

# ALGEBRA 2/TRIGONOMETRY

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

# ALGEBRA 2/TRIGONOMETRY

Friday, January 29, 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.

ALGEBRA 2/TRIGONOMETRY

## 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 A survey is to be conducted in a small upstate village to determine whether or not local residents should fund construction of a skateboard park by raising taxes. Which segment of the population would provide the most unbiased responses?

- (1) a club of local skateboard enthusiasts
- (2) senior citizens living on fixed incomes
- (3) a group opposed to any increase in taxes
- (4) every tenth person 18 years of age or older walking down Main St.

2 Which angle does *not* terminate in Quadrant IV when drawn on a unit circle in standard position?

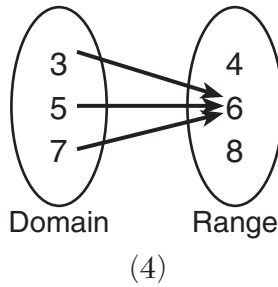
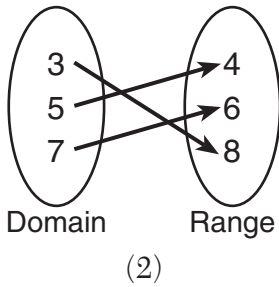
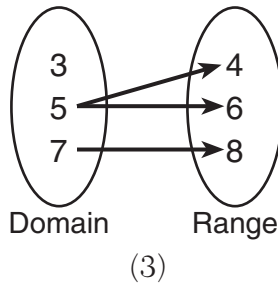
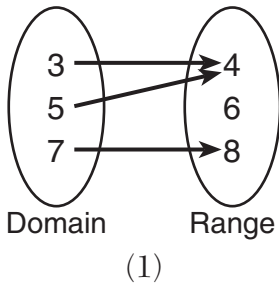
- (1)  $-300^\circ$
- (2)  $-50^\circ$
- (3)  $280^\circ$
- (4)  $1030^\circ$

3 The expression  $\frac{\frac{1}{x} + \frac{3}{y}}{\frac{2}{xy}}$  is equivalent to

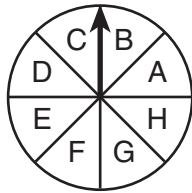
- (1)  $\frac{3}{2}$
- (2)  $\frac{3x + y}{2xy}$
- (3)  $\frac{3xy}{2}$
- (4)  $\frac{3x + y}{2}$

Use this space for computations.

4 Which relation does *not* represent a function?



5 In the diagram below, the spinner is divided into eight equal regions.



Which expression represents the probability of the spinner landing on *B exactly* three times in five spins?

(1)  ${}_8C_3\left(\frac{1}{5}\right)^3\left(\frac{4}{5}\right)^5$

(3)  ${}_5C_3\left(\frac{1}{8}\right)^2\left(\frac{7}{8}\right)^3$

(2)  ${}_8C_3\left(\frac{1}{5}\right)^5\left(\frac{4}{5}\right)^3$

(4)  ${}_5C_3\left(\frac{1}{8}\right)^3\left(\frac{7}{8}\right)^2$

Use this space for  
computations.

6 The expression  $\sqrt[3]{27a^{-6}b^3c^2}$  is equivalent to

(1)  $\frac{3bc^{\frac{2}{3}}}{a^2}$

(3)  $\frac{3b^6c^5}{a^3}$

(2)  $\frac{3b^9c^6}{a^{18}}$

(4)  $\frac{3b\sqrt[3]{3c^2}}{a^2}$

7 The amount of money in an account can be determined by the formula  $A = Pe^{rt}$ , where  $P$  is the initial investment,  $r$  is the annual interest rate, and  $t$  is the number of years the money was invested. What is the value of a \$5000 investment after 18 years, if it was invested at 4% interest compounded continuously?

(1) \$9367.30

(3) \$10,129.08

(2) \$9869.39

(4) \$10,272.17

8 What is  $\frac{x}{x-1} - \frac{1}{2-2x}$  expressed as a single fraction?

(1)  $\frac{x+1}{x-1}$

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

(2)  $\frac{2x-1}{2-2x}$

(4)  $\frac{2x-1}{2(x-1)}$

Use this space for computations.

9 What is the total number of points of intersection of the graphs of the equations  $2x^2 - y^2 = 8$  and  $y = x + 2$ ?

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

10 Given the sequence:  $x, (x + y), (x + 2y), \dots$

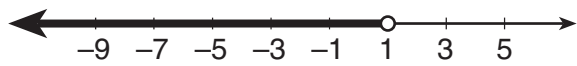
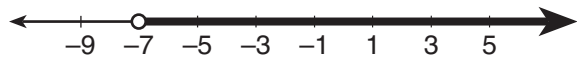
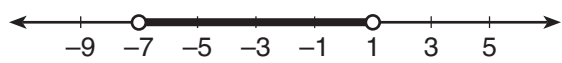
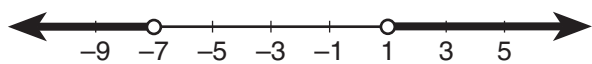
Which expression can be used to determine the common difference of this sequence?

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

11 In a circle with a diameter of 24 cm, a central angle of  $\frac{4\pi}{3}$  radians intercepts an arc. The length of the arc, in centimeters, is

- (1)  $8\pi$                                       (3)  $16\pi$   
(2)  $9\pi$                                       (4)  $32\pi$

12 Which graph is the solution to the inequality  $4|2x + 6| - 5 < 27$ ?



**Use this space for  
computations.**

**13** What is the sum of the roots of the equation  $-3x^2 + 6x - 2 = 0$ ?

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

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

(2) 2

(4) -2

**14** The scores of 1000 students on a standardized test were normally distributed with a mean of 50 and a standard deviation of 5. What is the expected number of students who had scores greater than 60?

(1) 1.7

(3) 46

(2) 23

(4) 304

**15** If  $T = \frac{10x^2}{y}$ , then  $\log T$  is equivalent to

(1)  $(1 + 2\log x) - \log y$

(3)  $(1 - 2\log x) + \log y$

(2)  $\log(1 + 2x) - \log y$

(4)  $2(1 - \log x) + \log y$

**16** Which statement regarding correlation is *not* true?

(1) The closer the absolute value of the correlation coefficient is to one, the closer the data conform to a line.

(2) A correlation coefficient measures the strength of the linear relationship between two variables.

(3) A negative correlation coefficient indicates that there is a weak relationship between two variables.

(4) A relation for which most of the data fall close to a line is considered strong.

Use this space for  
computations.

17 What is the value of  $\sum_{n=1}^3 \cos \frac{n\pi}{2}$ ?

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

18 The roots of the equation  $4(x^2 - 1) = -3x$  are

- (1) imaginary  
(2) real, rational, equal  
(3) real, rational, unequal  
(4) real, irrational, unequal

19 If  $f(x) = 2x^2 - 3x + 4$ , then  $f(x + 3)$  is equal to

- (1)  $2x^2 - 3x + 7$   
(2)  $2x^2 - 3x + 13$   
(3)  $2x^2 + 9x + 13$   
(4)  $2x^2 + 9x + 25$

20 The expression  $x(3i^2)^3 + 2xi^{12}$  is equivalent to

- (1)  $2x + 27xi$   
(2)  $-7x$   
(3)  $-25x$   
(4)  $-29x$

21 If the terminal side of angle  $\theta$  passes through the point  $(-3, -4)$ , what is the value of  $\sec \theta$ ?

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

Use this space for  
computations.

**22** When the inverse of  $\tan \theta$  is sketched, its domain is

(1)  $-1 \leq \theta \leq 1$

(3)  $0 \leq \theta \leq \pi$

(2)  $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$

(4)  $-\infty < \theta < \infty$

**23** What is the third term of the recursive sequence below?

$$a_1 = -6$$

$$a_n = \frac{1}{2}a_{n-1} - n$$

(1)  $-\frac{11}{2}$

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

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

(4)  $-4$

**24** What is the equation of a circle with its center at  $(0, -2)$  and passing through the point  $(3, -5)$ ?

(1)  $x^2 + (y + 2)^2 = 9$

(3)  $x^2 + (y + 2)^2 = 18$

(2)  $(x + 2)^2 + y^2 = 9$

(4)  $(x + 2)^2 + y^2 = 18$

**25** If angles  $A$  and  $B$  are complementary, then  $\sec B$  equals

(1)  $\csc(90^\circ - B)$

(3)  $\cos(B - 90^\circ)$

(2)  $\csc(B - 90^\circ)$

(4)  $\cos(90^\circ - B)$



**Use this space for  
computations.**

**26** The legs of a right triangle are represented by  $x + \sqrt{2}$  and  $x - \sqrt{2}$ .  
The length of the hypotenuse of the right triangle is represented by

(1)  $\sqrt{2x^2 + 4}$

(3)  $x\sqrt{2} + 2$

(2)  $2x^2 + 4$

(4)  $\sqrt{x^2 - 2}$

**27** What are the amplitude and the period of the graph represented by  
the equation  $y = -3\cos \frac{\theta}{3}$ ?

(1) amplitude:  $-3$ ; period:  $\frac{\pi}{3}$

(2) amplitude:  $-3$ ; period:  $6\pi$

(3) amplitude:  $3$ ; period:  $\frac{\pi}{3}$

(4) amplitude:  $3$ ; period:  $6\pi$

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## Part II

Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. 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 Solve algebraically for  $x$ :

$$\sqrt{2x + 1} + 4 = 8$$

**29** Factor completely:

$$x^3 + 3x^2 + 2x + 6$$

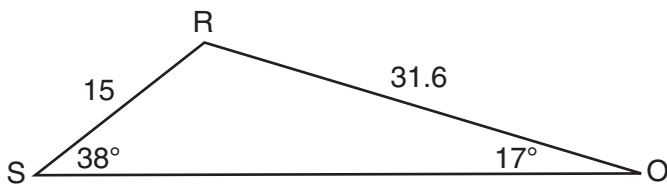
**30** Solve algebraically for the *exact* value of  $x$ :

$$\log_8 16 = x + 1$$

**31** Determine how many eleven-letter arrangements can be formed from the word  
“CATTARAUGUS.”

**32** Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

33 Determine the area, to the *nearest integer*, of  $\triangle SRO$  shown below.



**34** Prove that the equation shown below is an identity for all values for which the functions are defined:

$$\csc \theta \cdot \sin^2 \theta \cdot \cot \theta = \cos \theta$$



**35** Find the difference when  $\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x$  is subtracted from  $2x^3 + \frac{3}{4}x^2 - \frac{2}{9}$ .

### 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 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the *nearest hundredth*.

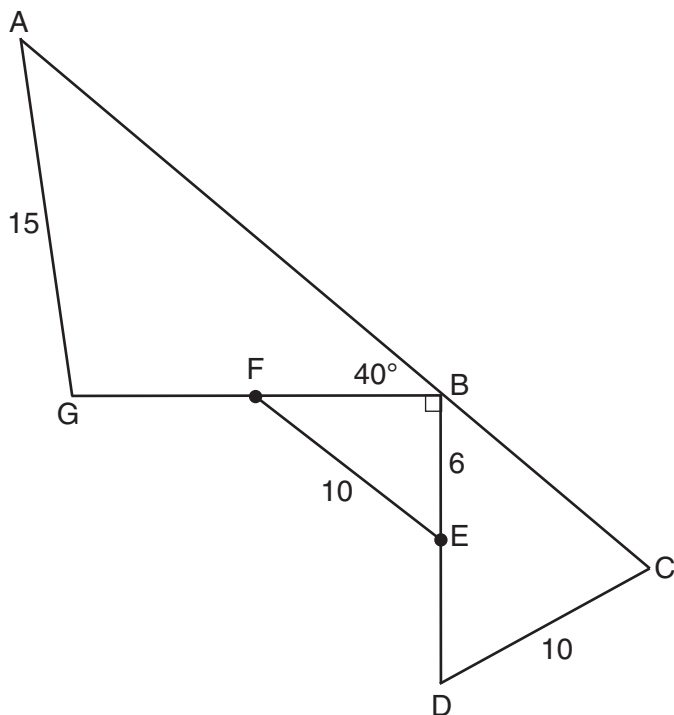
Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the *nearest tenth*.  
[Only an algebraic solution can receive full credit.]

