

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

# ALGEBRA 2/TRIGONOMETRY

Friday, June 17, 2016 — 9:15 a.m. to 12:15 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]

Use this space for  
computations.

1 The expression  $\frac{3}{4}\sqrt{-80}$  is equivalent to

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

(3)  $-3\sqrt{5}$

(2)  $2i\sqrt{15}$

(4)  $-2\sqrt{15}$

2 In  $\triangle RST$ ,  $m\angle S = 135$ ,  $r = 27$ , and  $t = 19$ . What is the area of  $\triangle RST$  to the nearest tenth of a square unit?

(1) 90.7

(3) 256.5

(2) 181.4

(4) 362.7

3 The expression  $\frac{\sqrt{5}}{7 - \sqrt{5}}$  is equivalent to

(1)  $\frac{7\sqrt{5} + 5}{54}$

(3)  $\frac{7\sqrt{5} + 5}{44}$

(2)  $\frac{7\sqrt{5} - 5}{54}$

(4)  $\frac{7\sqrt{5} - 5}{44}$

Use this space for computations.

4 A multiple-choice test has 4 possible choices for each question. A person guesses on 10 questions. What is the probability the person gets *exactly* 8 questions correct?

(1)  ${}_{10}C_8 \left(\frac{1}{4}\right)^2 \left(\frac{3}{4}\right)^8$

(3)  ${}_{10}C_8 \left(\frac{1}{10}\right)^2 \left(\frac{9}{10}\right)^8$

(2)  ${}_{10}C_8 \left(\frac{1}{4}\right)^8 \left(\frac{3}{4}\right)^2$

(4)  ${}_{10}C_8 \left(\frac{1}{10}\right)^8 \left(\frac{9}{10}\right)^2$

5 The summation  $2 \sum_{n=3}^6 \cos\left(\frac{\pi}{n-2}\right)$  equals

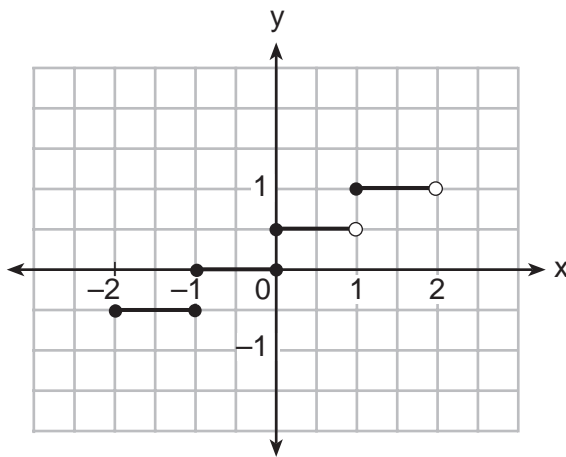
(1)  $-\frac{2 + \sqrt{2}}{2}$

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

(2)  $-2 + \sqrt{2}$

(4)  $-1 + \sqrt{2}$

6 The graph of a relation is shown below.



What is the domain of this relation?

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

(3)  $\{x \mid -2 \leq x < 2\}$

(2)  $\left\{-\frac{1}{2}, 0, \frac{1}{2}, 1\right\}$

(4)  $\{x \mid -2 \leq x \leq 2\}$



**Use this space for  
computations.**

**11** The solution of  $8^{1-p} = 16^{2p-1}$  is

(1)  $\frac{7}{11}$

(3)  $\frac{4}{9}$

(2)  $\frac{3}{5}$

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

**12** Which relation is *not* a function?

(1)  $\{(x,y):y = |x|\}$

(3)  $\{(x,y):y = x\}$

(2)  $\{(x,y):y = -x^2\}$

(4)  $\{(x,y):y = \pm\sqrt{x}\}$

**13** What does the correlation coefficient of  $-0.975$  on a linear regression indicate?

(1) The slope is positive.

(2) One variable causes the other.

(3) The scatterplot shows no association of the variables.

(4) One variable has a strong relationship with the other.

**14** Which angle has the same terminal side as an angle of  $155^\circ$ ?

(1)  $-205^\circ$

(3)  $25^\circ$

(2)  $-155^\circ$

(4)  $335^\circ$









**Use this space for  
computations.**

**26** Which equation is *not* true?

- (1)  $\cot^2 \theta = 1 - \sec^2 \theta$       (3)  $\sec^2 \theta = \tan^2 \theta + 1$   
(2)  $\sin^2 \theta = 1 - \cos^2 \theta$       (4)  $\csc^2 \theta = 1 + \cot^2 \theta$

**27** Which quadratic equation has roots whose sum is  $-\frac{9}{4}$  and product is  $\frac{2}{3}$ ?

- (1)  $12x^2 + 8x + 27 = 0$       (3)  $12x^2 - 8x - 27 = 0$   
(2)  $12x^2 - 27x + 8 = 0$       (4)  $12x^2 + 27x + 8 = 0$
-

## 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 Factor  $6x^3 + 33x^2 - 63x$  completely.

**29** Five thousand dollars is invested at an interest rate of 3.5% compounded quarterly. No money is deposited or withdrawn from the account. Using the formula below, determine, to the *nearest cent*, how much this investment will be worth in 18 years.

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

$A$  = amount

$P$  = principal

$r$  = interest rate

$n$  = number of times the interest rate compounded annually

$t$  = time in years

30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

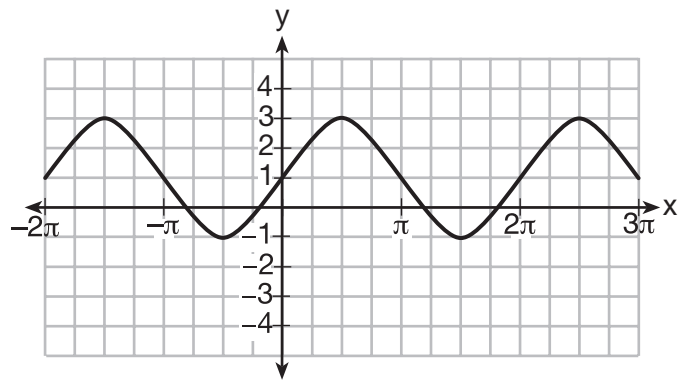
Day (x)	Population (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

31 Express  $\frac{2 + \frac{6}{x-3}}{\frac{x}{x-3}}$  in simplest form, when  $x \neq 0$  and  $x \neq 3$ .

**32** A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet.  
Find the radius of the circle, *in feet*.

33 A sine function is graphed below.



Determine and state the amplitude and period of this function.

**34** On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.



**35** Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .

### 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 lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

**38** Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

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

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$



# Reference Sheet

## Area of a Triangle

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

## Functions of the Sum of Two Angles

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

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

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

## Functions of the Difference of Two Angles

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

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

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

## Law of Sines

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

## Sum of a Finite Arithmetic Series

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

## Binomial Theorem

$$(a + b)^n = {}_n C_0 a^n b^0 + {}_n C_1 a^{n-1} b^1 + {}_n C_2 a^{n-2} b^2 + \dots + {}_n C_n a^0 b^n$$

$$(a + b)^n = \sum_{r=0}^n {}_n C_r a^{n-r} b^r$$

## Law of Cosines

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

## Functions of the Double Angle

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

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

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

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

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

## Functions of the Half Angle

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

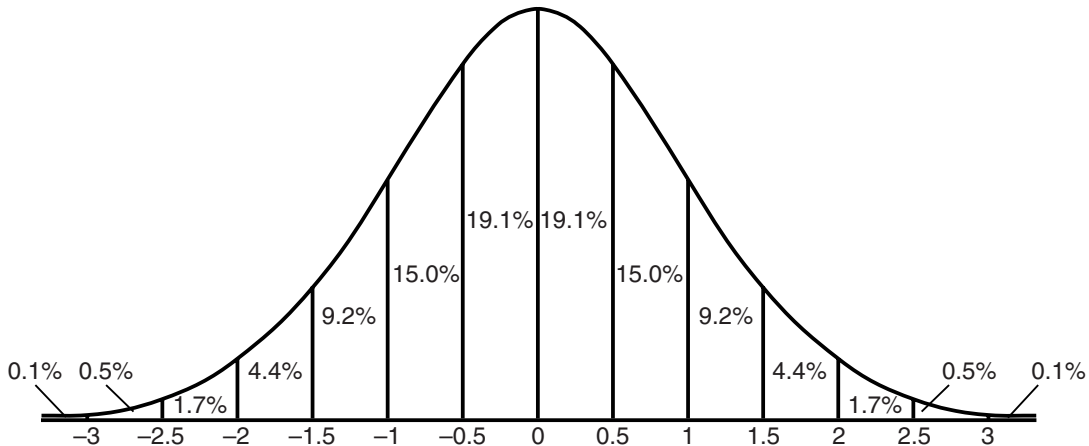
$$\cos \frac{1}{2} A = \pm \sqrt{\frac{1 + \cos A}{2}}$$

