

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

# GEOMETRY

Wednesday, January 25, 2023 — 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 35 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.**

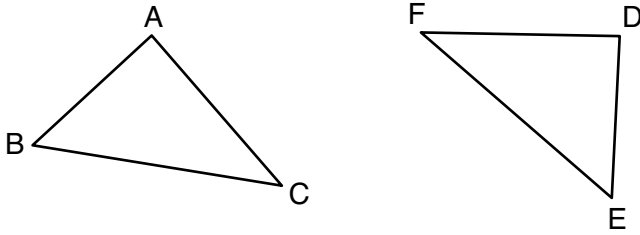
**DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.**

## 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 In the diagram below, a line reflection followed by a rotation maps  $\triangle ABC$  onto  $\triangle DEF$ .

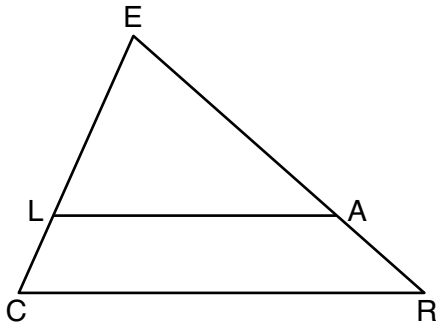


Which statement is always true?

- (1)  $\overline{BC} \cong \overline{EF}$                       (3)  $\angle A \cong \angle F$   
(2)  $\overline{AC} \cong \overline{DE}$                       (4)  $\angle B \cong \angle D$
- 2 A circle is continuously rotated about its diameter. Which three-dimensional object will be formed?
- (1) cone                                      (3) sphere  
(2) prism                                      (4) cylinder

Use this space for  
computations.

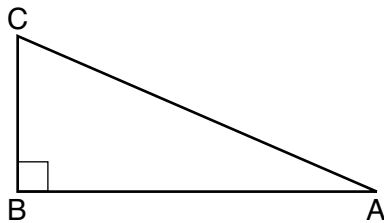
3 In the diagram below of  $\triangle CER$ ,  $\overline{LA} \parallel \overline{CR}$ .



If  $CL = 3.5$ ,  $LE = 7.5$ , and  $EA = 9.5$ , what is the length of  $\overline{AR}$ , to the nearest tenth?

- (1) 5.5                                      (3) 3.0  
(2) 4.4                                      (4) 2.8

4 Right triangle  $ABC$  is shown below.

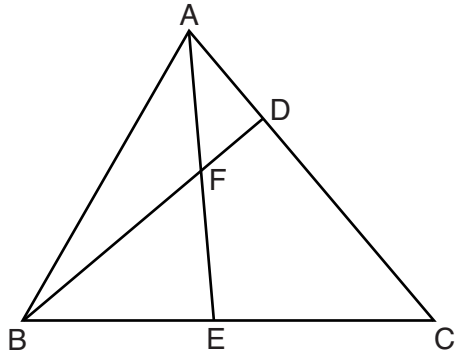


Which trigonometric equation is always true for triangle  $ABC$ ?

- (1)  $\sin A = \cos C$                       (3)  $\cos A = \cos C$   
(2)  $\cos A = \sin A$                       (4)  $\tan A = \tan C$

**Use this space for computations.**

- 5 In the diagram of  $\triangle ABC$  below,  $\overline{AE}$  bisects angle  $BAC$ , and altitude  $\overline{BD}$  is drawn.



If  $m\angle C = 50^\circ$  and  $m\angle ABC = 60^\circ$ ,  $m\angle FEB$  is

- |                |                |
|----------------|----------------|
| (1) $35^\circ$ | (3) $55^\circ$ |
| (2) $40^\circ$ | (4) $85^\circ$ |
- 6 A jewelry company makes copper heart pendants. Each heart uses  $0.75 \text{ in}^3$  of copper and there is 0.323 pound of copper per cubic inch. If copper costs \$3.68 per pound, what is the total cost for 24 copper hearts?
- |             |              |
|-------------|--------------|
| (1) \$5.81  | (3) \$66.24  |
| (2) \$21.40 | (4) \$205.08 |



Use this space for computations.

10 If the circumference of a standard lacrosse ball is 19.9 cm, what is the volume of this ball, to the nearest cubic centimeter?

- (1) 42                                      (3) 415  
(2) 133                                      (4) 1065

11 Which polygon always has a minimum rotation of  $180^\circ$  about its center to carry it onto itself?



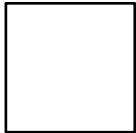
Rectangle

(1)



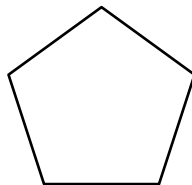
Isosceles trapezoid

(3)



Square

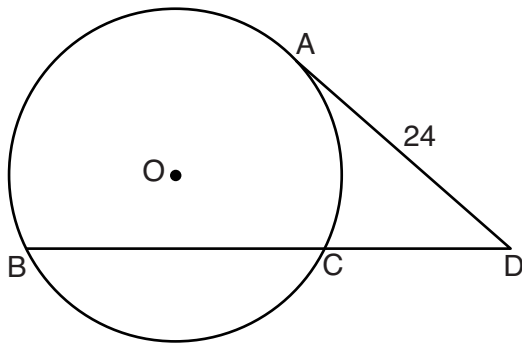
(2)



Regular pentagon

(4)

12 Circle  $O$  is drawn below with secant  $\overline{BCD}$ . The length of tangent  $\overline{AD}$  is 24.



If the ratio of  $DC:CB$  is 4:5, what is the length of  $\overline{CB}$ ?

- (1) 36                                      (3) 16  
(2) 20                                      (4) 4

Use this space for computations.

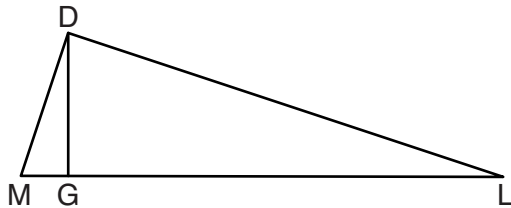
13 The equation of a line is  $3x - 5y = 8$ . All lines perpendicular to this line must have a slope of

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

14 What are the coordinates of the center and length of the radius of the circle whose equation is  $x^2 + y^2 + 2x - 16y + 49 = 0$ ?

- (1) center  $(1, -8)$  and radius 4  
(2) center  $(-1, 8)$  and radius 4  
(3) center  $(1, -8)$  and radius 16  
(4) center  $(-1, 8)$  and radius 16

15 In the diagram below of right triangle  $MDL$ , altitude  $\overline{DG}$  is drawn to hypotenuse  $\overline{ML}$ .



If  $MG = 3$  and  $GL = 24$ , what is the length of  $\overline{DG}$ ?

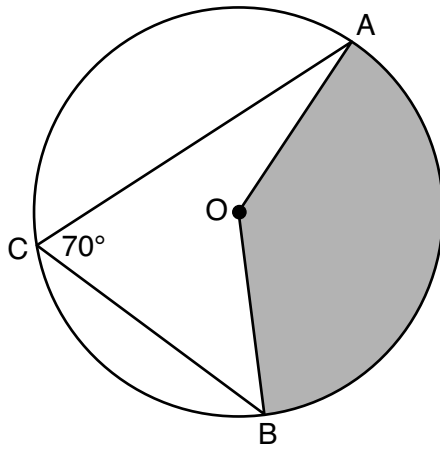
- (1) 8 (3)  $\sqrt{63}$   
(2) 9 (4)  $\sqrt{72}$

Use this space for computations.

16 Segment  $AB$  is the perpendicular bisector of  $\overline{CD}$  at point  $M$ . Which statement is always true?

- (1)  $\overline{CB} \cong \overline{DB}$                       (3)  $\triangle ACD \sim \triangle BCD$   
(2)  $\overline{CD} \cong \overline{AB}$                       (4)  $\triangle ACM \sim \triangle BCM$

17 In the diagram below of circle  $O$ ,  $\overline{AC}$  and  $\overline{BC}$  are chords, and  $m\angle ACB = 70^\circ$ .



If  $OA = 9$ , the area of the shaded sector  $AOB$  is

- (1)  $3.5\pi$                                       (3)  $15.75\pi$   
(2)  $7\pi$                                         (4)  $31.5\pi$



**Use this space for  
computations.**

**18** Quadrilateral  $BEST$  has diagonals that intersect at point  $D$ . Which statement would *not* be sufficient to prove quadrilateral  $BEST$  is a parallelogram?

(1)  $\overline{BD} \cong \overline{SD}$  and  $\overline{ED} \cong \overline{TD}$

(2)  $\overline{BE} \cong \overline{ST}$  and  $\overline{ES} \cong \overline{TB}$

(3)  $\overline{ES} \cong \overline{TB}$  and  $\overline{BE} \parallel \overline{TS}$

(4)  $\overline{ES} \parallel \overline{BT}$  and  $\overline{BE} \parallel \overline{TS}$

**19** The equation of line  $t$  is  $3x - y = 6$ . Line  $m$  is the image of line  $t$  after a dilation with a scale factor of  $\frac{1}{2}$  centered at the origin. What is an equation of line  $m$ ?

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

(3)  $y = 3x + 3$

(2)  $y = \frac{3}{2}x - 6$

(4)  $y = 3x - 3$

**20** A cylindrical pool has a diameter of 16 feet and height of 4 feet. The pool is filled to  $\frac{1}{2}$  foot below the top. How much water does the pool contain, to the *nearest gallon*? [ $1 \text{ ft}^3 = 7.48$  gallons]

(1) 704

(3) 5264

(2) 804

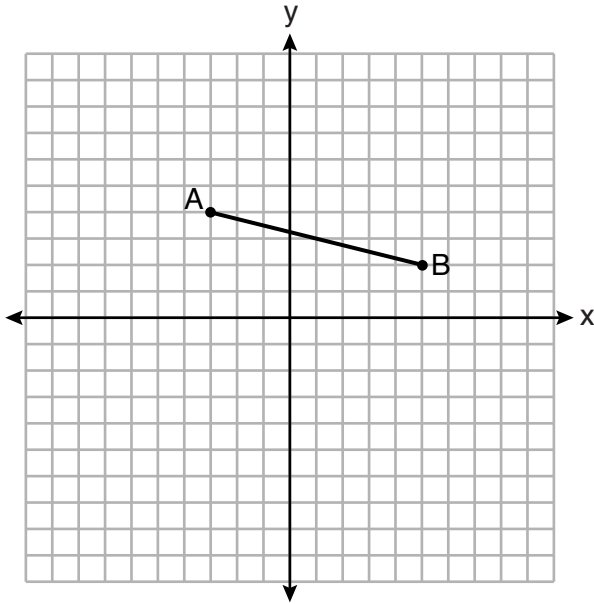
(4) 6016

**Use this space for computations.**

**21** The area of  $\triangle TAP$  is  $36 \text{ cm}^2$ . A second triangle,  $\triangle JOE$ , is formed by connecting the midpoints of each side of  $\triangle TAP$ . What is the area of  $\triangle JOE$ , in square centimeters?

- (1) 9
- (2) 12
- (3) 18
- (4) 27

**22** On the set of axes below, the endpoints of  $\overline{AB}$  have coordinates  $A(-3,4)$  and  $B(5,2)$ .

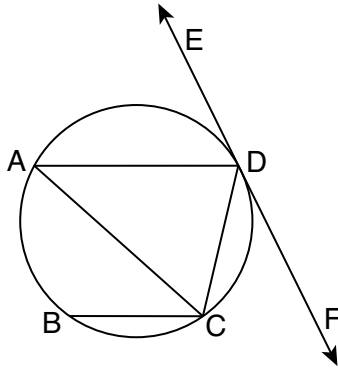


If  $\overline{AB}$  is dilated by a scale factor of 2 centered at  $(3,5)$ , what are the coordinates of the endpoints of its image,  $\overline{A'B'}$ ?

- (1)  $A'(-7,5)$  and  $B'(9,1)$
- (2)  $A'(-1,6)$  and  $B'(7,4)$
- (3)  $A'(-6,8)$  and  $B'(10,4)$
- (4)  $A'(-9,3)$  and  $B'(7,-1)$

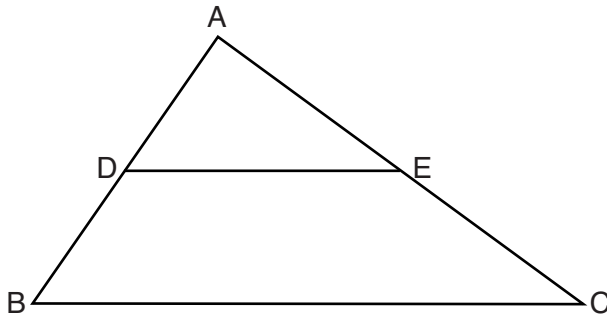
Use this space for computations.

- 23 In the circle below,  $\overline{AD}$ ,  $\overline{AC}$ ,  $\overline{BC}$ , and  $\overline{DC}$  are chords,  $\overline{EDF}$  is tangent at point  $D$ , and  $\overline{AD} \parallel \overline{BC}$ .



Which statement is always true?

- (1)  $\angle ADE \cong \angle CAD$                       (3)  $\angle BCA \cong \angle DCA$   
 (2)  $\angle CDF \cong \angle ACB$                       (4)  $\angle ADC \cong \angle ADE$
- 24 In the diagram below of  $\triangle ABC$ ,  $D$  and  $E$  are the midpoints of  $\overline{AB}$  and  $\overline{AC}$ , respectively, and  $\overline{DE}$  is drawn.



- I. AA similarity  
 II. SSS similarity  
 III. SAS similarity

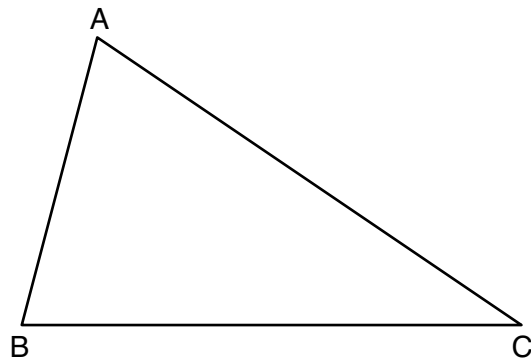
Which methods could be used to prove  $\triangle ABC \sim \triangle ADE$ ?

- (1) I and II, only                      (3) I and III, only  
 (2) II and III, only                      (4) I, II, and III

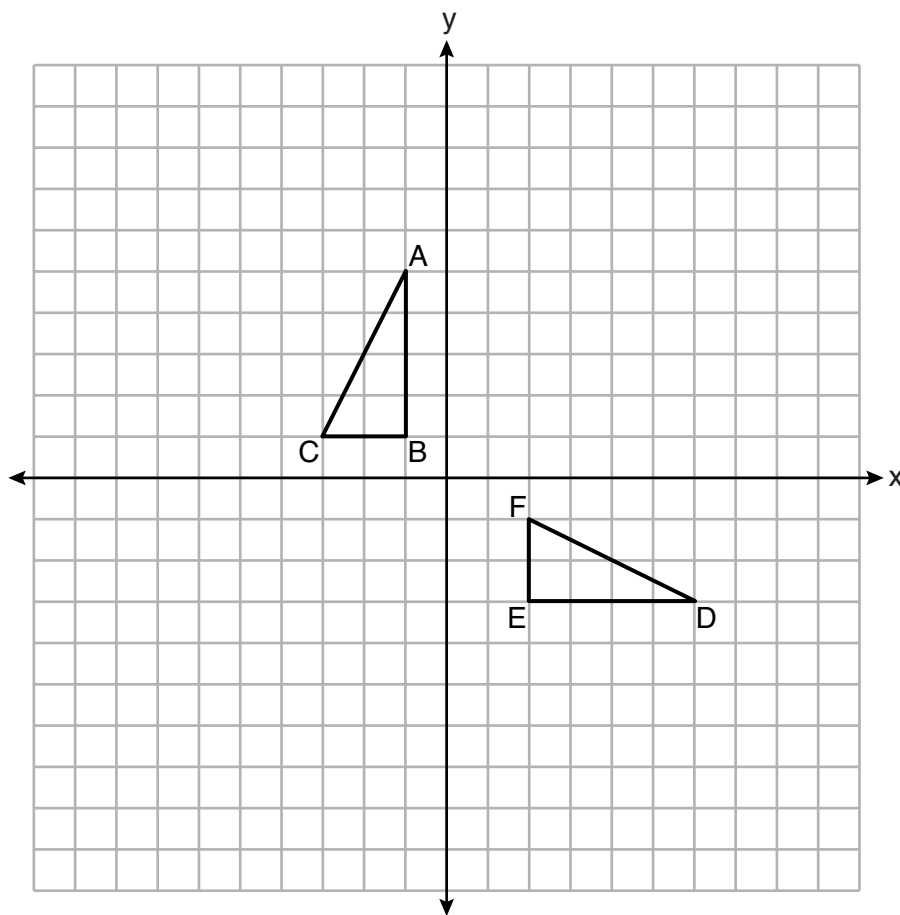
## Part II

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 angle bisector of  $\angle ABC$ .  
[Leave all construction marks.]

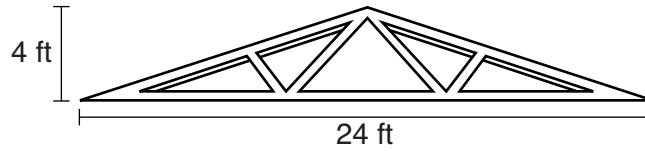


26 On the set of axes below,  $\triangle ABC$  and  $\triangle DEF$  are graphed.



Describe a sequence of rigid motions that would map  $\triangle ABC$  onto  $\triangle DEF$ .

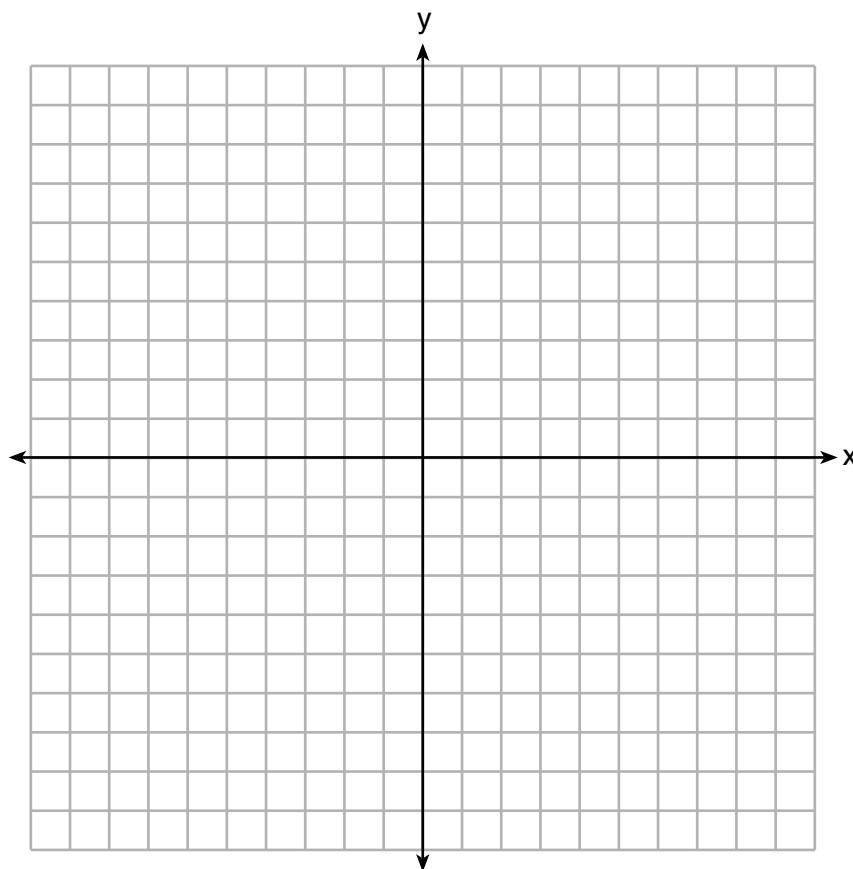
27 As shown in the diagram below, a symmetrical roof frame rises 4 feet above a house and has a width of 24 feet.



Determine and state, to the *nearest degree*, the angle of elevation of the roof frame.

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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

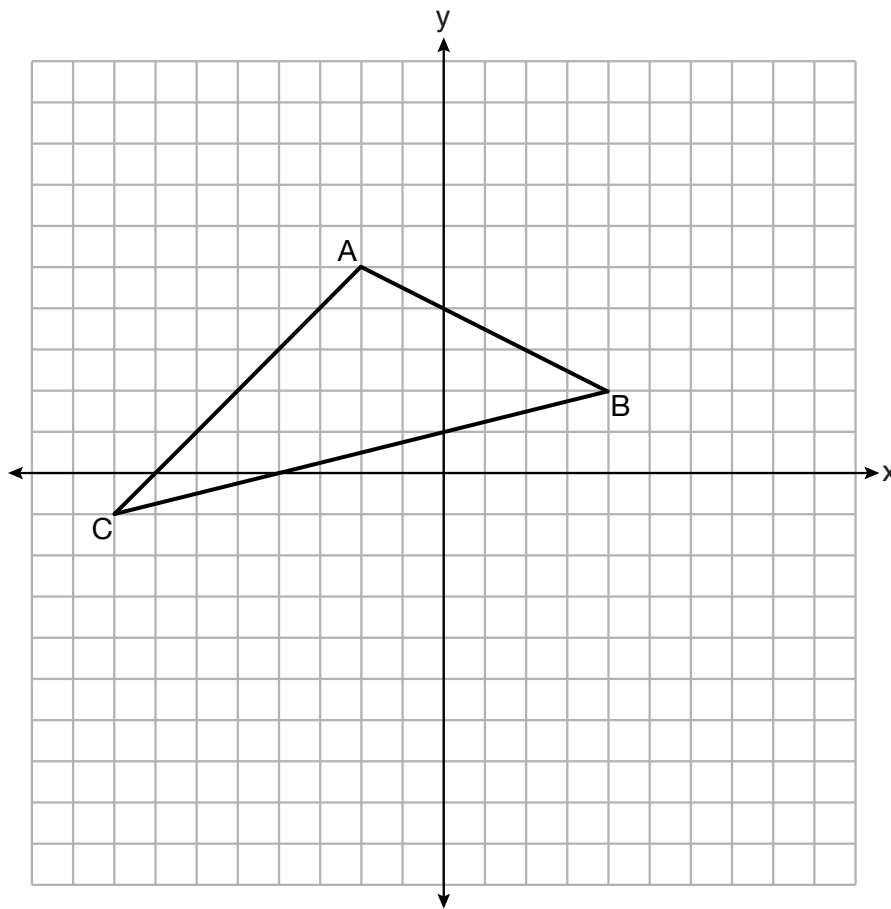


**29** In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .  
Is Brett correct? Explain why.



**30** The volume of a triangular prism is  $70 \text{ in}^3$ . The base of the prism is a right triangle with one leg whose measure is 5 inches. If the height of the prism is 4 inches, determine and state the length, in inches, of the other leg of the triangle.

31 Triangle  $ABC$  with coordinates  $A(-2,5)$ ,  $B(4,2)$ , and  $C(-8,-1)$  is graphed on the set of axes below.

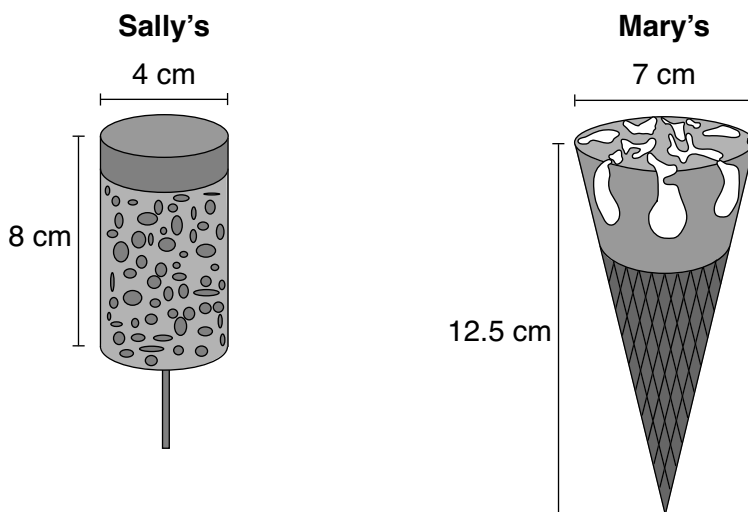


Determine and state the area of  $\triangle ABC$ .

### 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]

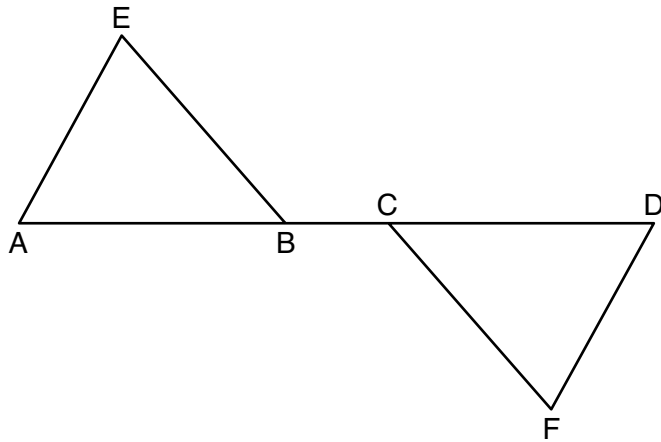
- 32 Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



Who was served more ice cream, Sally or Mary? Justify your answer.

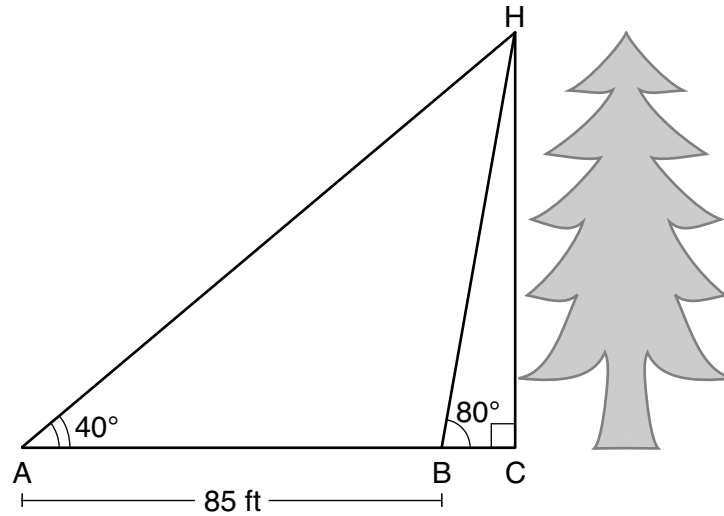
Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the nearest cubic centimeter.

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



Prove:  $\triangle EAB \cong \triangle FDC$

34 Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point  $A$  on the ground to the top of the tree,  $H$ , is  $40^\circ$ . The angle of elevation from point  $B$  on the ground to the top of the tree,  $H$ , is  $80^\circ$ . The distance between points  $A$  and  $B$  is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

Determine and state, to the *nearest foot*, the height of the tree.

