

# GEOMETRY (COMMON CORE)

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

# GEOMETRY (Common Core)

Thursday, January 26, 2017 — 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 36 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. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. This sheet is perforated so you may remove it from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice...

A graphing calculator, a straightedge (ruler), and a compass must be available for you to use while taking this examination.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

GEOMETRY (COMMON CORE)

## Part I

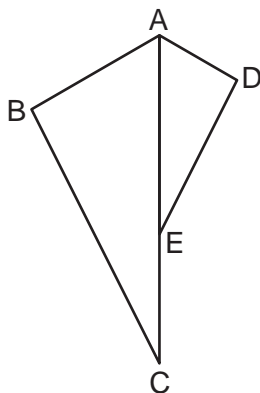
Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [48]

Use this space for  
computations.

1 Which equation represents the line that passes through the point  $(-2,2)$  and is parallel to  $y = \frac{1}{2}x + 8$ ?

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

2 In the diagram below,  $\triangle ADE$  is the image of  $\triangle ABC$  after a reflection over the line  $AC$  followed by a dilation of scale factor  $\frac{AE}{AC}$  centered at point  $A$ .



Which statement must be true?

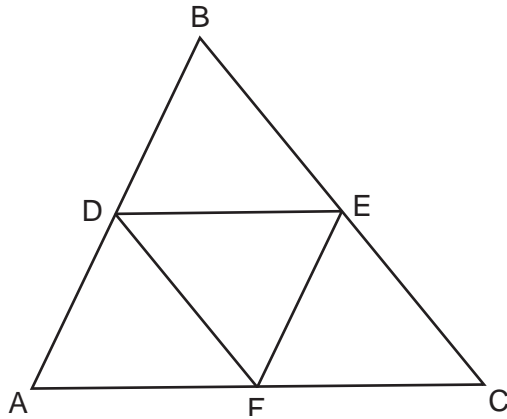
- (1)  $m\angle BAC = m\angle AED$             (3)  $m\angle DAE = \frac{1}{2}m\angle BAC$   
(2)  $m\angle ABC = m\angle ADE$             (4)  $m\angle ACB = \frac{1}{2}m\angle DAB$

3 Given  $\triangle ABC \cong \triangle DEF$ , which statement is *not* always true?

- (1)  $\overline{BC} \cong \overline{DF}$   
(2)  $m\angle A = m\angle D$   
(3) area of  $\triangle ABC =$  area of  $\triangle DEF$   
(4) perimeter of  $\triangle ABC =$  perimeter of  $\triangle DEF$

Use this space for computations.

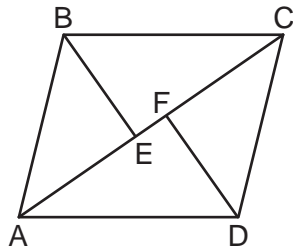
4 In the diagram below,  $\overline{DE}$ ,  $\overline{DF}$ , and  $\overline{EF}$  are midsegments of  $\triangle ABC$ .



The perimeter of quadrilateral  $ADEF$  is equivalent to

- (1)  $AB + BC + AC$
- (2)  $\frac{1}{2}AB + \frac{1}{2}AC$
- (3)  $2AB + 2AC$
- (4)  $AB + AC$

5 In the diagram below, if  $\triangle ABE \cong \triangle CDF$  and  $\overline{AEFC}$  is drawn, then it could be proven that quadrilateral  $ABCD$  is a



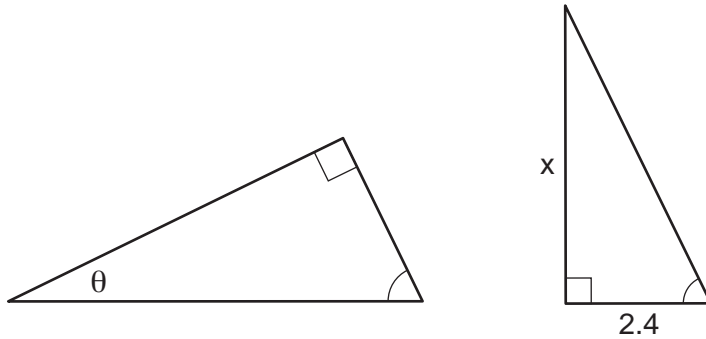
- (1) square
- (2) rhombus
- (3) rectangle
- (4) parallelogram

6 Under which transformation would  $\triangle A'B'C'$ , the image of  $\triangle ABC$ , not be congruent to  $\triangle ABC$ ?

- (1) reflection over the  $y$ -axis
- (2) rotation of  $90^\circ$  clockwise about the origin
- (3) translation of 3 units right and 2 units down
- (4) dilation with a scale factor of 2 centered at the origin

Use this space for computations.

7 The diagram below shows two similar triangles.



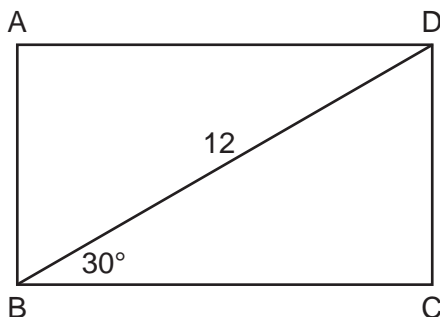
If  $\tan \theta = \frac{3}{7}$ , what is the value of  $x$ , to the *nearest tenth*?

- (1) 1.2
- (2) 5.6
- (3) 7.6
- (4) 8.8

8 A farmer has 64 feet of fence to enclose a rectangular vegetable garden. Which dimensions would result in the biggest area for this garden?

- (1) the length and the width are equal
- (2) the length is 2 more than the width
- (3) the length is 4 more than the width
- (4) the length is 6 more than the width

9 The diagram shows rectangle  $ABCD$ , with diagonal  $\overline{BD}$ .

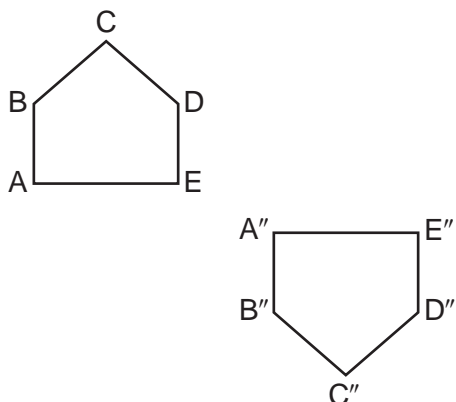


What is the perimeter of rectangle  $ABCD$ , to the *nearest tenth*?

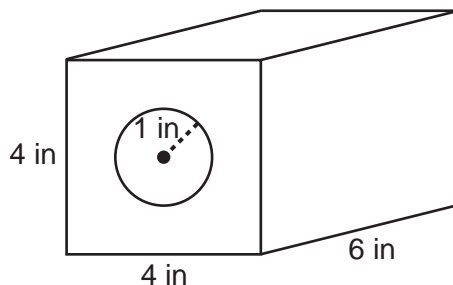
- (1) 28.4
- (2) 32.8
- (3) 48.0
- (4) 62.4

**Use this space for computations.**

- 10** Identify which sequence of transformations could map pentagon  $ABCDE$  onto pentagon  $A''B''C''D''E''$ , as shown below.



- (1) dilation followed by a rotation
  - (2) translation followed by a rotation
  - (3) line reflection followed by a translation
  - (4) line reflection followed by a line reflection
- 11** A solid metal prism has a rectangular base with sides of 4 inches and 6 inches, and a height of 4 inches. A hole in the shape of a cylinder, with a radius of 1 inch, is drilled through the entire length of the rectangular prism.

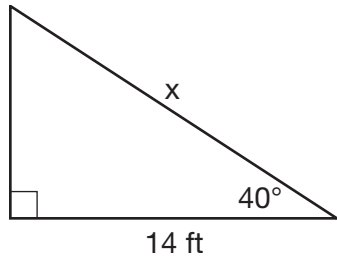


What is the approximate volume of the remaining solid, in cubic inches?

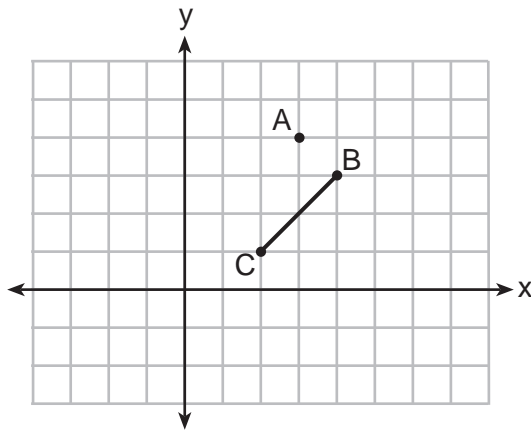
- (1) 19
- (2) 77
- (3) 93
- (4) 96

Use this space for computations.

- 12 Given the right triangle in the diagram below, what is the value of  $x$ , to the nearest foot?



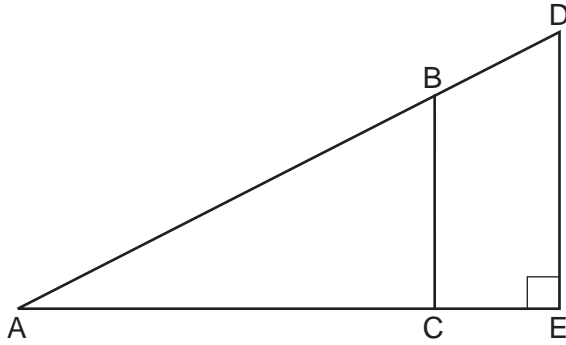
- (1) 11                                      (3) 18  
(2) 17                                      (4) 22
- 13 On the graph below, point  $A(3,4)$  and  $\overline{BC}$  with coordinates  $B(4,3)$  and  $C(2,1)$  are graphed.



- What are the coordinates of  $B'$  and  $C'$  after  $\overline{BC}$  undergoes a dilation centered at point  $A$  with a scale factor of 2?
- (1)  $B'(5,2)$  and  $C'(1,-2)$                                       (3)  $B'(5,0)$  and  $C'(1,-2)$   
(2)  $B'(6,1)$  and  $C'(0,-1)$                                       (4)  $B'(5,2)$  and  $C'(3,0)$

Use this space for  
computations.

14 In the diagram of right triangle  $ADE$  below,  $\overline{BC} \parallel \overline{DE}$ .



Which ratio is always equivalent to the sine of  $\angle A$ ?

(1)  $\frac{AD}{DE}$

(3)  $\frac{BC}{AB}$

(2)  $\frac{AE}{AD}$

(4)  $\frac{AB}{AC}$

15 In circle  $O$ , secants  $\overline{ADB}$  and  $\overline{AEC}$  are drawn from external point  $A$  such that points  $D$ ,  $B$ ,  $E$ , and  $C$  are on circle  $O$ . If  $AD = 8$ ,  $AE = 6$ , and  $EC$  is 12 more than  $BD$ , the length of  $\overline{BD}$  is

(1) 6

(3) 36

(2) 22

(4) 48

16 A parallelogram is always a rectangle if

(1) the diagonals are congruent

(2) the diagonals bisect each other

(3) the diagonals intersect at right angles

(4) the opposite angles are congruent

17 Which rotation about its center will carry a regular decagon onto itself?

- (1)  $54^\circ$
- (2)  $162^\circ$
- (3)  $198^\circ$
- (4)  $252^\circ$

18 The equation of a circle is  $x^2 + y^2 - 6y + 1 = 0$ . What are the coordinates of the center and the length of the radius of this circle?

- (1) center  $(0,3)$  and radius  $= 2\sqrt{2}$
- (2) center  $(0,-3)$  and radius  $= 2\sqrt{2}$
- (3) center  $(0,6)$  and radius  $= \sqrt{35}$
- (4) center  $(0,-6)$  and radius  $= \sqrt{35}$

19 Parallelogram  $ABCD$  has coordinates  $A(0,7)$  and  $C(2,1)$ . Which statement would prove that  $ABCD$  is a rhombus?

- (1) The midpoint of  $\overline{AC}$  is  $(1,4)$ .
- (2) The length of  $\overline{BD}$  is  $\sqrt{40}$ .
- (3) The slope of  $\overline{BD}$  is  $\frac{1}{3}$ .
- (4) The slope of  $\overline{AB}$  is  $\frac{1}{3}$ .

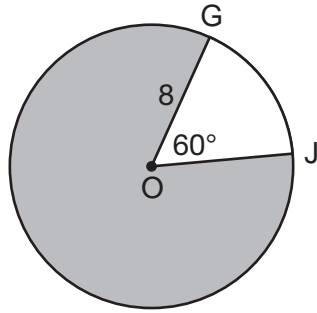
20 Point  $Q$  is on  $\overline{MN}$  such that  $MQ:QN = 2:3$ . If  $M$  has coordinates  $(3,5)$  and  $N$  has coordinates  $(8,-5)$ , the coordinates of  $Q$  are

- (1)  $(5,1)$
- (2)  $(5,0)$
- (3)  $(6,-1)$
- (4)  $(6,0)$



Use this space for  
computations.

- 21 In the diagram below of circle  $O$ ,  $GO = 8$  and  $m\angle GOJ = 60^\circ$ .



What is the area, in terms of  $\pi$ , of the shaded region?

- (1)  $\frac{4\pi}{3}$                       (3)  $\frac{32\pi}{3}$   
(2)  $\frac{20\pi}{3}$                       (4)  $\frac{160\pi}{3}$
- 22 A circle whose center is the origin passes through the point  $(-5,12)$ . Which point also lies on this circle?

- (1)  $(10,3)$                       (3)  $(11, 2\sqrt{12})$   
(2)  $(-12,13)$                       (4)  $(-8, 5\sqrt{21})$

- 23 A plane intersects a hexagonal prism. The plane is perpendicular to the base of the prism. Which two-dimensional figure is the cross section of the plane intersecting the prism?

- (1) triangle                      (3) hexagon  
(2) trapezoid                      (4) rectangle

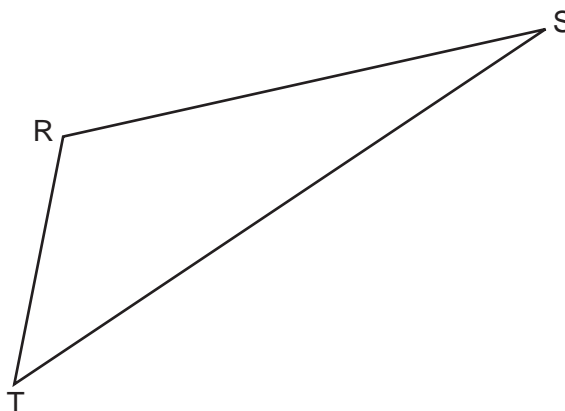
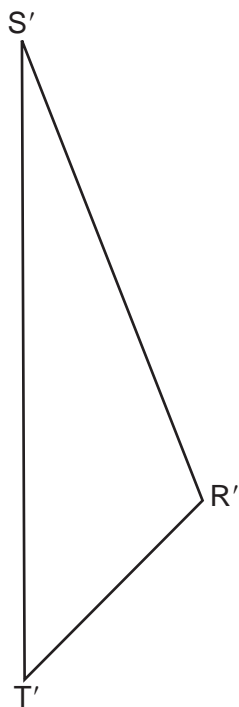
- 24 A water cup in the shape of a cone has a height of 4 inches and a maximum diameter of 3 inches. What is the volume of the water in the cup, to the *nearest tenth of a cubic inch*, when the cup is filled to half its height?

- (1) 1.2                      (3) 4.7  
(2) 3.5                      (4) 14.1

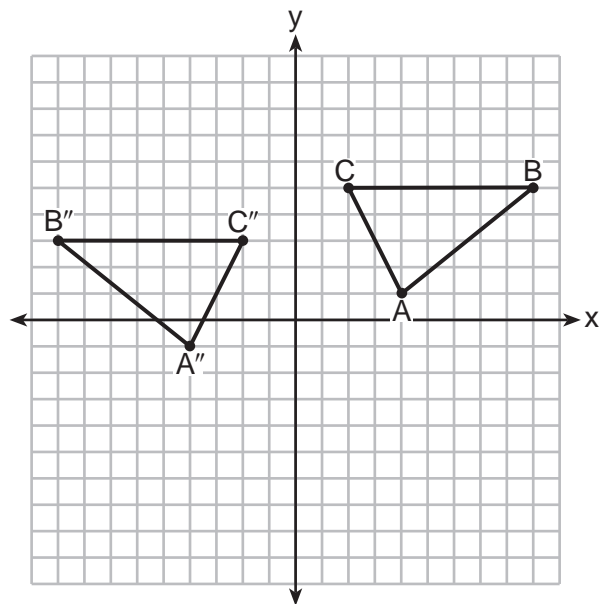
## Part II

Answer all 7 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [14]

- 25 Using a compass and straightedge, construct the line of reflection over which triangle  $RST$  reflects onto triangle  $R'S'T'$ . [Leave all construction marks.]



26 The graph below shows  $\triangle ABC$  and its image,  $\triangle A''B''C''$ .

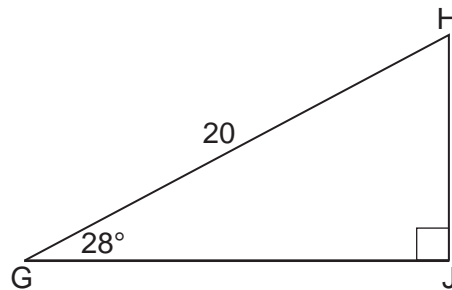


Describe a sequence of rigid motions which would map  $\triangle ABC$  onto  $\triangle A''B''C''$ .

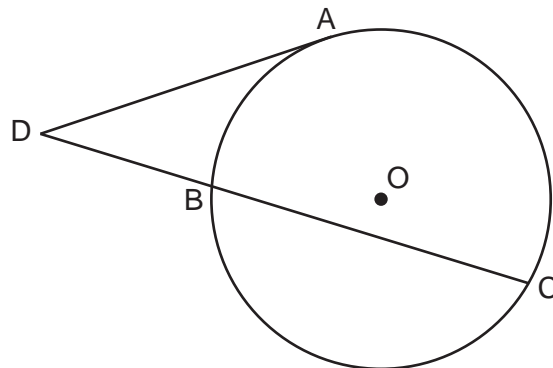
27 When instructed to find the length of  $\overline{HJ}$  in right triangle  $HJG$ , Alex wrote the equation

$\sin 28^\circ = \frac{HJ}{20}$  while Marlene wrote  $\cos 62^\circ = \frac{HJ}{20}$ . Are both students' equations correct?

Explain why.

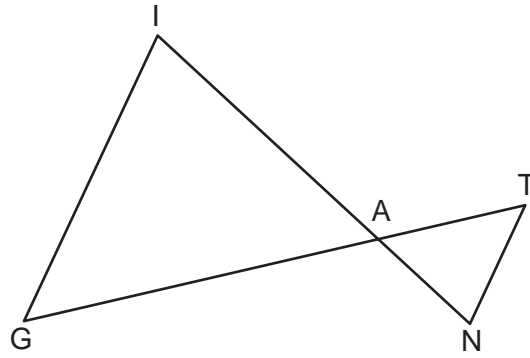


28 In the diagram below, tangent  $\overline{DA}$  and secant  $\overline{DBC}$  are drawn to circle  $O$  from external point  $D$ , such that  $\widehat{AC} \cong \widehat{BC}$ .



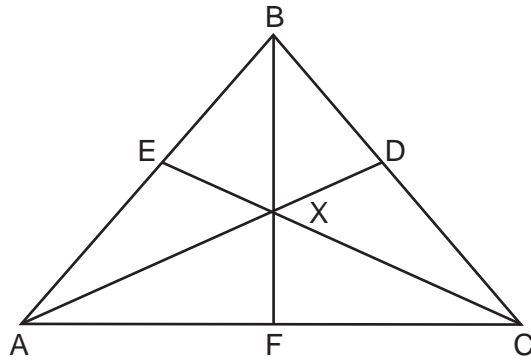
If  $m\widehat{BC} = 152^\circ$ , determine and state  $m\angle D$ .

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at A.



