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

GEOMETRY

Tuesday, June 20, 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 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.

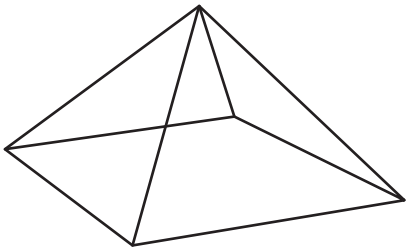
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

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.

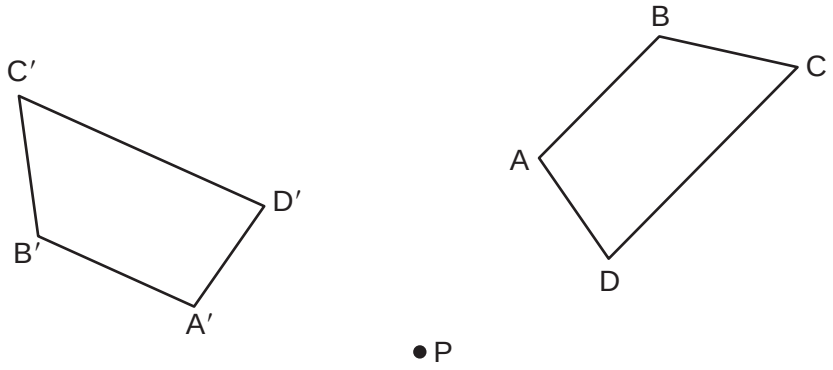
1 A square pyramid is intersected by a plane passing through the vertex and perpendicular to the base.



Which two-dimensional shape describes this cross section?

(1) square
(2) triangle
(3) pentagon
(4) rectangle

2 Trapezoid $ABCD$ is drawn such that $\overline{AB} \parallel \overline{DC}$.
Trapezoid $A'B'C'D'$ is the image of trapezoid $ABCD$ after a rotation of 110° counterclockwise about point P.



Which statement is always true?

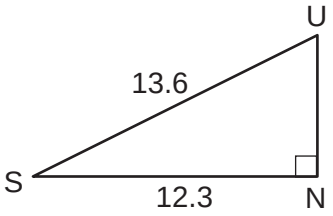
(1) $\angle A \cong \angle D'$
(2) $\overline{AC} \cong \overline{B'D'}$
(3) $\overline{A'B'} \parallel \overline{D'C'}$
(4) $\overline{B'A'} \cong \overline{C'D'}$

Use this space for computations.

3 What is the volume of a right circular cone that has a height of 7.2 centimeters and a radius of 2.5 centimeters, to the *nearest tenth of a cubic centimeter*?

(1) 37.7
(2) 47.1
(3) 113.1
(4) 141.4

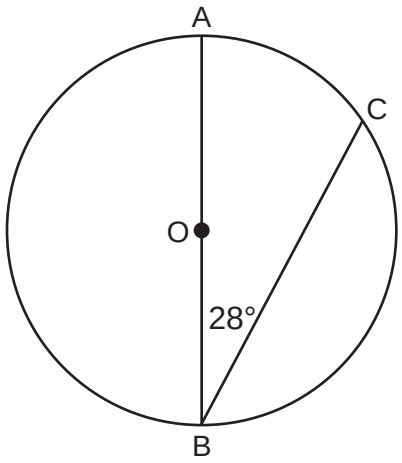
4 In the diagram below of right triangle SUN, where $\angle N$ is a right angle, $SU = 13.6$ and $SN = 12.3$.



What is $m\angle S$, to the *nearest degree*?

(1) 25°
(2) 42°
(3) 48°
(4) 65°

5 In the diagram below of circle O, diameter $\overline{AOB}$ and chord $\overline{CB}$ are drawn, and $m\angle B = 28°$.

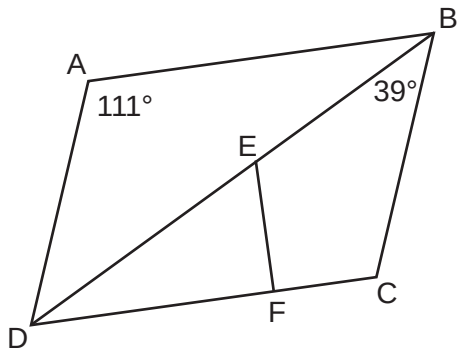


What is $m\overset{\frown}{BC}$?

(1) 56°
(2) 124°
(3) 152°
(4) 166°

Use this space for computations.

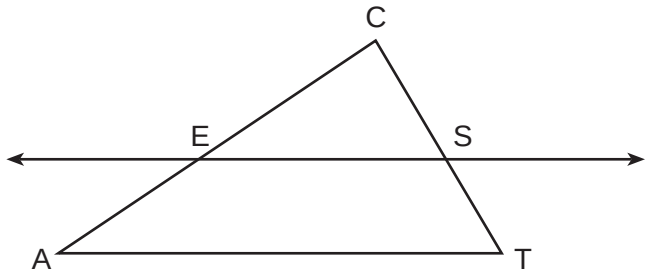
6 In the diagram below of parallelogram $ABCD$, diagonal $\overline{BED}$ and $\overline{EF}$ are drawn, $\overline{EF} \perp \overline{DFC}$, $m\angle DAB = 111°$, and $m\angle DBC = 39°$.



What is $m\angle DEF$?

(1) 30°
(2) 51°
(3) 60°
(4) 120°

7 In the diagram below of $\triangle ACT$, $\overleftrightarrow{ES}$ is drawn parallel to $\overline{AT}$ such that E is on $\overline{CA}$ and S is on $\overline{CT}$.

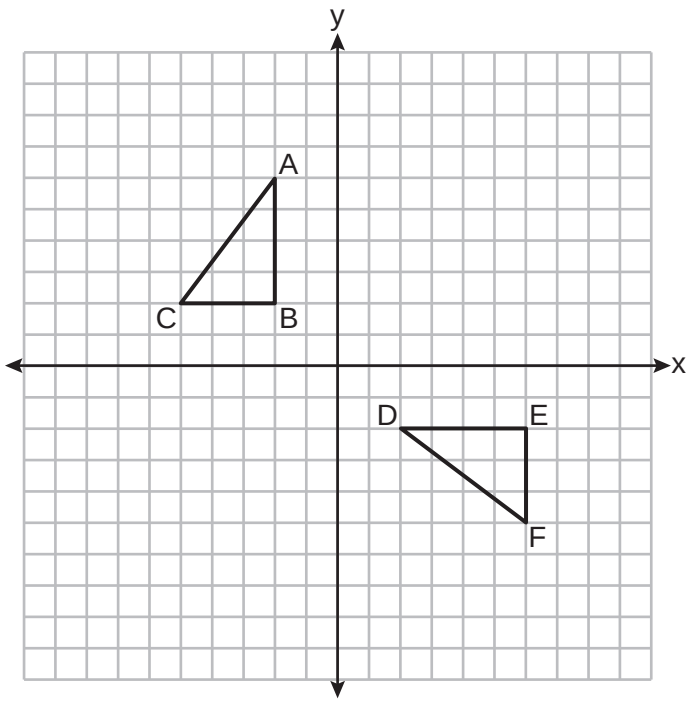


Which statement is always true?

(1) $\frac{CE}{CA} = \frac{CS}{ST}$
(2) $\frac{CE}{ES} = \frac{EA}{AT}$
(3) $\frac{CE}{EA} = \frac{CS}{ST}$
(4) $\frac{CE}{ST} = \frac{EA}{CS}$

Use this space for computations.

8 On the set of axes below, congruent triangles *ABC* and *DEF* are drawn.



Which sequence of transformations maps $\triangle ABC$ onto $\triangle DEF$?

(1) A counterclockwise rotation of 90 degrees about the origin, followed by a translation 8 units to the right.

(2) A counterclockwise rotation of 90 degrees about the origin, followed by a reflection over the y-axis.

(3) A counterclockwise rotation of 90 degrees about the origin, followed by a translation 4 units down.

(4) A clockwise rotation of 90 degrees about the origin, followed by a reflection over the x-axis.

9 An equation of circle M is $x^2 + y^2 + 6x - 2y + 1 = 0$. What are the coordinates of the center and the length of the radius of circle M?

(1) center $(3,-1)$ and radius 9

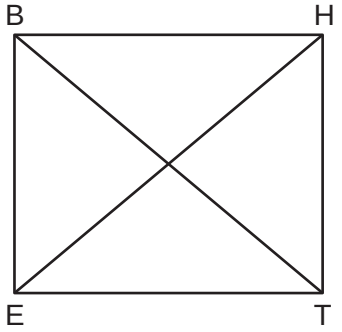
(2) center $(3,-1)$ and radius 3

(3) center $(-3,1)$ and radius 9

(4) center $(-3,1)$ and radius 3

Use this space for computations.

10 Parallelogram *BETH*, with diagonals $\overline{BT}$ and $\overline{HE}$, is drawn below.



Which additional statement is sufficient to prove that *BETH* is a rectangle?

(1) $\overline{BT} \perp \overline{HE}$

(2) $\overline{BE} \parallel \overline{HT}$

(3) $\overline{BT} \cong \overline{HE}$

(4) $\overline{BE} \cong \overline{ET}$

11 A gardener wants to buy enough mulch to cover a rectangular garden that is 3 feet by 10 feet. One bag contains 2 cubic feet of mulch and costs \$3.66. How much will the minimum number of bags cost to cover the garden with mulch 3 inches deep?

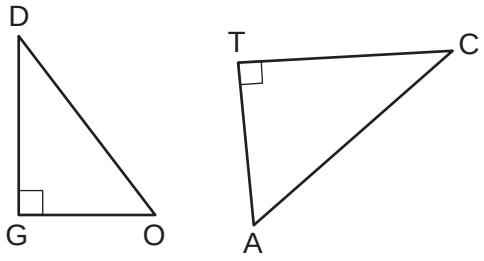
(1) \$3.66

(2) \$10.98

(3) \$14.64

(4) \$29.28

12 In the diagram below, $\triangle DOG \sim \triangle CAT$, where $\angle G$ and $\angle T$ are right angles.



Which expression is always equivalent to sin *D*?

(1) cos *A*

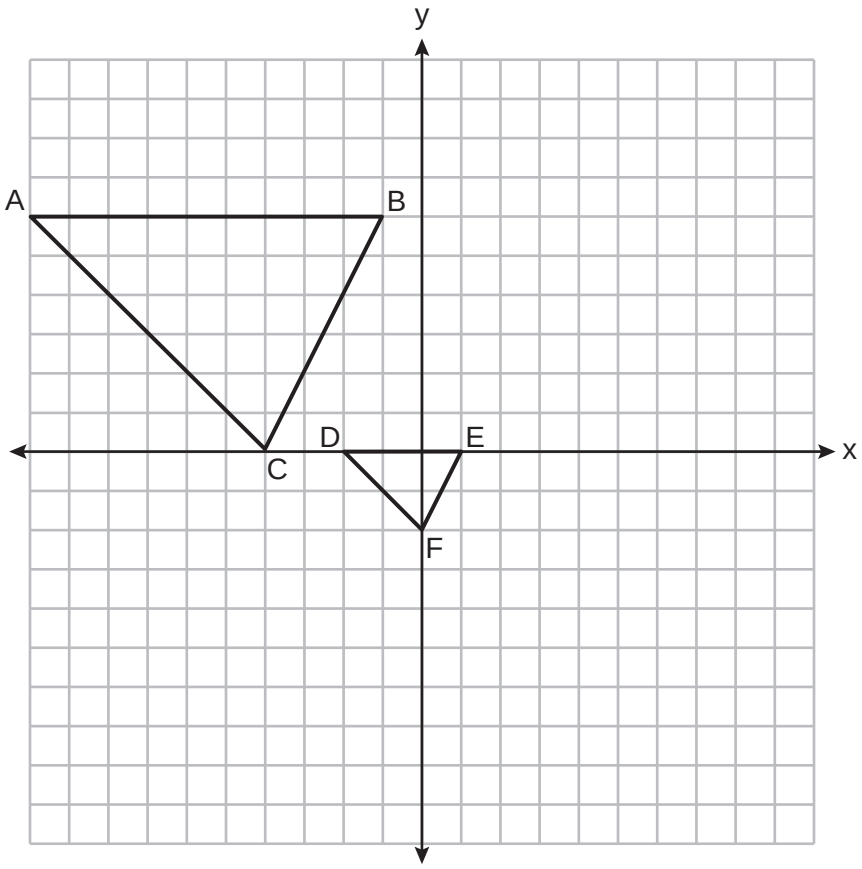
(2) sin *A*

(3) tan *A*

(4) cos *C*

Use this space for computations.

13 On the set of axes below, $\triangle DEF$ is the image of $\triangle ABC$ after a dilation of scale factor $\frac{1}{3}$.



The center of dilation is at

(1) (0,0)

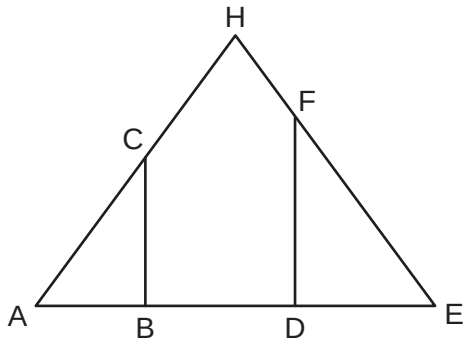
(2) (2,−3)

(3) (0,−2)

(4) (−4,0)

Use this space for computations.

14 In the diagram below of isosceles triangle AHE with the vertex angle at H, $\overline{CB} \perp \overline{AE}$ and $\overline{FD} \perp \overline{AE}$.



Which statement is always true?