**Part IV**

**Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. 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. [6]**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3,-1)$ ,  $U(-1,8)$ , and  $C(8,6)$

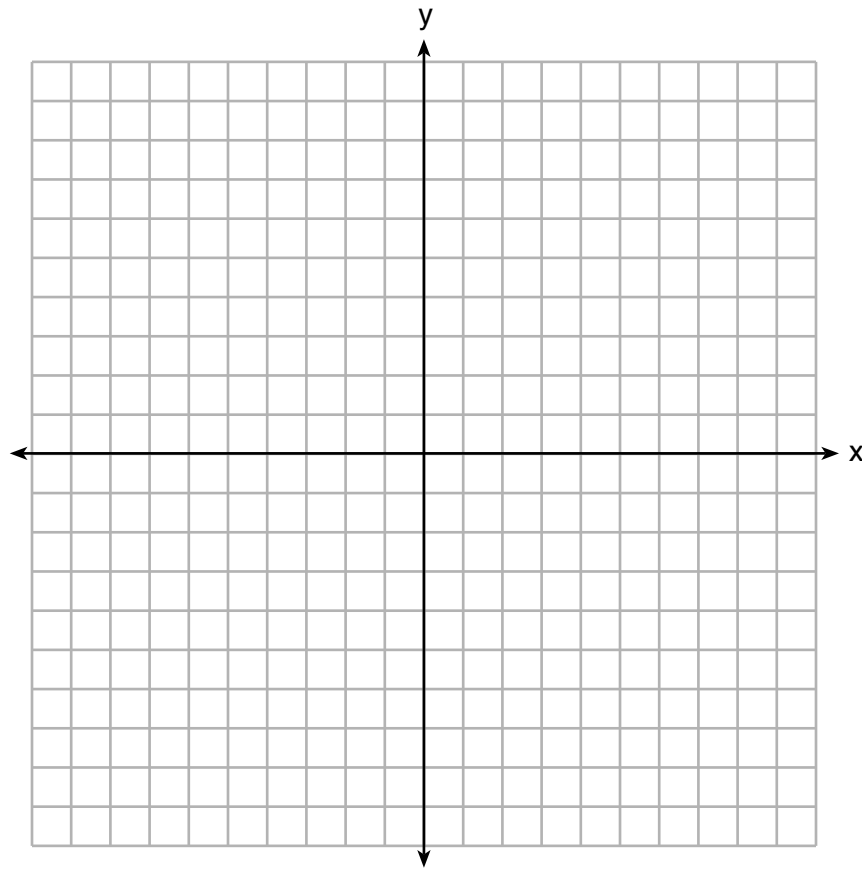
Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

**Question 35 is continued on the next page.**

**Question 35 continued**

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ .  
Prove quadrilateral  $DUCU'$  is a square.

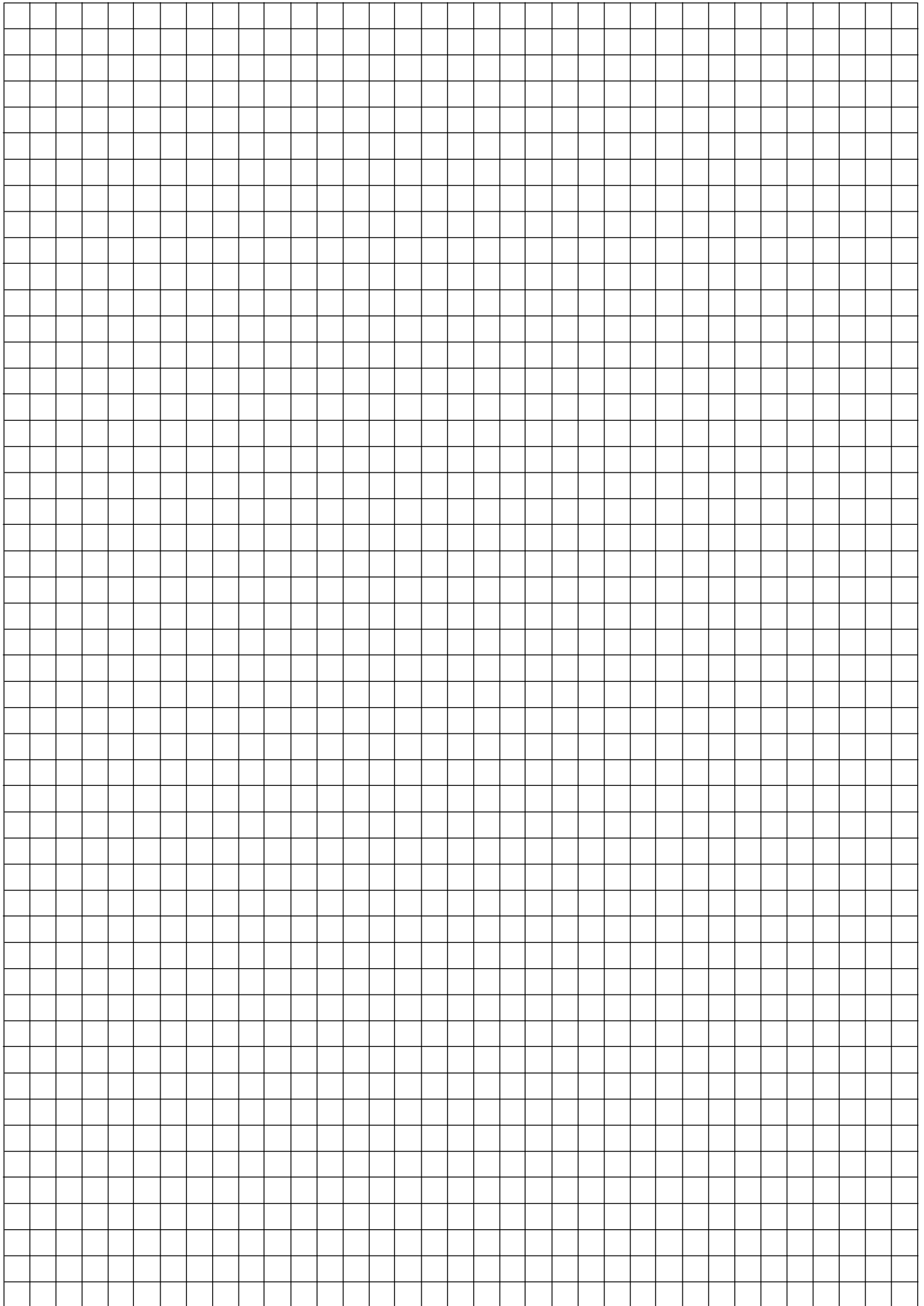






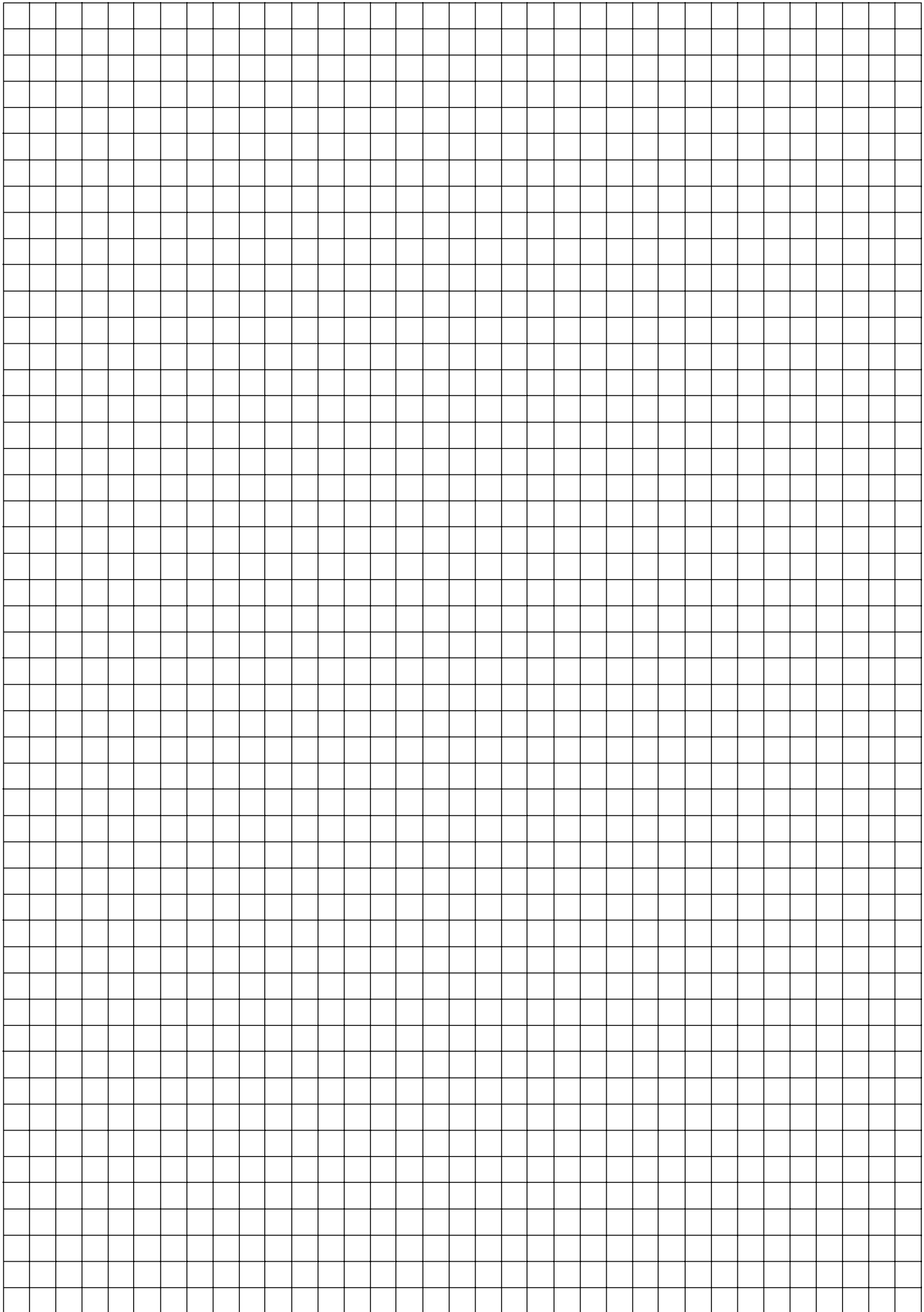
**Scrap Graph Paper — This sheet will *not* be scored.**

Tear Here



Tear Here

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



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## 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	$A = A_0 e^{k(t - t_0)} + B_0$

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# GEOMETRY

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Printed on Recycled Paper

# GEOMETRY

**Regents Examination in Geometry – January 2023**

**Scoring Key: Part I (Multiple-Choice Questions)**

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Geometry	January '23	1	1	MC	2	1
Geometry	January '23	2	3	MC	2	1
Geometry	January '23	3	2	MC	2	1
Geometry	January '23	4	1	MC	2	1
Geometry	January '23	5	4	MC	2	1
Geometry	January '23	6	2	MC	2	1
Geometry	January '23	7	1	MC	2	1
Geometry	January '23	8	2	MC	2	1
Geometry	January '23	9	3	MC	2	1
Geometry	January '23	10	2	MC	2	1
Geometry	January '23	11	1	MC	2	1
Geometry	January '23	12	2	MC	2	1
Geometry	January '23	13	4	MC	2	1
Geometry	January '23	14	2	MC	2	1
Geometry	January '23	15	4	MC	2	1
Geometry	January '23	16	1	MC	2	1
Geometry	January '23	17	4	MC	2	1
Geometry	January '23	18	3	MC	2	1
Geometry	January '23	19	4	MC	2	1
Geometry	January '23	20	3	MC	2	1
Geometry	January '23	21	1	MC	2	1
Geometry	January '23	22	4	MC	2	1
Geometry	January '23	23	2	MC	2	1
Geometry	January '23	24	4	MC	2	1

**Regents Examination in Geometry – January 2023**

**Scoring Key: Parts II, III, and IV (Constructed-Response Questions)**

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Geometry	January '23	25	-	CR	2	1
Geometry	January '23	26	-	CR	2	1
Geometry	January '23	27	-	CR	2	1
Geometry	January '23	28	-	CR	2	1
Geometry	January '23	29	-	CR	2	1
Geometry	January '23	30	-	CR	2	1
Geometry	January '23	31	-	CR	2	1
Geometry	January '23	32	-	CR	4	1
Geometry	January '23	33	-	CR	4	1
Geometry	January '23	34	-	CR	4	1
Geometry	January '23	35	-	CR	6	1

Key
MC = Multiple-choice question
CR = Constructed-response question

The chart for determining students' final examination scores for the **January 2023 Regents Examination in Geometry** will be posted on the Department's web site at: <https://www.nysedregents.org/geometryre/> on the day of the examination. Conversion charts provided for the previous administrations of the Regents Examination in Geometry must NOT be used to determine students' final scores for this administration.

# FOR TEACHERS ONLY

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

## GEOMETRY

Wednesday, January 25, 2023 — 9:15 a.m. to 12:15 p.m., only

### RATING GUIDE

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.nysed.gov/state-assessment/high-school-regents-examinations> 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. 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: <https://www.nysedregents.org/geometryre/>.

**Note: The rubric definition for a 0-credit response has been updated based on feedback from New York State mathematics educators.**

## Mechanics of Rating

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

Do *not* attempt to correct the student's work by making insertions or changes of any kind. In scoring the constructed-response 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 constructed-response 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 constructed-response 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.nysed.gov/state-assessment/high-school-regents-examinations> on Wednesday, January 25, 2023. 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.

# General Rules for Applying Mathematics Rubrics

## I. General Principles for Rating

The rubrics for the constructed-response questions on the Regents Examination in Geometry 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*, 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.
- [1] Appropriate work is shown, but one construction error is made.
- or*
- [1] An angle bisector is constructed, but from a vertex other than  $B$ .
- [0] A drawing that is not an appropriate construction is shown.
- or*
- [0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, 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] An appropriate sequence of rigid motions is written, but it is incomplete or partially correct.
- or*
- [1] An appropriate sequence is identified, but no specific description is written.
- [0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

- (27) [2] 18, and correct work is shown.
- [1] Appropriate work is shown, but one computational or rounding error is made.
- or**
- [1] Appropriate work is shown, but one conceptual error is made.
- or**
- [1] A correct relevant trigonometric equation is written, but no further correct work is shown.
- or**
- [1] 18, but no work is shown.
- [0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.
- 
- (28) [2]  $P(4,1.4)$ , 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]  $P(4,1.4)$ , but no work is shown.
- [0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.
- 
- (29) [2] Yes is indicated, and a correct explanation is written.
- [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] Yes, but the explanation is incomplete or partially correct.
- [0] Yes, but no work is shown.
- or**
- [0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(30) [2] 7, and correct work is shown.

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

*or*

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

*or*

[1] Correct work is shown to find 17.5, the area of the base, but no further correct work is shown.

*or*

[1] 7, but no work is shown.

[0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

(31) [2] 27, and correct work is shown.

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

*or*

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

*or*

[1] 27, but no work is shown.

[0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, 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] Mary is indicated and a correct justification is given. 60, and correct work is shown.

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

*or*

[3] Mary and the volume of the cylinder and cone are found, but no further correct work is shown.

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

*or*

[2] Correct work is shown to find the volume of the cylinder and cone. No further correct work is shown.

[1] Correct work is shown to find the volume of the cylinder or cone, but no further correct work is shown.

*or*

[1] Mary and 60, but no work is shown.

[0] Mary, but no further correct work is shown.

*or*

[0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

- (33) [4] A complete and correct proof that includes a concluding statement is written.
- [3] 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, or no concluding statement is written.
- [2] 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 are incorrect.
- or***
- [2] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
- [1] Only one correct statement and reason 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 does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

- (34) [4] A complete and correct explanation is written. 84, and correct work is shown.
- [3] Appropriate work is shown, but one computational or rounding error is made.
- or***
- [3] Correct work is shown to find 84, but the explanation is incomplete or partially correct.
- [2] Appropriate work is shown, but two or more computational or rounding errors are made.
- or***
- [2] A complete and correct explanation is written, but no further correct work is shown.
- or***
- [2] 84, and correct work is shown, but no further correct work is shown.
- [1] An incomplete or partially correct explanation is written, but no further correct work is shown.
- or***
- [1] A correct relevant trigonometric equation is written, but no further correct work is shown.
- or***
- [1] 84, but no work is shown.
- [0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

## Part IV

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

(35) [6] Correct work with concluding statements is shown to prove  $\triangle DUC$  is a right triangle and  $DUCU'$  is a square.

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

**or**

[5] Appropriate work is shown, but one concluding statement is missing or incorrect.

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

**or**

[4] Appropriate work is shown, but one conceptual error is made in proving the square.

**or**

[4] Appropriate work is shown, but both concluding statements are missing or incorrect.

[3] Appropriate work is shown, but two or more computational or graphing errors are made, and one concluding statement is missing or incorrect.

**or**

[3] Appropriate work is shown, but one conceptual error in proving the square and one computational or graphing error are made.

**or**

[3] Correct work with concluding statements is shown to prove  $\triangle DUC$  is a right triangle and  $U'(6, -3)$  is located, but no further correct work is shown.

[2] Correct work with concluding statements is shown to prove  $\triangle DUC$  is a right triangle, but no further correct work is shown.

**or**

[2]  $U'(6, -3)$  is located and correct work is shown to find the slopes of all four sides and/or the lengths of all four sides, but no further correct work is shown.

[1]  $U'(6, -3)$  is located, but no further correct work is shown.

[0] A zero response does not contain enough relevant course-level work to receive any credit, does not satisfy the criteria for one or more credits, or is a correct response that was obtained by an obviously incorrect procedure.

**Map to the Learning Standards  
Geometry  
January 2023**

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



**Regents Examination in Geometry**  
**January 2023**  
**Chart for Converting Total Test Raw Scores to**  
**Final Examination Scores (Scale Scores)**

**The *Chart for Determining the Final Examination Score for the January 2023 Regents Examination in Geometry* will be posted on the Department’s web site at: <http://www.nysed.gov/state-assessment/high-school-regents-examinations> on Wednesday, January 25, 2023. Conversion charts provided for previous administrations of the Regents Examination in Geometry 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.nysed.gov/state-assessment/teacher-feedback-state-assessments>.
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

Wednesday, January 25, 2023 — 9:15 a.m. to 12:15 p.m., only

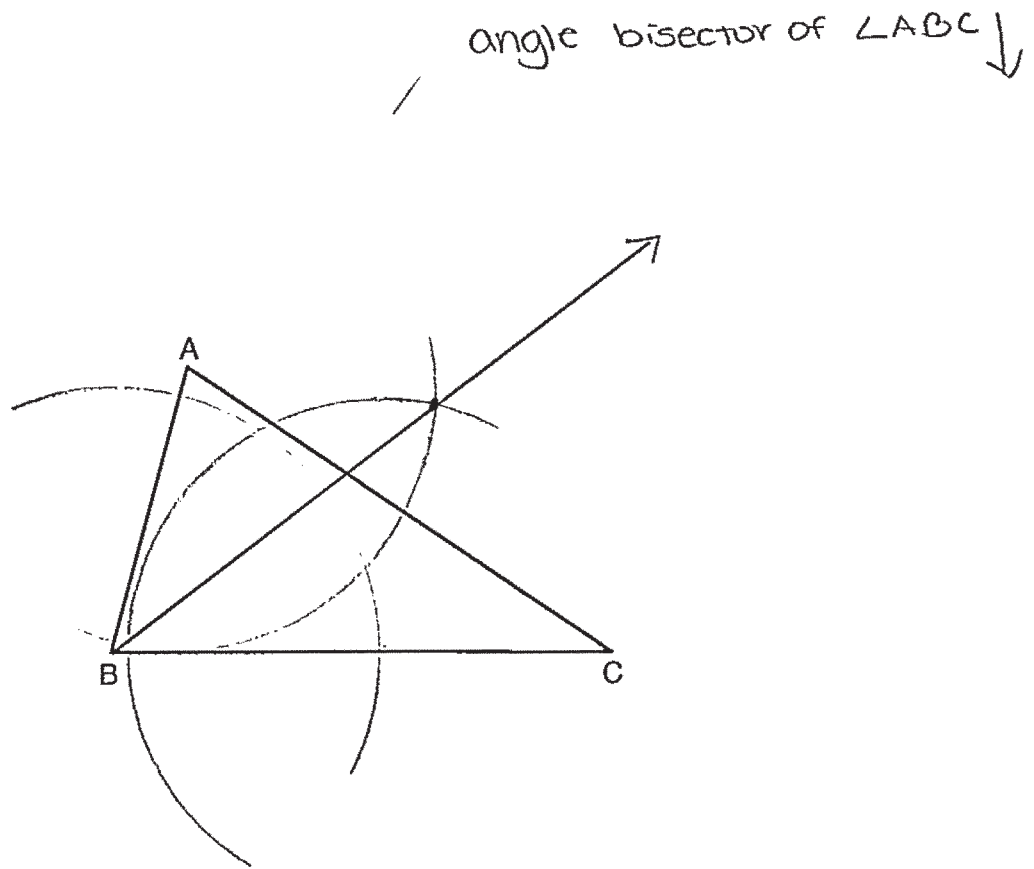
## MODEL RESPONSE SET

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**Question 25**

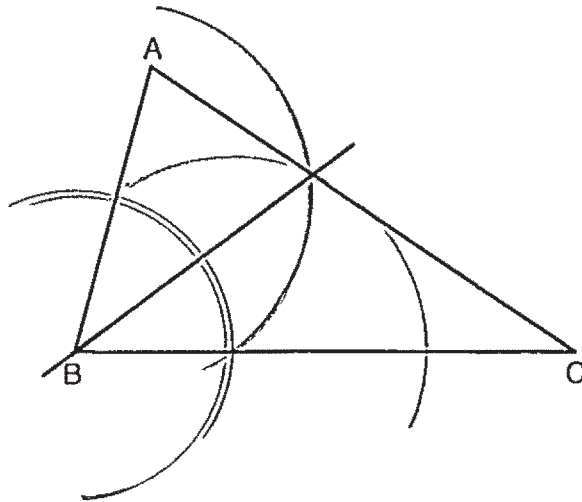
**25** Using a compass and straightedge, construct the angle bisector of  $\angle ABC$ .  
[Leave all construction marks.]



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

**Question 25**

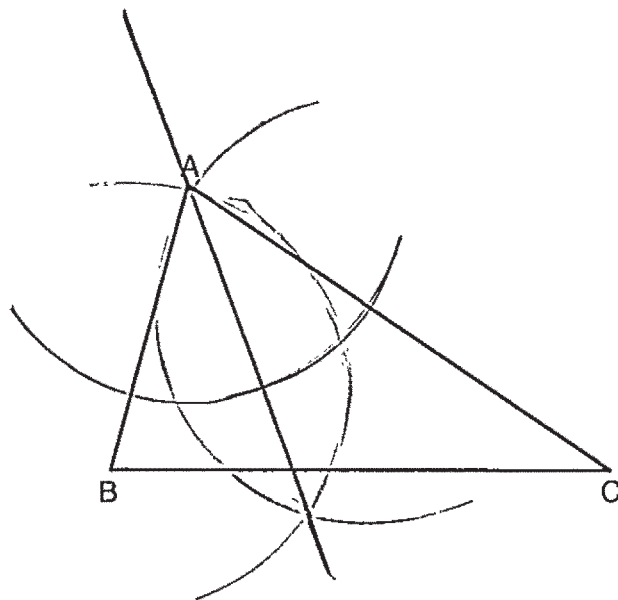
**25** Using a compass and straightedge, construct the angle bisector of  $\angle ABC$ .  
[Leave all construction marks.]



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

**Question 25**

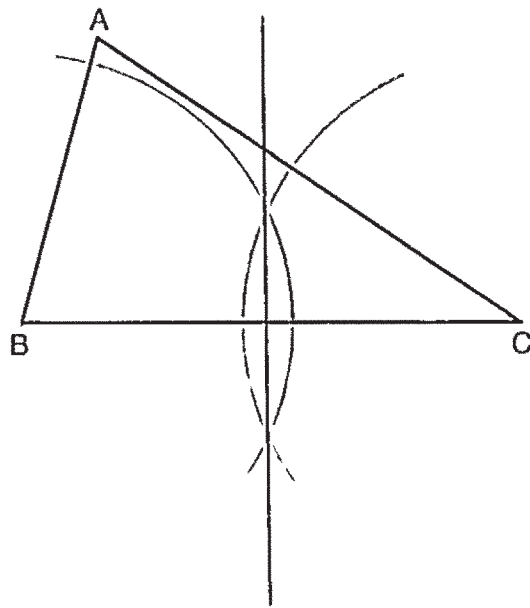
**25** Using a compass and straightedge, construct the angle bisector of  $\angle ABC$ .  
[Leave all construction marks.]



**Score 1:** The student constructed the bisector of angle A.

**Question 25**

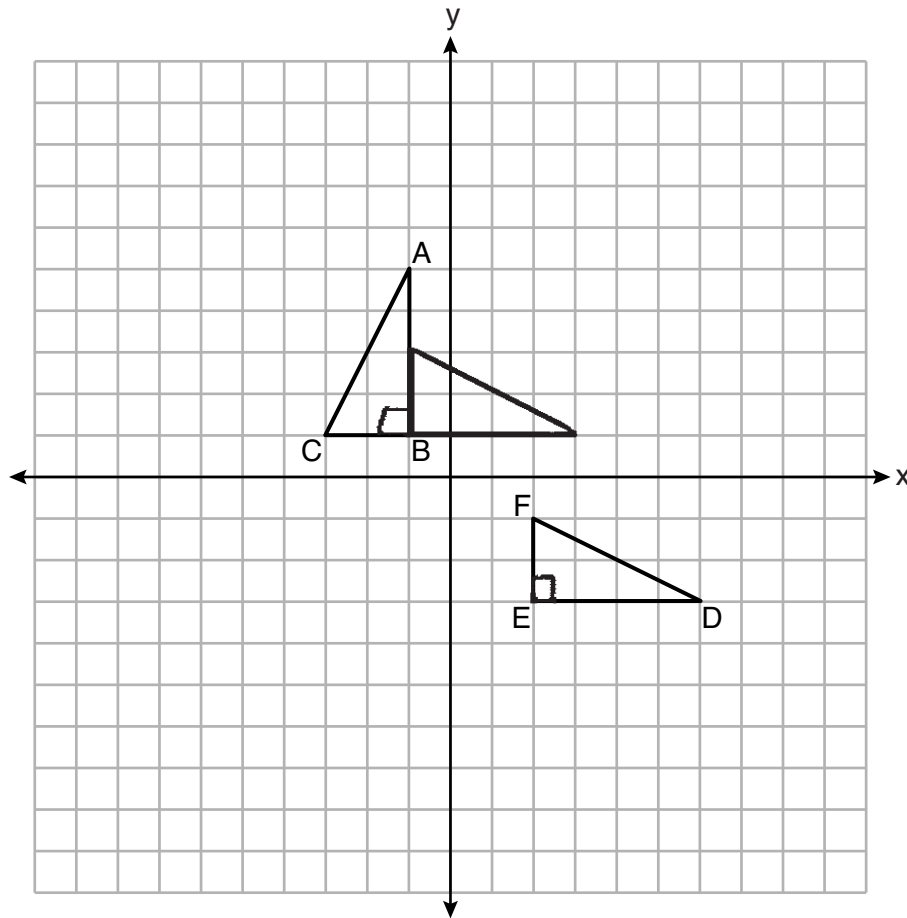
**25** Using a compass and straightedge, construct the angle bisector of  $\angle ABC$ .  
[Leave all construction marks.]



