The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA 2 /TRIGONOMETRY

Wednesday, January 25, 2017 — 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 39 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 for graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc.

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 27 questions in this part. Each correct answer will receive 2 credits. 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. [54]

1 What is $510°$ expressed in radian measure?

(1) 2.83

(3) $\dfrac{17\pi}{6}$

(2) $\dfrac{5\pi}{6}$

(4) $\dfrac{17\pi}{12}$

2 Four surveys are described below. Which survey methodology would lead to the *least* biased conclusion?

(1) One hundred randomly chosen heart surgeons were polled by telephone about how to get children to eat healthier foods.

(2) A country and western radio station asked one hundred of its listeners to call a telephone number and answer a question about rap music.

(3) From calls made to one hundred randomly generated telephone numbers, people replied to a question about television shows they watch.

(4) The first one hundred people who left the World of Baseball Bookstore replied to a question about the importance of baseball to society.

3 When factored completely, $x^4 - 13x^2 + 36$ is equivalent to

(1) $(x^2 - 6)(x^2 - 6)$

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

(3) $(x - 2)(x - 2)\,(x - 3)(x - 3)$

(4) $(x - 2)(x + 2)\,(x - 3)(x + 3)$

4 Which ordered pair is a solution to the system below?

$$x^2 - 4y^2 = 16$$
$$y = x - 4$$

(1) $(0, -4)$

(3) $(6, 2)$

(2) $(4, 0)$

(4) $(2, -2)$

5 Three freshmen, five sophomores, and four juniors are on the school's chess team. The coach must select three students to attend the citywide tournament. Which expression could be used to determine how many different groups of three students can be made from this team?

(1) $_{12}C_3$

(3) $_3C_1 \cdot {}_5C_1 \cdot {}_4C_1$

(2) $_{12}P_3$

(4) $_3P_1 \cdot {}_5P_1 \cdot {}_4P_1$

6 A survey of high school girls found that the mean number of text messages sent per day by the girls was 62, with a standard deviation of 12. If a normal distribution is assumed, which interval represents the number of texts sent by 68.2% of the girls?

(1) 38–86

(3) 50–74

(2) 44–80

(4) 56–68

7 The expression $9^{\frac{3}{2}} \cdot 27^{\frac{1}{2}}$ is equivalent to

(1) 3^2

(3) 243^2

(2) $3^{\frac{9}{2}}$

(4) $243^{\frac{3}{4}}$

8 The ratio $\dfrac{\text{Arc}\cos\frac{1}{2}}{\text{Arc}\tan 1}$ is equal to

(1) $\dfrac{3}{4}$

(3) $\dfrac{4}{3}$

(2) $\dfrac{3\pi}{4}$

(4) $\dfrac{4\pi}{3}$

9 Which summation will *not* produce $2 + 4 + 6 + 8 + 10 + 12$?

(1) $\displaystyle\sum_{b=2}^{12} b$

(3) $\displaystyle\sum_{d=2}^{7} (2d - 2)$

(2) $\displaystyle\sum_{a=1}^{6} 2a$

(4) $2\displaystyle\sum_{c=0}^{5} (c + 1)$

10 The expression $\frac{1}{3}\sqrt{6}\left(3m\sqrt{2} - k\sqrt{3}\right)$ is equivalent to

(1) $2m\sqrt{3} - k\sqrt{2}$ (3) $2m - k\sqrt{2}$

(2) $2m\sqrt{3} - 3k\sqrt{2}$ (4) $12m - k\sqrt{6}$

11 If $\log_3 (x + 1) - \log_3 x = 2$, then x equals

(1) $-\frac{9}{8}$ (3) $\frac{1}{8}$

(2) $-\frac{6}{5}$ (4) $\frac{1}{5}$

12 Which relation is *not* a function?

(1) $xy = 4$ (3) $y = 4 \sin x$

(2) $y = \log_4 x$ (4) $4x^2 - y^2 = 4$

13 What is the area of parallelogram $ABCD$ if $AB = 4$, $AD = 5\sqrt{3}$, and $m\angle A = 60$?

(1) 15   (3) $5\sqrt{3}$

(2) 30   (4) $10\sqrt{3}$

14 The maximum point on the graph of the equation $y = f(x)$ is $(2,-3)$. What is the maximum point on the graph of the equation $y = f(x - 4)$?

(1) $(2,-7)$ (3) $(6,-7)$

(2) $(-2,-3)$ (4) $(6,-3)$

15 The formula of the nth term of the sequence 3, -6, 12, -24, 48. . . is

(1) $a_n = -2(3)^n$ (3) $a_n = -2(3)^{n-1}$

(2) $a_n = 3(-2)^n$ (4) $a_n = 3(-2)^{n-1}$

16 The expression $\dfrac{3}{a-1} + \dfrac{3}{1-a}$ is equivalent to

(1) 0 (3) 6

(2) $\dfrac{6}{a^2-1}$ (4) $\dfrac{6}{1-a^2}$

17 The product of $\left(2\sqrt{2}+5i\right)$ and $\left(5\sqrt{2}-2i\right)$ is

(1) 30 (3) $30 + 29i\sqrt{2}$

(2) $30 + 21i\sqrt{2}$ (4) $10 + 21i\sqrt{2}$

18 Which quadratic equation has roots with a sum of $\dfrac{7}{6}$ and a product of $-\dfrac{1}{2}$?

(1) $6x^2 + 7x + 3 = 0$ (3) $6x^2 - 7x - 3 = 0$
(2) $6x^2 + 7x - 3 = 0$ (4) $6x^2 - 7x + 3 = 0$

19 The range of the function $f(x) = 3|x - 4| - 5$ is
(1) $x \geq 0$ (3) $x \geq -5$
(2) $f(x) \geq 0$ (4) $f(x) \geq -5$

20 The graph of the equation $y = m^x$ passes through the point
(1) $(1,m)$ (3) $(m,0)$
(2) $(0,m)$ (4) $(m,1)$

21 If $\sin\theta = \dfrac{1}{2}$, and θ terminates in Quadrant II, what is the value of $\csc\theta \cdot \cot\theta$?

(1) $-2\sqrt{3}$ (3) -2

(2) $\dfrac{\sqrt{3}}{2}$ (4) $\dfrac{2\sqrt{3}}{3}$

22 A circle has a radius of 12 units. For this circle, which expression *incorrectly* states the length of the arc intercepted by the given central angle?

(1) angle = 120°

    arc length = 8π

(2) angle = 6°

    arc length = 72

(3) angle = $\frac{2}{3}$ radian

    arc length = 8

(4) angle = $\frac{\pi}{3}$ radians

    arc length = 4π

23 How many different four-letter arrangements can be made from the letters in the word "CHAIRS," if the same letter may be used only once?

(1) 360

(2) 420

(3) 720

(4) 840

24 The sets below represent test scores for two students in Mrs. Silvio's trigonometry class.

$$\text{Michelle: } \{71, 68, 84, 88\}$$

$$\text{Valerie: } \{78, 82, 76, 80\}$$

Which statement correctly describes the relationship between the two students' test scores?

(1) Michelle's mean test score is greater and her test scores have a greater interquartile range.

(2) Michelle's population standard deviation is greater, but her range is smaller.

(3) Valerie's mean test score is greater and her interquartile range is greater.

(4) Valerie's mean test score is greater, but her population standard deviation is smaller.

25 A support wire 20 meters long runs from the top of a utility pole to a point on the ground 17 meters from the base of the pole. What is the measure, to the *nearest minute,* of the angle formed by the pole and the wire?

(1) 31° 47′

(2) 31° 48′

(3) 58° 12′

(4) 58° 13′

26 If $f(x) = 3x - 2$ and $f^{-1}(x) = \dfrac{x+2}{3}$, then $f \circ f^{-1}(x)$ equals

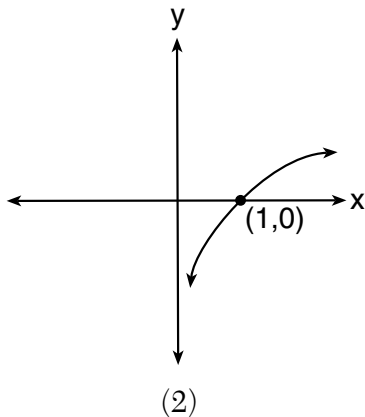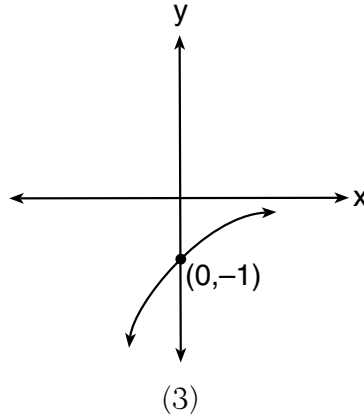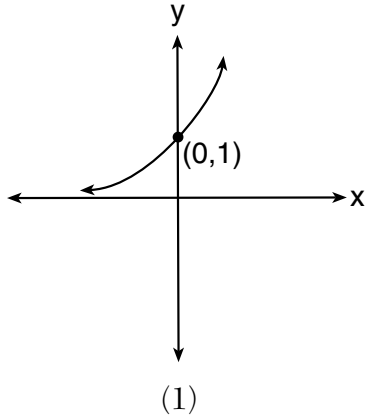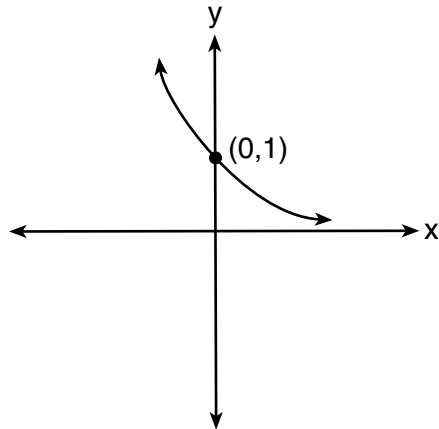(1) x (3) $(3x - 2) \div \left(\dfrac{x+2}{3}\right)$