(1) $\frac{AH}{AC} = \frac{EH}{EF}$

(2) $\frac{AC}{EF} = \frac{AB}{ED}$

(3) $\frac{AB}{ED} = \frac{CB}{FE}$

(4) $\frac{AD}{AB} = \frac{BE}{DE}$

15 Rectangle $ABCD$ has two vertices at coordinates $A(-1,-3)$ and $B(6,5)$. The slope of $\overline{BC}$ is

(1) $-\frac{7}{8}$

(2) $\frac{7}{8}$

(3) $-\frac{8}{7}$

(4) $\frac{8}{7}$

16 In right triangle ABC, $m\angle A = 90°$, $m\angle B = 18°$, and $AC = 8$.

To the *nearest tenth*, the length of $\overline{BC}$ is

(1) 2.5

(2) 8.4

(3) 24.6

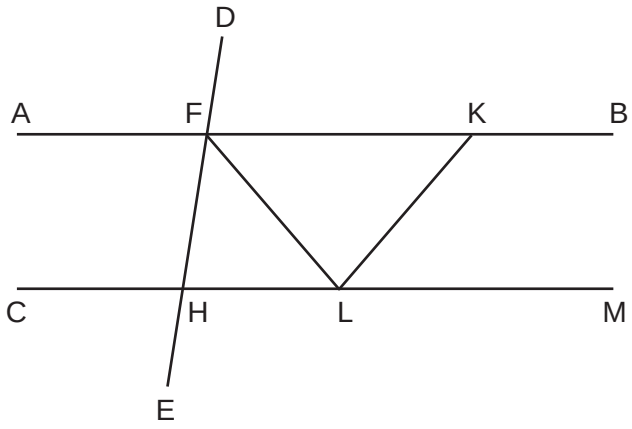
(4) 25.9

Use this space for computations.

17 The measure of one of the base angles of an isosceles triangle is 42°. The measure of an exterior angle at the vertex of the triangle is

(1) 42°
(2) 84°
(3) 96°
(4) 138°

18 In the diagram below, $\overline{AFKB} \parallel \overline{CHLM}$, $\overline{FH} \cong \overline{LH}$, $\overline{FL} \cong \overline{KL}$, and $\overline{LF}$ bisects $\angle HFK$.



Which statement is always true?

(1) $2(\text{m}\angle HLF) = \text{m}\angle CHE$
(2) $2(\text{m}\angle FLK) = \text{m}\angle LKB$
(3) $\text{m}\angle AFD = \text{m}\angle BKL$
(4) $\text{m}\angle DFK = \text{m}\angle KLF$

19 The line whose equation is $6x + 3y = 3$ is dilated by a scale factor of 2 centered at the point (0,0). An equation of its image is

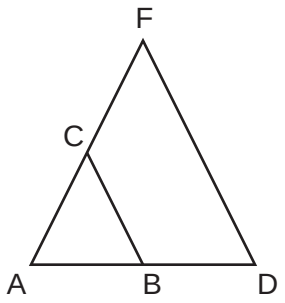
(1) $y = -2x + 1$
(2) $y = -2x + 2$
(3) $y = -4x + 1$
(4) $y = -4x + 2$

Use this space for computations.

20 Which figure will *not* carry onto itself after a 120-degree rotation about its center?

(1) equilateral triangle
(2) regular hexagon
(3) regular octagon
(4) regular nonagon

21 Triangle ADF is drawn and $\overline{BC} \parallel \overline{DF}$.



Which statement must be true?

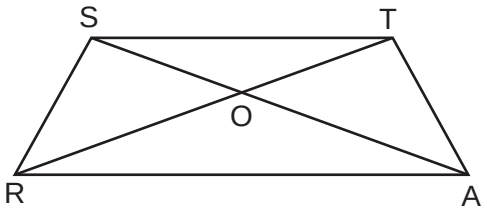
(1) $\frac{AB}{BC} = \frac{BD}{DF}$
(2) $BC = \frac{1}{2}DF$
(3) $AB{:}AD = AC{:}CF$
(4) $\angle ACB \cong \angle AFD$

22 In $\triangle ABC$, M is the midpoint of $\overline{AB}$ and N is the midpoint of $\overline{AC}$. If $MN = x + 13$ and $BC = 5x - 1$, what is the length of $\overline{MN}$?

(1) 3.5
(2) 9
(3) 16.5
(4) 22

Use this space for computations.

23 In the diagram below of isosceles trapezoid $STAR$, diagonals $\overline{AS}$ and $\overline{RT}$ intersect at O and $\overline{ST} \parallel \overline{RA}$, with nonparallel sides $\overline{SR}$ and $\overline{TA}$.



Which pair of triangles are *not* always similar?

(1) $\triangle STO$ and $\triangle ARO$

(2) $\triangle SOR$ and $\triangle TOA$

(3) $\triangle SRA$ and $\triangle ATS$

(4) $\triangle SRT$ and $\triangle TAS$

24 The endpoints of $\overline{AB}$ are $A(0,4)$ and $B(-4,6)$. Which equation of a line represents the perpendicular bisector of $\overline{AB}$?

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

(2) $y = -2x + 1$

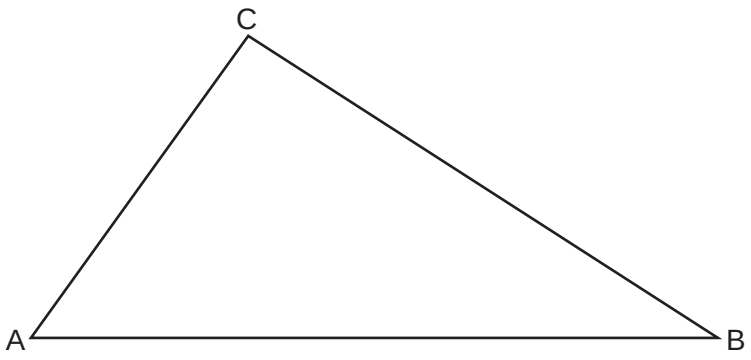
(3) $y = 2x + 8$

(4) $y = 2x + 9$

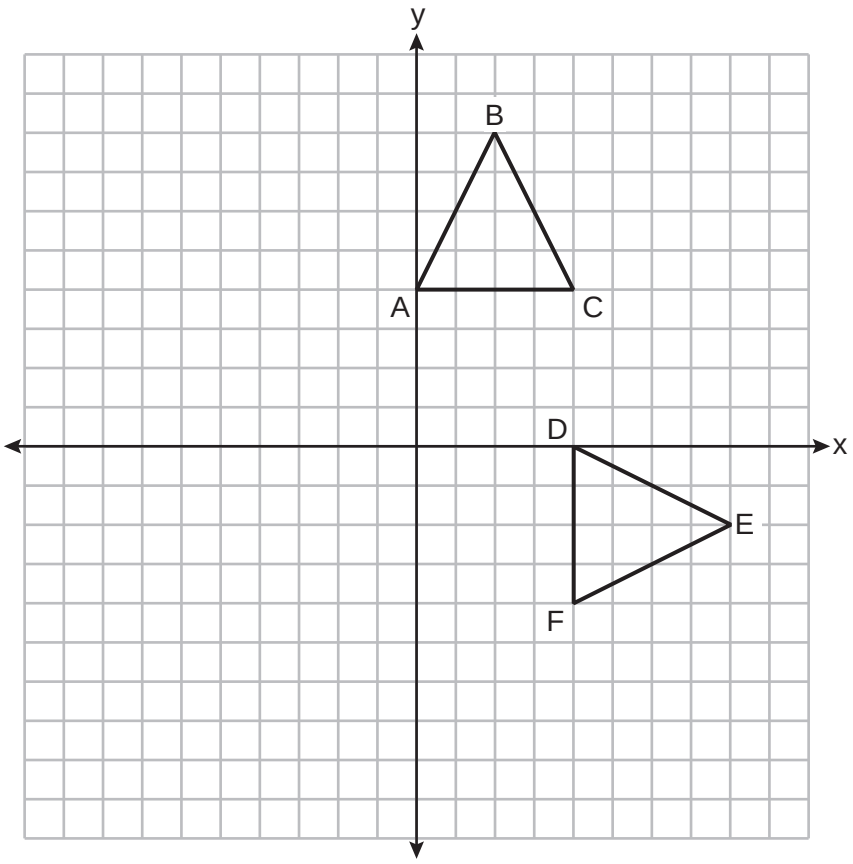
Part II

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 In $\triangle ABC$ below, use a compass and straightedge to construct the altitude from C to $\overline{AB}$. [Leave all construction marks.]



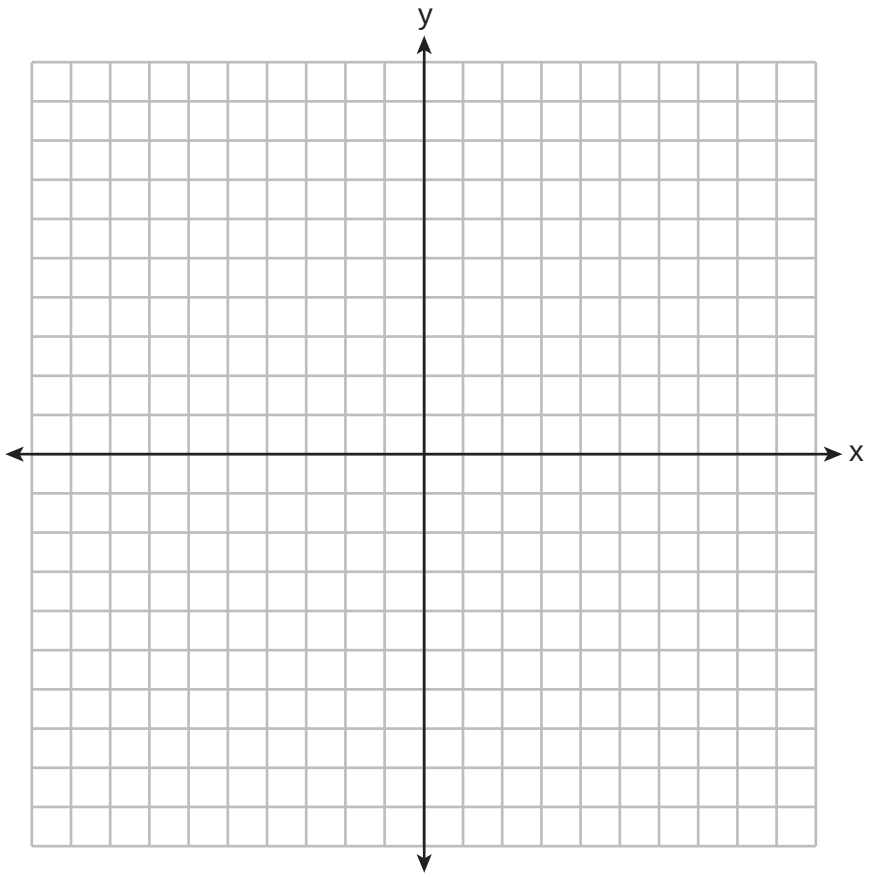
26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

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

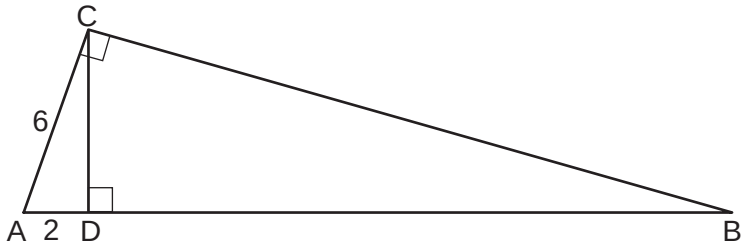


28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]

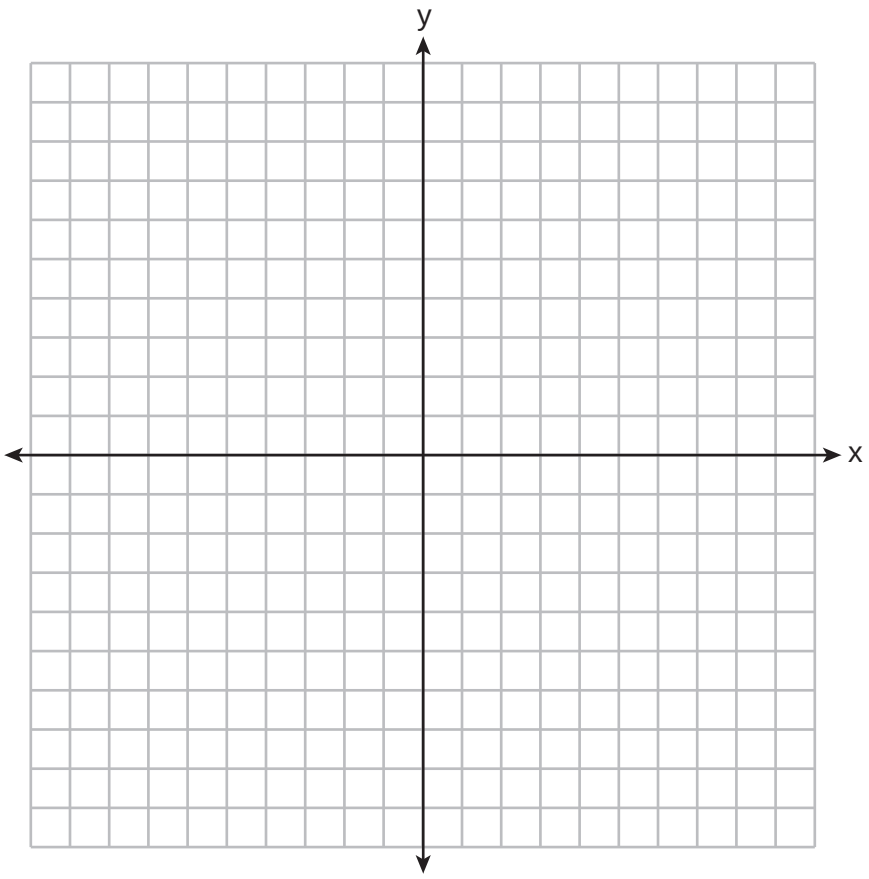
30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

31 Triangle RST has vertices with coordinates $R(-3,-2)$, $S(3,2)$ and $T(4,-4)$. Determine and state an equation of the line parallel to $\overline{RT}$ that passes through point S.