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

Question 26

26 On the set of axes below,  $\triangle ABC$  and  $\triangle DEF$  are graphed.



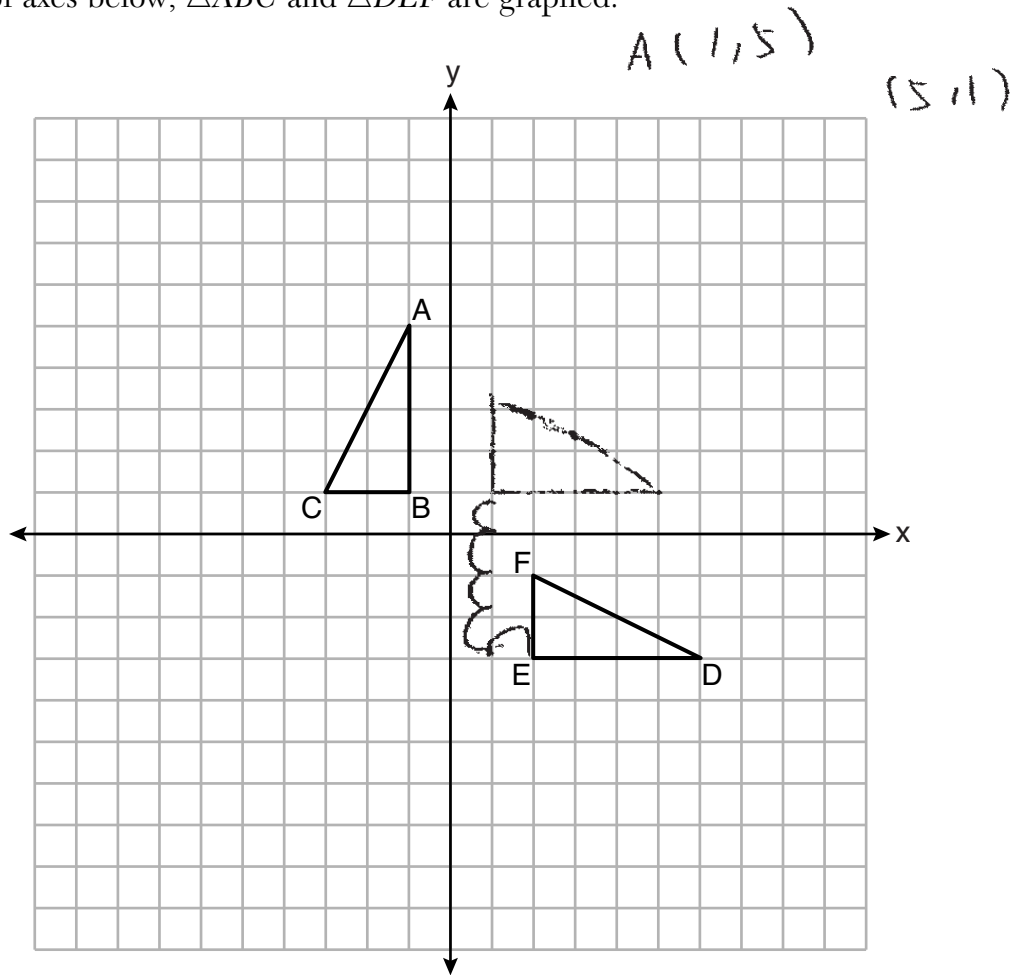
Describe a sequence of rigid motions that would map  $\triangle ABC$  onto  $\triangle DEF$ .

a rotation of  $90^\circ$  clockwise about point B and then a translation  
down 4 and to the right by 3

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

Question 26

26 On the set of axes below,  $\triangle ABC$  and  $\triangle DEF$  are graphed.



Describe a sequence of rigid motions that would map  $\triangle ABC$  onto  $\triangle DEF$ .

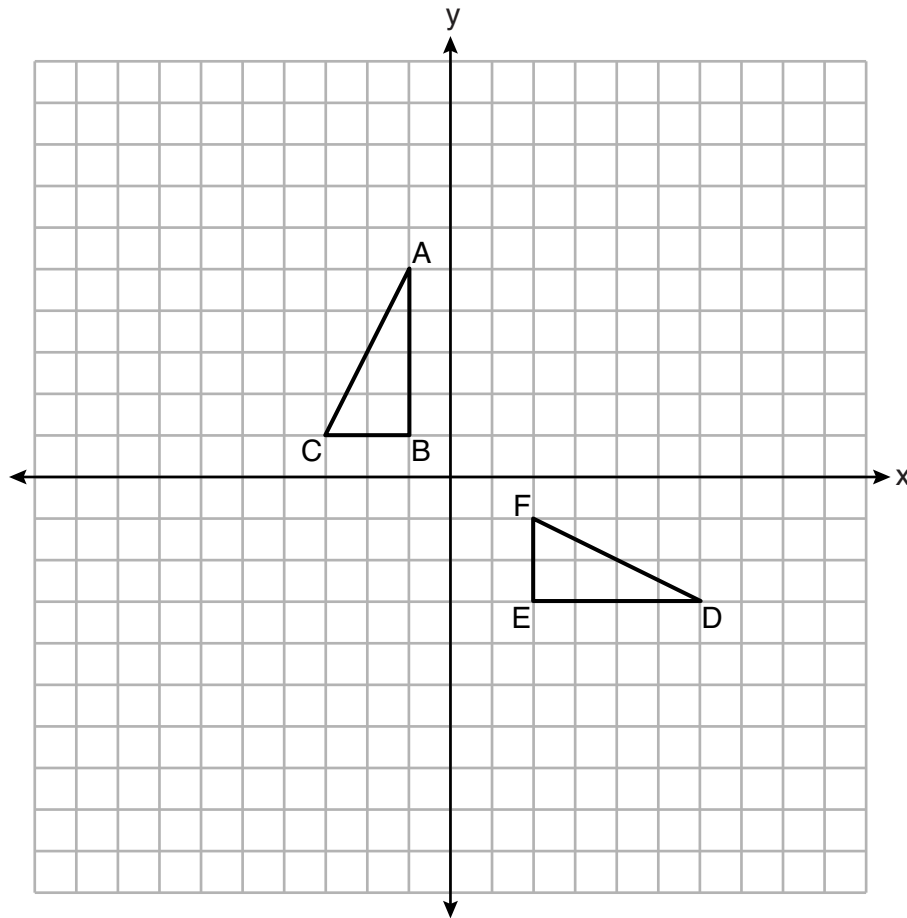
First, rotate  $90^\circ$  clockwise, then translate one unit right and four units down.

**Score 1:** The student described an appropriate sequence of rigid motions, but the center of rotation was not stated.



Question 26

26 On the set of axes below,  $\triangle ABC$  and  $\triangle DEF$  are graphed.



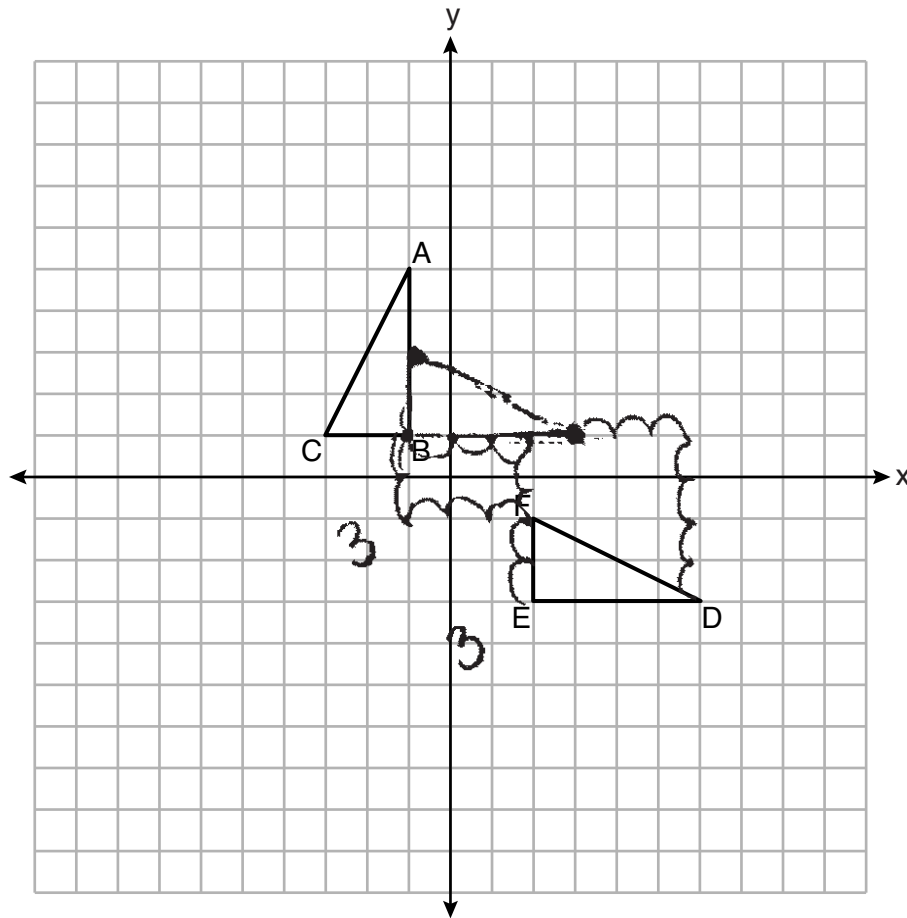
Describe a sequence of rigid motions that would map  $\triangle ABC$  onto  $\triangle DEF$ .

Rotate  $90^\circ$  clockwise  
Translate down so that  $A \rightarrow D$   
 $B \rightarrow E$   $E \rightarrow F$

**Score 1:** The student described an appropriate sequence of rigid motions, but the description was incomplete.

Question 26

26 On the set of axes below,  $\triangle ABC$  and  $\triangle DEF$  are graphed.



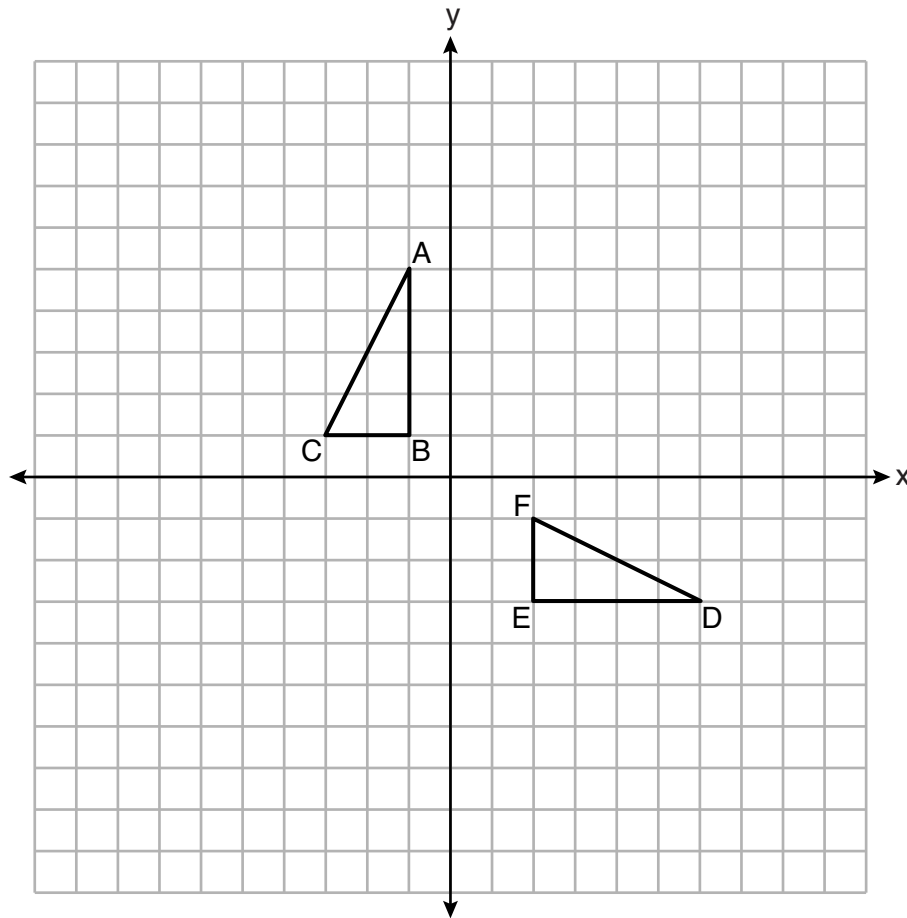
Describe a sequence of rigid motions that would map  $\triangle ABC$  onto  $\triangle DEF$ .

a rotation counterclockwise  $270^\circ$  about point B  
a translation down 3 and right 4 units

**Score 1:** The student gave a correct description of the rotation, but gave an incorrect description of the translation.

**Question 26**

**26** On the set of axes below,  $\triangle ABC$  and  $\triangle DEF$  are graphed.



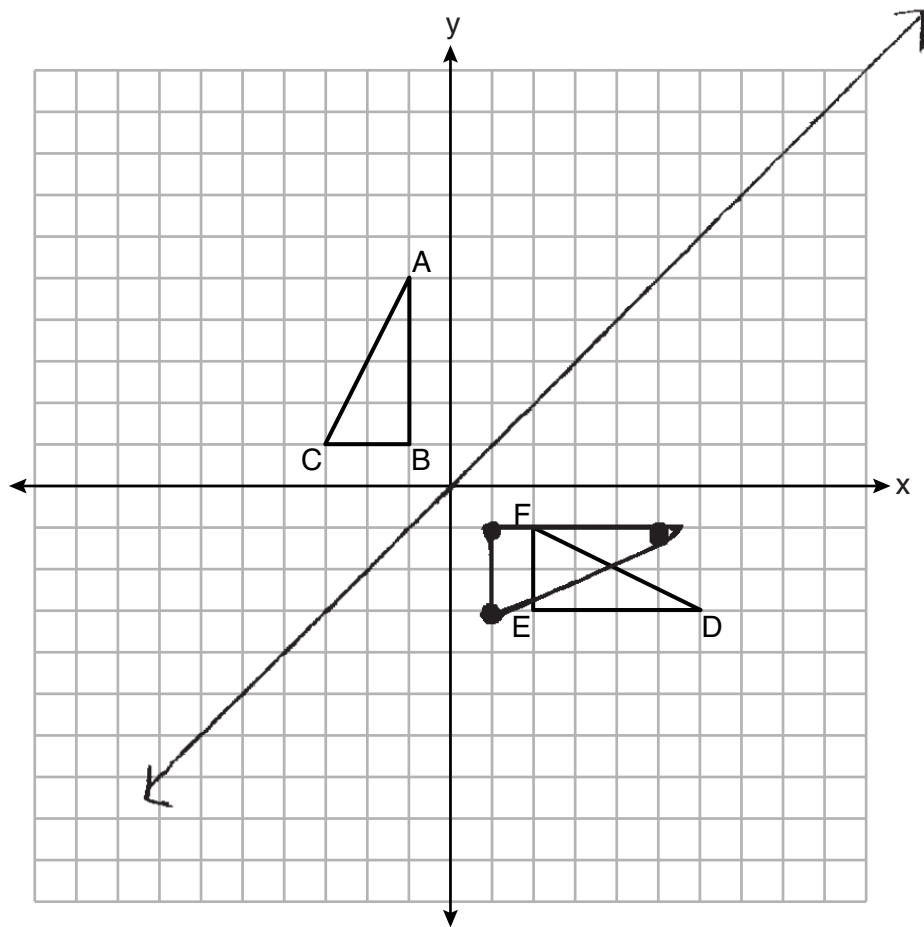
Describe a sequence of rigid motions that would map  $\triangle ABC$  onto  $\triangle DEF$ .

A rotation followed by a translation

**Score 1:** The student described an appropriate sequence, but the description was incomplete.

Question 26

26 On the set of axes below,  $\triangle ABC$  and  $\triangle DEF$  are graphed.



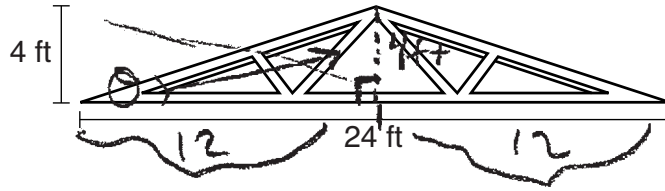
Describe a sequence of rigid motions that would map  $\triangle ABC$  onto  $\triangle DEF$ .

A reflection over the line  $y=x$ ,  
followed by a translation of right 1.

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

Question 27

27 As shown in the diagram below, a symmetrical roof frame rises 4 feet above a house and has a width of 24 feet.



Determine and state, to the *nearest degree*, the angle of elevation of the roof frame.

$$\tan \theta = \frac{4}{12}$$

$$\theta = \tan^{-1}\left(\frac{4}{12}\right)$$

$$\theta = 18.4$$

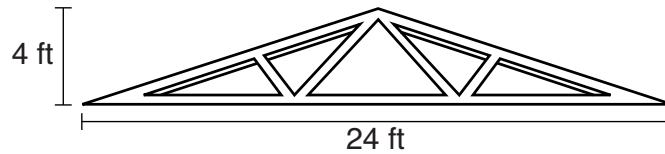
$$\theta = 18^\circ$$

Angle of elevation =  $18^\circ$

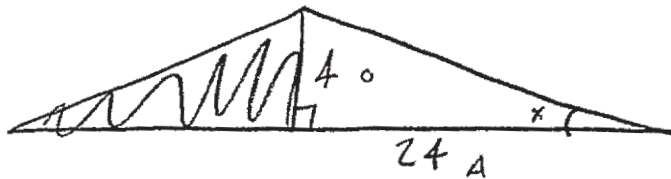
**Score 2:** The student gave a complete and correct response.

Question 27

27 As shown in the diagram below, a symmetrical roof frame rises 4 feet above a house and has a width of 24 feet.



Determine and state, to the *nearest degree*, the angle of elevation of the roof frame.



$$\tan(x) = \frac{4}{24}$$

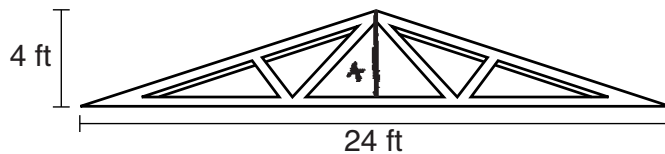
$$\tan^{-1}\left(\frac{4}{24}\right)$$

$$x = 9^\circ$$

**Score 1:** The student wrote an incorrect trigonometric equation, but solved the equation correctly.

**Question 27**

**27** As shown in the diagram below, a symmetrical roof frame rises 4 feet above a house and has a width of 24 feet.



Determine and state, to the *nearest degree*, the angle of elevation of the roof frame.

$$\frac{24}{2} = 12$$

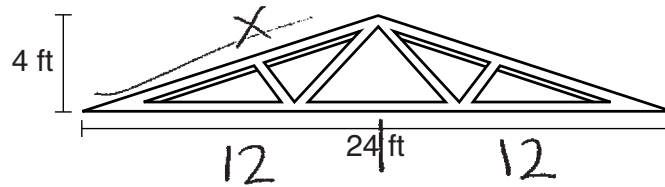
$$\text{Tan.} = \frac{\text{opp.}}{\text{adj.}}$$

$$\text{Tan}^{-1} \frac{4}{12} = 14.03624347 \approx 14^\circ$$

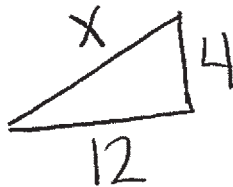
**Score 1:** The student wrote a correct trigonometric equation, but no further correct work was shown.

Question 27

27 As shown in the diagram below, a symmetrical roof frame rises 4 feet above a house and has a width of 24 feet.



Determine and state, to the nearest degree, the angle of elevation of the roof frame.



$$4^2 + 12^2 = X^2$$

$$16 + 144 = X^2$$

$$\sqrt{160} = \sqrt{X^2}$$

$$12.64911064 = X$$

$$13^\circ = X$$

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



**Question 28**

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

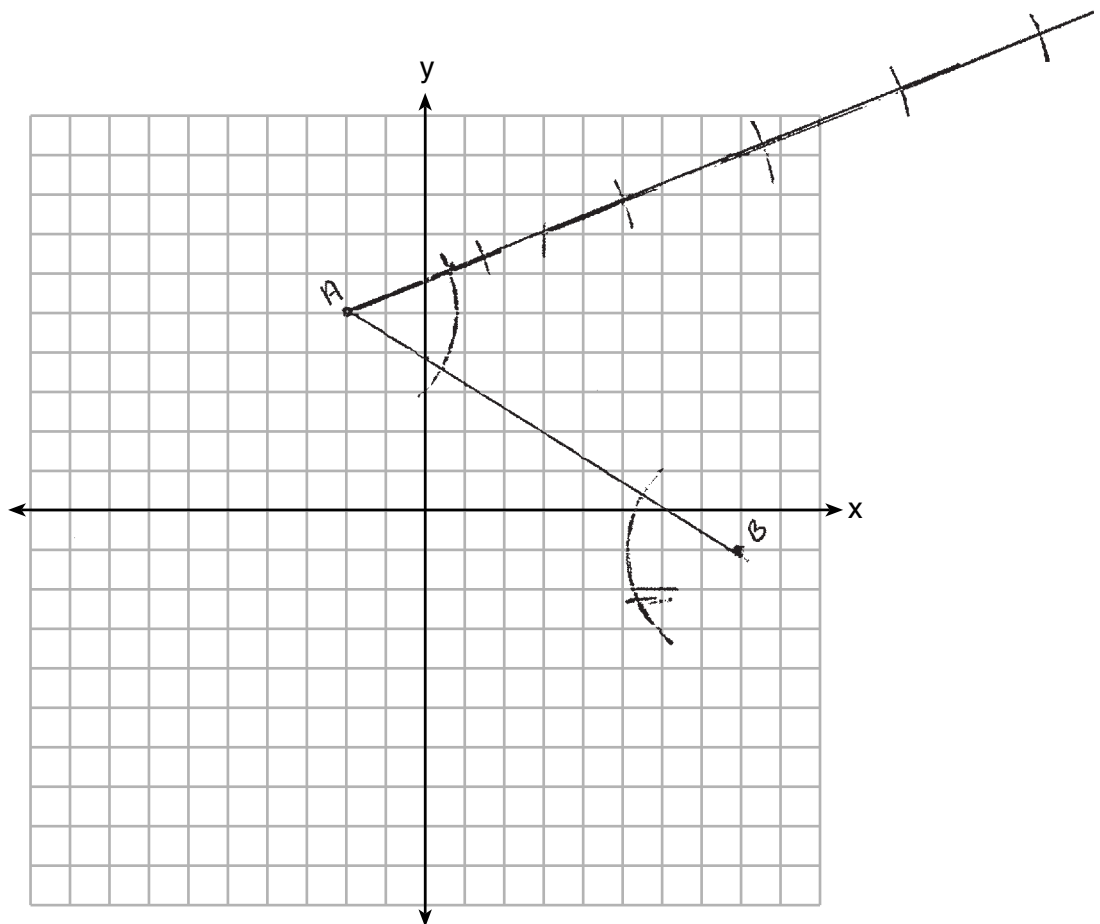
[The use of the set of axes below is optional.]

$$K = \frac{3}{5}$$

$$P(x_1 + K(x_2 - x_1), y_1 + K(x_2 - y_1))$$

$$P(-2 + \frac{3}{5}(8+2), 5 + \frac{3}{5}(-1-5))$$

$$P(4, 1.4)$$



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

**Question 28**

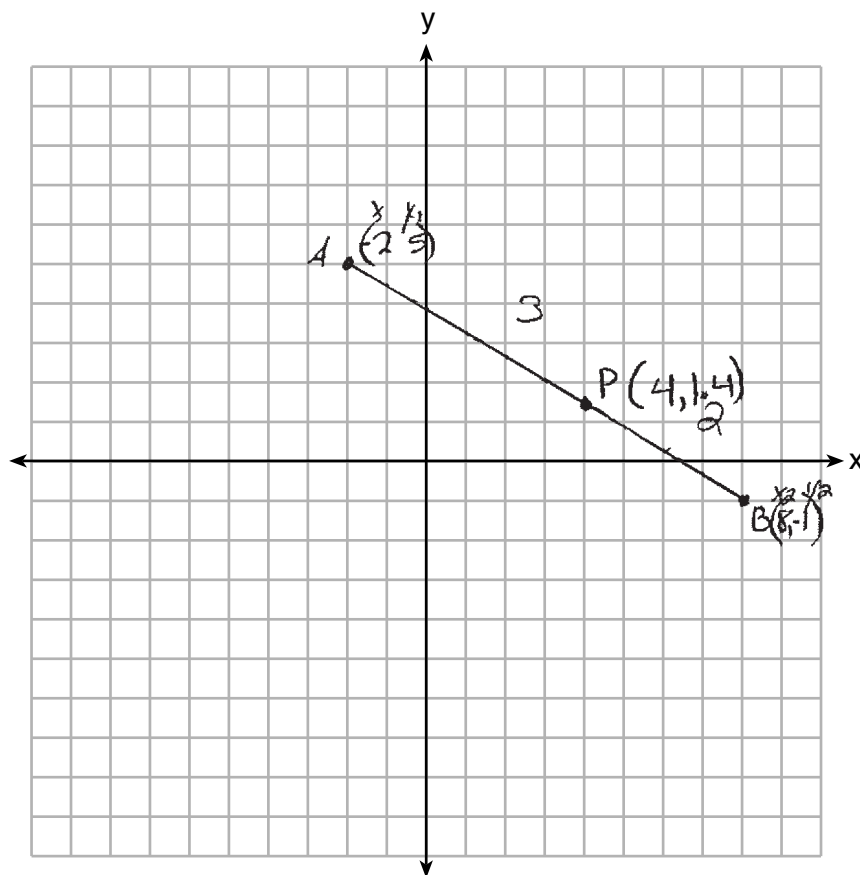
**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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

$$\text{Find } x: -2 + \frac{3}{5}(8 - (-2)) = 4$$

$$\text{Find } y: 5 + \frac{3}{5}(-1 - 5) = 1.4$$

$$P = (4, 1.4)$$



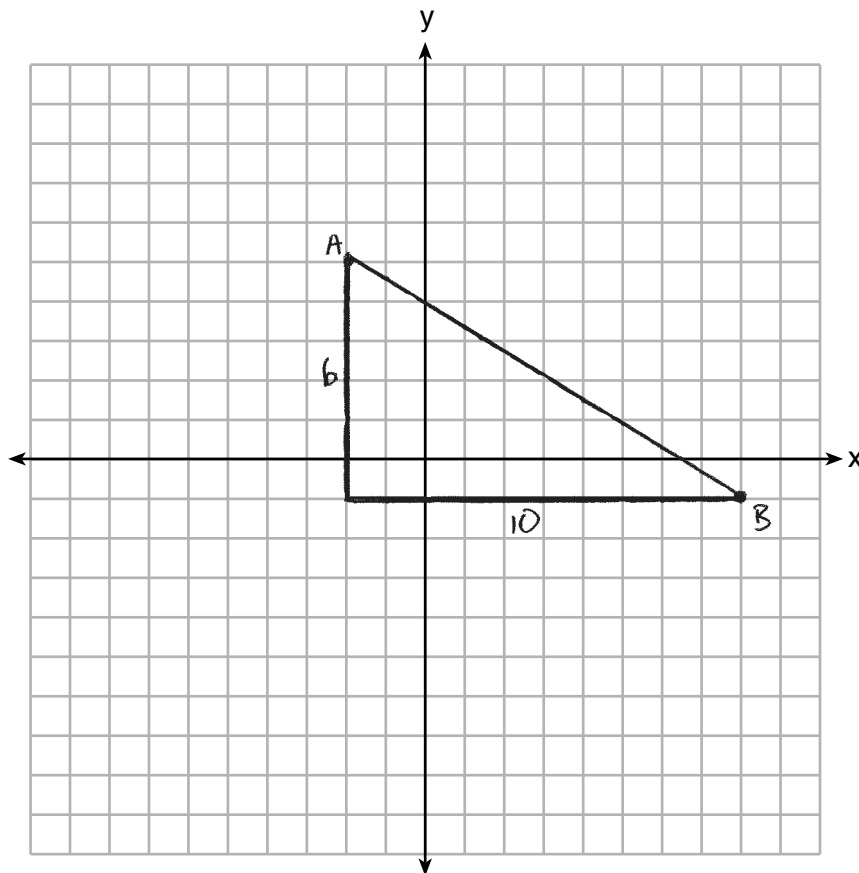
**Score 2:** The student gave a complete and correct response.