Prove:  $\triangle GIA \sim \triangle TNA$

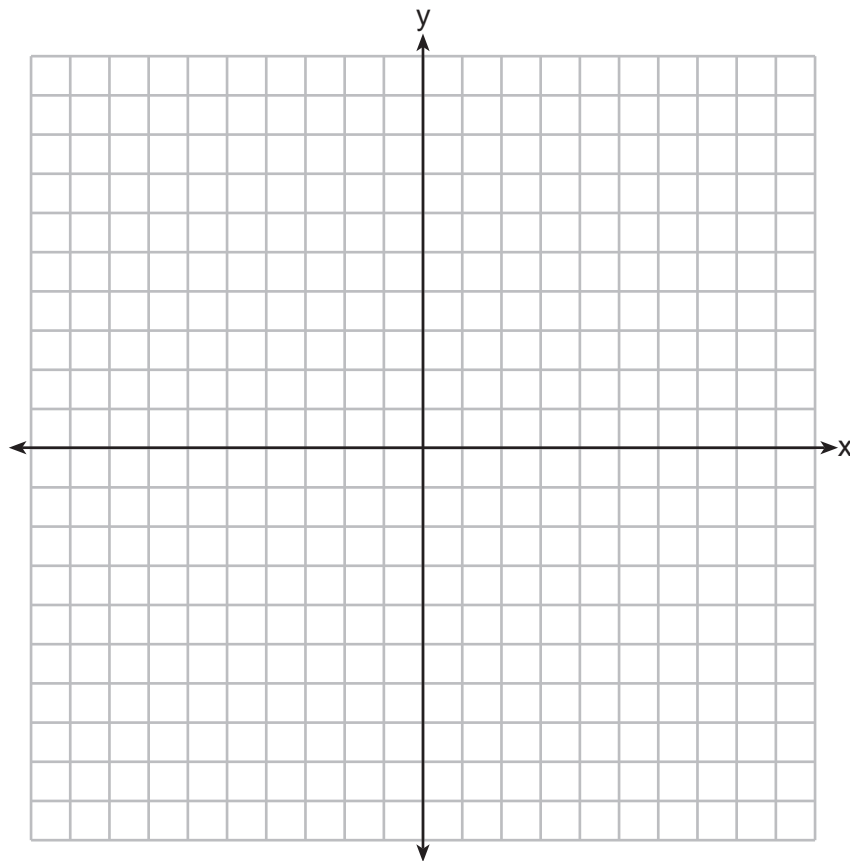
30 In the diagram below of isosceles triangle  $ABC$ ,  $\overline{AB} \cong \overline{CB}$  and angle bisectors  $\overline{AD}$ ,  $\overline{BF}$ , and  $\overline{CE}$  are drawn and intersect at  $X$ .



If  $m\angle BAC = 50^\circ$ , find  $m\angle AXC$ .

**31** In square  $GEOM$ , the coordinates of  $G$  are  $(2, -2)$  and the coordinates of  $O$  are  $(-4, 2)$ . Determine and state the coordinates of vertices  $E$  and  $M$ .

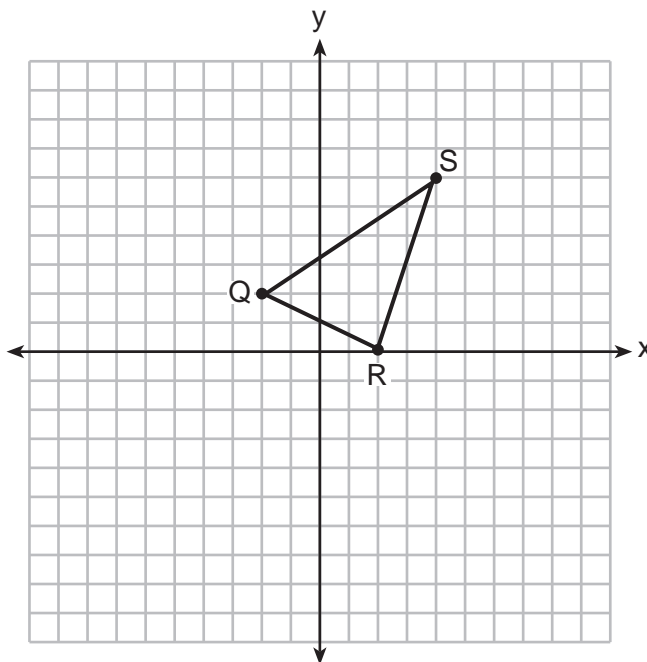
[The use of the set of axes below is optional.]



### 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. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

32 Triangle  $QRS$  is graphed on the set of axes below.

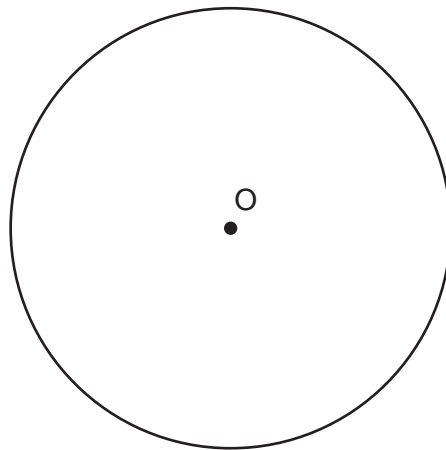


On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

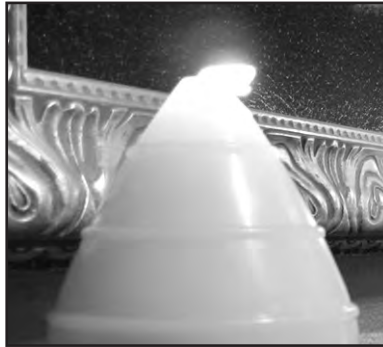


**33** Using a compass and straightedge, construct a regular hexagon inscribed in circle  $O$  below. Label it  $ABCDEF$ . [Leave all construction marks.]



If chords  $\overline{FB}$  and  $\overline{FC}$  are drawn, which type of triangle, according to its angles, would  $\triangle FBC$  be? Explain your answer.

34 A candle maker uses a mold to make candles like the one shown below.

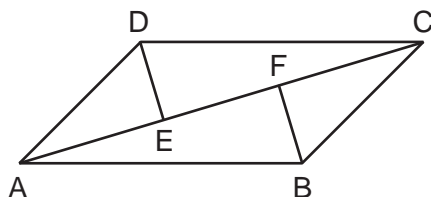


The height of the candle is 13 cm and the circumference of the candle at its widest measure is 31.416 cm. Use modeling to approximate how much wax, to the *nearest cubic centimeter*, is needed to make this candle. Justify your answer.

Part IV

Answer the 2 questions in this part. Each correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

- 35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



Prove:  $\overline{AE} \cong \overline{CF}$

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is  $2.7 \text{ g/cm}^3$ , and the cost of aluminum is \$0.38 per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?

**Work space for question 36 is continued on the next page.**

**Question 36 continued**



## High School Math Reference Sheet

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5280 feet	1 pound = 0.454 kilogram	1 quart = 2 pints
1 mile = 1760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2000 pounds	1 gallon = 3.785 liters
		1 liter = 0.264 gallon
		1 liter = 1000 cubic centimeters

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

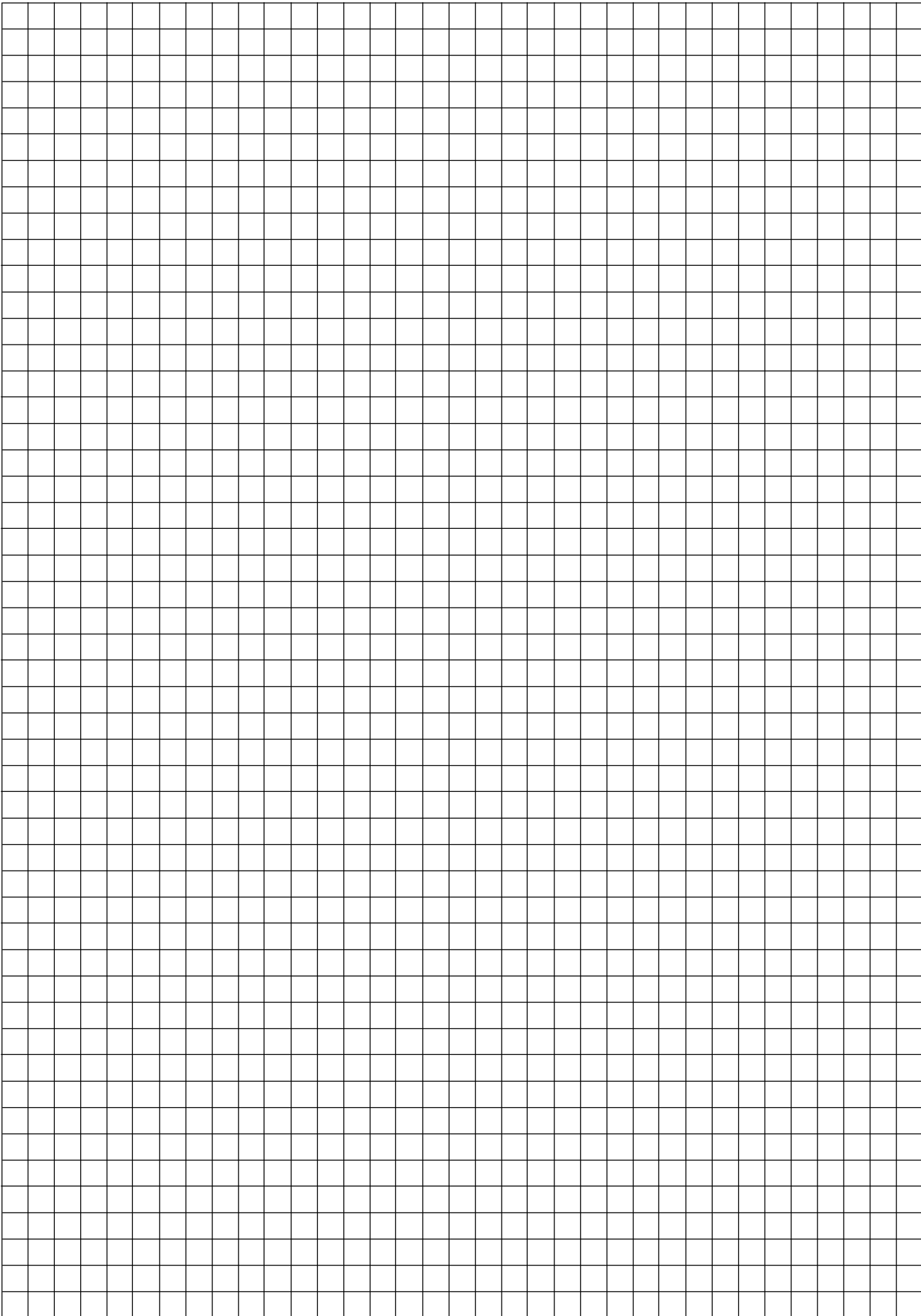
Pythagorean Theorem	$a^2 + b^2 = c^2$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Geometric Sequence	$a_n = a_1 r^{n-1}$
Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Radians	1 radian = $\frac{180}{\pi}$ degrees
Degrees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

Tear Here

Tear Here



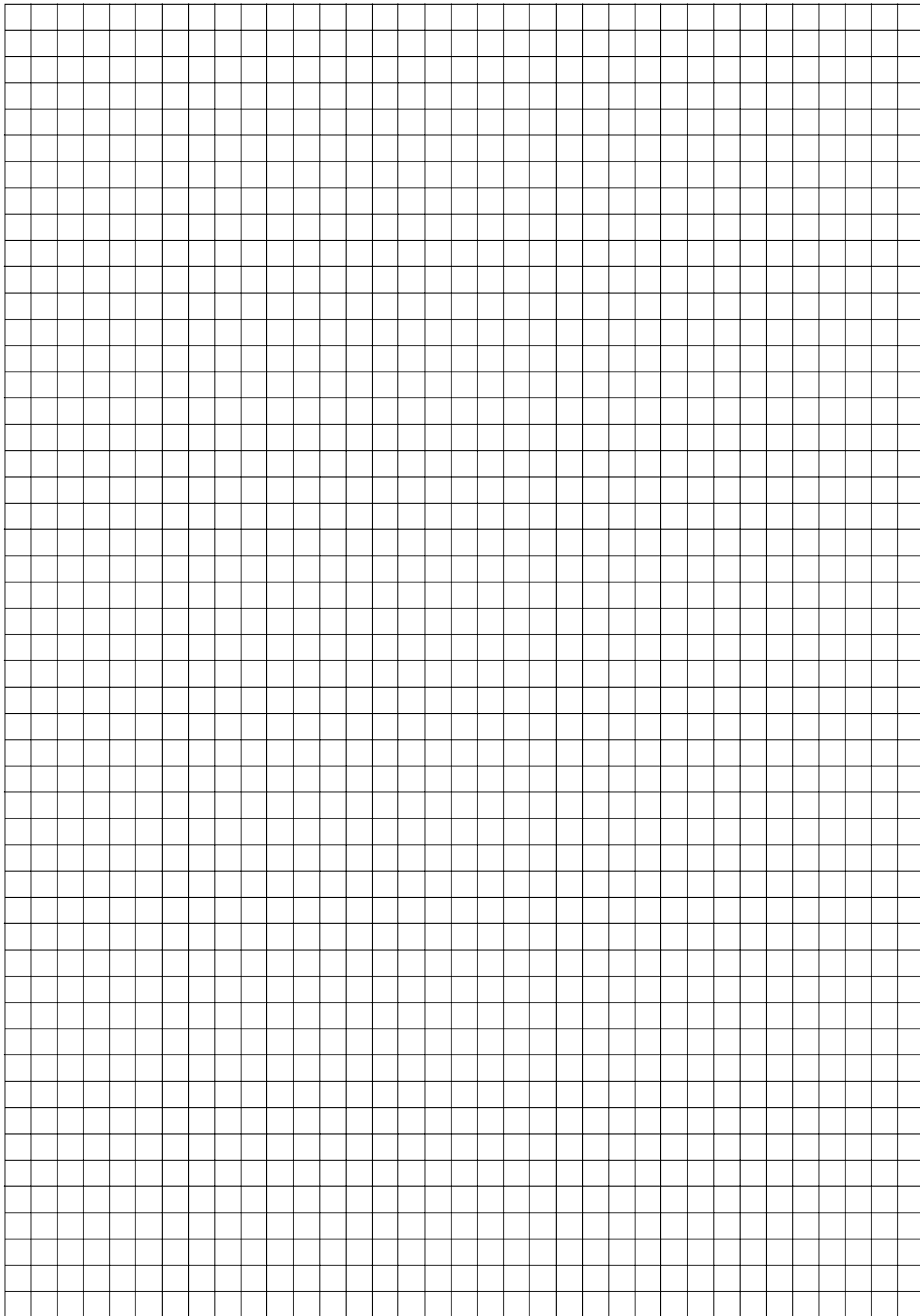
**Scrap Graph Paper — This sheet will *not* be scored.**



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



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Tear Here



# GEOMETRY (COMMON CORE)

Printed on Recycled Paper

GEOMETRY (COMMON CORE)

# FOR TEACHERS ONLY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

## GEOMETRY (COMMON CORE)

Thursday, January 26, 2017 — 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 Geometry (Common Core). More detailed information about scoring is provided in the publication *Information Booklet for Scoring the Regents Examination in Geometry (Common Core)*.

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 Thursday, January 26, 2017. Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score. The student's scale score should be entered in the box provided on the student's separate answer sheet. The scale score is the student's final examination score.

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

### Part I

Allow a total of 48 credits, 2 credits for each of the following. Allow credit if the student has written the correct answer instead of the numeral 1, 2, 3, or 4.

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

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.

The Department is providing supplemental scoring guidance, the “Model Response Set,” for the Regents Examination in Geometry (Common Core). This guidance is intended to be part of the scorer training. Schools should use the Model Response Set along with the rubrics in the Scoring Key and Rating Guide to help guide scoring of student work. While not reflective of all scenarios, the Model Response Set illustrates how less common student responses to constructed-response questions may be scored. The Model Response Set will be available on the Department’s web site at: <http://www.nysedregents.org/geometrycc/>.

# General Rules for Applying Mathematics Rubrics

## I. General Principles for Rating

The rubrics for the constructed-response questions on the Regents Examination in Geometry (Common Core) are designed to provide a systematic, consistent method for awarding credit. The rubrics are not to be considered all-inclusive; it is impossible to anticipate all the different methods that students might use to solve a given problem. Each response must be rated carefully using the teacher's professional judgment and knowledge of mathematics; all calculations must be checked. The specific rubrics for each question must be applied consistently to all responses. In cases that are not specifically addressed in the rubrics, raters must follow the general rating guidelines in the publication *Information Booklet for Scoring the Regents Examination in Geometry (Common Core)*, use their own professional judgment, confer with other mathematics teachers, and/or contact the State Education Department for guidance. During each Regents Examination administration period, rating questions may be referred directly to the Education Department. The contact numbers are sent to all schools before each administration period.

## II. Full-Credit Responses

A full-credit response provides a complete and correct answer to all parts of the question. Sufficient work is shown to enable the rater to determine how the student arrived at the correct answer.

When the rubric for the full-credit response includes one or more examples of an acceptable method for solving the question (usually introduced by the phrase “such as”), it does not mean that there are no additional acceptable methods of arriving at the correct answer. Unless otherwise specified, mathematically correct alternative solutions should be awarded credit. The only exceptions are those questions that specify the type of solution that must be used; e.g., an algebraic solution or a graphic solution. A correct solution using a method other than the one specified is awarded half the credit of a correct solution using the specified method.

## III. Appropriate Work

*Full-Credit Responses:* The directions in the examination booklet for all the constructed-response questions state: “Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc.” The student has the responsibility of providing the correct answer **and** showing how that answer was obtained. The student must “construct” the response; the teacher should not have to search through a group of seemingly random calculations scribbled on the student paper to ascertain what method the student may have used.

*Responses With Errors:* Rubrics that state “Appropriate work is shown, but...” are intended to be used with solutions that show an essentially complete response to the question but contain certain types of errors, whether computational, rounding, graphing, or conceptual. If the response is incomplete; i.e., an equation is written but not solved or an equation is solved but not all of the parts of the question are answered, appropriate work has **not** been shown. Other rubrics address incomplete responses.

## IV. Multiple Errors

*Computational Errors, Graphing Errors, and Rounding Errors:* Each of these types of errors results in a 1-credit deduction. Any combination of two of these types of errors results in a 2-credit deduction. No more than 2 credits should be deducted for such mechanical errors in a 4-credit question and no more than 3 credits should be deducted in a 6-credit question. The teacher must carefully review the student's work to determine what errors were made and what type of errors they were.

*Conceptual Errors:* A conceptual error involves a more serious lack of knowledge or procedure. Examples of conceptual errors include using the incorrect formula for the area of a figure, choosing the incorrect trigonometric function, or multiplying the exponents instead of adding them when multiplying terms with exponents.

If a response shows repeated occurrences of the same conceptual error, the student should not be penalized twice. If the same conceptual error is repeated in responses to other questions, credit should be deducted in each response.

For 4- and 6-credit questions, if a response shows one conceptual error and one computational, graphing, or rounding error, the teacher must award credit that takes into account both errors. Refer to the rubric for specific scoring guidelines.

## Part II

For each question, use the specific criteria to award a maximum of 2 credits. Unless otherwise specified, mathematically correct alternative solutions should be awarded appropriate credit.

(25) [2] A correct construction is drawn showing all appropriate arcs, and the line of reflection is correctly drawn.

[1] A correct construction is drawn showing all appropriate arcs, but the line of reflection is not drawn or is drawn incorrectly.

[0] A drawing that is not an appropriate construction 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.

(26) [2] A correct sequence of rigid motions is described.

[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] A reflection and translation are identified, but no specific description is written.

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

(27) [2] Yes, and a correct explanation is written.

[1] An appropriate explanation is written, but it is incomplete.

[0] Yes, but no explanation is written.

*or*

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



(28) [2] 48, and appropriate 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]  $m\widehat{AC} = 152$  and  $m\widehat{AB} = 56$  are stated, but no further correct work is shown.

*or*

[1] 48, 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] A complete and correct proof that includes a conclusion is written.