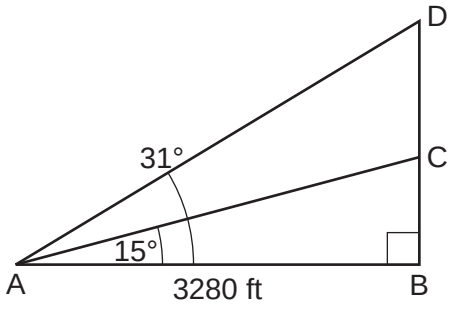
[The use of the set of axes below is optional.]



Part III

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.



Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.

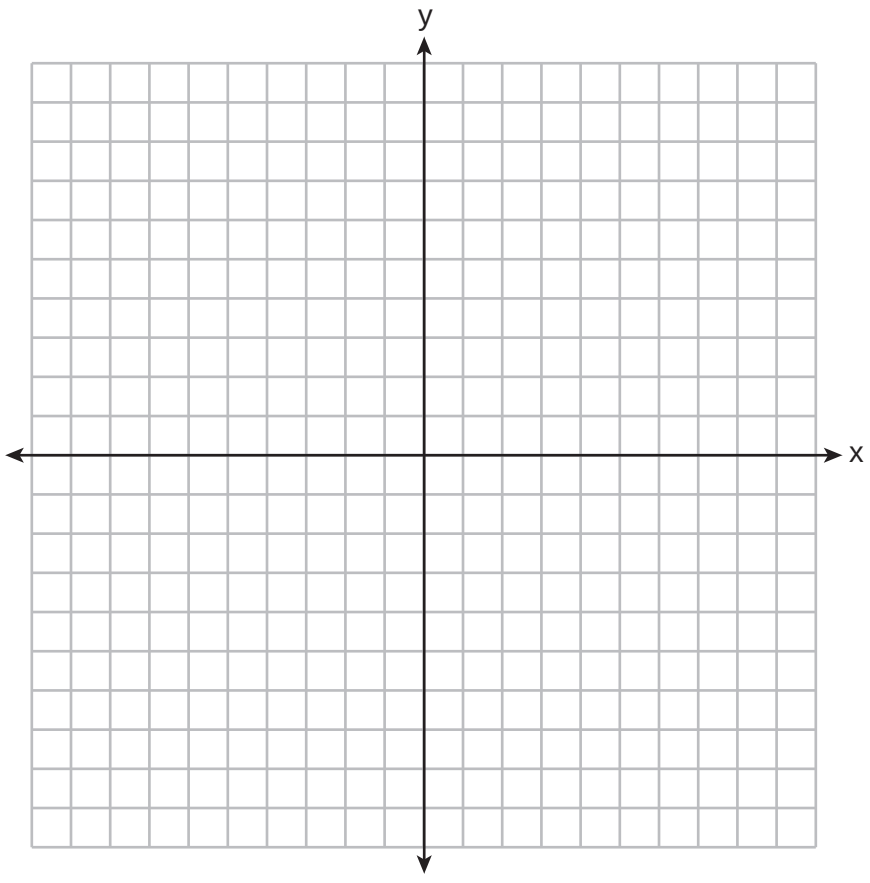
What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

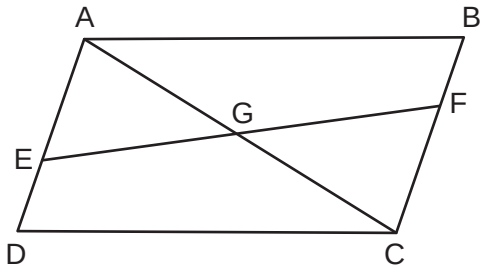
Determine and state the area of *MATH*.



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: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



Prove: G is the midpoint of $\overline{EF}$

Work space for question 35 is continued on the next page.

Question 35 continued

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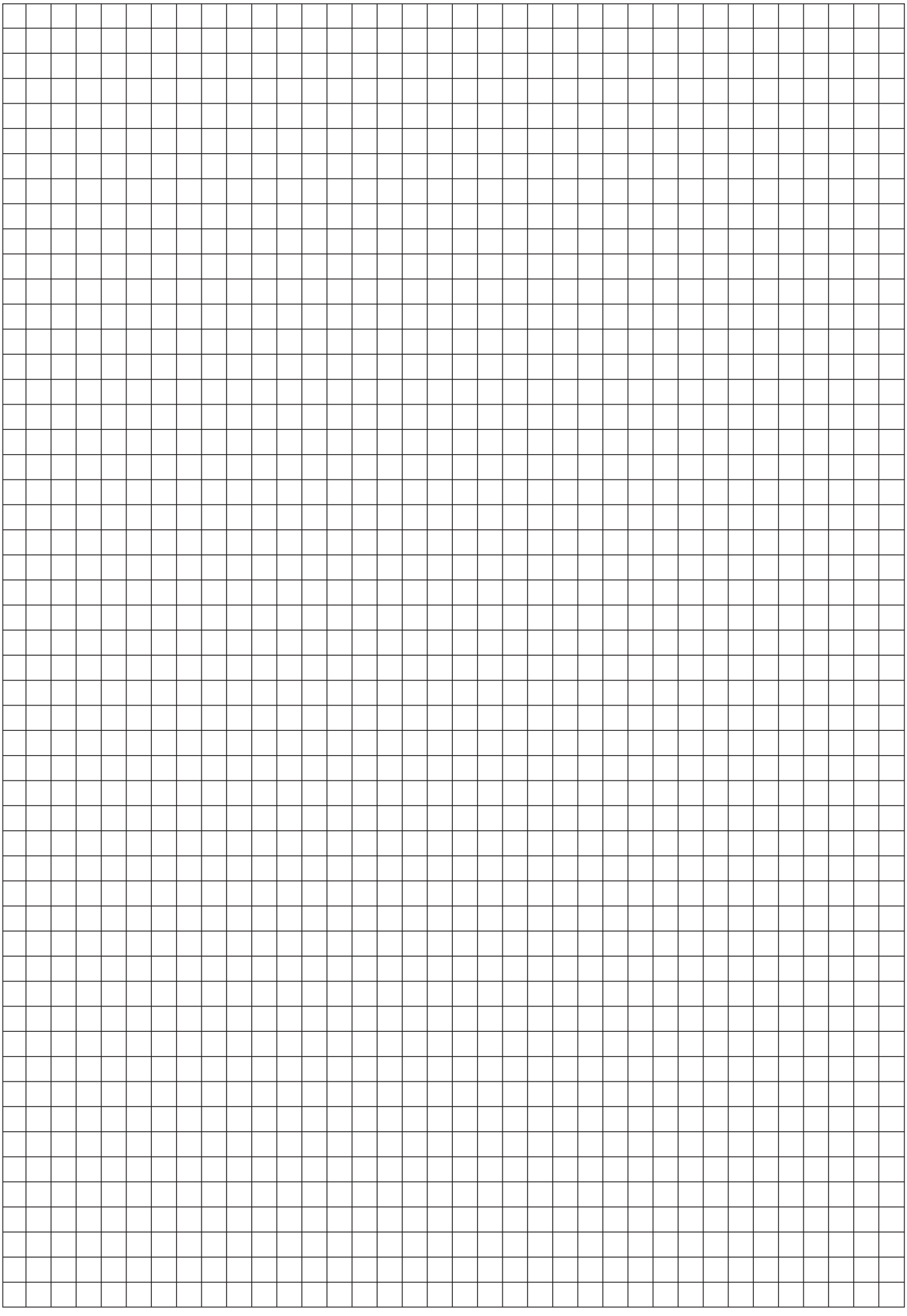
Scrap Graph Paper — this sheet will *not* be scored.



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High School Math Reference Sheet

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 5280 feet
1 mile = 1760 yards
1 mile = 1.609 kilometers

1 kilometer = 0.62 mile
1 pound = 16 ounces
1 pound = 0.454 kilogram
1 kilogram = 2.2 pounds
1 ton = 2000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
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	$S_n = \frac{a_1 - a_1 r^n}{1 - \mathrm{r}}$ 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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Regents Examination in Geometry – June 2023

Scoring Key: Part I (Multiple-Choice Questions)

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

Regents Examination in Geometry – June 2023

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

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

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

The chart for determining students' final examination scores for the **June 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

Tuesday, June 20, 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: https://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: https://www.nysed.gov/state-assessment/high-school-regents-examinations by Tuesday, June 20, 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 of the altitude is drawn showing all appropriate arcs.

[1] A correct construction is drawn showing all appropriate arcs, but the altitude is not drawn.

or

[1] A correct construction is drawn showing all appropriate arcs, but an altitude other than one from C to $\overline{AB}$ is drawn.

[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 transformations is described.

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

or

[1] An appropriate sequence of transformations is described, but one conceptual error is made.

or

[1] An appropriate sequence of transformations is written, but it is incomplete or partially correct.

[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]** $(-1,3)$, and correct work is shown.

[1] Appropriate work is shown, but one computational or graphing error is made. Appropriate coordinates are stated.

or

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

or

[1] Appropriate work is shown and point R is graphed correctly, but the coordinates are not stated or are stated incorrectly.

or

[1] $(-1,3)$, 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]** 29, 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] 29, 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]** 48π, 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 the volume of all three snowballs, but no further correct work is shown.

or

[1] 48π, 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.

(30) **[2]** 18, 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] A correct equation is written to determine the length of $\overline{AB}$, 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.

(31) **[2]** $y - 2 = -\frac{2}{7}(x - 3)$ or an equivalent equation, 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] Correct work is shown to find a slope of $-\frac{2}{7}$, but no further correct work is shown.

or

[1] $y - 2 = -\frac{2}{7}(x - 3)$, 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]** 1092, 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 the length of $\overline{CB}$ and $\overline{DB}$, but no further correct work is shown.

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

or

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

or

[2] Correct work is shown to find the length of $\overline{CB}$ or $\overline{DB}$, but no further correct work is shown.

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

or

[1] At least one correct relevant trigonometric equation is written, but no further correct work is shown.

or

[1] 1092, 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.

(33) **[4]** 346, 827, and correct work is shown. 3, and a correct justification is given.

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

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

or

[2] Correct work is shown to find the volumes of the can and the container, but no further correct work is shown.

[1] Correct work is shown to find the volume of either the can or the container, but no further correct work is shown.

or

[1] 346, 827, and 3, 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.

(34) **[4]** Correct work is shown to prove parallelogram *MATH* is a rhombus, and correct concluding statement(s) are written. 68, and correct work is shown.

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

or

[3] Correct work is shown to prove parallelogram *MATH* is a rhombus and 68, but the concluding statement is missing or incorrect.

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

or

[2] Correct work is shown to prove parallelogram *MATH* is a rhombus and correct concluding statement(s) are written, but no further correct work is shown.

or

[2] Correct work is shown to find 68, but no further correct work is shown.

[1] Correct work is shown to find the lengths of at least two consecutive sides, and/or the slopes of the two diagonals, 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.

Part IV

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

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

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

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

or

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

or

[4] $\triangle AGE \cong \triangle CGF$ is proven, but no further correct work is shown.

[3] A proof is written that demonstrates a method of proof, but three statements and/or reasons are missing or are incorrect.

or

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

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

or

[2] A proof is written that demonstrates a method of proof, but two conceptual errors are made.

or

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

[1] Only one correct relevant statement and reason are written.

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, 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.

Map to the Learning Standards
Geometry
June 2023

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

Regents Examination in Geometry

June 2023

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

The *Chart for Determining the Final Examination Score for the June 2023 Regents Examination in Geometry* will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations on Tuesday, June 20, 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 https://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

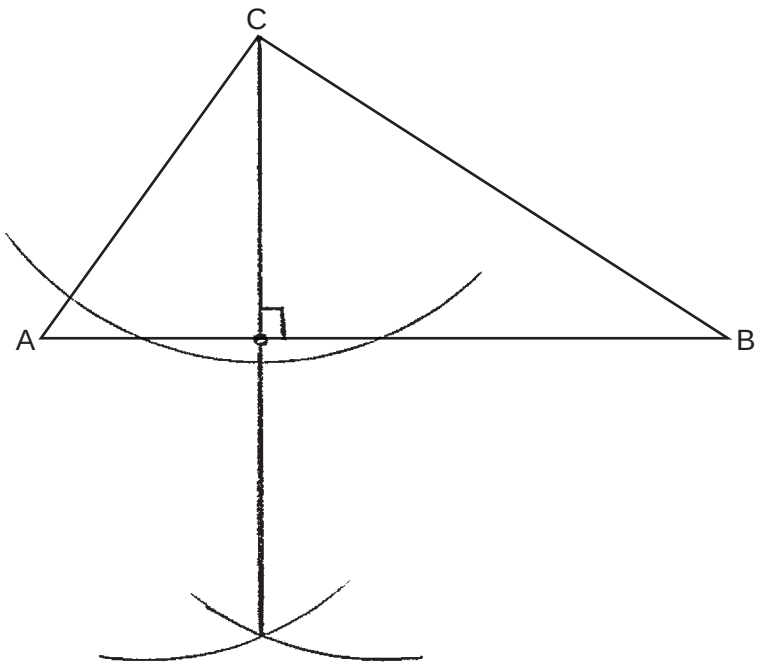
Tuesday, June 20, 2023 — 9:15 a.m. to 12:15 p.m., only

MODEL RESPONSE SET

Table of Contents

Question 25

25 In $\triangle ABC$ below, use a compass and straightedge to construct the altitude from C to $\overline{AB}$. [Leave all construction marks.]