**Question 28**

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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

$$\begin{array}{l} \frac{3}{5}(10) = 6 \quad | \quad \frac{3}{5}(6) = 3.6 \\ A(-2, 5) \\ + 6 \quad - 3.6 \\ \hline P(4, 1.4) \end{array}$$



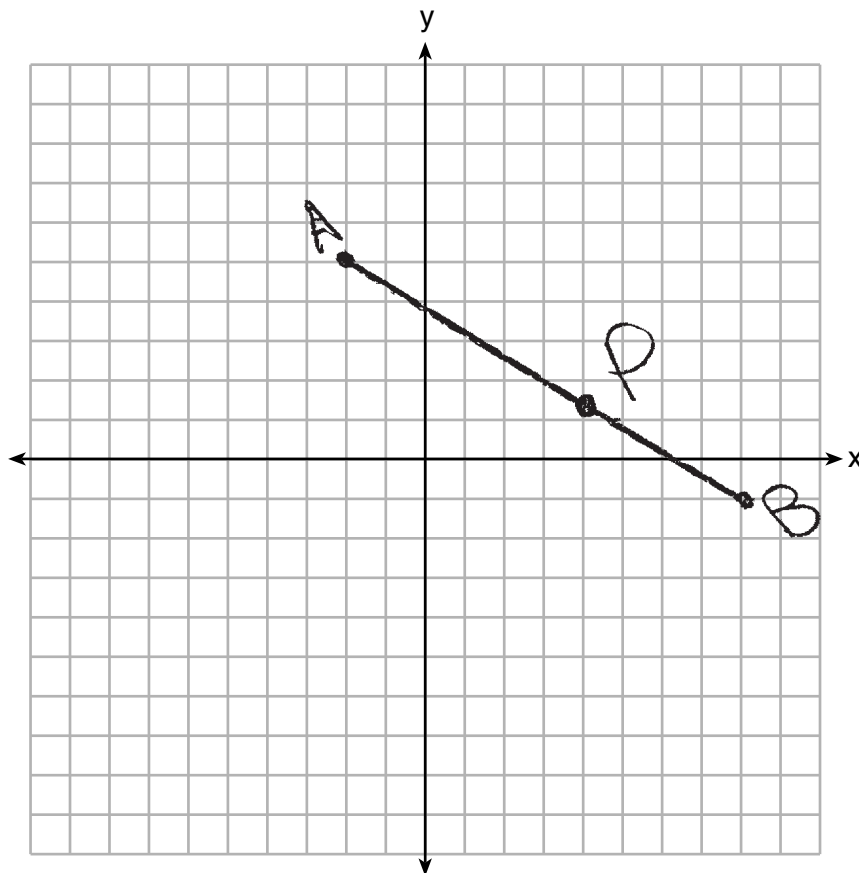
**Score 2:** The student gave a complete and correct response.

**Question 28**

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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

$$P = (4, 1.4)$$



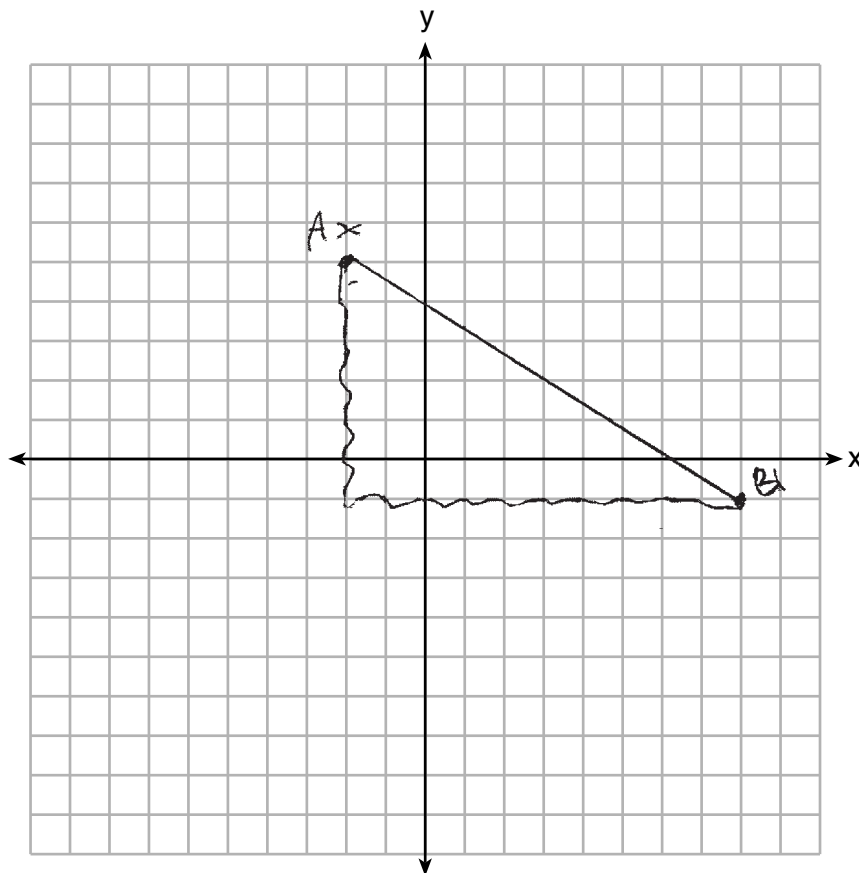
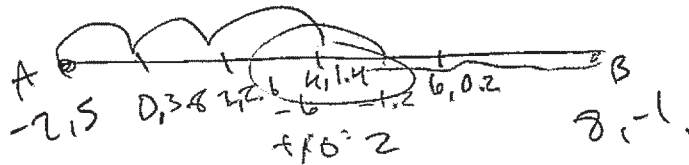
**Score 1:** The student gave a correct answer, but no work was shown.

**Question 28**

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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

$P = 4, 1.4$



**Score 1:** The student determined point  $P$ , but did not state it as a coordinate.

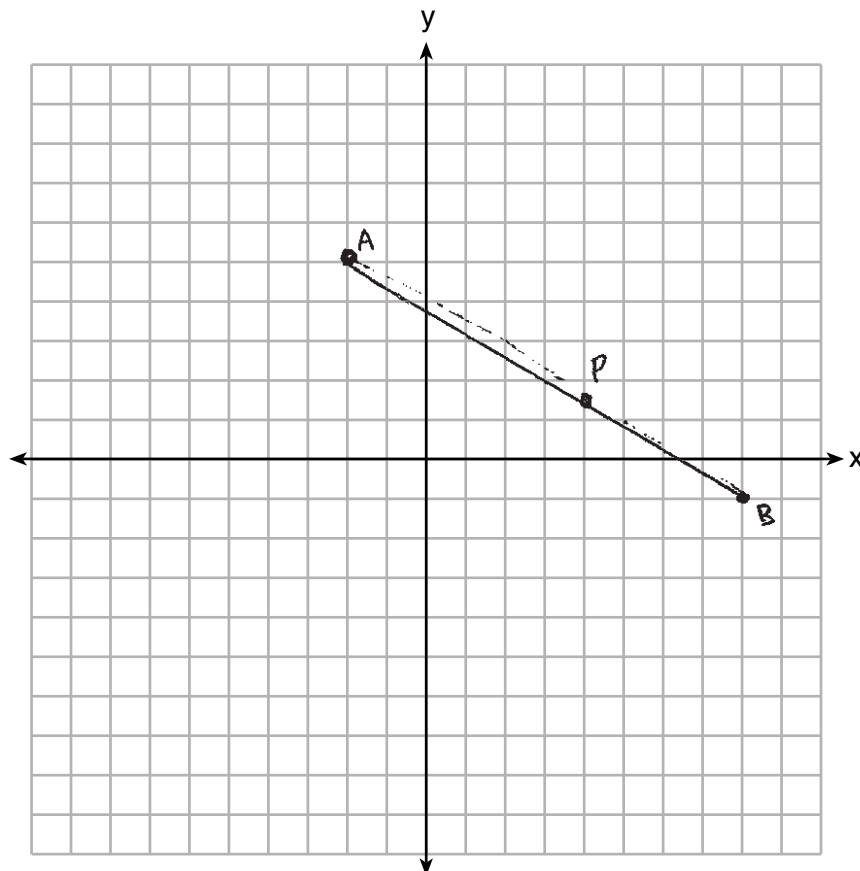
**Question 28**

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2, 5)$  and  $B(8, -1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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

$x$	$y$
$8 - (-2)$	$5 - (-1)$
$\downarrow$	$\downarrow$
$10 \left(\frac{3}{5}\right)$	$6 \left(\frac{3}{5}\right)$
$6$	$3.6$

$P(4, 1.5)$

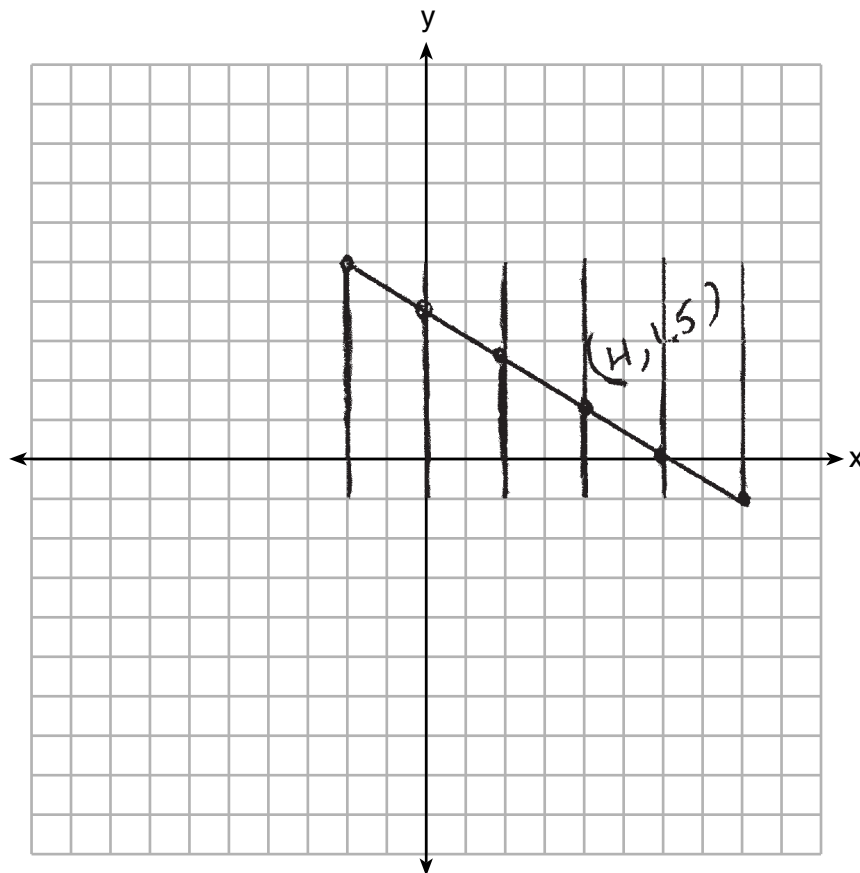


**Score 1:** The student showed correct work to determine the  $x$ -coordinate of  $P$ , but made an error in determining the  $y$ -coordinate.

**Question 28**

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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

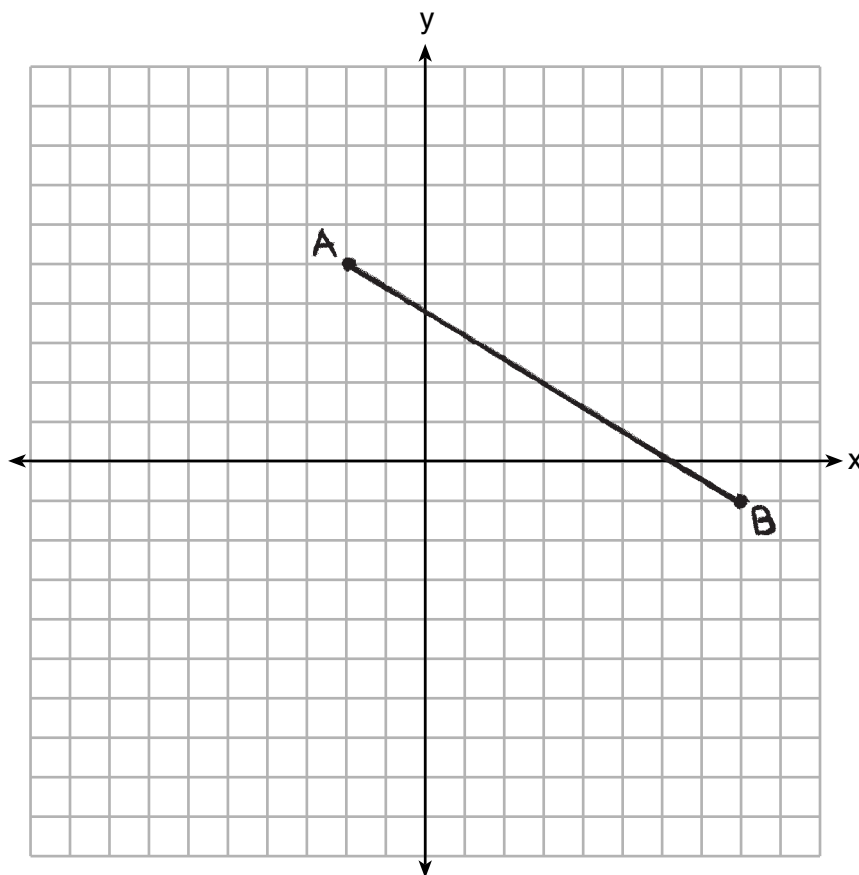


**Score 1:** The student showed correct work to partition the line segment, but made an error in determining the  $y$ -coordinate.

**Question 28**

**28** Directed line segment  $AB$  has endpoints whose coordinates are  $A(-2,5)$  and  $B(8,-1)$ . Determine and state the coordinates of  $P$ , the point which divides the segment in the ratio 3:2.

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



**Score 0:** The student graphed  $\overline{AB}$  correctly, but no further correct work is shown.



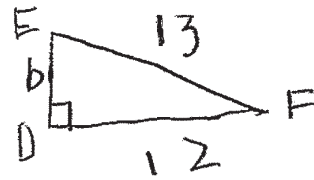
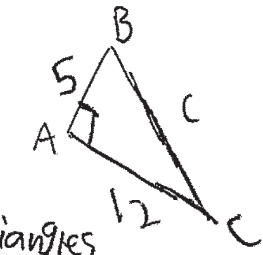
Question 29

29 In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .

Is Brett correct? Explain why.

Yes, through the  
Pythagorean theorem

I proved that the triangles  
have  $\cong$  sides making  $5^2 + 12^2 = c^2$   
them  $\cong$  and  $\sim$  through  
SAS.



$$12^2 + b^2 = 13^2$$

$$144 + b^2 = 169$$

$$b^2 = 25$$

$$b = 5$$

$$\sqrt{169} = \sqrt{c^2}$$

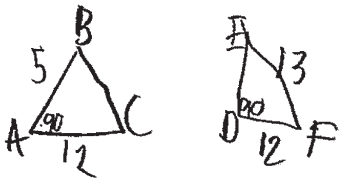
$$c = 13$$

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

Question 29

29 In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .

Is Brett correct? Explain why.



$$a^2 + b^2 = c^2$$

$$5^2 + 12^2 = c^2$$

$$25 + 144 = c^2$$

$$\sqrt{169} = \sqrt{c^2}$$

$$13 = c = \overline{BC}$$

$$5 = a = \overline{DE}$$

$$\frac{5}{5} = \frac{13}{13} = \frac{12}{12} = 1$$

$\overline{AB} \cong \overline{DE}$ ,  $\overline{BC} \cong \overline{EF}$ , and  $\overline{AC} \cong \overline{DF}$  b/c they have the same lengths.

$\triangle ABC \cong \triangle DEF$  by SSS  $\checkmark$  SSS.

$\frac{\overline{AB}}{\overline{DE}} \cong \frac{\overline{BC}}{\overline{EF}} = \frac{\overline{AC}}{\overline{DF}}$  b/c they are proportionally =

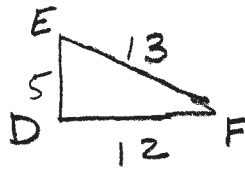
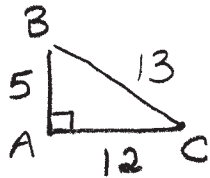
$\triangle ABC \sim \triangle DEF$  by SSS  $\sim$

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

Question 29

29 In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .

Is Brett correct? Explain why.



$$5^2 + 12^2 = (BC)^2$$

$$25 + 144 = (BC)^2$$

$$169 = BC^2$$

$$\sqrt{169} = BC$$

$$13 = BC$$

$$(ED)^2 + 144 = 169$$

$$(ED)^2 = 25$$

$$ED = \sqrt{25}$$

$$ED = 5$$

$\triangle ABC \cong \triangle DEF$  because  
of SSS  $\cong$  SSS.

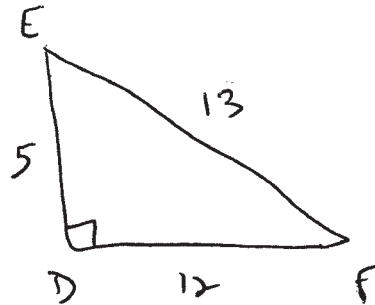
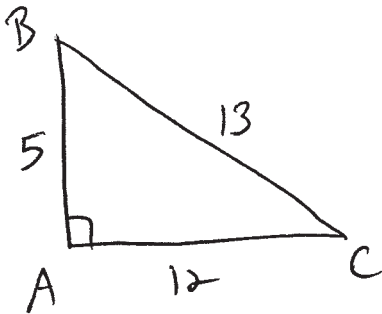
If the 2  $\triangle$ s are  $\cong$   
it also means that  
they are similar  $\sim$ .  
All  $\cong$   $\triangle$ s are  $\sim$ .

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

Question 29

29 In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .

Is Brett correct? Explain why.



Pythagorean Triples 5-12-13

Yes.  $\triangle ABC$  is 5, 12, 13 Pythagorean Triple

and  $\triangle DEF$  is also 5, 12, 13.

$\triangle ABC \cong \triangle DEF$  by SSS.

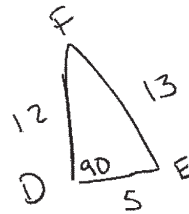
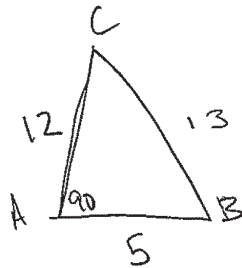
Since the  $\triangle$ 's  $\cong$ , they must be similar.

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

Question 29

29 In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .

Is Brett correct? Explain why.



$$5^2 + 12^2 = x^2$$
$$25 + 144 = \sqrt{169}$$
$$13$$

$$12^2 + x^2 = 13^2$$
$$\sqrt{25}$$
$$5$$

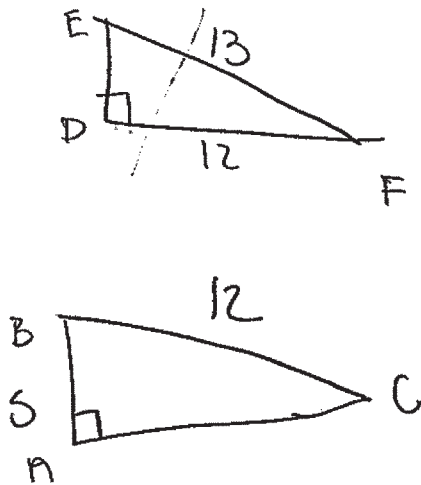
Brett is correct because both triangles are right triangles and if we use the pythagorean theorem, we find out that all the side lengths correspond/are equal to each other. (SSS)

**Score 1:** The student did not explain why the triangles are similar.

Question 29

29 In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .

Is Brett correct? Explain why.



yes because they both have right  $\angle$ 's and one side  $\cong$ .

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

Question 29

29 In  $\triangle ABC$ ,  $AB = 5$ ,  $AC = 12$ , and  $m\angle A = 90^\circ$ . In  $\triangle DEF$ ,  $m\angle D = 90^\circ$ ,  $DF = 12$ , and  $EF = 13$ . Brett claims  $\triangle ABC \cong \triangle DEF$  and  $\triangle ABC \sim \triangle DEF$ .

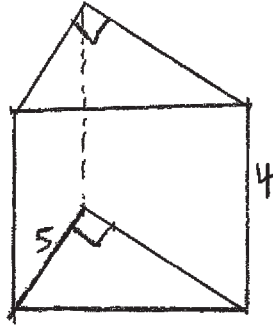
Is Brett correct? Explain why.

I would say Brett is half-correct, both triangles are  $90^\circ$ . That is where the similarities end though. The triangle cannot be congruent because the angle lengths differ.

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

Question 30

30 The volume of a triangular prism is  $70 \text{ in}^3$ . The base of the prism is a right triangle with one leg whose measure is 5 inches. If the height of the prism is 4 inches, determine and state the length, in inches, of the other leg of the triangle.



$$\begin{aligned} V &= B \cdot h \\ 70 &= B \cdot 4 \\ 70 &= \frac{4B}{4} \\ 17.5 &= B \end{aligned}$$

$$\begin{aligned} A_{\Delta} &= \frac{1}{2} l_1 \cdot l_2 \\ 17.5 &= \frac{1}{2} 5 \cdot l_2 \\ 17.5 &= \frac{2.5 l_2}{2.5} \end{aligned}$$

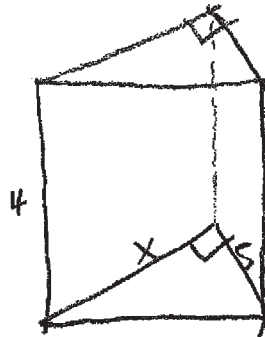
$$\boxed{7 = l_2}$$

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



**Question 30**

**30** The volume of a triangular prism is  $70 \text{ in}^3$ . The base of the prism is a right triangle with one leg whose measure is 5 inches. If the height of the prism is 4 inches, determine and state the length, in inches, of the other leg of the triangle.



$$V = B h$$

$$V = \left(\frac{1}{2} l \cdot b\right) h$$

$$70 = \left(\frac{1}{2} x \cdot 5\right) 4$$

$$\begin{array}{r} 70 = 10x \\ \hline 10 \quad \hline 10 \end{array}$$

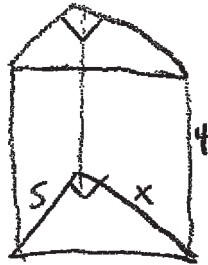
$$\boxed{7 = x}$$

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

Question 30

30 The volume of a triangular prism is  $70 \text{ in}^3$ . The base of the prism is a right triangle with one leg whose measure is 5 inches. If the height of the prism is 4 inches, determine and state the length, in inches, of the other leg of the triangle.

$$V = 70$$



$$V = B \cdot h$$

$$70 = 4B$$

$$17.5 = B$$

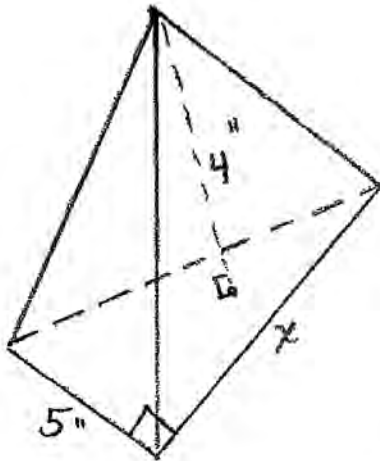
$$5x = 17.5$$

$$x = 3.5$$

**Score 1:** The student found the correct area of the base of the triangular prism, but no further correct work was shown.

Question 30

30 The volume of a triangular prism is  $70 \text{ in}^3$ . The base of the prism is a right triangle with one leg whose measure is 5 inches. If the height of the prism is 4 inches, determine and state the length, in inches, of the other leg of the triangle.

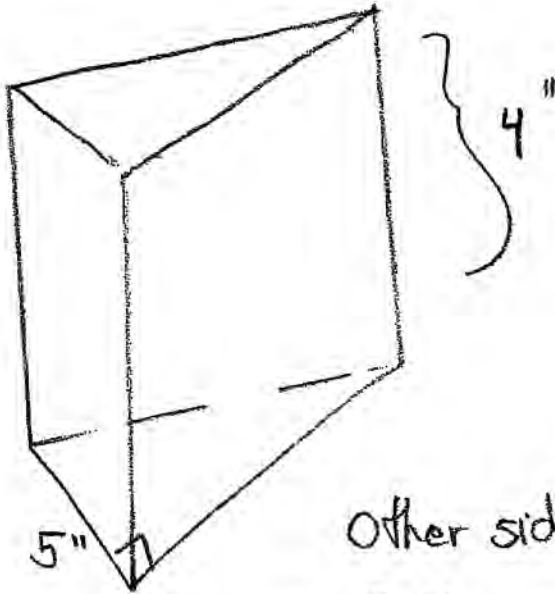


$$V = \frac{1}{3} Bh$$
$$70 = \frac{1}{3} \left( \frac{1}{2} bh \right) 4$$
$$70 = \frac{1}{3} \left( \frac{1}{2} (5)(x) \right) 4^2$$
$$210 = 10x$$
$$21 = x$$

**Score 1:** The student made an error in drawing and using a pyramid instead of a prism.

Question 30

30 The volume of a triangular prism is  $70 \text{ in}^3$ . The base of the prism is a right triangle with one leg whose measure is 5 inches. If the height of the prism is 4 inches, determine and state the length, in inches, of the other leg of the triangle.