(2) $\dfrac{1}{x}$ (4) $(3x - 2) \cdot \left(\dfrac{x+2}{3}\right)$

27 The graph of $f(x)$ is shown below. Which graph represents $f^{-1}(x)$?
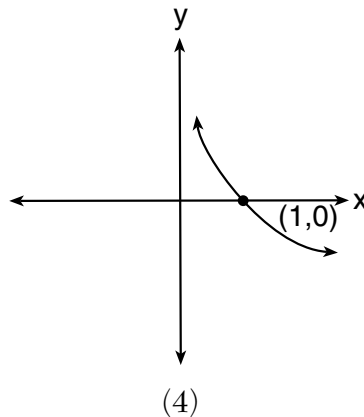
Part II

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. 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]

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

**29** Determine the exact value of $\left(\dfrac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

31 Express $\dfrac{12x^{-5}y^5}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.
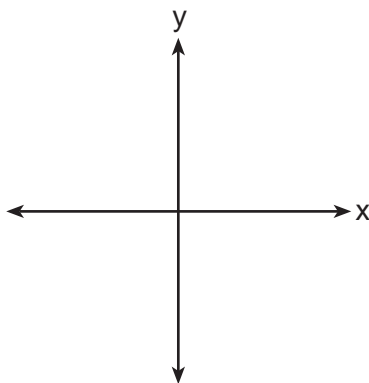
35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.

Part III

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. 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. [12]

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places*.

State the strength and direction indicated by the correlation coefficient.

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

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. A correct numerical answer with no work shown will receive only 1 credit. The answer should be written in pen. [6]

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Reference Sheet

Area of a Triangle

$K = \dfrac{1}{2} ab \sin C$

Functions of the Sum of Two Angles

$\sin (A + B) = \sin A \cos B + \cos A \sin B$

$\cos (A + B) = \cos A \cos B - \sin A \sin B$

$\tan (A + B) = \dfrac{\tan A + \tan B}{1 - \tan A \tan B}$

Functions of the Difference of Two Angles

$\sin (A - B) = \sin A \cos B - \cos A \sin B$

$\cos (A - B) = \cos A \cos B + \sin A \sin B$

$\tan (A - B) = \dfrac{\tan A - \tan B}{1 + \tan A \tan B}$

Law of Sines

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Sum of a Finite Arithmetic Series

$S_n = \dfrac{n(a_1 + a_n)}{2}$

Binomial Theorem

$(a + b)^n = {}_nC_0a^nb^0 + {}_nC_1a^{n-1}b^1 + {}_nC_2a^{n-2}b^2 + \ldots + {}_nC_na^0b^n$

$(a + b)^n = \displaystyle\sum_{r=0}^{n} {}_nC_r\, a^{n-r}b^r$

Law of Cosines

$a^2 = b^2 + c^2 - 2bc \cos A$

Functions of the Double Angle

$\sin 2A = 2 \sin A \cos A$

$\cos 2A = \cos^2 A - \sin^2 A$

$\cos 2A = 2 \cos^2 A - 1$

$\cos 2A = 1 - 2 \sin^2 A$

$\tan 2A = \dfrac{2 \tan A}{1 - \tan^2 A}$

Functions of the Half Angle

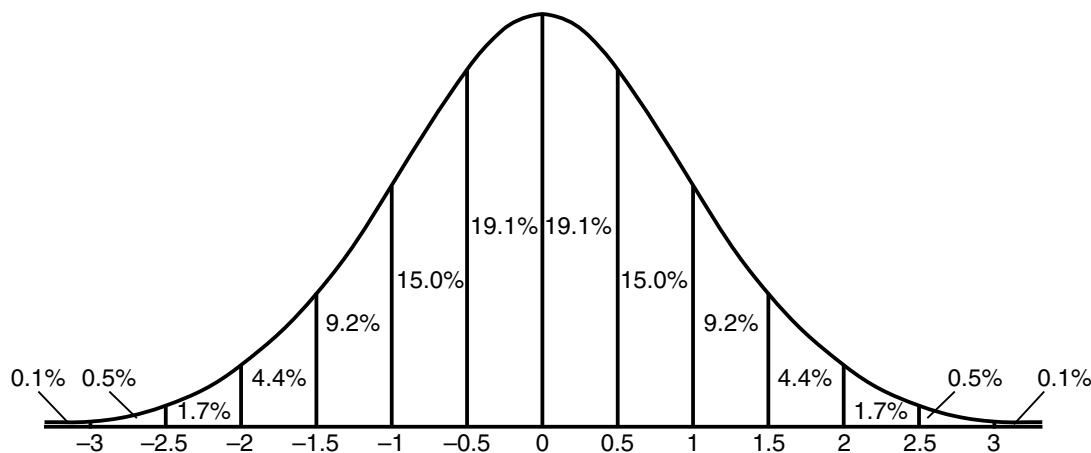$\sin \dfrac{1}{2} A = \pm \sqrt{\dfrac{1 - \cos A}{2}}$