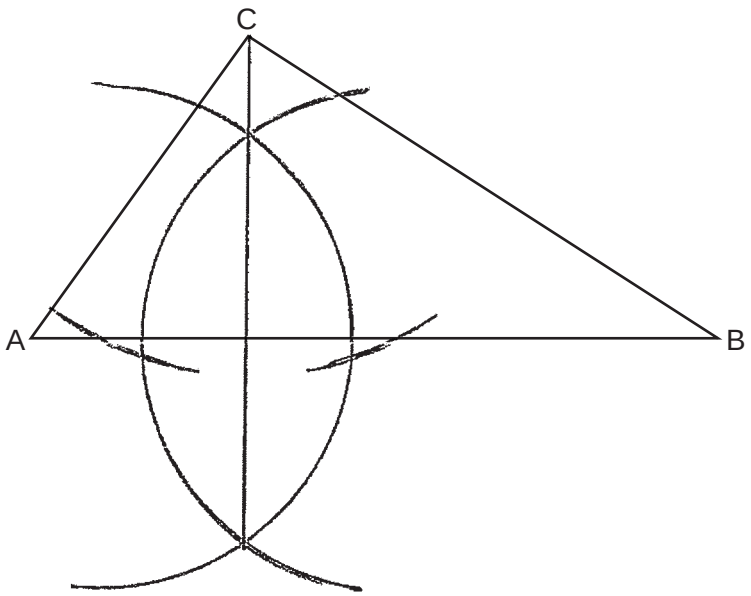


Score 2: The student gave a complete and correct response.

[2]

Question 25

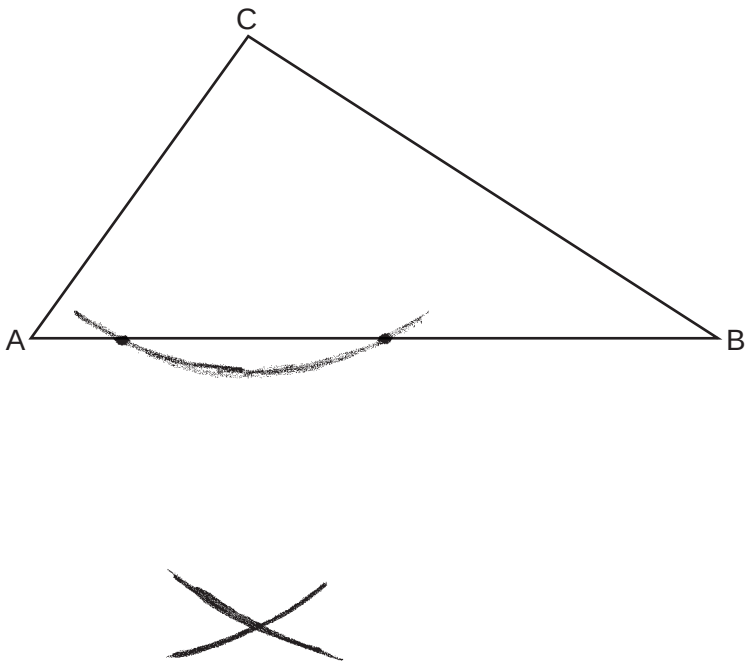
25 In $\triangle ABC$ below, use a compass and straightedge to construct the altitude from C to $\overline{AB}$. [Leave all construction marks.]



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

Question 25

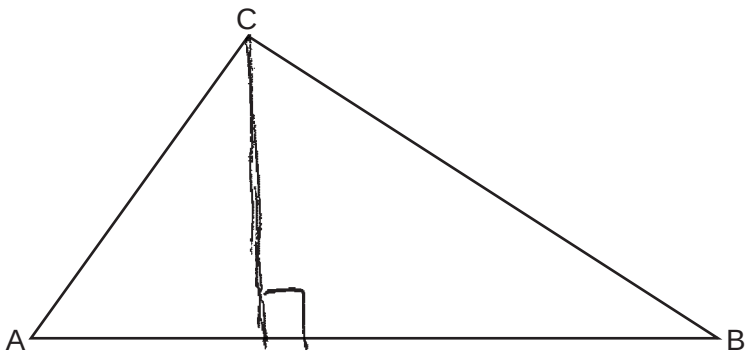
25 In $\triangle ABC$ below, use a compass and straightedge to construct the altitude from C to $\overline{AB}$. [Leave all construction marks.]



Score 1: The student constructed all appropriate arcs, but the altitude was not drawn.

Question 25

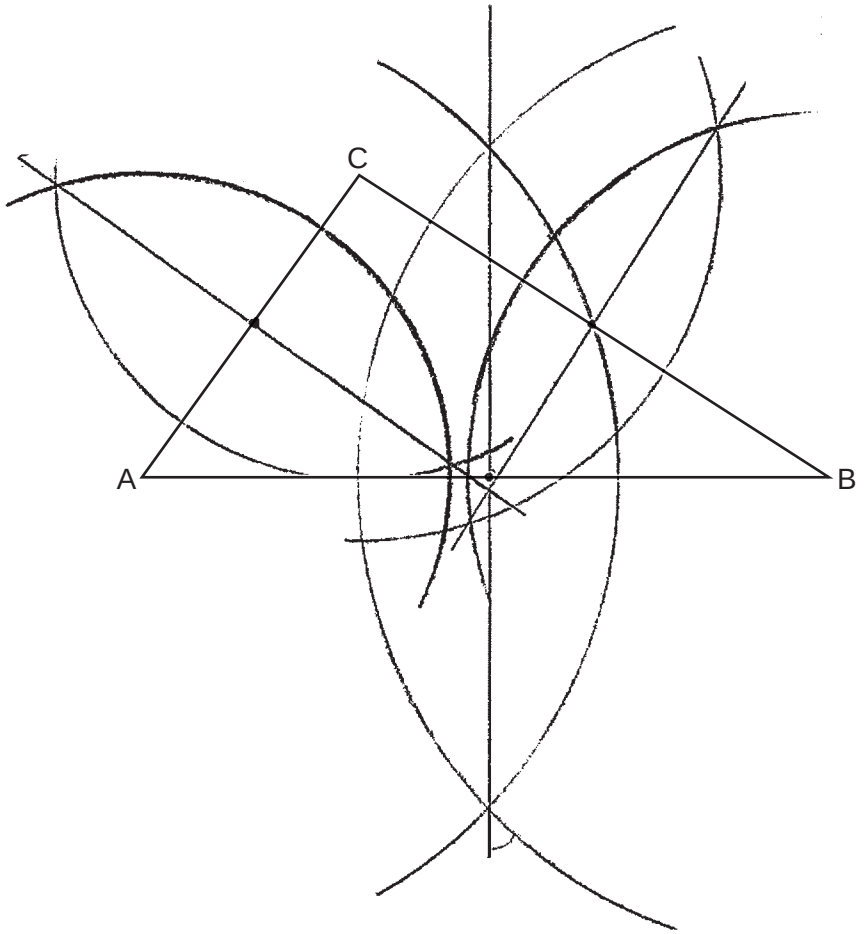
25 In $\triangle ABC$ below, use a compass and straightedge to construct the altitude from C to $\overline{AB}$. [Leave all construction marks.]



Score 0: The student made a drawing that was not an appropriate construction.

Question 25

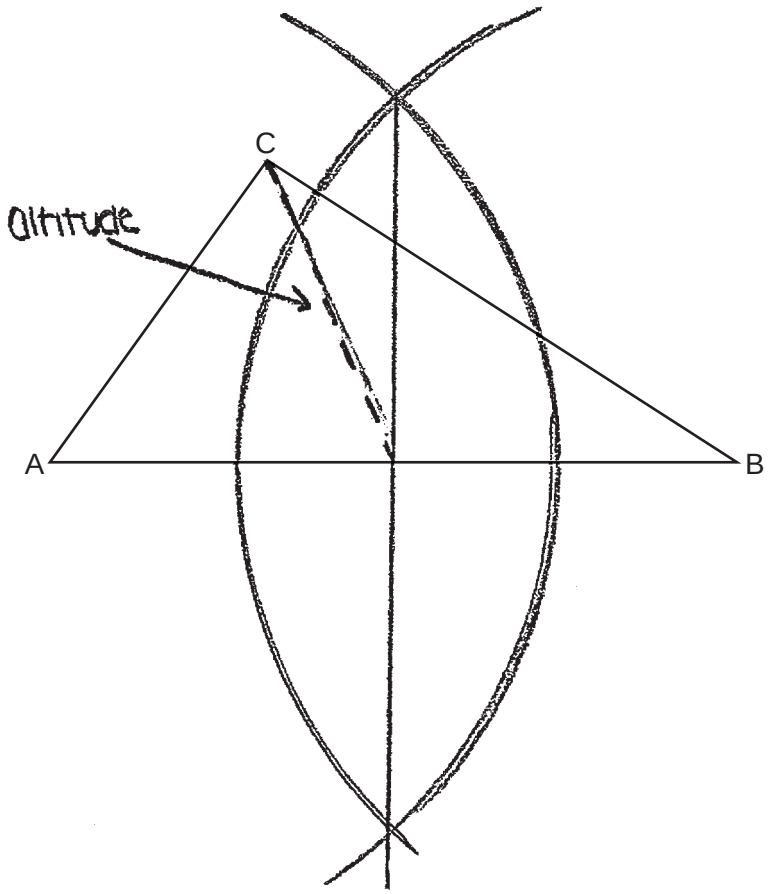
25 In $\triangle ABC$ below, use a compass and straightedge to construct the altitude from C to $\overline{AB}$. [Leave all construction marks.]



Score 0: The student gave a completely incorrect response.

Question 25

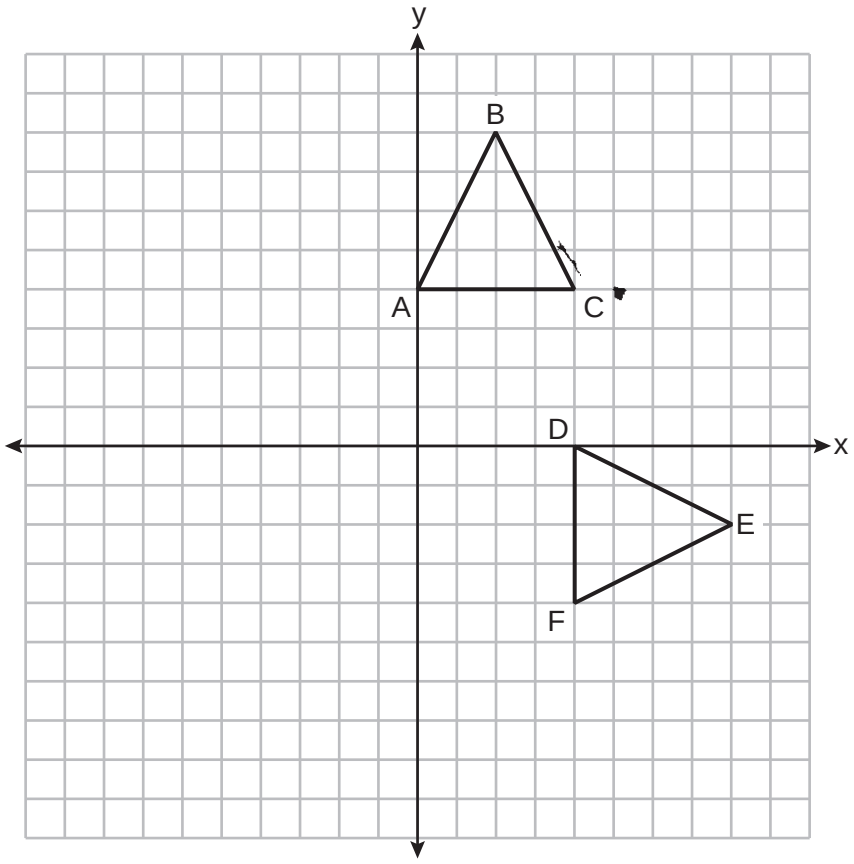
25 In $\triangle ABC$ below, use a compass and straightedge to construct the altitude from C to $\overline{AB}$. [Leave all construction marks.]



Score 0: The student gave a completely incorrect response.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



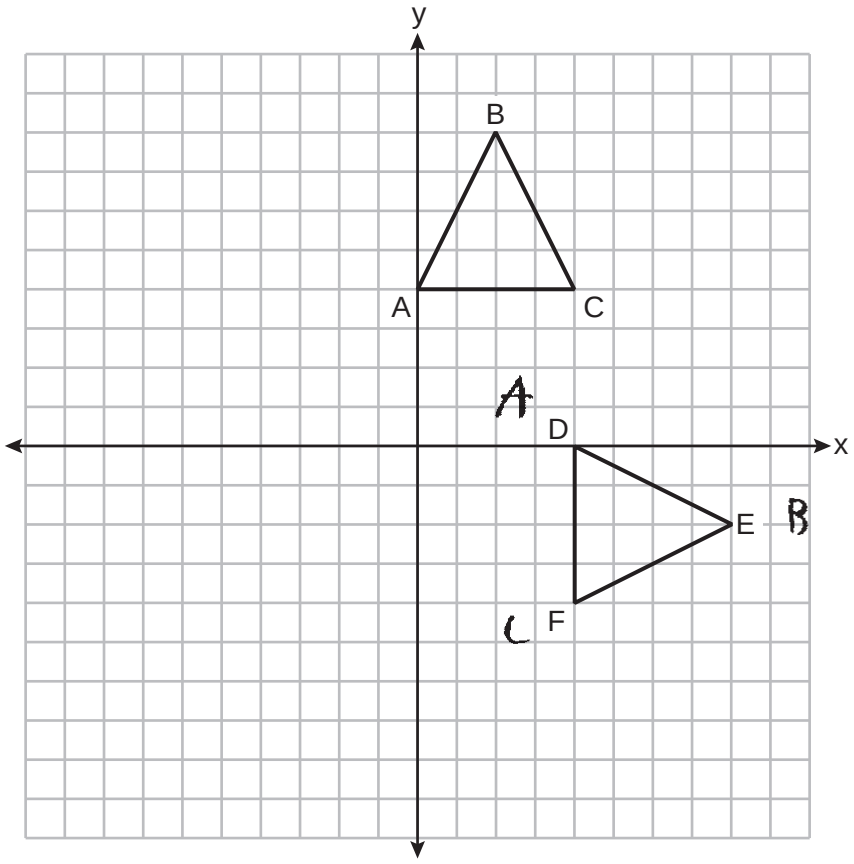
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