[1] Appropriate work is shown, but only one correct statement and reason are written.

*or*

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

[0] The “given” and/or the “prove” statements are written, but no further correct relevant statements are written.

*or*

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

- (30) [2] 130, and appropriate work is shown, such as a labeled diagram.
- [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] The measures of two angles of  $\triangle AXC$ ,  $\triangle AXF$ , or  $\triangle CFX$  are found, but no further correct work is shown.
- or***
- [1] 130, 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] (1,3) and  $(-3,-3)$ , and correct work is shown.
- [1] Appropriate work is shown, but one computational or graphing error is made.
- or***
- [1] Appropriate work is shown, but one conceptual error is made.
- or***
- [1] One of the vertices is found correctly, but no further correct work is shown.
- or***
- [1] (1,3) and  $(-3,-3)$ , 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.
-

### 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.

(32) [4]  $\triangle Q'R'S'$  is graphed and labeled correctly, and a correct explanation is written.

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

*or*

[3]  $\triangle Q'R'S'$  is graphed and labeled correctly. The slopes of  $\overline{QR}$  and  $\overline{Q'R'}$  are stated correctly, but no explanation is written.

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

*or*

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

*or*

[2]  $\triangle Q'R'S'$  is graphed and labeled correctly, but no further correct work is shown.

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

*or*

[1]  $Q'(-3,3)$ ,  $R'(3,0)$ , and  $S'(6,9)$  are stated, 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.

- (33) [4] A correctly labeled construction of regular hexagon  $ABCDEF$  is drawn showing all appropriate arcs, right triangle, and an appropriate explanation is written.
- [3] An appropriate construction of regular hexagon  $ABCDEF$  is drawn, right triangle, and an appropriate explanation is written, but one construction error is made.

**or**

- [3] A correct construction of a regular hexagon is drawn showing all appropriate arcs, right triangle, and an appropriate explanation is written, but the construction is not labeled or is labeled incorrectly.

**or**

- [3] A correctly labeled construction of regular hexagon  $ABCDEF$  is drawn showing all appropriate arcs, and right triangle, but an appropriate explanation is not written or is incorrect.

- [2] Appropriate work is shown, but one conceptual error is made. An appropriate answer is stated, and an appropriate explanation is written.

**or**

- [2] A correctly labeled construction of regular hexagon  $ABCDEF$  is drawn, but no further correct work is shown.

**or**

- [2] Right triangle is stated, and an appropriate explanation is written, but the construction is not drawn or is drawn incorrectly.

- [1] Appropriate work is shown to find the angles of  $\triangle FBC$ , but no further correct work is shown.

**or**

- [1] All construction arcs are drawn, but no further correct work is shown.

- [0] A drawing that is not an appropriate construction is drawn.

**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) [4] 340, and an appropriate justification 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.
- or***
- [2] The radius of the candle at its widest measure is found correctly, but no further correct work is shown.
- [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or***
- [1] 340, 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 each question, use the specific criteria to award a maximum of 6 credits. Unless otherwise specified, mathematically correct alternative solutions should be awarded appropriate credit.

(35) [6] A complete and correct proof that includes a concluding statement is written.

[5] A proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one statement and/or reason is missing or incorrect.

[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements and/or reasons are missing or incorrect.

[3] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but three statements and/or reasons are missing or incorrect.

*or*

[3] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.

[2] A proof is written that demonstrates a method of proof, but one conceptual error is made, and one statement and/or reason is missing or incorrect.

*or*

[2] Some correct relevant statements about the proof are made, but four statements and/or reasons are missing or incorrect.

[1] Only one or two correct relevant statements and reasons are written.

[0] The “given” and/or the “prove” statements are written, but no further correct relevant statements are written.

*or*

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

- (36) [6] Rectangular design, \$19.06, and correct work is shown.
- [5] Appropriate work is shown, but one computational or rounding error is made.
- or*
- [5] Appropriate work is shown, but either rectangular design or the \$19.06 difference is missing.
- [4] Correct work is shown to find the cost of both post designs, but no further correct work is shown.
- or*
- [4] Appropriate work is shown, but two or more computational or rounding errors are made.
- or*
- [4] Appropriate work is shown, but one conceptual error is made.
- [3] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
- or*
- [3] Correct work is shown to determine the weight of both post designs, but no further correct work is shown.
- or*
- [3] Correct work is shown to find the cost for one of the post designs, but no further correct work is shown.
- [2] Appropriate work is shown, but one conceptual error and two or more computational errors are made.
- or*
- [2] Appropriate work is shown, but two conceptual errors are made.
- or*
- [2] Correct work is shown to determine the volumes for both post designs, but no further correct work is shown.
- [1] Correct work is shown to determine the dimensions of the inner and outer solids, but no further correct work is shown.
- or*
- [1] Correct work is shown to determine the volume of one post design, but no further correct work is shown.
- or*
- [1] Rectangular design and \$19.06, but no work or no 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.

**Map to the Common Core Learning Standards  
Geometry (Common Core)  
January 2017**

<b>Question</b>	<b>Type</b>	<b>Credits</b>	<b>Cluster</b>
1	Multiple Choice	2	G-GPE.B
2	Multiple Choice	2	G-SRT.A
3	Multiple Choice	2	G-CO.B
4	Multiple Choice	2	G-CO.C
5	Multiple Choice	2	G-CO.C
6	Multiple Choice	2	G-CO.C
7	Multiple Choice	2	G-SRT.C
8	Multiple Choice	2	G-MG.A
9	Multiple Choice	2	G-SRT.C
10	Multiple Choice	2	G-CO.A
11	Multiple Choice	2	G-GMD.A
12	Multiple Choice	2	G-SRT.C
13	Multiple Choice	2	G-SRT.A
14	Multiple Choice	2	G-SRT.C
15	Multiple Choice	2	G-C.A
16	Multiple Choice	2	G-CO.C
17	Multiple Choice	2	G-CO.A
18	Multiple Choice	2	G-GPE.A
19	Multiple Choice	2	G-CO.C
20	Multiple Choice	2	G-GPE.B
21	Multiple Choice	2	G-C.B
22	Multiple Choice	2	G-GPE.B
23	Multiple Choice	2	G-GMD.B
24	Multiple Choice	2	G-GMD.A
25	Constructed Response	2	G-CO.D
26	Constructed Response	2	G-CO.A
27	Constructed Response	2	G-SRT.C
28	Constructed Response	2	G-C.A
29	Constructed Response	2	G-SRT.A
30	Constructed Response	2	G-CO.C
31	Constructed Response	2	G-GPE.B
32	Constructed Response	4	G-SRT.A
33	Constructed Response	4	G-CO.D
34	Constructed Response	4	G-MG.A
35	Constructed Response	6	G-SRT.B
36	Constructed Response	6	G-MG.A



## Regents Examination in Geometry (Common Core)

January 2017

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

**The *Chart for Determining the Final Examination Score for the January 2017 Regents Examination in Geometry (Common Core)* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Thursday, January 26, 2017. Conversion charts provided for previous administrations of the Regents Examination in Geometry (Common Core) 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

# GEOMETRY (COMMON CORE)

Thursday, January 26, 2017 — 9:15 a.m. to 12:15 p.m.

## MODEL RESPONSE SET

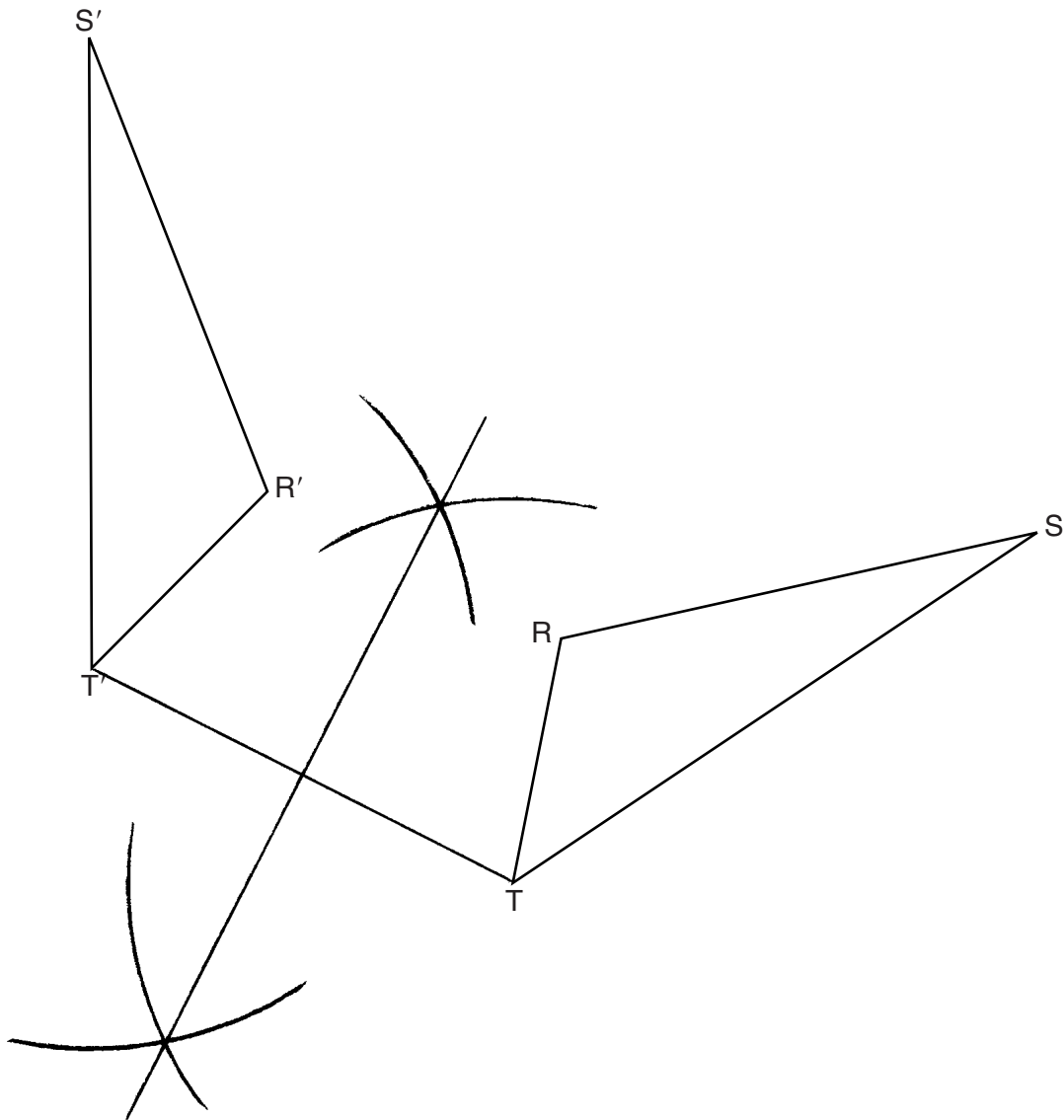
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**Question 25**

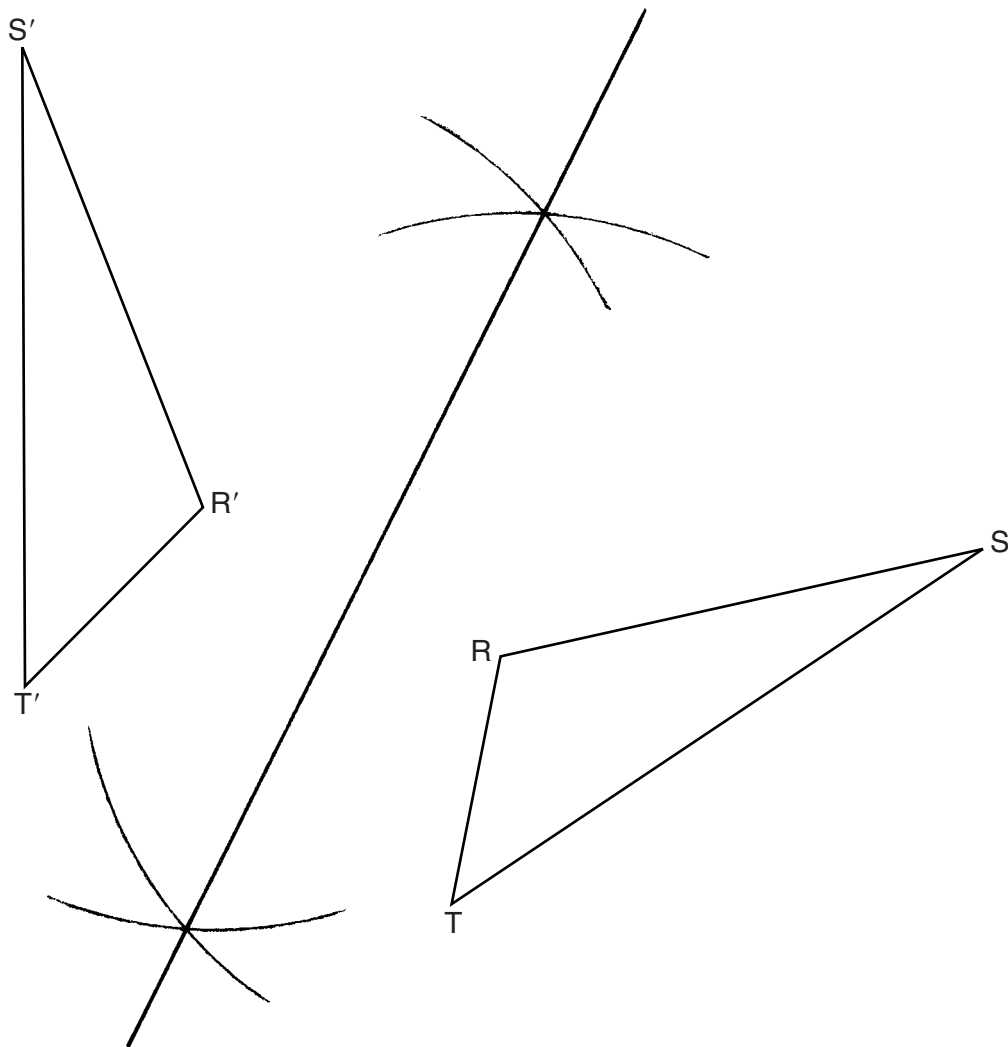
**25** Using a compass and straightedge, construct the line of reflection over which triangle  $RST$  reflects onto triangle  $R'S'T'$ . [Leave all construction marks.]



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

**Question 25**

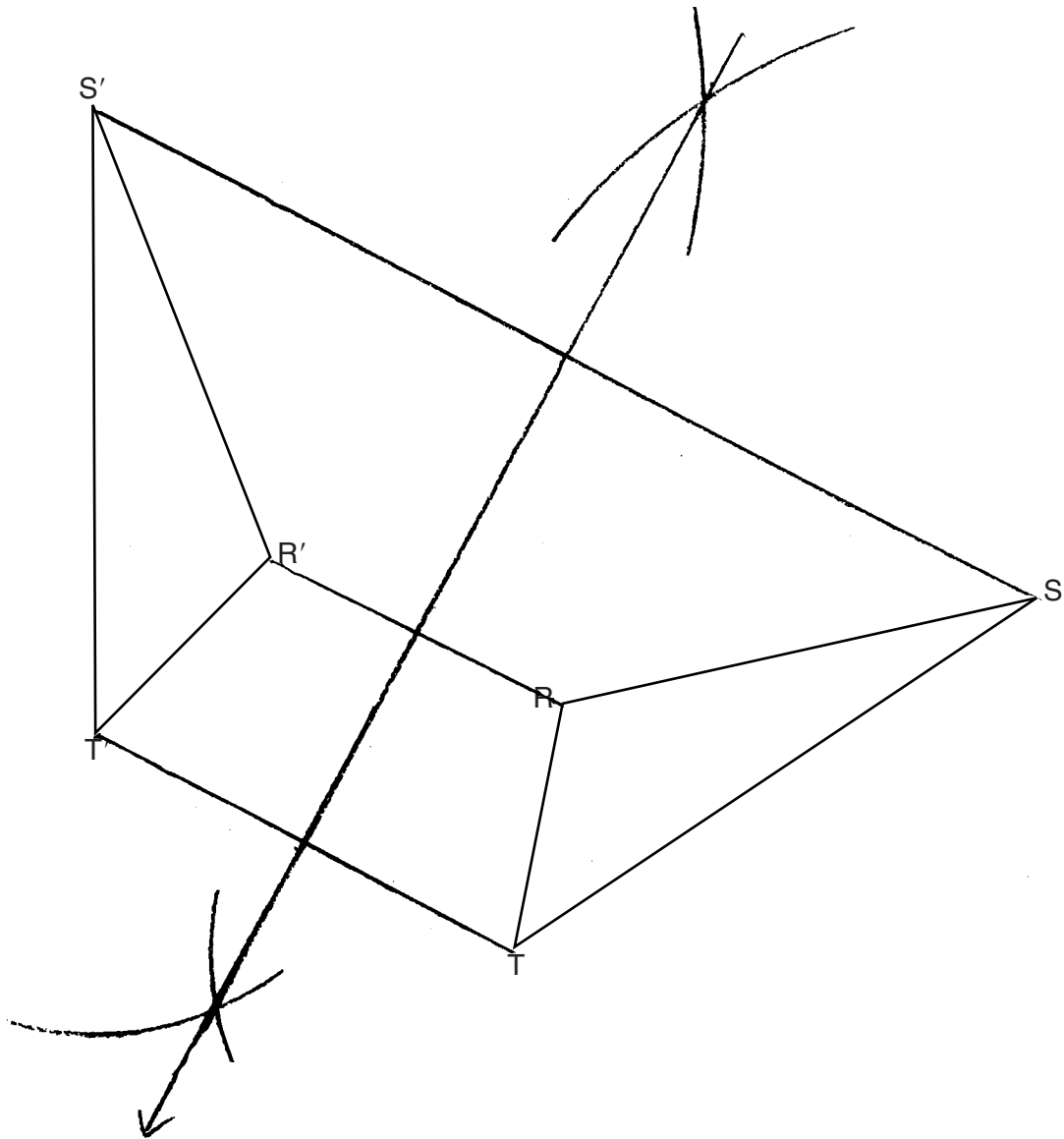
**25** Using a compass and straightedge, construct the line of reflection over which triangle  $RST$  reflects onto triangle  $R'S'T'$ . [Leave all construction marks.]



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

**Question 25**

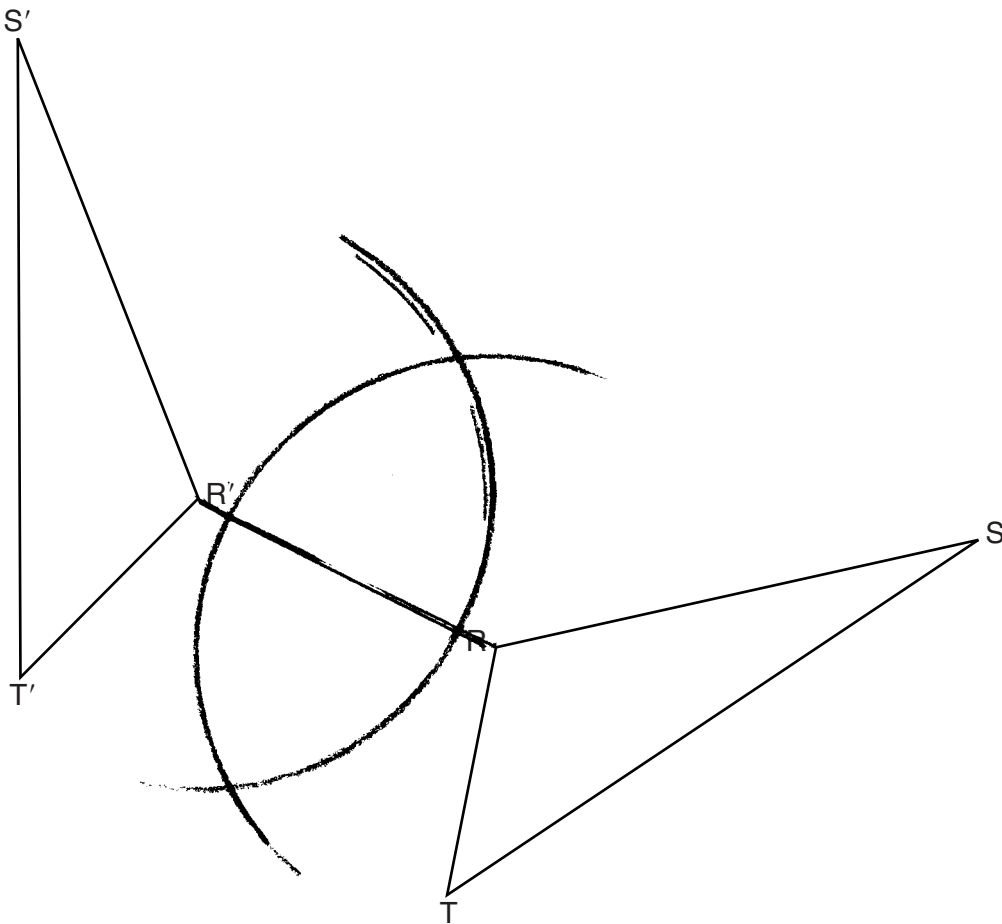
**25** Using a compass and straightedge, construct the line of reflection over which triangle  $RST$  reflects onto triangle  $R'S'T'$ . [Leave all construction marks.]