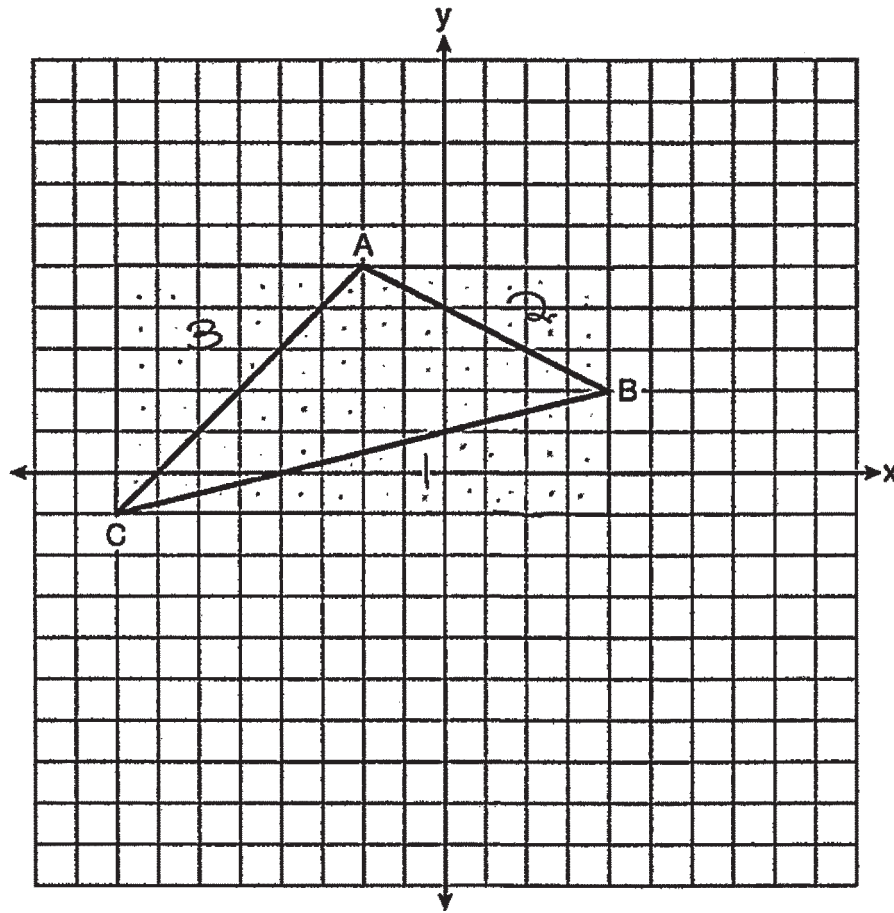


Other side must be 12, due to the Pythagorean theorem triple of 5, 12, 13.

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

**Question 31**

**31** Triangle  $ABC$  with coordinates  $A(-2,5)$ ,  $B(4,2)$ , and  $C(-8,-1)$  is graphed on the set of axes below.



Determine and state the area of  $\triangle ABC$ .

$$\begin{aligned} &\underline{1} \\ A &= \frac{1}{2}bh \\ A &= \frac{1}{2}(12)(3) \\ A &= 18 \end{aligned}$$

$$\begin{aligned} &\underline{2} \\ A &= \frac{1}{2}bh \\ A &= \frac{1}{2}(6)(3) \\ A &= 9 \end{aligned}$$

$$\begin{aligned} &\underline{3} \\ A &= \frac{1}{2}bh \\ A &= \frac{1}{2}(6)(6) \\ A &= 18 \end{aligned}$$

$$\begin{aligned} A &= l \cdot w \\ A &= (12)(6) \\ A &= 72 \end{aligned}$$

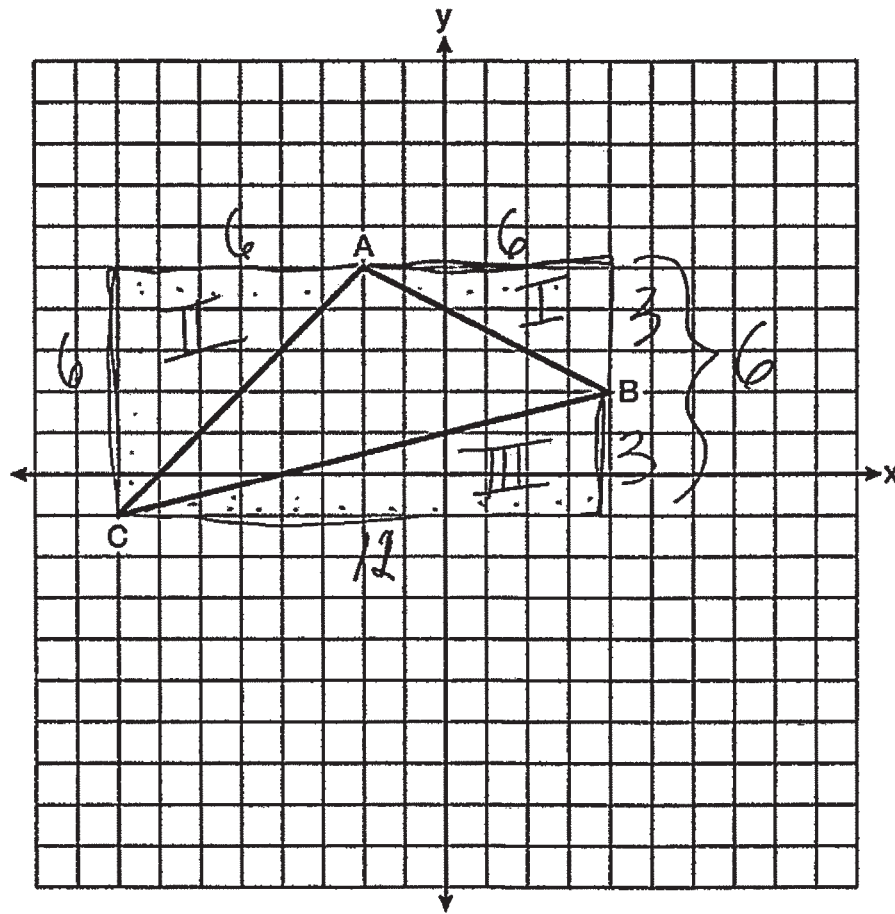
$$18 + 18 + 9 = 45$$

$$72 - 45 = 27$$

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

Question 31

31 Triangle  $ABC$  with coordinates  $A(-2,5)$ ,  $B(4,2)$ , and  $C(-8,-1)$  is graphed on the set of axes below.



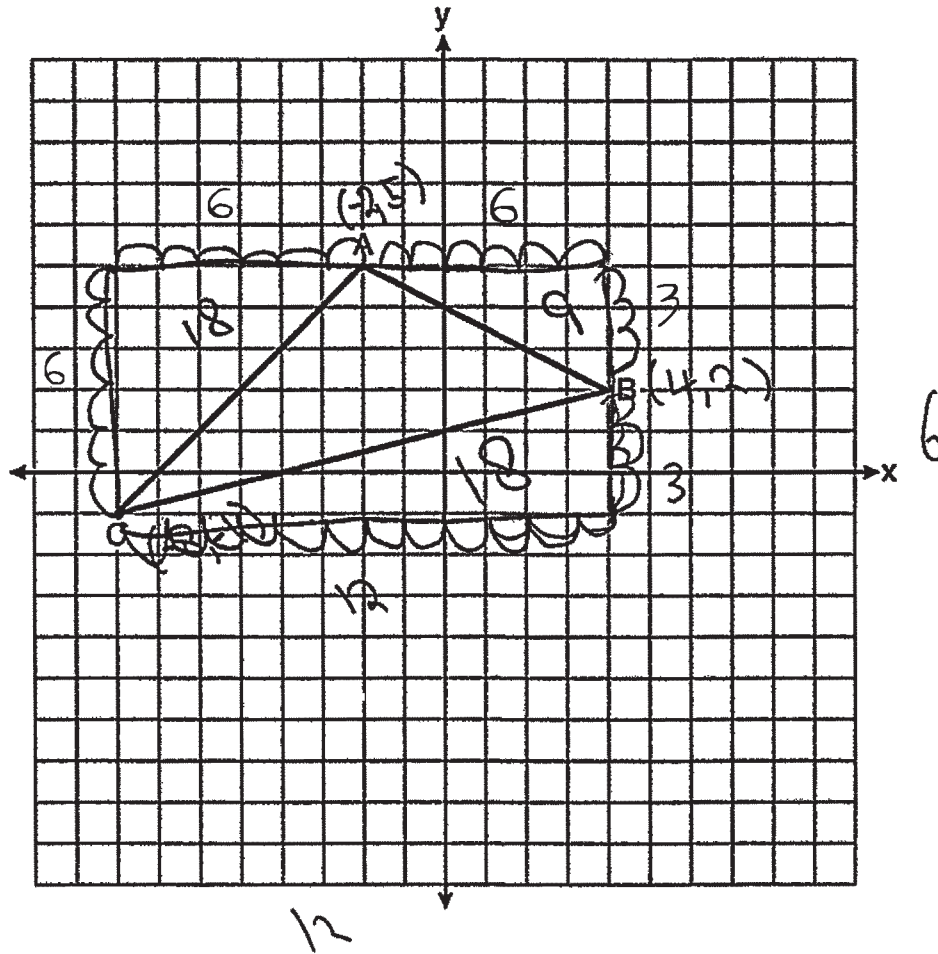
Determine and state the area of  $\triangle ABC$ .

$$\begin{aligned}
 & \text{A of } \square - \text{A of } \triangle I - \triangle II - \triangle III \\
 & 12 \cdot 6 - \frac{bh}{2} - \frac{bh}{2} - \frac{bh}{2} \\
 & = 72 - \frac{6(3)}{2} - \frac{6(6)}{2} - \frac{12(3)}{2} \\
 & = 72 - (9 + 18 + 18) \\
 & = 72 - 45 \\
 & \text{Area} = 27
 \end{aligned}$$

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

Question 31

31 Triangle  $ABC$  with coordinates  $A(-2,5)$ ,  $B(4,2)$ , and  $C(-8,-1)$  is graphed on the set of axes below.



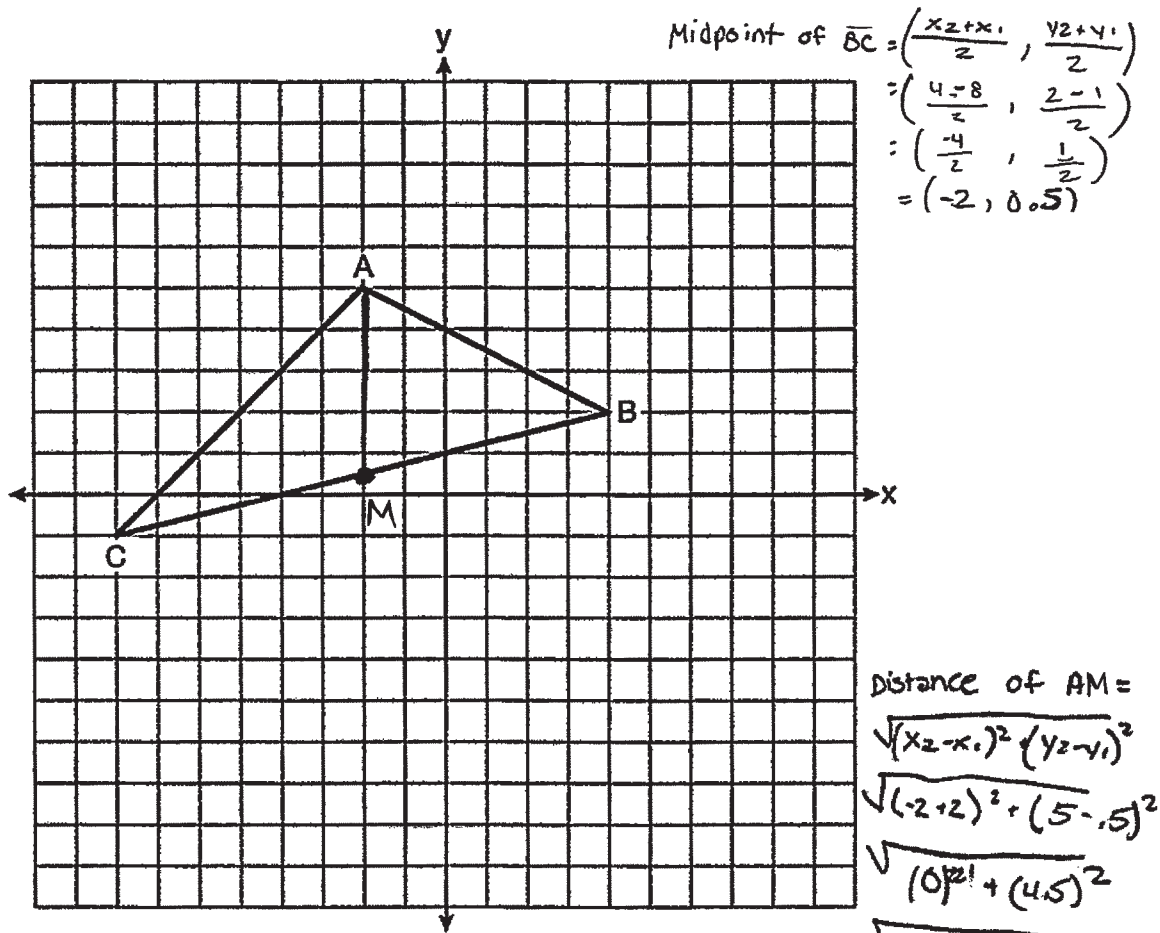
Determine and state the area of  $\triangle ABC$ .

$$\frac{72 - 45}{ABC = 27}$$

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

Question 31

31 Triangle  $ABC$  with coordinates  $A(-2,5)$ ,  $B(4,2)$ , and  $C(-8,-1)$  is graphed on the set of axes below.



Determine and state the area of  $\triangle ABC$ .

$$A = \frac{1}{2} bh$$

$$A = \frac{1}{2} (\sqrt{153} \cdot \sqrt{20.25})$$

$$A = \frac{1}{2} (55.609259458)$$

$$A = 27.8309629729$$

$$\text{Distance of } BC = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(4 + 8)^2 + (2 + 1)^2}$$

$$= \sqrt{(12)^2 + (3)^2}$$

$$= \sqrt{144 + 9}$$

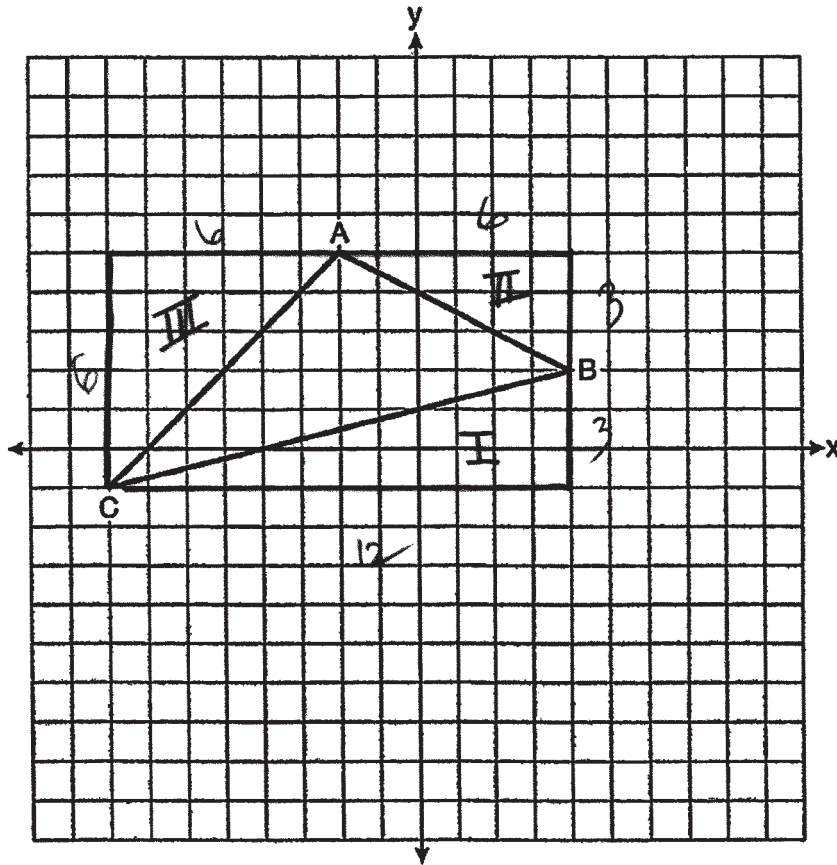
$$= \sqrt{153}$$

**Score 1:** The student made an error using the median instead of the altitude in determining the area.



Question 31

31 Triangle  $ABC$  with coordinates  $A(-2,5)$ ,  $B(4,2)$ , and  $C(-8,-1)$  is graphed on the set of axes below.



Determine and state the area of  $\triangle ABC$ .

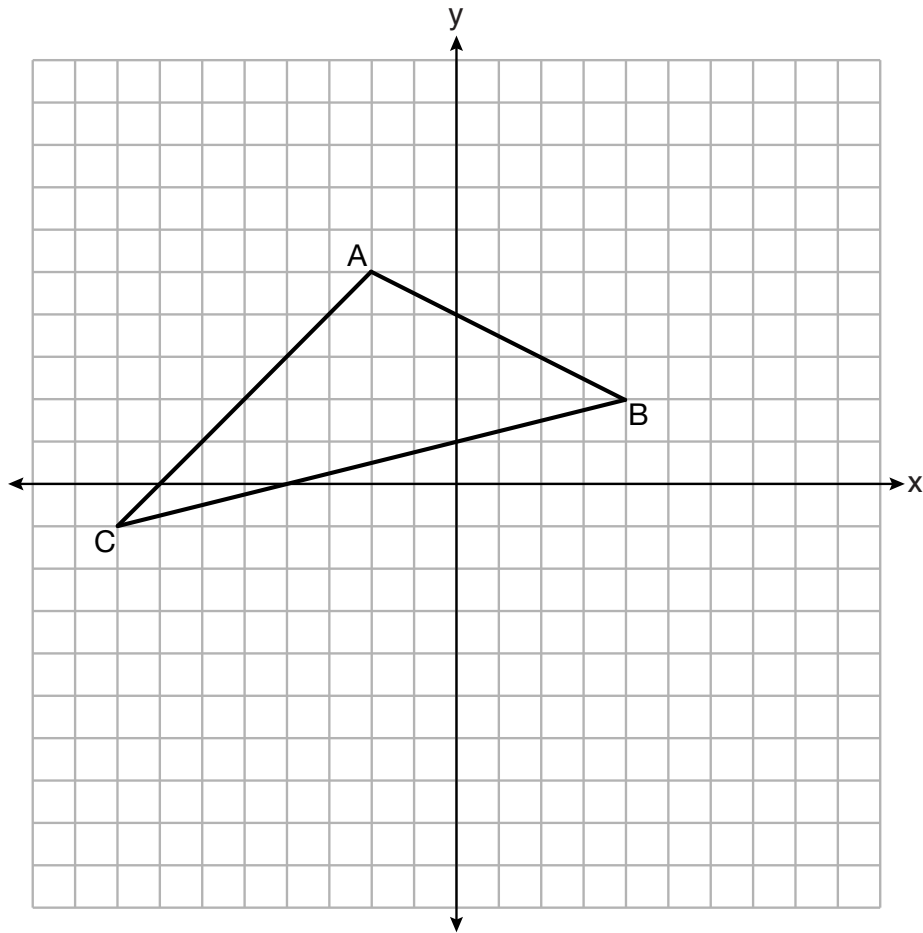
$$\begin{aligned}
 &A_{\text{of } \square} - A_{\triangle I} - A_{\triangle II} - A_{\triangle III} \\
 &12 \cdot 6 - \frac{12(3)}{2} - \frac{6(3)}{2} - \frac{6(6)}{2} \\
 &72 - 18 - 9 - 18
 \end{aligned}$$

$$A_{ABC} = 81$$

**Score 1:** The student made a computational error in determining the area of the triangle.

**Question 31**

**31** Triangle  $ABC$  with coordinates  $A(-2,5)$ ,  $B(4,2)$ , and  $C(-8,-1)$  is graphed on the set of axes below.



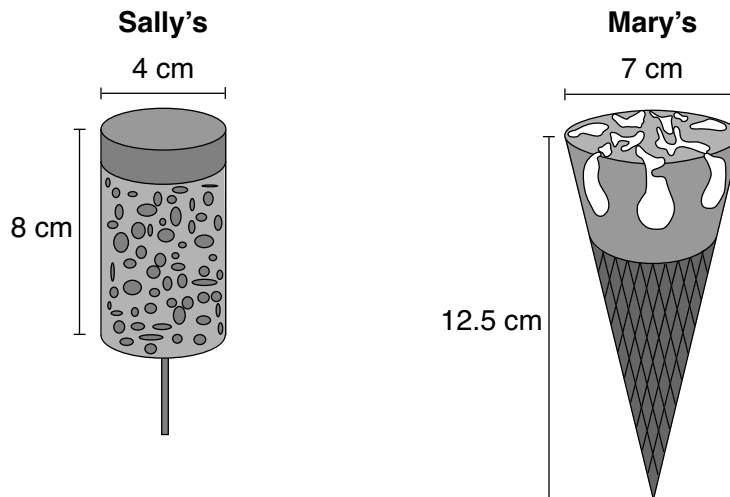
Determine and state the area of  $\triangle ABC$ .

$$\begin{aligned} A &= \frac{1}{2}bh \\ A &= \frac{1}{2}(12)(6) \\ A &= 36 \end{aligned}$$

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

**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



Who was served more ice cream, Sally or Mary? Justify your answer.

$$\begin{aligned} \text{Sally} &= \pi (2)^2 \cdot 8 & V &= \frac{1}{3} (\pi) (3.5)^2 \cdot (12.5) \\ \text{Sally} &= 100.53 \text{ cm}^3 & V &= 160.35 \text{ cm}^3 \end{aligned}$$

Mary has more ice cream

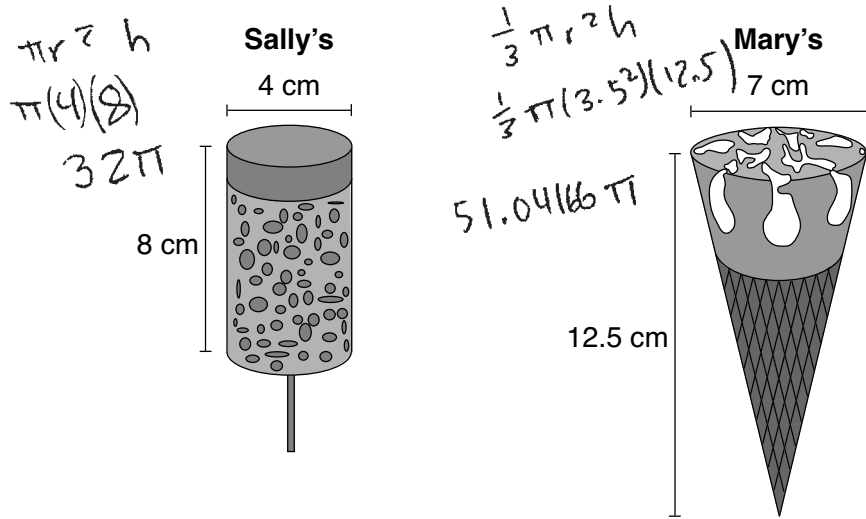
Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the nearest cubic centimeter.

$$160.35 - 100.53 = 60 \text{ cm}^3$$

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

**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



Who was served more ice cream, Sally or Mary? Justify your answer.

Mary, because the volume of her container filled is  $51.0416\pi$  while Sally's is only  $32\pi$

Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the nearest cubic centimeter.

$$51.0416\pi - 32\pi = 59.82116011$$

60 cubic cm

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

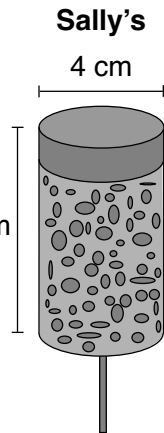
**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.

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

$$V = \pi (2)^2 (8)$$

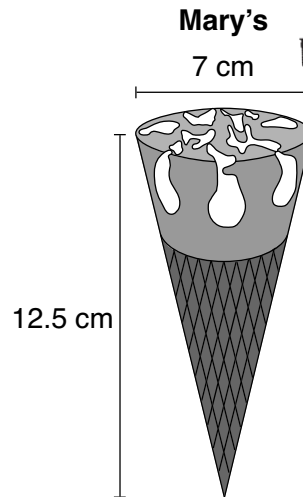
$$V = 101 \text{ cm}^3$$



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

$$V = \frac{1}{3} \pi (3.5)^2 (12.5)$$

$$V = 160 \text{ cm}^3$$



Who was served more ice cream, Sally or Mary? Justify your answer.

Mary's ice cream because it has more volume for the cone than the cylinder.

Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the nearest cubic centimeter.

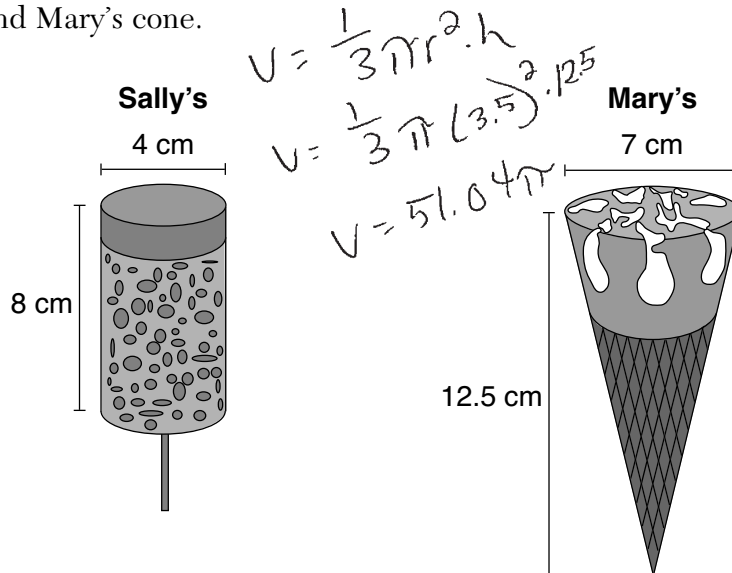
cylinder  
 $V = 101 \text{ cm}^3$

cone  
 $V = 160 \text{ cm}^3$

**Score 3:** The student correctly determined Mary had more ice cream, but no further correct work was shown.

**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



Who was served more ice cream, Sally or Mary? Justify your answer.

