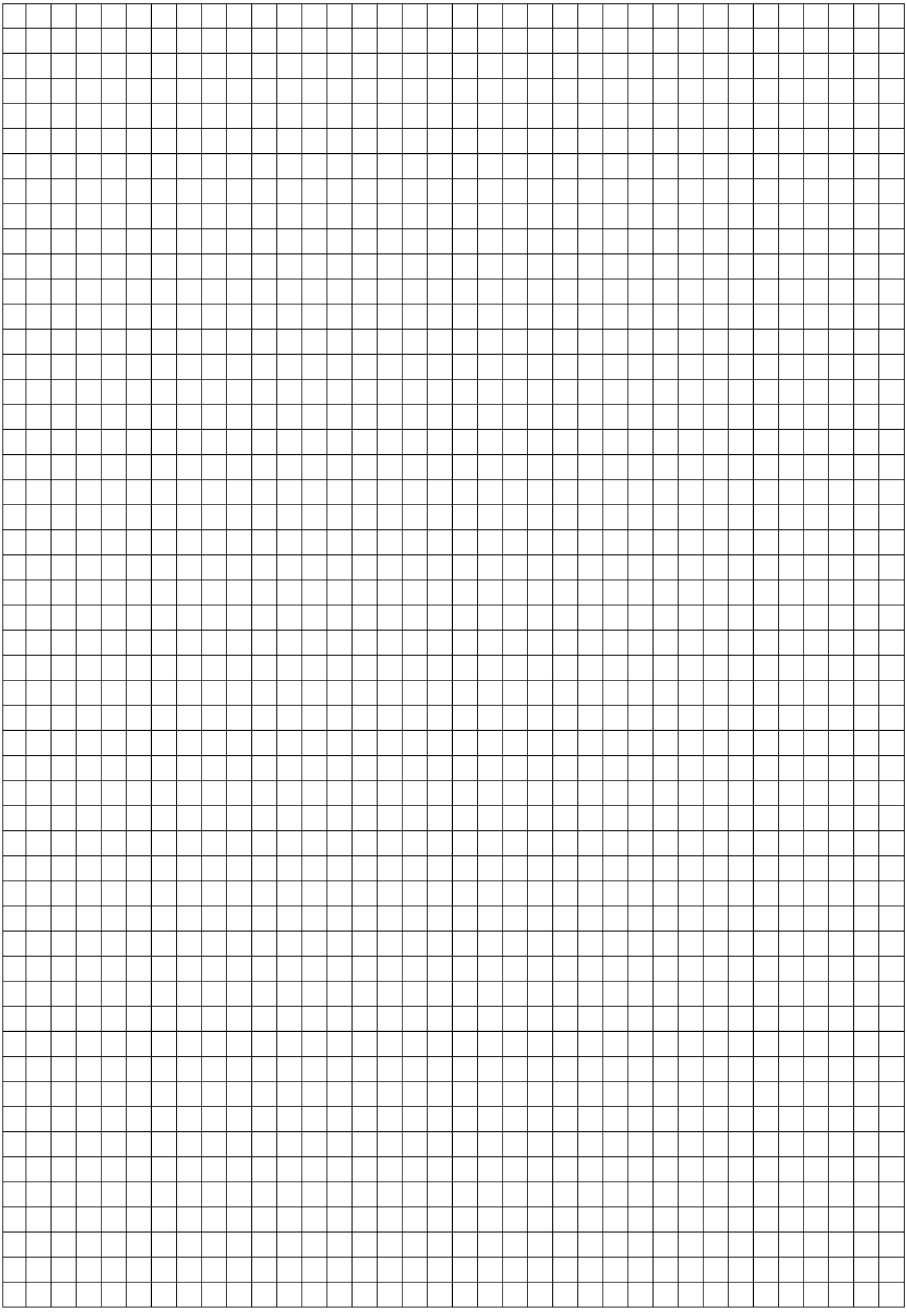

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High School Math Reference Sheet

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 5280 feet
1 mile = 1760 yards
1 mile = 1.609 kilometers

1 kilometer = 0.62 mile
1 pound = 16 ounces
1 pound = 0.454 kilogram
1 kilogram = 2.2 pounds
1 ton = 2000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 3.785 liters
1 liter = 0.264 gallon
1 liter = 1000 cubic centimeters

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

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

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

Regents Examination in Algebra II – January 2023

Scoring Key: Part I (Multiple-Choice Questions)

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

Regents Examination in Algebra II – January 2023

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

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Algebra II	January '23	**25**	-	CR	2	1
Algebra II	January '23	**26**	-	CR	2	1
Algebra II	January '23	**27**	-	CR	2	1
Algebra II	January '23	**28**	-	CR	2	1
Algebra II	January '23	**29**	-	CR	2	1
Algebra II	January '23	**30**	-	CR	2	1
Algebra II	January '23	**31**	-	CR	2	1
Algebra II	January '23	**32**	-	CR	2	1
Algebra II	January '23	**33**	-	CR	4	1
Algebra II	January '23	**34**	-	CR	4	1
Algebra II	January '23	**35**	-	CR	4	1
Algebra II	January '23	**36**	-	CR	4	1
Algebra II	January '23	**37**	-	CR	6	1

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

The chart for determining students' final examination scores for the **January 2023 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

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RATING GUIDE

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: http://www.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/.

Note: The rubric definition for a 0-credit response has been updated based on feedback from New York State mathematics educators.

Mechanics of Rating

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

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

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

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

Raters should record the student's scores for all questions and the total raw score on the student's separate answer sheet. Then the student's total raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: http://www.nysed.gov/state-assessment/ by Thursday, January 26, 2023. 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]** ± 1 and -4 and correct algebraic 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] Appropriate work is shown, but only two zeros are stated correctly.

or

[1] ± 1 and -4, but a method other than algebraic is used.

or

[1] ± 1 and -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]** $-\frac{1}{3}$, 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] $-\frac{1}{3}$, 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.

(27) **[2]** $\frac{5}{36}$ 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.

[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]** 43 and correct work is shown.

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

or

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

or

[1] 43, but no work is shown.

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

(29) **[2]** $y = 2.459(1.616)^x$

[1] One rounding or notation error is made.

or

[1] One conceptual error is made.

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

(30) **[2]** $x^5 - 3x^4 + 9x^3 - x^2 + 29x - 7$, and correct work is shown.

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

or

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

or

[1] Appropriate work is shown, but the polynomial is not written in standard form.

or

[1] $x^5 - 3x^4 + 9x^3 - x^2 + 29x - 7$, 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.

(31) **[2]** $(x + 2)(x - 2)(x + 1)(x - 1)$ and correct work is shown.

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

or

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

or

[1] $(x + 2)(x - 2)(x + 1)(x - 1)$, 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 explanation is written.

[1] One conceptual error is made.

or

[1] An incomplete explanation is written.

[0] Negative, 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.

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]** 4, 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 to find $-\frac{3}{2}$ and 4, but $-\frac{3}{2}$ is not rejected.

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

or

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

or

[2] 4, but a method other than algebraic is used.

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

or

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

or

[1] 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.

(34) **[4]** 0.1 and 0.2 or equivalent answers are written, and no, and a correct explanation is given.

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

or

[3] 0.1 and 0.2 and no, and an incomplete explanation is given.

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

or

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

or

[2] 0.1 and 0.2, but the explanation is incorrect or missing.

or

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

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

or

[1] 0.1 or 0.2, but no further correct work is shown.

[0] No, 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.

(35) **[4]** A correct graph is drawn and correct descriptions are written.

[3] One graphing error is made.

[2] Two or more graphing errors are made.

or

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

or

[2] Correct descriptions are written, but no further correct work is shown.

[1] One correct description is written, but no further correct 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]** -3.88, and correct work is shown, and a correct explanation is written.

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

or

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

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

or

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

or

[2] Appropriate work is shown to find -3.88, but no further correct work is shown.

or

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

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

or

[1] -3.88, but no work is shown.

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

Part IV

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

(37) **[6]** $T = (400 - 75)e^{-0.0735t} + 75$ or equivalent, 300, 0.0817 and 17 minutes with correct work shown.

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

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

or

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

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

or

[2] Appropriate work is shown to find 0.0817, but no further correct work is shown.

or

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

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

or

[1] $T = (400 - 75)e^{-0.0735t} + 75$ is written, but no further correct work is shown.

or

[1] 300, but no further correct work is shown.

or

[1] 0.0817, but no work is shown.

or

[1] 17, 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 2023

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

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

Regents Examination in Algebra II

January 2023

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

The *Chart for Determining the Final Examination Score for the January 2023 Regents Examination in Algebra II* will be posted on the Department's web site at: http://www.nysed.gov/state-assessment/ by Thursday, January 26, 2023. 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 26, 2023 — 1:15 to 4:15 p.m., only

MODEL RESPONSE SET

Table of Contents

Question 25

25 Algebraically determine the zeros of the function below.

$$r(x) = 3x^3 + 12x^2 - 3x - 12$$

$0 = 3x^2(x+4) - 3(x+4)$

$0 = (3x^2 - 3)(x+4)$

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

$\sqrt{x^2} = \sqrt{1}$

$x = \pm 1$

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

Question 25

25 Algebraically determine the zeros of the function below.

$$r(x) = 3x^3 + 12x^2 - 3x - 12$$

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

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

$(x+4)(3x^2 - 3) = 0$

$(x+4) = 0$

$x = -4$

$3x^2 - 3 = 0$

$3x^2 = 3$

$x^2 = 1$

$x = \pm\sqrt{1}$

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

Question 25

25 Algebraically determine the zeros of the function below.

$$r(x) = 3x^3 + 12x^2 - 3x - 12$$

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

$(3x^2-3)(x+4) = 0$

$3x^2 - 3 = 0$ $\quad +3 \quad +3$

$\frac{3x^2}{3} = \frac{3}{3}$

$x^2 = 1$

$x = 1$

$x + 4 = 0$ $\quad -4 \quad -4$

$x = -4$

Score 1: The student did not indicate $x = -1$.

Question 25

25 Algebraically determine the zeros of the function below.

$$r(x) = 3x^3 + 12x^2 - 3x - 12$$

1

-1

-4

Score 1: The student did not show any work.

Question 25

25 Algebraically determine the zeros of the function below.

$r(x) = 3x^3 + 12x^2 - 3x - 12$ =0

+12 +12

1,0
-1,0
-4,0

$3x^3 + 12x^2 - 3x = 12$

$3x^3$

Score 0: The student did not algebraically determine the zeros, and attempted to write the zeros as coordinates.

Question 26

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

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

$a^{3x+3} = a^2$

$3x + 3 = 2$

$-3 \quad -3$

$3x = -1$

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

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

Question 26

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

$a^{x+1} = \sqrt[3]{a^2}$

$a^{x+1} = a^{\frac{2}{3}}$

$x + 1 = \frac{2}{3}$

$-1 \quad -1$

$x = \frac{2}{3} - 1$

$\boxed{x = -.\overline{33}}$

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

Question 26

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

$a^{x+1} = a^{\frac{2}{3}}$

$x+1 = \frac{2}{3}$

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

Score 1: The student made an error by writing $a^{\frac{3}{2}}$.