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

**Question 25**

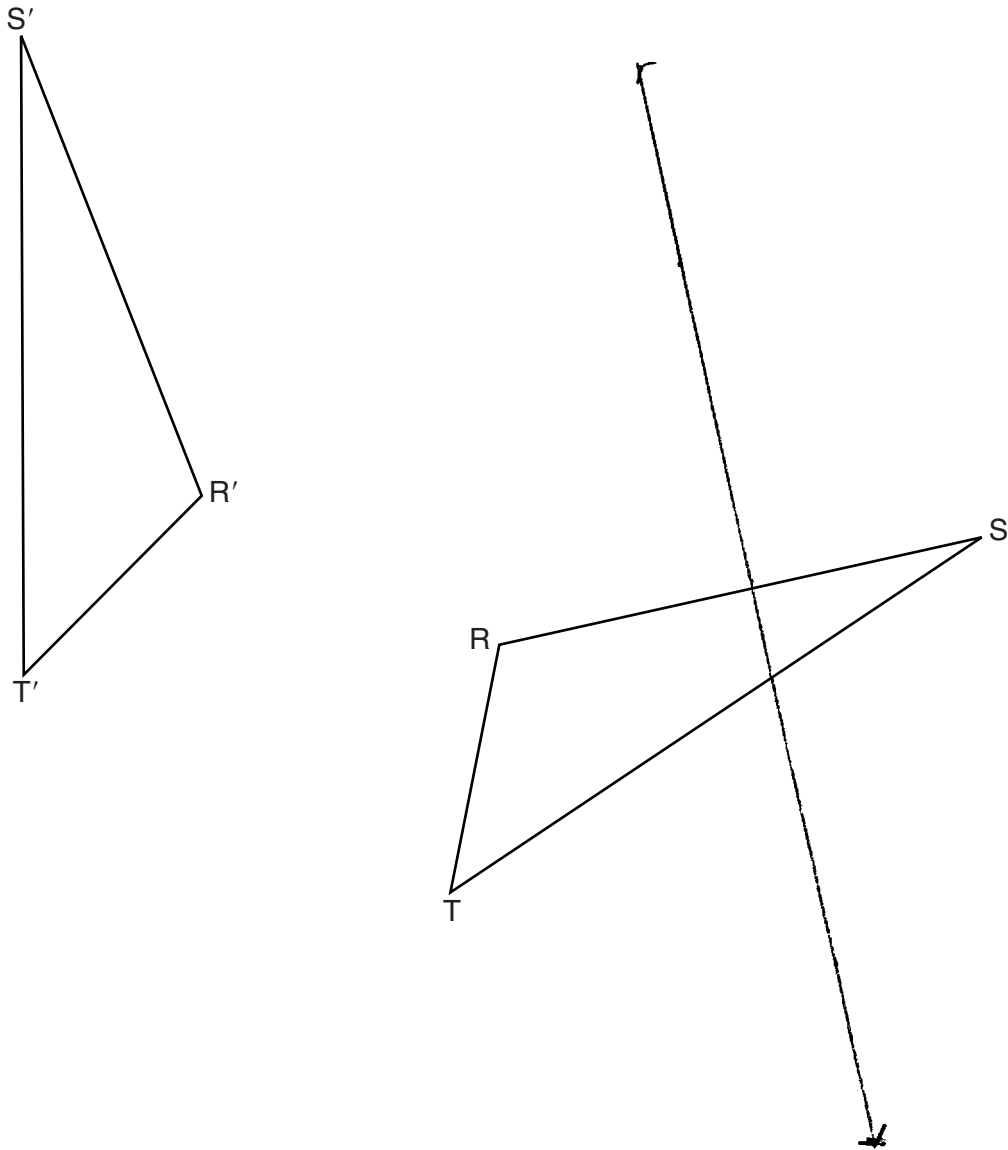
**25** Using a compass and straightedge, construct the line of reflection over which triangle  $RST$  reflects onto triangle  $R'S'T'$ . [Leave all construction marks.]



**Score 1:** The student had a correct construction, but did not draw the line of reflection.

**Question 25**

**25** Using a compass and straightedge, construct the line of reflection over which triangle  $RST$  reflects onto triangle  $R'S'T'$ . [Leave all construction marks.]

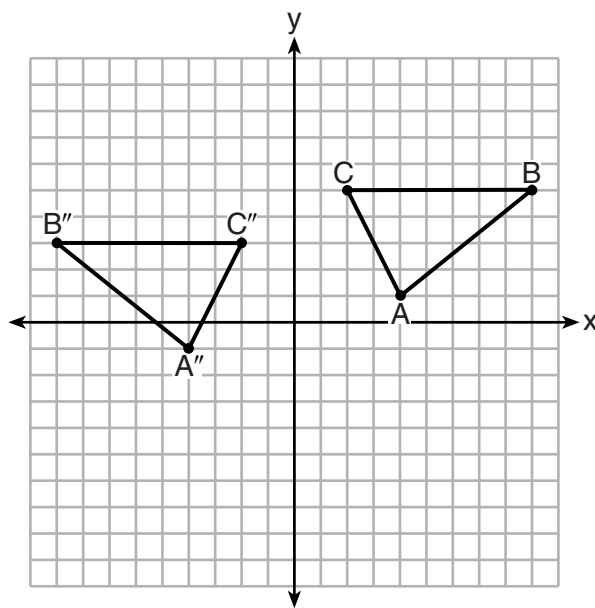


**Score 0:** The student had a completely incorrect response.



**Question 26**

**26** The graph below shows  $\triangle ABC$  and its image,  $\triangle A''B''C''$ .



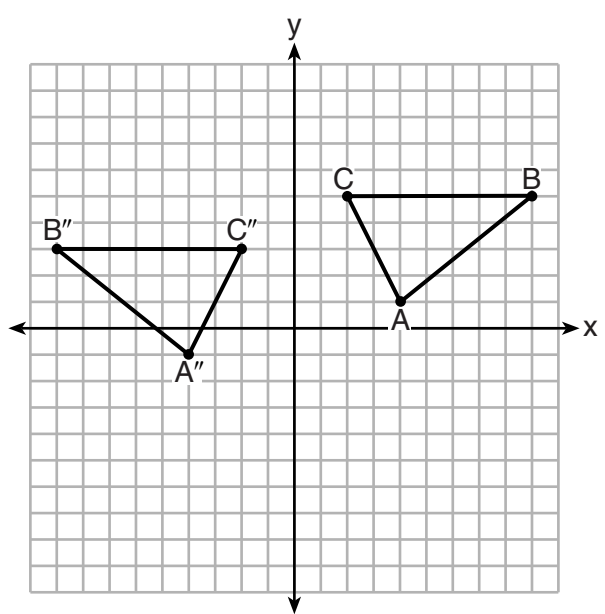
Describe a sequence of rigid motions which would map  $\triangle ABC$  onto  $\triangle A''B''C''$ .

Translate  $\triangle ABC$  left 4 units and down 2 units followed by a reflection over line  $x = -2$

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

**Question 26**

**26** The graph below shows  $\triangle ABC$  and its image,  $\triangle A''B''C''$ .



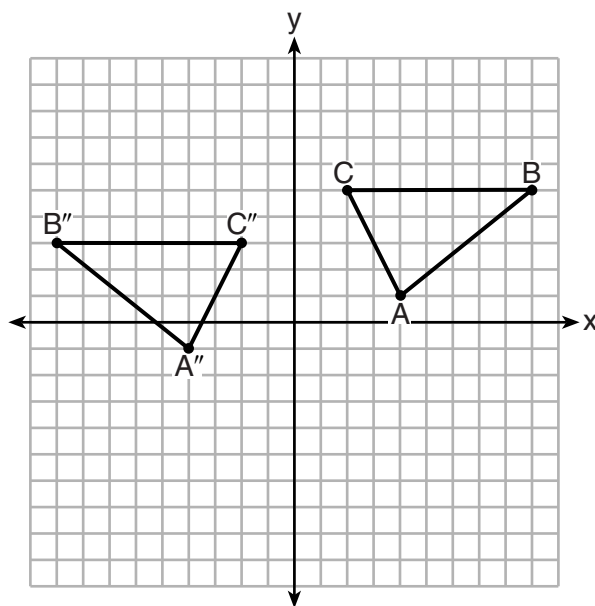
Describe a sequence of rigid motions which would map  $\triangle ABC$  onto  $\triangle A''B''C''$ .

*Reflection across the y-axis followed by  $T_{(0,-2)}$*

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

**Question 26**

**26** The graph below shows  $\triangle ABC$  and its image,  $\triangle A''B''C''$ .



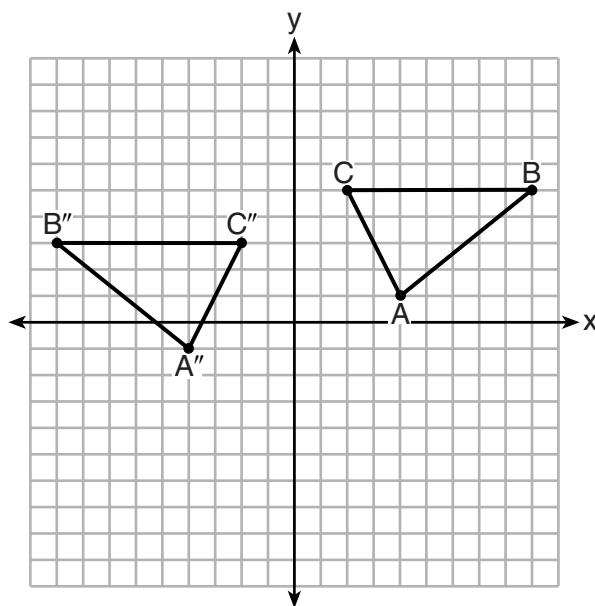
Describe a sequence of rigid motions which would map  $\triangle ABC$  onto  $\triangle A''B''C''$ .

1.)  $r_{y\text{-axis}}$  (reflection)  
2.)  $T_{0,2}$  (Translation)

**Score 1:** The student wrote an incorrect translation by translating in the wrong direction.

**Question 26**

**26** The graph below shows  $\triangle ABC$  and its image,  $\triangle A''B''C''$ .



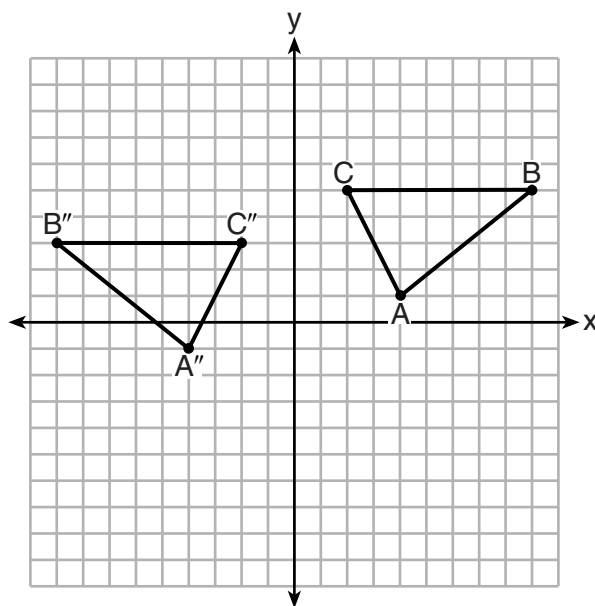
Describe a sequence of rigid motions which would map  $\triangle ABC$  onto  $\triangle A''B''C''$ .

a reflection over the y-axis,  
followed by a translation 2 units up

**Score 1:** The student completed a correct sequence of rigid motions, but went from the image to the pre-image.

**Question 26**

**26** The graph below shows  $\triangle ABC$  and its image,  $\triangle A''B''C''$ .



Describe a sequence of rigid motions which would map  $\triangle ABC$  onto  $\triangle A''B''C''$ .

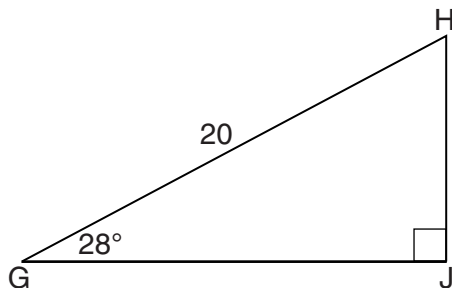
A translation over 4 down 2  
across the y-axis.

**Score 0:** The student's description did not have enough detail to receive any credit.

**Question 27**

27 When instructed to find the length of  $\overline{HJ}$  in right triangle  $HJG$ , Alex wrote the equation  $\sin 28^\circ = \frac{HJ}{20}$  while Marlene wrote  $\cos 62^\circ = \frac{HJ}{20}$ . Are both students' equations correct?

Explain why.



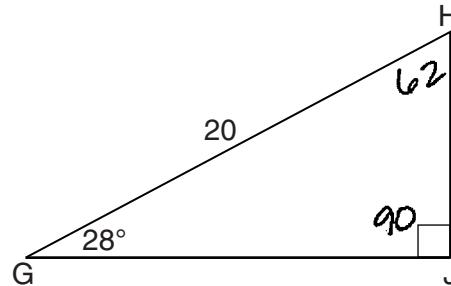
Yes, b/c  $28^\circ$  and  $62^\circ$  are acute angles and complementary angles. Since the sin of an angle equals the cos of its complement, both equations are correct.

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

**Question 27**

27 When instructed to find the length of  $\overline{HJ}$  in right triangle  $HJG$ , Alex wrote the equation  $\sin 28^\circ = \frac{HJ}{20}$  while Marlene wrote  $\cos 62^\circ = \frac{HJ}{20}$ . Are both students' equations correct?

Explain why.



SOHCAHTOA

$$\begin{array}{r} 90 \\ -28 \\ \hline 62 \end{array}$$

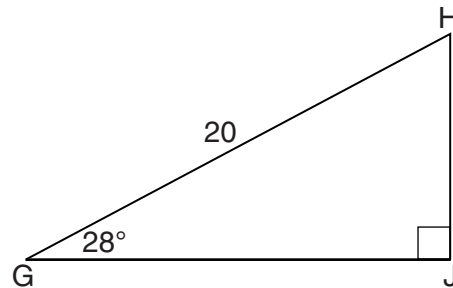
Yes, both students are right because  $\text{sine} = \frac{\text{opposite}}{\text{hypotenuse}}$  and  $\text{Cosine} = \frac{\text{adjacent}}{\text{hypotenuse}}$ , so both of the equations written are correct. Both Marlene and Alex could find HJ because HJ is opposite from  $28^\circ$ , but <sup>also</sup> adjacent to  $62^\circ$ . So both are correct ways to get the answer.

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

**Question 27**

**27** When instructed to find the length of  $\overline{HJ}$  in right triangle  $HJG$ , Alex wrote the equation  $\sin 28^\circ = \frac{HJ}{20}$  while Marlene wrote  $\cos 62^\circ = \frac{HJ}{20}$ . Are both students' equations correct?

Explain why.



yes both students are correct because  $\cos 62$  and  $\sin 28$  are equal to each other.

**Score 1:** The student wrote an incomplete explanation by not explaining why  $\cos 62^\circ$  and  $\sin 28^\circ$  are equal.



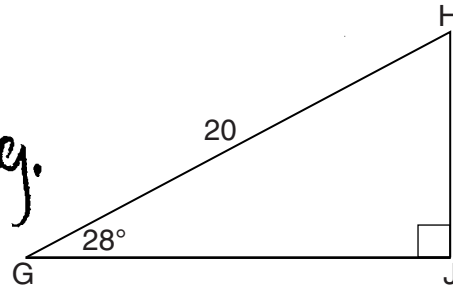
Question 27

27 When instructed to find the length of  $\overline{HJ}$  in right triangle  $HJG$ , Alex wrote the equation

$\sin 28^\circ = \frac{HJ}{20}$  while Marlene wrote  $\cos 62^\circ = \frac{HJ}{20}$ . Are both students' equations correct?

Explain why.

Alex is right  
Marlene is wrong.



$\sin 28 = \frac{HJ}{20}$      $\cos = \frac{GJ}{20}$   
 $\begin{matrix} \text{sin} \\ \text{SOH} \\ \text{O/H} \end{matrix}$      $\begin{matrix} \text{cos} \\ \text{CAH} \\ \text{A/H} \end{matrix}$      $\begin{matrix} \text{Tan} \\ \text{TOA} \\ \text{O/A} \end{matrix}$

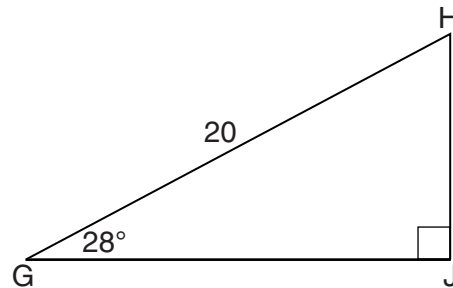
Since you have to find the length of  $\overline{HJ}$  you would use sin because it is opposite of the angle 28 and there is a hypotenuse in this triangle, so Alex is right. Marlene would be right if you needed to find the length of  $\overline{GJ}$ .

**Score 1:** The student made an error by not considering complementary angles.

**Question 27**

27 When instructed to find the length of  $\overline{HJ}$  in right triangle  $HJG$ , Alex wrote the equation  $\sin 28^\circ = \frac{HJ}{20}$  while Marlene wrote  $\cos 62^\circ = \frac{HJ}{20}$ . Are both students' equations correct?

Explain why.

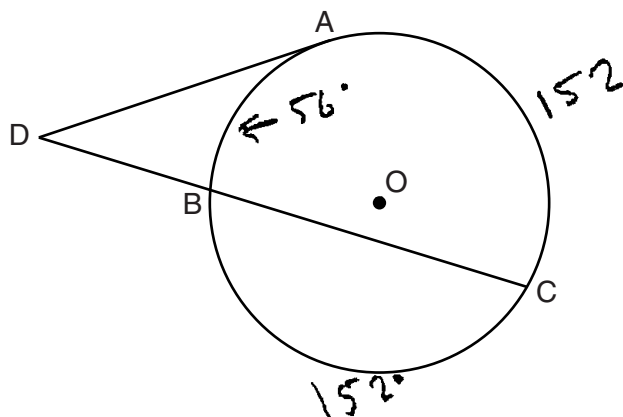


No, Marlene is right since the side opposite the 62° is not in the equation.

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

Question 28

28 In the diagram below, tangent  $\overline{DA}$  and secant  $\overline{DBC}$  are drawn to circle  $O$  from external point  $D$ , such that  $\widehat{AC} \cong \widehat{BC}$ .



If  $m\widehat{BC} = 152^\circ$ , determine and state  $m\angle D$ .

$$360 - 152 - 152 = 56$$

$$152 - 56 = 96$$

$$96 / 2 = 48$$

$m\angle D = 48^\circ$

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

Question 28

28 In the diagram below, tangent  $\overline{DA}$  and secant  $\overline{DBC}$  are drawn to circle  $O$  from external point  $D$ , such that  $\widehat{AC} \cong \widehat{BC}$ .