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

## Sum of a Finite Geometric Series

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

## Normal Curve Standard Deviation



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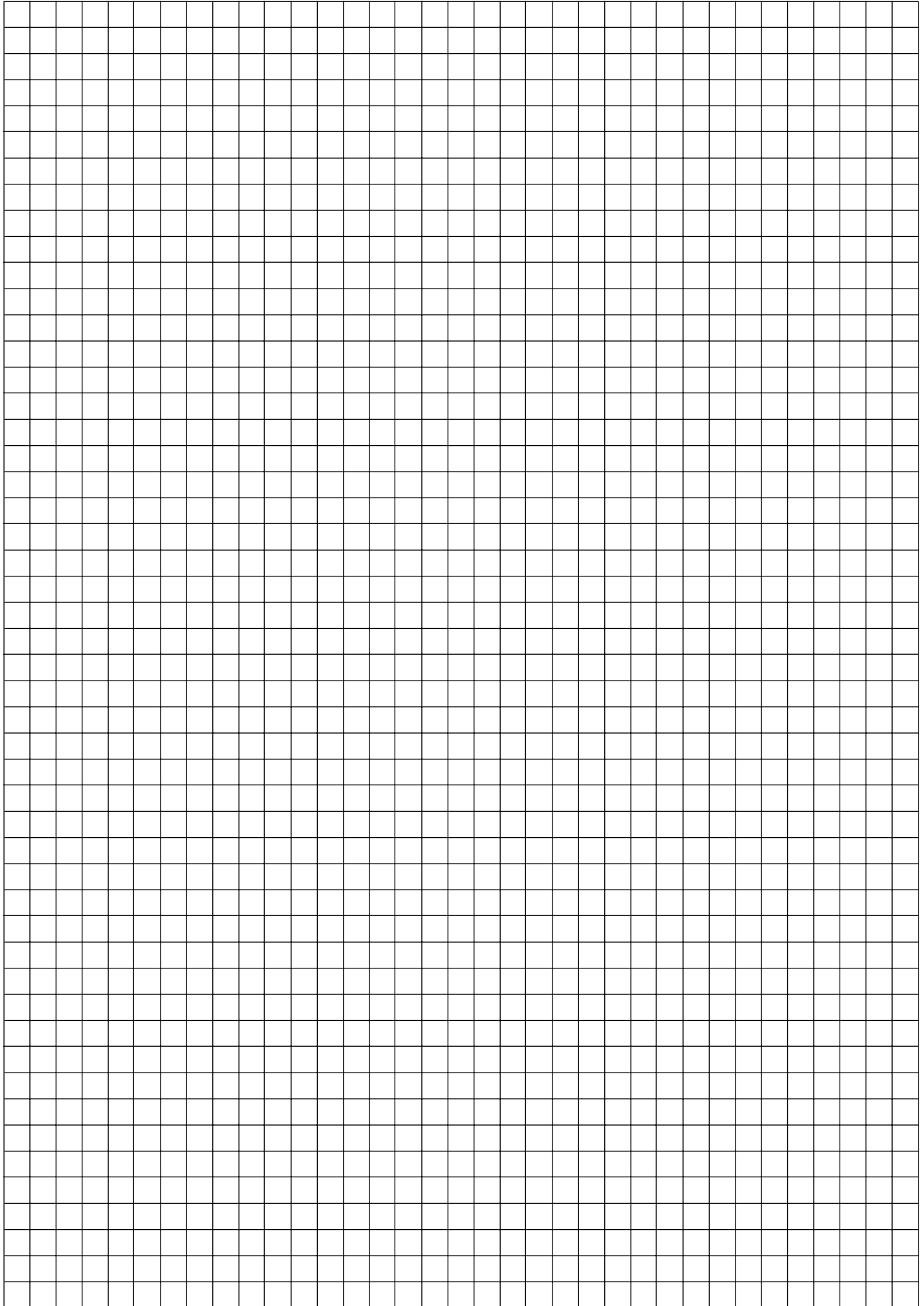
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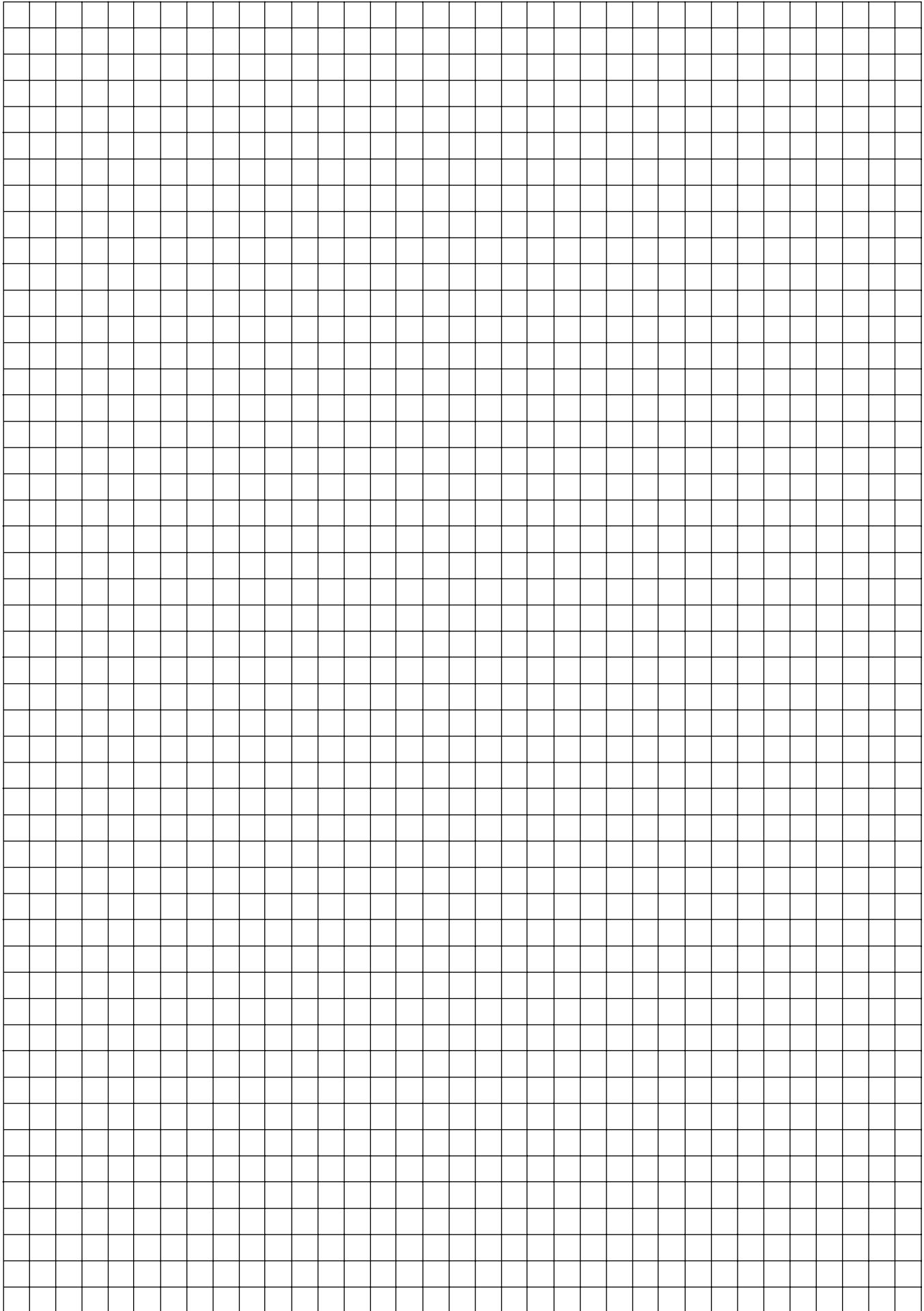
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# FOR TEACHERS ONLY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

## ALGEBRA 2/TRIGONOMETRY

Friday, June 17, 2016 — 9:15 a.m. to 12:15 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 Examinations 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 Friday, June 17, 2016. 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) . . . . . 1 . . . . .	(10) . . . . . 2 . . . . .	(19) . . . . . 3 . . . . .
(2) . . . . . 2 . . . . .	(11) . . . . . 1 . . . . .	(20) . . . . . 3 . . . . .
(3) . . . . . 3 . . . . .	(12) . . . . . 4 . . . . .	(21) . . . . . 4 . . . . .
(4) . . . . . 2 . . . . .	(13) . . . . . 4 . . . . .	(22) . . . . . 1 . . . . .
(5) . . . . . 4 . . . . .	(14) . . . . . 1 . . . . .	(23) . . . . . 3 . . . . .
(6) . . . . . 3 . . . . .	(15) . . . . . 4 . . . . .	(24) . . . . . 2 . . . . .
(7) . . . . . 3 . . . . .	(16) . . . . . 1 . . . . .	(25) . . . . . 2 . . . . .
(8) . . . . . 3 . . . . .	(17) . . . . . 4 . . . . .	(26) . . . . . 1 . . . . .
(9) . . . . . 1 . . . . .	(18) . . . . . 1 . . . . .	(27) . . . . . 4 . . . . .

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

Beginning in June 2013, the Department is providing supplemental scoring guidance, the “Sample Response Set,” for the Regents Examination in Algebra 2/Trigonometry. This guidance is not required as part of the scorer training. It is at the school’s discretion to incorporate it into the scorer training or to use it as supplemental information during scoring. While not reflective of all scenarios, the sample student responses selected for the Sample Response Set illustrate how less common student responses to open-ended questions may be scored. The Sample Response Set will be available on the Department’s web site at: <http://www.nysedregents.org/a2trig/home.html>.

# 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]  $3x(2x - 3)(x + 7)$ , 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]  $3x(2x - 3)(x + 7)$ , but no work is shown.

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

(29) [2] 9,362.36 or equivalent, 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] A correct equation with numerical values is given.

*or*

[1] 9,362.36 or equivalent, 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.



(30) [2]  $y = 239.21(1.48)^x$

[1] One rounding error is made.

*or*

[1] The expression  $239.21(1.48)^x$  is written.

*or*

[1] An incorrect exponential regression equation is written.

[0] A regression equation other than exponential is written.

*or*

[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] 2, 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] 2, but no work is shown.

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

(32) [2] 6, 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] 6, 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] Amplitude 2 and period  $2\pi$ .  
[1] Either amplitude 2 or period  $2\pi$  is written.  
**or**  
[1] 2 and  $2\pi$  are written, but not labeled.  
[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] 131, 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] Appropriate work is shown to find 62.4%, but no further correct work is shown.  
**or**  
[1] 131, 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.
- (35) [2]  $-\frac{12}{13}$  or  $-0.\overline{923076}$ , 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]  $-\frac{12}{13}$  or equivalent, 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 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] 115.4, and correct work is shown.

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

[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, such as finding either 35.1 or 29.5.

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

*or*

[1] A correct substitution is made into the Law of Cosines for the largest angle, but no further correct work is shown.

*or*

[1] 115.4, but no work is shown.

