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 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) \( \frac{7\sqrt{5} - 5}{44} \)
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) \(10C_8 \left( \frac{1}{4} \right)^8 \left( \frac{3}{4} \right)^2\)  
(2) \(10C_8 \left( \frac{1}{4} \right)^8 \left( \frac{3}{4} \right)^2\)  
(3) \(10C_8 \left( \frac{1}{10} \right)^8 \left( \frac{9}{10} \right)^2\)  
(4) \(10C_8 \left( \frac{1}{10} \right)^8 \left( \frac{9}{10} \right)^2\)

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

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

6. The graph of a relation is shown below.

![Graph of a relation](image)

What is the domain of this relation?

(1) \([-2, -1, 0, 1]\)  
(2) \(\left[-\frac{1}{2}, 0, \frac{1}{2}, 1\right]\)  
(3) \(\{x \mid -2 \leq x < 2\}\)  
(4) \(\{x \mid -2 \leq x \leq 2\}\)
7 The Mathematics Club will select a president, a vice president, and a treasurer for the club. If there are 15 members in the club, how many different selections of a president, a vice president, and a treasurer are possible if each club member can be selected to only one position?

(1) 42
(2) 455
(3) 2730
(4) 3375

8 For which equation will \( f(-2) = -6? \)

(1) \( f(x) = x^3 + x \)
(2) \( f(x) = x^4 - 5x \)
(3) \( f(x) = 4x^3 + 6x^2 - x \)
(4) \( f(x) = -3x^3 - 4x^2 + 4x \)

9 What is the product of \( x^2 - 2x + 3 \) and \( x + 1? \)

(1) \( x^3 - x^2 + x + 3 \)
(2) \( x^3 - 2x^2 + 3x \)
(3) \( x^2 - 3x + 2 \)
(4) \( x^2 - x + 4 \)

10 A principal is concerned about the decline in the number of students who purchase food from the cafeteria. A survey was developed to assist the principal. The most appropriate method would be for the principal to randomly select 100 students from

(1) the junior class
(2) the student directory
(3) the Algebra 2/Trigonometry classes
(4) the students who are eating during fourth period lunch in the cafeteria
11 The solution of $8^{1-p} = 16^{2p-1}$ is

(1) $\frac{7}{11}$  
(2) $\frac{3}{5}$  
(3) $\frac{4}{9}$  
(4) $\frac{2}{5}$

12 Which relation is not a function?

(1) $\{(x,y): y = |x|\}$  
(2) $\{(x,y): y = -x^2\}$  
(3) $\{(x,y): y = x\}$  
(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) $-205^\circ$  
(2) $-155^\circ$  
(3) $25^\circ$  
(4) $335^\circ$
15 For any power of \( i \), the imaginary unit, where \( b \) is a whole number, \( i^{4b+3} \) equals

(1) 1 
(2) \( i \) 
(3) \(-1\) 
(4) \(-i\)

16 What is the solution set of \( x - \frac{10}{x} + 3 = 0 \)?

(1) \([-5, 2]\) 
(2) \([-2, 5]\) 
(3) \([-1, 10]\) 
(4) \([-10, 1]\)

17 In triangle \( ABC \), if \( m\angle A = 40 \), \( BC = 10 \), and \( AB = 12 \), then \( m\angle C \) can be

(1) an acute angle, only 
(2) a right angle, only 
(3) an obtuse angle, only 
(4) either an acute or an obtuse angle

18 To the nearest thousandth, what is \( 23^\circ 50' \), in radian measure?

(1) 0.416 
(2) 0.415 
(3) 0.410 
(4) 0.409
19 When \( f(x) = \frac{x - 7}{2} \), what is the value of \( (f \circ f^{-1})(3) \)?

(1) \( 2x + 7 \)  
(2) \( -2 \)  
(3) \( 3 \)  
(4) \( x \)

20 What is the equation of the circle passing through the point \((-5, -2)\) whose center is at \((-2, 3)\)?

(1) \( (x + 5)^2 + (y + 2)^2 = 34 \)  
(2) \( (x + 5)^2 + (y + 2)^2 = 50 \)  
(3) \( (x + 2)^2 + (y - 3)^2 = 34 \)  
(4) \( (x + 2)^2 + (y - 3)^2 = 50 \)

21 If \( a = -2 \) and \( b = -3 \), what is the value of the expression \( \frac{c^a}{c^b} - \frac{c^b}{c^a} \), when \( c \neq 0 \)?