①  $\widehat{BC} = 152$   
 $\widehat{BC} \cong \widehat{AC}$   
 $\widehat{AC} = 152$

② 
$$\begin{array}{r} 152 \\ + 152 \\ \hline 304 \end{array}$$

③ 
$$\begin{array}{r} 360 \\ - 304 \\ \hline 56 \end{array}$$

④ 
$$\begin{array}{r} 28 \\ \overline{) 56} \\ \underline{4} \\ 16 \end{array}$$

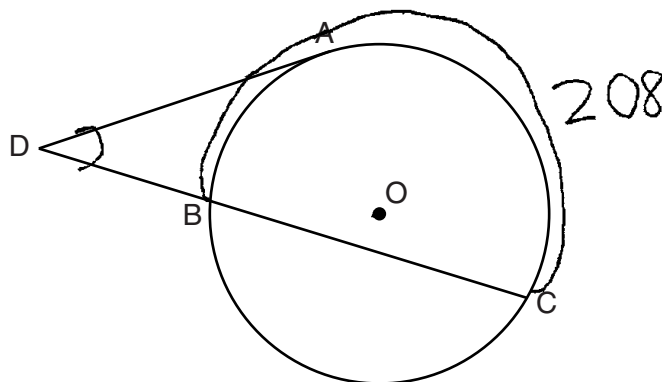
If  $m\widehat{BC} = 152^\circ$ , determine and state  $m\angle D$ .

28°

**Score 1:** The student showed appropriate work to find  $m\widehat{AC}$  and  $m\widehat{AB}$ , but no further correct work was shown.

**Question 28**

28 In the diagram below, tangent  $\overline{DA}$  and secant  $\overline{DBC}$  are drawn to circle  $O$  from external point  $D$ , such that  $\widehat{AC} \cong \widehat{BC}$ .



If  $m\widehat{BC} = 152^\circ$ , determine and state  $m\angle D$ . 152

$$\begin{array}{r} 360 \\ -152 \\ \hline 208 \end{array}$$

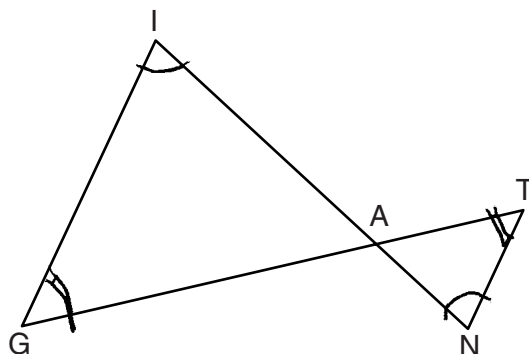
$$\begin{aligned} \angle D &= \frac{1}{2} \widehat{BAC} \\ &= \frac{1}{2} (208) \end{aligned}$$

$$\angle D = 104$$

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

Question 29

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at A.



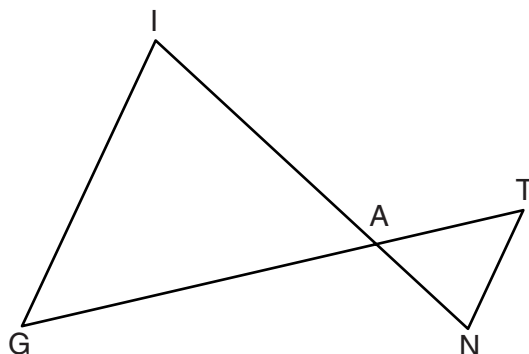
Prove:  $\triangle GIA \sim \triangle TNA$

$\overline{GI} \parallel \overline{NT}$ ,  $\overline{IN}$  intersects  $\overline{GT}$  at A  
(Given)  
↓  
 $\angle I \cong \angle N$ ,  $\angle G \cong \angle T$   
(// lines cut by a transversal  
makes  $\cong$  alt. int.  $\angle$ s)  
↓  
 $\triangle GIA \sim \triangle TNA$   
(AA)

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

**Question 29**

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at  $A$ .



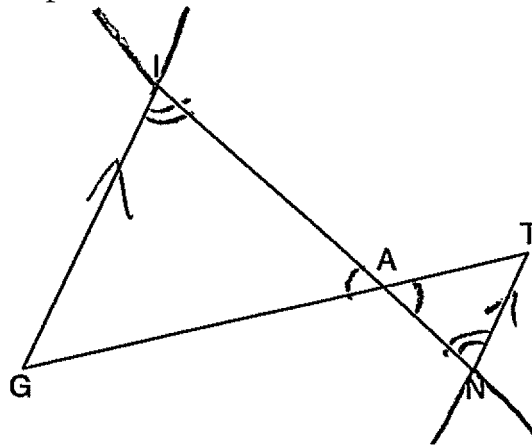
Prove:  $\triangle GIA \sim \triangle TNA$

Rotate  $\triangle TNA$   $180^\circ$  about point  $A$ .  
This rotation will put  $T'$  on  $\overline{GA}$  and  
 $N'$  on  $\overline{IA}$  and keep  $\overline{GI} \parallel \overline{N'T'}$ . Now  
dilate  $\triangle T'N'A$  by a scale factor of  
 $\frac{GA}{TA}$  and centered at  $A$ , which maps  $\triangle T'N'A$   
onto  $\triangle GIA$ .  
This similarity transformation  
proves  $\triangle GIA \sim \triangle TNA$

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

Question 29

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at A.



Prove:  $\triangle GIA \sim \triangle TNA$

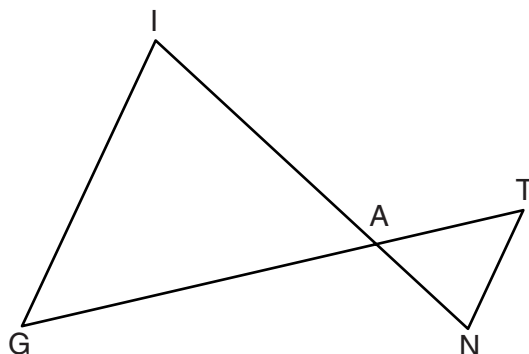
statements	Reasons
$\overline{GI}$ parallel to $\overline{NT}$	Given
$\overline{IN}$ intersects $\overline{GT}$ at A	
$\angle IAG \cong \angle NAT$	- Vertical Angles are $\cong$
$\angle GIA \cong \angle TNA$	- Two parallel lines cut by a transversal creates congruent alternate interior angles
$\triangle GIA \sim \triangle TNA$	- AA similarity Criterion

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



Question 29

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at A.



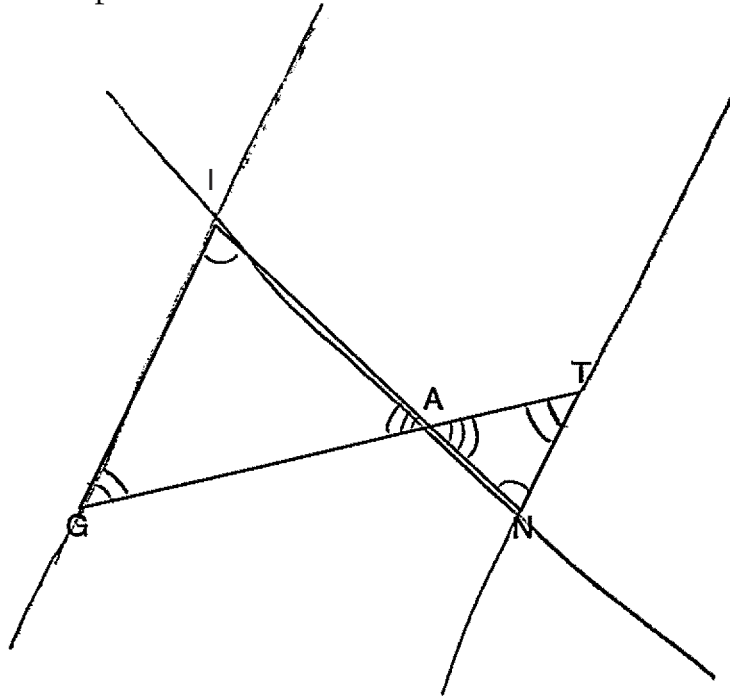
Prove:  $\triangle GIA \sim \triangle TNA$

Statement	Reason
1. $\overline{IN}$ intersects $\overline{GT}$ at A	1. Given
2. $\angle IAG \cong \angle NAT$	2. Vertical $\angle$ 's are $\cong$
3. $\overline{GI}$ is parallel to $\overline{NT}$	3. Given
4. $\angle G \cong \angle T$	4. Alternate interior $\angle$ 's are $\cong$
5. $\triangle GIA \sim \triangle TNA$	5. AA Thm.

**Score 1:** The student wrote an incomplete reason for statement 4.

**Question 29**

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at A.



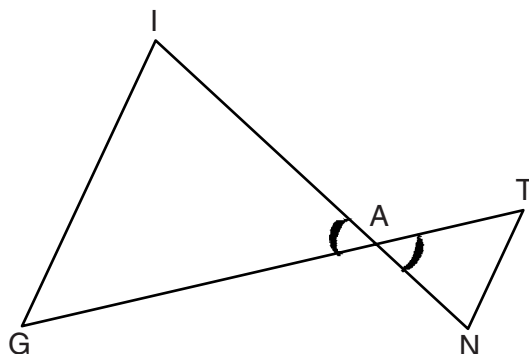
Prove:  $\triangle GIA \sim \triangle TNA$

Statement	Reason
1. Given	1. Given
2. $\angle G \cong \angle T$ $\angle I \cong \angle N$	2. alternate interior angles.
3. $\angle TAN \cong \angle GAI$	3. vertical angles are $\cong$
4. $\triangle GIA \cong \triangle TNA$	4. AA

**Score 1:** The student only had one relevant correct statement and reason.

Question 29

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at A.



Prove:  $\triangle GIA \sim \triangle TNA$

1)  $\overline{GI} \parallel \overline{NT}$

2)  $\overline{IN}$  intersects  $\overline{GT}$  at A

3)  $\angle IAG \cong \angle TAN$

1) Given

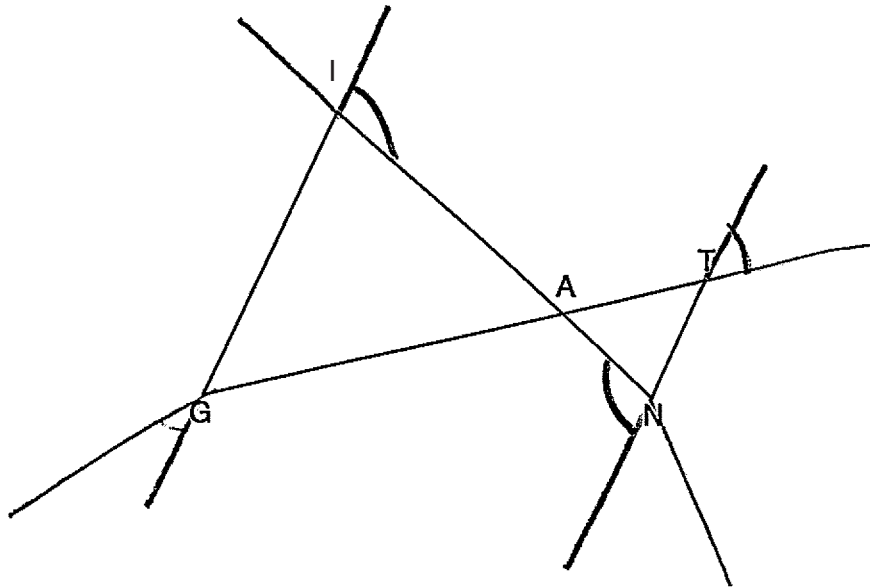
2) Given

3) Vertical  $\angle$ 's

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

Question 29

29 In the diagram below,  $\overline{GI}$  is parallel to  $\overline{NT}$ , and  $\overline{IN}$  intersects  $\overline{GT}$  at A.



Prove:  $\triangle GIA \sim \triangle TNA$

$\overline{GI}$  is parallel to  $\overline{NT}$  given  
 $\angle N \cong \angle I$  alternate interior

$\angle G \cong \angle T$  alt. ext.

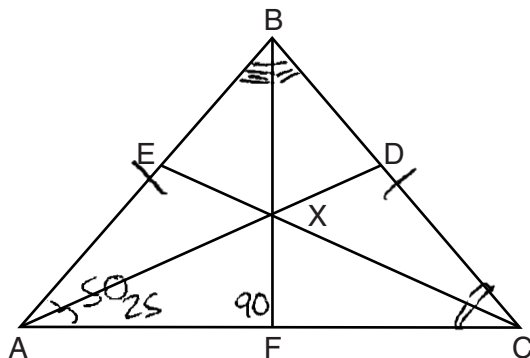
$\angle A \cong \angle A$  by something that starts with R.

$\triangle GIA \cong \triangle TNA$

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

**Question 30**

30 In the diagram below of isosceles triangle  $ABC$ ,  $\overline{AB} \cong \overline{CB}$  and angle bisectors  $\overline{AD}$ ,  $\overline{BF}$ , and  $\overline{CE}$  are drawn and intersect at  $X$ .



If  $m\angle BAC = 50^\circ$ , find  $m\angle AXC$ .

$$\begin{array}{r}
 90 \\
 + 25 \\
 \hline
 \textcircled{115}
 \end{array}$$
  

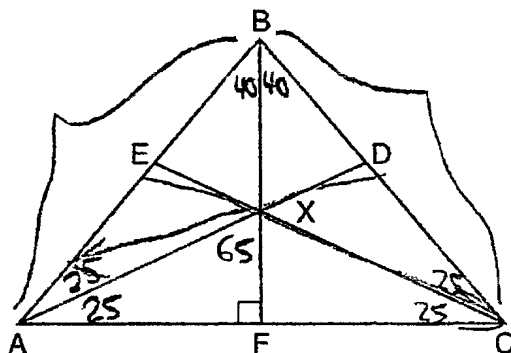
$$\begin{array}{r}
 180 \\
 - 115 \\
 \hline
 \textcircled{65 \times 2}
 \end{array}$$
  

$$\textcircled{m\angle AXC = 130^\circ}$$

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

**Question 30**

30 In the diagram below of isosceles triangle  $ABC$ ,  $\overline{AB} \cong \overline{CB}$  and angle bisectors  $\overline{AD}$ ,  $\overline{BF}$ , and  $\overline{CE}$  are drawn and intersect at  $X$ .



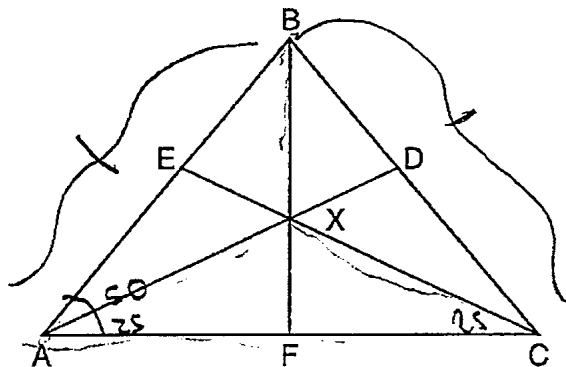
If  $m\angle BAC = 50^\circ$ , find  $m\angle AXC$ .

130°

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

Question 30

30 In the diagram below of isosceles triangle  $ABC$ ,  $\overline{AB} \cong \overline{CB}$  and angle bisectors  $\overline{AD}$ ,  $\overline{BF}$ , and  $\overline{CE}$  are drawn and intersect at  $X$ .



$$\begin{array}{r} 180 \\ - 80 \\ \hline 30 \end{array}$$

If  $m\angle BAC = 50^\circ$ , find  $m\angle AXC$ .

$$m\angle BAC = 50$$

$$m\angle XAF = 25$$

$\triangle ABC$  is isosceles so the angles opposite the congruent sides are equal, so  $m\angle BCF$  is also  $50^\circ$

$\overline{EC}$  is an angle bisector so  $m\angle ECA = 25^\circ$ .

$$\begin{array}{r} 25 \\ + 25 \\ \hline 50 \end{array}$$

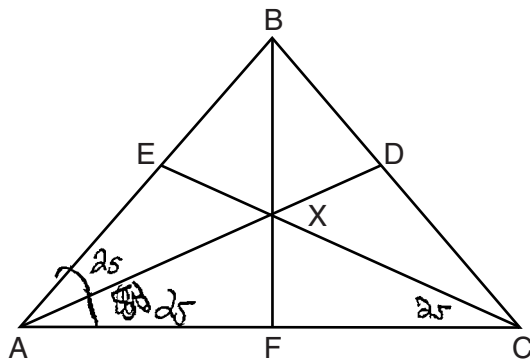
$$\begin{array}{r} 180 \\ - 50 \\ \hline 130^\circ \end{array}$$

$$m\angle AXC = 130^\circ$$

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

**Question 30**

**30** In the diagram below of isosceles triangle  $ABC$ ,  $\overline{AB} \cong \overline{CB}$  and angle bisectors  $\overline{AD}$ ,  $\overline{BF}$ , and  $\overline{CE}$  are drawn and intersect at  $X$ .



If  $m\angle BAC = 50^\circ$ , find  $m\angle AXC$ .

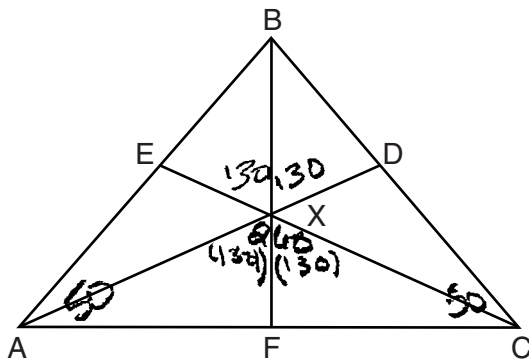
$$\begin{aligned} 25 + 25 &= 50 \\ 180 - 50 &= 30 \\ \angle AXC &= 30 \end{aligned}$$

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



**Question 30**

**30** In the diagram below of isosceles triangle  $ABC$ ,  $\overline{AB} \cong \overline{CB}$  and angle bisectors  $\overline{AD}$ ,  $\overline{BF}$ , and  $\overline{CE}$  are drawn and intersect at  $X$ .



If  $m\angle BAC = 50^\circ$ , find  $m\angle AXC$ .

$$\begin{array}{r} 360 \\ -100 \\ \hline 260 \end{array}$$

$$\frac{260}{2} = 130$$

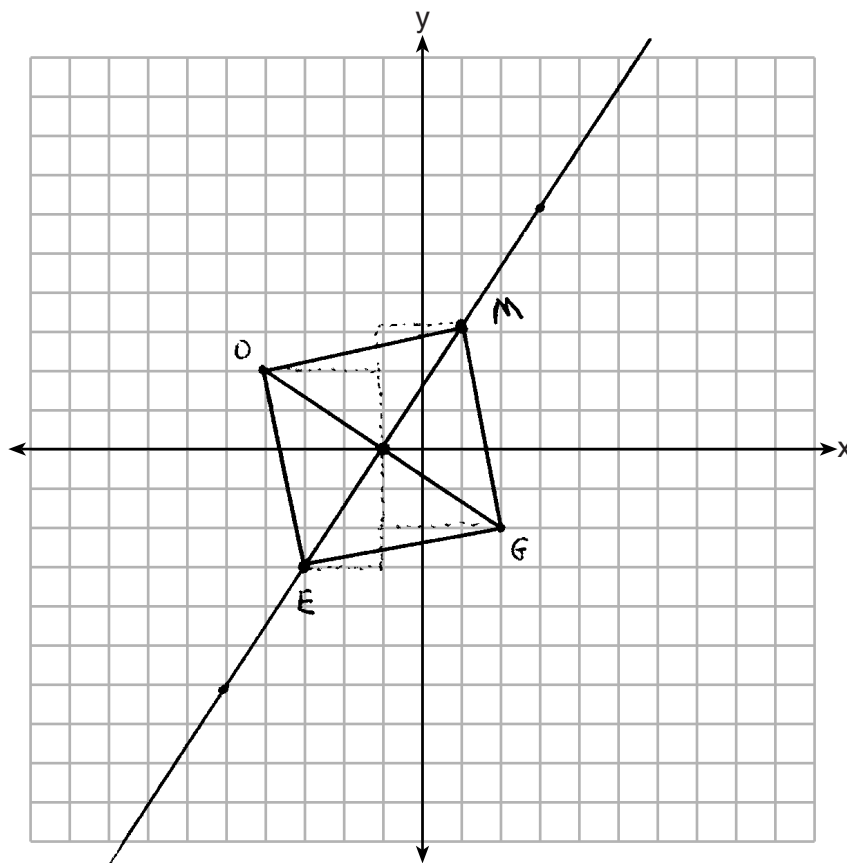
**Score 0:** The student obtained the correct answer by an incorrect method.