Mary, because her volume is  $51.04\pi$  and Sally's is  $32\pi$ .  
 $V = \pi r^2 h$   
 $V = \pi (2)^2 h$   
 $V = \pi 4 \cdot 8$   
 $V = 32\pi$   
 $V = \pi r^2 h$   
 $V = \pi (3.5)^2 \cdot 12.5$   
 $V = 453.125\pi$

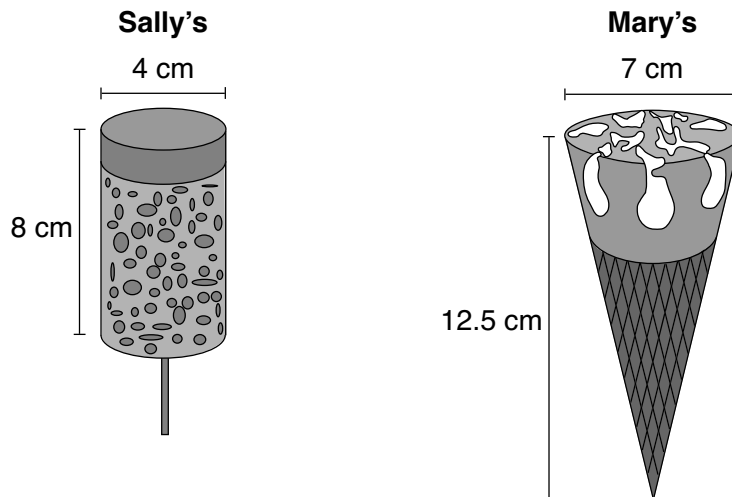
Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the nearest cubic centimeter.

$160.35$   
 $- 100.53$   
 $59.82$

**Score 3:** The student made a rounding error in determining the difference in the volumes of the ice creams.

**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



Who was served more ice cream, Sally or Mary? Justify your answer.

$$\begin{aligned} \text{Sally} \\ V &= \pi r^2 h \\ V &= \pi (2)^2 8 \\ V &= 100.5 \end{aligned}$$

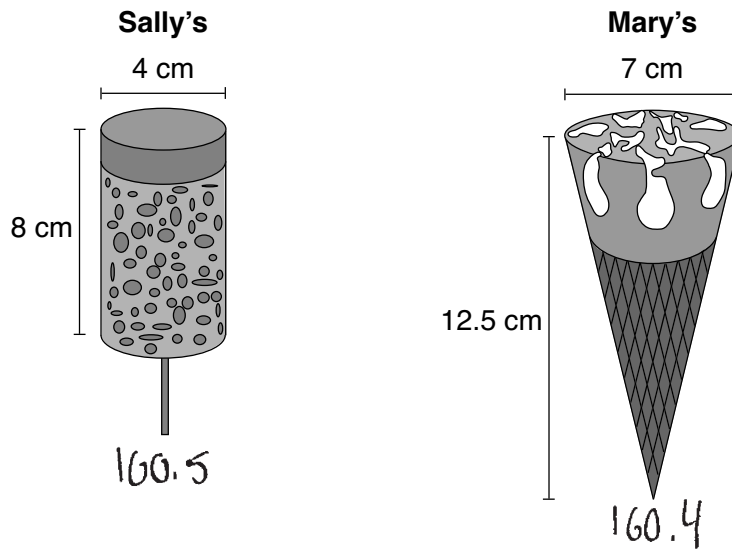
$$\begin{aligned} \text{Mary} \\ V &= \frac{1}{3} \pi r^2 h \\ V &= \frac{1}{3} \pi (3.5)^2 (12.5) \\ V &= 160.35 \end{aligned}$$

Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the *nearest cubic centimeter*.

**Score 2:** The student correctly determined the volume of the cylinder and cone, but no further correct work was shown.

**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



Who was served more ice cream, Sally or Mary? Justify your answer.

mary cause its bigger

Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the *nearest cubic centimeter*.

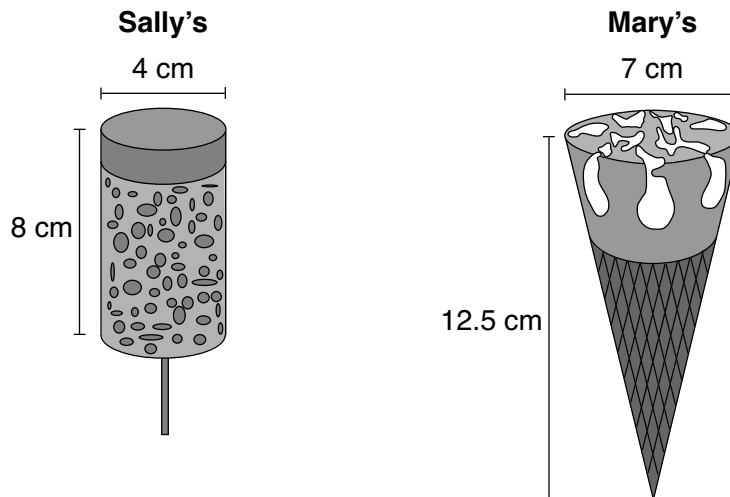
60

**Score 1:** The student indicated Mary and 60, but appropriate work was not shown.



**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



Who was served more ice cream, Sally or Mary? Justify your answer.

$$\begin{aligned}
 V &= Bh \\
 V &= \pi r^2 h \\
 V &= (4 \pi)(8) \\
 V &= 100.5309649
 \end{aligned}$$

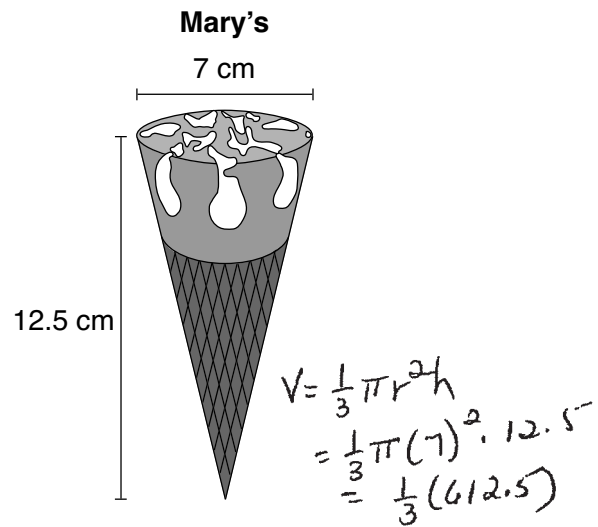
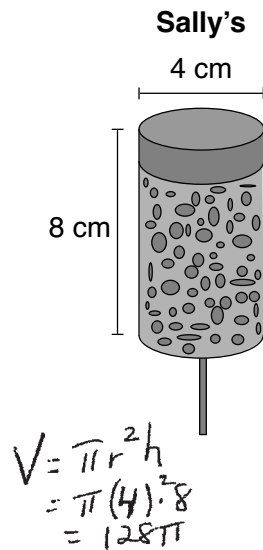
$$\begin{aligned}
 V &= Bh \\
 V &= \pi r^2 h \\
 V &= (2.25 \pi)(12.5) \\
 V &= 481.0563751
 \end{aligned}$$

Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the *nearest cubic centimeter*.

**Score 1:** The student correctly determined the volume of the cylinder, but no further correct work was shown.

**Question 32**

**32** Sally and Mary both get ice cream from an ice cream truck. Sally's ice cream is served as a cylinder with a diameter of 4 cm and a total height of 8 cm. Mary's ice cream is served as a cone with a diameter of 7 cm and a total height of 12.5 cm. Assume that ice cream fills Sally's cylinder and Mary's cone.



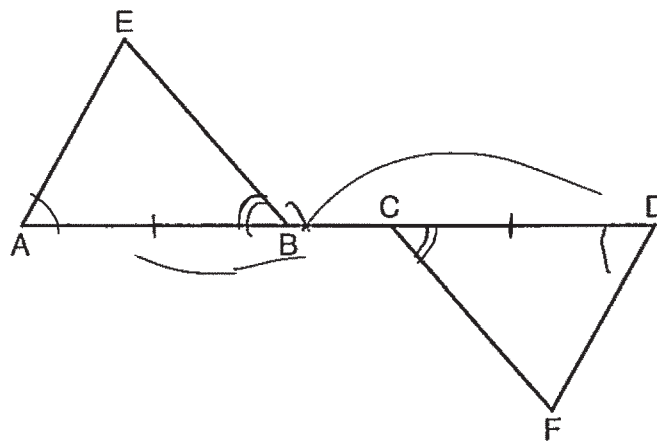
Who was served more ice cream, Sally or Mary? Justify your answer.

Determine and state how much more is served in the larger ice cream than the smaller ice cream, to the *nearest cubic centimeter*.

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

Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



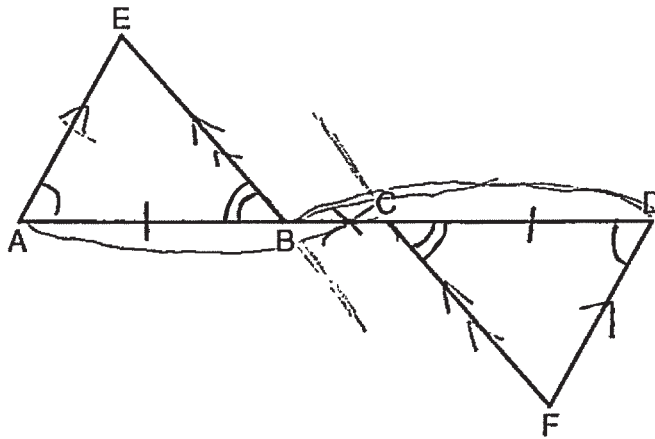
Prove:  $\triangle EAB \cong \triangle FDC$

Statements	Reasons
1. $\triangle AEB$ $\overline{AE} \parallel \overline{DF}$ $\triangle DFC$	1. Given
$\overline{ABCD}$ $\overline{EB} \parallel \overline{FC}$	2. If two parallel lines are cut by a transversal, then the alternate interior angles are congruent (1)
2. $\angle A \cong \angle D$ (A $\cong$ A) $\angle EBC \cong \angle FCB$	3. A linear pair form supplementary angles (2)
3. $\angle ABE$ and $\angle EBC$ , $\angle DCF$ and $\angle FCB$ are supplementary	4. Supplements of congruent angles are congruent (2) (3)
4. <del>Supplementary of congru</del> $\angle ABE \cong \angle DCF$ (A $\cong$ A)	5. Given
5. $\overline{AC} \cong \overline{DB}$	6. Reflexive property
6. $\overline{BC} \cong \overline{BC}$	7. Subtraction post property (5, 6)
7. <del><math>\overline{AC} - \overline{BC} \cong \overline{DB} - \overline{BC}</math></del> $\overline{AB} \cong \overline{CD}$ (6 $\cong$ 6)	8. ASA postulate (2) (4) (7)
8. <del><math>\triangle AEB</math></del> $\triangle EAB \cong \triangle FDC$	

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

Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



Prove:  $\triangle EAB \cong \triangle FDC$

①  $\triangle AEB, \triangle DFC, \overline{ABCD}, \overline{AE} \parallel \overline{DF}, \overline{EB} \parallel \overline{FC}, \overline{AC} \cong \overline{DB}$  ① given

②  $\angle A \cong \angle D$

③  $\overline{BC} \cong \overline{BC}$

④  $\overline{AB} \cong \overline{CD}$

⑤  $\angle EBA \cong \angle FCD$

⑥  $\triangle EAB \cong \triangle FDC$

② alternate interior angles are congruent in parallel lines

③ reflexive

④ subtraction postulate

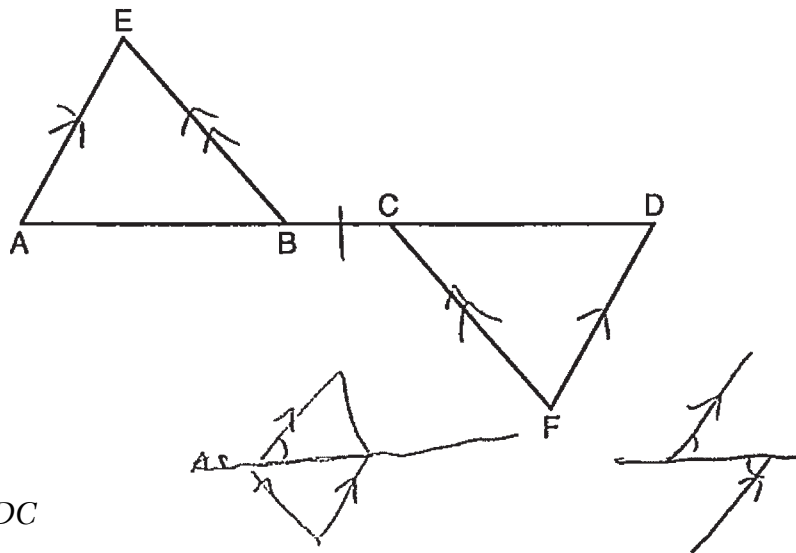
⑤ alternate exterior angles are congruent in parallel lines

⑥ ASA Postulate

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

Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



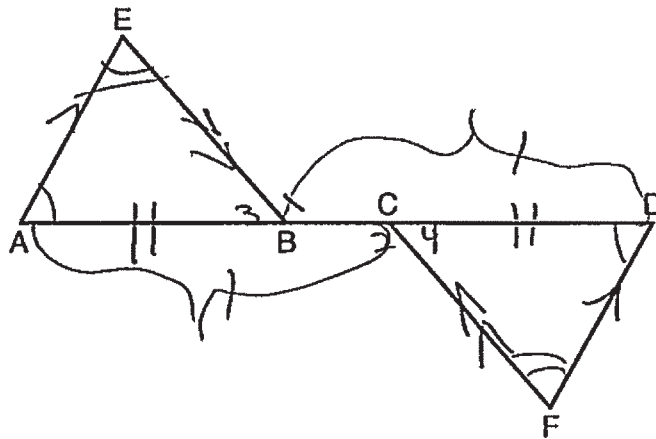
Prove:  $\triangle EAB \cong \triangle FDC$

Statement	Reason
1) $\triangle AEB, \triangle DFC, \overline{ABCD}, \overline{AE} \parallel \overline{DF}$ $\overline{EB} \parallel \overline{FC}, \overline{AC} \cong \overline{DB}$	1) given
2) $\overline{BC} \cong \overline{BC}$	2) reflexive property
3) $\overline{AC} - \overline{BC} \cong \overline{DB} - \overline{BC}$	3) equals minus equals the result are equal
④ $\overline{AB} \cong \overline{CD}$	4) $\parallel$ lines form alternate interior angles that are congruent.
4) $\angle EAB \cong \angle CDF$ (A) $\angle EBA \cong \angle FCD$ (A)	5) ASA postulate.
5) $\triangle EAB \cong \triangle FDC$	

**Score 3:** The student wrote an incorrect reason in step 4 for  $\angle EBA \cong \angle FCD$ .

Question 33

33 Given:  $\triangle AEB$  and  $\triangle FDC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



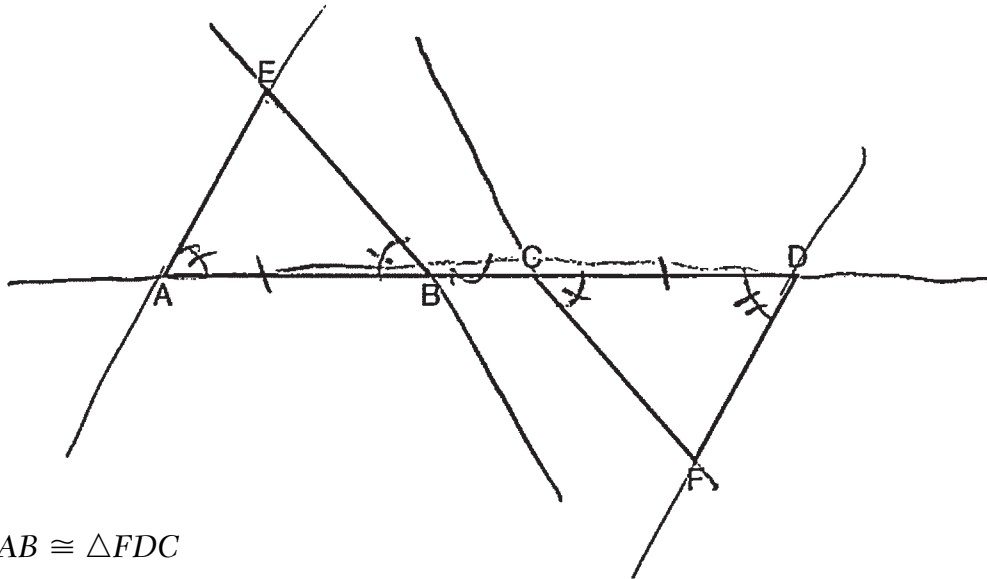
Prove:  $\triangle EAB \cong \triangle FDC$

S	R
<p>① <math>\overline{AE} \parallel \overline{DF}</math>, <math>\overline{EB} \parallel \overline{FC}</math>  <math>\overline{AC} \cong \overline{DB}</math>    <math>\overline{ABCD}</math></p> <p>② <math>\overline{BC} \cong \overline{BC}</math></p> <p>③ <math>\overline{AC} - \overline{BC} \cong \overline{BD} - \overline{BC}</math>  <math>\overline{AB} \cong \overline{DC}</math></p> <p>④ <math>\angle E \cong \angle F</math>  <math>\angle A \cong \angle D</math></p> <p>⑤ <math>\triangle EAB \cong \triangle FDC</math></p>	<p>① Given</p> <p>② reflexive</p> <p>③ Subtraction postulate</p> <p>④ When <math>\parallel</math> lines are cut by a transversal alt int <math>\angle</math>'s are <math>\cong</math></p> <p>⑤ AAS</p>

**Score 3:** The student wrote an incorrect statement and reason in step 4 for  $\angle E \cong \angle F$ .

Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



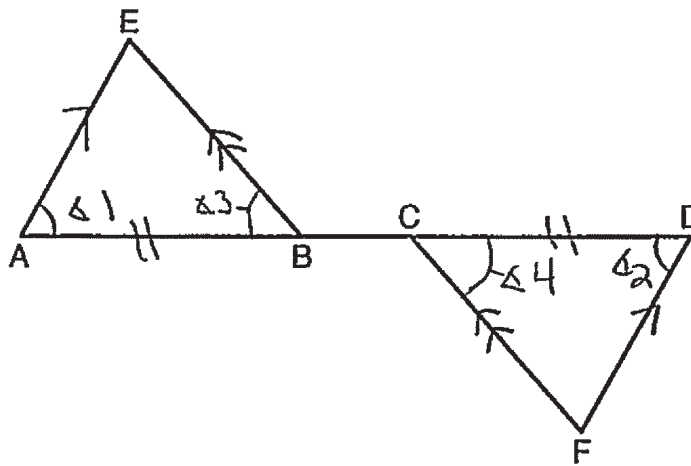
Prove:  $\triangle EAB \cong \triangle FDC$

Statements	Reasons
1. $\triangle AEB, \triangle DFC, \overline{ABCD}, \overline{AE} \parallel \overline{DF}, \overline{EB} \parallel \overline{FC}$	1. Given
2. $\angle A \cong \angle D$	2. When 2 $\parallel$ lines are cut by a transversal, alternate exterior angles are congruent
3. $\angle EBA \cong \angle FCD$	3. When 2 $\parallel$ lines are cut by a transversal, alternate interior angles are congruent
4. $\overline{AC} \cong \overline{DB}$	4. Given
5. $\overline{CB} \cong \overline{CB}$	5. Reflexive Postulate
6. $\overline{AB} \cong \overline{CD}$	6. Subtraction Postulate
7. $\triangle EAB \cong \triangle FDC$	7. ASA $\cong$

**Score 2:** The student wrote incorrect reasons in steps 2 and 3.

Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



Prove:  $\triangle EAB \cong \triangle FDC$

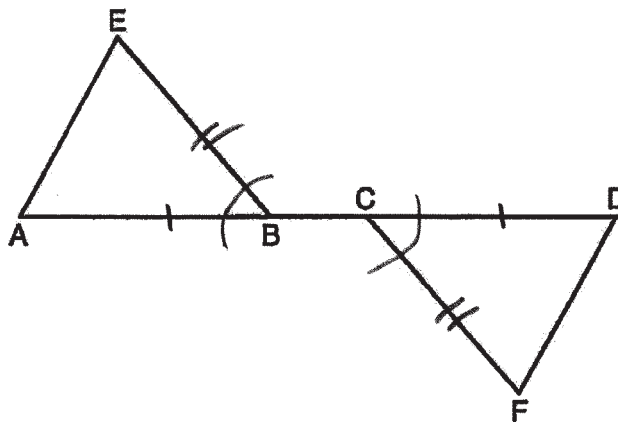
- 1)  $\overline{AE} \parallel \overline{DF}$       1) Given
- $\overline{EB} \parallel \overline{FC}$
- 2)  $\angle 1 \cong \angle 2$       2) Alt. interior  $\angle$ s  $\cong$
- 3)  $\angle 3 \cong \angle 4$       3) Alt. interior  $\angle$ s  $\cong$
- 4)  $\overline{AC} \cong \overline{DB}$       4) Given
- 5)  $\overline{CB} \cong \overline{CB}$       5) reflexive property
- 6)  $\overline{AC} - \overline{BC} \cong$       6) subtraction property  
 $\overline{DB} - \overline{CB}$   
or  
 $\overline{AB} \cong \overline{CD}$
- 7)  $\triangle EAB \cong \triangle FDC$       7) ASA

**Score 2:** The student wrote an incomplete reason in step 2 and an incorrect reason in step 3.



Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



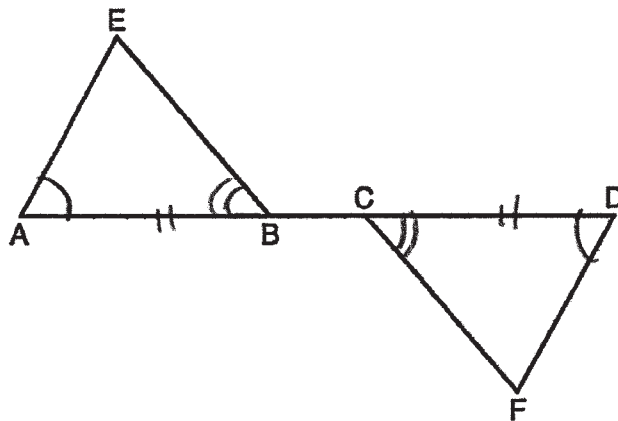
Prove:  $\triangle EAB \cong \triangle FDC$

1. $\overline{ABCD}$ , $\overline{AE} \parallel \overline{DF}$ , $\overline{EB} \parallel \overline{FC}$	1. given
2. $\overline{BC} \cong \overline{BC}$	2. Reflexive
S 3. $\overline{AB} \cong \overline{CD}$	3. substitution
S 4. $\overline{EB} \cong \overline{FC}$	4. Parallel lines create $\cong$ segments
A 5. $\angle EBA \cong \angle DCF$	5. $\cong$ Corresponding exterior $\angle$ s
6. $\triangle EAB \cong \triangle FDC$	6. SAS

**Score 1:** The student had only one correct statement and reason in step 2.

Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



Prove:  $\triangle EAB \cong \triangle FDC$

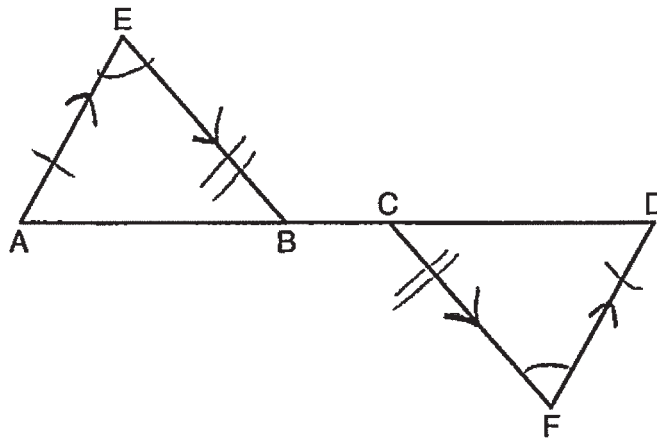
- |   |                         |
|---|-------------------------|
| 1. $\triangle AEB, \triangle DFC, \overline{ABCD}$<br>$\overline{AE} \parallel \overline{DF}, \overline{EB} \parallel \overline{FC}$<br>$\overline{AC} \cong \overline{DB}$ | $(S \cong S)$           |
| 2. $\angle A \cong \angle D$  | $(\angle \cong \angle)$ |
| 3. $\angle EBA \cong \angle FCD$  | $(\angle \cong \angle)$ |
| 4. $\triangle EAB \cong \triangle FDC$  |                         |

- |  |
|--|
| 1. Given   |
| 2. Parallel lines cut by a transversal form $\cong$ alternate interior angles. |
| 3. Parallel lines cut by a transversal form $\cong$ alternate interior angles. |
| 4. $AAS \cong AAS$   |

**Score 1:** The student had only one correct statement and reason in step 2.

Question 33

33 Given:  $\triangle AEB$  and  $\triangle DFC$ ,  $\overline{ABCD}$ ,  $\overline{AE} \parallel \overline{DF}$ ,  $\overline{EB} \parallel \overline{FC}$ ,  $\overline{AC} \cong \overline{DB}$



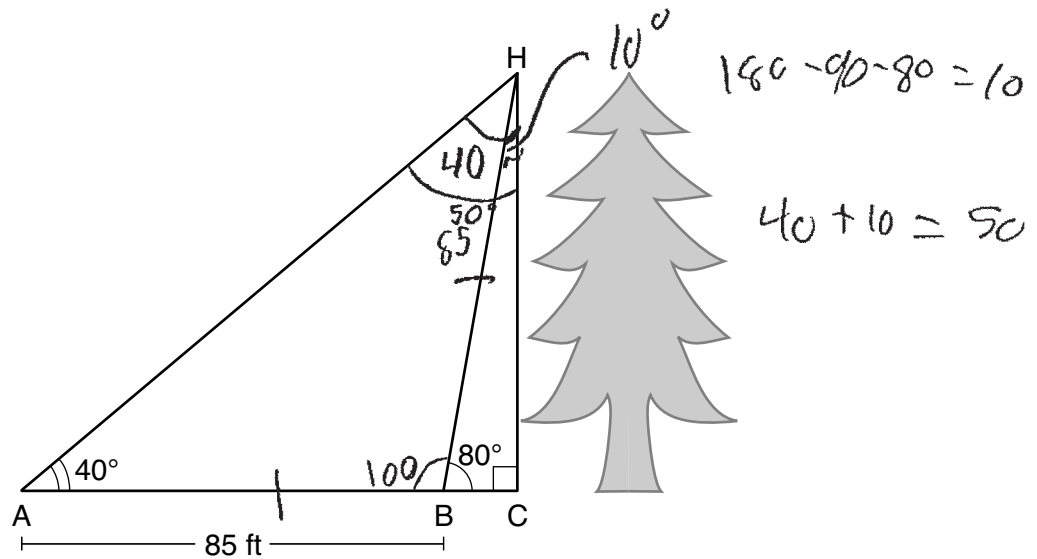
Prove:  $\triangle EAB \cong \triangle FDC$

S	R
1. $\overline{AE} \parallel \overline{DF}$ , $\overline{EB} \parallel \overline{FC}$	1. given
2. $\overline{AC} \cong \overline{DB}$	2. given
3. $\angle AEB \cong \angle DFC$	3. parallel lines form congruent alt $\angle$ s
4. $\overline{AE} \cong \overline{DF}$	4. parallel lines form $\cong$ lines
5. $\overline{EB} \cong \overline{FC}$	5. parallel lines form $\cong$ lines
6. $\triangle AEB \cong \triangle DFC$	6. SAS

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

Question 34

34 Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point A on the ground to the top of the tree, H, is  $40^\circ$ . The angle of elevation from point B on the ground to the top of the tree, H, is  $80^\circ$ . The distance between points A and B is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

$\angle ABC$  is  $180^\circ$  b/c it is a straight line on the ground. This means that  $\angle ABH$  and  $\angle CBH$  are supplementary. Since  $\angle CBH$  is  $80^\circ$  we know  $\angle ABH$  is  $100^\circ$ . We already know that  $\angle A$  is  $40^\circ$ . We now know two  $m\angle$ 's. Since a  $\triangle$ 's  $\angle$ 's add to  $180^\circ$  we can do  $100 + 40 + x = 180$ .  $\angle AHB = 40$ . Two  $m\angle$ 's are  $\cong$  meaning

Determine and state, to the nearest foot, the height of the tree.