(1) \( 0 \)  
(2) \( \frac{c^2 + 1}{c} \)  
(3) \( 2c \)  
(4) \( \frac{c^2 - 1}{c} \)

22 What is the fourth term in the expansion of \( (2x - 1)^6 \)?

(1) \(-160x^3\)  
(2) \(-40x^3\)  
(3) \(16x^4\)  
(4) \(240x^4\)
23 If the roots of a quadratic equation are real, irrational, and unequal, the discriminant could have a value of

(1) 1  (3) 8
(2) 0  (4) –6

24 What is the $n$th term of the sequence $–1, 3, 7, 11, \ldots$?

(1) $a_n = –1 – 4(n – 1)$
(2) $a_n = –1 + 4(n – 1)$
(3) $a_n = 4 – (n – 1)$
(4) $a_n = 4 + (n – 1)$

25 What is the sample standard deviation of the data in the table below, rounded to the nearest tenth?

<table>
<thead>
<tr>
<th>Scores</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>60</td>
<td>2</td>
</tr>
<tr>
<td>70</td>
<td>7</td>
</tr>
<tr>
<td>80</td>
<td>6</td>
</tr>
<tr>
<td>90</td>
<td>3</td>
</tr>
<tr>
<td>100</td>
<td>2</td>
</tr>
</tbody>
</table>

(1) 12.5  (3) 17.1
(2) 12.8  (4) 18.7
26 Which equation is not true?

(1) $\cot^2 \theta = 1 - \sec^2 \theta$  
(2) $\sin^2 \theta = 1 - \cos^2 \theta$  
(3) $\sec^2 \theta = \tan^2 \theta + 1$  
(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) $12x^2 + 8x + 27 = 0$  
(2) $12x^2 - 27x + 8 = 0$  
(3) $12x^2 - 8x - 27 = 0$  
(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
A colony of bacteria grows exponentially. The table below shows the data collected daily.

<table>
<thead>
<tr>
<th>Day (x)</th>
<th>Population (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>1</td>
<td>425</td>
</tr>
<tr>
<td>2</td>
<td>570</td>
</tr>
<tr>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>1035</td>
</tr>
<tr>
<td>5</td>
<td>1650</td>
</tr>
<tr>
<td>6</td>
<td>2600</td>
</tr>
</tbody>
</table>

State the exponential regression equation for the data, rounding all values to the nearest hundredth.
31 Express \( \frac{2 + \frac{6}{x - 3}}{x} \) 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, \( \text{in feet} \).
A sine function is graphed below.

Determine and state the amplitude and period of this function.
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: \( \log_{16} \left( \frac{p^2 - p + 4}{11002} \right) - \log_{16} (2p + 11) = \frac{3}{4} \)
Reference Sheet

Area of a Triangle
\[ K = \frac{1}{2} ab \sin C \]

Functions of the Sum of Two Angles
\[
\begin{align*}
\sin (A + B) &= \sin A \cos B + \cos A \sin B \\
\cos (A + B) &= \cos A \cos B - \sin A \sin B \\
\tan (A + B) &= \frac{\tan A + \tan B}{1 - \tan A \tan B}
\end{align*}
\]

Functions of the Difference of Two Angles
\[
\begin{align*}
\sin (A - B) &= \sin A \cos B - \cos A \sin B \\
\cos (A - B) &= \cos A \cos B + \sin A \sin B \\
\tan (A - B) &= \frac{\tan A - \tan B}{1 + \tan A \tan B}
\end{align*}
\]

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
\[ (a + b)^n = \sum_{r=0}^{n} \binom{n}{r} a^{n-r} b^r \]

Law of Cosines
\[ a^2 = b^2 + c^2 - 2bc \cos A \]