$\cos \dfrac{1}{2} A = \pm \sqrt{\dfrac{1 + \cos A}{2}}$

$\tan \dfrac{1}{2} A = \pm \sqrt{\dfrac{1 - \cos A}{1 + \cos A}}$

Sum of a Finite Geometric Series

$S_n = \dfrac{a_1(1 - r^n)}{1 - r}$

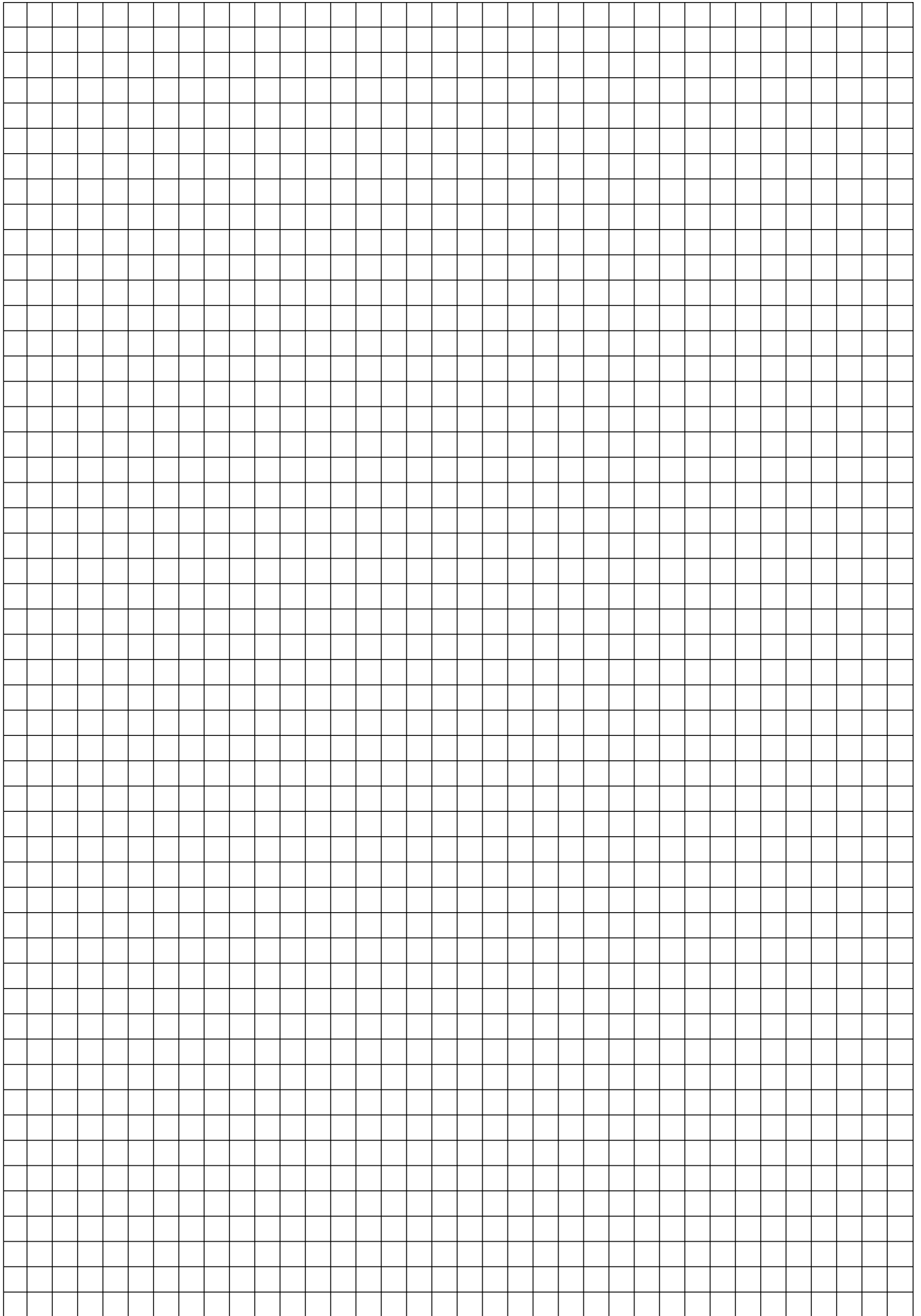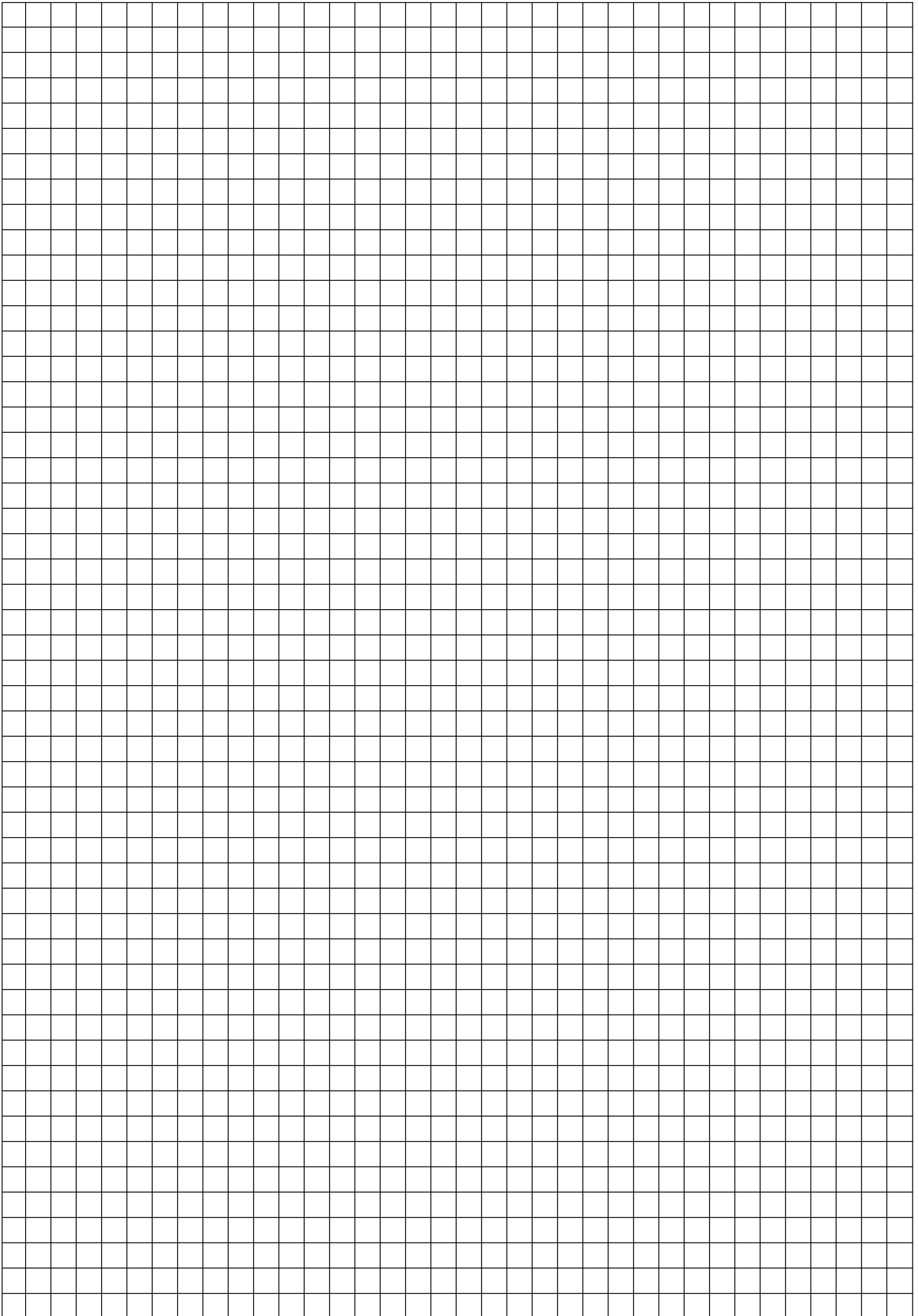## Normal Curve
Standard Deviation

FOR TEACHERS ONLY

ALGEBRA 2/TRIGONOMETRY

Wednesday, January 25, 2017 — 1:15 to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Mechanics of Rating

The following procedures are to be followed for scoring student answer papers for the Regents Examination in Algebra 2/Trigonometry. More detailed information about scoring is provided in the publication *Information Booklet for Scoring the Regents Examination in Mathematics.*

Do *not* attempt to correct the student's work by making insertions or changes of any kind. In scoring the open-ended 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 open-ended questions on a student's paper. Teachers may not score their own students' answer papers. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

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

Raters should record the student's scores for all questions and the total raw score on the student's separate answer sheet. Then the student's total raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Wednesday, January 25, 2017. Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score. The student's scale score should be entered in the box provided on the student's separate answer sheet. The scale score is the student's final examination score.

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

Part I

Allow a total of 54 credits, 2 credits for each of the following.

(1) 3	(10) 1	(19) . . . . . 4 . . . . .
(2) 3	(11) 3	(20) . . . . . 1 . . . . .
(3) 4	(12) 4	(21) . . . . . 1 . . . . .
(4) 2	(13) 2	(22) . . . . . 2 . . . . .
(5) 1	(14) 4	(23) . . . . . 1 . . . . .
(6) 3	(15) 4	(24) . . . . . 4 . . . . .
(7) 2	(16) 1	(25) . . . . . 4 . . . . .
(8) 3	(17) 2	(26) . . . . . 1 . . . . .
(9) 1	(18) 3	(27) . . . . . 4 . . . . .

General Rules for Applying Mathematics Rubrics

I. General Principles for Rating

The rubrics for the constructed-response questions on the Regents Examination in Algebra 2/Trigonometry 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 Examinations in Mathematics,* 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 any response. 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.

(28) **[2]** 325,985, and correct work is shown.

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

or

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

or

   [1] 325,985, but no work is shown.

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

(29) **[2]** $\frac{16}{9}$

   [1] One computational or simplification error is made.

or

   [1] One conceptual error is made.

or

   [1] The answer is not expressed as a fraction.

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

(30) **[2]** $7 + 4i\sqrt{3}$

[1] One computational or simplification error is made.

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

[1] One conceptual error is made.

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

[1] $7 + \sqrt{-48}$ or $7 - 4i\sqrt{3}$ is written, but no further correct work is shown.

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

(31) **[2]** $\dfrac{y^7}{2x^2}$

[1] One computational or simplification error is made.

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

[1] One conceptual error is made.

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

(32) **[2]** 1320, and correct work is shown.

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

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

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

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

[1] Correct work is shown to find 73, the number of seats in the 30th row, but no further correct work is shown.

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

[1] 1320, but no work is shown.

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

(33) **[2]** $x^2 + 4x + 1$, 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, such as finding $f(g(x + 2)) = x^2 - 2x + 1$.

or

[1] $(x + 2)^2 - 3$ is stated, but no further correct work is shown.

or

[1] $x^2 + 4x + 1$, but no work is shown.

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

(34) **[2]** An angle in standard position is drawn correctly, including the direction of the rotation, and $-\cos 70$ is stated.

[1] An angle in standard position is drawn correctly, but no further correct work is shown.

or

[1] $-\cos 70$, but no further correct work is shown.

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

(35) **[2]** "$x < -1$ or $x > 4$" or an equivalent notation or graphical representation, 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 the answer is not stated as a disjunction.

or

[1] Appropriate work is shown to find either $x < -1$ or $x > 4$, but no further correct work is shown.

or

[1] "$x < -1$ or $x > 4$," but a method other than algebraic is used.

or

[1] "$x < -1$ or $x > 4$," but no work is shown.