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

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 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



Find  $m\angle A$  to the *nearest tenth*.

Find  $BC$  to the *nearest tenth*.



# 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

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

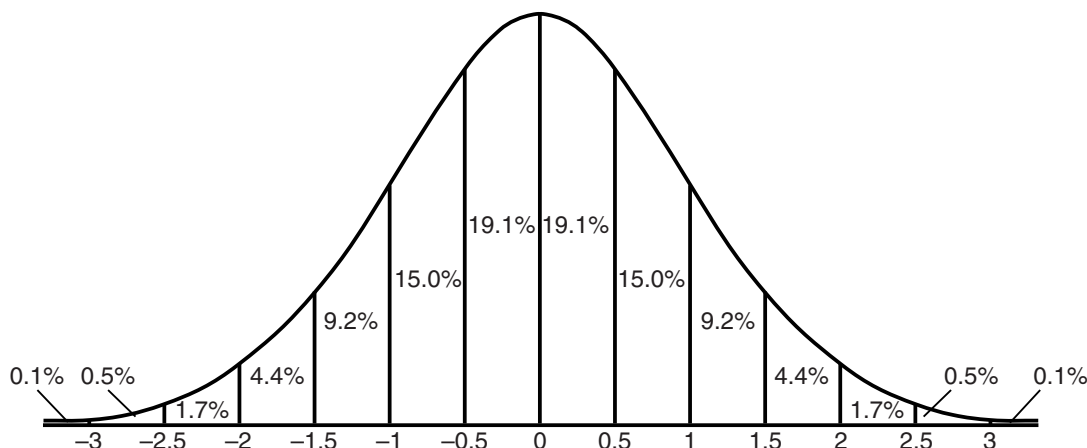
$$\cos \frac{1}{2} A = \pm \sqrt{\frac{1 + \cos A}{2}}$$

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

## Sum of a Finite Geometric Series

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

## Normal Curve Standard Deviation



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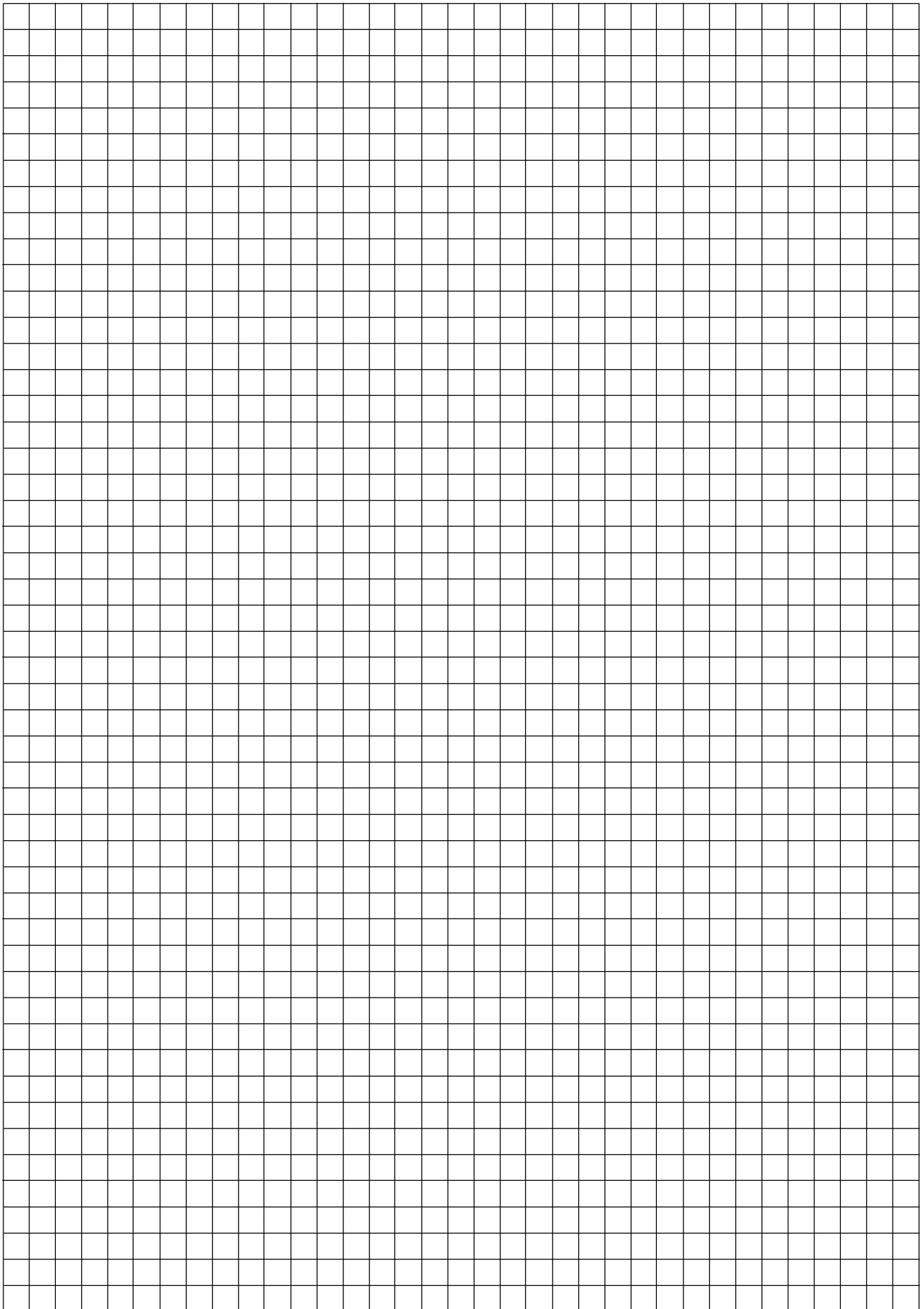
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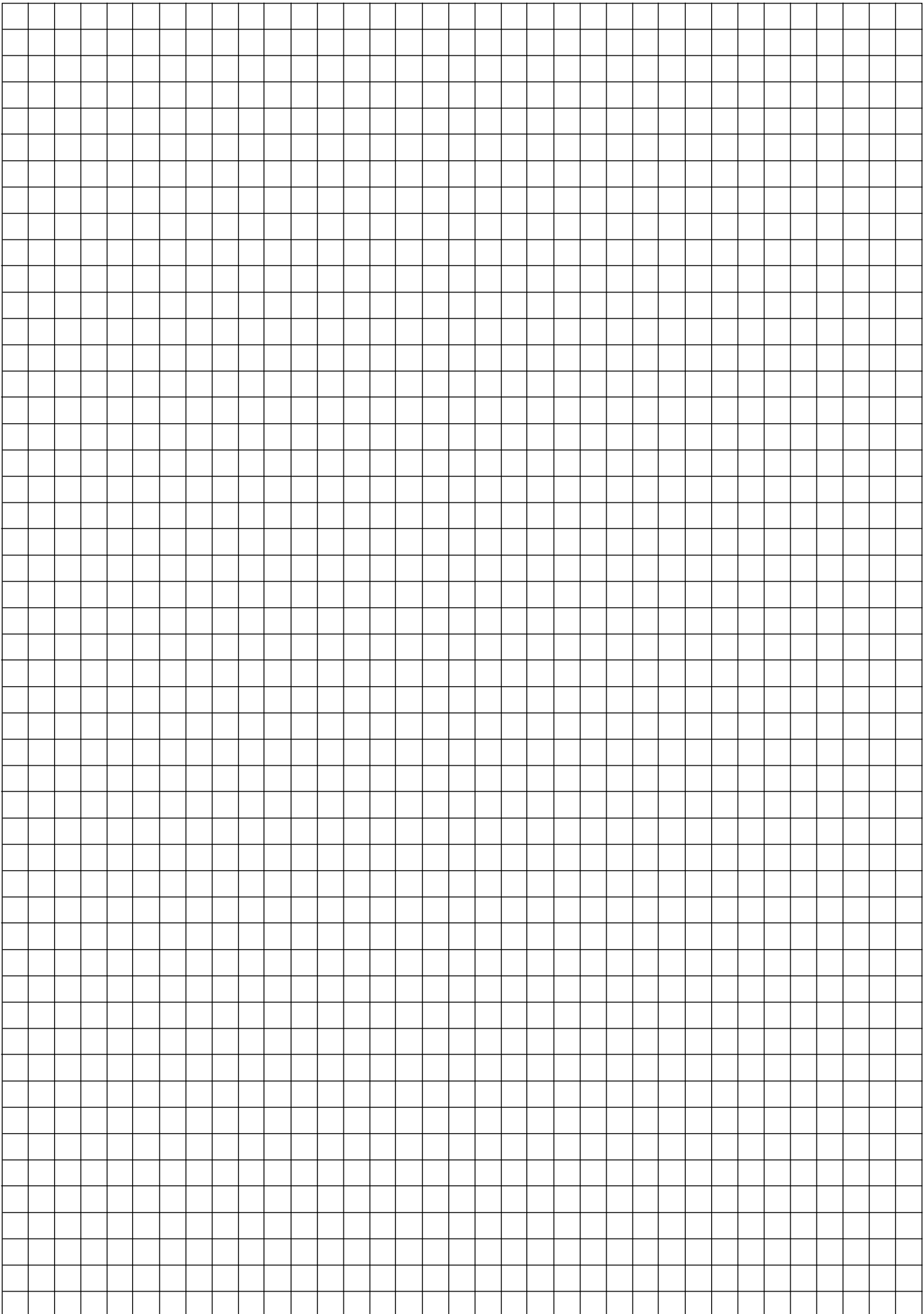
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**Scrap Graph Paper — This sheet will *not* be scored.**



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# ALGEBRA 2/TRIGONOMETRY

Printed on Recycled Paper

ALGEBRA 2/TRIGONOMETRY

# FOR TEACHERS ONLY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

## ALGEBRA 2/TRIGONOMETRY

Friday, January 29, 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, January 29, 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) . . . . . 4 . . . . .	(10) . . . . . 2 . . . . .	(19) . . . . . 3 . . . . .
(2) . . . . . 1 . . . . .	(11) . . . . . 3 . . . . .	(20) . . . . . 3 . . . . .
(3) . . . . . 4 . . . . .	(12) . . . . . 2 . . . . .	(21) . . . . . 2 . . . . .
(4) . . . . . 3 . . . . .	(13) . . . . . 2 . . . . .	(22) . . . . . 4 . . . . .
(5) . . . . . 4 . . . . .	(14) . . . . . 2 . . . . .	(23) . . . . . 1 . . . . .
(6) . . . . . 1 . . . . .	(15) . . . . . 1 . . . . .	(24) . . . . . 3 . . . . .
(7) . . . . . 4 . . . . .	(16) . . . . . 3 . . . . .	(25) . . . . . 1 . . . . .
(8) . . . . . 3 . . . . .	(17) . . . . . 2 . . . . .	(26) . . . . . 1 . . . . .
(9) . . . . . 2 . . . . .	(18) . . . . . 4 . . . . .	(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] 7.5, and correct algebraic 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] 7.5, but a method other than algebraic is used.

*or*

[1] 7.5, 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]  $(x^2 + 2)(x + 3)$ , and correct work is shown.