**Question 31**

**31** In square  $GEOM$ , the coordinates of  $G$  are  $(2, -2)$  and the coordinates of  $O$  are  $(-4, 2)$ . Determine and state the coordinates of vertices  $E$  and  $M$ .

[The use of the set of axes below is optional.]

$M(1, 3)$   
 $E(-3, -3)$



$$\overline{GO} \rightarrow \frac{-4}{2} = -\frac{2}{1}$$
$$\perp \rightarrow \frac{6}{4} = \frac{3}{2}$$

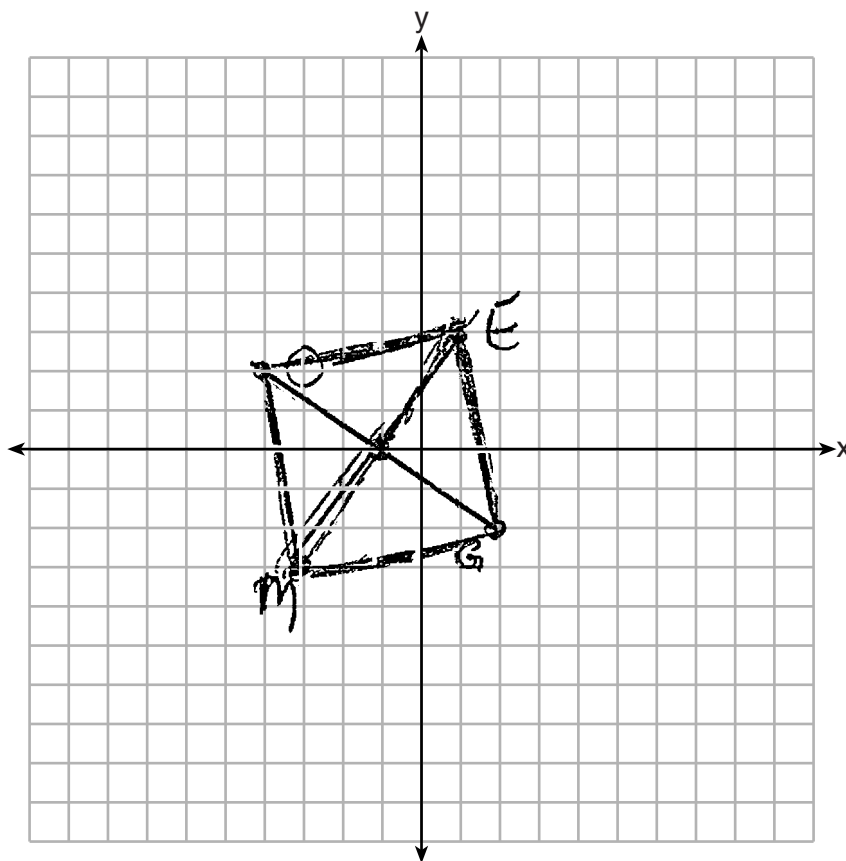
**Score 2:** The student had a complete and correct response.

**Question 31**

**31** In square  $GEOM$ , the coordinates of  $G$  are  $(2, -2)$  and the coordinates of  $O$  are  $(-4, 2)$ . Determine and state the coordinates of vertices  $E$  and  $M$ .

[The use of the set of axes below is optional.]

$M(-3, -3) E(1, 3)$



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

**Question 31**

**31** In square  $GEOM$ , the coordinates of  $G$  are  $(2, -2)$  and the coordinates of  $O$  are  $(-4, 2)$ . Determine and state the coordinates of vertices  $E$  and  $M$ .

[The use of the set of axes below is optional.]

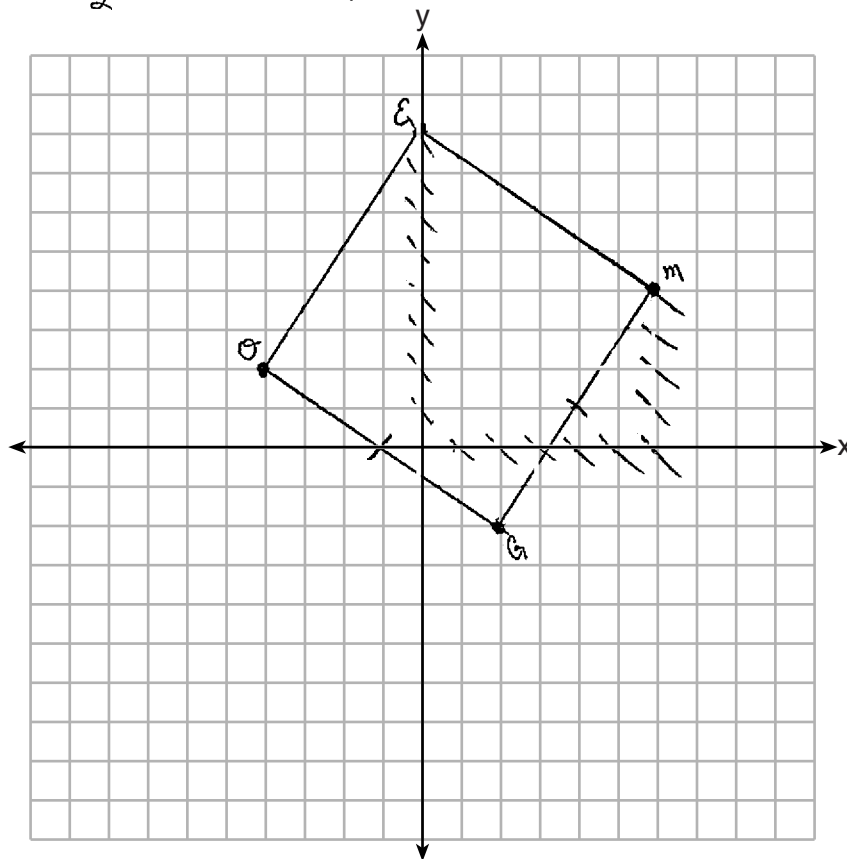
$$m = \frac{\Delta y}{\Delta x}$$

$$m = \frac{2 - (-2)}{-4 - 2}$$

$$m = \frac{4}{-6} = -\frac{2}{3}$$

$$E(0, 8)$$

$$M(6, 4)$$



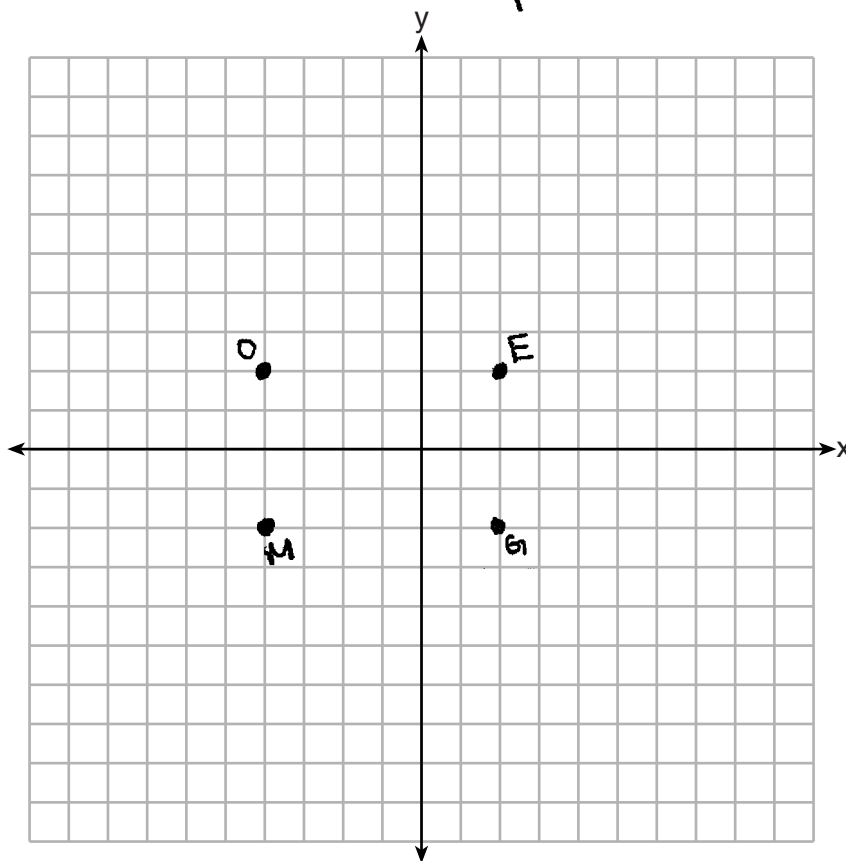
**Score 1:** The student made an error in the order of the vertices of square  $GEOM$ .

**Question 31**

**31** In square  $GEOM$ , the coordinates of  $G$  are  $(2, -2)$  and the coordinates of  $O$  are  $(-4, 2)$ . Determine and state the coordinates of vertices  $E$  and  $M$ .

[The use of the set of axes below is optional.]

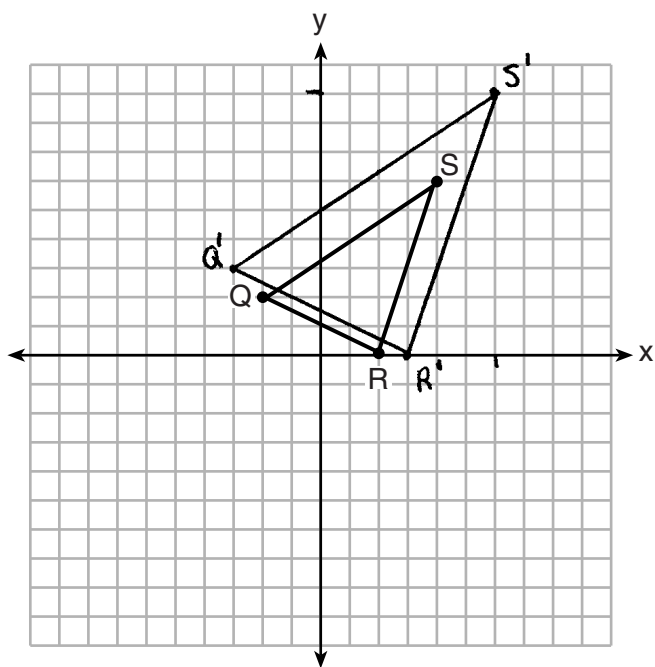
$E(2, 2)$   
 $M(-4, 2)$



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

**Question 32**

32 Triangle  $QRS$  is graphed on the set of axes below.



On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

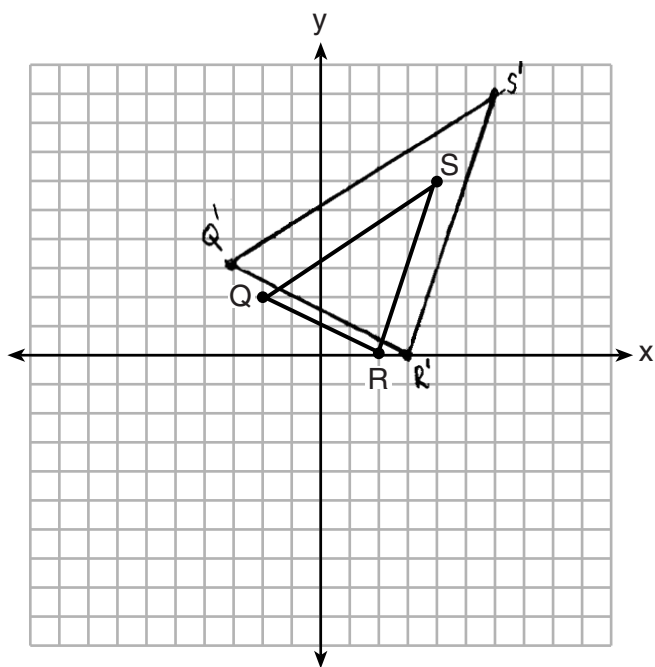
Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

A dilation will preserve the slopes of lines so the slope of  $\overline{Q'R'}$  will be the same as the slope of  $\overline{QR}$ . Because the slopes are equal then  $\overline{Q'R'} \parallel \overline{QR}$ .

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

**Question 32**

32 Triangle  $QRS$  is graphed on the set of axes below.



$R(1, 0)$   
 $S(4, 6)$   
 $Q(-2, 2)$   
 $\downarrow$   
 $R'(3, 0)$   
 $S'(6, 9)$   
 $Q'(-3, 3)$

On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

$$\text{Slope } \overline{QR} = \frac{2}{-4} = -\frac{1}{2}$$

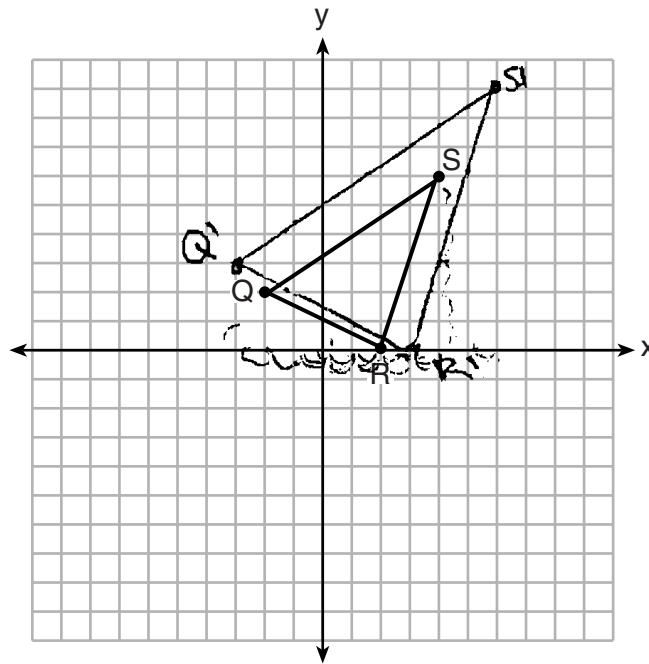
$$\text{Slope } \overline{Q'R'} = \frac{3}{-6} = -\frac{1}{2}$$

$\overline{Q'R'} \parallel \overline{QR}$  b/c  
 they have the  
 same slopes,  
 which makes  
 them parallel.

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

**Question 32**

32 Triangle  $QRS$  is graphed on the set of axes below.



On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

$$\begin{aligned} Q(-2, 2) &\rightarrow (-3, 3) \\ R(2, 4) &\rightarrow (3, 0) \\ S(4, 6) &\rightarrow (6, 9) \end{aligned}$$

Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

$$m_{\overline{Q'R'}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 2}{-3 - (-2)} = \frac{1}{-1} = -1$$

$$m_{\overline{QR}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - 2}{2 - 0} = \frac{2}{2} = 1$$

$\therefore \overline{Q'R'} \parallel \overline{QR}$  because the slopes are the same.

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



Question 32

32 Triangle  $QRS$  is graphed on the set of axes below.

$$Q \rightarrow (-2, 2)$$

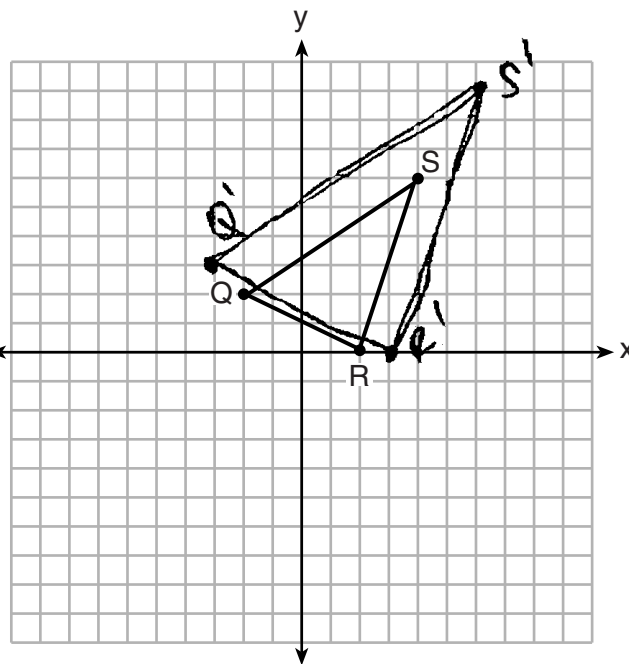
$$R \rightarrow (2, 0)$$

$$S \rightarrow (4, 6)$$

$$Q' \rightarrow (-3, 3)$$

$$R' \rightarrow (3, 0)$$

$$S' \rightarrow (6, 9)$$



On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

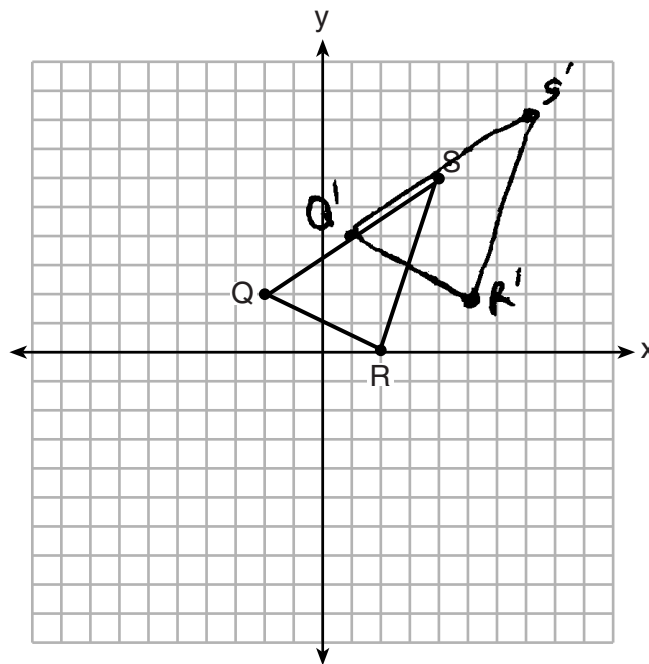
Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

$\overline{Q'R'} \parallel \overline{QR}$  because they have the same slopes. The slope of  $\overline{Q'R'}$  is  $\frac{3}{6}$  & the slope of  $\overline{QR}$  is  $\frac{1}{2}$ . When  $\frac{3}{6}$  is simplified, it becomes  $\frac{1}{2}$ . Therefore  $\overline{Q'R'} \parallel \overline{QR}$ .

**Score 3:** The student made an error in stating the slope is  $\frac{1}{2}$ .

**Question 32**

32 Triangle  $QRS$  is graphed on the set of axes below.



$Q(-2, 2)$	$Q'(4, 4)$
$R(2, 0)$	$R'(5, 2)$
$S(4, 4)$	$S'(7, 8)$
	$\rightarrow \uparrow 2$

On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

$$m_{\overline{QR}} = \frac{0-2}{2-(-2)} = \frac{-2}{4} = -\frac{1}{2}$$

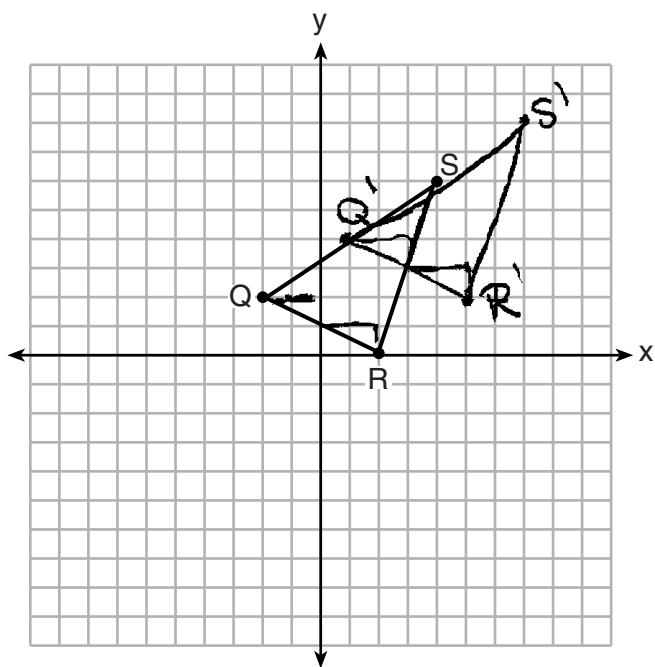
$$m_{\overline{Q'R'}} = \frac{2-4}{5-1} = \frac{-2}{4} = -\frac{1}{2}$$

} slopes are =  
∴ lines are ||

**Score 2:** The student made an error in the transformation by translating  $\triangle QRS$  instead of dilating  $\triangle QRS$ .