Question 26

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

$a^{x+1} = \sqrt[3]{a^2}$

$a^{x+1} = a^{2/3}$

$x+1 = \frac{2}{3}$

$x = \frac{2}{3} - 1$

$x = -1\frac{2}{3}$

Score 1: The student made a computational error.

Question 26

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

$a^{x+1} = \sqrt[3]{a^2}$

$2^{x+1} = \sqrt[3]{2^2}$

$2^{x+1} = \sqrt[3]{4}$

$\sqrt[x+1]{2^{x+1}} = \sqrt[x+1]{1.6}$

$\sqrt[x+1]{2} = \sqrt[x+1]{1.6}$

$\sqrt[x]{2} = \sqrt[x]{1.6}$

$x = 3.2$

Score 0: The student showed no correct work.

Question 26

26 Given $a > 0$, solve the equation $a^{x+1} = \sqrt[3]{a^2}$ for x algebraically.

$a^{x+1} = \sqrt[3]{a^2}$

$x + 1 = \frac{\frac{1}{3}}{a^2}$

$x + 1 = a^2 - \frac{1}{3}$

$-1 \quad -1$

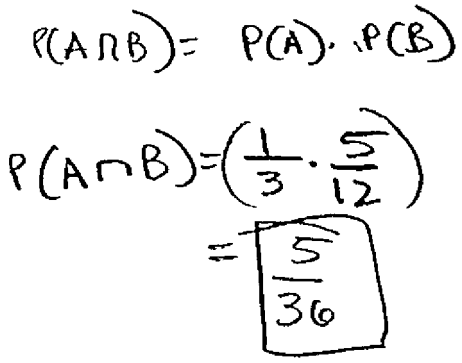
$x = a^2 - \frac{1}{3}$

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

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

Question 27

27 Given $P(A) = \frac{1}{3}$ and $P(B) = \frac{5}{12}$, where A and B are independent events, determine $P(A \cap B)$.



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

Question 27

27 Given $P(A) = \frac{1}{3}$ and $P(B) = \frac{5}{12}$, where A and B are independent events, determine $P(A \cap B)$.

$\frac{1}{3} \times \frac{5}{12} = \boxed{\frac{5}{36}}$

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

Question 27

27 Given $P(A) = \frac{1}{3}$ and $P(B) = \frac{5}{12}$, where A and B are independent events, determine $P(A \cap B)$.

$\frac{1}{3} \cdot \frac{5}{12} = \frac{5}{36}$

$= 14\%$

Score 1: The student received a deduction for rounding the answer to 14%.

Question 27

27 Given $P(A) = \frac{1}{3}$ and $P(B) = \frac{5}{12}$, where A and B are independent events, determine $P(A \cap B)$.

$P(A \cap B) = \frac{P(B) - P(A)}{P(B)}$

$\frac{\frac{5}{12} - \frac{1}{3}}{\frac{5}{4}}$

$P(A \cap B) = \frac{1}{5}$

Score 0: The student made multiple errors.

Question 27

27 Given $P(A) = \frac{1}{3}$ and $P(B) = \frac{5}{12}$, where A and B are independent events, determine $P(A \cap B)$.

$(Pa) + (PB) = P(A+B)$

$\frac{1}{3} + \frac{5}{12} = P\left(\frac{1}{3}\right)\left(\frac{5}{12}\right)$

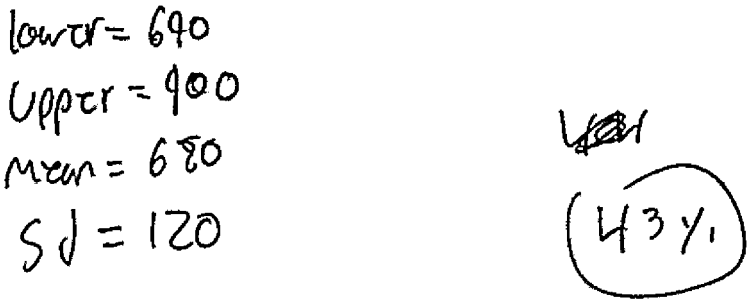
$.333 + .416 = .138$

Score 0: The student made multiple errors.

Question 28

28 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120.

Determine the percentage of scores between 690 and 900, to the *nearest percent*.



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

Question 28

28 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120.

Determine the percentage of scores between 690 and 900, to the *nearest percent*.

2nd | Vars | normalcdf(690, 900, 680, 120)

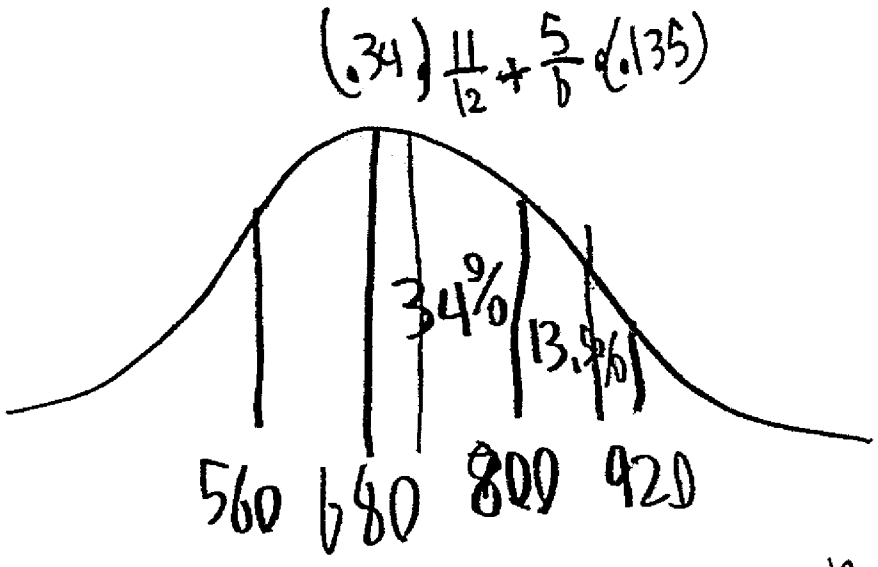
43%

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

Question 28

28 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120.

Determine the percentage of scores between 690 and 900, to the *nearest percent*.



$(.34 \cdot (\frac{11}{12})) + (.135 \cdot (\frac{5}{10})) = .42416$

42%

Score 1: The student used estimates to get 42%.

Question 28

28 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120.

Determine the percentage of scores between 690 and 900, to the *nearest percent*.

$\bar{X} = 680$

$SD = 120$

lower = 690

upper = 900

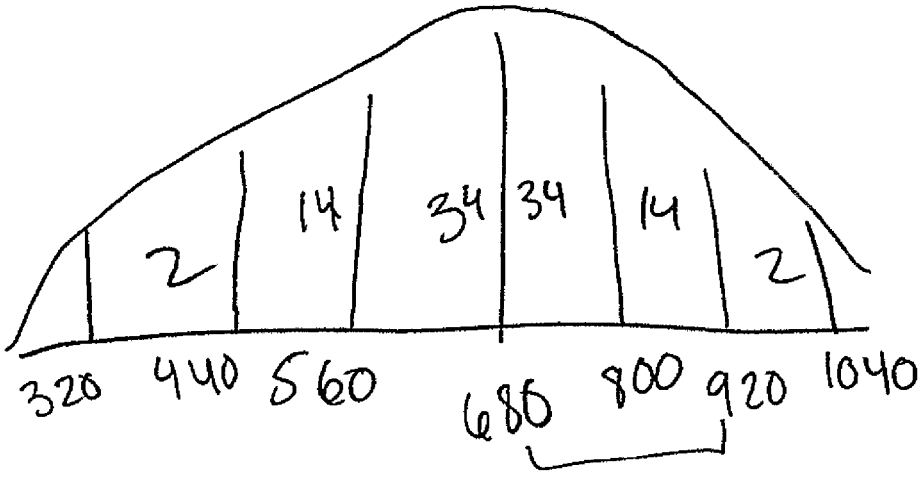
43.3 %

Score 1: The student made a rounding error.

Question 28

28 The scores on a collegiate mathematics readiness assessment are approximately normally distributed with a mean of 680 and a standard deviation of 120.

Determine the percentage of scores between 690 and 900, to the *nearest percent*.



2%

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

Question 29

29 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth.*

Stat > Edit > CALC > ExpReg

$y = a*b^x$

$a = 2.458522514$

$b = 1.615900171$

$y = (2.459)(1.616)^x$

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

Question 29

29 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth.*

$y = a * b^x$

$a = 2.458522514$

$b = 1.615900017$

$r^2 = .994530794$

$r = .997216478$

$y = a * b^x$

$a = 2.459$

$b = 1.616$

$r^2 = .995$

$r = .997$

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

Question 29

29 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth.*

$y = ab^x$

$y = 2.46(1.62)^x$

Score 1: The student made a rounding error.

Question 29

29 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth.*

$y = 2.439(1.619)^x$

Score 1: The student made a transcription error entering the data.

Question 29

29 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth.*

$y = ab^x$

$y = ax + b$

$y = 7.289x - 7.627$

Score 1: The student found a correct linear regression function.

Question 29

29 Consider the data in the table below.

x	1	2	3	4	5	6
y	3.9	6	11	18.1	28	40.3

State an exponential regression equation to model these data, rounding all values to the *nearest thousandth.*

$y = ab^x$

$y = 2.715 \cdot 1.579^x$

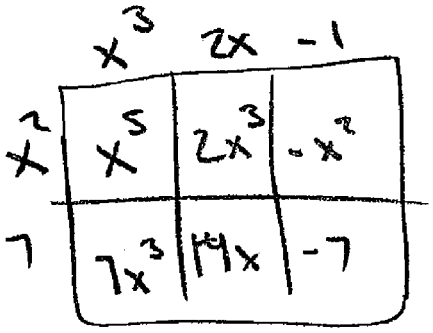
$y = 4.287^x$

Score 0: The student made multiple errors.

Question 30

30 Write the expression $A(x) \bullet B(x) - 3C(x)$ as a polynomial in standard form.

$$A(x) = x^3 + 2x - 1$$
$$B(x) = x^2 + 7$$
$$C(x) = x^4 - 5x$$



$(x^3 + 2x - 1)(x^2 + 7) - 3(x^4 - 5x)$

$x^5 + 9x^3 - x^2 + 14x - 7 - 3x^4 + 15x$

$x^5 - 3x^4 + 9x^3 - x^2 + 29x - 7$

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

Question 30

30 Write the expression $A(x) \bullet B(x) - 3C(x)$ as a polynomial in standard form.

$$A(x) = x^3 + 2x - 1$$
$$B(x) = x^2 + 7$$
$$C(x) = x^4 - 5x$$

$(x^2+7)(x^3+2x-1)$

$x^5+2x^3-x^2+7x^3+14x-7$

$x^5+9x^3-x^2+14x-7$

$3(x^4-5x)$

$3x^4-15x$

$x^5+9x^3-x^2+14x-7$

$-\quad 3x^4-15x$

$x^5-3x^4+9x^3-x^2+29x-7$

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

Question 30

30 Write the expression $A(x) \bullet B(x) - 3C(x)$ as a polynomial in standard form.

$$A(x) = x^3 + 2x - 1$$
$$B(x) = x^2 + 7$$
$$C(x) = x^4 - 5x$$

$(x^3+2x-1)(x^2+7) - 3(x^4-5x)$

$x^5+7x^3+2x^3+14x-x^2-7$

$x^5+9x^3-x^2+14x-7-3x^4-15x$

$x^5-3x^4+9x^3-x^2-x-7$

Score 1: The student multiplied $-3C(x)$ incorrectly.