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

- (37) [4]  $\frac{4}{3} \leq c \leq 12$  or an equivalent conjunction, and correct algebraic work is shown.
- [3] Appropriate work is shown, but one computational error is made.
- or**
- [3] Appropriate work is shown, but the answer is not stated as a conjunction.
- [2] Appropriate work is shown, but two or more computational errors are made.
- or**
- [2] Appropriate work is shown to find  $\frac{4}{3}$  and 12, but no further correct work is shown.
- or**
- [2] Appropriate work is shown, but one conceptual error is made.
- or**
- [2]  $\frac{4}{3} \leq c \leq 12$ , but a method other than algebraic is used.
- [1] Appropriate work is shown, but one computational and one conceptual error are made.
- or**
- [1] Appropriate work is shown to find  $c \leq 12$ , but no further correct work is shown.
- or**
- [1]  $\frac{4}{3} \leq c \leq 12$ , 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] 60, 90, 270, 300, and correct work is shown.
- [3] Appropriate work is shown, but one computational, factoring, or graphing error is made.
- or***
- [3] Appropriate work is shown, but only three of the angles are stated correctly.
- [2] Appropriate work is shown, but two or more computational, factoring, or graphing errors are made.
- or***
- [2] Appropriate work is shown, but one conceptual error is made.
- or***
- [2] Appropriate work is shown, but only two of the angles are stated correctly.
- [1] Appropriate work is shown, but one conceptual error and one computational, factoring, or graphing error are made.
- or***
- [1] Appropriate work is shown, but only one of the angles is stated correctly.
- or***
- [1] 60, 90, 270, 300, 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] 21 and  $-4$ , and correct algebraic work is shown.

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

**or**

[5] Appropriate work is shown, but  $-4$  is rejected.

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

**or**

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

**or**

[4] Appropriate work is shown to find  $(p - 21)(p + 4) = 0$ , but no further correct work is shown.

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

**or**

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

**or**

[3]  $p^2 - 17p - 84 = 0$  is written, but no further correct work is shown.

**or**

[3] 21 and  $-4$ , but a method other than algebraic is used.

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

**or**

[2]  $\frac{p^2 - p + 4}{2p + 11} = 16^{\frac{3}{4}}$  is written, but no further correct work is shown.

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

***or***

[1]  $\log_{16}\left(\frac{p^2 - p + 4}{2p + 11}\right) = \frac{3}{4}$  is written, but no further correct work is shown.

***or***

[1] 21 and  $-4$ , but no work is shown.

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

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## Map to Core Curriculum

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

### Regents Examination in Algebra 2/Trigonometry June 2016

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

**The *Chart for Determining the Final Examination Score for the June 2016 Regents Examination in Algebra 2/Trigonometry* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Friday, June 17, 2016. 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

Friday, June 17, 2016 — 9:15 a.m. – 12:15 p.m.

## SAMPLE RESPONSE SET

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### Question 28

28 Factor  $6x^3 + 33x^2 - 63x$  completely.

$$3x(2x^2 + 11x - 21)$$

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

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

Question 28

28 Factor  $6x^3 + 33x^2 - 63x$  completely.

$$\begin{aligned} & 3x(2x^2 + 11x - 21) \quad ac = -42 < \begin{matrix} 14 \\ -3 \end{matrix} \\ & 3x(2x^2 + 14x - 3x - 21) \\ & 3x(2x^2 + 14x) \quad (-3x - 21) \\ & \quad \downarrow \\ & 3x \quad 2x(x+7) - 3(x+7) \\ & \quad \boxed{3x(2x-3)(x+7)} \end{aligned}$$

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

Question 28

28 Factor  $6x^3 + 33x^2 - 63x$  completely.

$$3x(2x^2 + 11x - 21)$$

$3x$	$(x+7)$	$(2x-3)$
$\frac{3x=0}{3 \quad 3}$	$\frac{x+7=0}{-7 \quad -7}$	$\frac{2x-3=0}{+3 \quad +3}$
$x=0$	$x=-7$	$\frac{2x=3}{2}$
		$x=\frac{3}{2}$

$$x^2 + 11x - 42$$

$$(x+14)(x-3)$$

$$(2x+14)(2x-3)$$

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

**Score: 1** The student made an error by treating the expression as an equation.

**Question 28**

**28** Factor  $6x^3 + 33x^2 - 63x$  completely.

$$3x(2x^2 + 11x - 21)$$

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

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

**Question 28**

**28** Factor  $6x^3 + 33x^2 - 63x$  completely.

$$3x(2x^2 + 11x - 21)$$

**Score: 1** The student did not factor completely.

Question 28

28 Factor  $6x^3 + 33x^2 - 63x$  completely.

$$3x \sqrt{2x^2 + 11x - 21} = 0$$

$\frac{3x}{3} = \frac{0}{3}$	$2x^2 + 11x - 21$
$x = 0$	$2(2x-3)(x+7)$
$2x-3=0$ $\frac{2x}{2} = \frac{3}{2}$ $x = \frac{3}{2}$	$x+7=0$ $\frac{-7}{-7} = \frac{-7}{-7}$ $x = -7$
<del><math>x = \frac{3}{2}</math></del>	

$$\boxed{\{x=0\}}$$

~~$$2x^2 - 6x + 7x - 21 = 0$$~~

$$2x^2 + 11x - 3x - 21 = 0$$

$$(3(\frac{3}{2})) \sqrt{2(\frac{3}{2})^2 + 11(\frac{3}{2}) - 21} = 0$$

$$15.75 \neq 0$$

$$(3(7)) \sqrt{2(7^2) + 11(7) - 21}$$

$$21(98) + 77 - 21$$

$$2098 + 77 - 21$$

$$214 \neq 0$$

**Score: 0** The student factored incorrectly and treated the expression as an equation.

### Question 29

29 Five thousand dollars is invested at an interest rate of 3.5% compounded quarterly. No money is deposited or withdrawn from the account. Using the formula below, determine, to the *nearest cent*, how much this investment will be worth in 18 years.

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

$A$  = amount

$P$  = principal

$r$  = interest rate

$n$  = number of times the interest rate compounded annually

$t$  = time in years

$$A = 5000\left(1 + \frac{0.035}{4}\right)^{4 \cdot 18}$$

$$A = \$9362.36$$

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



### Question 29

29 Five thousand dollars is invested at an interest rate of 3.5% compounded quarterly. No money is deposited or withdrawn from the account. Using the formula below, determine, to the *nearest cent*, how much this investment will be worth in 18 years.

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

$A$  = amount

$P$  = principal

$r$  = interest rate

$n$  = number of times the interest rate compounded annually

$t$  = time in years

$$A = 5,000(1 + 0.35)^{18.4}$$
$$A = 5,000(1.035)^{72}$$
$$A = \$59,521.68$$

**Score: 1** The student did not divide 0.035 by 4 to get the quarterly rate.

### Question 29

29 Five thousand dollars is invested at an interest rate of 3.5% compounded quarterly. No money is deposited or withdrawn from the account. Using the formula below, determine, to the *nearest cent*, how much this investment will be worth in 18 years.

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

$A$  = amount

$P$  = principal

$r$  = interest rate

$n$  = number of times the interest rate compounded annually

$t$  = time in years

$$A = 5,000 \left(1 + \frac{.035}{4}\right)^{18}$$

~~$$A = 5,848.890$$~~

$$A = 5,848.895519$$

$$A = \$5,848.90$$

**Score: 1** The student did not multiply the number of years by 4.

### Question 29

**29** Five thousand dollars is invested at an interest rate of 3.5% compounded quarterly. No money is deposited or withdrawn from the account. Using the formula below, determine, to the *nearest cent*, how much this investment will be worth in 18 years.

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

$A$  = amount

$P$  = principal

$r$  = interest rate

$n$  = number of times the interest rate compounded annually

$t$  = time in years

$$5000\left(1 + \frac{3.5}{4}\right)^{18 \times 4}$$

$$2069, 883, 615.22$$

**Score: 0** The student gave a completely incorrect response.

**Question 30**

**30** A colony of bacteria grows exponentially. The table below shows the data collected daily.

Day (x)	Population (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$$a = 239.21$$

$$b = 1.48$$

$$y = 239.21(1.48)^x$$

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

**Question 30**

**30** A colony of bacteria grows exponentially. The table below shows the data collected daily.

Day (x)	Population (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$$y = a * b^x$$

$$a = 239.21 \quad b = 1.48$$

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

**Question 30**

**30** A colony of bacteria grows exponentially. The table below shows the data collected daily.

Day (x)	Population (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$$y = ab^x$$
$$y = 245.95 (1.47)^x$$

**Score: 1** The student wrote an incorrect exponential regression equation. [The student may have not cleared the frequency on the exponential regression screen on the calculator after doing question number 25.]

**Question 30**

**30** A colony of bacteria grows exponentially. The table below shows the data collected daily.

<b>Day</b> (x)	<b>Population</b> (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$$239.21(1.48)^x$$

**Score: 1** The student wrote an expression instead of an equation.

**Question 30**

30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

Day (x)	Population (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$$y = ab^x$$

$$a = 239.2$$

$$b = 1.5$$

$$y = [(239.2)(1.5)]^x$$

**Score: 0** The student rounded both values to the nearest tenth and made a conceptual error when writing the equation.



**Question 30**

**30** A colony of bacteria grows exponentially. The table below shows the data collected daily.

Day (x)	Population (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$$a = 239.211$$

$$b = 1.481$$

$$239.211(1.481)^x$$

**Score: 0** The student rounded incorrectly and wrote an expression instead of an equation.

**Question 30**

30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

Day (x)	Population (y)
0	200
1	425
2	570
3	800
4	1035
5	1650
6	2600

State the exponential regression equation for the data, rounding all values to the *nearest hundredth*.

$$y = ax + b$$

$$a = 361.25$$

$$b = -43.75$$

$$y = 361.25x - 43.75$$

**Score: 0** The student made an error by finding a linear regression.

**Question 31**

31 Express  $\frac{2 + \frac{6}{x-3}}{\frac{x}{x-3}}$  in simplest form, when  $x \neq 0$  and  $x \neq 3$ .

$$\frac{2 + \frac{6}{x-3}}{\frac{x}{x-3}} \left( \frac{x-3}{x-3} \right) =$$

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

$$\boxed{2}$$

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

$$2$$

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

Question 31

31 Express  $\frac{2 + \frac{6}{x-3}}{\frac{x}{x-3}}$  in simplest form, when  $x \neq 0$  and  $x \neq 3$ .

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

$$\frac{2x - \cancel{6}}{\cancel{x-3}} \cdot \frac{\cancel{x-3}}{x}$$

$$\frac{2x}{x}$$

$$\boxed{2}$$

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

Question 31

31 Express  $\frac{2 + \frac{6}{x-3}}{\frac{x}{x-3}}$  in simplest form, when  $x \neq 0$  and  $x \neq 3$ .

$$\frac{2 + \frac{6}{x-3} \quad (x-3)}{\frac{x}{x-3} \quad (x-3)}$$
$$\frac{2+6}{x} = \left(\frac{8}{x}\right)$$

**Score: 1** The student made an error by not multiplying both terms of the numerator by  $(x - 3)$ .

Question 31

31 Express  $2 + \frac{6}{x-3}$  in simplest form, when  $x \neq 0$  and  $x \neq 3$ .

$$\frac{x-3}{1} \frac{2}{1} + \frac{6}{\cancel{x-3}} \frac{\cancel{x-3}}{1}$$
$$\frac{x}{\cancel{x-3}} \frac{\cancel{x-3}}{1}$$

$$\frac{2x-6+6}{x}$$

$$\frac{2x}{x}$$

Score: 1 The student did not simplify completely.