**Question 32**

**32** Triangle  $QRS$  is graphed on the set of axes below.



On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

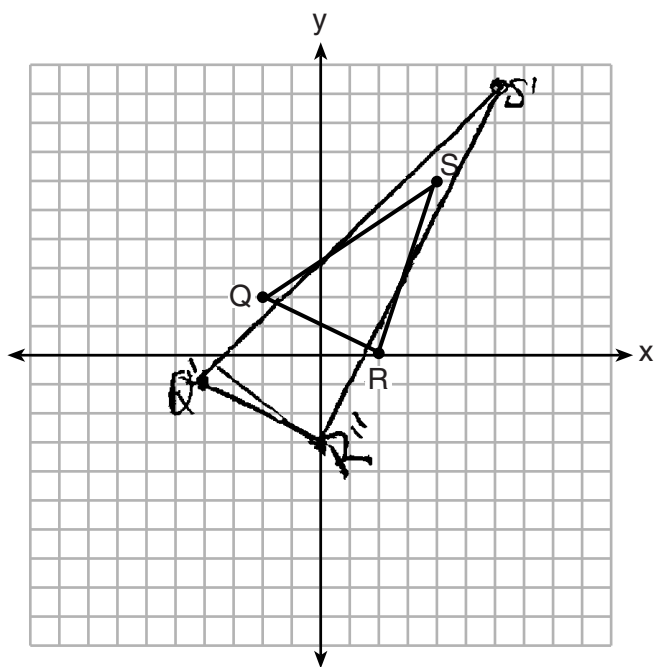
Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

*QR has a slope of  $\frac{2}{1}$  and  $Q'R'$  also has a slope of  $\frac{2}{1}$ . Because their slopes are congruent, they are parallel.*

**Score 1:** The student transformed  $\triangle QRS$  incorrectly and found the incorrect slope. The student correctly interpreted that same slopes form parallel sides.

**Question 32**

**32** Triangle  $QRS$  is graphed on the set of axes below.



On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

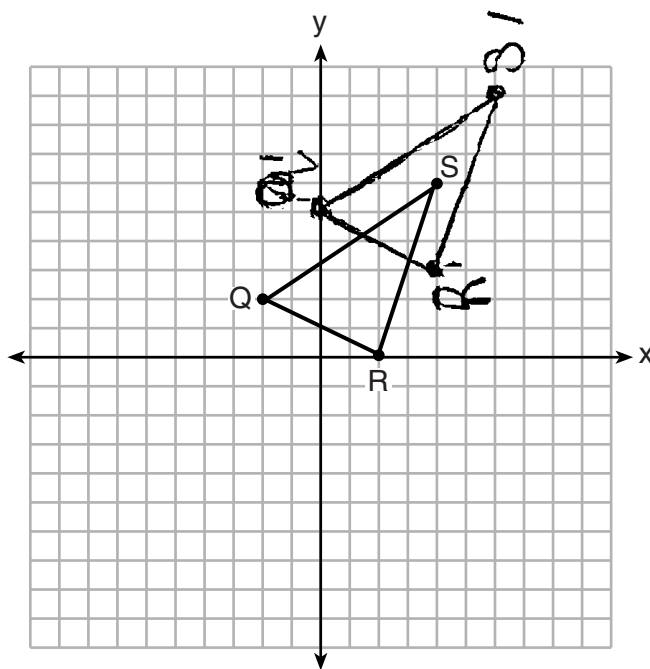
$$\overline{QR} = \frac{-2}{4} = \boxed{-\frac{1}{2}}$$

$$\overline{Q'R'} = \frac{-2}{4} = \boxed{-\frac{1}{2}}$$

**Score 1:** The student found the appropriate slopes of  $\overline{QR}$  and  $\overline{Q'R'}$ , but no further correct work was shown.

**Question 32**

**32** Triangle  $QRS$  is graphed on the set of axes below.



On the same set of axes, graph and label  $\triangle Q'R'S'$ , the image of  $\triangle QRS$  after a dilation with a scale factor of  $\frac{3}{2}$  centered at the origin.

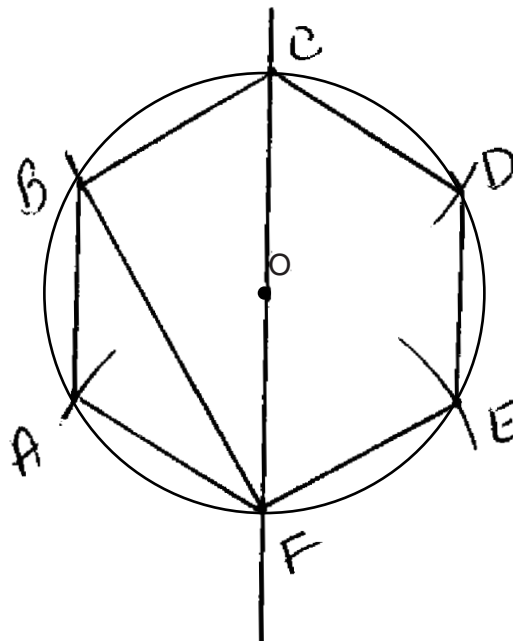
Use slopes to explain why  $\overline{Q'R'} \parallel \overline{QR}$ .

They are parallel because they never touch

**Score 0:** The student graphed the transformation incorrectly and wrote an incorrect explanation.

**Question 33**

**33** Using a compass and straightedge, construct a regular hexagon inscribed in circle  $O$  below. Label it  $ABCDEF$ . [Leave all construction marks.]



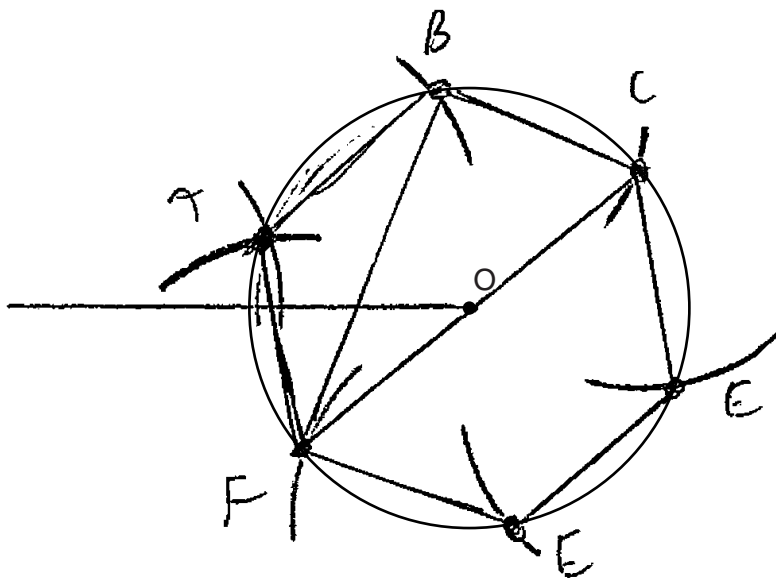
If chords  $\overline{FB}$  and  $\overline{FC}$  are drawn, which type of triangle, according to its angles, would  $\triangle FBC$  be? Explain your answer.

Right  $\Delta$ , because  $\angle CBF$  is inscribed in a semi-circle.

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

**Question 33**

**33** Using a compass and straightedge, construct a regular hexagon inscribed in circle  $O$  below. Label it  $ABCDEF$ . [Leave all construction marks.]



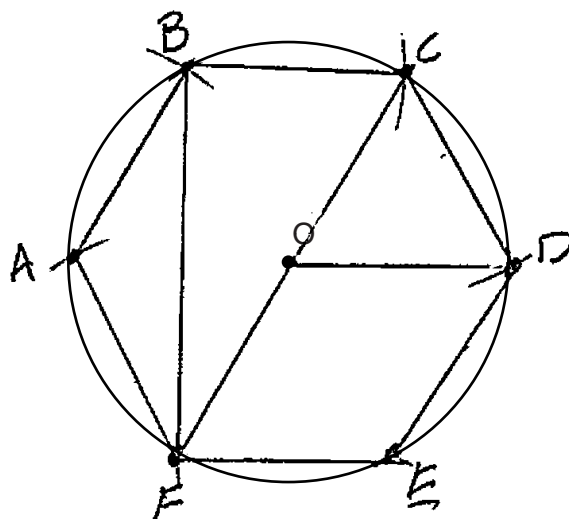
If chords  $\overline{FB}$  and  $\overline{FC}$  are drawn, which type of triangle, according to its angles, would  $\triangle FBC$  be? Explain your answer.

right triangle

**Score 3:** The student did not write an explanation.

**Question 33**

**33** Using a compass and straightedge, construct a regular hexagon inscribed in circle  $O$  below. Label it  $ABCDEF$ . [Leave all construction marks.]



If chords  $\overline{FB}$  and  $\overline{FC}$  are drawn, which type of triangle, according to its angles, would  $\triangle FBC$  be? Explain your answer.

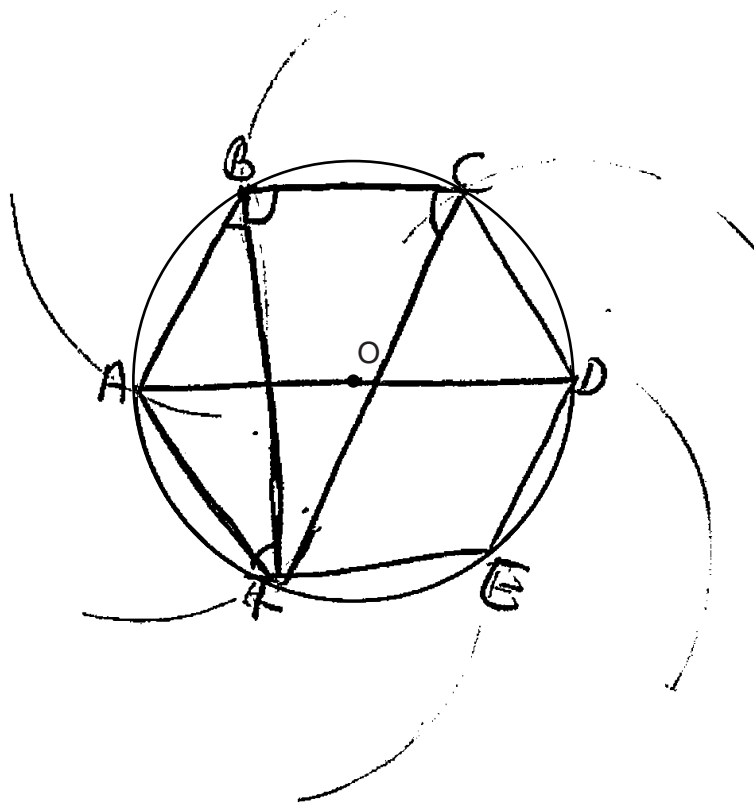
*a 30, 60, 90° triangle because  $\overline{FC}$  is the diameter.*

**Score 3:** The student wrote an incomplete explanation.



**Question 33**

**33** Using a compass and straightedge, construct a regular hexagon inscribed in circle  $O$  below. Label it  $ABCDEF$ . [Leave all construction marks.]



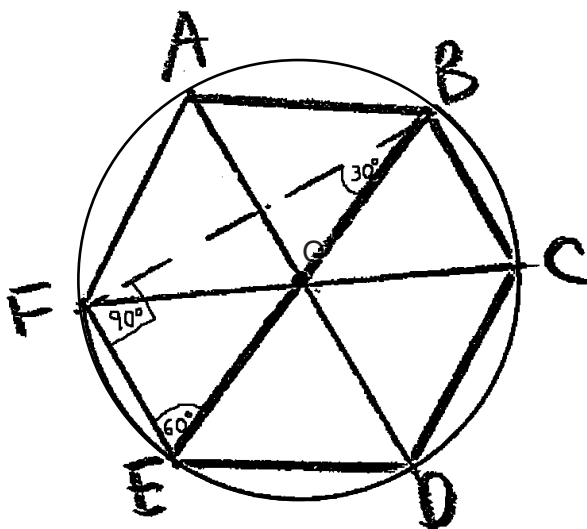
If chords  $\overline{FB}$  and  $\overline{FC}$  are drawn, which type of triangle, according to its angles, would  $\triangle FBC$  be? Explain your answer.

$\triangle FBC$  would be an isosceles triangle because both base angles  $\angle B, \angle C$  are equal to each other.

**Score 2:** The student constructed and labeled the hexagon correctly, but no further correct work was shown.

**Question 33**

**33** Using a compass and straightedge, construct a regular hexagon inscribed in circle  $O$  below. Label it  $ABCDEF$ . [Leave all construction marks.]



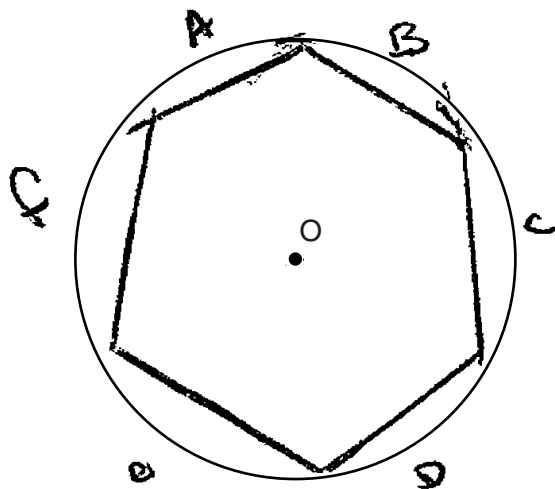
If chords  $\overline{FB}$  and  $\overline{FC}$  are drawn, which type of triangle, according to its angles, would  $\triangle FBC$  be? Explain your answer.

*It would be a right triangle*

**Score 1:** The student made a drawing that was not a construction. The triangle was correctly identified as a right triangle, but the explanation was missing.

**Question 33**

**33** Using a compass and straightedge, construct a regular hexagon inscribed in circle  $O$  below. Label it  $ABCDEF$ . [Leave all construction marks.]



If chords  $\overline{FB}$  and  $\overline{FC}$  are drawn, which type of triangle, according to its angles, would  $\triangle FBC$  be? Explain your answer.

*a right triangle, because it has a right angle.*

**Score 0:** The student made a drawing that was not a construction. The explanation was incorrect because  $\triangle FBC$  cannot be identified according to the student's drawing.

### Question 34

34 A candle maker uses a mold to make candles like the one shown below.



The height of the candle is 13 cm and the circumference of the candle at its widest measure is 31.416 cm. Use modeling to approximate how much wax, to the *nearest cubic centimeter*, is needed to make this candle. Justify your answer.

The student's work includes a triangle on the left, a diagram of a cone with a vertical line indicating a height of 13, and several equations:

$$V = \frac{1}{3} \pi r^2 h$$
$$V = \frac{1}{3} \pi (5)^2 13$$
$$V \approx 340.$$
$$31.416 = \frac{2\pi r}{2\pi}$$
$$r = 5.000$$

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

### Question 34

34 A candle maker uses a mold to make candles like the one shown below.



The height of the candle is 13 cm and the circumference of the candle at its widest measure is 31.416 cm. Use modeling to approximate how much wax, to the *nearest cubic centimeter*, is needed to make this candle. Justify your answer.

$$31.416 = \pi d$$

$$d = 10.0051$$

$$r = 5.00255$$

$$V = \frac{1}{3} \pi r^2 h$$

$$V = \frac{1}{3} \pi (25.0255)(13)$$

$$V = \frac{1}{3} (325.331) \pi$$

$$V = 108.444 \pi$$

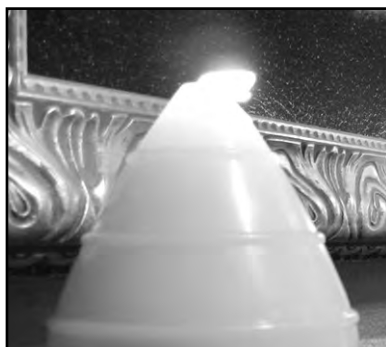
$$V = 341$$

Using the formula for circumference of a circle you find the diameter and radius. Then you use formula for volume of a cone to find the amount of wax needed.

**Score 3:** The student divided the circumference by 3.14 instead of  $\pi$ .

### Question 34

34 A candle maker uses a mold to make candles like the one shown below.



The height of the candle is 13 cm and the circumference of the candle at its widest measure is 31.416 cm. Use modeling to approximate how much wax, to the *nearest cubic centimeter*, is needed to make this candle. Justify your answer.

$$\frac{31.416}{2} = 15.708$$

$$V = \frac{1}{3} \pi r^2 h$$

$$V = \frac{1}{3} \pi (15.708)^2 (13)$$

$$V = \frac{1}{3} \pi (246.741264) (13)$$

$$V = 1069.212144 \pi$$

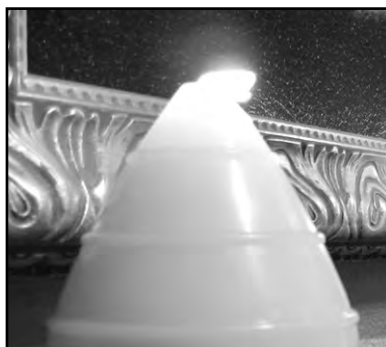
$$V = 3359.02$$

$$V = 3359$$

**Score 2:** The student use an incorrect method to find the radius.

### Question 34

34 A candle maker uses a mold to make candles like the one shown below.



The height of the candle is 13 cm and the circumference of the candle at its widest measure is 31.416 cm. Use modeling to approximate how much wax, to the *nearest cubic centimeter*, is needed to make this candle. Justify your answer.

$$\begin{aligned} V &= \frac{1}{3} \pi r^2 h \\ V &= \frac{1}{3} \pi (15.708)^2 (13) \\ &= \frac{1}{3} \pi (246.741264) (13) \\ &= \frac{1}{3} \pi (3207.636432) \\ &= 1069.212144 \\ &= \boxed{1069\pi} \end{aligned}$$

$\frac{31.416}{2} = 15.708$

**Score 1:** The student used an incorrect method to find the radius and wrote the volume in terms of  $\pi$ .

Question 34

34 A candle maker uses a mold to make candles like the one shown below.



13 cm

The height of the candle is 13 cm and the circumference of the candle at its widest measure is 31.416 cm. Use modeling to approximate how much wax, to the *nearest cubic centimeter*, is needed to make this candle. Justify your answer.

$$C = 2\pi r$$
$$\frac{31.416}{2} = \frac{2\pi r}{2}$$
$$15.708 = \pi r$$

$$A = \pi r^2$$
$$A = \pi (15.708)^2$$
$$A = 246.741264\pi$$
$$A = 1775.1605423$$

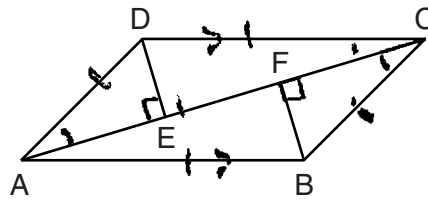
$$A = 1775 \text{ cubic cm}$$

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



Question 35

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



$$\triangle CDE \cong \triangle ABF$$

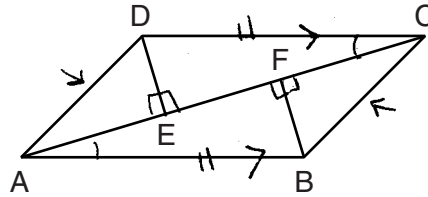
Prove:  $\overline{AE} \cong \overline{CF}$