Question 30

30 Write the expression $A(x) \bullet B(x) - 3C(x)$ as a polynomial in standard form.

$A(x) = x^3 + 2x - 1$ $ax + bx$

$B(x) = x^2 + 7$

$C(x) = x^4 - 5x$

$(x^3 + 2x - 1)(x^2 + 7) - 3(x^4 - 5x)$

$x^5 + (7x^3 + 2x)^3 + 14x - x^2 - 7$

$x^5 + 9x^3 - x^2 + 14x - 7 - 3x^4 + 15x$

Score 1: The student did not write the expression in standard form.

Question 30

30 Write the expression $A(x) \bullet B(x) - 3C(x)$ as a polynomial in standard form.

$A(x) = x^3 + 2x - 1$
$B(x) = x^2 + 7$
$C(x) = x^4 - 5x$

$(x^3 + 2x - 1) \bullet (x^2 + 7) - 3(x^4 - 5x)$

$(x^5 + 2x^3 - x^2 + 7x^3 + 14x - 7)$

$(x^5 + 9x^3 - x^2 - 7) - 3x^4 - 15x$

$x^5 + -3x^4 + 9x^3 - x^2 - 15x - 7$

Score 0: The student made multiple errors.

Question 30

30 Write the expression $A(x) \bullet B(x) - 3C(x)$ as a polynomial in standard form.

$$A(x) = x^3 + 2x - 1$$
$$B(x) = x^2 + 7$$
$$C(x) = x^4 - 5x$$

$(x^3+2x-1)(x^2+7) - 3(x^4-5x)$

	x^3	$2x$	-1
x^2	x^5	$2x^3$	$-x^2$
7	$7x^3$	$14x$	-7

$x^5 + 9x^3 - x^2 + 14x - 7$

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

Question 31

31 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.

$x^4 - 5x^2 + 4$

$x^4 - 4x^2 - x^2 + 4$

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

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

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

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

Question 31

31 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.

$x^4 - 5x^2 + 4$

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

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

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

Question 31

31 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.

$x^4 - 5x^2 + 4$

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

Score 1: The student did not factor completely.

Question 31

31 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.

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

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

Score 1: The student made one factoring error.

Question 31

31 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.

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

plugged into calculator

Score 1: The student did not show enough correct work to receive full credit.

Question 31

31 Over the set of integers, completely factor $x^4 - 5x^2 + 4$.

$x^4 - 5x^2 + 4$

$a = 1$
$b = -5$
$c = 4$

$\frac{5 \pm \sqrt{(-5)^2 - 4(1)(4)}}{2(1)}$

$\frac{5 \pm 3}{2}$

$\frac{5+3}{2} = 4$

$\frac{5-3}{2} = 1$

$\{1, 4\}$

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

Question 32

32 Natalia's teacher has given her the following information about angle θ.

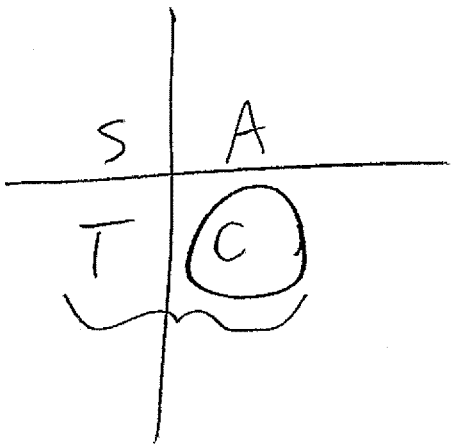
- $\pi < \theta < 2\pi$ (180 < θ < 360)
- $\cos\theta = \frac{\sqrt{3}}{4}$ → is positive

Explain how Natalia can determine if the value of tan θ is positive or negative.

$\cos = \frac{A}{H}$

$\tan = \frac{O}{A}$

tanθ is negative because cosθ is positive which lands it in the Fourth quadrant. only cosθ can be positive because the angle is between 180° and 360°



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

Question 32

32 Natalia's teacher has given her the following information about angle θ.

- $\pi < \theta < 2\pi$ (180 < θ < 360)
- $\cos\theta = \frac{\sqrt{3}}{4}$

Explain how Natalia can determine if the value of tan θ is positive or negative.

Depending on what quadrant cos θ is. Since cos θ = $\frac{\sqrt{3}}{4}$ and in positive it means its either in quadrant I or IV. However $\pi < \theta < 2\pi$ means $180 < \theta < 360$ therefor it can't be quadrant I, because quad I is 90°. Then θ is negative because the given information indicates quad IV and tan is only positive in quad III.

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

Question 32

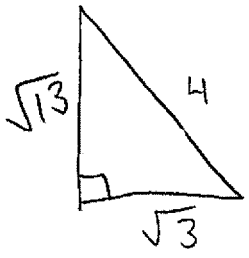
32 Natalia's teacher has given her the following information about angle θ.

- $\pi < \theta < 2\pi$
- $\cos\theta = \frac{\sqrt{3}}{4}$

↓ positive in cos

Explain how Natalia can determine if the value of tan θ is positive or negative.

SohCahToa



$a^2 + b^2 = c^2$

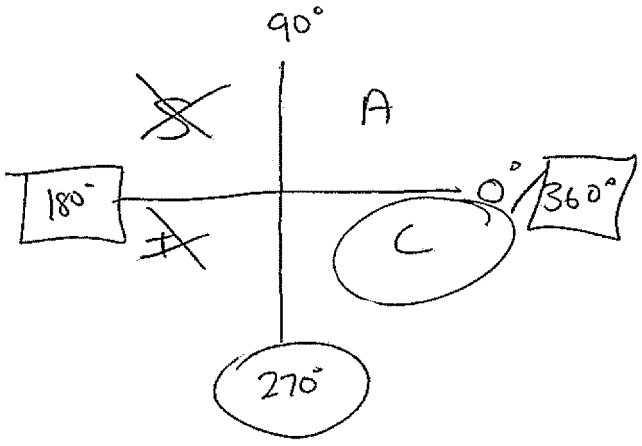
$\sqrt{3}^2 + b^2 = 4^2$

$3 + b^2 = 16$

$b^2 = 13$

$b = \sqrt{13}$

$\text{Tan}\theta = \frac{\sqrt{13}}{\sqrt{3}}$



$\pi = 180$

$2\pi = 360$

$180^\circ < \theta < 360^\circ$

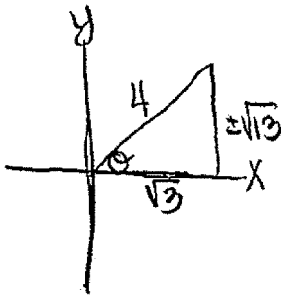
Score 1: The student gave a correct justification, not an explanation.

Question 32

32 Natalia's teacher has given her the following information about angle θ.

- $\pi < \theta < 2\pi$ SohCah Toa
- $\cos\theta = \frac{\sqrt{3}}{4}$ adj / hyp

Explain how Natalia can determine if the value of tan θ is positive or negative.



$a^2+b^2=c^2$

$(\sqrt{3})^2+b^2=4^2$

$3+b^2=16$

$-3 \quad -3$

$\sqrt{b^2}=\sqrt{13}$

$b=\pm\sqrt{13}$

$\tan\theta = \frac{\sqrt{13}\cdot\sqrt{3}}{\sqrt{3}\cdot\sqrt{3}}$ $\frac{\sqrt{39}}{3}$

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

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

$(\sqrt{49-10x})^2 = (2x-5)^2$

$49 - 10x = 4x^2 - 20x + 25$

$0 = 4x^2 - 10x - 24$

$0 = 2(2x^2 - 5x - 12)$

$0 = 2(2x+3)(x-4)$

$0 \neq 2 \quad 0 = 2x+3 \quad 0 = x-4$

$x = -\frac{3}{2} \quad x = 4$

reject

$\{4\}$

check

$\sqrt{49-10(4)} + 5 = 2(4)$

$\sqrt{9} + 5 = 8$

$3 + 5 = 8$

$8 = 8$

$\sqrt{49-10(-\frac{3}{2})} + 5 = 2(-\frac{3}{2})$

$\sqrt{64} + 5 = -3$

$8 + 5 = -3$

$13 \neq -3$

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

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

$-5 \quad -5$

$(\sqrt{49-10x})^2 = (2x-5)^2$ $(2x-5)$

$49 - 10x = 4x^2 - 20x + 25$

$+10x$

$49 = 4x^2 + 10x + 25$

$-25 \quad -25$

$24 = 4x^2 + 10x$

-24

$4x^2 + 10x - 24$

$\sqrt{49-10(4)} + 5 = 2(4)$

$8 = 8$

$\frac{10 + \sqrt{(10)^2 - 4(4)(-24)}}{2(4)} = 4$

$\sqrt{49-10(-\frac{3}{2})} = 2(-\frac{3}{2})$

$13 \neq -3$

$\frac{10 - \sqrt{(10)^2 - 4(4)(-24)}}{2(4)} = -\frac{3}{2}$

Score 3: The student did not clearly reject $-\frac{3}{2}$.

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

$\sqrt{49-10x} + 5 = 2x$

$-5 \quad -5$

$\left(\sqrt{49-10x}\right)^2 = (2x-5)^2$

$49 - 10x = (2x-5)^2$

	$2x$	-5
$2x$	$4x^2$	$-10x$
-5	$-10x$	25

$49 - 10x = 4x^2 - 20x + 125$

$-49 + 10x \qquad +10x \quad -49$

$0 = 4x^2 - 10x - 24$

$x = \dfrac{+10 \pm \sqrt{100 - 4(4)(-24)}}{8}$

$x = \dfrac{10 \pm 22}{8}$

$x = \dfrac{32}{8} = 4$

$x = \dfrac{-12}{8} = -1.5$

check:

$\sqrt{49-10(4)} + 5 = 2(4)$

$\sqrt{49-40} + 5 = 8$

$\sqrt{9} + 5 = 8$

$3 + 5 = 8$ ✓

$\sqrt{49-10(-1.5)} + 5 = -3$

$\sqrt{64} + 5 = -3$

$-8 + 5 = -3$ ✓

Score 3: The student made a computational error evaluating $\sqrt{64}$.