Question 31

31 Express  $\frac{2 + \frac{6}{x-3}}{\frac{x}{x-3}}$  in simplest form, when  $x \neq 0$  and  $x \neq 3$ .

$$\frac{2 + \frac{6}{x-3} \quad (\cancel{x-3})}{\frac{x}{\cancel{x-3}} \quad (\cancel{x-3})}$$

$$\frac{2 + 6}{x}$$

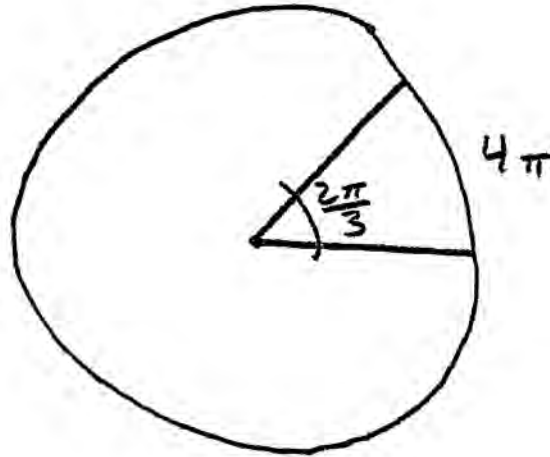
$$\frac{8}{x}$$

$$x = \frac{8}{x}$$

**Score: 0** The student made an error by not multiplying both terms of the numerator by  $(x - 3)$  and stated the final answer as an equation.

Question 32

- 32 A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet. Find the radius of the circle, in feet.



$$s = \theta r$$

$$s = 4\pi$$

$$\theta = \frac{2\pi}{3}$$

$$\frac{3}{2\pi} \cdot 4\pi = \left(\frac{2\pi}{3}\right) r \cdot \frac{3}{2\pi}$$

$$6 = r$$

$$\textcircled{6}$$

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



**Question 32**

32 A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet.  
Find the radius of the circle, *in feet*.

$$\frac{2\pi}{3} \cdot r = 4\pi$$

$$\frac{r}{3} = 2$$

$$r = 6$$

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

**Question 32**

**32** A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet.  
Find the radius of the circle, *in feet*.

$$\frac{2(180)}{3} = 120$$

$$\frac{120}{360} = \frac{2}{4\pi r}$$

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

$$r = 6$$

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

Question 32

32 A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet.  
Find the radius of the circle, *in feet*.

$$\frac{\frac{2\pi}{3}}{2\pi} = \frac{4\pi}{2\pi r}$$

$$8\pi^2 = \frac{4\pi^2 r}{3}$$

$$24\pi^2 = 4\pi^2 r$$

$$6 = r$$

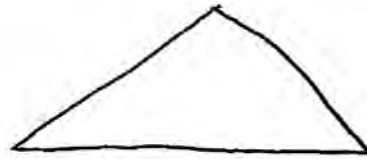
**Score: 2** The student gave a complete and correct response.

Question 32

32 A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet.  
Find the radius of the circle, in feet.



$$\frac{2\pi}{3} \times \frac{1}{4\pi} = \boxed{\frac{1}{6} \text{ (feet)}}$$



**Score: 1** The student made an error by dividing  $\frac{2\pi}{3}$  by  $4\pi$ .

**Question 32**

**32** A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet.  
Find the radius of the circle, *in feet*.

$$S = \theta r$$

$$\frac{4\pi}{\frac{2\pi}{3}} = \frac{\frac{2\pi}{3} r}{\frac{2\pi}{3}}$$

$$\frac{2}{3} = r$$

**Score: 1** The student made an error when dividing by  $\frac{2\pi}{3}$ .

**Question 32**

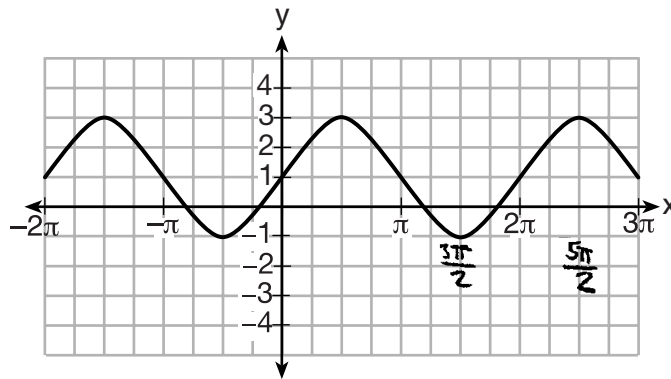
**32** A central angle whose measure is  $\frac{2\pi}{3}$  radians intercepts an arc with a length of  $4\pi$  feet.  
Find the radius of the circle, *in feet*.

$$S = \theta r$$
$$1 \quad \frac{2\pi}{3} = \frac{4\pi r}{4\pi}$$
$$2 \quad \frac{4\pi}{4\pi}$$
$$r = \frac{3}{2\pi}$$

**Score: 0** The student made an error by interchanging the arc length and angle measure, and then made an error when dividing by  $4\pi$ .

**Question 33**

**33** A sine function is graphed below.



$$\frac{4\pi + \pi}{2} - \frac{4\pi}{2} = \frac{5\pi}{2}$$

Determine and state the amplitude and period of this function.

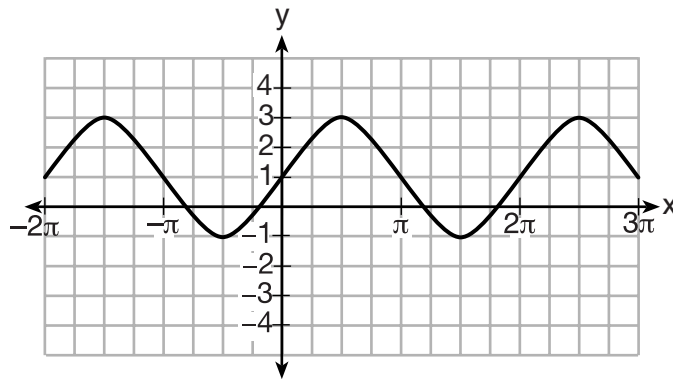
Amplitude : 2

Period :  $2\pi$

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

Question 33

33 A sine function is graphed below.



Determine and state the amplitude and period of this function.

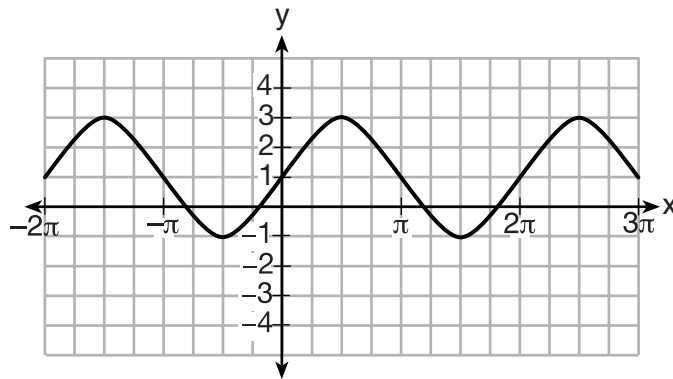
~~Handwritten scribbles~~ 1.5  
450  
Amp = 2  
per = ~~2.5π~~ 2.5π

Score: 1 The student stated an incorrect period.



**Question 33**

**33** A sine function is graphed below.



Determine and state the amplitude and period of this function.

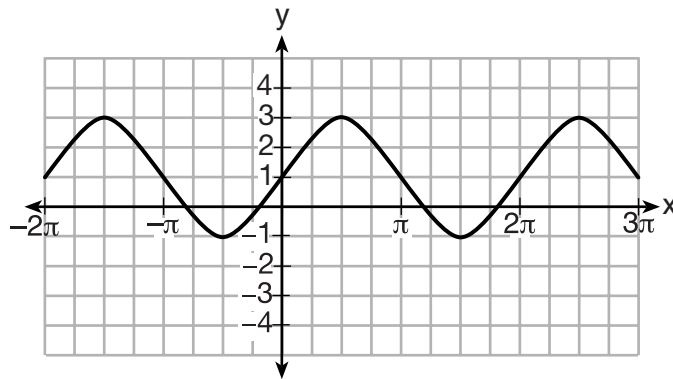
$$\text{Amplitude} = 4$$

$$\text{Period} = 2\pi$$

**Score: 1** The student stated an incorrect amplitude.

**Question 33**

**33** A sine function is graphed below.



Determine and state the amplitude and period of this function.