Functions of the Double Angle
\[
\begin{align*}
\sin 2A &= 2 \sin A \cos A \\
\cos 2A &= \cos^2 A - \sin^2 A \\
\cos 2A &= 2 \cos^2 A - 1 \\
\cos 2A &= 1 - 2 \sin^2 A \\
\tan 2A &= \frac{2 \tan A}{1 - \tan^2 A}
\end{align*}
\]

Functions of the Half Angle
\[
\begin{align*}
\sin \frac{A}{2} &= \pm \sqrt{\frac{1 - \cos A}{2}} \\
\cos \frac{A}{2} &= \pm \sqrt{\frac{1 + \cos A}{2}} \\
\tan \frac{A}{2} &= \pm \sqrt{\frac{1 - \cos A}{1 + \cos A}}
\end{align*}
\]

Sum of a Finite Geometric Series
\[ S_n = \frac{a_1(1 - r^n)}{1 - r} \]
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.

<p>| | | | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>(1)</td>
<td>1</td>
<td></td>
<td>(10)</td>
<td>2</td>
</tr>
<tr>
<td>(2)</td>
<td>2</td>
<td></td>
<td>(11)</td>
<td>1</td>
</tr>
<tr>
<td>(3)</td>
<td>3</td>
<td></td>
<td>(12)</td>
<td>4</td>
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<td>2</td>
<td></td>
<td>(13)</td>
<td>4</td>
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<td>4</td>
<td></td>
<td>(14)</td>
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<td>3</td>
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<td>(16)</td>
<td>1</td>
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<td></td>
<td>(17)</td>
<td>4</td>
</tr>
<tr>
<td>(9)</td>
<td>1</td>
<td></td>
<td>(18)</td>
<td>1</td>
</tr>
</tbody>
</table>

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) \[ y = 239.21(1.48)^x \]

[1] One rounding error is made.

\[ \text{or} \]

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

\[ \text{or} \]

[1] An incorrect exponential regression equation is written.

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

\[ \text{or} \]

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

(31) \[ 2, \text{ and correct work is shown.} \]

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

\[ \text{or} \]

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

\[ \text{or} \]

[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) \[ 6, \text{ and correct work is shown.} \]

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

\[ \text{or} \]

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

\[ \text{or} \]

[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 \(-0.923076\), 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.
[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] \(\frac{p^2 - p + 4}{2p + 11} = \frac{3}{16} \) 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.
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:


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 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.

Map to Core Curriculum

<table>
<thead>
<tr>
<th>Content Strands</th>
<th>Item Numbers</th>
</tr>
</thead>
<tbody>
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<td>Number Sense and Operations</td>
<td>1, 5, 9, 15</td>
</tr>
<tr>
<td>Algebra</td>
<td>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</td>
</tr>
<tr>
<td>Measurement</td>
<td>18</td>
</tr>
<tr>
<td>Statistics and Probability</td>
<td>4, 7, 10, 13, 25, 30, 34</td>
</tr>
</tbody>
</table>
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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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.
28 Factor $6x^3 + 33x^2 - 63x$ completely.

Score: 2  The student gave a complete and correct response.
28 Factor $6x^3 + 33x^2 - 63x$ completely.

Score: 1  The student made an error by treating the expression as an equation.
Question 28

28 Factor \(6x^3 + 33x^2 - 63x\) completely.

\[ 3x \left( 2x^2 + 11x - 33 \right) \]

\[ 3x \left( 2x + 9 \right) \left( x - 3 \right) \]

Score: 1 The student made one factoring error.
28 Factor $6x^3 + 33x^2 - 63x$ completely.

\[ 3x(2x^2 + 11x - 21) \]

Score: 1 The student did not factor completely.
28 Factor $6x^3 + 33x^2 - 63x$ completely.