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

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

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

$4x^2 - 20x + 10$

$\sqrt{49-10x} + 5 = 2x - 5$

$-5 \quad -5$

$\left(\sqrt{49-10x}\right)^2 = (2x-5)^2$

$49 - 10x = 4x^2 - 20x + 10$

$-49 \quad +10x$

$4x^2 - 10x - 39$

$a \quad b \quad c$

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

$= \frac{10 \pm \sqrt{100 - 4(4)(-39)}}{8}$

$\frac{10 \pm \sqrt{724}}{8}$

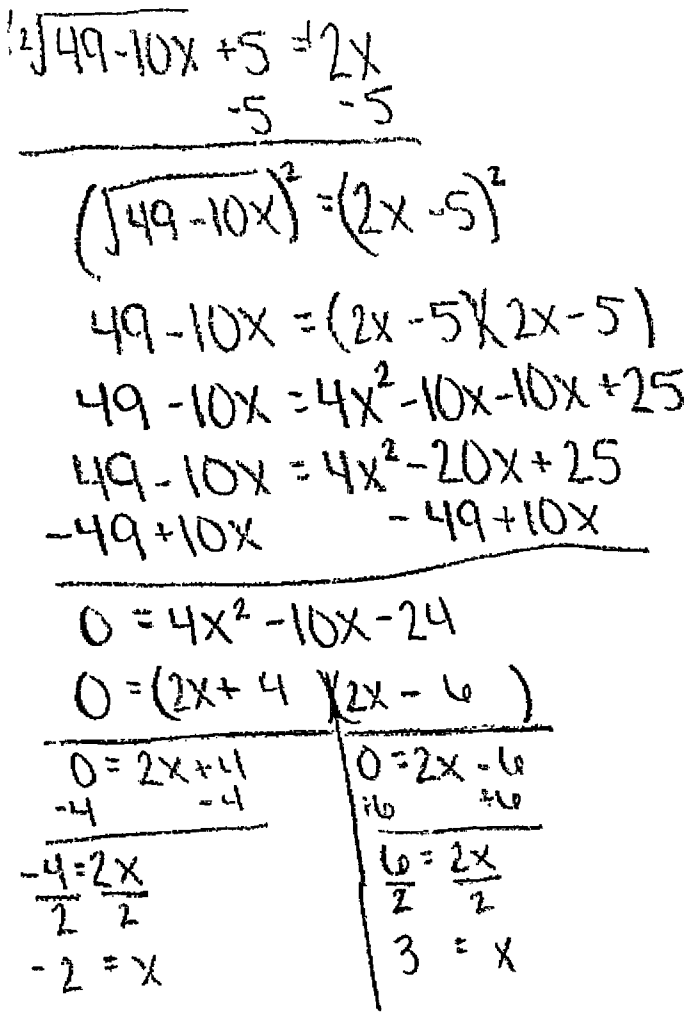
4.61

-2.11

Score 2: The student made two or more computational errors.

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.



Score 2: The student made a factoring error and did not check for extraneous roots.

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

$(\sqrt{49-10x})^2 = (2x-5)^2$

$49 - 10x = 4x^2 - 20x + 25$

$+10x \quad -49$

$-49 + 10x$

$4x^2 - 10x - 24 = 0$

$-(2x - 12)(2x + 2)$

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

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

$4x^2 - 20x + 25$

Score 1: The student wrote a correct quadratic equation in standard form.

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

$\sqrt{-10x+99} = 2x-5$

$X = 4$

Score 1: The student received one credit for $x = 4$.

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

$\sqrt{49-10x}+5=2x$

$+10x \quad +10x$

$\sqrt{49}+5=12x$

$7+5=12x$

$\frac{12}{12}=\frac{12x}{12}$

$1=x$

$\boxed{x=1}$

Score 0: The student made multiple conceptual errors.

Question 33

33 Solve the equation $\sqrt{49 - 10x} + 5 = 2x$ algebraically.

$\sqrt{49-10x}^2 = (2x-5)^2$

$49 - 10x = 4x^2 - 20x + 25$

$24 - 10x = 4x^2 - 20x$

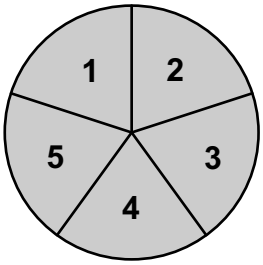
$24 = 4x^2 - 10x$

$24 = 2x(2x-5)$

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

Question 34

34 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.



She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game.

State the proportion of 2's that were spun.

1/10

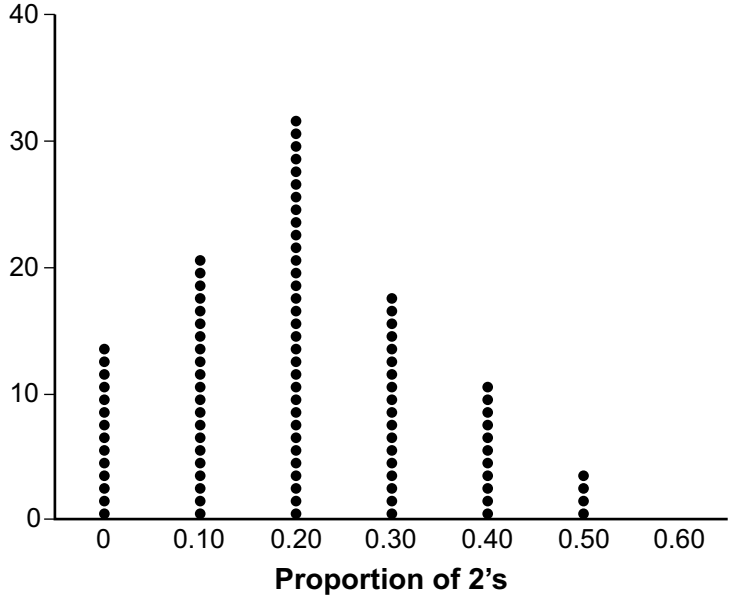
State the theoretical probability of spinning a 2.

1/5

Question 34 is continued on the next page.

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

The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.

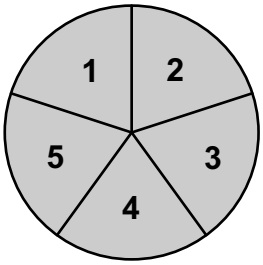


Does the output indicate that the carnival game was unfair? Explain your answer.

No, because .10 occurs 21% of the time which is not unusal.

Question 34

34 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.



She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game.

State the proportion of 2's that were spun.

$\frac{1}{10}$

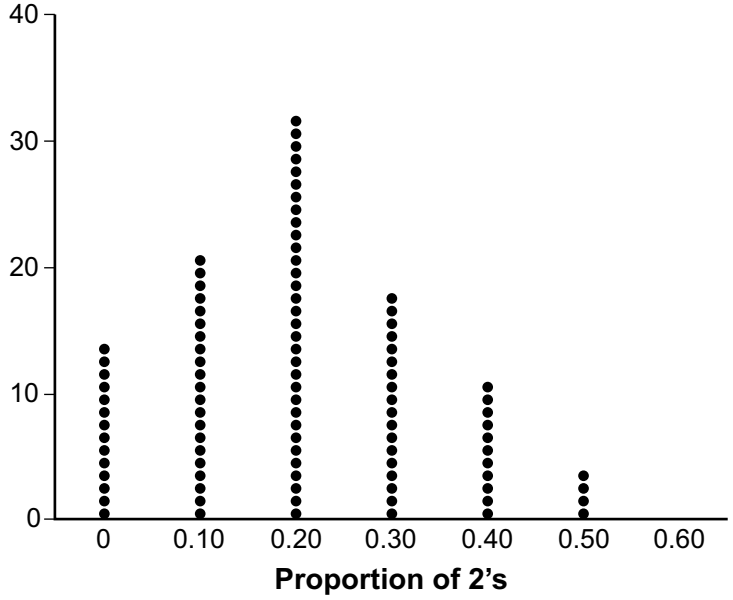
State the theoretical probability of spinning a 2.

$\frac{1}{5}$

Question 34 is continued on the next page.

Score 3: The student wrote an incomplete explanation.

The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.

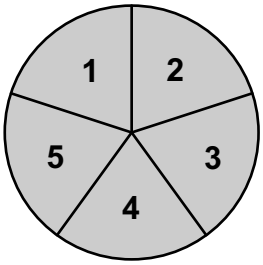


Does the output indicate that the carnival game was unfair? Explain your answer.

No, it happened alot so it is not unusual.

Question 34

34 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.



She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game.

State the proportion of 2's that were spun.

$\frac{1}{10}$ is the proportion.

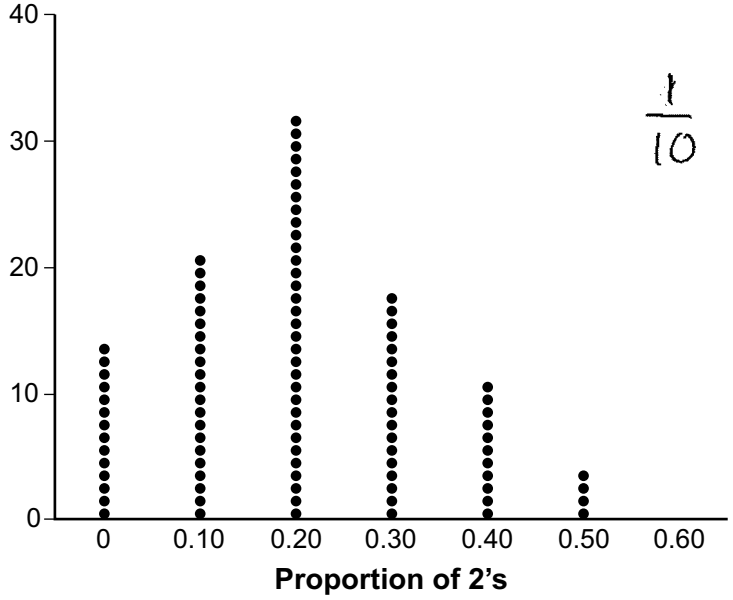
State the theoretical probability of spinning a 2.

There is a $\frac{1}{5}$ chance the number 2 will be spun.

Question 34 is continued on the next page.

Score 2: The student received no credit for the explanation.

The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.



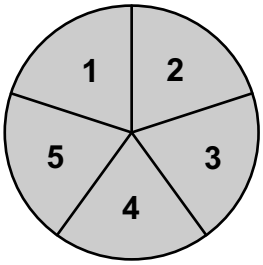
$\frac{1}{10} \neq \frac{1}{5}$

Does the output indicate that the carnival game was unfair? Explain your answer.

NO, it indicates that it was fair because there were 100 tries and it is not dependent on anything.

Question 34

34 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.



She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game.

State the proportion of 2's that were spun.

$\frac{1}{10}$

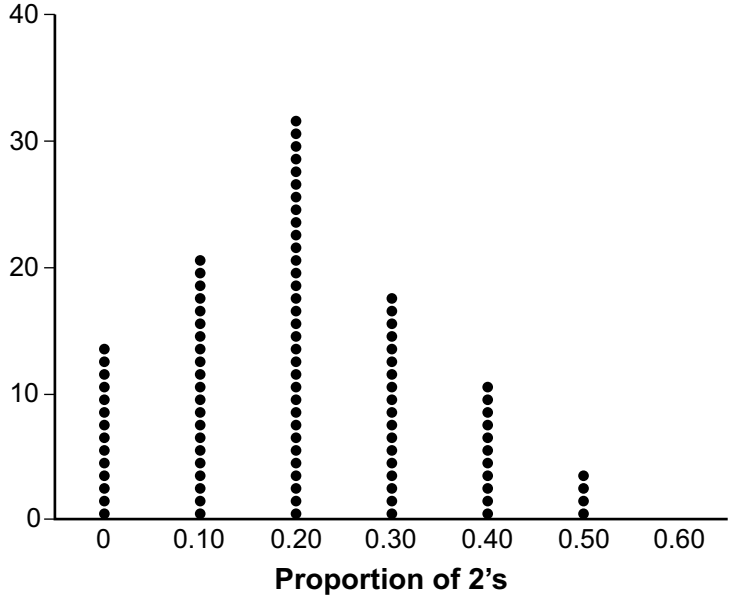
State the theoretical probability of spinning a 2.