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

*or*

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

*or*

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

*or*

[1]  $(x^2 + 2)(x + 3)$ , 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]  $\frac{1}{3}$  or  $0.\overline{3}$  and correct algebraic 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]  $\frac{1}{3}$ , but a method other than algebraic is used.
- or**
- [1]  $\frac{1}{3}$ , 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.
- (31) [2] 1,663,200, 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]  $\frac{11!}{3!2!2!}$  is written, but no further correct work is shown.
- or**
- [1] 1,663,200, but no work is shown.
- [0] 39,916,800 is found, but no further correct work is shown.
- or**
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- (32) [2]  $-2.27$ , 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]  $-2.27$ , 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] 194, 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 substitution into the area formula is made, but no further correct work is shown.
- or**
- [1] 194, but no work is shown.
- [0]  $125^\circ$  is found, but no further correct work is shown.
- or**
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- (34) [2] Correct work is shown to prove the identity.
- [1] Appropriate work is shown, but one substitution or simplification error is made.
- or**
- [1] Appropriate work is shown, but one conceptual error is made.
- or**
- [1] All trigonometric functions are written in terms of  $\sin \theta$  and  $\cos \theta$ , but no further correct work is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- (35) [2]  $\frac{2}{3}x^3 + \frac{11}{8}x^2 - \frac{7}{9}x - \frac{2}{9}$ , 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]  $\frac{2}{3}x^3 + \frac{11}{8}x^2 - \frac{7}{9}x - \frac{2}{9}$ , 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]  $-5 \pm \sqrt{33}$ , and correct work is shown using completing the square.
- [3] Appropriate work is shown, but one computational error is made.
- or*
- [3] Appropriate work is shown, but only one root is stated.
- or*
- [3] Appropriate work is shown to find  $x + 5 = \pm\sqrt{33}$ , but no further correct work is shown.
- [2] Appropriate work is shown, but two or more computational errors are made.
- or*
- [2] Appropriate work is shown, but one conceptual error is made.
- or*
- [2] Appropriate work is shown to find  $(x + 5)^2 = 33$ , but no further correct work is shown.
- or*
- [2]  $-5 \pm \sqrt{33}$ , but the quadratic formula is used.
- [1] Appropriate work is shown, but one conceptual error and one computational error are made.
- or*
- [1]  $x^2 + 10x + 25 = 33$  is written, but no further correct work is shown.
- or*
- [1]  $-5 \pm \sqrt{33}$ , 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]  $y = 2.19(3.23)^x$  and 4.5, and correct algebraic work is shown.
- [3] Appropriate work is shown, but one computational or rounding error is made.
- or***
- [3] The expression  $2.19(3.23)^x$  is written and 4.5, and appropriate work is shown.
- or***
- [3] An incorrect exponential regression equation is written and solved appropriately.
- or***
- [3]  $y = 2.19(3.23)^x$  and 4.5, but a method other than algebraic is used or no work is shown.
- [2] Appropriate work is shown, but two or more computational or rounding errors are made.
- or***
- [2] Appropriate work is shown, but one conceptual error is made.
- or***
- [2]  $y = 2.19(3.23)^x$ , but no further correct work is shown.
- or***
- [2] The expression  $2.19(3.23)^x$  is written and 4.5, but no work is shown.
- [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or***
- [1] An incorrect exponential equation is written, but no further correct work is shown.
- or***
- [1] A regression equation other than exponential is written and solved appropriately.
- or***
- [1] The expression  $2.19(3.23)^x$  is written, but no further correct work is shown.
- or***
- [1] 4.5, 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] 0, 120, 240, and correct algebraic work is shown.
- [3] Appropriate work is shown, but one computational or factoring error is made.
- or***
- [3] Appropriate work is shown to find two of the correct values.
- [2] Appropriate work is shown, but two or more computational or factoring errors are made.
- or***
- [2] Appropriate work is shown, but one conceptual error is made.
- or***
- [2] Appropriate work is shown to find  $(2\cos x + 1)(\cos x - 1) = 0$ , but no further correct work is shown.
- or***
- [2] A correct substitution is made into the quadratic formula, but no further correct work is shown.
- or***
- [2] 0, 120, and 240, but a method other than algebraic is used.
- [1] Appropriate work is shown, but one conceptual error and one computational or factoring error are made.
- or***
- [1]  $2\cos^2 x - \cos x - 1 = 0$  is written, but no further correct work is shown.
- or***
- [1] 0, 120, 240, 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] 43.3 and 11.7, and correct work is shown.
- [5] Appropriate work is shown, but one computational or rounding error is made.
- or*
- [5] Appropriate work is shown to find 11.7 and  $BG = 16$ .
- [4] Appropriate work is shown, but two computational or rounding errors are made.
- or*
- [4] Appropriate work is shown, but one conceptual error is made.
- or*
- [4] Appropriate work is shown to find 11.7, but no further correct work is shown.
- [3] Appropriate work is shown, but three or more computational or rounding errors are made.
- or*
- [3] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or*
- [3] Appropriate work is shown to find  $m\angle C$  and/or  $m\angle D$  and  $BG = 16$ , but no further correct work is shown.
- [2] Appropriate work is shown, but one conceptual error and two or more computational or rounding errors are made.
- or*
- [2] Appropriate work is shown, but two conceptual errors are made.
- or*
- [2] Appropriate work is shown to find 43.3, but no further correct work is shown.
- or*
- [2] Appropriate work is shown to find  $m\angle C$  and/or  $m\angle D$ , but no further correct work is shown.
- or*
- [2] 43.3 and 11.7, but no work is shown.

[1]  $BG = 16$ , but no further correct work is shown.

*or*

[1] 43.3 and 11.7, 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.

---

## Map to Core Curriculum

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

### Regents Examination in Algebra 2/Trigonometry

January 2016

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

**The *Chart for Determining the Final Examination Score for the January 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, January 29, 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, January 29, 2016 — 9:15 a.m. – 12:15 p.m.

## SAMPLE RESPONSE SET

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**Question 28**

28 Solve algebraically for  $x$ :

$$\sqrt{2x + 1} + 4 = 8$$

$$\sqrt{2x + 1} = 4$$

$$2x + 1 = 16$$

$$x = 7.5$$

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

Question 28

28 Solve algebraically for x:

$$\begin{aligned} \sqrt{2x+1} + 4 &= 8 \\ \sqrt{2x+1} &= 4 \\ (\sqrt{2x+1})^2 &= (4)^2 \\ 2x+1 &= 16 \\ 2x &= 15 \\ x &= 7.5 \end{aligned}$$

$$\begin{aligned} \sqrt{2x+1} &= -16 \\ 2x+1 &= -16 \\ 2x &= -17 \\ x &= -8.5 \text{ Reject} \end{aligned}$$

**Score 1:** The student made an error by treating the square root as an absolute value.

**Question 28**

**28** Solve algebraically for  $x$ :

$$\sqrt{2x + 1} + 4 = 8$$

$$\sqrt{2x + 1} + 4 = 8$$

$$2x + 1 + 4 = 64$$

$$2x = 59$$

$$x = 29.5$$

**Score 1:** The student made an error when squaring both sides of the equation.

**Question 28**

28 Solve algebraically for  $x$ :

$$\sqrt{2x + 1} + 4 = 8$$

$$\sqrt{2x + 1} = 4$$

$$2x + 1 = 4$$

$$2x = 3$$

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

**Score 1:** The student made a conceptual error by not squaring both sides of the equation.

Question 28

28 Solve algebraically for  $x$ :

$$\sqrt{2x+1} + 4 = 8$$

$$\sqrt{2x+1} + 4 = 8$$

~~-4~~  
-4

$$(\sqrt{2x+1})^2 = (4)^2$$

$$4x^2 + 1 = 16$$

~~-1~~  
-1

$$4x^2 = 15$$

~~-4~~  
-4

$$\sqrt{x^2} = \sqrt{3.75}$$

$$x = 1.936491673$$

**Score 0:** The student made one error when squaring the radical and a second error by not stating  $\pm\sqrt{3.75}$ .

**Question 29**

**29** Factor completely:

$$x^3 + 3x^2 + 2x + 6$$

$$x^3 + 3x^2 + 2x + 6$$

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

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

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

**Question 29**

**29** Factor completely:

$$x^3 + 3x^2 + 2x + 6$$

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

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

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

**Score 1:** The student incorrectly factored  $(x^2 + 2)$ .

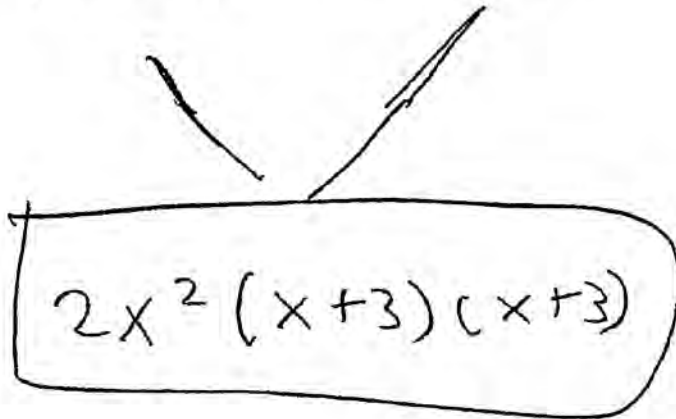


**Question 29**

**29** Factor completely:

$$x^3 + 3x^2 + 2x + 6$$

$$\begin{array}{ll} x^3 + 3x^2 & 2x + 6 \\ x^2(x + 3) & 2(x + 3) \end{array}$$


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

**Score 1:** The student made an error in factoring by grouping.

Question 29

29 Factor completely:

$$x^3 + 3x^2 + 2x + 6$$

$$\begin{aligned} & x^3 + 3x^2 + 2x + 6 \\ & \underline{x^2}(x+3) + \underline{2}(x+3) \\ & (x^2+2)(x+3) \\ & \begin{array}{l} x^2+2=0 \\ -2 \quad -2 \\ \sqrt{x^2} = \sqrt{-2} \\ x = \sqrt{-2} \end{array} \quad \begin{array}{l} x+3=0 \\ -3 \quad -3 \\ x = -3 \end{array} \end{aligned}$$

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

**Question 29**

**29** Factor completely:

$$x^3 + 3x^2 + 2x + 6$$

$$X(x^2 + 3x + 2) + 6$$

$$(x+6)(x^2 + 3x + 2) = 0$$

$$(x+6)(x+2)(x+1) = 0$$

$$X+6=0 \quad X+2=0 \quad X+1=0$$

$$X=-6 \quad X=-2 \quad X=-1$$

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

**Question 30**

**30** Solve algebraically for the *exact* value of  $x$ :

$$\log_8 16 = x + 1$$

$$8^{x+1} = 16$$

$$2^{3x+3} = 2^4$$

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

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

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

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

**Question 30**

**30** Solve algebraically for the *exact* value of  $x$ :

$$\log_8 16 = x + 1$$

$$\frac{\log 16}{\log 8} = x + 1$$

$$1.\bar{3} = x + 1$$

$$0.\bar{3} = x$$

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

**Question 30**

**30** Solve algebraically for the *exact* value of  $x$ :

$$\log_8 16 = x + 1$$

$$\begin{aligned} \sqrt[8]{16} &= x + 1 \\ \sqrt[8]{8} &= x \end{aligned}$$

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

**Question 30**

**30** Solve algebraically for the *exact* value of  $x$ :

$$\log_8 16 = x + 1$$

$$\begin{aligned}8(x+1) &= 16 \\8x + 8 &= 16 \\8x &= 8 \\x &= 1\end{aligned}$$

**Score 1:** The student made an error by not raising 8 to the power of  $(x + 1)$ .

**Question 30**

**30** Solve algebraically for the *exact* value of  $x$ :

$$\log_8 16 = x + 1$$

$$\log_8 16 = x + 1$$

$$1.204119983 = x + 1$$

-1                      -1

$$-0.204119983 = x$$

**Score 1:** The student made an error by calculating  $\log 16$ .



Question 30

30 Solve algebraically for the *exact* value of  $x$ :

$$\begin{aligned} \log_8 16 &= x + 1 \\ \log 16 &= \log 8^{(x+1)} \\ 2^4 &= (2^3)^{x-1} \\ 4 &= 3x - 3 \\ +3 & \quad +3 \\ \hline 7 &= 3x \\ \frac{7}{3} &= x \end{aligned}$$