[0] Appropriate work is shown to find $x = 4$ and $x = -1$, but no further correct work is shown.

or

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

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.

(36) **[4]** $y = 0.098x + 0.402$, and strong positive is stated.

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

or

[3] $y = 0.098x + 0.402$, and either strong or positive is stated.

or

[3] The expression $0.098x + 0.402$ is written and strong positive is stated.

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

or

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

or

[2] $y = 0.098x + 0.402$, but no further correct work is shown.

or

[2] The expression $0.098x + 0.402$ is written and either strong or positive is stated.

or

[2] An appropriate strength and direction are stated based on a stated correlation coefficient.

or

[2] An incorrect linear regression equation is written, but an appropriate strength and direction are stated.

or

[2] Strong positive is stated, but no further correct work is shown.

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

or

[1] The expression $0.098x + 0.402$ is written, but no further correct work is shown.

[0] Strong positive is stated, but no work is shown.

or

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

(37) **[4]** (4,2) and (1,−1) or an equivalent answer, 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 (4,2) or (1,−1), but no further correct work is shown.

or

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

[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] (4,2) and (1,−1), but a method other than algebraic is used.

or

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

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

or

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

or

[1] (4,2) and (1,−1), but no work is shown.

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

(38) **[4]** 5.75, and correct algebraic work is shown.

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

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

or

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

or

[2] A correct substitution into the quadratic formula is made, but no further correct work is shown.

or

[2] 5.75, but a method other than algebraic is used.

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

or

[1] 5.75, but no work is shown.

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

Part IV

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

(39) **[6]** 59 and 35, and correct work is shown.

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

or

[5] Appropriate work is shown to find 59, but 17, the angle between the resultant and the 43-pound force, is found.

[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.

or

[4] Appropriate work is shown to find 59, but no further correct work is shown.

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

or

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

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

or

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

or

[2] A correct substitution is made into the Law of Cosines, but no further correct work is shown.

or

[2] 59 and 35, but no work is shown.

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

or

[1] A correctly labeled diagram is drawn, but no further correct work is shown.

or

[1] 59, but no work is shown.

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

Map to Core Curriculum

Content Strands	Item Numbers
Number Sense and Operations	17, 29, 30
Algebra	3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 25, 26, 27, 28, 31, 32, 33, 34, 35, 37, 38, 39
Measurement	1
Statistics and Probability	2, 5, 6, 23, 24, 36

Regents Examination in Algebra 2/Trigonometry

January 2017

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

The Chart for Determining the Final Examination Score for the January 2017 Regents Examination in Algebra 2/Trigonometry will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Wednesday, January 25, 2017. Conversion charts provided for previous administrations of the Regents Examination in Algebra 2/Trigonometry must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

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

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

2. Select the test title.

3. Complete the required demographic fields.

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

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

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA 2/ TRIGONOMETRY

Wednesday, January 25, 2017 — 1:15 – 4:15 p.m.

SAMPLE RESPONSE SET

Table of Contents

Question 28

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$$G(30) = 500e^{(.216)(30)}$$
$$500e^{(6.48)}$$
$$500(651.9709463$$
$$325985.4732$$
$$\boxed{325985}$$

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

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$$G = 500 \, e^{(0.216 \cdot 30)}$$

$$\boxed{G = 325986}$$

Score 1: The student made a rounding error.

Question 28

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$$G = 500\,e^{0.216(0.5)}$$
$$= 500\,e^{0.108}$$
$$= \underline{\underline{557}}$$

Score 1: The student made an error by using 0.5.

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$$G(t) = 500e^{0.216(60)}$$

$$= 500e^{12.96}$$

$$= 212533057$$

Score 1: The student made an error by using 60 minutes.

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$$G(30) = 500e^{.216 \times 30}$$
$$= 18616.5$$
$$= \underline{18617}$$

Score 1: The student correctly substituted into the function, but did not use 30 as an exponent.

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$$G(30) = 500e^{.216(30)}$$

$$\frac{G(30)}{30} \quad \frac{325985.4731}{30}$$

$$G = 10866.18244$$

Score 0: The student made an error by dividing by 30 and did not round properly.

Question 29

29 Determine the exact value of $\left(\dfrac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\dfrac{1}{\left(\dfrac{27}{64}\right)^{2/3}} = \dfrac{1}{9/16} = \dfrac{16}{9}$$

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

Question 29

29 Determine the exact value of $\left(\dfrac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\frac{16}{9}$$

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

Question 29

29 Determine the exact value of $\left(\dfrac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\left(\frac{27}{64}\right)^{-2/3} = \left(\frac{64}{27}\right)^{2/3} = \left(\sqrt[3]{\frac{64}{27}}\right)^{2} = \left(\frac{4}{3}\right)^{2} = \frac{16}{9}$$

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

Question 29

29 Determine the exact value of $\left(\dfrac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\left(\frac{27}{64}\right)^{3/2}$$

$$\left(3\sqrt{3}\right)^3$$

$$\frac{3^3\left(\sqrt{3}\right)^3}{8^3}$$

$$\frac{27 \cdot 3\sqrt{3}}{512}$$

$$= \frac{81\sqrt{3}}{512}$$

Score 1: The student made an error by using the negative reciprocal of $-\dfrac{2}{3}$.

Question 29

29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\left(\frac{27}{64}\right)^{\frac{2}{3}} = \left(\sqrt[3]{\frac{27}{64}}\right)^2 = \frac{9}{16}$$

Score 1: The student made a transcription error by not writing $-\frac{2}{3}$.

Question 29

29 Determine the exact value of $\left(\dfrac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\left(\frac{27}{64}\right)^{-\frac{2}{3}}$$

$$\left(0.421875\right)^{-\frac{2}{3}} = 1.\overline{7}$$

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

29 Determine the exact value of $\left(\dfrac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\left(\frac{64}{27}\right)^{3/2} = 3\cdot 649$$

Score 0: The student made an error by using the negative reciprocal of the exponent and expressed the answer as a decimal.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

$$\boxed{7 + 4i\sqrt{3}}$$

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

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

$i\sqrt{48}$

$16 \cdot 3$

$7+ \qquad 4i\sqrt{3}$

$$\boxed{7 + 4i\sqrt{3}}$$

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

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

$$7 - \sqrt{12 \cdot 4}$$

$$7 - 2i\sqrt{12}$$

$$7 - 2i\sqrt{4 \cdot 3}$$

$$7 - 2i(2)\sqrt{3}$$

$$\boxed{7 - 4i\sqrt{3}}$$

Score 1: The student wrote $7 - \sqrt{-48}$ in simplest $a + bi$ form, but did not state the conjugate.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

$$7 - i\sqrt{16}\sqrt{3}$$
$$\boxed{-7 + 4i\sqrt{3}}$$

Score 1: The student wrote the additive inverse of $7 - \sqrt{-48}$ in simplest $a + bi$ form, not the conjugate.

Algebra 2/Trigonometry – Jan. '17   [18]

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

$$7 + \sqrt{-48}$$

$$7 + 2\sqrt{12}\,i$$

Score 1: The student stated the conjugate correctly, but did not express it in simplest form.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

$$\frac{1}{7-\sqrt{-48}} \cdot \frac{7+\sqrt{-48}}{7+\sqrt{-48}}$$

$$\frac{1}{7-i\sqrt{48}} \cdot \frac{7+i\sqrt{48}}{7+i\sqrt{48}} = \frac{7+i\sqrt{48}}{97} = \frac{7+4i\sqrt{3}}{97}$$

Score 1: The student found the multiplicative inverse of $7-\sqrt{-48}$.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

$$7 + \sqrt{48}$$

Score 0: The student gave a completely incorrect response.

Question 31

31 Express $\dfrac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

$$\frac{12x^{3}y^{2}y^{5}}{24x^{5}} = \frac{y^{7}}{2x^{2}}$$

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

Question 31

31 Express $\dfrac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

$$\frac{y^{7}}{2x^{2}}$$

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

Algebra 2/Trigonometry – Jan. '17   [23]

Question 31

31 Express $\dfrac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

$$\frac{12}{24} \qquad \frac{x^{-5}}{x^{-3}} \qquad \frac{y^{5}}{y^{-2}}$$

$$\frac{1}{2} \qquad x^{-2} \qquad y^{7}$$

$$\boxed{\dfrac{y^{7}}{2x^{2}}}$$

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

Question 31

31 Express $\dfrac{12x^{-5}y^5}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

$$\frac{1}{2} \; x^{-5-^-3} \; y^{5-^-2}$$

$$\frac{1}{2} \; x^{-5+3} \; y^{5+2}$$

$$\frac{1}{2} \; x^{-2} \; y^{7}$$

$$\frac{x^{-2} y^7}{2}$$

Score 1: The student did not express the answer using only positive exponents.

31 Express $\dfrac{12x^{-5}y^5}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

$$\frac{12\,x^3\,y^5\,y^2}{24\,x^5}$$

$$\frac{x^3\,y^7}{2\,x^5}$$

Score 1: The student did not simplify completely.