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

\[
A = 5000 \left(1 + \frac{0.035}{4}\right)^{4 \times 18}
\]

\[
A = 9362.36
\]

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

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

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

Score: 0  The student gave a completely incorrect response.
30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

<table>
<thead>
<tr>
<th>Day (x)</th>
<th>Population (y)</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>1</td>
<td>425</td>
</tr>
<tr>
<td>2</td>
<td>570</td>
</tr>
<tr>
<td>3</td>
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</tr>
<tr>
<td>4</td>
<td>1035</td>
</tr>
<tr>
<td>5</td>
<td>1650</td>
</tr>
<tr>
<td>6</td>
<td>2600</td>
</tr>
</tbody>
</table>

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

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</tr>
<tr>
<td>6</td>
<td>2600</td>
</tr>
</tbody>
</table>

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

\[ y = a \times b^x \]

\[ a = 239.21 \quad b = 1.48 \]

**Score: 2** The student gave a complete and correct response.
30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

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</tr>
<tr>
<td>6</td>
<td>2600</td>
</tr>
</tbody>
</table>

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

$y = a \cdot b^x$

$y = 245.015 \cdot (1.47)^x$

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

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<td>2600</td>
</tr>
</tbody>
</table>

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

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</tr>
<tr>
<td>6</td>
<td>2600</td>
</tr>
</tbody>
</table>

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

\[ y = a \cdot b^x \]

\[ a = 239.2 \]
\[ b = 1.5 \]
\[ y = \left(239.2\right)\left(1.5\right)^x \]

Score: 0  The student rounded both values to the nearest tenth and made a conceptual error when writing the equation.
30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

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</thead>
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</tr>
<tr>
<td>6</td>
<td>2600</td>
</tr>
</tbody>
</table>

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

\[
A = 239.211 \\
B = 1.481 \\
239.211 \cdot (1.481)^x
\]

Score: 0 The student rounded incorrectly and wrote an expression instead of an equation.
30 A colony of bacteria grows exponentially. The table below shows the data collected daily.

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</tr>
<tr>
<td>6</td>
<td>2600</td>
</tr>
</tbody>
</table>

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

\[
\frac{2 + \frac{6}{x-3}}{x} = \frac{2x - 6 + 6}{x} = \frac{2x}{x} = 2
\]

**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 \( x \neq 3 \).

Score: 2  The student gave a complete and correct response.
Question 31

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

Score: 1  The student made an error by not multiplying both terms of the numerator by \((x - 3)\).
Question 31

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

\[
2 + \frac{6}{x - 3} \quad \text{over} \quad \frac{x}{x - 3}
\]

\[
\frac{2x - 6 + 6}{x} = \frac{2x}{x} = 2
\]

Score: 1  The student did not simplify completely.
31  Express \( \frac{2 + \frac{6}{x - 3}}{\frac{x}{x - 3}} \) in simplest form, when \( x \neq 0 \) and \( x \neq 3 \).

\[
\frac{2 + \frac{6}{x - 3}}{\frac{x}{x - 3}} = \frac{2(x - 3) + 6}{x} = \frac{2x - 6 + 6}{x} = \frac{2x}{x} = 2.
\]

**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.
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.

\[ S = \Theta r \]

\[ S = 4\pi \]

\[ \Theta = \frac{2\pi}{3} \]

\[ \frac{3}{2\pi} \cdot \frac{2\pi}{3} = \frac{3}{2\pi}r \]

\[ r = \frac{3}{2\pi} \]

\[ r = 3 \]

**Score:** 2  The student gave a complete and correct response.
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, \emph{in feet}.

\[
\frac{2\pi}{3} \cdot \frac{\theta}{3} = 4\pi
\]

\[
\frac{\theta}{3} = 2
\]

\[
\theta = 6
\]

\textbf{Score: 2} \quad \text{The student gave a complete and correct response.}
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.

\[
\frac{2(180)}{3} = 120
\]

\[
\frac{120}{360} = \frac{\frac{2}{4\pi}}{20\pi r}
\]

\[
\frac{1}{3} = \frac{2}{r}
\]

\[
r = 6
\]

**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.
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.

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

\[
S = r \theta \\
\frac{4\pi}{\frac{2\pi}{3}} = \frac{\frac{2\pi}{3}}{2\pi} \frac{r}{2} \\
\frac{2}{3} = r
\]

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

Score: 0  The student made an error by interchanging the arc length and angle measure, and then made an error when dividing by $4\pi$. 
A sine function is graphed below.

Determine and state the amplitude and period of this function.