translate ΔABC down 8 units, then rotate ΔABC 90° clockwise around point F

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

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



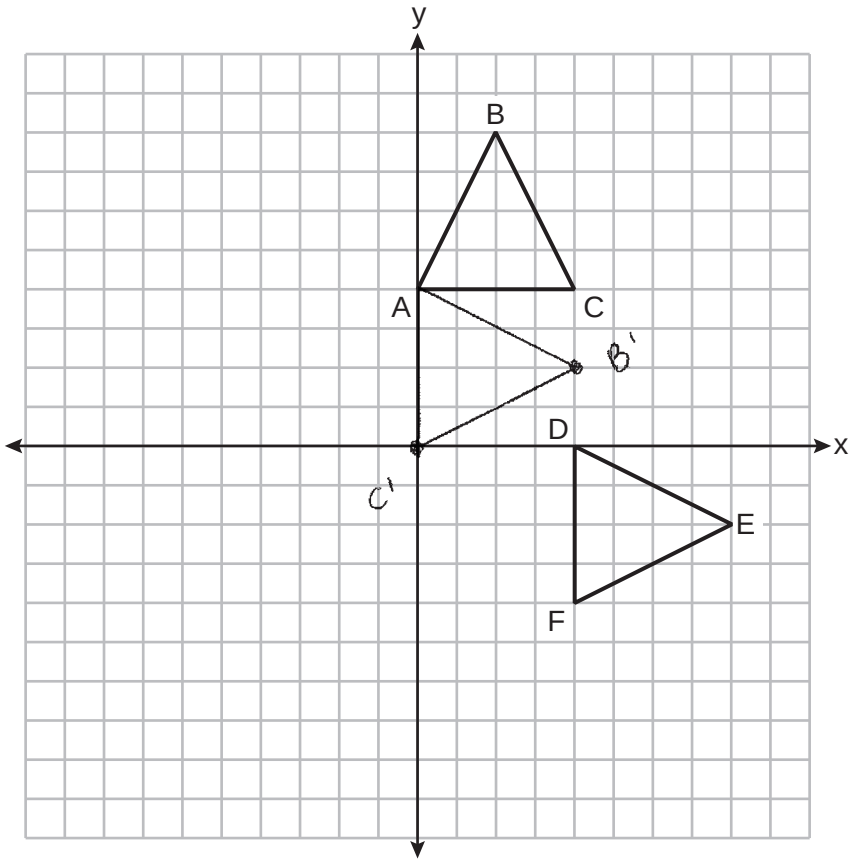
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

rotation 90° clockwise around the origin

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

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



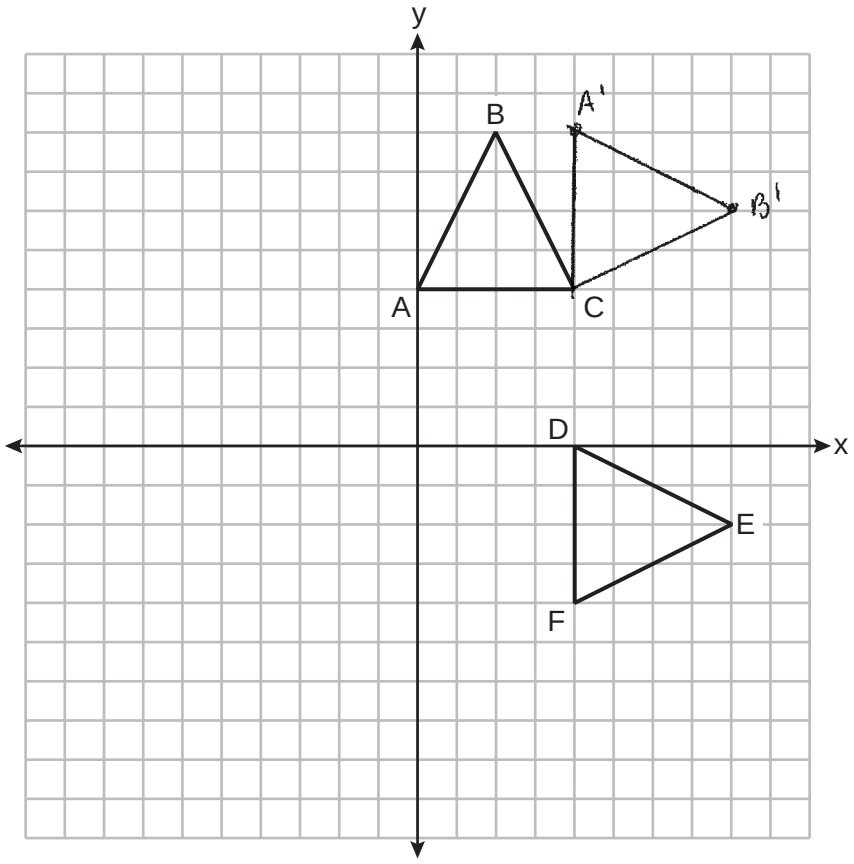
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

$T_{4,-4} \circ R_{A,-90°}$

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

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



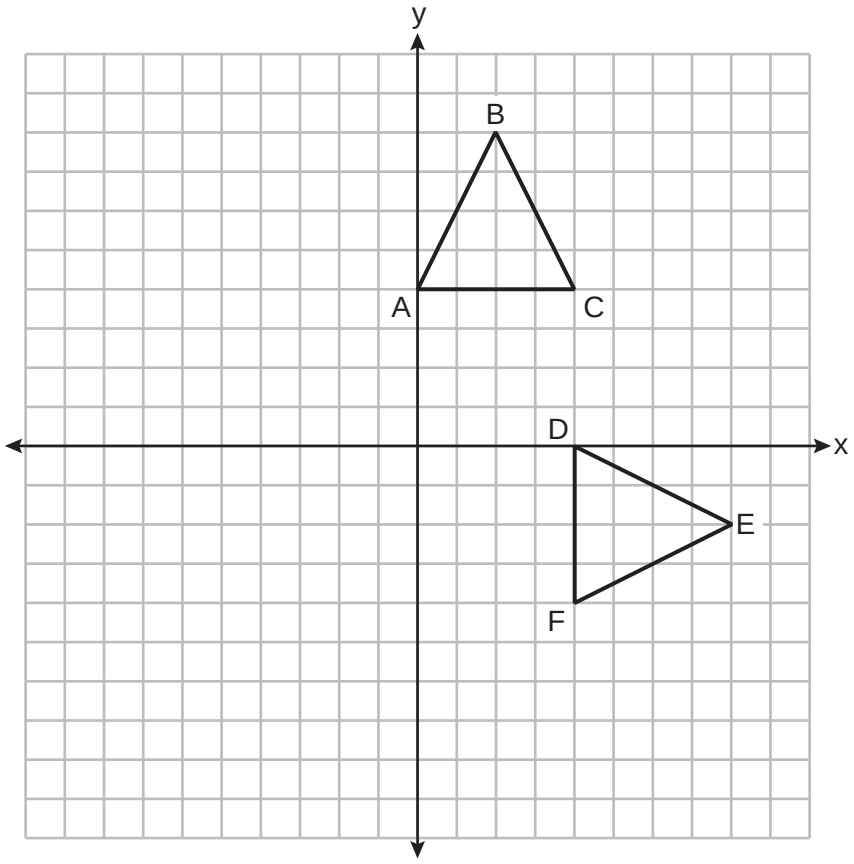
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

Rotation about point C, 90° clockwise, followed by a translation down by 8.

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

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



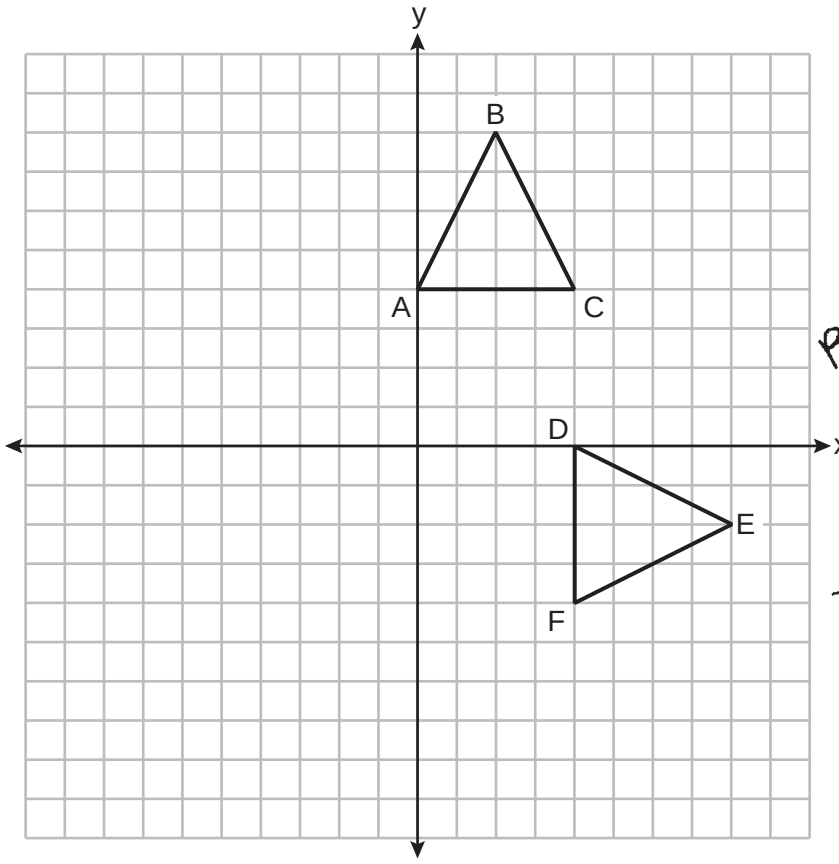
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

90° Counterclockwise rotation about the origin

Score 1: The student wrote an incorrect direction for the rotation.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



A = 0, 4

B = 2, 8

C = 4, 4

-y, x

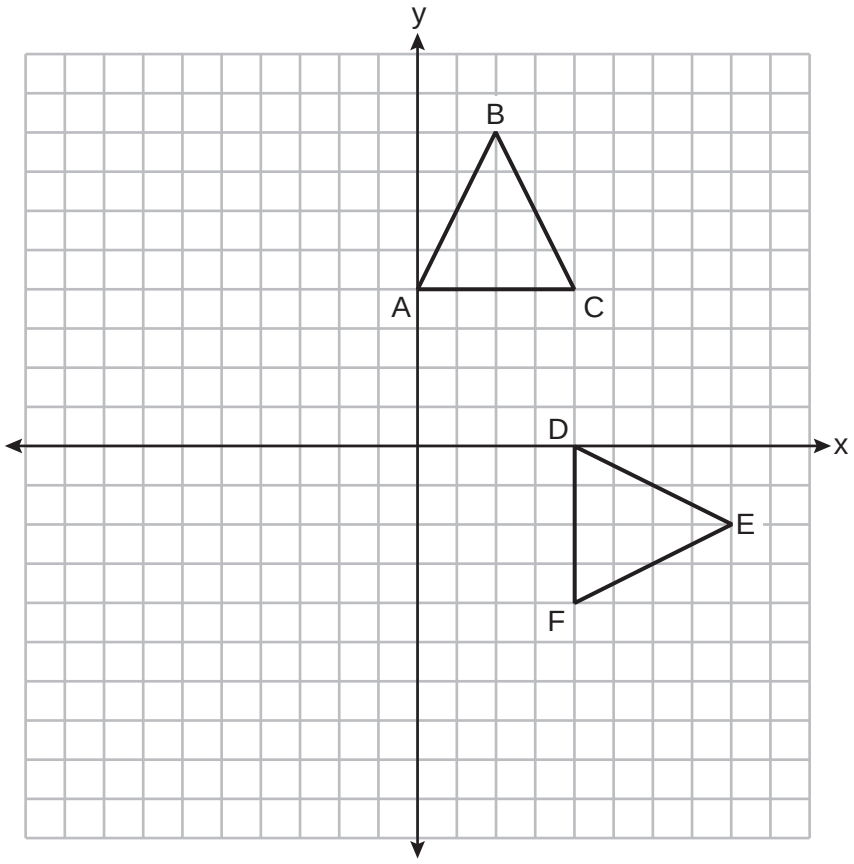
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

Rotation 270 counterclockwise

Score 1: The student did not state the center of rotation.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



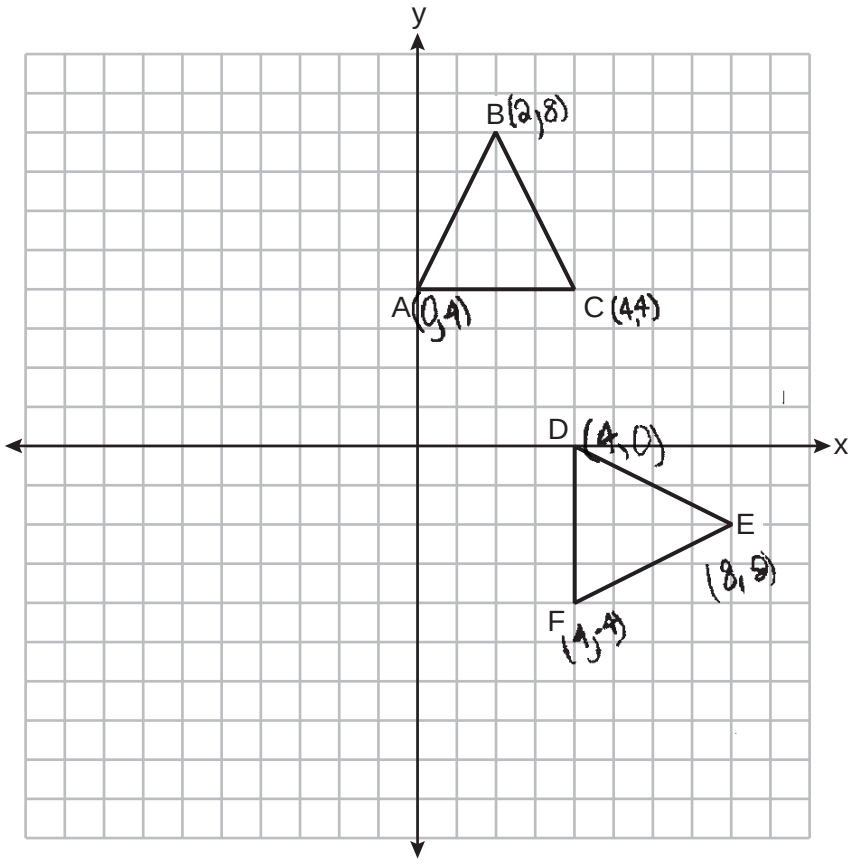
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

rotation 90° clockwise about C
translate 4 units down
reflect over the x-axis

Score 1: The student gave a correct description of the rotation and translation, but no further correct work was shown.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