The theoretical probability of spinning a 2 is 1/5.

Question 34 is continued on the next page.

Score 2: The student received no credit for the explanation.

The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.

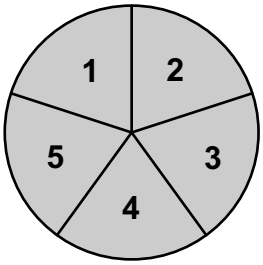


Does the output indicate that the carnival game was unfair? Explain your answer.

The output does indicate that the carnival game was unfair because there is only 0.20 chance to land on a 2, which is unlikely.

Question 34

34 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.



She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game.

State the proportion of 2's that were spun.

$\frac{1}{10}$

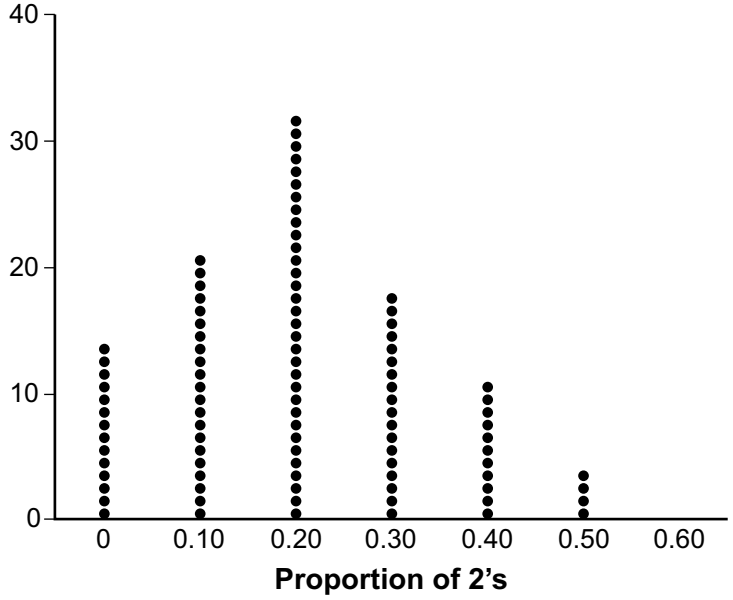
State the theoretical probability of spinning a 2.

once in every 10 turns you will spin a 2

Question 34 is continued on the next page.

Score 1: The student received one credit for $\frac{1}{10}$.

The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.

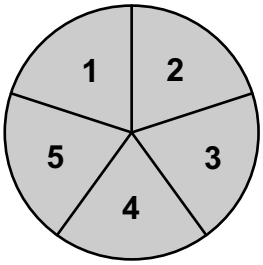


Does the output indicate that the carnival game was unfair? Explain your answer.

yes, because the number of 2's spun is not in a constant ratio.

Question 34

34 Joette is playing a carnival game. To win a prize, one has to correctly guess which of five equally sized regions a spinner will land on, as shown in the diagram below.



She complains that the game is unfair because her favorite number, 2, has only been spun once in ten times she played the game.

State the proportion of 2's that were spun.

$\frac{1}{5}$

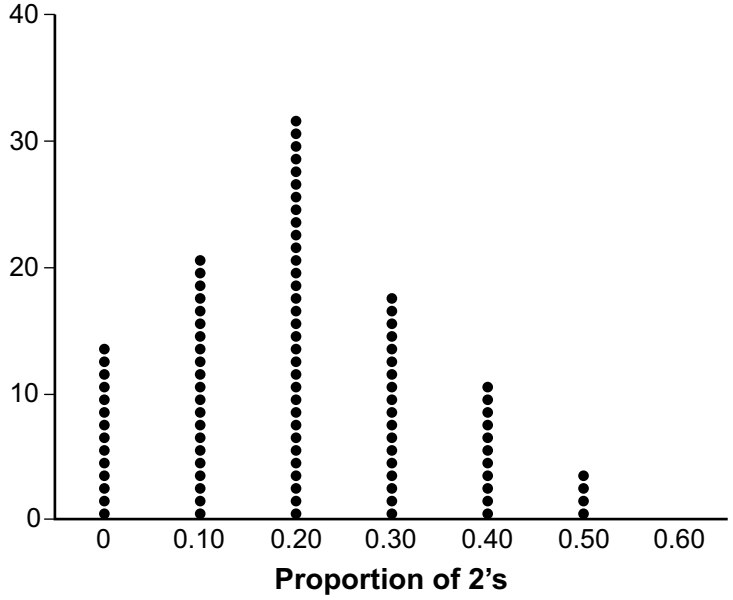
State the theoretical probability of spinning a 2.

$\frac{1}{2}$

Question 34 is continued on the next page.

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

The simulation output below shows the results of simulating ten spins of a fair spinner, repeated 100 times.

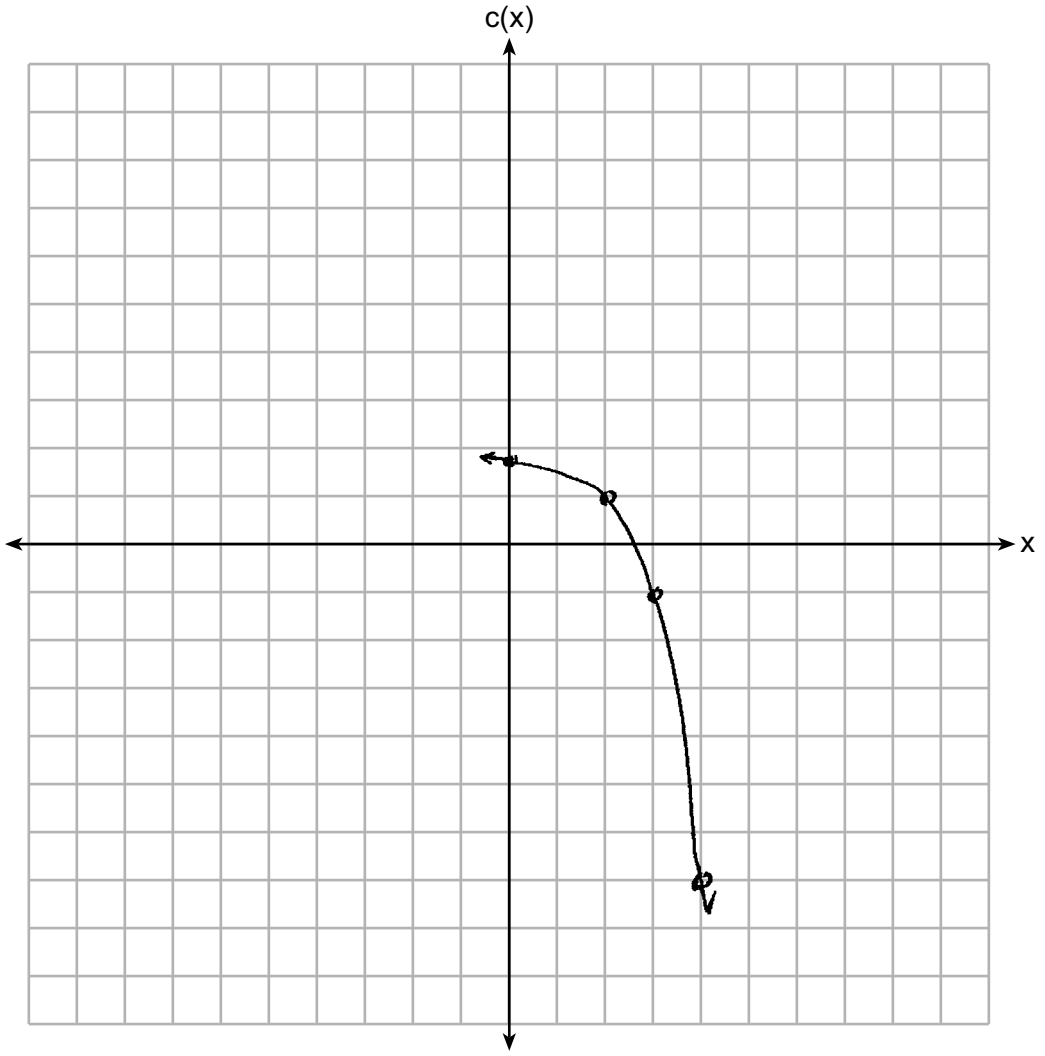


Does the output indicate that the carnival game was unfair? Explain your answer.

No because there is a more unlikely chance

Question 35

35 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.



Describe the end behavior of $c(x)$ as x approaches positive infinity.

$c(x) \rightarrow -\infty$

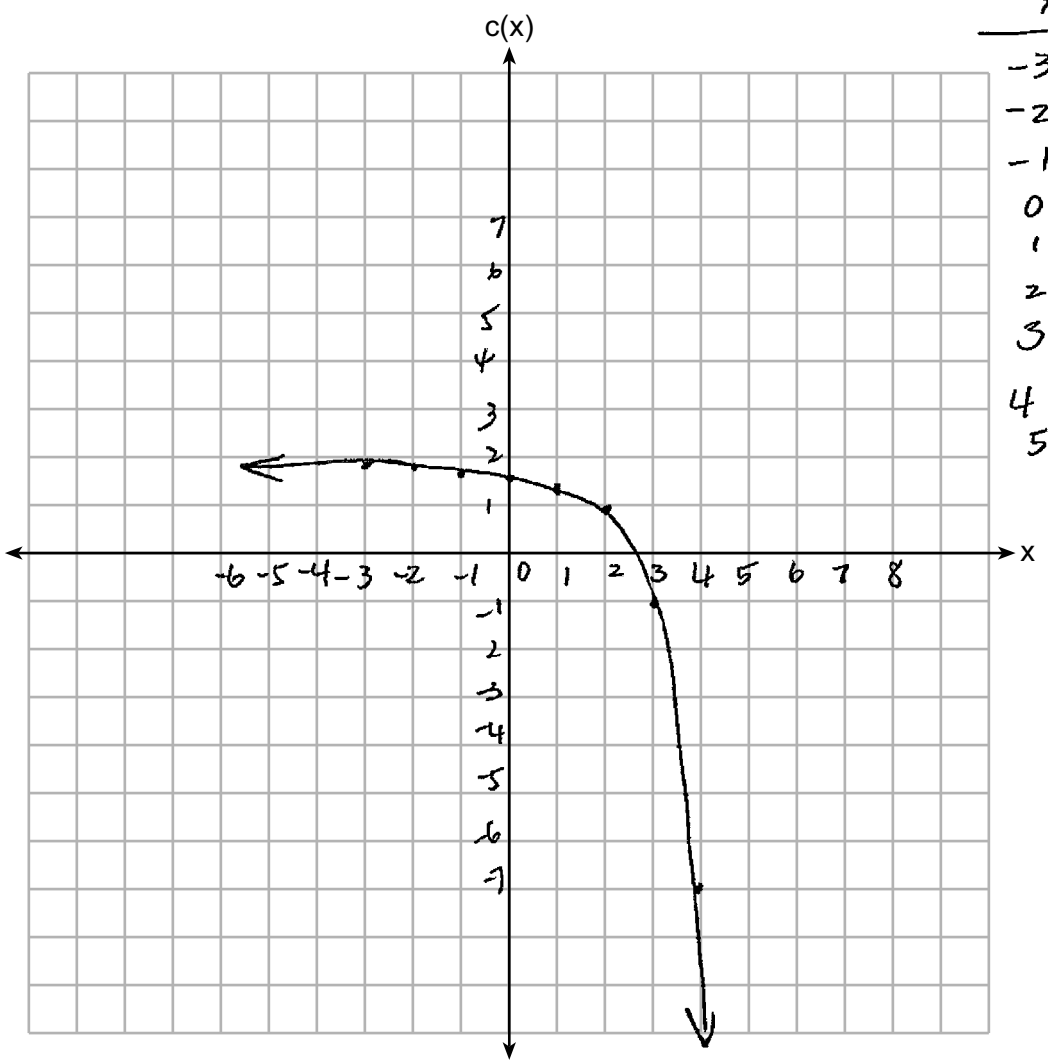
Describe the end behavior of $c(x)$ as x approaches negative infinity.