31 Express $\dfrac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

$$= \frac{1}{2} x^{-8} y^{3}$$

Score 0: The student added exponents and did not express the answer using only positive exponents.

Question 32

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$$S_n = \frac{n(a_1 + a_n)}{2}$$

$$S_n = \frac{30(15 + 73)}{2}$$

$$S_n = \frac{30(88)}{2}$$

$$S_n = \boxed{1320}$$

$$a_n = a + d(n-1)$$
$$a_n = 15 + 2(30-1)$$
$$a_n = 15 + 2(29)$$
$$a_n = 73$$

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

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.
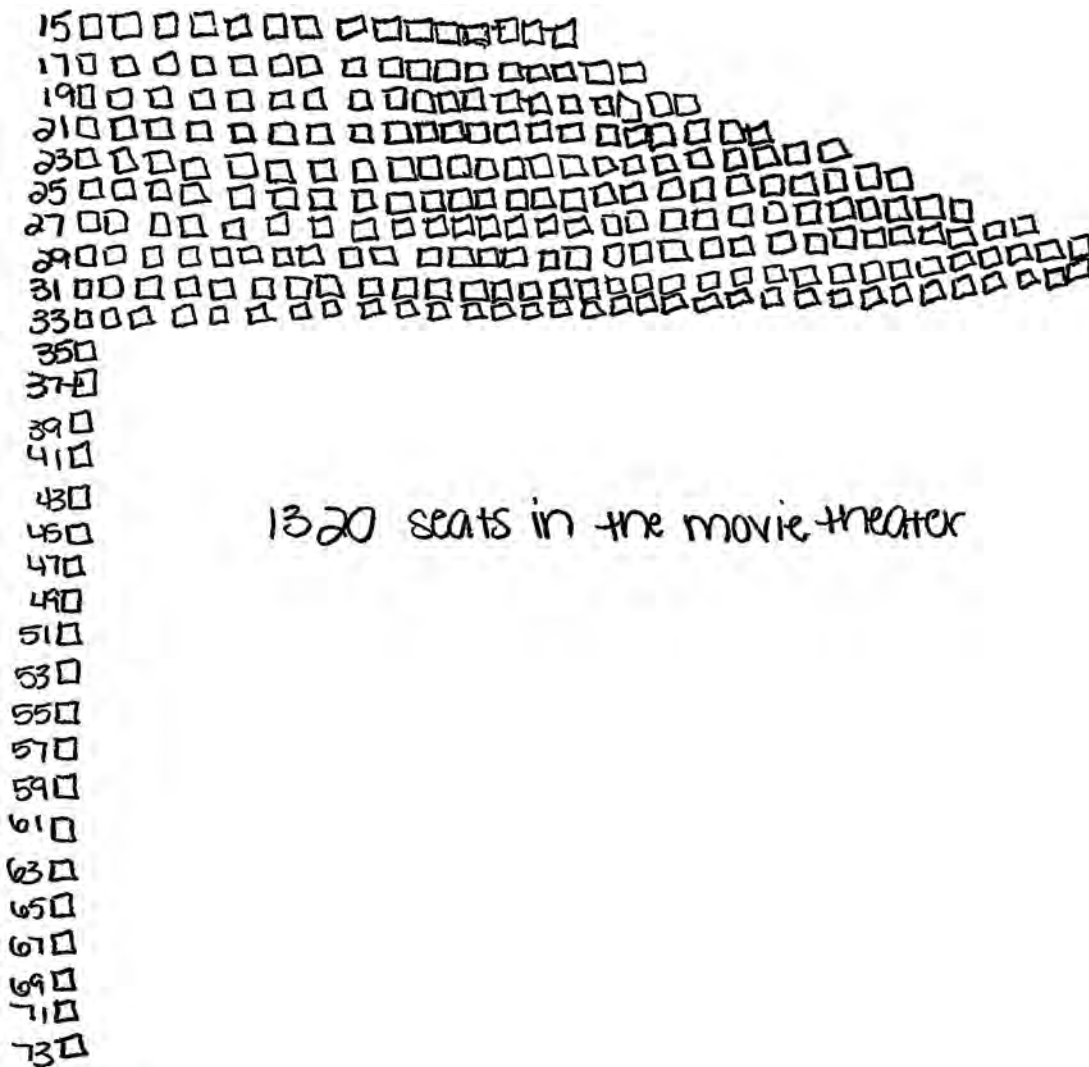
$$S_n = \frac{n\left(2a_1 + (n-1)d\right)}{2}$$

$$S_{30} = \frac{30\left(2(15) + 29(2)\right)}{2}$$

$$S_{30} = 1320$$

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

Question 32

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

15 □□ □ □ □ □ □□ □□□□□□□□
17 □ □ □ □ □ □ □□ □ □□□□ □□□□□□
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49 □
51 □
53 □
55 □
57 □
59 □
61 □
63 □
65 □
67 □
69 □
71 □
73 □

1320 seats in the movie theater

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

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

30 rows

15, 17, 19, 21, 23, 25
27, 29, 31, 33, 35, 37
39, 41, 43, 45, 47, 51
53, 55, 57, 59, 61,
63, 65, 67, 69, 71,
73, 75 = 1395

Score 1: The student did not list 49, but used it to find the sum, plus the 75.

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$$S_n = \frac{n(a_1 + a_n)}{2}$$

$$S_n = \frac{30(15+30)}{2}$$

$$S_n = \frac{1350}{2}$$

$$S_n = 675 \text{ seats}$$

Score 1: The student used 30 rows instead of 73 seats in row 30 when using the formula.

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$$a_{30} = 15 + 2(29)$$
$$15 + 58$$
$$a_{30} = 73$$

Score 1: The student calculated the number of seats in the last row, but did not calculate the total seating capacity.

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$$a_1 = 15 \qquad a_{30} = 73$$

$$a_n = a_1 + (n-1)(d)$$

$$a_{30} = 15 + (30-1)(2)$$
$$29(2)$$

$$a_{30} = 15 + 58$$

$$a_{30} = 73$$

675 seats

$$\overline{S_n} = \frac{n(a_1 + a_n)}{2}$$

$$S_{30} = \frac{30(15+30)}{2}$$

$$S_{30} = \frac{30(45)}{2}$$

$$\frac{1350}{2}$$

$$675$$

Score 1: The student calculated 73, the number of seats in row, 30, but used the 30 in the formula.

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$$x = 15(1 + .1\overline{3})^{30}$$
$$x = 15(1.1\overline{3})^{30}$$
$$x = 15(42.72970256)$$
$$x = 640.9455383$$
$$\boxed{x = 641 \text{ seats}}$$

Score 0: The student gave a completely incorrect response.

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

$x+2 \rightarrow f \rightarrow g$

$f(x) = x^2$

$f(x+2) = (x+2)(x+2)$
$\qquad = x^2 + 4x + 4$

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

$\boxed{x^2 + 4x + 1}$

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

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

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

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

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

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

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

$$\left(x^2 + 2x + 2x + 4 - 3\right.$$

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

$$g(f(x+2)) = (x+2)(x+2) - 3$$

$$\boxed{g(f(x+2)) = (x^2 + 4x + 4) - 3}$$

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

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

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

Score 1: The student made an error when squaring $x + 2$.

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.
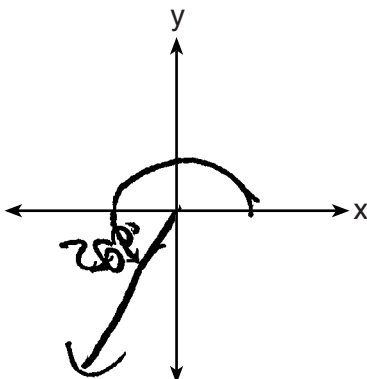
$$g(x+2) = x+2-3 = x-1$$

$$f(x-1)^2 = x^2 - 1$$

Score 0: The student evaluated the expression from left to right and made an error squaring $x - 1$.

Question 34

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.
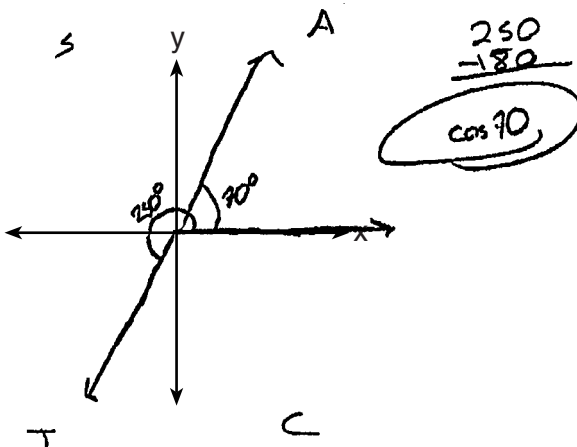

$$\cos 250 = \boxed{-\cos 70}$$

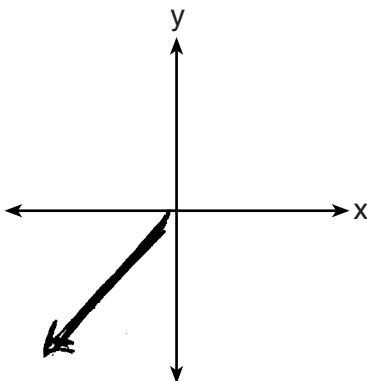**Score 2:** The student gave a complete and correct response.