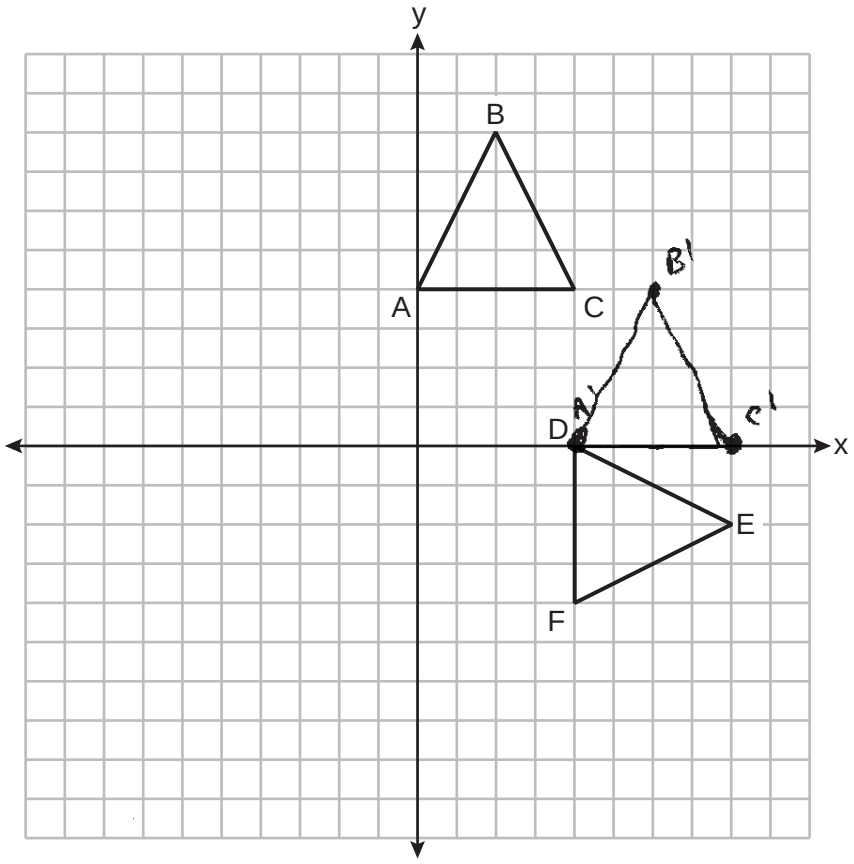
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

Rotate 90° clockwise

Score 1: The student did not state the center of rotation.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



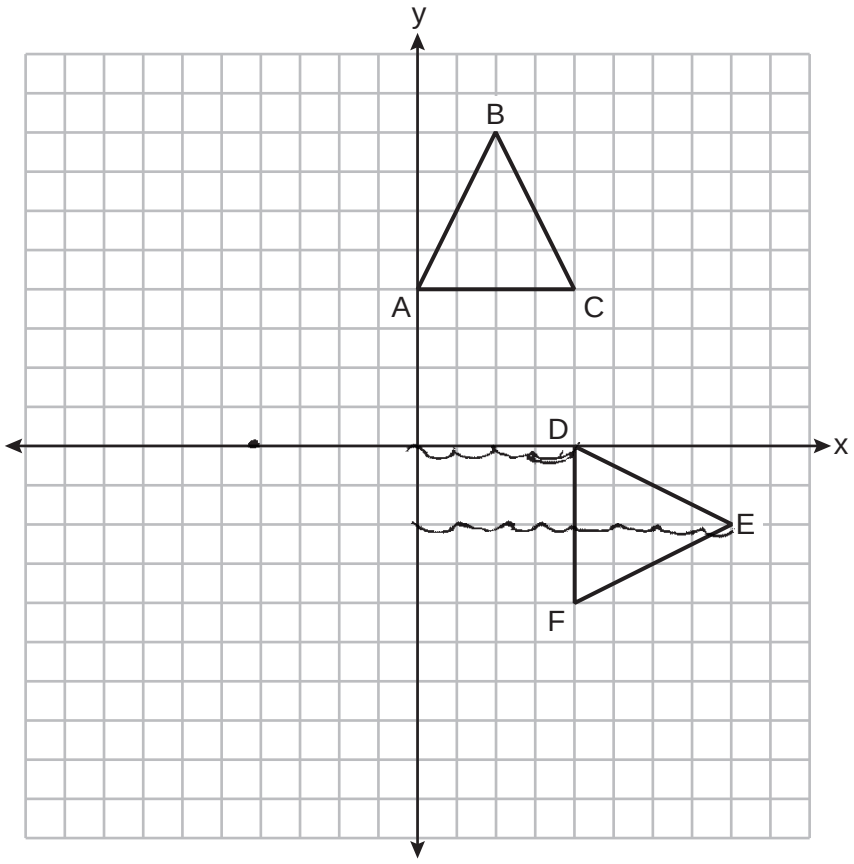
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

translation ⟨4,-4⟩ rotation 90 clockwise

Score 1: The student correctly stated the translation as a vector, but did not state the center of rotation.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



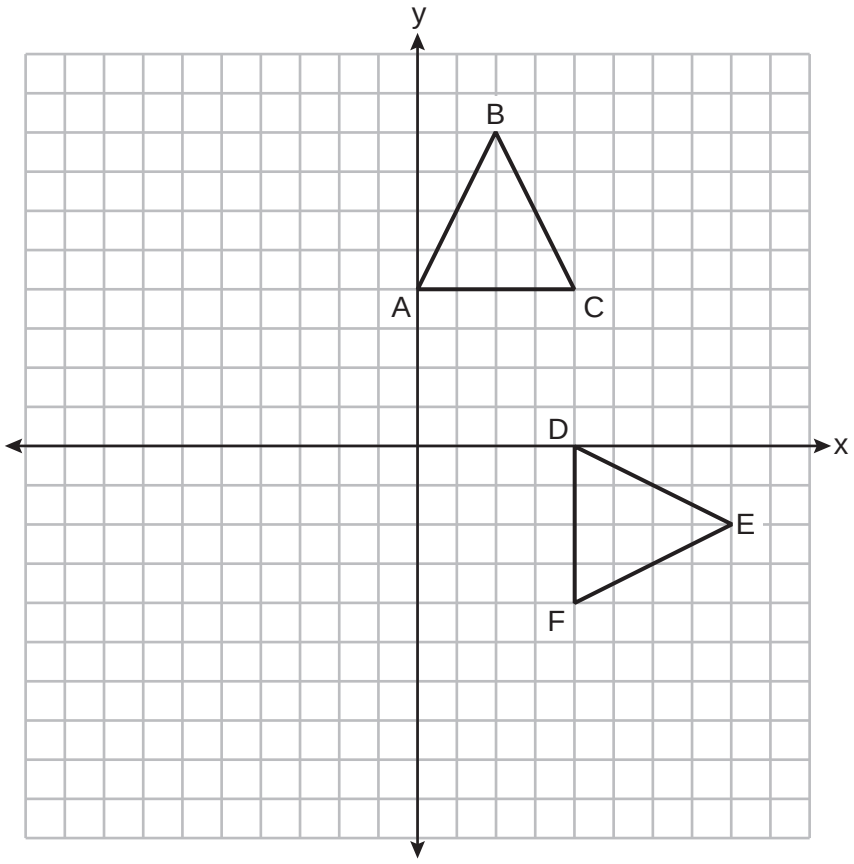
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

Bac took a counter clockwise rotation 90° 2 times

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

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



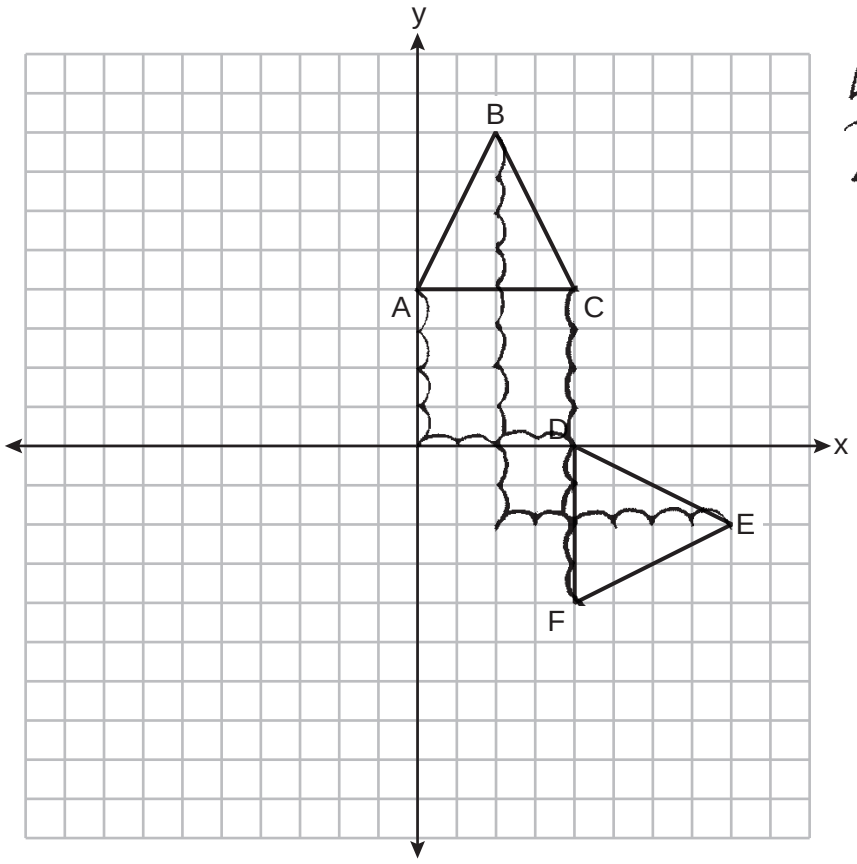
Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

Rotation and Reflection

Score 0: The student gave an incomplete rotation and an incorrect reflection.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



△ABC
△DEF

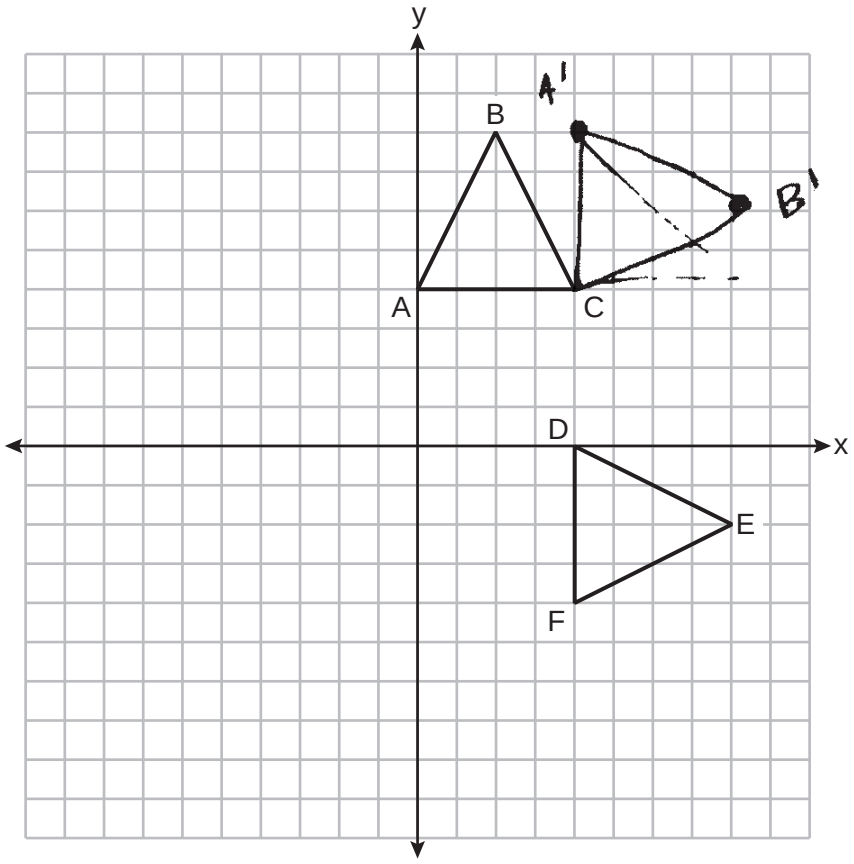
Describe a sequence of transformations that maps △*ABC* onto △*DEF*.

A to D is 4 down and 4 to the right
B to E is 10 down and 6 to the Right
C to F is 8 down and stops

Score 0: The student gave a completely incorrect description.

Question 26

26 Triangles *ABC* and *DEF* are graphed on the set of axes below.



Describe a sequence of transformations that maps $\triangle ABC$ onto $\triangle DEF$.

1. rotate ABC 180°
2. translate A'B'C (-8, 0)
3. Done.

Score 0: The student gave a completely incorrect description.