**amplitude**: 2  
**Period**: $\frac{5\pi}{2}$
Question 33

33 A sine function is graphed below.

Determine and state the amplitude and period of this function.

Score: 1 The student stated an incorrect period.
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.
33 A sine function is graphed below.

Determine and state the amplitude and period of this function.

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

\[
\frac{62.4}{100} = \frac{x}{210} \\
13104 = 100x \\
x = 131 \\
\text{131 students}
\]

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

\[
\text{normalcdf}(-79.9, 88.3, 82, 4.2)
\]

\[
131.1776002
\]

\[
\approx 131
\]

**Score: 2** The student gave a complete and correct response.
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.
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.
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: 0  The student made an error in calculating the percentage and did not round appropriately.
35 Given \( \tan \theta = -\frac{5}{12} \) and \( \frac{\pi}{2} < \theta < \pi \), determine the exact value of the expression \( \sin \theta \cot \theta \).

\[ \frac{\sin \theta}{\cos \theta} = -\frac{5}{12} \]

\[ \frac{\cos \theta}{\sin \theta} = \frac{-12}{5} \times \frac{-13}{5} = \frac{160}{65} \]

**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 \( \sin \theta \cot \theta \).

\[
\tan \theta = -\frac{5}{12} \\
\theta = \tan^{-1} \left(-\frac{5}{12}\right) \\
(\theta \approx 157.3801351) \\
\sin \theta \cot \theta = -0.9230769251 \\
\approx -0.923076
\]

Score: 2   The student gave a complete and correct response.
35 Given tan \( \theta = -\frac{5}{12} \) and \( \frac{\pi}{2} < \theta < \pi \), determine the exact value of the expression \( \sin \theta \cot \theta \).

Score: 1  The student made an error by placing the angle in Quadrant III.
35 Given $\tan \theta = -\frac{5}{12}$ and $\frac{\pi}{2} < \theta < \pi$, determine the exact value of the expression $\sin \theta \cot \theta$.

Score: 1  The student made an error by not finding the product.
35 Given \( \tan \theta = -\frac{5}{12} \) and \( \frac{\pi}{2} < \theta < \pi \), determine the exact value of the expression \( \sin \theta \cot \theta \).

Score: 1  The student labeled the triangle incorrectly.
35 Given \( \tan \theta = -\frac{5}{12} \) and \( \frac{\pi}{2} < \theta < \pi \), determine the exact value of the expression \( \sin \theta \cot \theta \).
35 Given \( \tan \theta = -\frac{5}{12} \) and \( \frac{\pi}{2} < \theta < \pi \), determine the exact value of the expression \( \sin \theta \cot \theta \).

\[
\begin{align*}
\theta &= \tan^{-1}(-\frac{5}{12}) \\
\theta &= -22.61986495 \\
\sin(-22.619\ldots) \cdot \frac{1}{\sin(-22.619\ldots)} &= 1
\end{align*}
\]

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

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

\[ 115.4^\circ \]

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

\[ \theta = \cos^{-1}\left( \frac{6^2 + 7^2 - 11^2}{2(6)(7)} \right) \]

\[ \theta = \cos^{-1}(0.5369335) \]

\[ \theta \approx 115.4 \]

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

\[ \text{Score: 3} \quad \text{The student made an error by dividing by 84 instead of } -84. \]
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.

\[ \cos A = \frac{6^2 + 7^2 - 11^2}{2 \cdot 6 \cdot 7} \]

\[ \cos A = \frac{36}{84} \]

\[ A = \arccos \left( \frac{36}{84} \right) \]

\[ A = 2.0 \, \text{degrees} \]

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

\[ \begin{align*}
11^2 &= 6^2 + 7^2 - 2(6)(7) \sin A \\
121 &= 36 + 49 - 84 \sin A \\
85 &= 84 \sin A \\
-85 &= -84 \sin A \\
\frac{36}{-84} &= \sin A \\
\sin^{-1}\left(\frac{36}{-84}\right) &= A \\
A &= -25.4
\end{align*}\]