**Score 1:** The student made a transcription error by writing  $(x - 1)$  instead of  $(x + 1)$ .

**Question 30**

**30** Solve algebraically for the *exact* value of  $x$ :

$$\log_8 16 = x + 1$$

$$16(x+1) = 8$$

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

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

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

Question 31

31 Determine how many eleven-letter arrangements can be formed from the word  
"CATARAUGUS."

~~CATARAUGUS.~~

3 A'S

2 T'S

2 U'S

11!

$$\frac{11!}{3! 2! 2!}$$

1663200

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

### Question 31

31 Determine how many eleven-letter arrangements can be formed from the word "CATTARAUGUS."

$$\frac{11!}{3 \cdot 2 \cdot 2 \cdot 2} = 1,663,200$$

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

**Question 31**

**31** Determine how many eleven-letter arrangements can be formed from the word "CATTARAUGUS."

$$\frac{11!}{3 \cdot 2 \cdot 2} = 3,326,400$$

**Score 1:** The student divided by an incorrect denominator.

**Question 31**

**31** Determine how many eleven-letter arrangements can be formed from the word "CATTARAUGUS."

$$\frac{11!}{3! + 2! + 2!}$$

$$\frac{11!}{10}$$

3,991,680

**Score 1:** The student added in the denominator instead of multiplying.

**Question 31**

**31** Determine how many eleven-letter arrangements can be formed from the word "CATTARAUGUS."

$$11! = 39,916,800$$

**Score 0:** The student only evaluated  $11!$ .

Question 32

32 Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

$$\frac{-130^\circ}{1} \cdot \frac{\pi}{180^\circ} = -\frac{13\pi}{18} = \boxed{-2.27}$$

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



**Question 32**

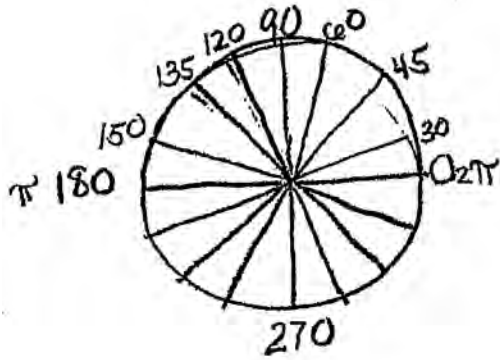
**32** Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

$-130^\circ$  in calculator  
Switch to radian mode  
 $-2.27$

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

Question 32

32 Express  $-130^\circ$  in radian measure, to the nearest hundredth.



$$\frac{-130}{180} \quad \frac{-13}{18}$$

-0.72

**Score 1:** The student did not include  $\pi$  in the formula.

**Question 32**

**32** Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

$$\pi - 180^\circ$$

$$\times - (130)$$

$$-130^\circ/\pi = 180^\circ/\pi$$

$$\boxed{-0.72 \pi}$$

**Score 1:** The student did not express the answer to the nearest hundredth.

**Question 32**

**32** Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

$$130 \cdot \left(\frac{1}{180}\right) = \frac{13}{18}$$

$-13\pi$
$18$

**Score 1:** The student did not express the answer to the nearest hundredth.

**Question 32**

**32** Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

$$\begin{aligned} -130 \cdot \frac{\pi}{180} &= \frac{-130\pi}{180} = \frac{-13\pi}{18} = \\ &= -2.27\pi \end{aligned}$$

**Score 1:** The student incorrectly included  $\pi$  in the final answer.

**Question 32**

**32** Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

$$-130^\circ \cdot \frac{\pi}{180^\circ} = \frac{-130\pi}{180} = \frac{-13}{18}\pi \approx .72\pi$$

**Score 0:** The student made an error when dividing  $-13$  by  $18$  and did not express the answer to the nearest hundredth.

Question 32

32 Express  $-130^\circ$  in radian measure, to the *nearest hundredth*.

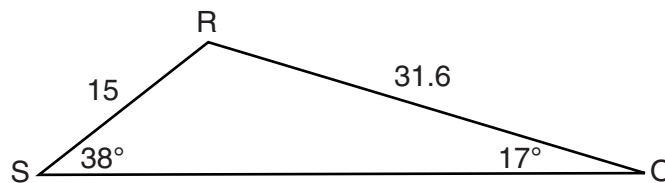
$$-130 \cdot \frac{180}{\pi}$$

$$\frac{-23400}{\pi} = -7442.451337$$

**Score 0:** The student used the wrong conversion and did not round to the nearest hundredth.

Question 33

33 Determine the area, to the nearest integer, of  $\triangle SRO$  shown below.



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

$$K = \frac{1}{2} (15)(31.6) \sin 125$$

$$K = 194.1390345$$

$$K = 194$$

$$\begin{array}{r} 38 \\ + 17 \\ \hline \end{array}$$

$$55$$

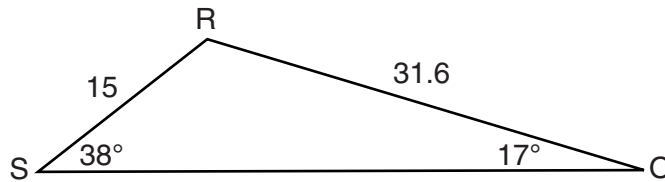
$$\begin{array}{r} 180 \\ - 55 \\ \hline 125 \end{array}$$

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



Question 33

33 Determine the area, to the nearest integer, of  $\triangle SRO$  shown below.



$$180 - (38 + 17) = 125$$

$$A = 15(31.6) \sin 125$$

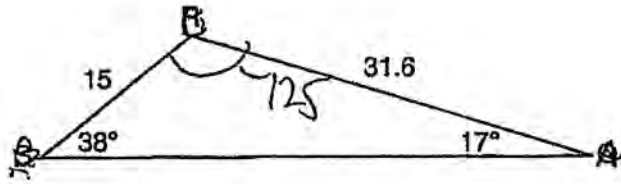
$$388.278069$$

$$A \approx 388$$

**Score 1:** The student did not divide by 2.

Question 33

33 Determine the area, to the nearest integer, of  $\triangle SRO$  shown below.



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

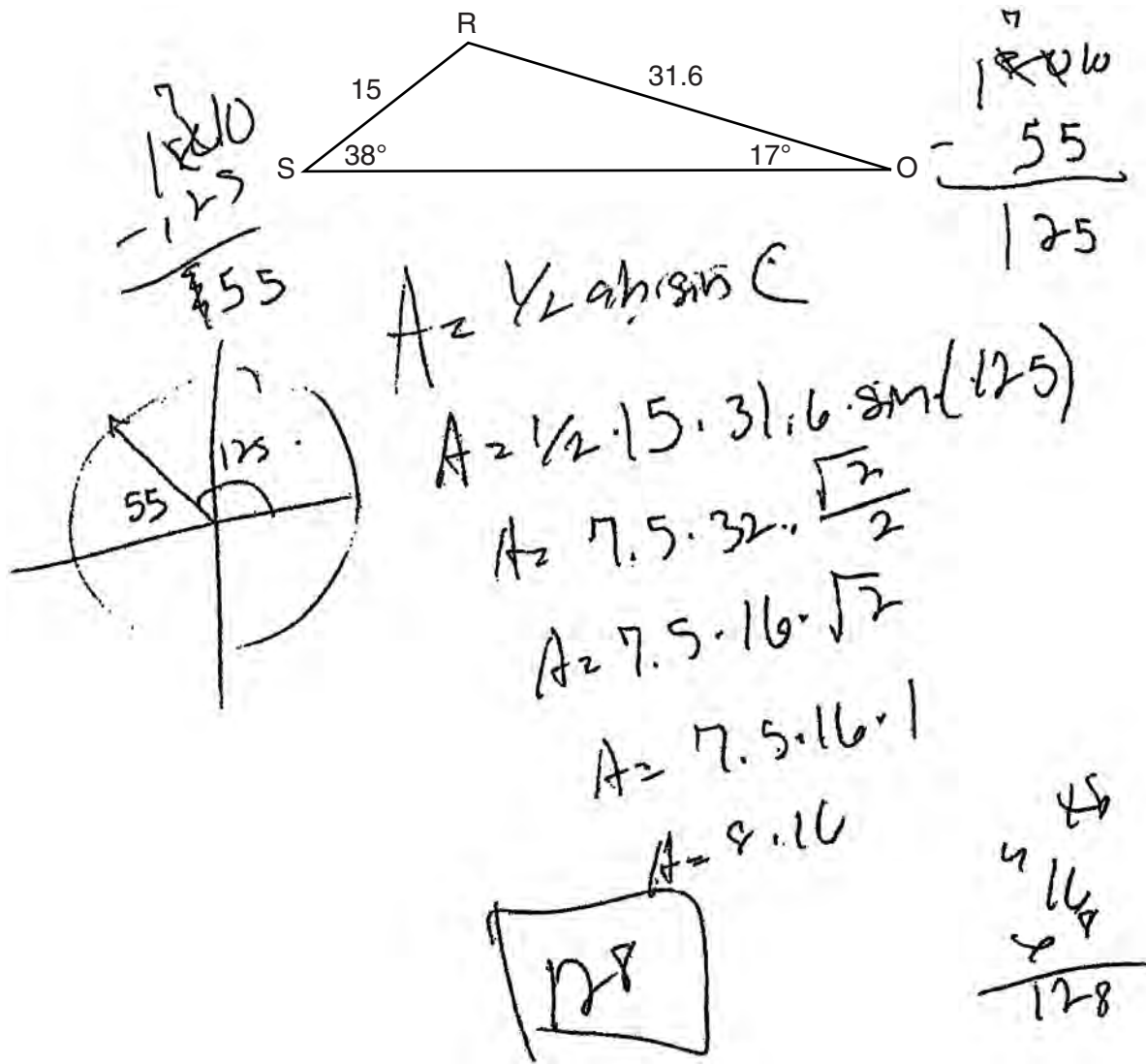
$$\frac{1}{2} (15)(31.6) \sin(125)$$

$$K = 194.13$$

**Score 1:** The student did not round to the nearest integer.

Question 33

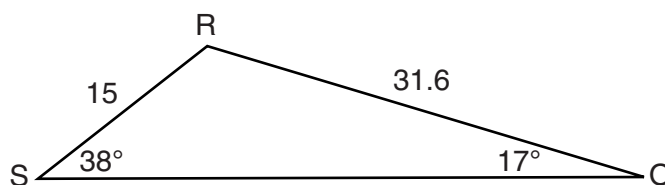
33 Determine the area, to the nearest integer, of  $\triangle SRO$  shown below.



**Score 1:** The student substituted correctly into the area formula.

**Question 33**

**33** Determine the area, to the *nearest integer*, of  $\triangle SRO$  shown below.

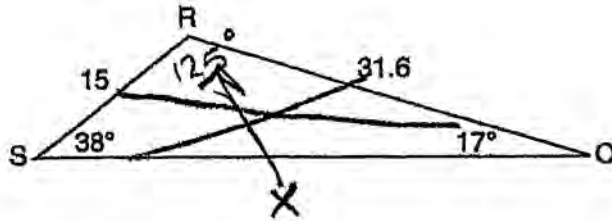


$$\begin{aligned} A &= \frac{1}{2}bh \\ &= \frac{1}{2} \times 15 \times 31.6 \\ &= 237 \end{aligned}$$

**Score 0:** The student used the incorrect formula.

Question 33

33 Determine the area, to the nearest integer, of  $\triangle SRO$  shown below.



$$\frac{X}{\sin 125^\circ} = \frac{31.6}{\sin 38^\circ}$$

$$25.885 =$$

$$42.0445$$

42

Score 0: The student wrote irrelevant work.