$c(x) \rightarrow 2$

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

Question 35

35 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.



X	Y
-3	1.9958
-2	1.9876
-1	1.9629
0	1.8888
1	1.6666
2	1
3	-1
4	-7
5	-25

Describe the end behavior of $c(x)$ as x approaches positive infinity.

When X is positive infinity, the c(x) will be negative number and keep going down with negative infinity number.

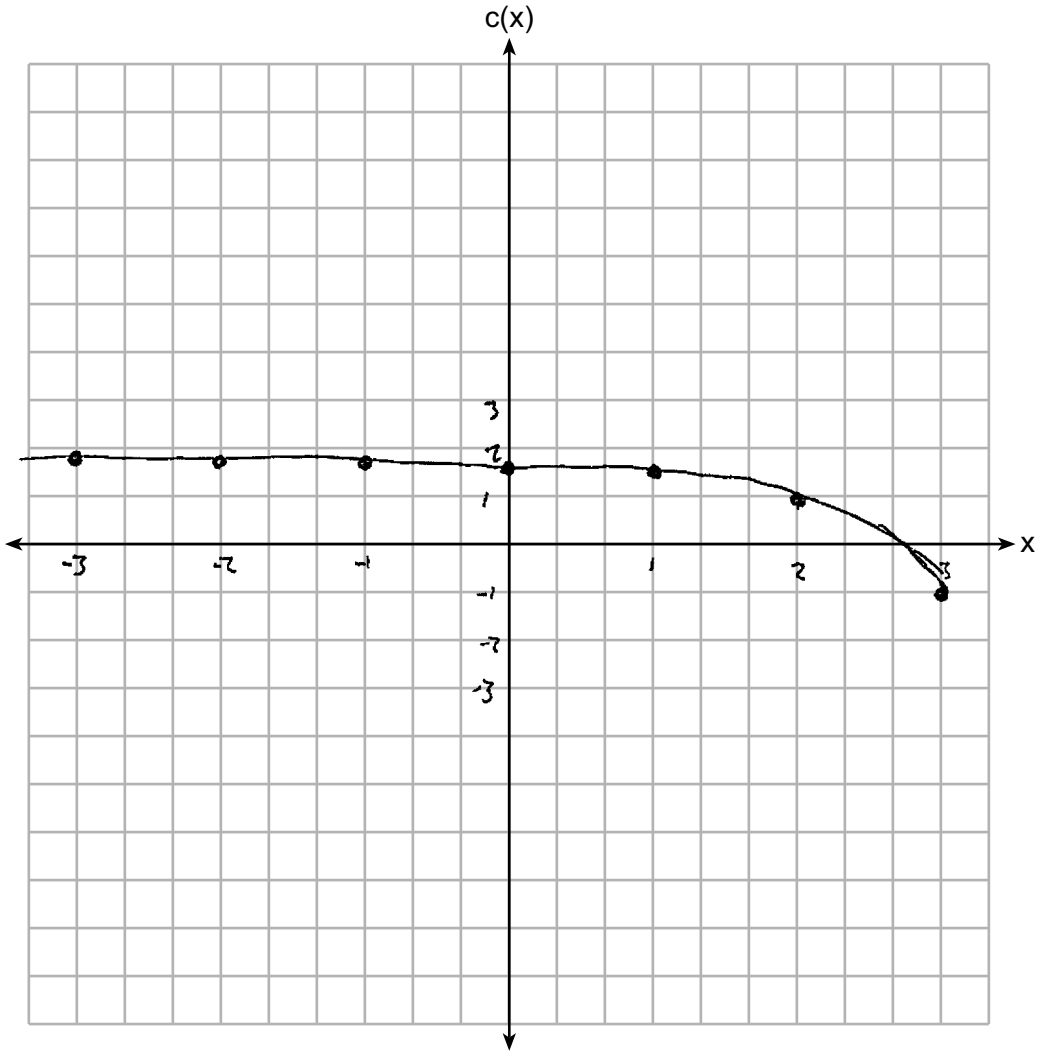
Describe the end behavior of $c(x)$ as x approaches negative infinity.

When x is negative infinity, c(x) will be positive and going left.

Score 3: The student incorrectly stated the end behavior as x approaches negative infinity.

Question 35

35 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.



Describe the end behavior of $c(x)$ as x approaches positive infinity.

$x \to \infty$

$c(x) \to -\infty$

Describe the end behavior of $c(x)$ as x approaches negative infinity.

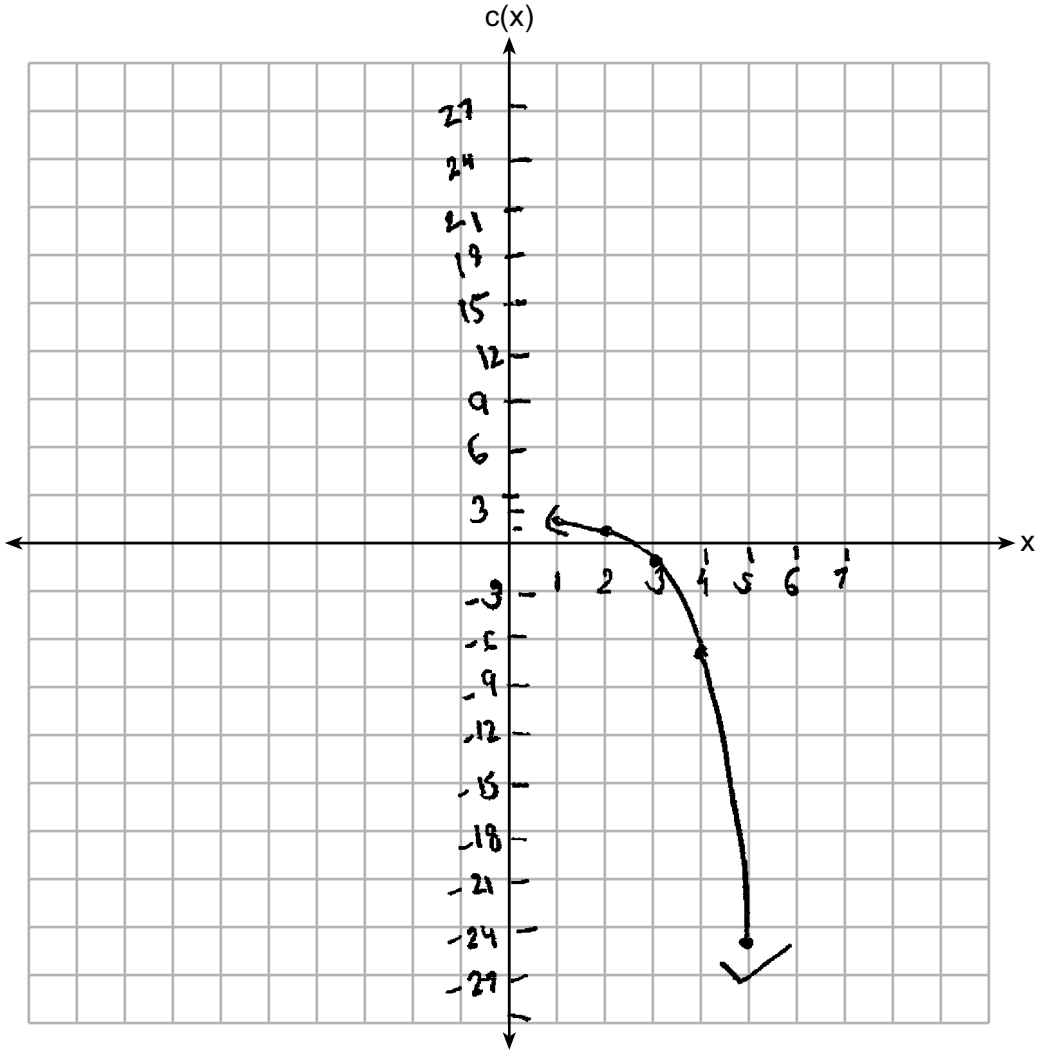
$x \to -\infty$

$c(x) \to 2$

Score 3: The student made a graphing error.

Question 35

35 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.



Describe the end behavior of $c(x)$ as x approaches positive infinity.

It becomes a straight line as it approaches the left side through (-)x and (+) y.

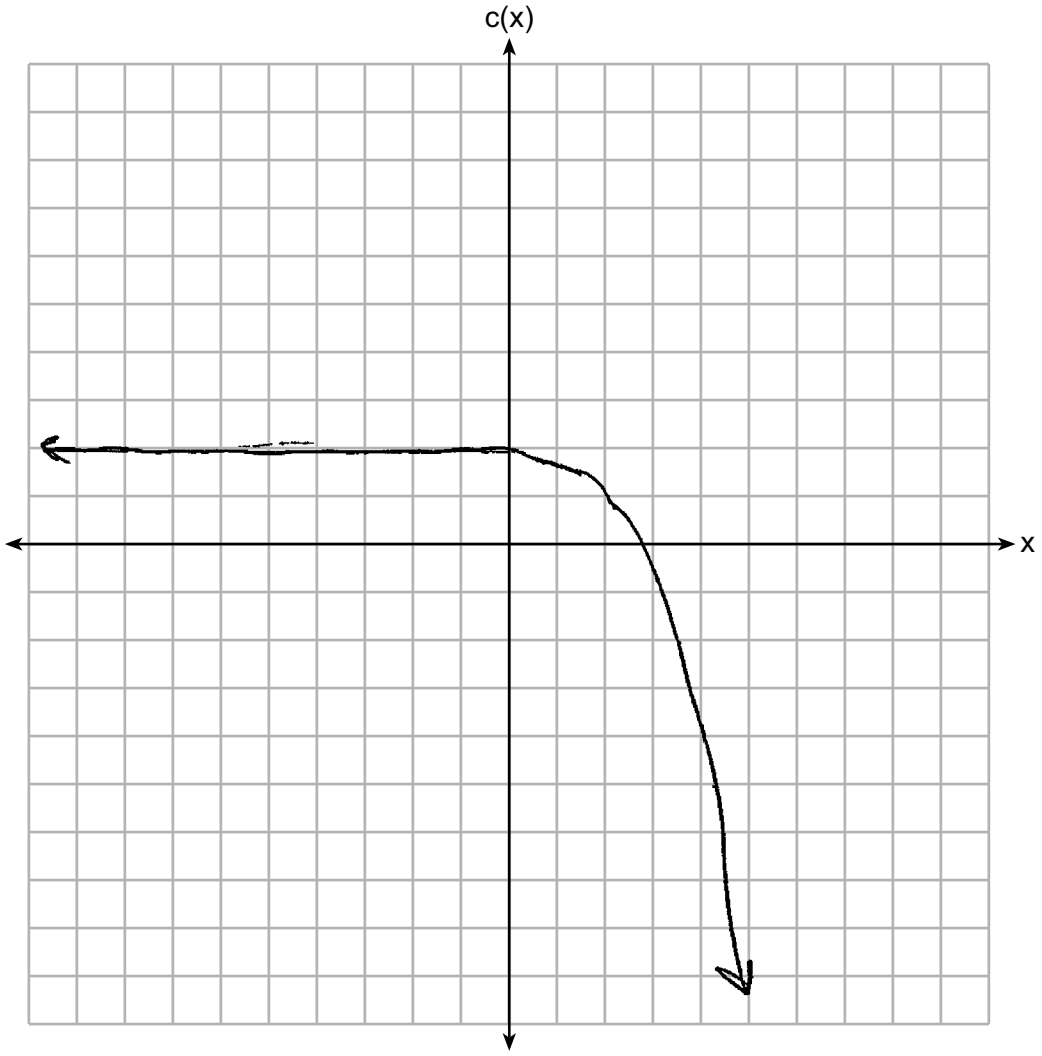
Describe the end behavior of $c(x)$ as x approaches negative infinity.