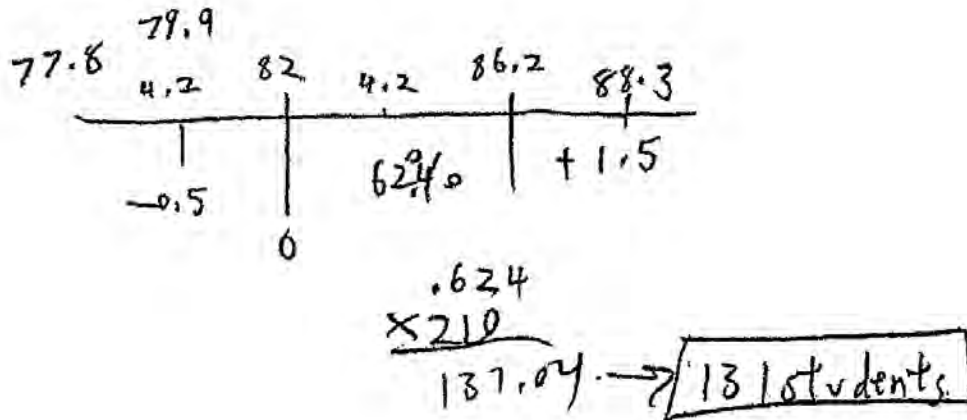
Amplitude - 2.3  
Period -  $\frac{1}{2}\pi$

**Score: 0** The student stated an incorrect amplitude and period.

### Question 34

34 On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.

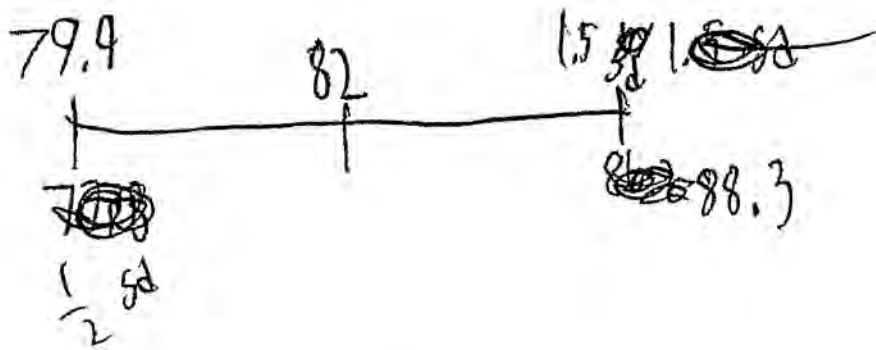


**Score: 2** The student gave a complete and correct response.

Question 34

34 On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.



$$\frac{62.4}{100} = \frac{x}{210}$$

$$13,104 = 100x$$

$$x = 131 \text{ students}$$

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

### Question 34

34 On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.

$$210 * \text{normalcdf}(79.9, 88.3, 82, 4.2)$$

$$131.1776002$$

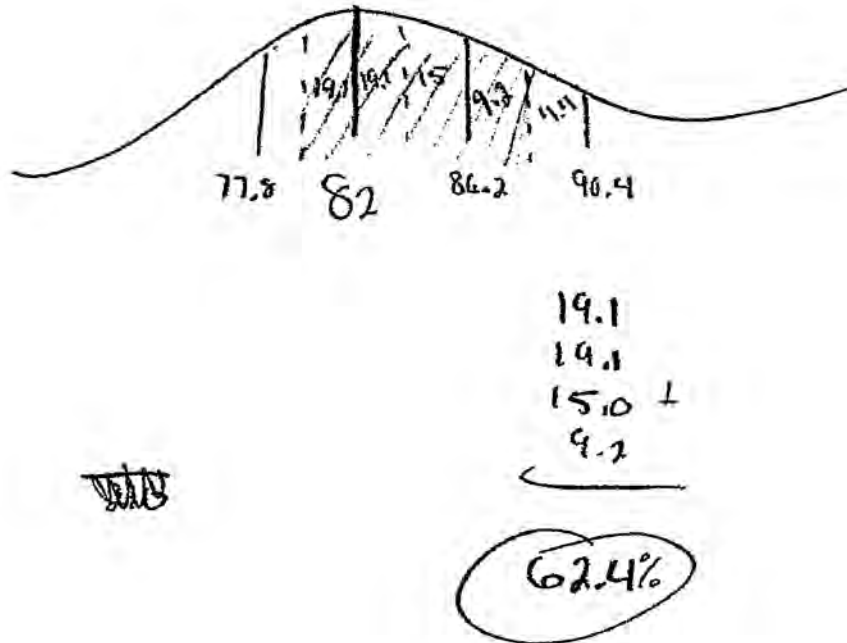
$$\approx 131$$

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

### Question 34

34 On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.

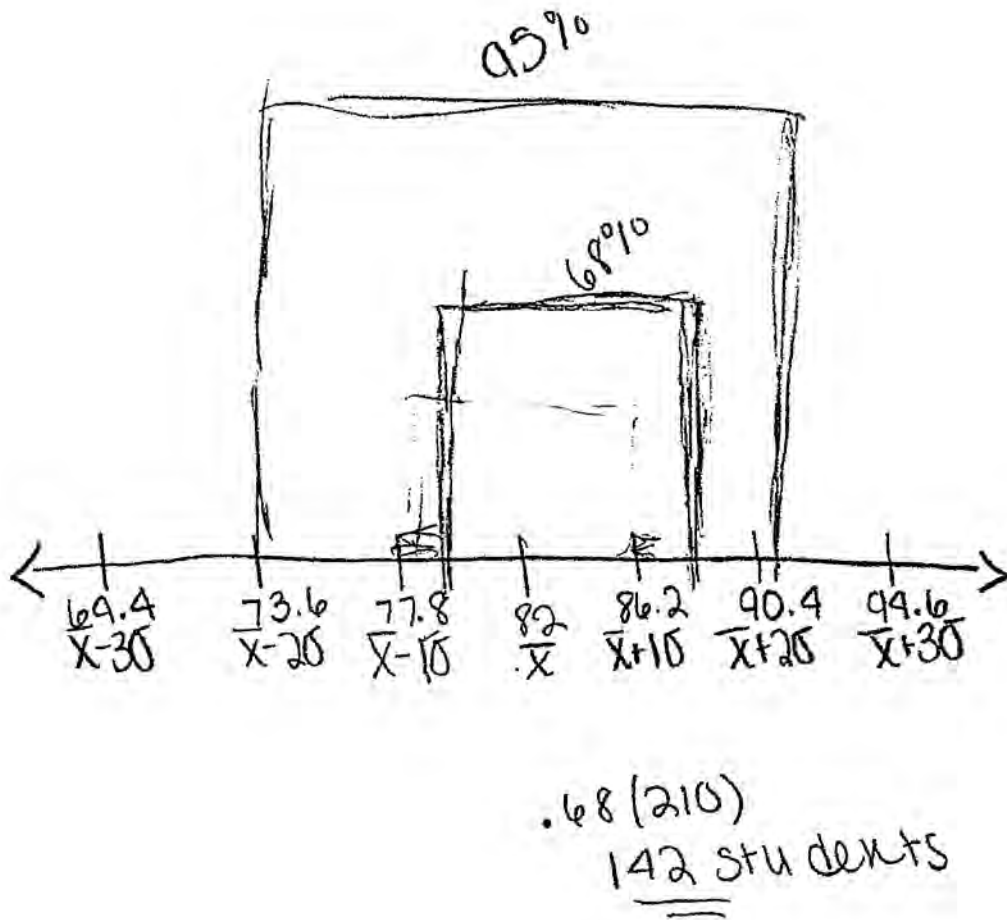


**Score: 1** The student did not determine the number of students.

Question 34

34 On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.



Score: 1 The student made an error in finding the percentage.

### Question 34

34 On the Algebra 2/Trigonometry midterm at Champion High School, the scores of 210 students were normally distributed with a mean of 82 and a standard deviation of 4.2.

Determine how many students scored between 79.9 and 88.3.

$$\bullet 68 \times 210$$

$$= \boxed{142.8 \text{ students}}$$

**Score: 0** The student made an error in calculating the percentage and did not round appropriately.



Question 35

35 Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .

Solowndora

$$\frac{\sin}{\cos} = -\frac{5}{12}$$



$$\sin \theta \left( \frac{\cos \theta}{\sin \theta} \right)$$

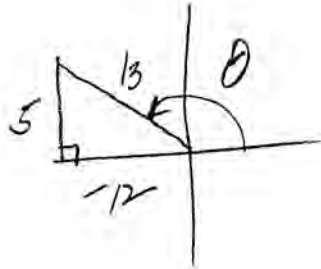
$$\left( \frac{5}{13} \right) \frac{-12}{13} \left( \frac{13}{5} \right)$$

$$\left( \frac{5}{13} \right) \left( \frac{-12}{5} \right) = \boxed{\frac{-60}{65}}$$

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

**Question 35**

35 Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .



$$\tan \theta = -\frac{5}{12}$$

$$\theta = \tan^{-1}\left(-\frac{5}{12}\right)$$

$$(\theta = 157.3801351)$$

$$\sin \theta \cot \theta = -0.9230769231$$

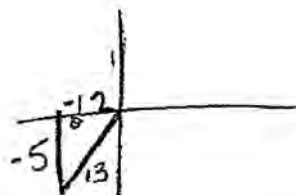
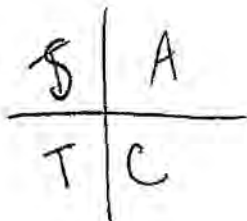
$$= -0.\overline{923076}$$

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

Question 35

35 Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .

$$\tan \theta = \frac{-5}{12} \text{ and } \frac{\pi}{2} < \theta < \pi$$

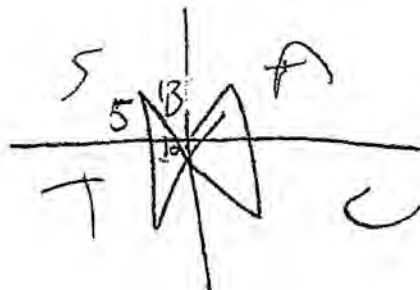


$$\sin \theta \cot \theta$$
$$\left(\frac{-5}{13}\right)\left(\frac{-12}{-5}\right) \quad \left(\frac{60}{-65}\right)$$

**Score: 1** The student made an error by placing the angle in Quadrant III.

### Question 35

35 Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .



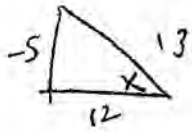
$$\sin \theta = \frac{5}{13}$$

$$\cot = -\frac{12}{5}$$

**Score: 1** The student made an error by not finding the product.

Question 35

35 Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .



$$\sin X = \frac{-5}{13}$$
$$\cot = -\frac{12}{5}$$

$$\left(-\frac{5}{13}\right)\left(-\frac{12}{5}\right) = \frac{60}{65}$$

**Score: 1** The student labeled the triangle incorrectly.

Question 35

35 Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .

$\frac{180}{2} \rightarrow 90 < \theta < 180 \rightarrow Q2$

sin  
csc  
tan  
cot

All  
6 positive

cos  
sec

SOH CAH TOA

$a^2 + b^2 = c^2$   
 $(12)^2 + (5)^2 = c^2$   
 $144 + 25 = c^2$   
 $\sqrt{169} = \sqrt{c^2}$   
 $13 = c$

$\tan \theta = -\frac{5}{12}$   
 $\sin \theta = \frac{5}{13}$   
 $\cos \theta = -\frac{12}{13}$

$\cot = \frac{1}{\tan} = \frac{1}{-5/12}$

$\sin \theta \cot \theta$   
 $(\frac{5}{13}) (\frac{-1}{5/12})$   
 $(\frac{5}{13}) (-\frac{2}{5})$   
 $-\frac{10}{65} \leftarrow \text{GCF} = 5$   
 $-\frac{2}{13}$

.15

**Score: 0** The student made a transcription error when expressing  $\cot \theta$  and did not express the exact value as the final answer.

### Question 35

35 Given  $\tan \theta = -\frac{5}{12}$  and  $\frac{\pi}{2} < \theta < \pi$ , determine the *exact* value of the expression  $\sin \theta \cot \theta$ .

$$\theta = \tan^{-1}\left(-\frac{5}{12}\right)$$

$$\theta = -22.61986495$$

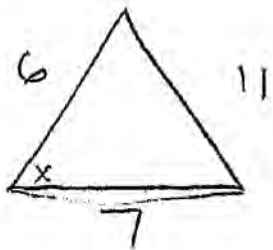
$$(\sin(-22.619\dots)) \left(\frac{1}{\sin(-22.619\dots)}\right)$$

$$\boxed{1}$$

**Score: 0** The student gave a completely incorrect response.

**Question 36**

**36** The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.



$$11^2 = 6^2 + 7^2 - 2(6)(7)\cos A$$

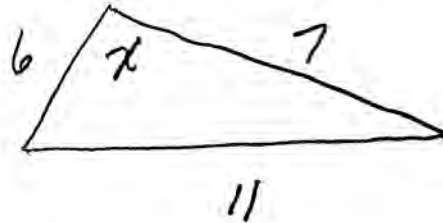
115.4°

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



Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.



$$x = \cos^{-1} \left( \frac{6^2 + 7^2 - 11^2}{2(6)(7)} \right)$$

$$x = 115.3769335$$

$$x \approx 115.4$$

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

Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.

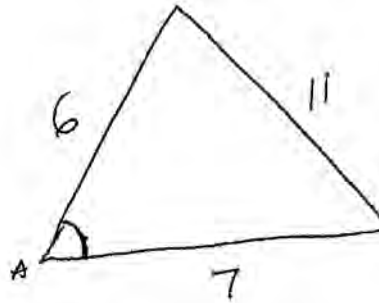
$$\begin{aligned} 11^2 &= (6^2) + (7^2) - 2(6)(7)(\cos X) \\ 121 &= 85 - 84 \cos X \\ -85 &= -85 - 84 \cos X \\ 36 &= \frac{84 \cos X}{84} \\ \frac{36}{84} &= \cos X \end{aligned}$$

$X = 64.16$

**Score: 3** The student made an error by dividing by 84 instead of  $-84$ .

Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the nearest tenth of a degree, the measure of the largest angle of the triangle.



$$\begin{aligned} 11^2 &= 6^2 + 7^2 - 2(6)(7) \cos A \\ 121 &= 85 - 84 \cos A \\ \hline -85 & \quad -85 \\ 36 &= -84 \cos A \\ \hline -84 & \quad -84 \\ \cos A &= -.4285714286 \\ A &= 2.01 \\ \boxed{A=2.0} \end{aligned}$$

**Score: 2** The student made an error by finding the measure of angle A in radians.

Question 36

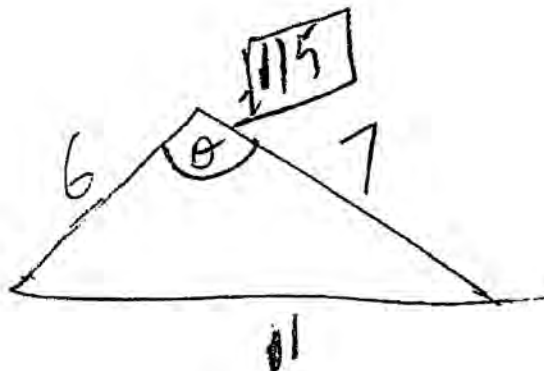
36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.

$$\begin{aligned} 11^2 &= 6^2 + 7^2 - 2(6)(7) \sin A \\ 121 &= \cancel{85} - \cancel{85} - 84 \sin A \\ \hline 36 &= \frac{-\cancel{84} \sin A}{-\cancel{84}} \\ \hline \frac{36}{-84} &= \sin A \\ \sin^{-1}\left(\frac{36}{-84}\right) \\ A &= -25.4 \end{aligned}$$

**Score: 2** The student made a transcription error by using sine instead of cosine, and did not recognize that  $-25.4$  is not a viable solution.

Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the nearest tenth of a degree, the measure of the largest angle of the triangle.



$$\cos \theta = 115.3$$

$$11^2 = 6^2 + 7^2 - 2(6)(7)\cos \theta$$

$$121 = 85 - 84\cos \theta$$

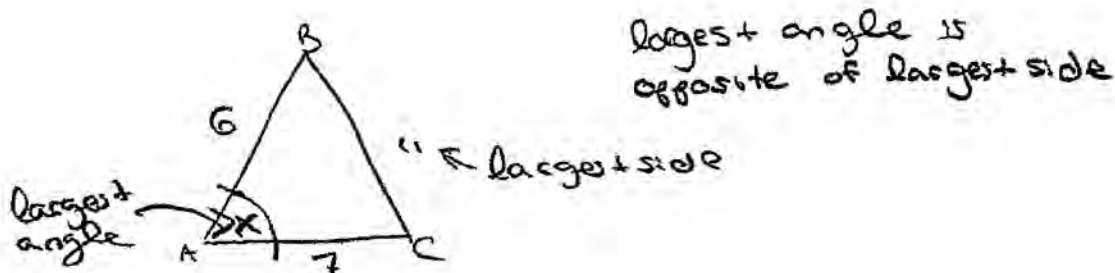
$$-36 = -84\cos \theta$$

$$\cos \theta = .42857$$

**Score: 2** The student stated  $\cos \theta = 115.3$  and did not round properly.

Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the nearest tenth of a degree, the measure of the largest angle of the triangle.



Law of Cosine

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

$$11^2 = 7^2 + 6^2 - 2(7)(6) \cos X$$

$$121 = 49 + 36 - 84 \cos X$$

$$121 = 85 - 84 \cos X$$

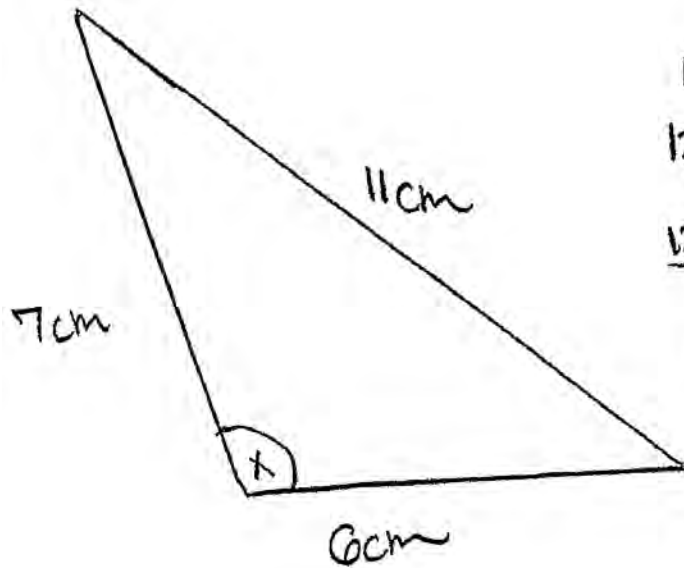
$$36 = -84 \cos X$$

$$-.43 = \cos X$$

**Score: 2** The student rounded prematurely and did not solve for  $x$ .

Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the nearest tenth of a degree, the measure of the largest angle of the triangle.



$$11^2 = 6^2 + 7^2 - 2(6)(7)\cos A$$

$$121 = 36 + 49 - 84\cos A$$

$$\frac{121}{1} = \frac{1}{1}\cos A$$

$$121 = \cos A$$

$$\boxed{121^\circ}$$

**Score: 1** The student made a correct substitution into the Law of Cosines.

Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.

$$\begin{aligned}6^2 &= 7^2 + 11^2 - 2(7)(11) \cos x \\36 &= 49 + 121 - 154 \cos x \\36 &= 170 - 154 \cos x \\-170 &\quad -170 \\ \hline -134 &= -154 \cos x \\ \hline -154 &\quad -154 \\ \hline \cos x &= .8701298701 \\ x &= 29.53^\circ\end{aligned}$$

**Score: 1** The student made an error by finding the smallest angle and rounding incorrectly.



Question 36

36 The lengths of the sides of a triangle are 6 cm, 11 cm, and 7 cm. Determine, to the *nearest tenth of a degree*, the measure of the largest angle of the triangle.

$$\frac{6}{\sin 7} = \frac{11}{\sin x}$$

$$\frac{\cancel{6} \sin x}{\cancel{6}} = \frac{11 \cdot \sin 7}{6}$$

$$\sin x = .2234 \dots$$

$$\sin^{-1}(.2234 \dots) = \textcircled{12.9}$$

**Score: 0** The student made an error by using the Law of Sines and treated the 7 as an angle.

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$+9 \quad +9$

$$\begin{array}{r} \frac{3}{2}c - 10 \leq 8 \\ \hline \frac{3}{2}c \leq 18 \\ \frac{3}{2}c \leq 18 \\ \hline \end{array}$$

$$\begin{array}{r} 3c \leq 36 \\ \hline 3 \quad 3 \\ \hline c \leq 12 \end{array}$$

$$\begin{array}{r} \frac{3}{2}c - 10 \geq -8 \\ \hline \frac{3}{2}c \geq 2 \\ \hline \end{array}$$

$$\frac{3}{2}c \geq 2$$

$$\begin{array}{r} 3c \geq 4 \\ \hline 3 \quad 3 \\ \hline \end{array}$$

$$c \geq \frac{4}{3}$$

~~$c \geq 9$~~   $12 \geq c \geq \frac{4}{3}$

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

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

~~+9~~ +9

$$\left| \frac{3}{2}c - 10 \right| \leq 8$$

$$\frac{3}{2}c - 10 \leq 8$$

+10 +10

$$\frac{3}{2} \left( \frac{2}{3} \right) \leq (18) \frac{2}{3}$$

$$c \leq 12$$

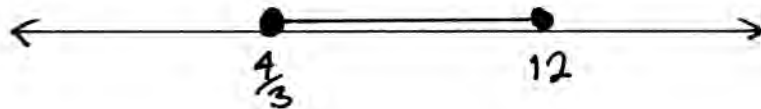
$$-\left( \frac{3}{2}c - 10 \right) \leq 8$$

$$-\frac{3}{2}c + 10 \leq 8$$

-10 -10

$$-\frac{2}{3} \left( -\frac{3}{2}c \right) \leq (-2) \frac{-2}{3}$$

$$c \geq \frac{4}{3}$$



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

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$$\frac{3}{2}c - 10 \leq 8$$