### Question 34

34 Prove that the equation shown below is an identity for all values for which the functions are defined:

$$\csc \theta \cdot \sin^2 \theta \cdot \cot \theta = \cos \theta$$

$$\frac{1}{\cancel{\sin \theta}} \cdot \cancel{\sin^2 \theta} \cdot \frac{\cos \theta}{\cancel{\sin \theta}} = \cos \theta$$

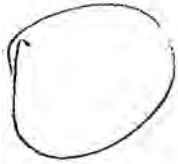
$$\cos \theta = \cos \theta$$

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

### Question 34

34 Prove that the equation shown below is an identity for all values for which the functions are defined:

$$\csc \theta \cdot \sin^2 \theta \cdot \cot \theta = \cos \theta$$



$$\frac{1}{\sin 30} \sin^2 30 \frac{1}{\tan 30} = \cos 30$$

$$(2)(.25)(.132050808) = .8660254038$$

$$(.5)(.132) = .066$$

$$.066 = .066$$

**Score 1:** The student did not prove the equation works for all values of  $\theta$ .

### Question 34

34 Prove that the equation shown below is an identity for all values for which the functions are defined:

$$\csc \theta \cdot \sin^2 \theta \cdot \cot \theta = \cos \theta$$

$$\frac{1}{\sin \theta} \cdot (\cancel{1 - \cos^2 \theta}) \cdot \frac{\cos \theta}{\sin \theta}$$

**Score 1:** The student wrote all the trigonometric functions in terms of  $\sin \theta$  and  $\cos \theta$ , but showed no further correct work.



### Question 34

34 Prove that the equation shown below is an identity for all values for which the functions are defined:

$$\begin{aligned} \cancel{\csc \theta} \cdot \sin^2 \theta \cdot \cot \theta &= \cos \theta \\ \left(\frac{1}{\sin \theta}\right)(\sin^2 \theta)\left(\frac{\sin \theta}{\cos \theta}\right) &= \cos \theta \\ \sin^2 \theta + \cos^2 \theta &= 1 \end{aligned}$$

**Score 0:** The student did not substitute for  $\cot \theta$  correctly and showed no further correct work.

**Question 35**

35 Find the difference when  $\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x$  is subtracted from  $2x^3 + \frac{3}{4}x^2 - \frac{2}{9}$ .

$$\begin{array}{r} (2x^3 + \frac{3}{4}x^2 - \frac{2}{9}) \\ - (\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x) \\ \hline \frac{2}{3}x^3 + \frac{11}{8}x^2 - \frac{7}{9}x - \frac{2}{9} \end{array}$$

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

Question 35

35 Find the difference when  $\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x$  is subtracted from  $2x^3 + \frac{3}{4}x^2 - \frac{2}{9}$ .

$$2x^3 + \frac{3}{4}x^2 - \frac{2}{9} - \left( \frac{4}{3}x^3 + \frac{5}{8}x^2 - \frac{7}{9}x \right)$$

$$\frac{2}{3}x^3 + \frac{11}{8}x^2 - \frac{7}{9}x - \frac{2}{9}$$

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

Question 35

35 Find the difference when  $\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x$  is subtracted from  $2x^3 + \frac{3}{4}x^2 - \frac{2}{9}$ .

$$\left(2x^3 + \frac{3}{4}x^2 - \frac{2}{9}\right) - \left(\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}\right)$$

$$\cancel{2x^3} + \cancel{\frac{3}{4}x^2} - \cancel{\frac{2}{9}} - \cancel{\frac{4}{3}x^3} + \cancel{\frac{5}{8}x^2} - \cancel{\frac{7}{9}}$$

$$\frac{2}{3}x^3 + \frac{11}{8}x^2 - 1$$

**Score 1:** The student made a transcription error by not writing  $-\frac{7}{9}x$ .

Question 35

35 Find the difference when  $\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x$  is subtracted from  $2x^3 + \frac{3}{4}x^2 - \frac{2}{9}$ .

$$\left(\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x\right) - \left(2x^3 + \frac{3}{4}x^2 - \frac{2}{9}\right)$$

$$\left(\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x\right) - 2x^3 - \frac{3}{4}x^2 + \frac{2}{9}$$

$$-\frac{5}{8}x^2 - \frac{6}{8}x^2 = -\frac{11}{8}x^2$$

$$-\frac{2}{3}x^3 - \frac{11}{8}x^2 + \frac{7}{9}x + \frac{2}{9}$$

**Score 1:** The student subtracted in the wrong order.

Question 35

35 Find the difference when  $\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x$  is subtracted from  $2x^3 + \frac{3}{4}x^2 - \frac{2}{9}$ .

$$\begin{array}{r} 2x^3 + \frac{3}{4}x^2 - \frac{2}{9} \\ - \frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x \end{array}$$

$$\frac{2}{3}x^3 + \frac{1}{8}x^2 + \frac{7}{9}x - \frac{2}{9}$$

**Score 1:** The student did not distribute the negative.

Question 35

35 Find the difference when  $\frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x$  is subtracted from  $2x^3 + \frac{3}{4}x^2 - \frac{2}{9}$ .

$$\begin{array}{r} 2x^3 + \frac{3}{4}x^2 - \frac{2}{9} \\ - \frac{4}{3}x^3 - \frac{5}{8}x^2 + \frac{7}{9}x \\ \hline \frac{2}{3}x^3 - \frac{5}{8}x^2 + \frac{5}{9}x \end{array}$$

**Score 0:** The student did not distribute the negative and combined unlike terms.

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$(x^2 + 10x + 25) - 8 = 0$$

$$(x + 5)^2 - 33 = 0$$

$$(x + 5)^2 = 33$$

$$x + 5 = \pm \sqrt{33}$$

$$x = -5 \pm \sqrt{33}$$

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



Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$x^2 + 10x = 8$$

$$x^2 + 10x + 25 = 8 + 25$$

$$(x + 5)^2 = 33$$

$$x + 5 = \pm\sqrt{33}$$

$$x = -5 \pm\sqrt{33}$$

$$x = -5 \pm 5.744562647$$

**Score 3:** The student did not give the exact values of  $x$  as the final answer.

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$\begin{aligned}x^2 + 10x - 8 &= 0 \\ &\quad +8 \quad +8 \\ \hline x^2 + 10x &= 8 \\ x^2 + 10x + 25 &= 8 + 25 \\ (x + 5)^2 &= 33 \\ \sqrt{(x + 5)^2} &= \sqrt{33} \\ x + 5 &= \sqrt{33} \\ x &= \sqrt{33} - 5\end{aligned}$$

**Score 3:** The student did not write  $\pm\sqrt{33}$ .

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$x^2 + 10x = 8$$

$$x^2 + 10x + 25 = 8 - 25$$

$$(x + 5)^2 = -17$$

$$x + 5 = \pm \sqrt{-17}$$

$$x = -5 \pm i\sqrt{17}$$

**Score 2:** The student made a conceptual error by adding 25 to the left and subtracting 25 from the right.

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$x^2 + 10x - 8 = 0$$

$$a = 1 \quad b = 10 \quad c = -8$$

$$x = \frac{-10 \pm \sqrt{100 - (-32)}}{2}$$

$$x = \frac{-10 \pm \sqrt{132}}{2}$$

$$x = \frac{-10 \pm 2\sqrt{33}}{2}$$

$$x = -5 \pm \sqrt{33}$$

**Score 2:** The student used the quadratic formula to solve for  $x$ .

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$x^2 + 10x - 8 = 0$$

$$x^2 + 10x + 100 = 8 + 100$$

$$(x + 10)^2 = 108$$

$$x + 10 = \sqrt{108}$$

$$x = -10 + \sqrt{108}$$

$$x = -10 + 6\sqrt{3}$$

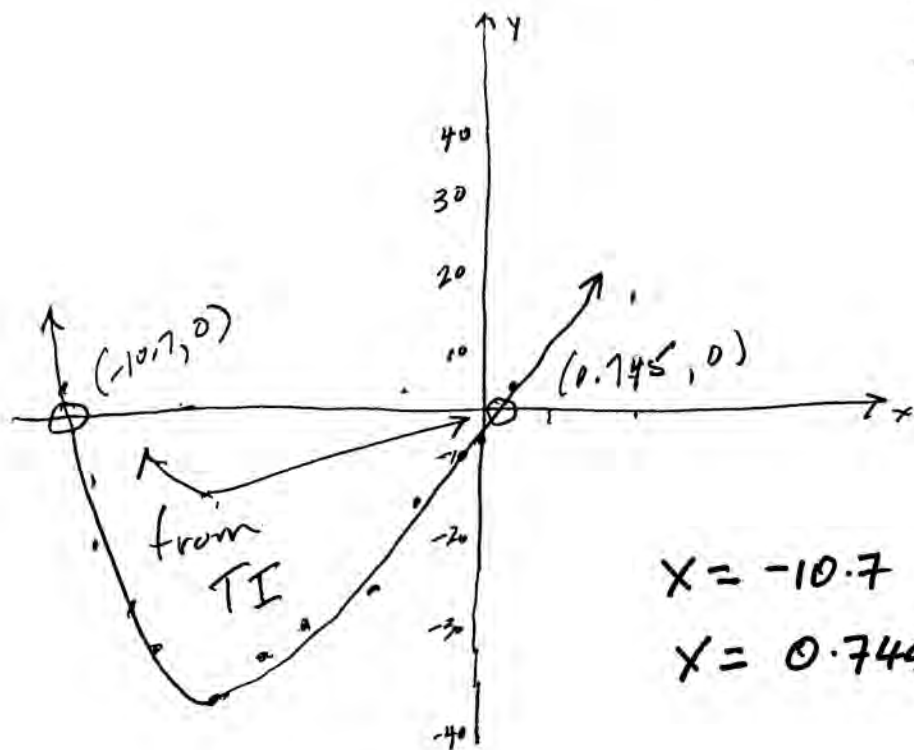
**Score 1:** The student made a conceptual error in completing the square by adding 100 to both sides and not writing  $\pm\sqrt{108}$ .

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$y_1 = x^2 + 10x - 8$$

x	y	
-2	-24	
-1	-17	FROM
0	-8	TABLE
1	3	
2	16	



**Score 1:** The student used a method other than completing the square and did not give exact values of  $x$ .

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$a = 1 \quad b = 10 \quad c = -8$$

$$x = \frac{-10 \pm \sqrt{10^2 - 4(1)(-8)}}{2(1)}$$

$$x = \frac{-10 \pm \sqrt{132}}{2}$$

$$x = .7445626465$$

$$x = -10.74456265$$

**Score 1:** The student used the quadratic formula and did not give the exact value of  $x$ .

Question 36

36 Find the exact roots of  $x^2 + 10x - 8 = 0$  by completing the square.

$$\begin{aligned}x^2 + 10x &= 8 \\x^2 + 10x + 25 &= 8 \\(x+5)(x+5) &= 8 \\(x+5)^2 &= 8^2 \\(x+5)^2 &= 64 \\(x+5)^2 - 64 &= 0\end{aligned}$$

**Score 0:** The student made a conceptual error by not adding 25 to both sides of the equation and another conceptual error by squaring the 8. The student also did not solve for  $x$ .



**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

$$y = 2.19 \cdot (3.23)^x$$

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth.  
[Only an algebraic solution can receive full credit.]

$$426.21 = 2.19 \cdot (3.23)^x$$

$$194.62 = 3.23^x$$

$$\log_{3.23} 194.62 = x$$

$$x = 4.5$$

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

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth.  
[Only an algebraic solution can receive full credit.]

$$y = a(B^{bx})$$
$$a = 2.19$$
$$B = 3.23$$
$$426.21 = 2.19(3.23^{bx})$$
$$194.6164384 = 3.23^{bx}$$
$$\log 194.6164384 = bx \log 3.23$$
$$x = 4.495617009$$
$$x = 4.5$$

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

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth.  
[Only an algebraic solution can receive full credit.]

$$y = ab^x$$
$$a = 8.26$$
$$b = 2.32$$

$$\frac{426.21}{8.26} = \frac{8.26}{8.26} \cdot 2.32^x$$

$$51.599 = 2.32^x$$

$$\frac{\log 51.599}{\log 2.32} = \frac{x \cdot \log 2.32}{\log 2.32}$$

$$x = 4.6859$$

$$\boxed{x = 4.7}$$

**Score 3:** The student solved an incorrect exponential regression equation appropriately.

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

$$y = 2.19 (3.23)^x$$

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth. [Only an algebraic solution can receive full credit.]

$$426.21 = 2.19 (3.23)^x$$

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

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

$$y = ab^x \quad a \approx 2.19 \quad b \approx 3.23 \quad y = 2.19 \times 3.23^x$$

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth. [Only an algebraic solution can receive full credit.]

$$426.21 = 2.19(3.23)^x$$

$$\log 426.21 = \log 2.19(3.23)^x$$

$$\log 426.21 = x \log 2.19(3.23)$$

$$\frac{\log 426.21}{\log 2.19(3.23)} = x$$

$$3.1 \approx x$$

**Score 2:** The student wrote a correct exponential regression equation, but made a conceptual error by not applying the product rule.