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.

Score 1: The student sketched the angle correctly, but did not state −cos 70.

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.
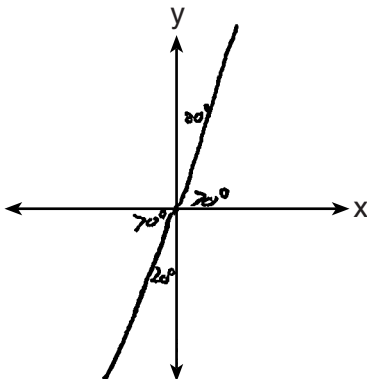

$- \cos 70$

Score 1: The student did not indicate the direction of rotation.

Question 34

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.

$$Cos\,250° = Cos\,70°$$

$$\begin{array}{r} 250 \\ -180 \\ \hline 70° \end{array}$$

$$Q\,III = \angle - 180$$

Score 0:   The student did not indicate the 250° angle and stated an incorrect sign for the function.

Question 35

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

Question 35

35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.

$$x^2 - 3x - 4 = 0$$

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

$$x = 4 \qquad or \qquad x = -1$$
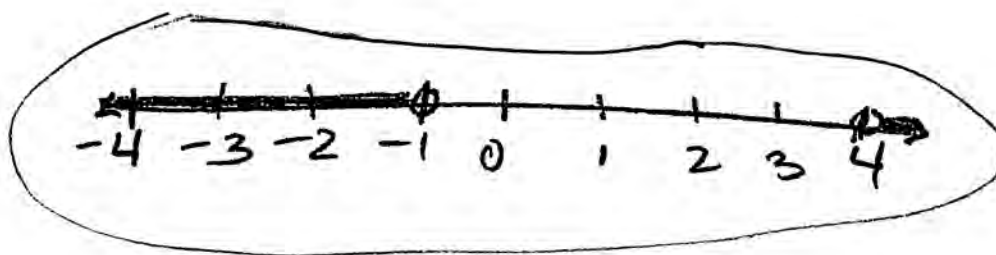
Score 2: The student gave a complete and correct response.

Question 35

35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.

$$x^2 - 3x - 4 > 0$$
$$(x+1)(x-4) > 0$$

$$x+1 > 0 \qquad x-4 > 0$$
$$x < -1 \qquad x > 4$$

Score 1: The student did not state the solution as a disjunction.

35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.

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

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

$$x = \frac{3 \pm \sqrt{9 + 16}}{2}$$

$$x = \frac{3 \pm \sqrt{25}}{2}$$

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

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

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

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

$x - 4 = 0 \qquad x + 1 = 0$

$x = 4 \qquad\quad x = -1$

Score 0: The student solved the equation $x^2 - 3x - 4 = 0$, but did nothing with the inequality.

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

$$y = .098x + .402$$

State the strength and direction indicated by the correlation coefficient.

high positive correlation

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

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

(handwritten above table: 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005)

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

linear regression → $y = .098x + .402$

State the strength and direction indicated by the correlation coefficient.

The correlation coefficient was .988 so it is pretty strong because it is closer to the points and +1 and not zero which means that the points are graphed in a direct relationship; as the years increase so does the minimum wage.

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

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

$$Y = .098x + .402$$

State the strength and direction indicated by the correlation coefficient.

• The direction is positive and the strength this 0.988.

Score 3: The student did not state the strength of the correlation coefficient appropriately.

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$y = mx + b$

$y = .098x + .402$

slope

y-intercept

Positive linear.

Score 3: The student did not state the strength of the correlation coefficient.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$$y = ax + b \qquad a = .098$$
$$b = .402$$
$$y = .098x + .402$$

$$r = +.988$$

Score 3: The student wrote a correct regression equation and indicated the direction when writing the correlation coefficient, but did not write the strength.

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$y = 0.0975454545x + .40227272 73$

$y = 0.098x + 0.402$

The strengh the very low and increases at a rate of 0.098 per 5 years

Score 2: The student wrote a correct regression, but described the slope instead of the correlation coefficient.

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places*.

$$.402 + .098x$$

State the strength and direction indicated by the correlation coefficient.

$$r = +.9876$$

Score 2: The student wrote an expression and indicated a positive correlation.

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$Y = ax + b$

$a = .098$

$b = .402$

Score 2: The student wrote a correct regression equation.

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

LinReg
_____

$y = wx + b$

$y = .0975 x + 0.4022$

Strength = 0.9875

Score 1: The student did not round correctly, and did not state the strength and the direction of the correlation coefficient.

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$y = ax + b$

$y = .09754x + .40227$

$-.40227$

$-.40227$

$-.40227 = .09754x$

$\dfrac{-.40227}{.09754} = \dfrac{.09754x}{.09754}$

$\boxed{x = -4.124}$

The correlation coefficient is weak.

Score 1: The student did not round the regression equation correctly and stated the wrong strength and no direction.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$y = mx + b$

positive

Score 0: The student stated strong positive, but gave no supporting evidence.

Question 37

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

$$y = x - 2$$

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

$$2x - 4 = x^2 - 3x$$

$$x^2 - 5x + 4 = 0$$

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

$$x = 4 \qquad x = 1$$

$$y + 2 = 4 \qquad\qquad y + 2 = 1$$

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

Solutions

$$(4, 2)$$

$$(1, -1)$$

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

Question 37

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

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

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

$$\begin{array}{c} -2 \quad -2 \\ y = x - 2 \end{array}$$

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

$$2\left(\frac{1}{2}x^2 - \frac{5}{2}x + 2 = 0\right)$$

$$x^2 - 5x + 4 = 0$$

$$\begin{array}{l} a: 1 \\ b: -5 \\ c: 4 \end{array} \qquad x = \frac{5 \pm \sqrt{25 - 4(1)(4)}}{2(1)}$$

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

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

$$= \frac{8}{2} = 4 \qquad\qquad = \frac{2}{2} = 1$$

$$\begin{array}{c} y + 2 = 4 \\ -2 \ -2 \\ \hline y = 2 \end{array} \qquad\qquad \begin{array}{c} y + 2 = 1 \\ -2 \ -2 \\ \hline y = -1 \end{array}$$

Score 4: The student gave a complete and correct response. The student clearly indicated which x-value was used to obtain the y-value.

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

$$\frac{y}{y+2} = \frac{y+2-3}{2}$$

$$\frac{y}{y+2} = \frac{y-1}{2}$$

$$2y = y^2 + y - 2$$

$$0 = y^2 - y - 2$$

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

$$\begin{array}{c|c} y = 2 & y = -1 \\ x = 4 & x = 1 \end{array}$$

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

Question 37

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

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

$$\frac{y}{y+2} = \frac{(y+2)-3}{2}$$

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

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

$x = 0$

-1

$x = 1$

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

$2y = y^2 + y - 2$

$-2y \qquad -2y$

$0 = y^2 - y - 2$

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

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

$y = +2 \qquad\qquad {-1} \ {-1}$

$\qquad\qquad y = -1$

$$\boxed{y = -1 \quad x = 1}$$

Score 3: The student found both y-values, but only one x-value.

Question 37

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

$$\frac{y}{y+2} = \frac{(y+2)-(3)}{2}$$

$$2y = (y+2)(y+2) - (3)$$

$$2y = y^2 + 4y + 4 - 3$$

$$-2y \qquad\qquad -2y$$

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

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

$$y = -1 \qquad y = -1$$

$$-1 + 2 = 1$$

$$\left\{ \begin{array}{l} y = -1 \\ x = 1 \end{array} \right\}$$

Score 2:   The student made a conceptual error performing the cross product.

Question 37

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

$$\overset{2x}{(\,)}(\,)^{2x}$$

$$\frac{-2\ -2}{y = x-2}$$

$$\overset{2x}{\left(\frac{y}{x}\right)} = \left(\frac{x-3}{2}\right)^{2x}$$

$$2y = x(x-3)$$

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

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

$$y + 2 = -5$$
$$-2 \qquad -2$$
$$\boxed{y = -7}$$

$$\frac{x^2 - 3x}{2} \times \frac{x-2}{1}$$

$$2(x-2) = x^2 - 3x$$

$$2x - 4 = x^2 - 3x$$
$$-2x + 4 \qquad -2x + 4$$

$$x^2 - 5x + 4 = 0$$

$$\boxed{(x + 5)(x - 1) = 0}$$

$$x + 5 = 0 \quad | \quad x - 1 = 0$$

$$x = -5 \quad | \quad x = 1$$

Score 2: The student did not factor correctly and only found one pair of solutions.