Opposite Sides  $\overline{AB} \cong \overline{BH}$   
Then it is isosceles.

SOTH  
CAH  
TOD

$\sin 80 = \frac{x}{85}$

$x = \sin 80 \cdot 85$

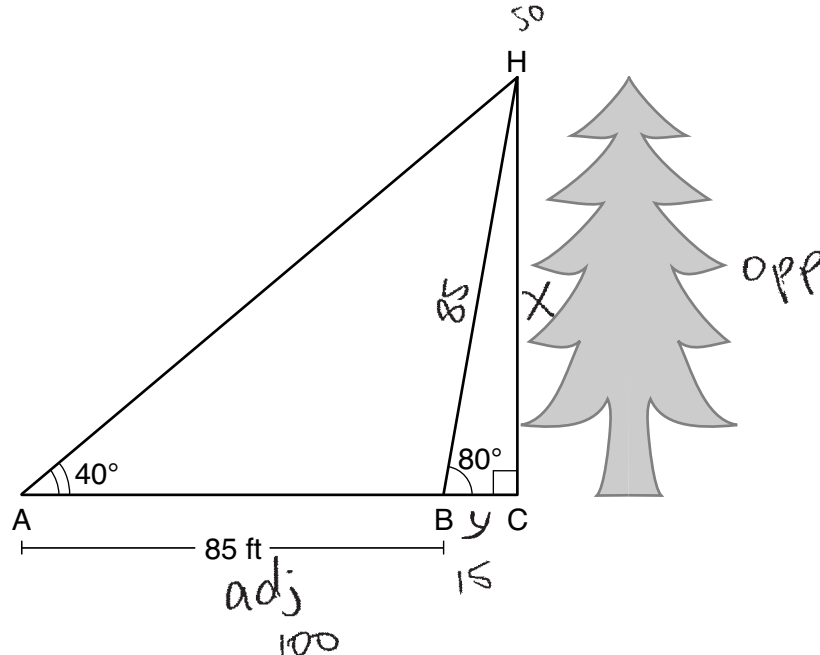
$x = 83.708$

84 ft

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

**Question 34**

34 Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point  $A$  on the ground to the top of the tree,  $H$ , is  $40^\circ$ . The angle of elevation from point  $B$  on the ground to the top of the tree,  $H$ , is  $80^\circ$ . The distance between points  $A$  and  $B$  is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

$\angle CBH$  is  $80^\circ$  and is a supplementary angle to  $\angle ABH$  making  $\angle ABH = 100^\circ$ .  
 $\angle BAH$  is already given as  $40^\circ$  and since another angle is  $100^\circ$ , the last angle would be  $40^\circ$ .  
 This creates an isosceles  $\triangle$  with 2 equivalent angle measures.

Determine and state, to the nearest foot, the height of the tree.

$$\cos 80^\circ = \frac{y}{25}$$

$$y = 14.7$$

$$y = 15$$

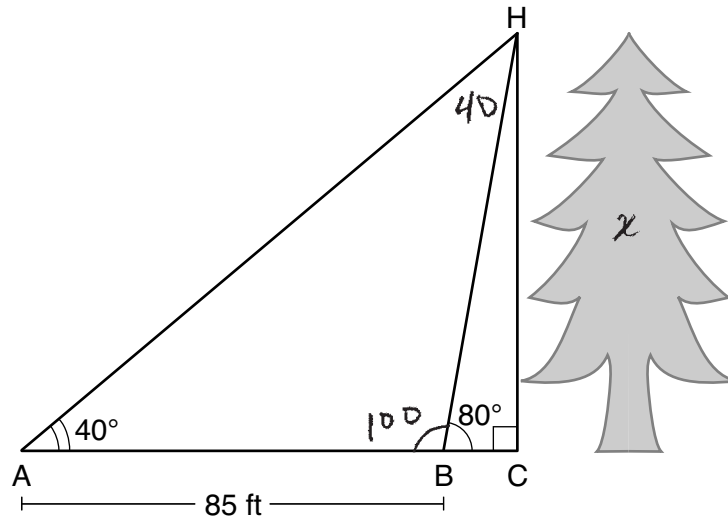
$$\tan 40^\circ = \frac{x}{100}$$

84 feet

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

**Question 34**

34 Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point  $A$  on the ground to the top of the tree,  $H$ , is  $40^\circ$ . The angle of elevation from point  $B$  on the ground to the top of the tree,  $H$ , is  $80^\circ$ . The distance between points  $A$  and  $B$  is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

$\triangle ABH$  is isosceles because  $\angle ABH$  is  $100^\circ$  and  $\angle A$  is given  $40^\circ$ . That means  $\angle AHB$  must be  $40^\circ$ , and isosceles triangles have 2 equal angles.

Determine and state, to the nearest foot, the height of the tree.

$$\sin 80 = \frac{x}{85}$$

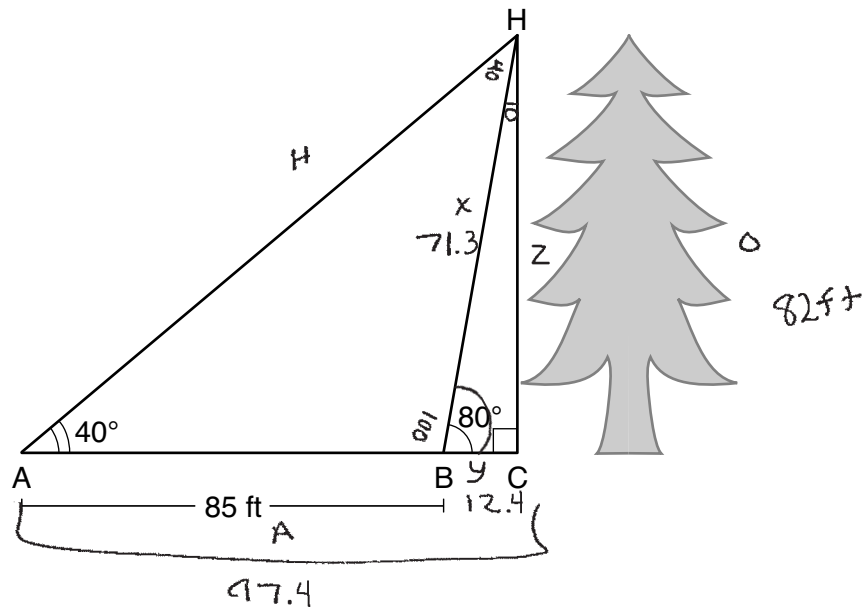
$$x = 14.76$$

$$x = 15$$

**Score 3:** The student wrote a correct explanation and a correct trigonometric equation, but no further correct work was shown.

**Question 34**

34 Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point  $A$  on the ground to the top of the tree,  $H$ , is  $40^\circ$ . The angle of elevation from point  $B$  on the ground to the top of the tree,  $H$ , is  $80^\circ$ . The distance between points  $A$  and  $B$  is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

Barry is correct bc  $\angle ABH$  is  $100^\circ$   
 $\angle A$  is  $40^\circ$ ;  $\angle AHB$  is  $40^\circ$  too bc  
 $100^\circ + 40^\circ = 140^\circ$  and a triangle is  $180^\circ$   
 $180^\circ - 140^\circ = 40^\circ$ .

Determine and state, to the nearest foot, the height of the tree.

$$\frac{\tan 40^\circ}{1} = \frac{x}{85}$$

$$x = 71.3$$

$$\frac{\cos 40^\circ}{1} = \frac{y}{71}$$

$$y = 12.4$$

$$\frac{\tan 40^\circ}{1} = \frac{z}{97.4}$$

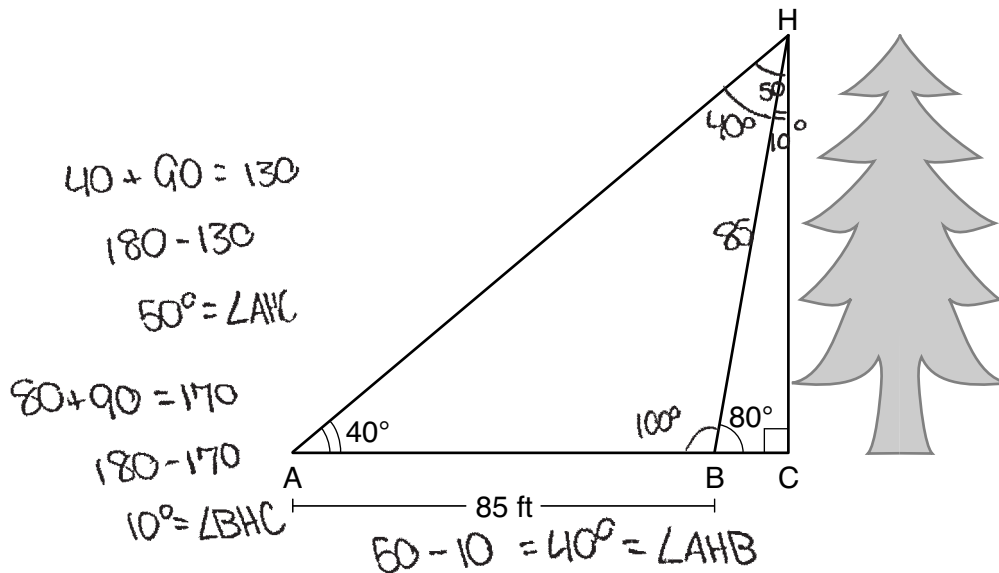
$$z = 81.7$$

The tree is  
82 ft tall

**Score 2:** The student wrote an incomplete explanation and made an error in using tangent in a non-right triangle.

**Question 34**

34 Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point  $A$  on the ground to the top of the tree,  $H$ , is  $40^\circ$ . The angle of elevation from point  $B$  on the ground to the top of the tree,  $H$ , is  $80^\circ$ . The distance between points  $A$  and  $B$  is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

He is correct b/c  $\angle AHB$  is  $40^\circ$  and an isosceles  $\triangle$  needs to have 2  $\cong$  base  $\angle$ 's to be isosceles.

Determine and state, to the *nearest foot*, the height of the tree.

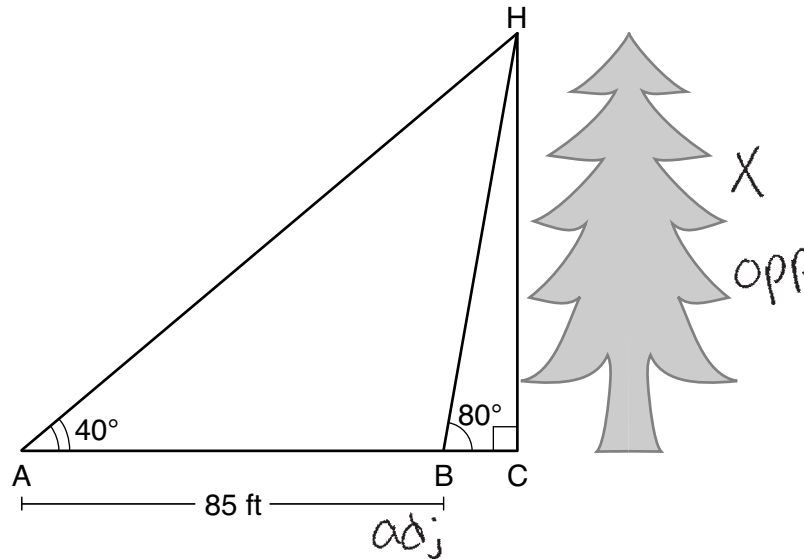
85 ft.

**Score 2:** The student wrote a complete and correct explanation, but no further correct work was shown.



**Question 34**

34 Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point  $A$  on the ground to the top of the tree,  $H$ , is  $40^\circ$ . The angle of elevation from point  $B$  on the ground to the top of the tree,  $H$ , is  $80^\circ$ . The distance between points  $A$  and  $B$  is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

$$\begin{array}{r} 180 \\ - 80 \\ \hline 100 \end{array}$$

$m\angle ABH$

$$\begin{array}{r} 180 \\ - 100 \\ \hline 80 \end{array}$$

$$80 \div 2 = 40 = m\angle AHB$$

Barry is correct - refer to justified work above as explanation.

Determine and state, to the nearest foot, the height of the tree.

TOA

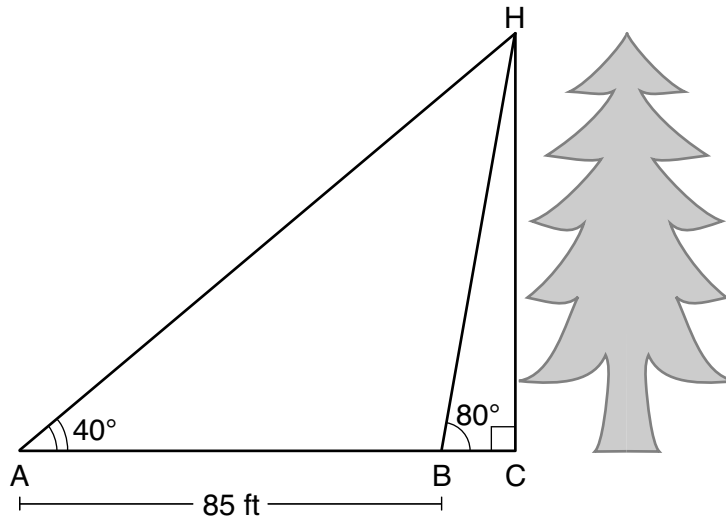
$$\frac{\tan(40)}{1} = \frac{x}{85}$$

$$\begin{aligned} x &= \tan(40) \cdot 85 \\ x &= 71.3235 \end{aligned}$$

**Score 1:** The student wrote an incomplete explanation. No further correct relevant work was shown.

**Question 34**

**34** Barry wants to find the height of a tree that is modeled in the diagram below, where  $\angle C$  is a right angle. The angle of elevation from point  $A$  on the ground to the top of the tree,  $H$ , is  $40^\circ$ . The angle of elevation from point  $B$  on the ground to the top of the tree,  $H$ , is  $80^\circ$ . The distance between points  $A$  and  $B$  is 85 feet.



Barry claims that  $\triangle ABH$  is isosceles. Explain why Barry is correct.

$\overline{AB}$  and  $\overline{BH}$  are the same length.

Determine and state, to the *nearest foot*, the height of the tree.

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

**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3, -1)$ ,  $U(-1, 8)$ , and  $C(8, 6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$m_{\overline{DU}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - (-1)}{-1 - (-3)} = \frac{9}{2}$$
$$m_{\overline{UC}} = \frac{6 - 8}{8 - (-1)} = \frac{-2}{9}$$

opp. reciprocal slopes  
 $\overline{DU} \perp \overline{UC}$   
 $\perp$  lines form right  $\angle$ 's.

$\triangle DUC$  is a right  $\triangle$  because  
it has a right angle.

**Question 35 is continued on the next page.**

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

Question 35 continued.

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ .  
 Prove quadrilateral  $DUCU'$  is a square.

$$d \overline{DU} = \frac{\sqrt{(8+1)^2 + (-1+3)^2}}{\sqrt{(9)^2 + (2)^2}}$$

$$\frac{\sqrt{81+4}}{\sqrt{85}}$$

$$d \overline{UC} = \frac{\sqrt{(8-6)^2 + (-1-8)^2}}{\sqrt{(2)^2 + (-9)^2}}$$

$$\frac{\sqrt{4+81}}{\sqrt{85}}$$

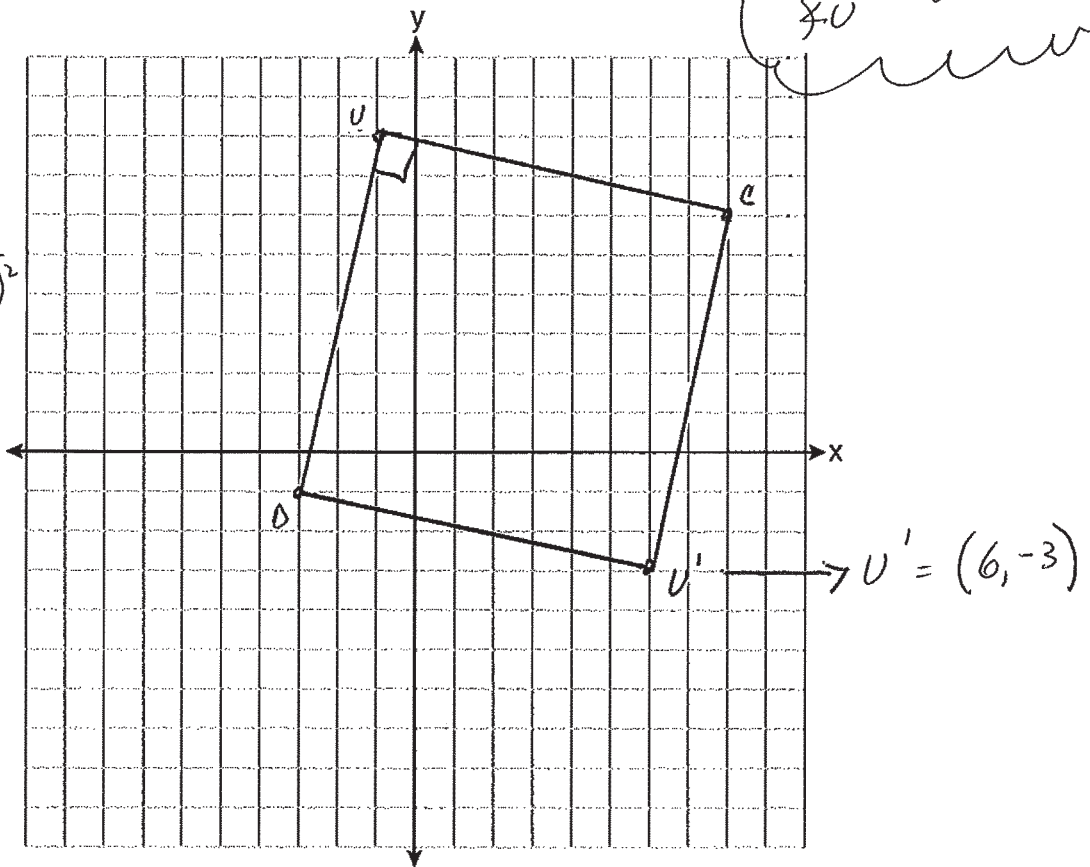
$$d \overline{CU'} = \frac{\sqrt{(8-6)^2 + (6+3)^2}}{\sqrt{(2)^2 + (9)^2}}$$

$$\frac{\sqrt{4+81}}{\sqrt{85}} = \sqrt{85}$$

*DUCU' is a square because it has 4 ≅ sides and a right ∠, ∠U*

$$d \overline{U'D} = \frac{\sqrt{(-3-6)^2 + (-1+3)^2}}{\sqrt{(9)^2 + (2)^2}}$$

$$\frac{\sqrt{81+4}}{\sqrt{85}}$$



**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3,-1)$ ,  $U(-1,8)$ , and  $C(8,6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$\begin{array}{l} DU = \sqrt{(1-(-3))^2 + (8-(-1))^2} \\ = \sqrt{2^2 + 9^2} \\ = \sqrt{4+81} \\ \boxed{DU = \sqrt{85}} \end{array} \quad \begin{array}{l} UC = \sqrt{(8-(-1))^2 + (6-8)^2} \\ = \sqrt{9^2 + (-2)^2} \\ = \sqrt{81+4} \\ \boxed{UC = \sqrt{85}} \end{array} \quad \begin{array}{l} CD = \sqrt{(8-(-3))^2 + (6-(-1))^2} \\ = \sqrt{11^2 + 7^2} \\ = \sqrt{121+49} \\ \boxed{CD = \sqrt{170}} \end{array}$$

$$\sqrt{85}^2 + \sqrt{85}^2 = \sqrt{170}^2$$

$$85 + 85 = 170$$

$$170 = 170$$

Since the Pythagorean Theorem works,

$\triangle DUC$  is a right  $\triangle$ .

**Question 35 is continued on the next page.**

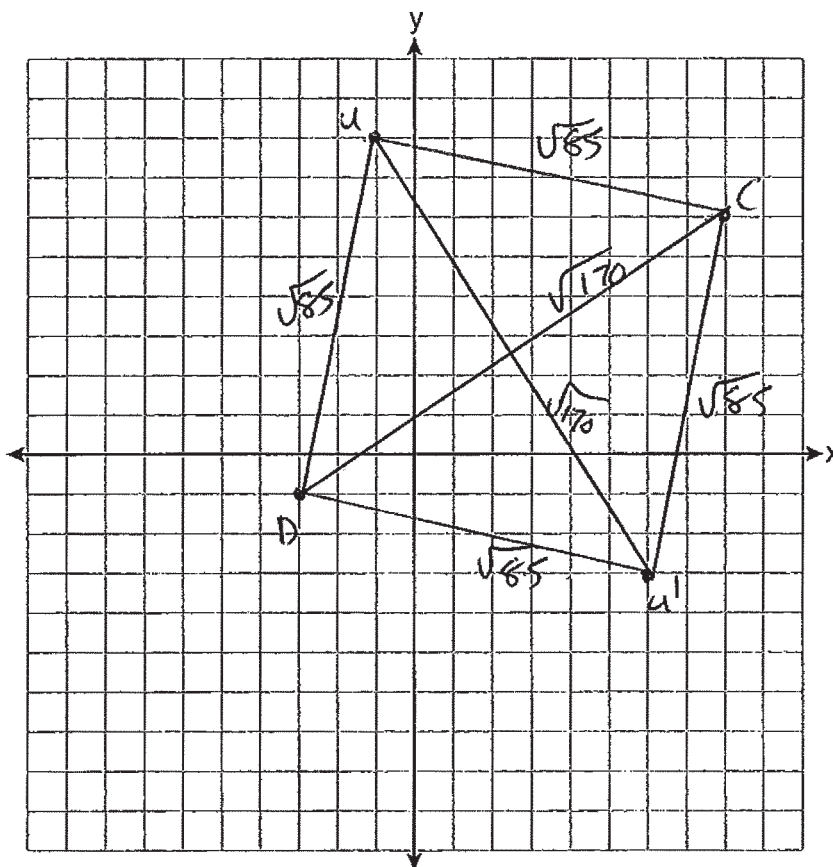
**Score 6:** The student gave a complete and correct response.

Question 35 continued.

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ . Prove quadrilateral  $DUCU'$  is a square.

$$\begin{array}{l}
 u' (6, -3) \\
 DU' = \sqrt{(6 - (-3))^2 + (-3 - (-1))^2} \\
 = \sqrt{9^2 + (-2)^2} \\
 = \sqrt{81 + 4} \\
 \boxed{DU' = \sqrt{85}}
 \end{array}
 \quad
 \begin{array}{l}
 u'C = \sqrt{(8 - 6)^2 + (6 - (-3))^2} \\
 = \sqrt{2^2 + 9^2} \\
 = \sqrt{4 + 81} \\
 \boxed{u'C = \sqrt{85}}
 \end{array}
 \quad
 \begin{array}{l}
 uu' = \sqrt{(6 - (-1))^2 + (-3 - 8)^2} \\
 = \sqrt{7^2 + (-11)^2} \\
 = \sqrt{49 + 121} \\
 \boxed{uu' = \sqrt{170}}
 \end{array}$$

Since all 4 sides of quadrilateral  $DUCU'$  are  $\cong$ , it is a rhombus  
 $\overline{DC} \cong \overline{uu'}$ . Since the diagonals of rhombus  $DUCU'$  are  $\cong$ , it is  
 a square.

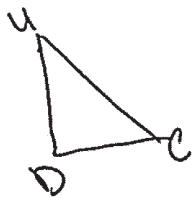


Question 35

35 Given: Triangle  $DUC$  with coordinates  $D(-3,-1)$ ,  $U(-1,8)$ , and  $C(8,6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]



$$\begin{aligned}
 & D(-3,-1) \quad 1 \\
 & U(-1,8) \quad 2 \\
 & m = \frac{y_2 - y_1}{x_2 - x_1} \\
 & = \frac{8 - (-1)}{-1 - (-3)} \\
 & = \frac{9}{2}
 \end{aligned}$$

$$\begin{aligned}
 & D(-3,-1) \quad 1 \\
 & C(8,6) \quad 2 \\
 & m = \frac{y_2 - y_1}{x_2 - x_1} \\
 & = \frac{6 - (-1)}{8 - (-3)} \\
 & = \frac{7}{11}
 \end{aligned}$$

$$\begin{aligned}
 & U(-1,8) \quad 1 \\
 & C(8,6) \quad 2 \\
 & m = \frac{y_2 - y_1}{x_2 - x_1} \\
 & = \frac{6 - 8}{8 - (-1)} \\
 & = \frac{-2}{9}
 \end{aligned}$$

$\triangle DUC$  is a Right triangle because lines  $\overline{DU}$  and  $\overline{UC}$ 's slopes are negative Reciprocals, meaning they are perpendicular. And perpendicular lines create  $90^\circ$  angles making the triangle a Right triangle.

Question 35 is continued on the next page.