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth. [Only an algebraic solution can receive full credit.]

nearest hundredth

$$y = ab^x$$

$$y = (2.19)(3.23)^x$$

$$426.21 = (2.19)(3.23)^x$$

$$\frac{426.21}{2.19} = \frac{(2.19)(3.23)^x}{2.19}$$

$$194.62 = 3.23^x$$

$$\frac{\log 194.62}{\log 3.23} = \frac{x \log 3.23}{\log 3.23}$$

$$5.2 = x$$

**Score 2:** The student wrote a correct exponential regression equation, but made a conceptual error by subtracting 2.19 instead of dividing.

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

$$y = a \cdot b^x \quad y = .71(4.05)^x$$

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth.  
[Only an algebraic solution can receive full credit.]

$$\frac{426.21}{.71} = \frac{.71(4.05)^x}{.71}$$

$$606.2957746 = (4.05)^x$$

$$\frac{\ln 606.2957746}{\ln 4.05} = \frac{x \ln 4.05}{\ln 4.05}$$

$$x = 4.573779424$$

$$x = 4.57$$

**Score 2:** The student solved an incorrect exponential regression equation appropriately, but did not round 4.57 to the nearest tenth.

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the *nearest hundredth*.

$$y = 8.26 (2.32)^x$$

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the *nearest tenth*.  
[Only an algebraic solution can receive full credit.]

**Score 1:** The student wrote an incorrect exponential regression equation.



**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth.  
[Only an algebraic solution can receive full credit.]

$$y = a \cdot b^x$$

$$a = 8.26$$

$$b = 2.32$$

$$\frac{426.21}{8.26} = \frac{8.26 \cdot 2.32^x}{8.26}$$

$$\frac{51.6}{2.32} = \frac{2.32^x}{2.32}$$

$$22.2$$

**Score 1:** The student solved an incorrect exponential equation, but made a conceptual error by dividing by 2.32.

**Question 37**

37 The table below gives the relationship between  $x$  and  $y$ .

<b>x</b>	1	2	3	4	5
<b>y</b>	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for  $y$  as a function of  $x$ , rounding all values to the nearest hundredth.

Using this equation, predict the value of  $x$  if  $y$  is 426.21, rounding to the nearest tenth. [Only an algebraic solution can receive full credit.]

4.2

$$y = ax^2 + bx + c$$

$$426.21 = 37.7x^2 + -98.86x + 70.38$$

$$\bar{x} = 3$$

$$355.83 = 37.7x^2 + -98.86$$

$$Sx = 1.58113883$$

$$\theta x = 1.414213562$$

$$Sy = 213.485842x$$

$$\theta y = 190.9475425$$

**Score 0:** The student wrote completely incorrect work.

Question 38

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

$$\int \cos^2 x - 1 = \cos x$$

$$\int \cos^2 x - \cos x - 1 = 0$$

$$a = 2 \quad b = -1 \quad c = -1$$

$$\cos x = \frac{1 \pm \sqrt{1 - (-8)}}{4} = \frac{1 \pm \sqrt{9}}{4}$$

$$\cos x = \frac{1 \pm 3}{4}$$

$$\cos x = \frac{1+3}{4} = 1$$

$$x = \arccos(1)$$

$$x = 0$$

$$\cos x = \frac{1-3}{4} = -\frac{1}{2}$$

$$\text{Q II, III; } 60$$

$$x = \arccos\left(-\frac{1}{2}\right)$$

$$x = 120, 240$$

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

Question 38

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

$$\cos 2x = \cos x$$

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

$$2\cos^2 x - \cos x - 1 = 0$$

$$(2\cos x + 1)(\cos x - 1) = 0$$

$$\cos x = -\frac{1}{2} \quad \cos x = 1$$

$$x = 120 \\ 240$$

$$0$$

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

Question 38

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

$$\begin{aligned}\cos 2x &= \cos x \\ 2\cos^2 x - 1 &= \cos x \\ 2\cos^2 x - \cos x - 1 &= 0 \\ (2\cos x - 1)(\cos x + 1) &= 0 \\ \left. \begin{aligned} 2\cos x - 1 &= 0 \\ \cos x &= \frac{1}{2} \end{aligned} \right\} \begin{aligned} \cos x + 1 &= 0 \\ \cos x &= -1 \end{aligned} \\ x &= 60^\circ \text{ and } 300^\circ & x &= 180^\circ \\ \boxed{x = 60^\circ, 180^\circ, 300^\circ} \end{aligned}$$

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

Question 38

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

$$\cos 2x = \cos x$$

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

$$2 \cos^2 x - \cos x - 1 = 0$$

$$(2 \cos x + 1)(\cos x - 1) = 0$$

$$\begin{array}{l|l} 2 \cos x + 1 = 0 & \cos x - 1 = 0 \\ \cos x = -\frac{1}{2} & \cos x = 1 \end{array}$$

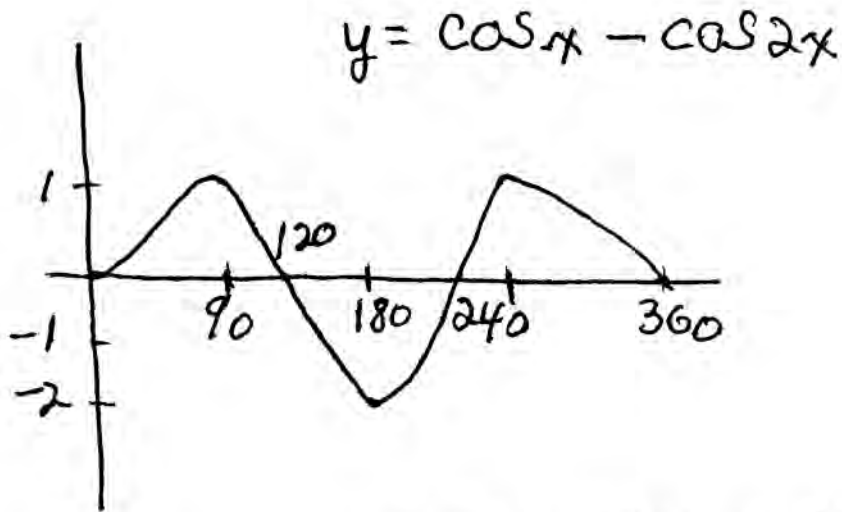
$$x = 120^\circ \text{ ; } 240^\circ$$

$$x = 0^\circ \text{ ; } 360^\circ$$

**Score 3:** The student stated a value that is not included in the domain.

Question 38

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



$x = 0, 120, 240$

**Score 2:** The student used a method other than algebraic.

Question 38

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

$$\begin{array}{r} \cos 2x = \cos x \\ -\cos x \quad -\cos x \end{array}$$

$$\cos x = 0$$

$$x = \cos^{-1}(0)$$

$$= \underline{90^\circ, 270^\circ}$$

**Score 2:** The student made a conceptual error by subtracting  $\cos x$ .



Question 38

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

$$2 \sin x \cos x - \cos x = 0$$

$$\cos x (2 \sin x - 1) = 0$$

$$\cos x = 0$$

$$\sin x = \frac{1}{2}$$

$$x = 30^\circ \text{ I, II}$$

$$30, 150, 270$$

**Score 1:** The student made a conceptual error by using the formula for  $\sin 2x$  and did not find all values of  $x$ .

Question 38

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

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

$$\cos^2 x = \cos x$$

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

$$\cos x (\cos x - 1) = 0$$

$$\begin{array}{l|l} \cos x = 0 & \cos x - 1 = 0 \\ x = 90^\circ & \cos x = 1 \\ & x = 0^\circ \end{array}$$

$$x = 0^\circ, 90^\circ$$

**Score 1:** The student made a conceptual error when replacing  $1 - 2\sin^2 x$  with  $\cos^2 x$  and did not find all the values of  $x$ .

Question 38

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

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

$$2 \sin x = 1$$

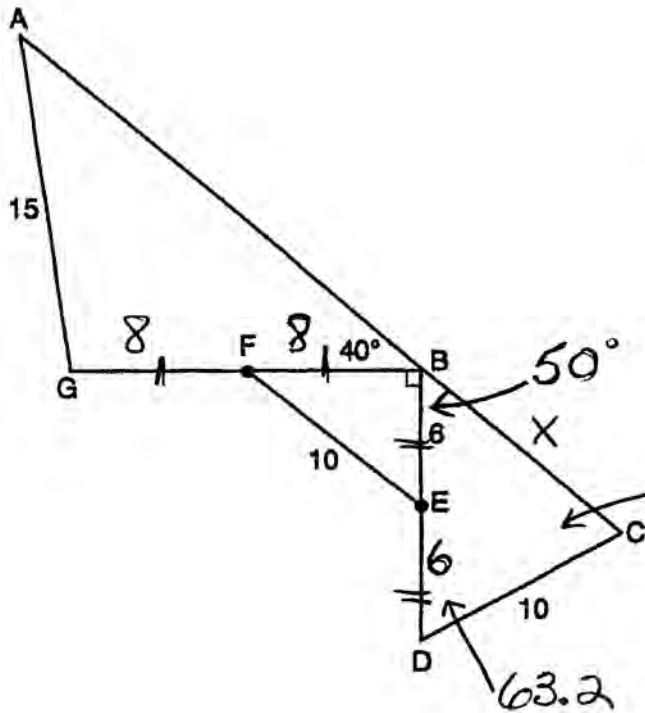
$$\sin x = \frac{1}{2}$$

$$x = 30$$

**Score 0:** The student made conceptual errors by using an incorrect substitution for  $\cos 2x$  and then dividing both sides by  $\cos x$ . The student did not find all values of  $x$ .