+10   +10

$$12 \Rightarrow c \geq 1.3$$

$$\frac{2}{3} \cdot \frac{3}{2}c \leq 18 \cdot \frac{2}{3}$$
$$c \leq 12$$

$$\frac{3}{2}c - 10 \geq -8$$

+10   +10

$$\frac{2}{3} \cdot \frac{3}{2}c \geq 2 \cdot \frac{2}{3}$$
$$c \geq 1.3$$

**Score: 3** The student made an error by expressing  $\frac{4}{3}$  as 1.3 instead of  $1.\bar{3}$ .

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$$\frac{3}{2}c - 10 - 9 \leq -1$$

$$\frac{3}{2}c - 19 \leq -1$$

$$\frac{3}{2}c \leq 18$$

$$c \leq 12$$

$$-\frac{3}{2}c + 10 - 9 \leq -1$$

$$\left\{ \frac{4}{3}, 12 \right\}$$

$$-\frac{3}{2}c + 1 \leq -1$$

$$-\frac{3}{2}c \leq -2$$

$$\frac{3}{2}c \geq 2$$

$$c \geq \frac{4}{3}$$

**Score: 3** The student made an error by not stating the solution as a conjunction.

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

+9 +9

$$\left| \frac{3}{2}c - 10 \right| < 8$$

$$\frac{3}{2}c - 10 < 8$$

$$\begin{array}{r} \frac{3}{2}c - 10 < 8 \\ \hline +10 \quad +10 \\ \hline \frac{3}{2}c < 18 \\ \frac{3}{2} \quad \frac{3}{2} \\ \hline c < 12 \end{array}$$

$$c < 12$$

$$-\frac{3}{2}c + 10 < 8$$

-10 -10

$$\begin{array}{r} -\frac{3}{2}c < -2 \\ \hline -\frac{3}{2}c < -\frac{3}{2} \end{array}$$

$$c > 1.\overline{33}$$

**Score: 2** The student made an error when writing the inequality symbol and did not write the solution as a conjunction.

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$$\begin{array}{l} \left( \frac{3}{2}c - 10 \right) - 9 \leq -1 \\ \quad \quad \quad +9 \quad +9 \\ \frac{3}{2}c - 10 \leq 8 \\ \quad \quad \quad +10 \quad +10 \\ \frac{2}{3} \cdot \frac{3}{2}c \leq 18 \cdot \frac{2}{3} \\ \boxed{c \leq 12} \end{array} \quad \left| \begin{array}{l} \left( -\frac{3}{2}c + 10 \right) - 9 \leq -1 \\ \quad \quad \quad +9 \quad +9 \\ -\frac{3}{2}c + 10 \leq 8 \\ \quad \quad \quad -10 \quad -10 \\ -\frac{2}{3} \cdot -\frac{3}{2}c \leq -2 \cdot -\frac{2}{3} \\ \boxed{c \leq \frac{4}{3}} \end{array} \right.$$

**Score: 2** The student did not reverse the inequality sign and did not write the solution as a conjunction.

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$+9 \quad +9$

$$\frac{3}{2}c - 10 \leq 8$$

$+10 \quad +10$

$$\left(\frac{3}{2}\right) \frac{3}{2}c \leq 18 \left(\frac{3}{2}\right)$$

$c \leq 27$

$$\frac{3}{2}c - 10 \geq -8$$

$+10 \quad +10$

$$\left(\frac{3}{2}\right) \frac{3}{2}c \geq 2 \left(\frac{3}{2}\right)$$

$c \geq 3$

**Score: 1** The student made a conceptual error by multiplying by  $\frac{3}{2}$  and then did not state the solution as a conjunction.



Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$$\begin{array}{r} +9 +9 \\ \hline \left| \frac{3}{2}c - 10 \right| \leq 8 \end{array}$$

$$\begin{array}{r} \frac{3}{2}c - 10 \leq 8 \\ +10 +10 \end{array}$$

$$\frac{3}{2}c \leq 18 \quad \div \frac{3}{2}$$

$$c \leq 12$$

**Score: 1** The student made an error by only solving for  $c \leq 12$ .

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$$\frac{3}{2}c + 10 - 9 \leq -1$$

$$\frac{3}{2}c + 1 \leq -1$$

$$\frac{3}{2}c \leq -2$$

$$c \leq -\frac{4}{3}$$

$$-\frac{3}{2}c - 10 - 9 \leq -1$$

$$-\frac{3}{2}c - 19 \leq -1$$

$$-\frac{3}{2}c \leq 18$$

$$c \geq -12$$

**Score: 0** The student gave a completely incorrect response.

Question 37

37 Solve algebraically for  $c$ :

$$\left| \frac{3}{2}c - 10 \right| - 9 \leq -1$$

$$\left| \frac{3}{2}c - 10 \right| \leq 8$$

$$\frac{3}{2}c - 10 \leq 8$$

$$\frac{3}{2}c \leq \frac{18}{3/2}$$

$$c \leq 8 \cdot \frac{2}{3}$$

$$c \leq \frac{16}{3}$$

$$c \leq 5.\overline{3}$$

$$c \leq 5.3$$

**Score: 0** The student attempted to solve only one inequality and made a transcription error.

Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$\begin{aligned} 2\cos^2 \theta - \cos \theta &= 0 \\ \cos \theta (2\cos \theta - 1) &= 0 \\ \cos \theta = 0 & \quad \left| \quad \cos \theta = \frac{1}{2} \right. \\ \theta &= 90, 270 \quad \left. \begin{array}{l} 60, 300 \\ 300 \end{array} \right. \end{aligned}$$

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

Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$\text{Let } u = \cos \theta$$

$$\frac{2u^2}{-u} = \frac{u}{-u}$$

$$2u^2 - u = 0$$

$$u(2u-1) = 0$$

$$u=0 \quad \left| \quad \begin{array}{l} 2u - 1 = 0 \\ +1 \quad +1 \end{array} \right.$$

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

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

$$\cos \theta = 0 \quad \cos \theta = \frac{1}{2}$$

$$\theta = 90^\circ, 270^\circ \quad \theta = 60^\circ, 300^\circ$$

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

Question 38

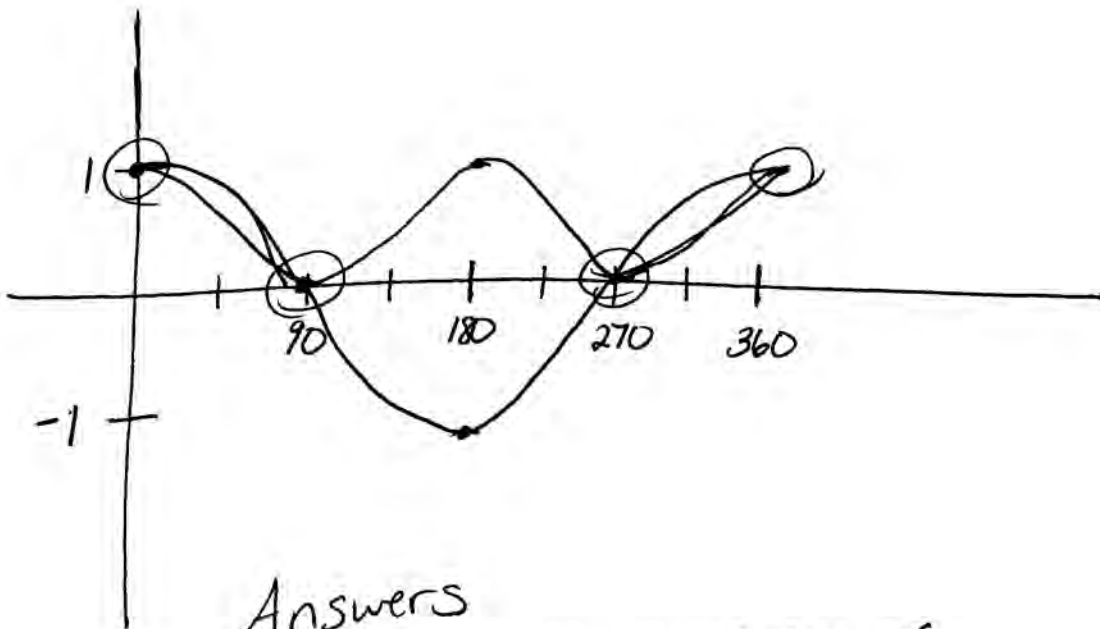
38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$\begin{array}{l}
 2\cos^2 \theta = \cos \theta \\
 \hline
 -\cos \theta - \cos \theta \\
 \hline
 2\cos^2 \theta - \cos \theta = 0 \\
 \cos \theta (2\cos \theta - 1) = 0 \\
 \cos \theta = 0 \quad 2\cos \theta - 1 = 0 \\
 \boxed{90^\circ, 180^\circ} \quad \hline
 \quad \quad \quad \frac{2\cos \theta = 1}{\frac{2}{2} \quad \frac{1}{2}} \\
 \quad \quad \quad \cos \theta = \frac{1}{2} \\
 \quad \quad \quad \text{ref } \angle = 60^\circ \\
 \quad \quad \quad \text{I} = 60^\circ \\
 \quad \quad \quad \text{IV} = 300^\circ
 \end{array}$$

**Score: 3** The student made an error by stating  $180^\circ$  instead of  $270^\circ$ .

Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .



Answers

$0^\circ, 90^\circ, 270^\circ, \cancel{360^\circ}$

**Score: 3** The student made a graphing error by graphing  $\cos^2 \theta$  instead of  $2\cos^2 \theta$ .

Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$\frac{2 \cos^2 \theta}{\cancel{\cos \theta}} = \frac{\cancel{\cos \theta}}{\cancel{\cos \theta}}$$

$$\frac{2 \cos \theta}{2} = \frac{1}{2}$$

$$\cos \theta = \frac{1}{2}$$

$$\theta = 60^\circ \text{ and } 300^\circ$$

**Score: 2** The student made a conceptual error by dividing both sides by  $\cos \theta$ .



Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$\cos = a$$

$$2a^2 - a = 0$$

$$a(2a - 1) = 0$$

$$a = 0$$

$$\begin{array}{r} 2a - 1 = 0 \\ +1 \quad +1 \\ \hline 2a = 1 \\ \hline a = \frac{1}{2} \end{array}$$

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

S A  
T C

$$\cos \theta = \frac{1}{2}$$

$$\theta = 60^\circ$$

Q<sub>1</sub>

Q<sub>4</sub>

60°

300°

(60° and 300°)

**Score: 2** The student did not use  $a = 0$ .

Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$2\cos^2 \theta - \cos \theta = 0$$

$$\cos \theta (2\cos \theta - 1) = 0$$

$$\cos \theta = 0 \quad 2\cos \theta - 1 = 0$$

$$\cos \theta = 0 \quad \cos \theta = \frac{1}{2}$$

$$\theta = 60^\circ \quad \theta = 90^\circ$$

**Score: 2** The student only found the two angles.

### Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$2\cos^2 \theta = \cos \theta$$

$$2\cos \theta = 1$$

$$\cos \theta = \frac{1}{2}$$

$$\theta = 60$$

**Score: 1** The student made a conceptual error by dividing both sides by  $\cos \theta$ , and then only found the one angle.

### Question 38

38 Solve  $2\cos^2 \theta = \cos \theta$  for all values of  $\theta$  in the interval  $0^\circ \leq \theta < 360^\circ$ .

$$2\cos^2 \theta = \cos \theta$$

$$2\cos \theta = 1$$

$$\cos \theta = \frac{1}{2}$$

$$\cos \theta = 60^\circ$$

**Score: 0** The student made a conceptual error by dividing by  $\cos \theta$  and then stated  $\cos \theta = 60$ , and did not find 300.

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{p^2 - p + 4}{2p + 11} = \frac{3}{4}$$

$$16^{\frac{3}{4}} = \frac{p^2 - p + 4}{2p + 11}$$

$$(2p + 11) \cdot 8 = \frac{p^2 - p + 4}{2p + 11} (2p + 11)$$

$$\begin{array}{r} 16p + 88 = p^2 - p + 4 \\ -16p - 88 \quad -16p - 88 \\ \hline 0 = p^2 - 17p - 84 \end{array}$$

$$0 = (p^2 - 21p) + 4p - 84$$

$$0 = p(p - 21) + 4(p - 21)$$

$$0 = (p + 4)(p - 21)$$

$p + 4 = 0$	$p - 21 = 0$
$p = -4$	$p = 21$

$$p = \{-4, 21\}$$

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

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{(p^2 - p + 4)}{(2p + 11)} = \frac{3}{4}$$

$$16^{\frac{3}{4}} = \frac{(p^2 - p + 4)}{(2p + 11)}$$

$$\frac{8}{1} = \frac{p^2 - p + 4}{(2p + 11)}$$

$$p^2 - p + 4 = 16p + 88$$

$$p^2 - 17p - 84 = 0$$

$$P = \frac{17 \pm \sqrt{17^2 - 4(-84)}}{2}$$

$$P = \frac{17 \pm \sqrt{625}}{2}$$

$$P = 21 \quad P = -4$$

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

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\begin{aligned}\log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) &= \frac{3}{4} \\ 16^{\frac{3}{4}} &= \frac{p^2 - p + 4}{2p + 11} \\ 16^{\frac{3}{4}}(2p + 11) &= p^2 - p + 4 \\ 8(2p + 11) &= p^2 - p + 4 \\ 16p + 88 &= p^2 - p + 4 \\ 0 &= p^2 - 17p - 84 \\ p^2 - 17p - 84 &= 0 \\ (p - 21)(p + 4) &= 0 \\ \cancel{p = 21}, p &= -4\end{aligned}$$

**Score: 5** The student made an error by rejecting  $p = 21$ .

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$\log_8(25) = 2$   
 $5^2 = 25$

$$\log_{16}\left(\frac{p^2 - p + 4}{2p + 11}\right) = \frac{3}{4}$$

$$16^{\frac{3}{4}} = \frac{p^2 - p + 4}{2p + 11}$$

$$8 = \frac{p^2 - p + 4}{2p + 11}$$

$$8(2p + 11) = p^2 - p + 4$$

$$16p + 88 = p^2 - p + 4$$

$$-p^2 - p + 16p + 88 - 4 = 0$$

$$p^2 + p - 16p - 88 + 4 = 0$$

$$p^2 - 15p - 84 = 0$$

$$p = \frac{15 \pm \sqrt{225 + 336}}{2} < \frac{15 + \sqrt{561}}{2}$$

$$p = \frac{15 - \sqrt{561}}{2}$$

**Score: 5** The student made a sign error when moving  $p$  to the other side of the equation.



Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{p^2 - p + 4}{2p + 11} = \frac{3}{4}$$

$$16^{3/4} = \frac{p^2 - p + 4}{2p + 11}$$

$$(2p + 11)8 = \frac{p^2 - p + 4}{2p + 11} (2p + 11)$$

$$2p + 88 = p^2 - p + 4$$

$$0 = p^2 - 3p - 84$$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-84)}}{2(1)}$$

$$x = \frac{3 \pm \sqrt{9 + 336}}{2}$$

$$x = \frac{3 \pm \sqrt{345}}{2}$$

$$x = \frac{3 \pm \sqrt{345}}{2}$$

**Score: 4** The student made an error using the distributive property and did not reject

$$\frac{3 - \sqrt{345}}{2}$$

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{p^2 - p + 4}{2p + 11} = \frac{3}{4}$$

$$\frac{p^2 - p + 4}{2p + 11} = 16^{\frac{3}{4}} = (\sqrt[4]{16})^3 = 2^3 = 8$$

$$p^2 - p + 4 = 16p + 88$$

$$p^2 - 17p - 84 = 0$$

$$p = \frac{17 \pm \sqrt{289 - (-336)}}{2}$$

**Score: 4** The student made a correct substitution into the quadratic formula, but showed no further work.

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{p^2 - p + 4}{2p + 11} = \frac{3}{4}$$

$$16^{\frac{3}{4}} = \frac{p^2 - p + 4}{2p + 11}$$

$$16p + 88 = p^2 - p + 4$$

$$0 = p^2 - 17p - 84$$

+1 ± -15

**Score: 3** The student wrote a correct quadratic equation.

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} p^2 - 3p - 7 = \frac{3}{4}$$

$$16^{\frac{3}{4}} = p^2 - 3p - 7$$

$$\cancel{8} = p^2 - 3p - 7$$

$$\hline p^2 - 3p - 15 = 0$$

$$p = \frac{3 \pm \sqrt{(-3)^2 - 4 \cdot 1 \cdot (-15)}}{2 \cdot 1}$$

$$p = \frac{3 \pm \sqrt{69}}{2}$$

**Score: 3** The student made a conceptual error by subtracting the polynomials instead of dividing them.

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{p^2 - p + 4}{2p + 11} = \frac{3}{4}$$

$$16^{\frac{3}{4}} = \frac{p^2 - p + 4}{2p + 11}$$

~~Ans~~ ↑  
( Into calc

~~8~~

$$y = 8 \rightarrow x = \textcircled{21}$$

**Score: 2** The student stated the equation in exponential form, but did not obtain 21 by an algebraic method.

### Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{(p^2 - p + 4)}{2p + 11} = \frac{3}{4}$$

$$16^{\frac{3}{4}} = \frac{(p^2 - p + 4)}{(2p + 11)}$$

**Score: 2** The student stated the equation correctly in exponential form.

Question 39

39 Solve for  $p$  algebraically:  $\log_{16} (p^2 - p + 4) - \log_{16} (2p + 11) = \frac{3}{4}$

$$\log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) = \frac{3}{4}$$

$$\log_{16} \frac{3}{4} \frac{p^2 - p + 4}{2p + 11}$$

**Score: 1** The student rewrote the log equation correctly.

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\log_{16} \frac{2p+11}{p^2-p+4} = \frac{3}{4}$$

$$16^{3/4} = \frac{2p+11}{p^2-p+4}$$

$$p^2 - p + 4 \left( 8 \right) = \left( \frac{2p+11}{p^2-p+4} \right) p^2 - p + 4$$

$$8p^2 - 8p + 32 = 2p + 11$$

$$(8p^2 - 10p) + 21 = 0 \quad \begin{matrix} m=168 \\ a=-10 \end{matrix}$$

**Score: 1** The student made a conceptual error in rewriting the log equation, but did write an appropriate exponential equation.



Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$\sqrt[4]{16} = 2^{\frac{3}{4}} = 8$$

$$16^{\frac{3}{4}} = (p^2 - p + 4)(2p + 11)$$

$$16^{\frac{3}{4}} = 2p^2 + 11p^2 - 2p^2 - 11p + 8p + 44$$

$$8 = 2p^3 + 9p^2 - 3p + 44$$

$$2p^3 + 9p^2 - 3p + 36 = 0$$

$$p^2(2p^2 + 9) - 3(p + 12) = 0$$

$$p(2p + 3)(p - 3)$$

$$(-3 + p) + (2p + 3)(p - 3)(p + 2) = 0$$

**Score: 0** The student wrote a completely incorrect response. No credit is given for finding 8.

Question 39

39 Solve for  $p$  algebraically:  $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

$$17 = \frac{p^2 - p + 4}{2p + 11}$$

$$24p + 132 = p^2 - p + 4$$

$$p^2 - 23p - 128 = 0$$

$$(p - 32)(p + 4) = 0$$

$$p = -32 \text{ or } p = -4$$

**Score: 0** The student made a conceptual error by evaluating  $16\left(\frac{3}{4}\right)$  followed by several computational errors, a factoring error, and did not reject  $p = -32$ .

## Regents Examination in Algebra 2/Trigonometry – June 2016

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