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

$$\frac{y \cancel{}}{y+2} \cancel{\times} \frac{y+2-3}{2}$$

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

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

$$y = (y-1)(y-3)$$

$$y - 1 = 0 \qquad y - 3 = 0$$
$$+1 +1 \qquad +3 +3$$

$$y = 1 \qquad\qquad y = 3$$
$$\vdots -2 \qquad\qquad \vdots -2$$

$$y = -2 \qquad\qquad y = -6$$

Score 1: The student wrote a correct equation in one variable, but then made numerous errors.

37 Solve the system of equations algebraically for x and y:

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

$$y + 2 = x$$

$2 + 2 = 4$

$y = 2$
$x = 4$

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

$$\frac{y}{4} = \frac{4-3}{2}$$

$4 = x^2 - 3x$
$-4 \quad -4$

$2y = 16 - 12$

$0 = x^2 - 3x - 4$

$\frac{2y}{2} = \frac{4}{2}$

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

$y = 2$

$\overline{x=4 \mid x=-1}$

$\boxed{\begin{array}{c} x = 4 \\ y = 2 \end{array}}$

Score 0: The student obtained one correct solution by an obviously incorrect procedure.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.
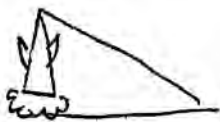
$$h = -16t^2 + 184t$$

$$529 = -16t^2 + 184t \quad _{-529}$$
$$-529$$

$$-16t^2 + 184t - 529 = 0$$

$$\text{let } t = x$$

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

$$X = \frac{-184 \pm \sqrt{184^2 - 4(-16)(-529)}}{2(-16)}$$

$$X = \frac{-184 \pm \sqrt{33856 - 33856}}{-32}$$

$$X = \frac{-184}{-32}$$

$$X = \frac{23}{4}$$

$$t = \frac{23}{4}$$

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

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$$h = -16t^2 + 184t$$

$$-16t^2 + 184t - 529 = 0$$

$$-16t^2 + 92t + 92t - 529 = 0$$

$$-4t(4t - 23) + 23(4t - 23) = 0$$

$$= (-4t + 23)(4t - 23) = 0$$

$$+4t = +23 \qquad 4t = 23$$
$$t = \dfrac{23}{4}\ {}_{sec} \qquad t = \dfrac{23}{4}$$

$$t = \dfrac{23}{4}\ \text{or } 5.75 \text{ seconds}$$

$$16(529) = 8464$$

$$-8464 \quad \div 184$$

2	8464
2	4232
2	2116
2	1058
23	529
23	23
	1

$$-8464$$
$$1 \to 8464$$
$$2 \to 4232$$
$$4 \to 2116$$
$$8 \to 1058$$
$$16 \to 529$$
$$368 \to 23$$
$$46 \to 184$$
$$92 \to 92$$

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

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$$529 = -16t^2 + 184t$$

$$-16t^2 + 184t - 529 = 0$$

$$x = \frac{-(184) \pm \sqrt{(184)^2 - 4(-16)(-529)}}{2(-16)}$$

$$\frac{-184 \pm \sqrt{33856 - 33856}}{-32}$$

$$\frac{-184}{-32} = 5.25$$

Score 3: The student made one error when converting the fraction to a decimal.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$$529 = -16t^2 + 184t$$
$$+16t^2$$

$$16t^2 - 184t + 529 = 0$$

$$\frac{+184 \pm \sqrt{184^2 - 4(16)(529)}}{2(16)}$$

$$\frac{184 \pm \sqrt{0}}{32}$$

$$= \frac{23 \pm 0}{2}$$

$$\frac{46 \pm \sqrt{0}}{4}$$

Score 3: The student made an error when reducing the fraction $\frac{184 \pm \sqrt{0}}{32}$.

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$$529 = -16t^2 + 184t$$
$$16t^2 - 184t + 529 = 0 \quad 9 = 0$$

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

$$x = \frac{-(184) \pm \sqrt{(184)^2 - 4(16)(529)}}{2(16)}$$

$$x = \frac{-184 \pm \sqrt{33856 - 33856}}{32}$$

$$x = \frac{-184 \pm \sqrt{0}}{32}$$

$$x = \frac{-184}{32}$$

$$x = -\frac{23}{4}$$

Score 2: The student wrote -184 instead of 184 in the quadratic formula. The final answer did not make sense in the context of the problem.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$$h = 16t^2 + 184t$$

$$529 = 16t^2 + 184t$$
$$-184 \qquad\qquad -184$$

$$\sqrt{345} = \sqrt{16t^2}$$

$$\frac{\sqrt{345}\, t = 4t}{4}$$

$$4.643543905 = t$$

Score 1: The student made a transcription error when writing the equation and made a conceptual error by subtracting 184 instead of 184t.

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$$529 = -16t^2 + 184t$$

$$529 = -32t + 184t$$

$$\frac{529}{152} = \frac{152t}{152}$$

$$3.4 \qquad Seconds$$

Score 0: The student made a conceptual error when going from line 1 to line 2, creating a simpler linear equation for which no credit was earned, and made a rounding error.

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$$\frac{529}{-16} = \frac{-16t^2}{-16}$$

$$\sqrt{-33.0625} = \sqrt{t^2}$$

$$t = 5.75 \text{ seconds}$$

Score 0: The student obtained a correct answer by an obviously incorrect procedure

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.
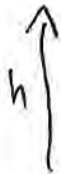
$529 = -16t^2 + 184t$
$-529 \qquad -529$

$0 = -16t^2 + 184t - 529$
$(-4t +)(4t -)$

$529 = -16t^2 + 184t$
$-184t \qquad -184t$

$529 - 184t = 16t^2$

16
44
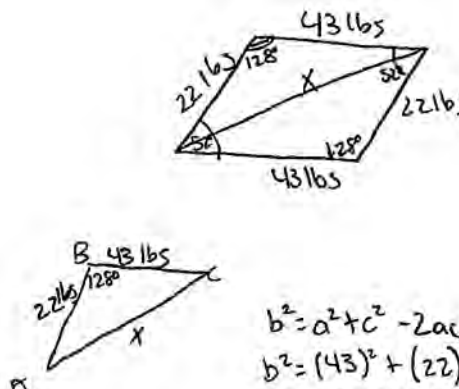
256

$t = 13 \qquad 21\ 76$

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

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$$180° - 52° = 128°$$
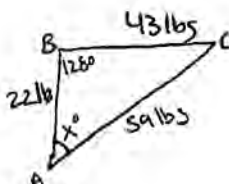
$$b^2 = a^2 + c^2 - 2ac\cos B$$
$$b^2 = (43)^2 + (22)^2 - 2(43)(22)\cos 128°$$
$$b^2 = 1849 + 484 - 1892\cos 128°$$
$$\sqrt{b^2} = \sqrt{2333 - 1892\cos 128}$$
$$b \approx 59 \text{ lbs.}$$

Resultant force ≈ 59 lbs.

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\frac{\sin A}{43 \text{ lbs}} = \frac{\sin 128}{59 \text{ lbs}}$$

$$\frac{59 \sin A}{59} = \frac{43 \sin 128}{59}$$

$$\sin^{-1}\left(\frac{43\sin 128}{59}\right) \approx 35°$$

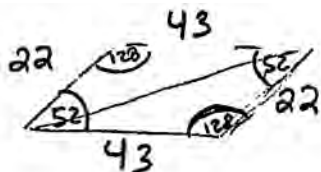**Score 6:**   The student gave a complete and correct response.

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.
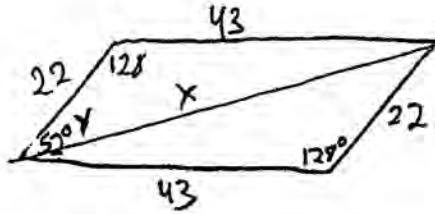
$$\overset{2}{x} = 22^2 + 43^2 - 2(22)(43)\cos 128$$
$$= 2333 + 1164.8$$
$$= 3497.8$$
$$x = 59$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$$43^2 = 22^2 + 59^2 - 2(22)59\cos y$$
$$1849 = 3965 - 2596 \cos y$$
$$-2116 = -2596 \cos y$$
$$.8151 = \cos y$$
$$35 = y$$

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

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

59

$$\frac{180}{-52} \over 128$$

$$a^2 = b^2 + c^2 - 2bc\,(\cos A)$$
$$a^2 = 43^2 + 22^2 - 2(43)(22)(\cos 128)$$
$$\sqrt{a^2} = \sqrt{3497.831511}$$
$$a = 59.14246792$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