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

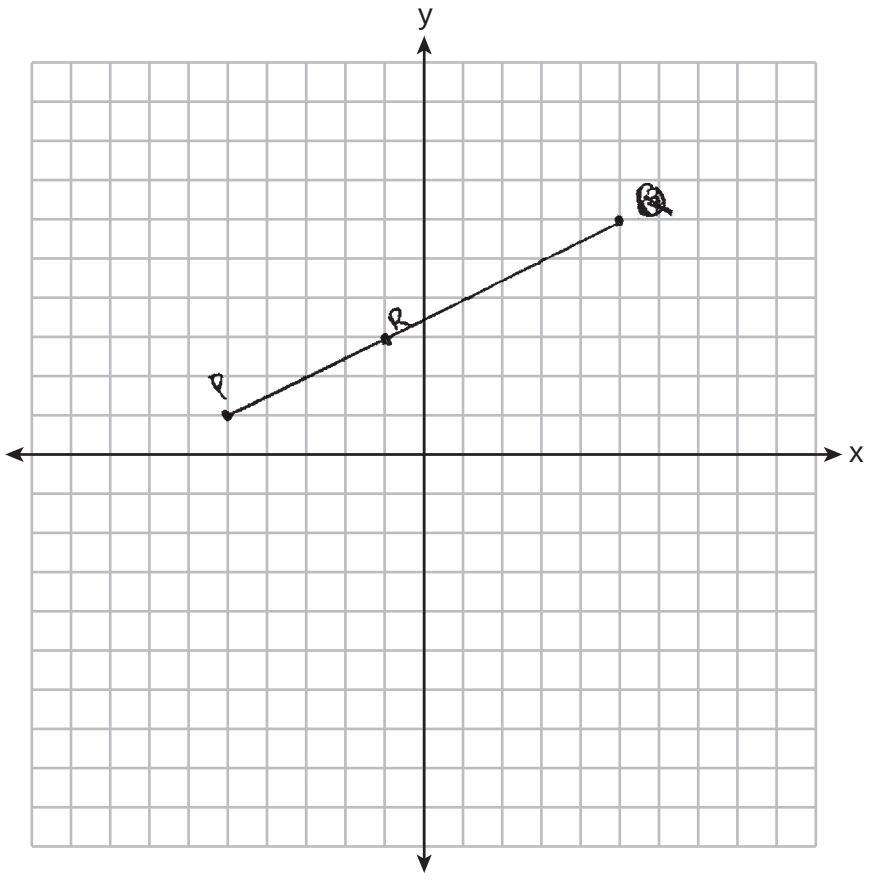
$\Delta x = 10$
$\Delta y = 5$

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

$\left(x + \frac{2}{5}(\Delta x) ; y + \frac{2}{5}(\Delta y)\right)$

$-5 + \frac{2}{5}(10) \quad 1 + \frac{2}{5}(5)$

$R = (-1, 3)$

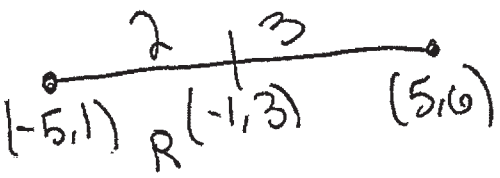


Score 2: The student gave a complete and correct response.

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

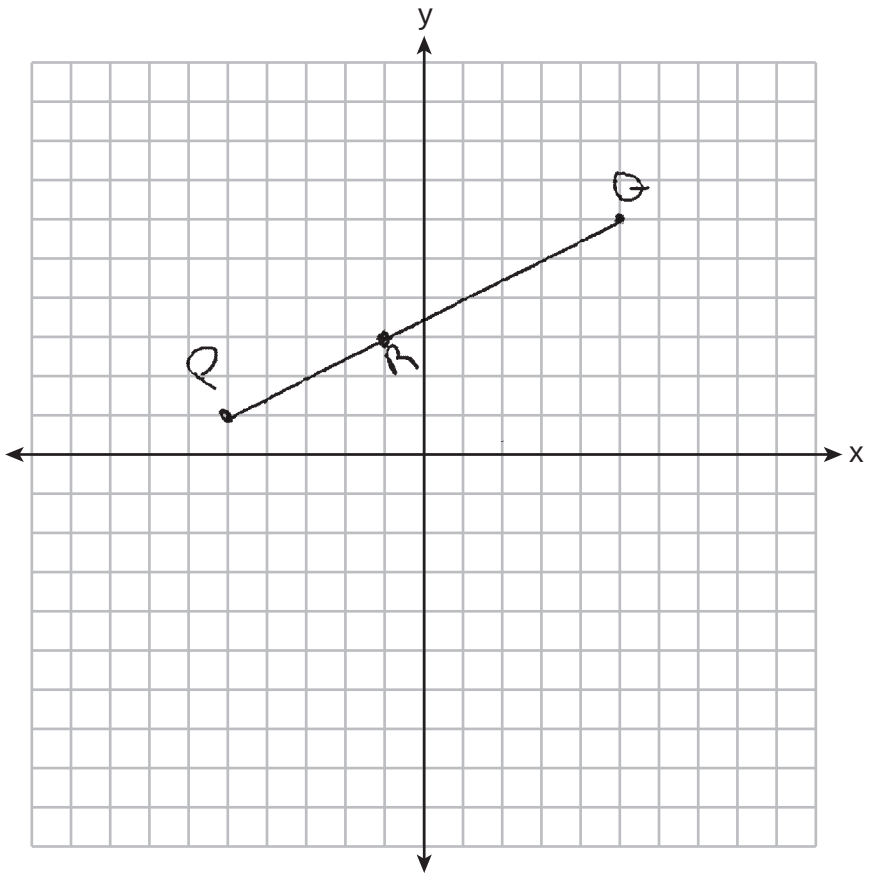
[The use of the set of axes below is optional.]



$5 - -5 = 10$ $\quad 6-1=5$

$10 \cdot \frac{2}{5} = 4$ $\quad 5 \cdot \frac{2}{5} = 2$

$-5+4=-1$ $\quad 1+2=3$



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

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

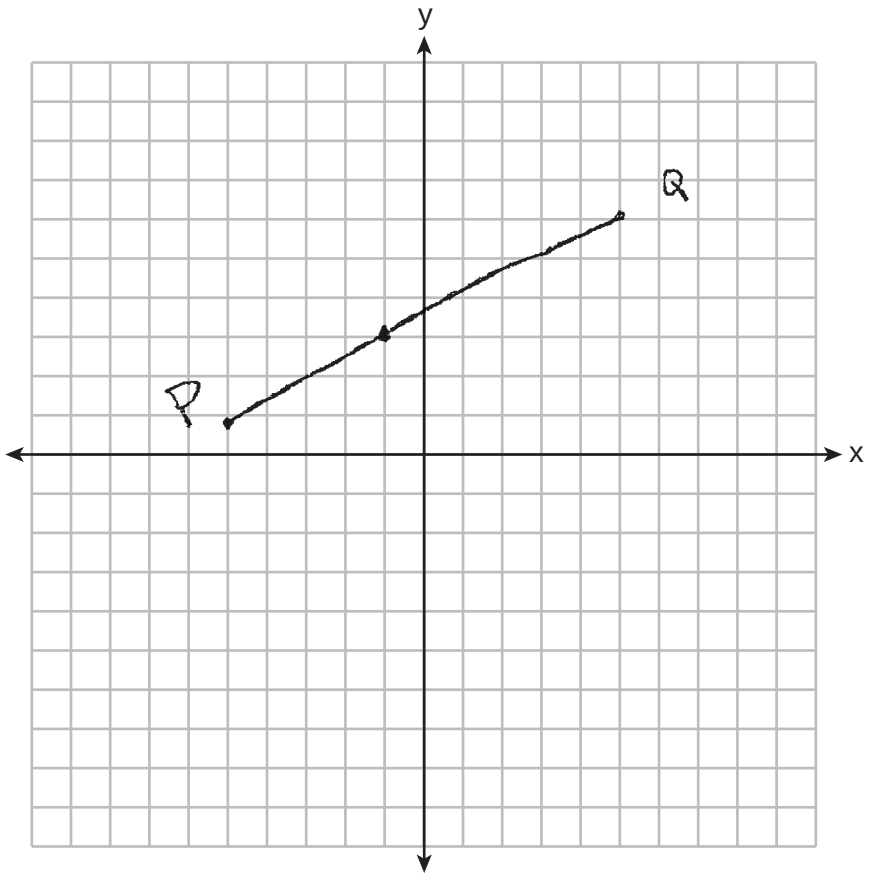
[The use of the set of axes below is optional.]

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

$(-1,3)$

$1 + \frac{2}{5}(6-1)$

$R(-1,3)$



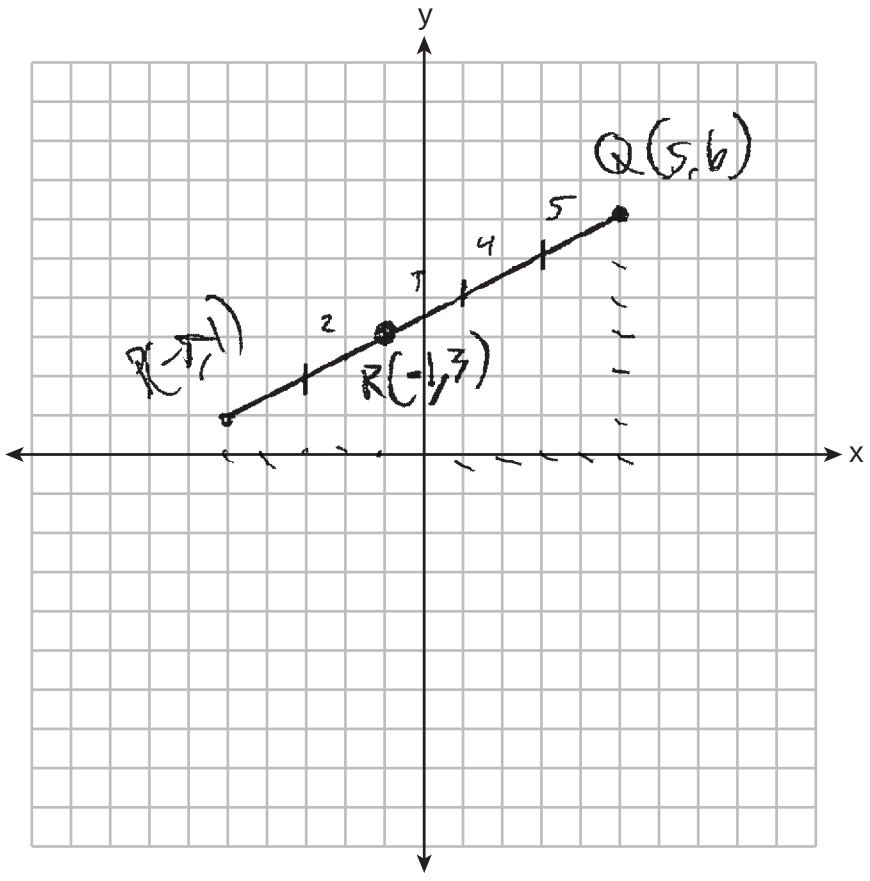
Score 2: The student gave a complete and correct response.

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

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

R(-1,3), for that is the proper location to place it if the line segment PQ is evenly divided into 5 segments to give the PR has two segments within it and that RQ has three.



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

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

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

-10

-5

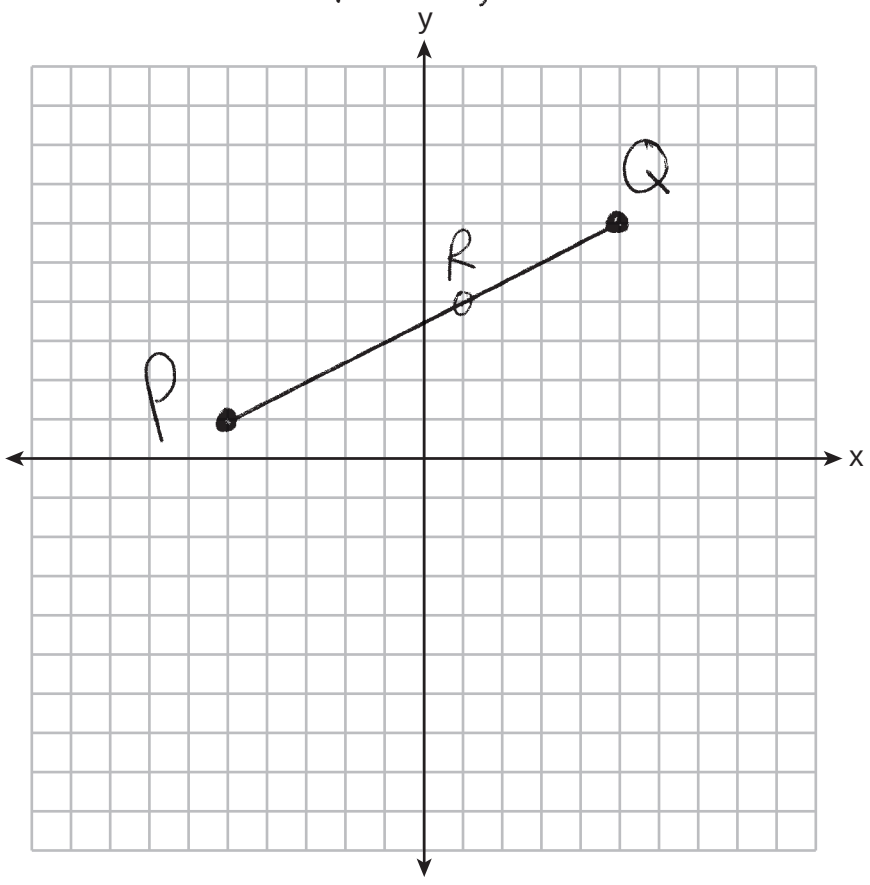
X

$\frac{2}{5}(-10)+5 = 1$

y

$\frac{2}{5}(-5)+6 =$

R(1,4)



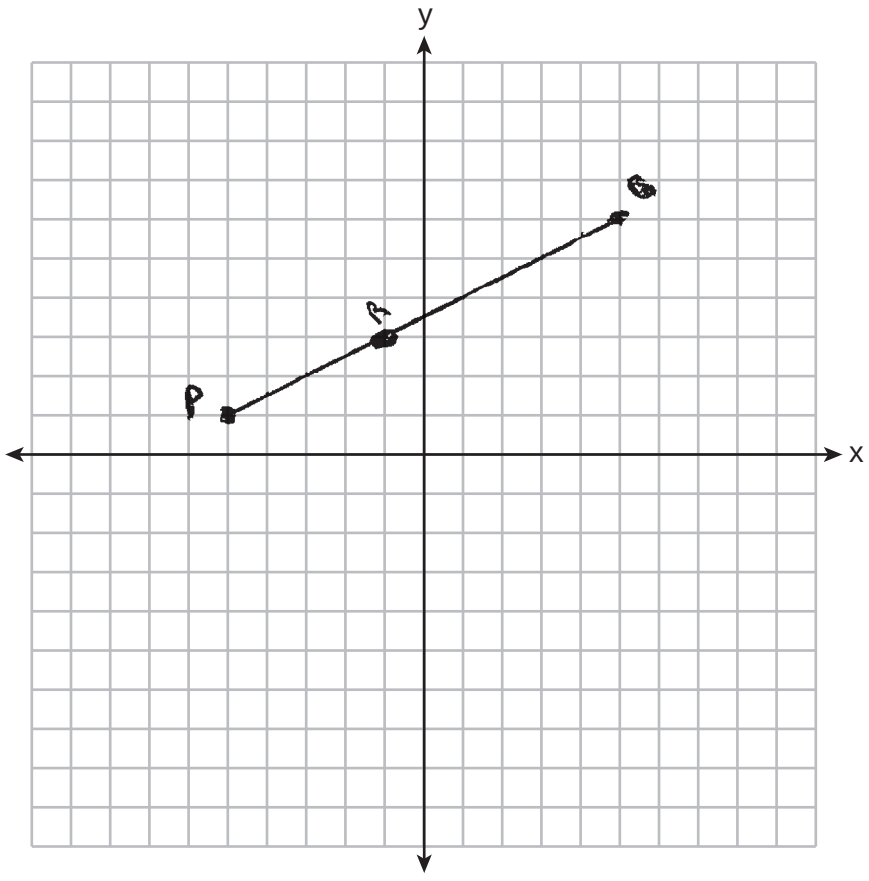
Score 1: The student determined the coordinates of R such that $PR:RQ$ was in a 3:2 ratio.