It falls below and continues through (+)x and (-)y.

Score 2: The student received two credits for the graph.

Question 35

35 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.



Describe the end behavior of $c(x)$ as x approaches positive infinity.

As x approaches infinity, c(x) approaches negative infinity

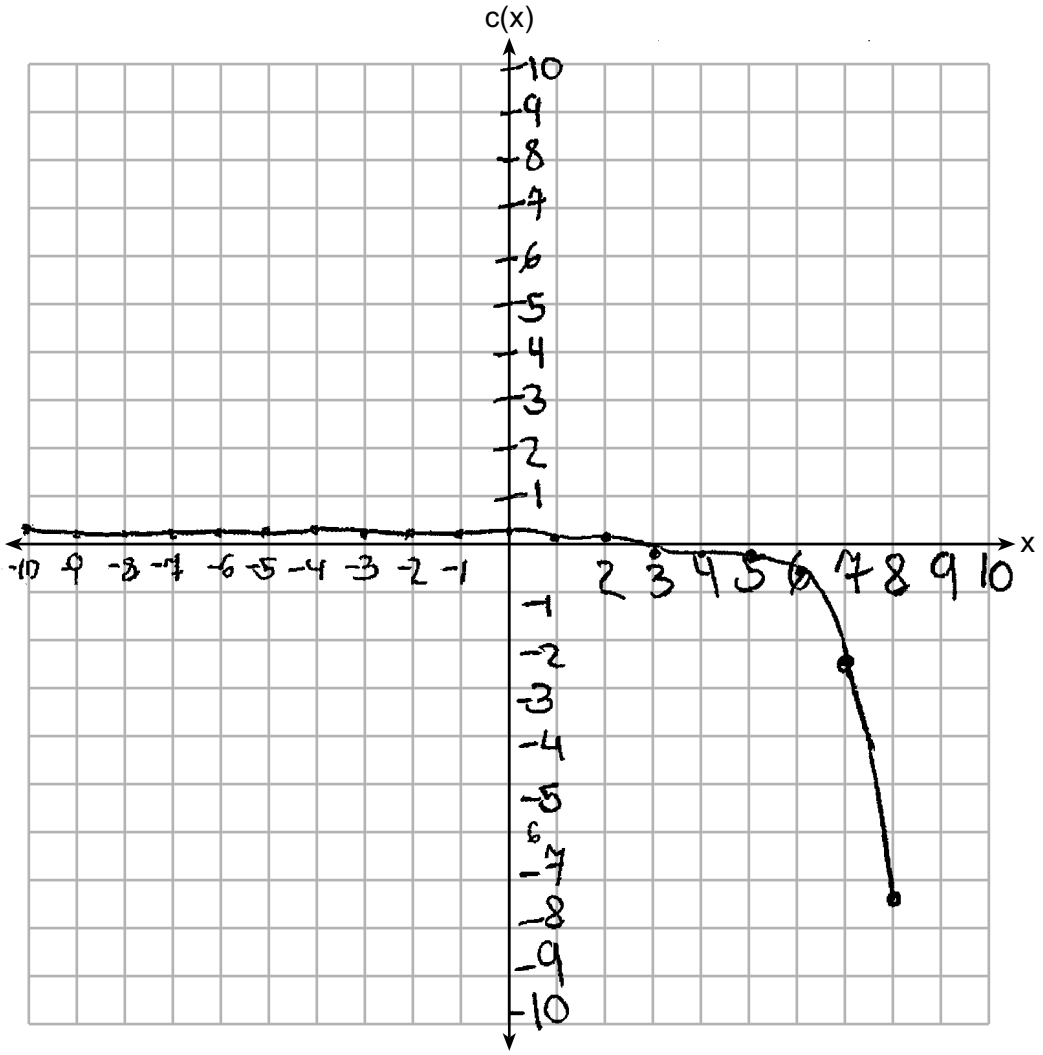
Describe the end behavior of $c(x)$ as x approaches negative infinity.

As x approaches negative infinity, c(x) approaches infinity.

Score 1: The student received one credit for describing the end behavior of $c(x)$ as x approaches positive infinity.

Question 35

35 Graph $c(x) = -9(3)^{x-4} + 2$ on the axes below.



Describe the end behavior of $c(x)$ as x approaches positive infinity.

$c(x) \to \infty$

Describe the end behavior of $c(x)$ as x approaches negative infinity.

$c(x) \to -\infty$

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

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

6 10

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

JUNE $B(6) = 24.9\sin(0.5(6) - 2.05) + 55.25 = 75.504$

OCTOBER $B(10) = 24.9\sin(0.5(10) - 2.05) + 55.25 = 59.992$

JUNE (6, 75.504) OCTOBER (10, 59.992)

$$\text{Avg rate of change} = \frac{\Delta Y}{\Delta X} = \frac{75.504 - 59.992}{6 - 10} = -3.878$$

$$= -3.88$$

Explain what this value represents in the given context.

this means that for every month, the temperature decreases by ≈3.88 degrees.

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

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

$24.9 \sin(0.5 \cdot 6 - 2.05) + 55.25 = 75.504$

$24.9 \sin(0.5 \cdot 10 - 2.05) + 55.25 = 59.992$

$59.992 - 75.504 = -15.512$

$-15.512 \div 4 = -3.878$ -3.88°F

Explain what this value represents in the given context.

-3.88°F shows that between each month from June to October the monthly high temperature dropped an average of 3.88°F each month.

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

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

6
J 10

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

$24.9\sin(0.5(6)-2.05)+55.25 = 55.663$
$24.9\sin(0.5(10)-2.05)+55.25 = 56.531$
J (6, 55.663)
O (10, 56.531)
$\frac{56.531 - 55.663}{10-6} = .217 = \boxed{.22°}$

Explain what this value represents in the given context.

The monthly high temperature changes .22° per month in between June and October.

Score 3: The student did not evaluate in radians.

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

$24.9\sin(0.5(10)-2.05)+55.25$

6 10

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

$\text{average rate of change} = \frac{f(b)-f(a)}{b-a} = \frac{f(10)-f(6)}{10-6} = \frac{60-75.5}{4} = 3.875 \approx 3.88$

average rate of change = 3.88

Explain what this value represents in the given context.

This value represents that between June and October, the monthly high temperatures differ by about 3.88.

Score 2: The student wrote positive 3.88 and gave an incomplete explanation.

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

$B(6) = 24.9\sin(0.5(6) - 2.05) + 55.25$

$B(6) \approx 75.50$

$B(10) = 24.9\sin(0.5(10) - 2.05) + 55.25$

$B(10) \approx 59.99$

$ARC = \frac{75.50 - 59.99}{6 - 10}$

$ARC = -3.88°$ per month

Explain what this value represents in the given context.

In Buffalo, New York, the temperature varies dependent on time of year. In summer months, like June it is warm. In fall months, like October, it is cooler.

Score 2: The student received no credit for the explanation.

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

6 10

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

$\frac{59.992 - 75.504}{10 - 6} = -3.878$ → 3.878

Explain what this value represents in the given context.

Number month that comes in the year.

Score 1: The student made a rounding error and received no credit for the explanation.

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

June - 6
October - 10

$B(6) = 24.9\sin(0.5(6) - 2.05) + 55.25$

$B(6) = 55.6628$

$B(10) = 24.9\sin(0.5(10) - 2.05) + 55.25$

$B(10) = 56.5315$

$$\frac{10 - 6}{56.5315 - 55.6628} =$$

4.60

Explain what this value represents in the given context.

In the given context, 4.60 represents the monthly high temperature increase from June to October in Buffalo NY.

Score 1: The student received one credit for an incomplete explanation.

Question 36

36 The monthly high temperature (°F) in Buffalo, New York can be modeled by $B(m) = 24.9\sin(0.5m - 2.05) + 55.25$, where m is the number of the month and January = 1.

Find the average rate of change in the monthly high temperature between June and October, to the *nearest hundredth*.

$B(6) = 24.9\sin(0.5(6) - 2.05) + 55.25$

$= 24.9\sin(.95) + 55.25$

$= 1.413 + 55.25$

$B(6) = 55.663$

$B(10) = 24.9\sin(0.5(10) - 2.05) + 55.25$

$B(10) = 24.9\sin(2.95) + 55.25$

$B(10) = 1.281 + 55.25$

$B(10) = 56.531$

Explain what this value represents in the given context.

The average monthly high temperature in Buffalo, New York is relatively the same in June and October.

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

Question 37

37 Objects cool at different rates based on the formula below.

$T = (T_0 - T_R)e^{-rt} + T_R$

T_0: initial temperature 400°F

T_R: room temperature 75°F

r: rate of cooling of the object .0735

t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (T_0 - T_r)e^{-rt} + T_R$

$T = (400 - 75)e^{-.0735t} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

$T = (400 - 75)e^{-.0735t} + 75$

$T = (400 - 75)e^{-.0735(5)} + 75$

$= (325)e^{-.3675} + 75$

$= 300.0505812$

= 300 degrees

Question 37 is continued on the next page.