**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.
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.

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

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

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

\[ 6^2 = 7^2 + 11^2 - 2(7)(11)\cos x \]

\[ 36 = 49 + 121 - 154 \cos x \]

\[ 36 = 170 - 154 \cos x \]

\[ -134 = -154 \cos x \]

\[ \cos x = \frac{-134}{-154} \]

\[ \cos x = 0.8701298701 \]

\[ x = 29.53^\circ \]

**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.

\[
\frac{6}{\sin 7} \times \frac{11}{\sin x} = \frac{11 \cdot \sin 7}{6}
\]

\[
6 \sin x = 11 \cdot \sin 7
\]

\[
\sin x = 0.2234 \ldots
\]

\[
\sin^{-1}(0.2234 \ldots) = 12.9
\]

Score: 0  The student made an error by using the Law of Sines and treated the 7 as an angle.
37 Solve algebraically for $c$:

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

\[
\frac{3}{2}c - 10 \geq 9
\]

\[
\frac{3}{2}c \geq 19
\]

\[
c \geq \frac{38}{3}
\]

\[
\frac{3}{2}c - 10 \leq -9
\]

\[
\frac{3}{2}c \leq 1
\]

\[
c \leq \frac{2}{3}
\]

\[
\text{Score: 4} \quad \text{The student gave a complete and a correct response.}
\]
37 Solve algebraically for $c$:

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

Score: 4  The student gave a complete and correct response.
37 Solve algebraically for \(c\):

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

\[
\begin{align*}
\frac{3}{2}c - 10 & \leq 8 \\
+10 & +10 \\
\frac{3}{2}c & \leq 18 \frac{2}{3} \\
\frac{3}{2}c & \leq 12 \\
\frac{1}{3} \cdot \frac{3}{2}c & \leq 2 \frac{2}{3} \\
\frac{3c}{6} & \frac{3}{2}c \geq 1 \frac{1}{3}
\end{align*}
\]

**Score:** 3  The student made an error by expressing \(\frac{4}{3}\) as 1.3 instead of 1.33. 
37 Solve algebraically for $c$:

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

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

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

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

$$c \leq 12$$

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

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

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

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

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

Score: 3  The student made an error by not stating the solution as a conjunction.
37 Solve algebraically for $c$:

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

\[\begin{align*}
&\frac{3}{2}c - 10 \leq 8 \\
&\frac{3}{2}c \leq 18 \\
&c \leq 12
\end{align*}\]

\[\begin{align*}
&\frac{3}{2}c + 10 \leq 8 \\
&\frac{3}{2}c \leq -2 \\
&c \geq -\frac{4}{3}
\end{align*}\]

Score: 2  The student made an error when writing the inequality symbol and did not write the solution as a conjunction.
37 Solve algebraically for $c$:

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

\[\begin{align*}
\left( \frac{3}{2}c - 10 \right) - 9 & \leq -1 \\
\frac{3}{2}c - 10 & \leq 8 \\
\frac{3}{2}c & \leq 18 \\
\frac{2}{3} \cdot \frac{3}{2}c & \leq \frac{2}{3} \cdot 18 \\
c & \leq 12
\end{align*}\]

\[\begin{align*}
\left( \frac{3}{2}c + 10 \right) - 9 & \leq -1 \\
\frac{3}{2}c + 10 & \leq 8 \\
\frac{3}{2}c & \leq -2 \\
\frac{2}{3} \cdot \frac{3}{2}c & \leq -2 \\
c & \leq \frac{4}{3}
\end{align*}\]

**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 $c$:

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

\[ \frac{3}{2}c - 10 \leq \frac{3}{2}c - 10 \]

\[ \frac{3}{2}c - 10 \leq 8 \]

\[ \frac{3}{2}c - 10 = 8 \]

\[ \frac{3}{2}c = 18 \]

\[ c = 12 \]

\[ c \leq 27 \]

\[ c \geq 3 \]

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

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

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

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

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

$$c \leq 12$$

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

\[
\left|\frac{3}{2}c - 10\right| - 9 \leq -1
\]
37 Solve algebraically for $c$:

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

**Score: 0** The student attempted to solve only one inequality and made a transcription error.
38 Solve $2\cos^2 \theta = \cos \theta$ for all values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$.