Question 39

- 39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$\frac{10}{\sin 50} = \frac{12}{\sin C}$$

$$\sin C = .91925$$

$$C = 66.8$$

$$\frac{X}{\sin 63.2} = \frac{12}{\sin 66.8}$$

$$X = 11.65$$

$$X = 11.7$$

Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

$$\frac{16}{\sin A} = \frac{15}{\sin 40}$$

$$\sin A = .6856$$

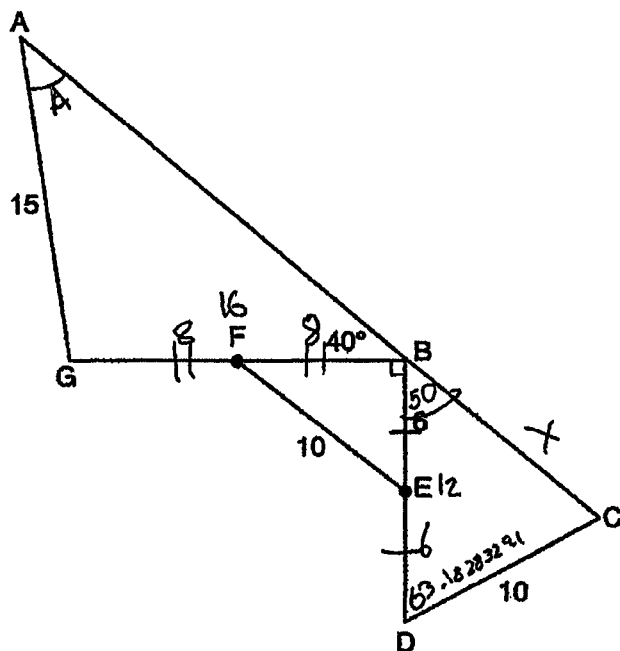
$$A = 43.28$$

$$A = 43.3$$

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

Question 39

- 39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$10^2 = 6^2 + x^2$$

$$100 = 36 + x^2$$

$$x = 8$$

$$\frac{15}{\sin 40} = \frac{16}{\sin A}$$

$$m\angle A = 43.3^\circ$$

$$\frac{10}{\sin 50} = \frac{12}{\sin C}$$

$$\frac{10}{\sin 50} = \frac{x}{\sin 63.18283291}$$

$$\overline{BC} = 11.7$$

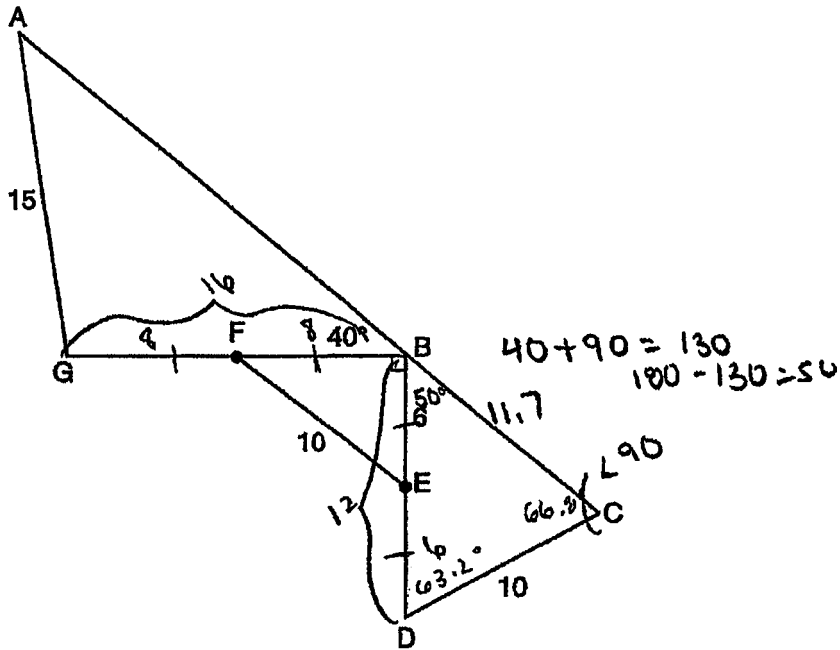
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

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

Question 39

- 39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

$$\frac{15}{\sin 40^\circ} = \frac{16}{\sin x}$$

$$x = 43.2$$

$$m\angle A = 43.2^\circ$$

$$\frac{10}{\sin 50^\circ} = \frac{12}{\sin C} = 66.8^\circ$$

$$180 - 66.8 - 50 = 63.2^\circ = m\angle D$$

$$\frac{x}{\sin 63.2} = \frac{10}{\sin 50^\circ}$$

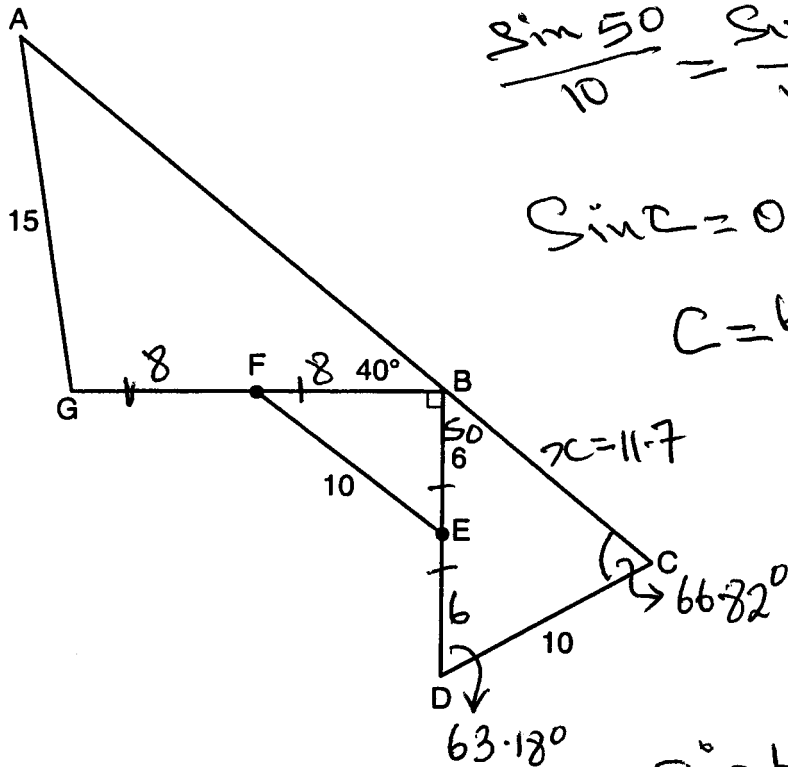
$$x = 11.7$$

$$\boxed{BC = 11.7}$$

**Score 5:** The student made one rounding error in  $m\angle A$ .

Question 39

- 39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$\frac{\sin 50}{10} = \frac{\sin C}{12}$$

$$\sin C = 0.919253333$$

$$C = 66.817^\circ$$

$$x = 11.7$$

$$C = 66.82^\circ$$

$$63.18^\circ$$

$$\frac{\sin 63.18}{x} = \frac{\sin 50}{10}$$

$$x = 11.65$$

$$11.7$$

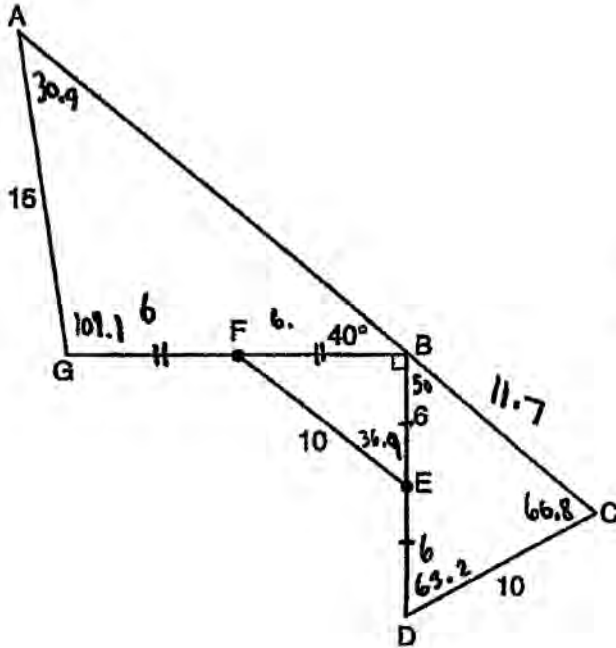
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

**Score 5:** The student showed appropriate work to find 11.7 and found  $BC$  to be 16.

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$\frac{15}{\sin 40} = \frac{12}{\sin x}$$

$$\frac{x}{\sin 101.1} = \frac{15}{\sin 40}$$

Find  $m\angle A$  to the nearest tenth.

$BC = 11.7$

Find  $BC$  to the nearest tenth.

$$\frac{10}{\sin 50} = \frac{12}{\sin x} \quad \frac{x}{\sin 63.2} = \frac{10}{\sin 50}$$

$m\angle A = 30.9$

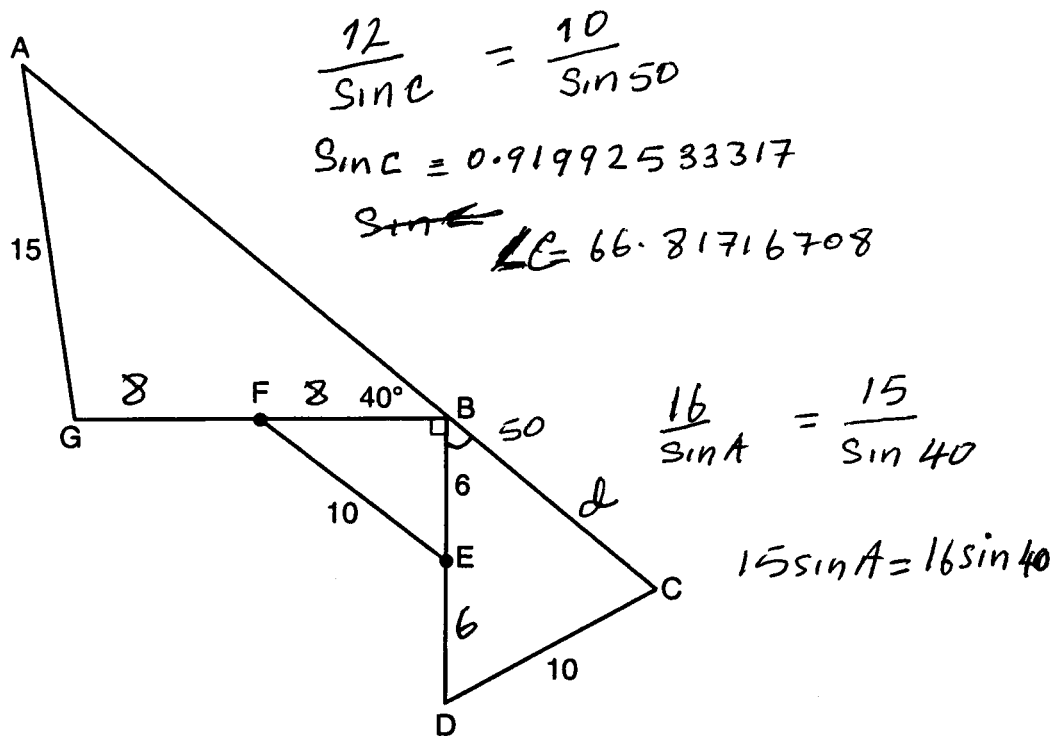
$$\frac{10}{\sin 90} = \frac{6}{\sin x}$$

Score 4: The student made one conceptual error by assuming  $\overline{GF}$  and  $\overline{FB}$  are congruent to  $\overline{BE}$ .



Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



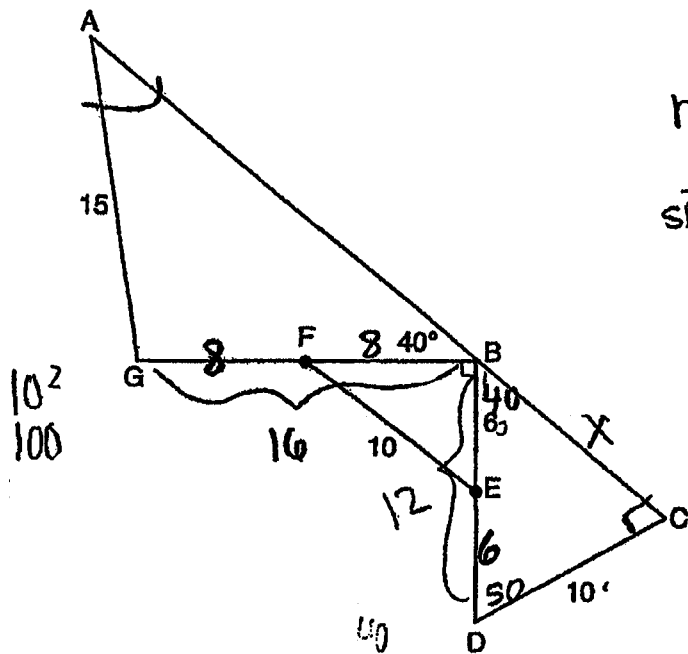
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

**Score 4:** The student found  $\angle C$  correctly, and  $BG = 16$  but made a computational error when evaluating  $\sin A$ .