Statement	Reason
1. quad $ABCD$ $\overline{AB} \cong \overline{CD}$ , $\overline{AB} \parallel \overline{CD}$ $\overline{BF} \perp \overline{AC}$ , $\overline{DE} \perp \overline{AC}$	1. given
2. $\angle AED$ and $\angle CFB$ are rt. $\angle$ 's	2. $\perp$ lines form rt. $\angle$ 's
3. $\angle AED \cong \angle CFB$	3. all rt. $\angle$ 's are $\cong$
4. $ABCD$ is a parallelogram	4. a quad that has one pair of sides $\cong$ and $\parallel$ is a parallelogram
5. $\overline{AD} \parallel \overline{BC}$	5. parallelograms have opposite sides $\parallel$ .
6. $\angle DAE \cong \angle BCF$	6. when 2 $\parallel$ lines are cut by a transversal, alt. int. $\angle$ 's are $\cong$
7. $\overline{DA} \cong \overline{BC}$	7. parallelograms have 2 pairs of $\cong$ sides
8. $\triangle ADE \cong \triangle CBF$	8. $AAS \cong AAS$
9. $\overline{AE} \cong \overline{CF}$	9. CPCTC

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

Question 35

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



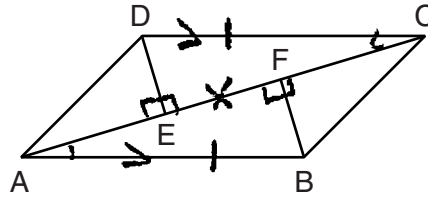
Prove:  $\overline{AE} \cong \overline{CF}$

- S 1. QUAD  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ ,  $\overline{BF} \perp \overline{AC}$ ,  $\overline{DE} \perp \overline{AC}$  1. Given
2. If 2 lines are  $\perp$ , then they form right  $\Delta$ s.
- A 3.  $\Delta DEC$  &  $\Delta BFA$  are rt.  $\Delta$ s,  $\Delta DEA$  &  $\Delta BFC$  are rt.  $\Delta$ s 3. All rt.  $\Delta$ s are  $\cong$ .
- A 4.  $\Delta DCE \cong \Delta BAF$  4. If 2 // lines are cut by a trans., then alt. int.  $\Delta$ s are  $\cong$ .
5.  $\Delta DCE \cong \Delta BAF$  5. AAS
- S 6.  $\overline{AC} \cong \overline{CA}$  6. Reflexive
7.  $\Delta CDA \cong \Delta ABC$  7. SAS
8.  $\Delta DEA$  &  $\Delta BFC$  are rt.  $\Delta$ s 8. If  $\Delta$  has a right  $\angle$ , it is a right  $\Delta$ .
9.  $\overline{DE} \cong \overline{BF}$ ,  $\overline{DA} \cong \overline{BC}$  9. CPCTC
10.  $\Delta DEA \cong \Delta BFC$  10. HL
11.  $\overline{AE} \cong \overline{CF}$  11. CPCTC

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

Question 35

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



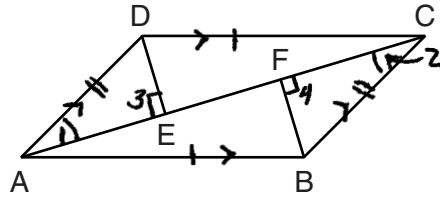
Prove:  $\overline{AE} \cong \overline{CF}$

Statements	Reasons
1. Given	1. Given
2. $\angle FAB \cong \angle ECD$	2. $\parallel$ lines form $\cong$ alt. interior $\angle$ 's
3. $\angle BFE$ and $\angle DEF$ are $\text{rt } \angle$ 's	3. $\perp$ lines form $\text{rt } \angle$ 's
4. $\angle BFE \cong \angle DEF$	4. All $\text{rt } \angle$ 's $\cong$
5. $\triangle FAB \cong \triangle ECD$	5. AAS $\cong$ AAS
6. $\overline{AF} \cong \overline{EC}$	6. Corresponding parts of $\cong \triangle$ 's $\cong$
7. $\overline{EF} \cong \overline{EF}$	7. Reflexive
8. $\overline{AE} \cong \overline{CF}$	8. Subtraction Property

**Score 5:** The student did not write the given statements in the proof.

Question 35

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



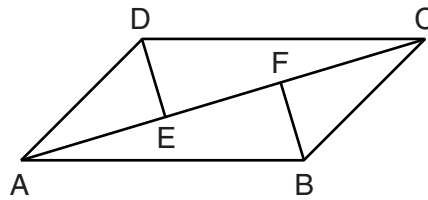
Prove:  $\overline{AE} \cong \overline{CF}$

Statements	Reasons
① Quad $ABCD$ , $\overline{AB} \cong \overline{CD}$ , $\overline{AB} \parallel \overline{CD}$ , $\overline{BF} \perp \overline{AC}$ , $\overline{DE} \perp \overline{AC}$	① Given
② $ABCD$ is a parallelogram	② If a quad has one pair of opp sides $\cong$ and $\parallel$ , then the quad is a parallelogram
A ③ $\angle 1 \cong \angle 2$	③ Alternate interior $\angle$ 's are $\cong$
S ④ $\overline{AD} \cong \overline{CB}$	④ Opp sides of a parallelogram are $\cong$
⑤ $\angle 3, \angle 4$ are RT $\angle$ 's	⑤ $\perp$ lines form RT $\angle$ 's
A ⑥ $\angle 3 \cong \angle 4$	⑥ All RT $\angle$ 's are $\cong$
⑦ $\triangle ADE \cong \triangle CBF$	⑦ AAS
⑧ $\overline{AE} \cong \overline{CF}$	⑧ CPCTC

**Score 4:** The student had one missing statement and reason to prove step 3, and had an incomplete reason in step 3.

Question 35

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



Prove:  $\overline{AE} \cong \overline{CF}$

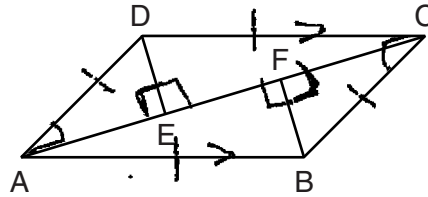
St.	R.
1) Quad $ABCD$ , $\overline{AB} \cong \overline{CD}$ , $\overline{AB} \parallel \overline{CD}$ , $\overline{BF} \perp \overline{AC}$ , $\overline{DE} \perp \overline{AC}$	1) given
2) $\triangle DEC \cong \triangle BFA$ $\triangle DEA \cong \triangle BFC$	2) All right $\triangle$ s are congruent.
3) $\angle DCE \cong \angle BAF$	3) If 2 $\parallel$ lines are cut by a transversal, alt. int. $\angle$ s are $\cong$ .
4) $\triangle DCE \cong \triangle BAF$	4) $\angle$ s
5) $\overline{AC} \cong \overline{CA}$	5) Reflexive property
6) $\triangle CDA \cong \triangle ABC$	6) SAS
7) $\overline{DA} \cong \overline{BC}$	7) CPCTC
8) $\triangle DEA \cong \triangle BFC$	8) HL
9) $\overline{AE} \cong \overline{CF}$	9) CPCTC

**Score 3:** The student had one missing statement and reason to prove step 2, and two missing statements and reasons to prove step 8.

**Question 35**

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .

AAS  
 $\triangle ADE \cong \triangle CBF$



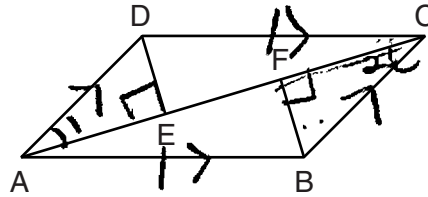
Prove:  $\overline{AE} \cong \overline{CF}$

Statements	Reasons
① Quadrilateral $ABCD$	① Given
S ② $\overline{AD} \cong \overline{CB}$	② If quadrilateral, then opposite sides are congruent
③ $\overline{AB} \parallel \overline{CD}$	③ Given
A ④ $\angle DAE \cong \angle BCF$	④ If 2    lines are crossed by a transversal, then alternate interior $\angle$ 's $\cong$ .
⑤ $\overline{BF}$ & $\overline{DE}$ are perpendicular to diagonal $AC$ at points $F$ and $E$	⑤ Given
A ⑥ $\angle DEA$ & $\angle BFC$ are right angles	⑥ If perpendicular, then right $\angle$ 's
⑦ $\angle DEA \cong \angle BFC$	⑦ If right $\angle$ 's, then $\cong$ $\angle$ 's.
⑧ $\triangle DEA \cong \triangle BFC$	⑧ AAS
⑨ $\overline{AE} \cong \overline{CF}$	⑨ CPCTC

**Score 2:** The student made a conceptual error by not proving that  $ABCD$  is a parallelogram, and one statement and reason were missing to prove step 4.

Question 35

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



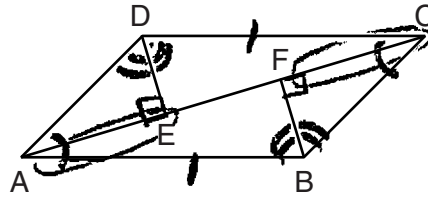
Prove:  $\overline{AE} \cong \overline{CF}$

statements	Reasons
① quadrilateral $ABCD$ , $\overline{AB} \cong \overline{CD}$ , $\overline{AB} \parallel \overline{CD}$ $\overline{BF}$ and $\overline{DE}$ are $\perp$ to diagonal $\overline{AC}$	① Given
② $\overline{DA} \parallel \overline{CB}$	② quadrilaterals have 2 pairs of    sides
③ $\angle 1 \cong \angle 2$	③ Alternate interior $\angle$ 's $\cong$ when lines are
④ $\triangle AED \cong \triangle CFB$	④ AAS $\cong$ AAS
⑤ $\overline{AE} \cong \overline{CF}$	⑤ CPCTC

Score 1: Only one or two correct relevant statements and reasons are written.

Question 35

35 In quadrilateral  $ABCD$ ,  $\overline{AB} \cong \overline{CD}$ ,  $\overline{AB} \parallel \overline{CD}$ , and  $\overline{BF}$  and  $\overline{DE}$  are perpendicular to diagonal  $\overline{AC}$  at points  $F$  and  $E$ .



Prove:  $\overline{AE} \cong \overline{CF}$

$AB \cong CD$	given
$\overline{AB} \parallel \overline{CD}$	given
$\overline{BF} \perp \overline{DE} \perp \overline{AC}$	given
$\angle D \cong \angle B$	vertical $\angle$ 's =
$\angle C \cong \angle A$	vertical $\angle$ 's =
$\triangle DEA = \triangle BFC$	$\angle$ 's =
$\triangle DEC = \triangle BFA$	$\angle$ 's =
$\overline{AE} \cong \overline{CF}$	equal $\angle$ 's + equal length <del>distance</del>

Score 0: The student had a completely incorrect response.



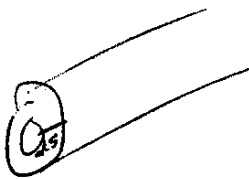
**Question 36**

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is  $2.7 \text{ g/cm}^3$ , and the cost of aluminum is \$0.38 per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?



$$\begin{aligned}V &= \pi r^2 h - \pi r^2 h \\V &= \pi(26.7)^2(750) - \pi(12.1)^2(750) \\V &= 534667.5\pi - 439230\pi \\V &= 95437.5\pi \\V &= 299825.7489 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}V &= lwh - lwh \\V &= 40 \cdot 40 \cdot 750 - 25^2(750) \\V &= 1200000 - 918750 \\V &= 281250 \text{ cm}^3\end{aligned}$$

Work space for question 36 is continued on the next page.

Question 36

Question 36 continued

$$\frac{299825.7489 \text{ cm}^3}{1} \left( \frac{2.7 \text{ g}}{\text{cm}^3} \right) \left( \frac{1 \text{ kg}}{1000 \text{ g}} \right) \left( \frac{\$0.38}{1 \text{ kg}} \right)$$

$$\$307.6212183$$

$$\$307.62$$

$$\frac{281250 \text{ cm}^3}{1} \left( \frac{2.7 \text{ g}}{\text{cm}^3} \right) \left( \frac{1 \text{ kg}}{1000 \text{ g}} \right) \left( \frac{\$0.38}{1 \text{ kg}} \right)$$

$$\$288.5625$$

$$\$288.56$$

$$\begin{array}{r} 307.62 \\ - 288.56 \\ \hline \end{array}$$

$\$19.06$  saved  
to use the  
rectangles

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

**Question 36**

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is 2.7 g/cm<sup>3</sup>, and the cost of aluminum is \$0.38 per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?

$$V = \pi r^2 h$$

$$V = \pi (26.7)^2 (750)$$

$$V = 1679707.49 \text{ cm}^3$$

$$V = \pi (24.2)^2 (750)$$

$$V = 1379881.741 \text{ cm}^3$$

$$1679707.49 - 1379881.741$$

$$V = 299825.7488$$

$$\times 2.7$$

$$\frac{809529.5218}{1000}$$

$$809.5295218$$

$$\times .38$$

$$\text{\$ } 307.62$$

$$V = lwh$$

$$V = (40)(40)(750)$$

$$V = 1200000$$

$$V = (37.5)(37.5)(750)$$

$$V = 1054687.5$$

$$1200000 - 1054687.5$$

$$V = 145312.5$$

$$\times 2.7$$

$$392343.75$$

$$\frac{\quad}{1000}$$

$$392.34375$$

$$\times .38$$

$$\text{\$ } 149.09$$

Work space for question 36 is continued on the next page.

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**Question 36**

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**Question 36 continued**

$$\begin{array}{r} 307.62 \\ -149.09 \\ \hline 158.53 \end{array}$$

Rectangular Poles are cheaper  
by \$158.53 per pole

**Score 5:** The student only subtracted 2.5 cm once when finding the volume of the rectangular prism.

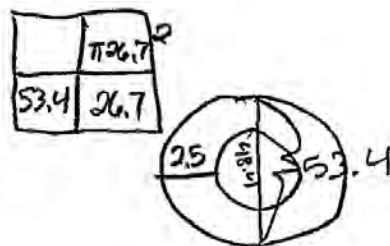
**Question 36**

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is  $2.7 \text{ g/cm}^3$ , and the cost of aluminum is  $\$0.38$  per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?



$$53.4 - 5 = 48.4$$



$$A = \pi(26.7)^2 = 2239.6100$$

$$A = \pi(24.2)^2 = 1839.8423$$

$$2239.6100 - 1839.8423 =$$

$$399.7677 \times 7.5 = 2998.2578 \text{ cm}^3$$

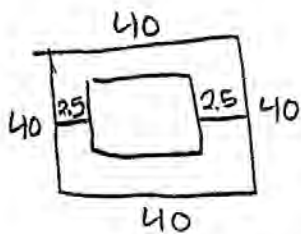
$$2998.2578 \times 2.7 = 8095.2961$$

$$8095.2961 \times 0.38 = \cancel{3076.21}$$

Work space for question 36 is continued on the next page.

## Question 36

### Question 36 continued



$$A = 40 \times 40 = 1600$$

$$A = 35 \times 35 = 1225$$

$$1600 - 1225 = 375$$

$$375 \times 7.5 = 2812.5 \text{ cm}^3$$

$$2812.5 \times 2.7 = 7593.75$$

$$7593.75 \times 0.38 = 2885.63$$

The rectangular-prism design will cost less and you will be saving \$190.58 per street light

**Score 4:** The student did not perform either conversion required by the problem.

**Question 36**

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is  $2.7 \text{ g/cm}^3$ , and the cost of aluminum is \$0.38 per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?

Volume of Rect. Prism

$$V = lwh \quad V = lwh$$

$$= (40)(40)(750) \quad = (35)(35)(750)$$

$$= 1,200,000 \quad = 918,750$$

$$V = 281,250 \text{ cm}^3$$

$$\begin{array}{r} \times 2.7 \\ \hline 759,375 \\ \hline 1000 \end{array} = 759.375 \text{ kg}$$

$$\begin{array}{r} \times .38 \\ \hline \$ 288.56 \end{array}$$

Volume of Cylinder

$$V = \pi r^2 h \quad V = \pi r^2 h$$

$$= \pi (53.4)^2 (7.5) \quad = \pi (50.9)^2 (7.5)$$

$$= 67188.2996 \quad \checkmark$$

$$= 61044.52247$$

∩

Work space for question 36 is continued on the next page.

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**Question 36**

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**Question 36 continued**

**Score 3:** The student found the cost for the rectangular prism post, but no further correct work was shown.



**Question 36**

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is  $2.7 \text{ g/cm}^3$ , and the cost of aluminum is \$0.38 per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?

$$7.5 \cdot 40^2 - 37.5^2 = \text{Square base}$$

$$1600 - 1406.25 = 193.75$$

$$2.5 \cdot 193.75 = 484.375 \text{ cm}^3$$

$$7.5 \cdot 53.4^2 - 50.9^2 = \text{Cylindrical base}$$

$$7.5 \cdot 819.77 = 6143.78 \text{ cm}^3$$

$$6143.78 \times 2.7 = 16588 \text{ g}$$

$$484.375 \times 2.7 = \frac{1317.81}{1000}$$

$$3.923 \text{ kg}$$

$$16.588 \text{ kg}$$

$$\begin{array}{r} -6.30 \\ \$1.99 \\ \hline \end{array}$$

\$41.81 saved per pole

Work space for question 36 is continued on the next page.

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**Question 36**

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**Question 36 continued**

**Score 2:** The student's procedure was correct, but contained multiple errors, such as using the diameter instead of the radius. The student stated an appropriate cost difference, but did not identify which post design will cost less.

**Question 36**

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is  $2.7 \text{ g/cm}^3$ , and the cost of aluminum is \$0.38 per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?

$$V = \pi r^2 h$$
$$V = \pi (53.4)^2 (750)$$
$$V = 6718829.96$$

$$V = \pi (48.4)^2 (750)$$
$$V = 5519526.965$$

$$V_{\text{cylinder}} = 1199302.995$$

$$V = lwh$$
$$V = (40)(40)(750)$$
$$V = 1200000$$
$$V = (35)(35)(750)$$
$$V = 918750$$
$$V_{\text{rect}} = 281250$$

$$\begin{array}{r} 1199302.995 \\ - 281250 \\ \hline 918052.995 \\ \times .38 \end{array}$$

\$348860.14 cheaper for rectangular poles

Work space for question 36 is continued on the next page.

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**Question 36**

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**Question 36 continued**

**Score 1:** The student found the volume of only one post, and no further correct relevant work was shown.

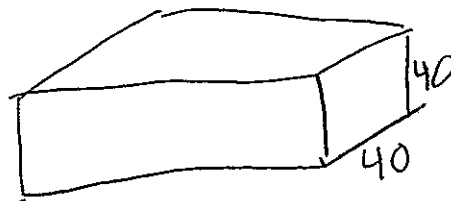
### Question 36

**36** New streetlights will be installed along a section of the highway. The posts for the streetlights will be 7.5 m tall and made of aluminum. The city can choose to buy the posts shaped like cylinders or the posts shaped like rectangular prisms. The cylindrical posts have a hollow core, with aluminum 2.5 cm thick, and an outer diameter of 53.4 cm. The rectangular-prism posts have a hollow core, with aluminum 2.5 cm thick, and a square base that measures 40 cm on each side.

The density of aluminum is  $2.7 \text{ g/cm}^3$ , and the cost of aluminum is \$0.38 per kilogram.

If all posts must be the same shape, which post design will cost the town less?

How much money will be saved per streetlight post with the less expensive design?



$$\begin{aligned}V &= lwh \\V &= 2.5(40)(40) \\V &= 4,000 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}V &= \pi r^2 h \\V &= \pi (26.7)^2 7.5 \\V &= 16,797.0749\end{aligned}$$

The post shaped like a rectangular prism would cost less because it is smaller so it'll need less aluminum.

Work space for question 36 is continued on the next page.

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**Question 36**

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**Question 36 continued**

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

## Regents Examination in Geometry (Common Core) – January 2017

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

(Use for the January 2017 exam only.)

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

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

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

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