Score: 4  The student gave a complete and correct response.
38 Solve \(2 \cos^2 \theta = \cos \theta\) for all values of \(\theta\) in the interval \(0^\circ \leq \theta < 360^\circ\).

Let \(u = \cos \theta\)

\[
2u^2 = u
\]

\[-u - u\]

\[
2u^2 - u = 0
\]

\[
u(u - 1) = 0
\]

\[
u = 0 \quad \text{or} \quad 2u - 1 = 0
\]

\[
u = 0 \quad \text{or} \quad u = \frac{1}{2}
\]

\[
\cos \theta = 0 \quad \cos \theta = \frac{1}{2}
\]

\[
\theta = 90^\circ, 270^\circ \quad \theta = 60^\circ, 300^\circ
\]

**Score: 4** The student gave a complete and correct response.
38 Solve $2\cos^2 \theta = \cos \theta$ for all values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$.

Score: 3  The student made an error by stating $180^\circ$ instead of $270^\circ$. 
38 Solve $2 \cos^2 \theta = \cos \theta$ for all values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$.

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 $0^\circ \leq \theta < 360^\circ$.

\[
\begin{align*}
2 \cos^2 \theta &= \cos \theta \\
\frac{2 \cos \theta}{\cos \theta} &= \frac{\cos \theta}{\cos \theta} \\
2 \cos \theta &= 1 \\
\cos \theta &= \frac{1}{2} \\
\theta &= 60^\circ \text{ and } 300^\circ
\end{align*}
\]

**Score: 2** The student made a conceptual error by dividing both sides by $\cos \theta$. 
Solve \(2\cos^2 \theta = \cos \theta\) for all values of \(\theta\) in the interval \(0^\circ \leq \theta < 360^\circ\).

\[
\begin{align*}
\cos^2 \theta &= a \\
2a^2 - a &= 0 \\
a(2a - 1) &= 0
\end{align*}
\]

\[
\begin{align*}
a &= 0 \\
2a - 1 &= 0 \\
\frac{a}{1} &= \frac{1}{2} \\
2 &= 2
\end{align*}
\]

\[
\cos \theta = \frac{1}{2}
\]

\[
\theta = 60^\circ
\]

\[
(60^\circ \text{ and } 300^\circ)
\]

\[
\begin{array}{c|c}
Q_1 & Q_2 \\
60^\circ & 300^\circ
\end{array}
\]

**Score: 2**  The student did not use \(a = 0\).
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

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

Score: 1  The student made a conceptual error by dividing both sides by $\cos \theta$, and then only found the one angle.
38 Solve $2\cos^2 \theta = \cos \theta$ for all values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$.

Score: 0  The student made a conceptual error by dividing by $\cos \theta$ and then stated $\cos \theta = \frac{1}{2}$, and did not find $300$. 
39 Solve for $p$ algebraically: $\log_{16} (p^2 - p + 4) - \log_{16} (2p + 11) = \frac{3}{4}$

Score: 6  The student gave a complete and correct response.
39 Solve for $p$ algebraically: $\log_{16}(p^2 - p + 4) - \log_{16}(2p + 11) = \frac{3}{4}$

Score: 6  The student gave a complete and correct response.
39 Solve for \( p \) algebraically: \( \log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) = \frac{3}{4} \)

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

**Score: 5**  The student made an error by rejecting \( p = 21 \).
39 Solve for \( p \) algebraically: \( \log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) - \log_{16} (2p + 11) = \frac{3}{4} \)

**Score:** 5  The student made a sign error when moving \( p \) to the other side of the equation.
39 Solve for $p$ algebraically: \[ \log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) - \log_{16} (2p + 11) = \frac{3}{4} \]

\[
\begin{align*}
16^{\frac{3}{4}} &= \frac{p^2 - p + 4}{2p + 11} \\
(2p+11)^3 &= \frac{p^2 - p + 4}{2p + 11} (2p+11) \\
2p+88 &= p^2 - p + 4 \\
0 &= p^2 - 3p - 84 \\
x &= \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-84)}}{2(1)} \\
x &= \frac{3 \pm \sqrt{9 + 336}}{2} \\
x &= \frac{3 \pm \sqrt{345}}{2} \\
x &= \frac{3 \pm \sqrt{345}}{2}
\end{align*}
\]