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$m\angle A =$$

$$\frac{16}{\sin A} = \frac{15}{\sin 40}$$

$$\frac{15 \sin A}{15} = \frac{16 \sin 40}{15}$$



Q: I, ~~B~~  
 R: 43.28596  
θ: 43.3

$$180 - (40 + 90)$$

$$= 50$$

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

$$d = 10^2 + 12^2 - 2(10)(12) \cos 50$$

$$d = 89.730976$$

$$d = 89.7$$

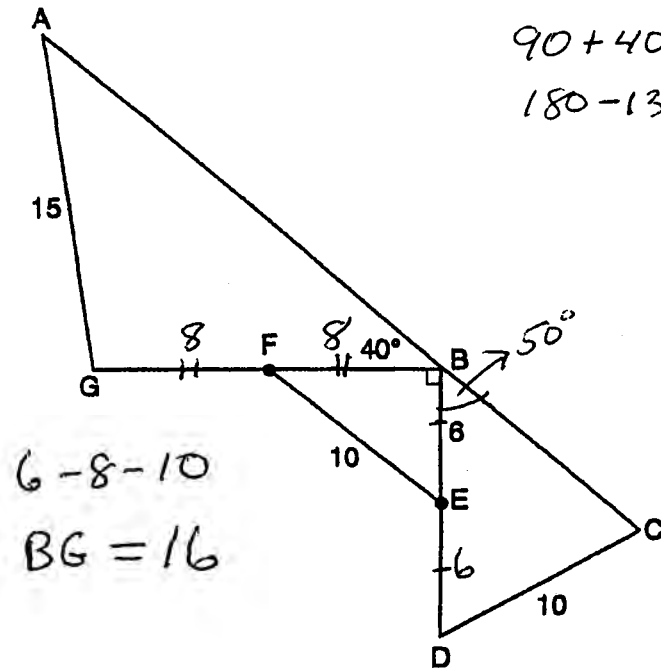
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

**Score 3:** The student correctly found  $\angle A$  and the student found  $BC$ .

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



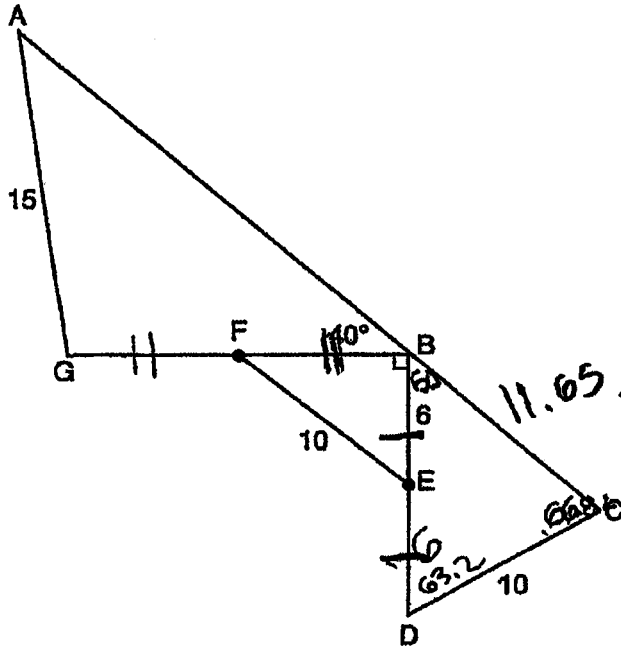
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

**Score 3:** The student found  $m\angle C$  and  $BG$ , but showed no further work.

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$\frac{x}{\sin 63.2} = \frac{10}{\sin 50}$$

$$\frac{\sin 50}{\sin 63.2} = \frac{10 \sin 63.2}{\sin 50}$$

$$11.65 \frac{10}{\sin 50} = \frac{12}{\sin \theta}$$

$$\frac{10 \sin \theta}{10} = \frac{12 \sin 50}{10}$$

$$\theta = 66.82$$

Find  $m\angle A$  to the nearest tenth.

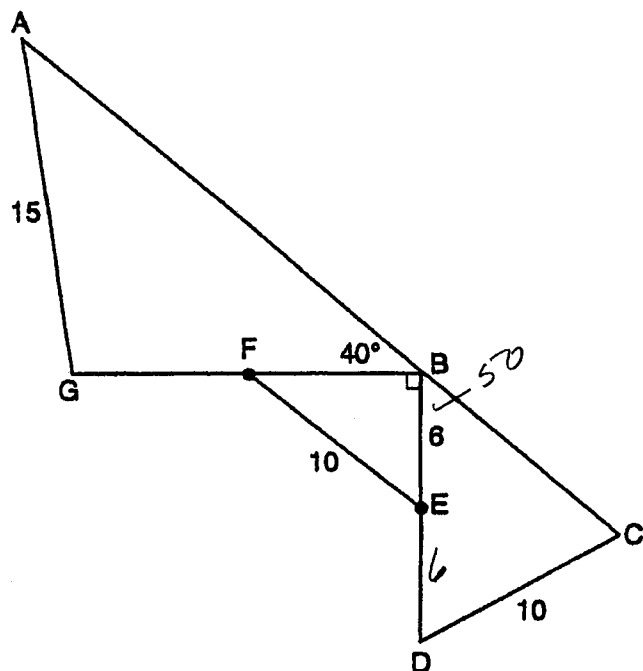
$$BC = 11.65$$

Find  $BC$  to the nearest tenth.

**Score 3:** The student showed appropriate work to find  $BC$ , but did not round properly.

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$\frac{12}{\sin C} = \frac{10}{\sin 50}$$

$$10 \sin C = 12 \sin 50$$

$$C = \sin^{-1} \left( \frac{12 \sin 50}{10} \right)$$

$$C \approx 66.81716709$$

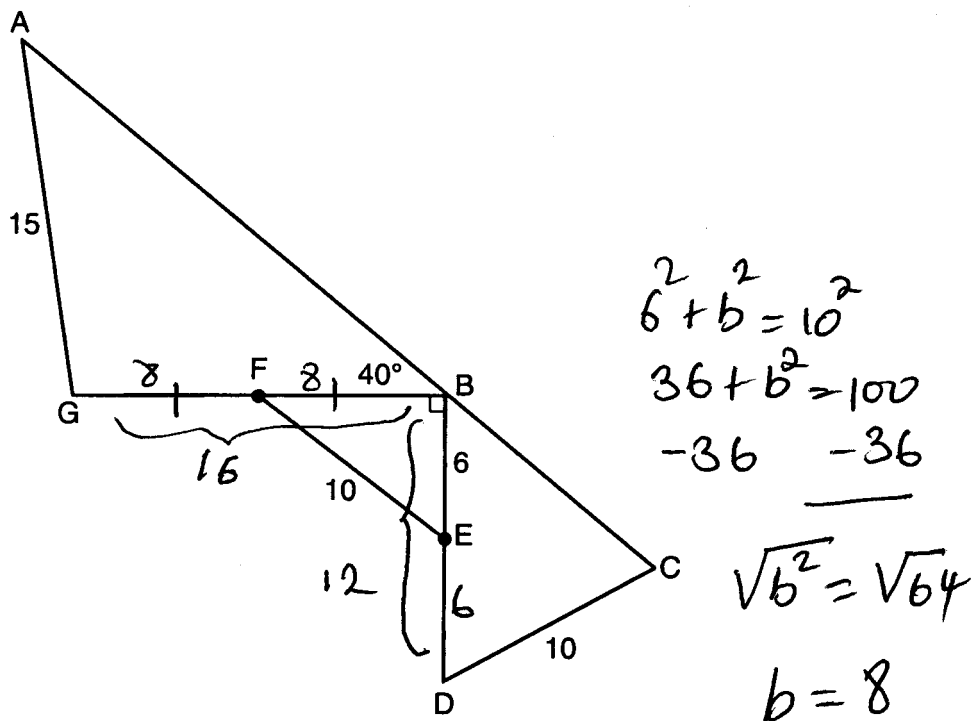
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

**Score 2:** The student found  $m\angle C$ , but showed no further work.

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



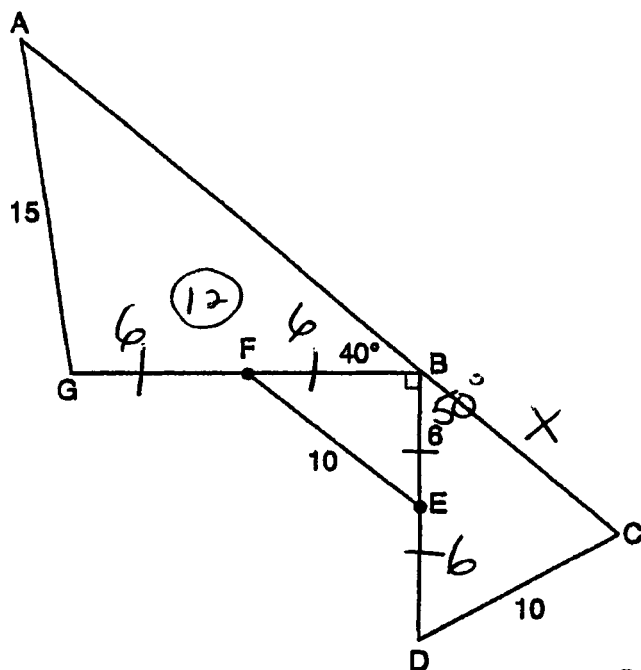
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

**Score 1:** The student found  $\overline{BG}$ , but showed no further work.

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



$$X^2 = 12^2 + 10^2 - 2(12)(10)\cos 50$$

$$X^2 = 144 + 100 - 154.269$$

$$X^2 = 89.731$$

$$X = 9.47$$

$$X = 9.5$$

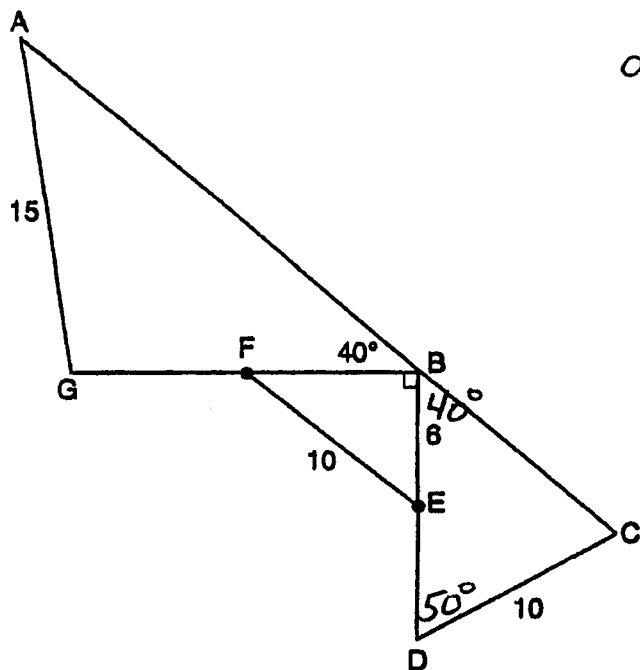
Find  $m\angle A$  to the nearest tenth.

Find  $BC$  to the nearest tenth.

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

Question 39

39 Given:  $DC = 10$ ,  $AG = 15$ ,  $BE = 6$ ,  $FE = 10$ ,  
 $m\angle ABG = 40$ ,  $m\angle GBD = 90$ ,  $m\angle C < 90$ ,  
 $\overline{BE} \cong \overline{ED}$ , and  $\overline{GF} \cong \overline{FB}$



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

$$a = 10^2 + 12^2 - 2(10)(12) \cos 50$$

$$a = 89.730976$$

$$a = 89.7$$

Find  $m\angle A$  to the nearest tenth. = 89.7

Find  $BC$  to the nearest tenth.

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



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

To determine the student’s final examination score, find the student’s total test raw score in the column labeled “Raw Score” and then locate the scale score that corresponds to that raw score. The scale score is the student’s final examination score. Enter this score in the space labeled “Scale Score” on the student’s answer sheet.

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

Because scale scores corresponding to raw scores in the conversion chart change from one administration to another, it is crucial that for each administration the conversion chart provided for that administration be used to determine the student’s final score. The chart above is usable only for this administration of the Regents Examination in Algebra 2/Trigonometry.