**Score 5:** The student wrote an incomplete concluding statement in proving the square.

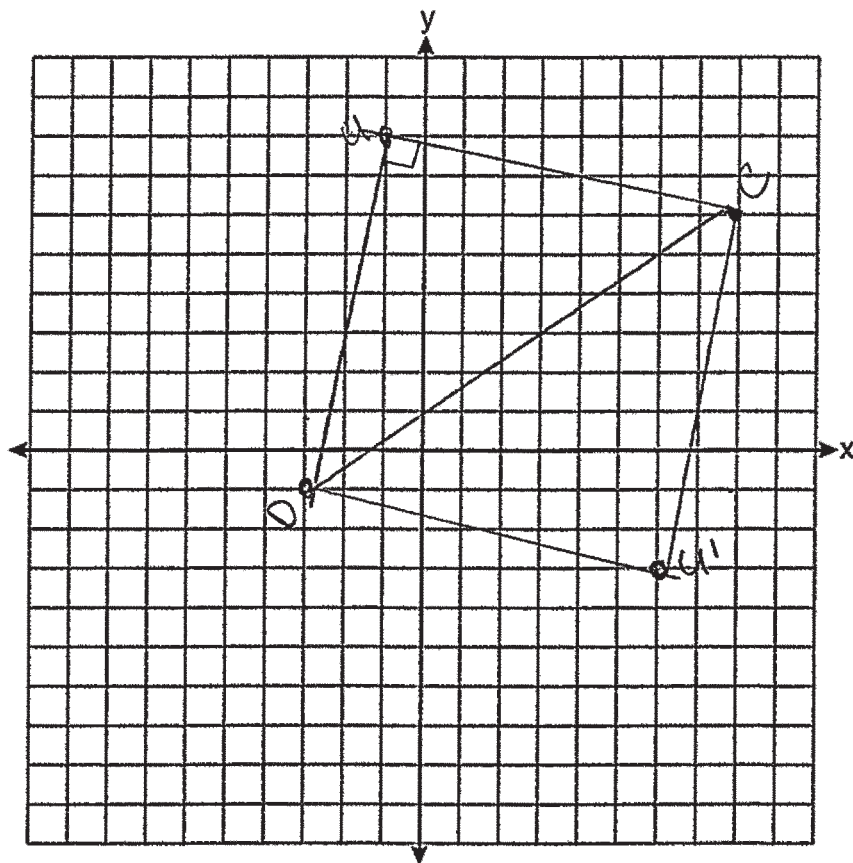
Question 35 continued.

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ .  
 Prove quadrilateral  $DUCU'$  is a square.

$$\begin{array}{l}
 D(-3, -1) \quad 1 \\
 U(-1, 8) \quad 2 \\
 D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 = \sqrt{(-1 - -3)^2 + (8 - -1)^2} \\
 = \sqrt{85}
 \end{array}
 \left. \begin{array}{l}
 U(-1, 8) \quad 1 \\
 C(8, 6) \quad 2 \\
 D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 = \sqrt{(8 - -1)^2 + (6 - 8)^2} \\
 = \sqrt{85}
 \end{array} \right\}
 \left. \begin{array}{l}
 C(8, 6) \quad 1 \\
 U'(6, -3) \quad 2 \\
 D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 = \sqrt{(6 - 8)^2 + (-3 - 6)^2} \\
 = \sqrt{85}
 \end{array} \right\}
 \left. \begin{array}{l}
 U'(6, -3) \quad 1 \\
 D(-3, -1) \quad 2 \\
 D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
 = \sqrt{(-3 - 6)^2 + (-1 - -3)^2} \\
 = \sqrt{85}
 \end{array} \right\}$$

$DUCU'$  is a rhombus because all the sides are equal.

$DUCU'$  is a square because all the sides are equal.





**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3, -1)$ ,  $U(-1, 8)$ , and  $C(8, 6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$m\overline{DU} = \frac{8+1}{-1+3} = \frac{9}{2}$$

$$m\overline{UC} = \frac{6-8}{8+1} = \frac{-2}{9}$$

The slopes of  $\overline{DU}$  and  $\overline{UC}$  are negative reciprocals,  $\therefore$   
 $\overline{DU}$  is  $\perp$  to  $\overline{UC}$ ,  $\therefore$  perpendicular  
lines form right  $\angle$ s,  $\therefore \triangle DUC$   
contains a rt.  $\angle$ ,  $\therefore \triangle DUC$   
is a rt.  $\triangle$ .

**Question 35 is continued on the next page.**

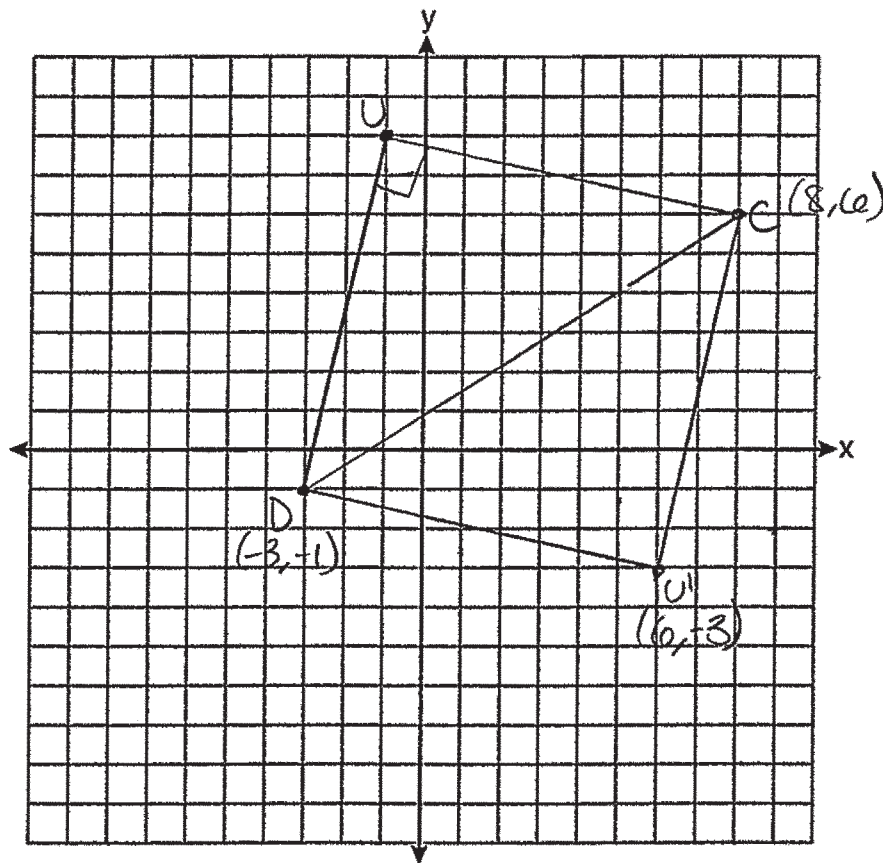
**Score 4:** The student made a conceptual error in proving the square.

Question 35 continued.

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ . Prove quadrilateral  $DUCU'$  is a square.

$$m \overline{CU'} = \frac{6+3}{8-6} = \frac{9}{2}$$
$$m \overline{DU'} = \frac{-1+3}{-3-6} = \frac{2}{-9}$$

The slopes of  $\overline{DU'}$  and  $\overline{CU'}$  are negative reciprocals,  $\therefore \overline{DU'}$  is  $\perp$  to  $\overline{CU'}$ ,  $\therefore$  perpendicular lines form rt.  $\angle$ s,  $\therefore$  quad  $DUCU'$  contains 2 rt.  $\angle$ s,  $\therefore$  quad  $DUCU'$  is a square.



**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3, -1)$ ,  $U(-1, 8)$ , and  $C(8, 6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$\text{slope of } \overline{DU} = \frac{8 - (-1)}{-1 - (-3)} = \frac{9}{2}$$

$$\text{slope of } \overline{UC} = \frac{8 - 6}{-1 - 8} = -\frac{2}{9}$$

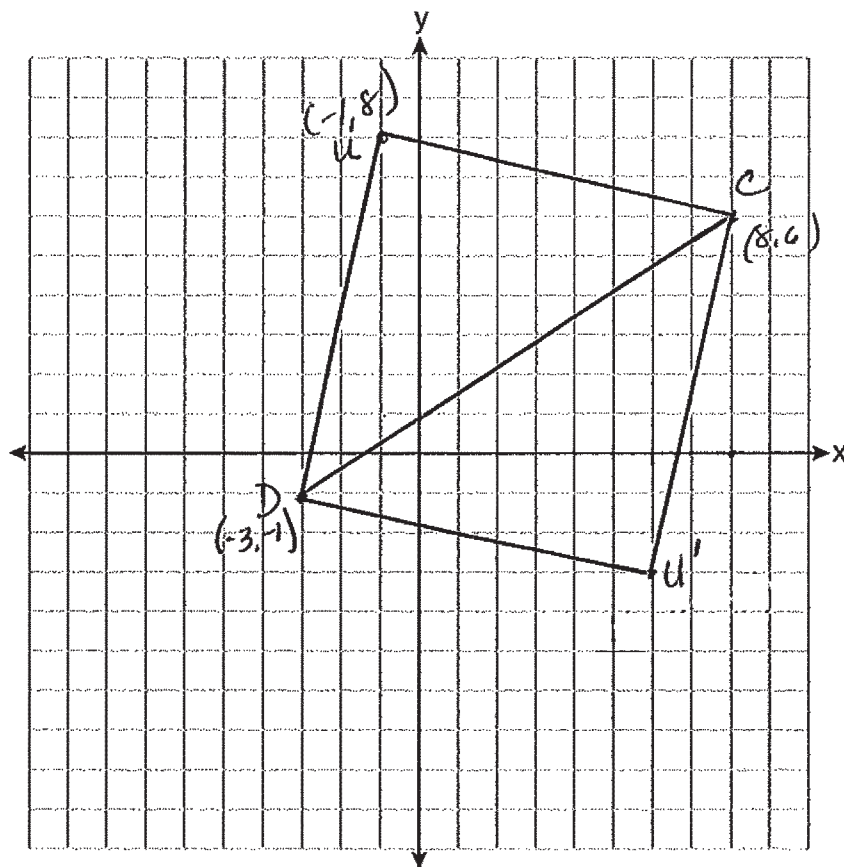
Since the slopes are negative reciprocals  
the lines are perpendicular and perpendicular  
lines form right angles. Therefore  $\triangle DUC$  is  
a right triangle.

**Question 35 is continued on the next page.**

**Score 3:** The student proved  $\triangle DUC$  is a right triangle and located  $U'$ . No further correct work was shown.

Question 35 continued.

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ . Prove quadrilateral  $DUCU'$  is a square.



**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3, -1)$ ,  $U(-1, 8)$ , and  $C(8, 6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$m_{\overline{DU}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - (-1)}{-1 - (-3)} = \frac{9}{2}$$
$$m_{\overline{UC}} = \frac{6 - 8}{8 - (-1)} = \frac{-2}{9}$$

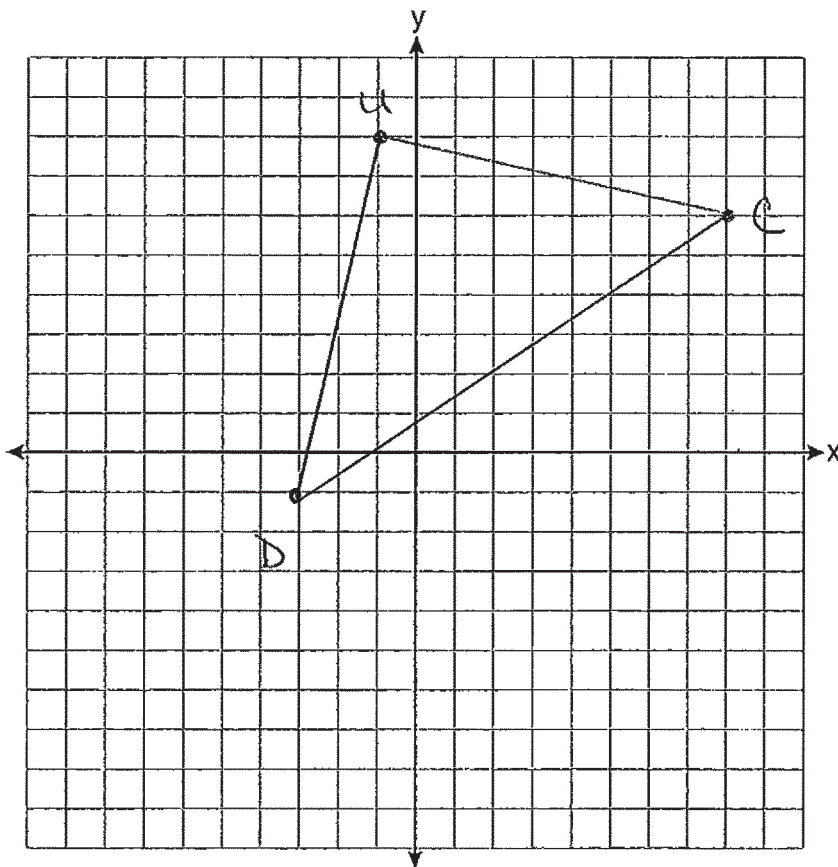
opposite reciprocal slopes  
 $\overline{DU} \perp \overline{UC}$   
 $\perp$  lines form rt  $\angle$ s.  
 $\angle U$  is a rt.  $\angle$ .  
 $\triangle DUC$  is a rt  $\triangle$  because  
it has a rt.  $\angle$ .

**Question 35 is continued on the next page.**

**Score 2:** The student proved  $\triangle DUC$  is a right triangle. No further correct work was shown.

**Question 35 continued.**

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ . Prove quadrilateral  $DUCU'$  is a square.



**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3,-1)$ ,  $U(-1,8)$ , and  $C(8,6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$DU = \sqrt{(-3-(-1))^2 + (-1-8)^2} = \sqrt{(-2)^2 + (-9)^2} = \sqrt{85}$$

$$UC = \sqrt{(-1-8)^2 + (8-6)^2} = \sqrt{(-9)^2 + 2^2} = \sqrt{85}$$

$$DC = \sqrt{(-3-8)^2 + (-1-6)^2} = \sqrt{(-11)^2 + (-7)^2} = \sqrt{170}$$

$$\Rightarrow (\sqrt{85})^2 + (\sqrt{85})^2 = (\sqrt{170})^2$$

$$\Rightarrow (\sqrt{85})^2 + (\sqrt{85})^2 = 170, (\sqrt{170})^2 = 170$$

$$\Rightarrow DU^2 + UC^2 = DC^2$$

$\Rightarrow \triangle DUC$  is a right triangle (converse of Pythagore theorem)

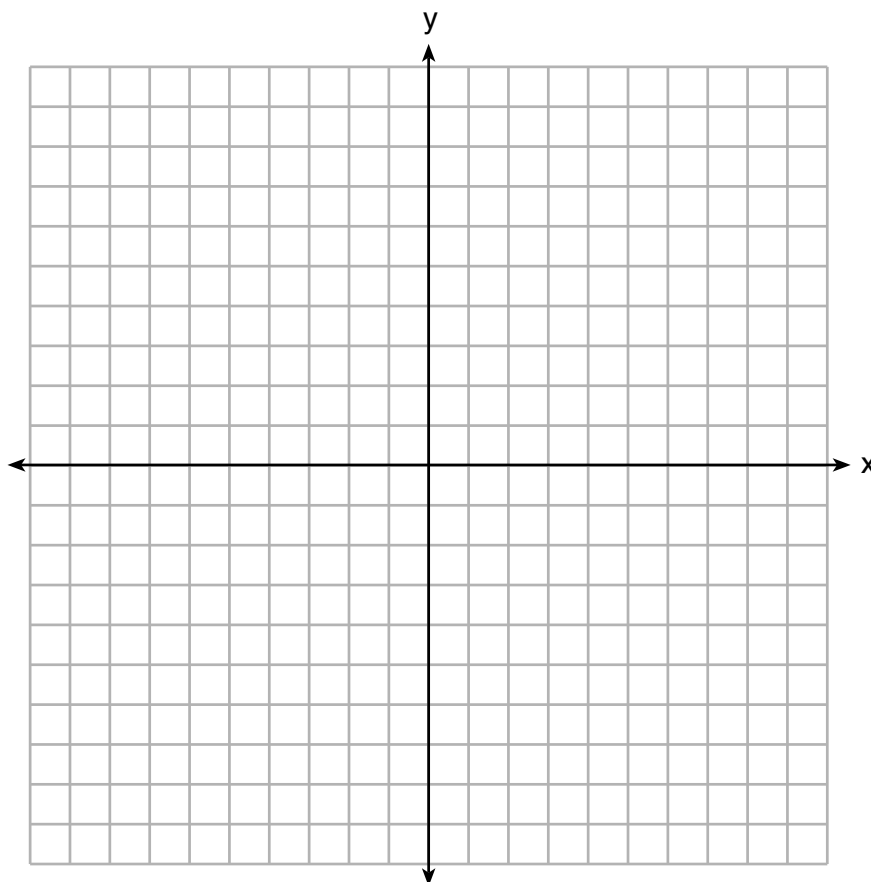
**Question 35 is continued on the next page.**

**Score 2:** The student proved  $\triangle DUC$  is a right triangle. No further correct work was shown.

Question 35 continued.

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ .  
Prove quadrilateral  $DUCU'$  is a square.

$$\begin{aligned} &U \text{ and } U' \text{ are reflected over } \overline{DC} \\ \Rightarrow &\begin{cases} OU = OU' \\ OD = OC \\ UU' \perp DC \end{cases} \Rightarrow DUCU' \text{ is a rhombus} \end{aligned}$$





**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3, -1)$ ,  $U(-1, 8)$ , and  $C(8, 6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$\text{Slope } \overline{DU} = \frac{8 - (-1)}{-1 - (-3)} = \frac{9}{2}$$

$$\text{Slope } \overline{UC} = \frac{6 - 8}{8 - (-1)} = \frac{-2}{9}$$

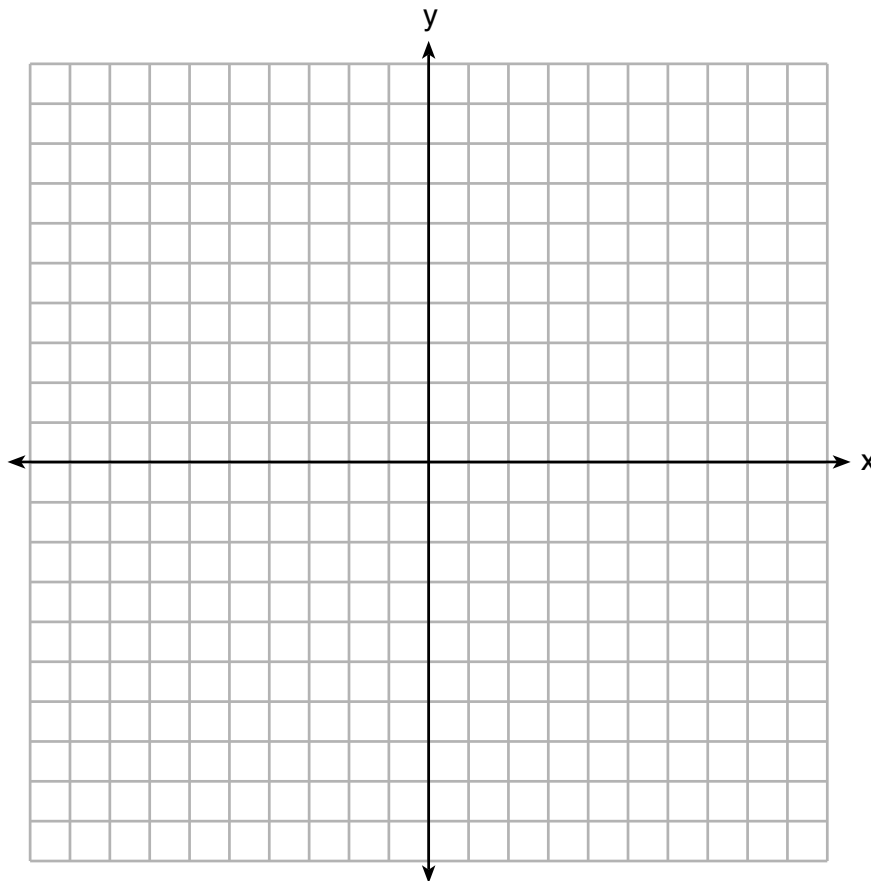
$\overline{DU} \perp \overline{UC}$  because they  
have opposite reciprocal  
slopes.

**Question 35 is continued on the next page.**

**Score 1:** The student wrote an incomplete conclusion in proving the right triangle. No further correct work was shown.

**Question 35 continued.**

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ .  
Prove quadrilateral  $DUCU'$  is a square.



**Question 35**

**35** Given: Triangle  $DUC$  with coordinates  $D(-3,-1)$ ,  $U(-1,8)$ , and  $C(8,6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$\sqrt{(-1 - (-3))^2 + (8 - (-1))^2}$$
$$\sqrt{85}$$

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$\sqrt{(8 - (-1))^2 + (6 - (-8))^2}$$
$$\sqrt{85}$$

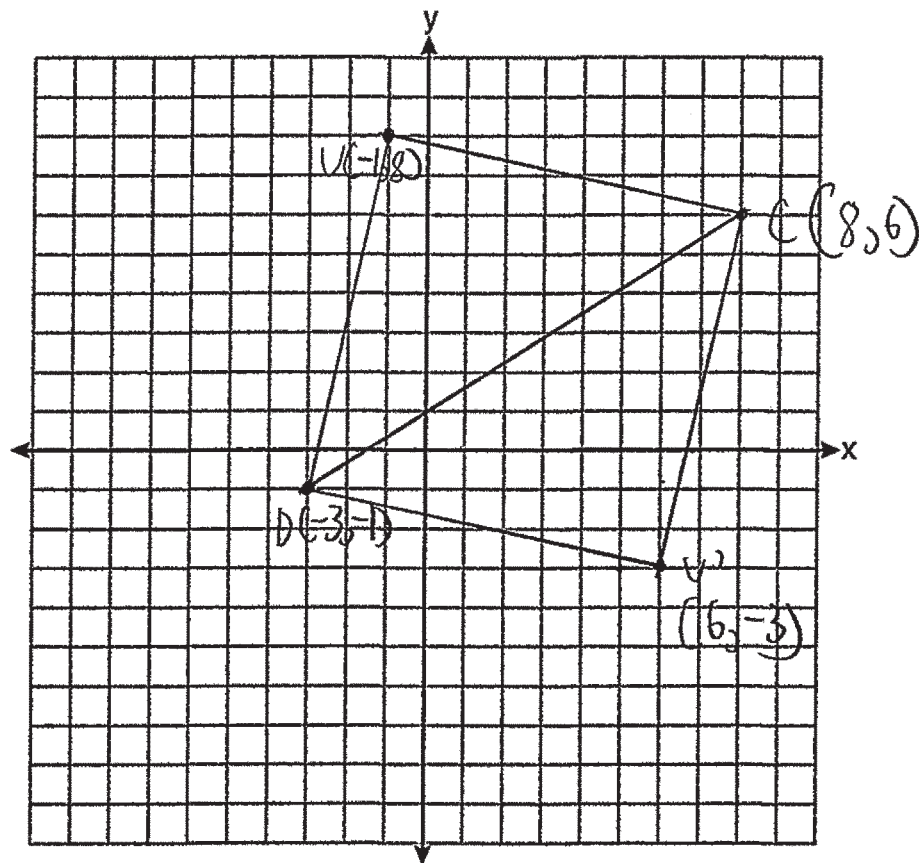
$\triangle DUC$  is a right triangle  
because it forms a right angle.

**Question 35 is continued on the next page.**

**Score 1:** The student located  $U'$ . The student did not show enough correct relevant work to receive any additional credit.

Question 35 continued.

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ . Prove quadrilateral  $DUCU'$  is a square.



Question 35

35 Given: Triangle  $DUC$  with coordinates  $D(-3,-1)$ ,  $U(-1,8)$ , and  $C(8,6)$

Prove:  $\triangle DUC$  is a right triangle

[The use of the set of axes on the next page is optional.]

$$\overline{DU} = \sqrt{\underbrace{(-1 - (-3))^2}_{(2)^2 = 4} + \underbrace{(8 - (-1))^2}_{(9)^2 = 81}}$$

$$\overline{DU} = \sqrt{85}$$

$$\overline{UC} = \sqrt{\underbrace{(8 - (-1))^2}_{(9)^2} + \underbrace{(6 - 8)^2}_{(-2)^2}}$$

$$\overline{UC} = \sqrt{81 + 4} = \sqrt{85}$$

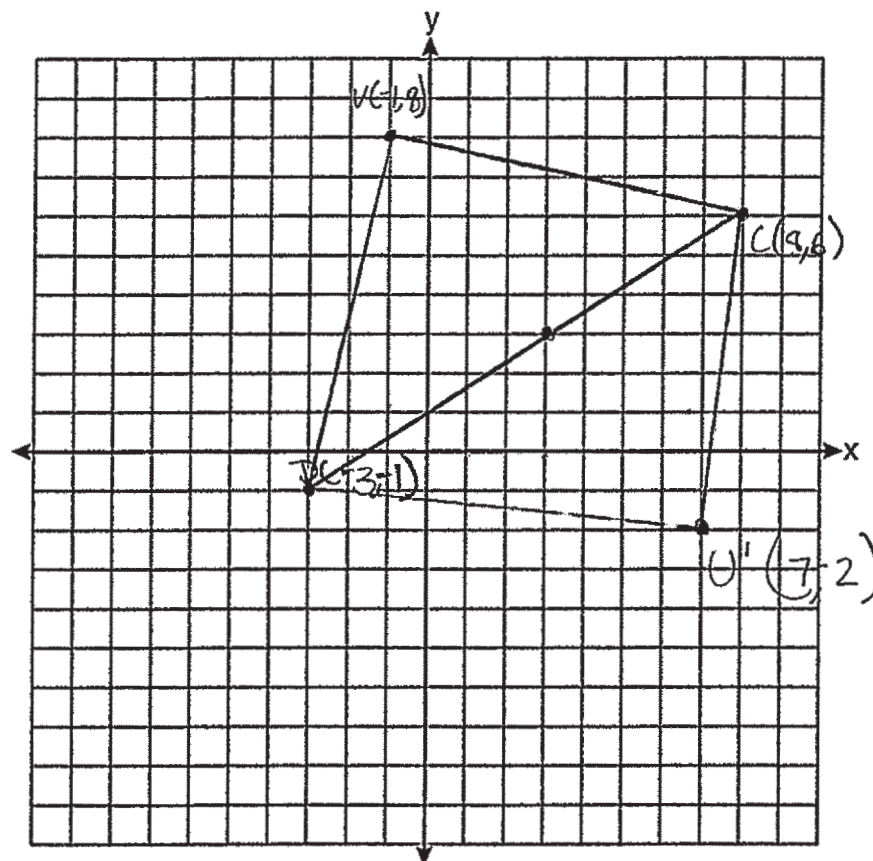
2 equal sides  
~~are as they are~~  
~~in a triangle~~

Question 35 is continued on the next page.

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

**Question 35 continued.**

Point  $U$  is reflected over  $\overline{DC}$  to locate its image point,  $U'$ , forming quadrilateral  $DUCU'$ .  
Prove quadrilateral  $DUCU'$  is a square.



## Regents Examination in Geometry – January 2023

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

(Use for the January 2023 exam only.)

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