Score: 4  The student made an error using the distributive property and did not reject \[ \frac{3}{2} - \frac{\sqrt{345}}{2} \].
39 Solve for \( p \) algebraically: \( \log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) = \frac{3}{4} \)

\[
\begin{align*}
\log_{16} \frac{p^2 - p + 4}{2p + 11} &= \frac{3}{4} \\
p^2 - p + 4 &= 16^{\frac{3}{4}} = (\sqrt[4]{16})^3 = 2^3 = 8 \\
p^2 - p + 4 &= 16p + 88 \\
p^2 - 17p - 84 &= 0 \\
p &= \frac{17 \pm \sqrt{289 - 4(-336)}}{2}
\end{align*}
\]

**Score: 4**  The student made a correct substitution into the quadratic formula, but showed no further work.
39 Solve for \( p \) algebraically: \( \log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) - \log_{16} \left( 2p + 11 \right) = \frac{3}{4} \)

Score: 3  The student wrote a correct quadratic equation.
39 Solve for $p$ algebraically: $\log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) = \frac{3}{4}$

\[
\log_{16} \left( \frac{p^2 - 3p - 7}{p^2 - 3p - 7} \right) = \frac{3}{4}
\]

\[
\frac{3}{4} = \frac{p^2 - 3p - 7}{p^2 - 3p - 7}
\]

\[
16 = p^2 - 3p - 7
\]

\[
8 = p^2 - 3p - 7
\]

\[
-8 = p^2 - 3p - 7
\]

\[
p^2 - 3p - 15 = 0
\]

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

\[
p = \frac{3 \pm \sqrt{69}}{2}
\]

Score: 3  The student made a conceptual error by subtracting the polynomials instead of dividing them.
Question 39

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

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

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

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

Score: 2 The student stated the equation correctly in exponential form.
39 Solve for \( p \) algebraically: \( \log_{16} \left( \frac{p^2 - p + 4}{2p + 11} \right) = \frac{3}{4} \)

**Score: 1**  The student rewrote the log equation correctly.
Question 39

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

\[
\begin{align*}
\log_{16} \frac{2p+11}{p^2-p+4} &= \frac{3}{4} \\
16^{3/4} &= \frac{2p+11}{p^2-p+4} \\
p^2 - p + 4 &= \left(\frac{2p+11}{p^2-p+4}\right) \left(p^2-p+4\right) \\
8p^2 - 8p + 32 &= 2p + 11 \\
-2p - 11 &= -2p - 11 \\
(8p^2 - 10p) + 21 &= 0
\end{align*}
\]

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

\[
\begin{align*}
\log_{16} \frac{3}{4} &= (p^2 - p + 4)(2p + 11) \\
\log_{16} 8 &= 2p^2 + 11p^2 - 2p - 11p + 8p + 44 \\
\log_{16} 8 &= 2p^3 + 9p^2 - 3p + 44 \\
\frac{3}{4} &= 2p^3 + 9p^2 - 3p + 44
\end{align*}
\]

\[
\begin{align*}
2p^3 + 9p^2 - 3p + 36 &= 0 \\
p^2(2p^2 + 9p - 3) - 3(p + 12) &= 0 \\
p(2p + 3)(p - 3) &= 0
\end{align*}
\]

\[
\begin{align*}
(-3 + p) + (2p + 3)(p - 3)(p + 2) &= 0
\end{align*}
\]

Score: 0  The student wrote a completely incorrect response. No credit is given for finding 8.
39 Solve for $p$ algebraically: $\log_{16} \left( p^2 - p + 4 \right) - \log_{16} \left( 2p + 11 \right) = \frac{3}{4}$

\[
\begin{align*}
12 &= \frac{p^2 - p + 4}{3p + 11} \\
34p + 132 &= p^2 - p + 4 \\
p^2 - 33p - 128 &= 0 \\
(p - 32)(p + 4) &= 0 \\
p &= 32 \text{ or } p = -4
\end{align*}
\]

**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)

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<thead>
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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.