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

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$T = (T_0 - T_r)e^{-rt} + T_r$

$270 = (450 - 75)e^{-r(8)} + 75$

$-270 = (375)e^{-r8} + 75$

$-75 \quad -75$

$\frac{195}{375} = \frac{375e^{-r8}}{375}$

$.52 = e^{-r8}$

$\log_b a = n \quad b^n = a$

$\log_e .52 = -r8$

$-.65392646744 = \frac{-r8}{8}$

$-1(-.08174080843) = r$

$.0817 = r$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

$(375)e^{-.0817t} + 75 = (325)e^{-.0735t} + 75$

I plugged them into y

2nd → calc → intersect finder

about 17 minutes

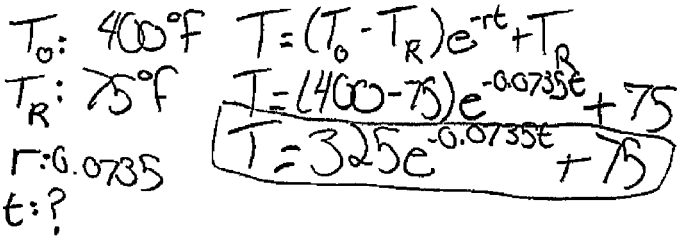
Question 37

37 Objects cool at different rates based on the formula below.

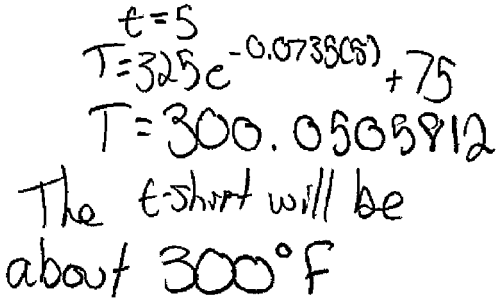
$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.



Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.



Question 37 is continued on the next page.

Score 5: The student made one computational error in the fourth part.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$T_0 = 450°F$
$T_R = 75°F$
$r = ?$
$t = 8$
$T = 270°F$

$T = (T_0 - T_R)e^{-rt} + T_R$

$270 = (450 - 75)e^{-r(8)} + 75$

$-75 \quad -75$

$\frac{195}{375} = \frac{375e^{-8r}}{375}$

$\ln(0.52 = e^{-8r})$

$\ln .52 = \ln e^{-8r}$

$\ln .52 = -8r \ln e$

$\frac{\ln .52}{-8} = r$

$r = 0.081740808 4$

$r \approx 0.0817$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

T-shirt
$T_0 = 400°F$
$T_R = 75°F$
$r = 0.0735$
$t = ?$
$T = 325e^{-0.0735t} + 75$

hoodie
$T_0 = 450$
$T_R = 75$
$r = 0.0917$
$t = ?$
$T = (450 - 75)e^{-0.0917t} + 75$

$325e^{-0.0735t} + 75 = 375e^{-0.0917t} + 75$

$-75 \quad = \quad -75$

$\frac{325e^{-0.0735t}}{325} = \frac{375e^{-0.0917t}}{325}$

$\ln\left(e^{-0.0735t} = \frac{375}{325}e^{-0.0917t}\right)$

$-0.0735t \ln e = \ln \frac{375}{325} + 0.0917t \ln e$

$-0.1652t = \ln \frac{375}{325} \quad t = -1$

Question 37

37 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (400 - 75)\, e^{-.0735t} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

$T = (400 - 75)\, e^{-.0735(5)} + 75$

$T = 300°$

Question 37 is continued on the next page.

Score 4: The student received no credit for the fourth part.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$270 = (450 - 75)e^{-r(8)} + 75$

$195 = (375)e^{-r(8)}$

$\ln \frac{195}{375} = -r(8) \ln e$

$\frac{\ln \frac{195}{375}}{-8} = r$

$r = 0.0817$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

plug equations in to calculator

$t = 18$

Question 37

37 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (400° - 75°)e^{-.0735(5)} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

$T = 300°$

Question 37 is continued on the next page.

Score 4: The student made a notation error in the first part and wrote an incorrect time in the fourth part.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$270 = (450 - 75)e^{-r(8)} + 75$

$-75 \qquad\qquad -75$

$\frac{195}{375} = \frac{(375)e^{-r(8)}}{375}$

$.52 = e^{-r(8)}$

$\ln(.52) = -r(8)$

$\frac{\ln(.52)}{8} = \frac{-r(8)}{8}$

$-r = -.08 \quad r = 0.0817$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

18 minutes

x	Hoodie	Tshirt
17	168.51	168.16
17.5	164.76	164.8
18	161.17	161.56

Question 37

37 Objects cool at different rates based on the formula below.

$T = (T_0 - T_R)e^{-rt} + T_R$

T_0: initial temperature 400

T_R: room temperature 75

r: rate of cooling of the object 0.0735

t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (400 - 75)e^{-0.0735t} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

Question 37 is continued on the next page.

Score 3: The student received one credit for part one and two credits for part three.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$270 = (450 - 75)e^{-8x} + 75$

$195 = 375e^{-8x}$

$0.52 = e^{-8x}$

$\frac{\ln 0.52 = -8x \ln e}{-8}$

$r = 0.081740808 4$

$r = 0.0817$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

$375e^{-0.0817t} = 325e^{-0.0735t}$

$-0.0817t \ln 375e = -0.0735t \ln 325e$

$-0.0817 + 1.021094418 = -0.0735t$

$\ln 375e$

$= 0.0082t$

125 minutes

Question 37

37 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (400 - 75)e^{-0.0735(5)} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

$= 300°F$

Question 37 is continued on the next page.

Score 3: The student made a notation error in part one, a rounding error in part three, and showed no work in part four.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$270 = (450 - 75)e^{-r(8)} + 75$

$-75 \quad -75$

$\frac{195}{375} = \frac{375e^{-r8}}{375}$

$.52 = e^{-8r}$

$\frac{\ln .52}{-8} = \frac{-8r}{-8}$

$r = 0.082$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

17 minutes

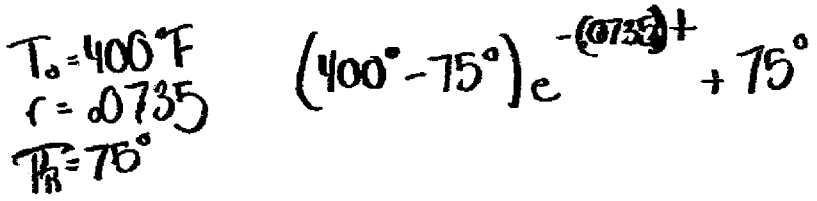
Question 37

37 Objects cool at different rates based on the formula below.

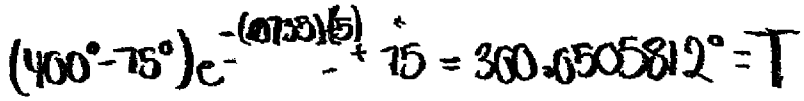
$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.



Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.



Question 37 is continued on the next page.

Score 2: The student received two credits for part three.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$(450 - 75)e^{-4r} + 75 = 270$

$-75 \quad -75$

$.52 = e^{-8r}$

$\frac{\ln(.52)}{-8} = \frac{-8r}{-8}$

$r = .0817$

$\frac{195}{375} = \frac{(375)e^{-8r}}{375}$

*The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

Question 37

37 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (400 - 75)e^{-0.0735t} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

$T = (400 - 75)e^{-0.0735(5)} + 75$

$T = 300°F$

Question 37 is continued on the next page.

Score 2: The student received no credit on parts three and four.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$270 = (450-75)e^{-8r} + 75$

$-75 \qquad\qquad -75$

$\frac{195}{375} = \frac{375e^{-8r}}{375}$

$.52 = e^{-8r}$

$\ln .52 = \ln e^{-8r}$

$\frac{\ln .52}{-8} = \frac{-8r}{-8}$

$r = -.082$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

T $300 = (400-75)e^{-.082t}$

$\frac{300}{325} = \frac{325}{325}$

$.923 = e^{-.082t}$

$\frac{\ln .923}{-.082} = \frac{-.082t}{-.082}$

$x = 1$ minute

Question 37

37 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T=(400-75)e^{-.0735(5)}+75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

300°F

Question 37 is continued on the next page.

Score 1: The student only received credit for the second part.

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$= (450 - 75)e^{-x(8)} + 75$

$195 = (450 - 75)e^{-8x}$

$.52000$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

T mintes

Question 37

37 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature 400

T_R: room temperature 75

r: rate of cooling of the object 0.0735

t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (400 - 75)e^{-0.0735t} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

$T = (400 - 75)e^{-0.0735(5)} + 75$

T = 225 degrees

Question 37 is continued on the next page.

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

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$270 = (450-75)e^{-r(8)} + 75$

$\frac{270}{375} = \frac{375e^{-r(8)}}{375} + 75$

$\frac{18}{25} = e^{-8r} + 75$

-75

$\frac{18}{25} - 75 = e^{-8r}$

$\log \frac{18}{25} - 25 = \log e^{-8r}$

$\frac{-75 \log \frac{18}{25}}{-8 \log e} = \frac{-8r \log e}{-8 \log e}$

$-0.5809 = r$

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

$(270-75)e^{-(0.5809)t} + 75 = (225-75)e^{-0.0735t}$

$195e^{-0.5809t} - 75 = 150e^{-0.0735t}$ $+75$ -75

$-0.5809t \log 195e = -0.0735t \log 150e$

Question 37

37 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

T_0: initial temperature
T_R: room temperature
r: rate of cooling of the object
t: time in minutes that the object cools to a temperature, T

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to 400°F. The rate of cooling for the shirt is 0.0735 and the room temperature is 75°F. Using this information, write an equation for the temperature of the shirt, T, after t minutes.

$T = (400-75)^{-.0735 \cdot 5} + 75$

Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes.

$(325)^{-.07355} + 75 = 78°$ degrees

Question 37 is continued on the next page.

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

At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to 450°F. After eight minutes, the hoodie measured 270°F. The room temperature is still 75°F. Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*.

$T = (450-75)^{\circ} + 75$ 06

The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

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

Regents Examination in Algebra II – January 2023

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

(Use for the January 2023 exam only.)

Raw Score	Scale Score	Performance Level
86	**100**	5
85	**99**	5
84	**98**	5
83	**96**	5
82	**95**	5
81	**94**	5
80	**94**	5
79	**93**	5
78	**92**	5
77	**91**	5
76	**90**	5
75	**90**	5
74	**89**	5
73	**88**	5
72	**88**	5
71	**87**	5
70	**86**	5
69	**86**	5
68	**86**	5
67	**85**	5
66	**84**	4
65	**84**	4
64	**83**	4
63	**83**	4
62	**83**	4
61	**82**	4
60	**82**	4
59	**81**	4
58	**81**	4

Raw Score	Scale Score	Performance Level
57	**81**	4
56	**80**	4
55	**80**	4
54	**80**	4
53	**79**	4
52	**79**	4
51	**79**	4
50	**78**	4
49	**78**	4
48	**77**	3
47	**77**	3
46	**77**	3
45	**76**	3
44	**76**	3
43	**75**	3
42	**75**	3
41	**75**	3
40	**74**	3
39	**73**	3
38	**73**	3
37	**72**	3
36	**72**	3
35	**71**	3
34	**70**	3
33	**69**	3
32	**69**	3
31	**68**	3
30	**67**	3
29	**66**	3

Raw Score	Scale Score	Performance Level
28	**65**	3
27	**64**	2
26	**63**	2
25	**61**	2
24	**60**	2
23	**59**	2
22	**57**	2
21	**55**	2
20	**54**	1
19	**53**	1
18	**51**	1
17	**49**	1
16	**47**	1
15	**45**	1
14	**43**	1
13	**41**	1
12	**39**	1
11	**36**	1
10	**34**	1
9	**31**	1
8	**28**	1
7	**25**	1
6	**22**	1
5	**19**	1
4	**16**	1
3	**12**	1
2	**8**	1
1	**4**	1
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.