35°
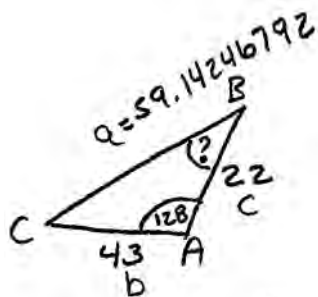
$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{59.14246}{\sin 128} = \frac{43}{\sin B}$$

$$\frac{33.88446241}{59.14246} = \frac{59.14246\sin B}{59.14246}$$

$$\sin B = .57292954$$

$$\text{ref } \angle = 34.9547$$
$$\approx 35°$$

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

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

Work shown:
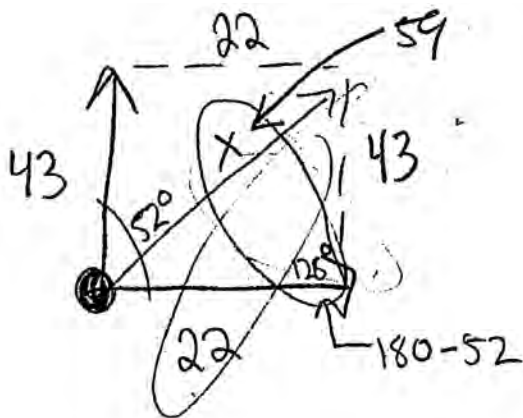
$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$a^2 = (22)^2 + (43)^2 - 2(22)(43)\cos 128°$$
$$\sqrt{a^2} = \sqrt{3497.83\ldots}$$
$$a = 59.14 \rightarrow \boxed{59}$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

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

$$\frac{\sin 128°}{59} = \frac{\sin x}{22}$$

$$x = 17.08$$

$$\boxed{17°}$$

Score 5: The student did not solve for the correct angle. Since the student only gave one legible response to find 59, it can be scored, even though it is crossed out.
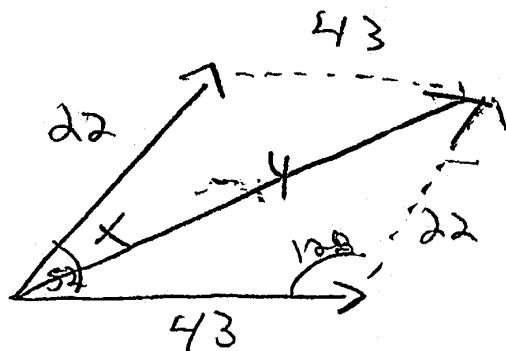
Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$\begin{array}{r} 180 \\ -52 \\ \hline 128 \end{array}$

$a^2 = b^2 + c^2 - 2(b)(c) \cos A$

$y^2 = 43^2 + 22^2 - 2(43)(22) \cos 128$

$y^2 = 2333 + 1164.831511$

$\sqrt{y^2} \sqrt{3490.831511}$

$y = 59.14246792$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$\dfrac{59.1924\ldots}{\sin 128} = \dfrac{22}{\sin x}$

$10.33623658 = \dfrac{59.1424}{\sin x}$

$\sin x = .2931267022$

$x = 17°2'$

$\boxed{x = 17°}$

Score 4: The student did not round the magnitude to 59 and solved for the wrong angle.

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.
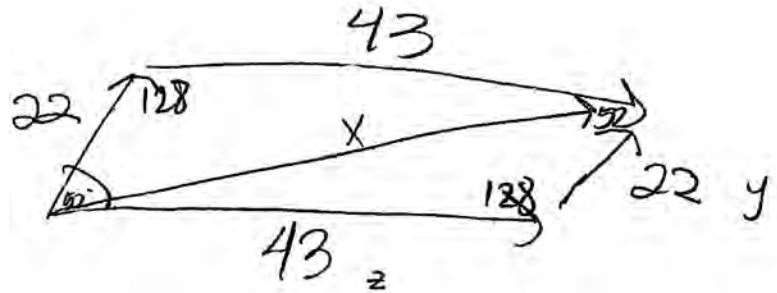
$$X^2 = Y^2 + Z^2 - 2YZ \cos X$$
$$X^2 = 22^2 + 43^2 - 2(22)(43)\cos 128°$$
$$X^2 = 2333 - 1892 \cos 128°$$
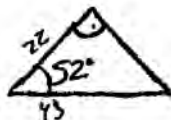$$\sqrt{X^2} = \sqrt{3497.831511}$$

$$\boxed{X = 59}$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 4: The student only determined the magnitude.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$$C^2 = a^2 + b^2 - 2ab \cos C$$
$$c^2 = 22^2 + 43^2 - 2(22)(43) \cos 52$$
$$c^2 = 484 + 1849 - 1892 \cos 52$$
$$c^2 = 2333 - 1164.831511$$

$$c^2 = 1168.168489$$
$$c = \sqrt{1168.168489}$$
$$c = 34.17847991$$

resultant force = 34 pounds

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$$\frac{\sin a}{43} = \frac{\sin 52}{34}$$
$$43 \sin 52 = 34 \sin a$$
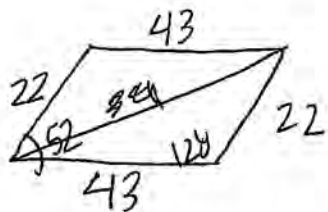$$\sin a = .9966018354$$
$$a = 85.27520583$$

$$m\angle = 85°$$

Score 4:   The student made a conceptual error by using 52° instead of 128° when solving for both the magnitude and the angle.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound*, the magnitude of the resultant force.

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a^2 = (43)^2 + (22)^2 - 2 \cdot 43 \cdot 22 \cdot \cos 128°$$

$$a^2 = 1,849 + 484 - 1,164.83511$$

$$\sqrt{a^2} = \sqrt{1,168.16848}$$

$$a = 34.17847991$$

$$a = 34 \quad \boxed{magnitude = 34 lbs}$$

$$180 - 52 = 128$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$$22^2 = 43^2 + 34^2 - 2(43)(34)(\cos A)$$

$$484 = 3,005 - 2924 \cos A$$

$$-2521 = -2924 \cos A$$

$$\frac{-2521}{-2924} = \frac{-2924 \cos A}{-2924}$$
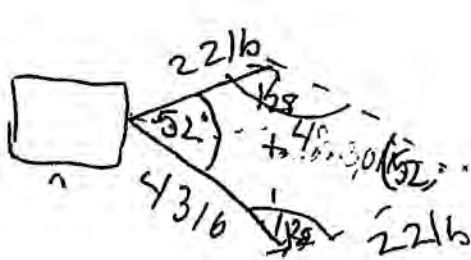
$$\cos A = .8621751026$$

$$A = 30.93831245$$

$$A = \boxed{30°}$$

Score 4: The student made an error in sign when computing the magnitude and found the wrong angle.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$a^2 = 22^2 + 43^2 - 2(22)(43)\cos 128$$
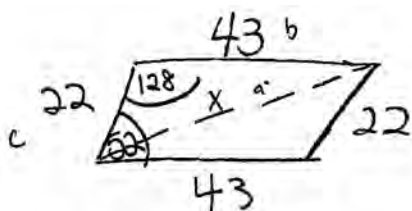$$a^2 = 3497.83$$
$$\boxed{a = 59.14 \text{ lb}}$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 3:   The student did not round the magnitude correctly and did not find the correct angle.

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$a^2 = 2333 - 1892 \cos 128$

$a^2 = 2333 + 1310.958895$

$\sqrt{a^2} = 1022.041105$

$a = 31.96937761$

$a^2 = b^2 + c^2 - 2bc \cos A$

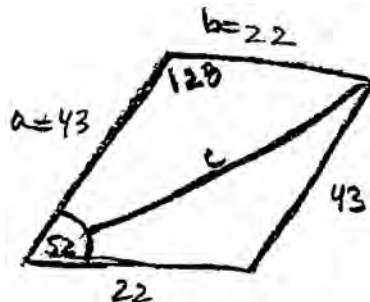$a^2 = 43^2 + 22^2 - 2(43)(22) \cos 128$

$a^2 = 1849 + 484 - 1892 \cos 128$

32°

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 2: The student only made a correct substitution into the Law of Cosines.

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39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 1: The student only drew a correct diagram.

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$$c^2 = (22)^2 + (43)^2 - 2(22)(43)\cos 52$$
$$\sqrt{c^2} = \sqrt{2641}$$
$$c = 51.39$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 0:   The student used 52° instead of 128° and made both a computational and a rounding error.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$$\angle = 22^2 + 43^2 - 2(22)(43)\cos 52$$

$$\angle c^2 = 51.39434363 \qquad \begin{array}{r} 43 \\ +22 \\ \hline \end{array}$$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$$\frac{65}{\sin 52°} = \frac{51.4}{\sin A}$$

$$\sin A = \frac{51.4(\sin 52)}{65}$$

$$\sin A = .8944770767$$

$$\boxed{\sin A = 51°}$$

Score 0: The student used 52° instead of 128°, calculated in radians and did not round correctly. The student also added the forces and made a computational error.

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

Regents Examination in Algebra 2/Trigonometry – January 2017

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

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

To determine the student's final examination 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 2/Trigonometry.