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

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

R (-1, 3)



Score 1: The student determined the coordinates of R, but did not show work.

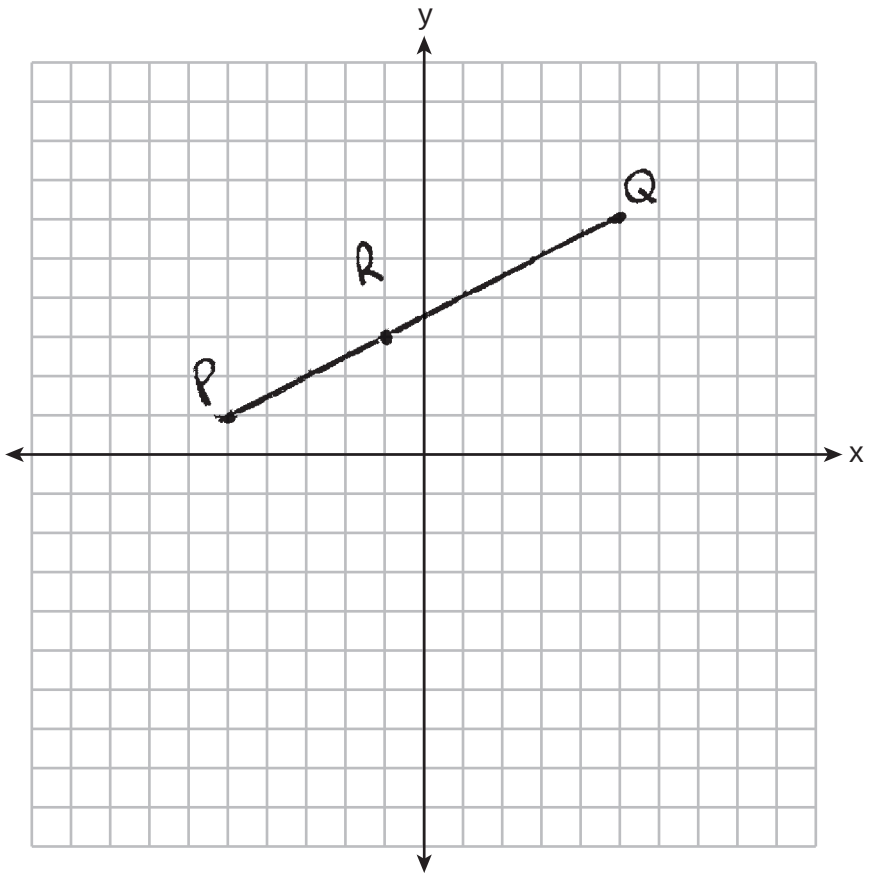
Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

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

The distance of $\overline{PR}$ to the distance of $\overline{RQ}$ when simplified results in the ratio of 2:3

:R(-1, 3)



Score 1: The student determined the coordinates of R, but did not show work.

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

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

$2 = \sqrt{(-5-x)^2+(1-x)^2}$

$2 = \sqrt{(-25+x^2)+1+x^2}$

$2^2 = \sqrt{(26+2x^2)}^2$

$4 = 26+2x^2$

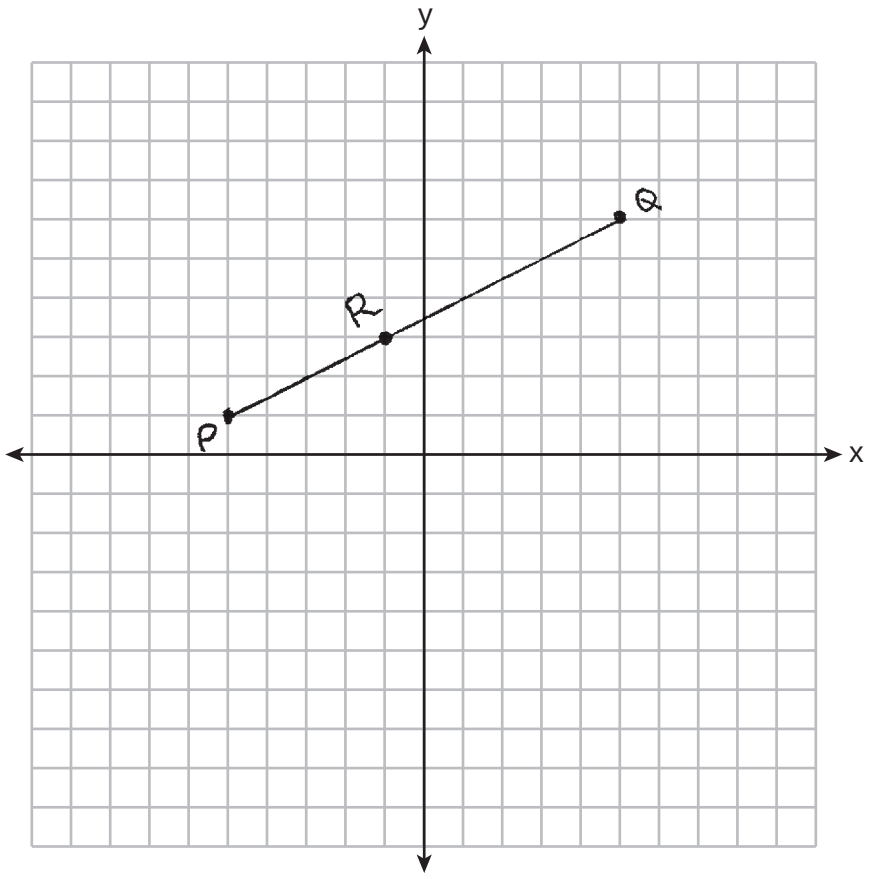
$d = \sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$

$d = \sqrt{(-5-5)^2+(1-6)^2}$

$= \sqrt{(0)^2+(-5)^2}$

$= \sqrt{25}$

$= 5$



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

Question 27

27 Line segment PQ has endpoints $P(-5,1)$ and $Q(5,6)$, and point R is on $\overline{PQ}$. Determine and state the coordinates of R, such that $PR:RQ = 2:3$.

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

$\overline{PQ} = 10$ units

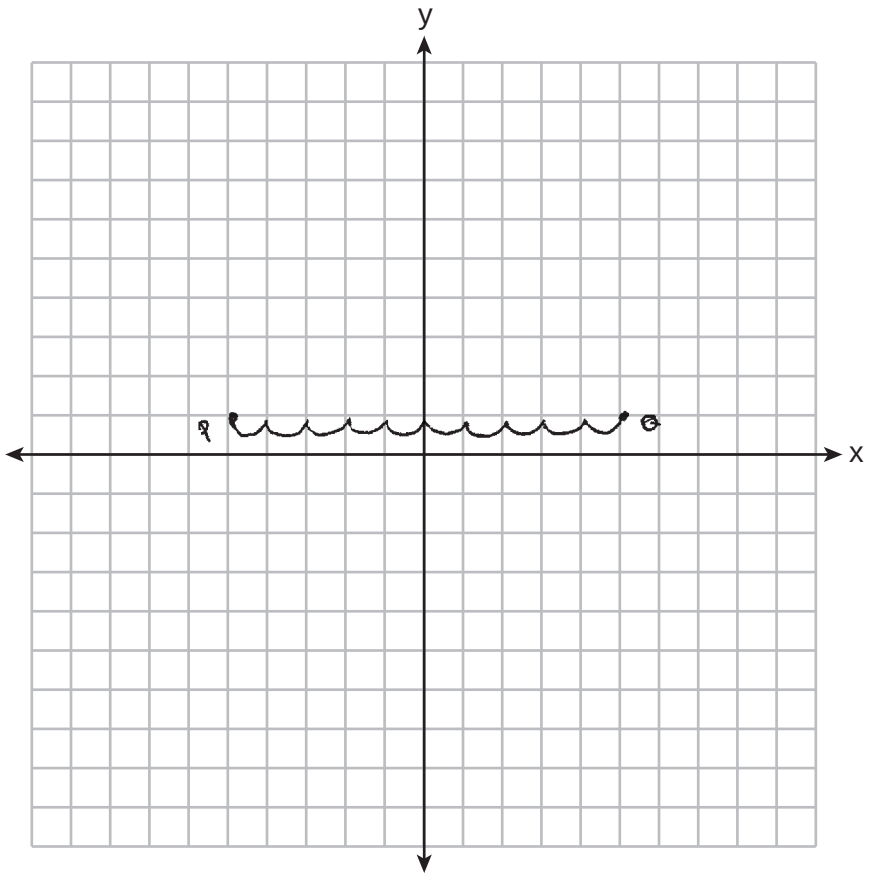
Let $x = R$

$2x + 3x = 10$

$\frac{5}{5}x = \frac{10}{5}$

$x = 2$

(-3,1)



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

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.

$\frac{80}{360} = \frac{x}{6.4^2\pi}$

$\frac{360x}{360} = \frac{1029.4.3708}{360}$

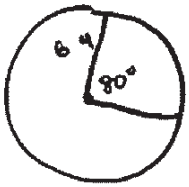
$x = 28.5454$

29

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

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.



$A = \pi r^2$.

$A = \pi(6.4)^2$

$A = 40.96\pi$

$\frac{80}{360}(40.96\pi)$

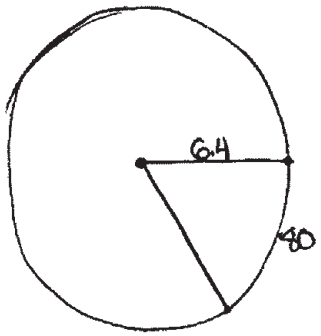
$= 28.59547$

29

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

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.



$A = \pi(6.4)^2$

$A = 128.6796351$

$\frac{80}{360} = \frac{X}{128.6796351}$

$\frac{360X = 10294.37081}{360}$

$X = 28.59547447$

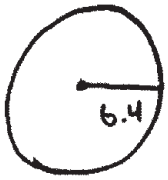
≈ 29

$\approx 29 in^2$

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

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.



$\pi 6.4^2 = 128.6796357$

$\frac{80}{360} = \frac{x}{128.6796357}$

$360x = 10294.37681$

$x = 29$ in

Score 1: The student determined the area of the sector in inches, not square inches.

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.

$\downarrow$

$\frac{\theta}{360}$

$\frac{80}{360} \cdot 2\pi(6.4) = 8.936\ldots$

$\approx 9\ \text{in.}^2$

Score 1: The student made an error in using a formula for arc length, but found an appropriate answer.

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.

$\frac{x}{360} \cdot \pi \cdot r^2 = A$.

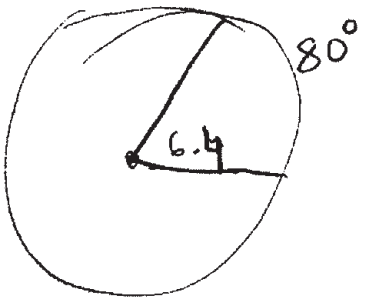
$\frac{80}{360} \cdot \pi \cdot 6.4^2 = \frac{64\pi}{45}$ or 4.468

(4)

Score 1: The student made an error in not squaring the radius, but found an appropriate answer.

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.



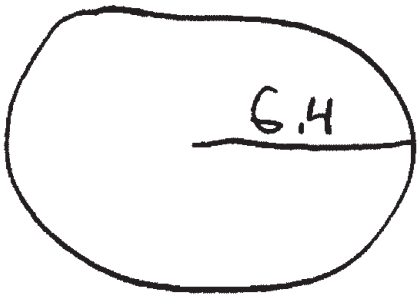
$\frac{2}{9}\pi 12.8$

Area = 8 inches

Score 0: The student used an incorrect formula and made one rounding error.

Question 28

28 A circle has a radius of 6.4 inches. Determine and state, to the *nearest square inch*, the area of a sector whose arc measures 80°.



$A = \pi r^2$

$A = \pi 6.4^2$

$A = 128.6$

$A = 129$

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

Question 29

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]

$V = \frac{4}{3}\pi r^3$

$V = \frac{4}{3}\pi 1^3$

$V = \frac{4}{3}\pi 2^3$

$V = \frac{4}{3}\pi 3^3$

$1.\overline{3}\pi$

$10.\overline{6}\pi$

$+ \quad 36\pi$

$48\pi ft^3$

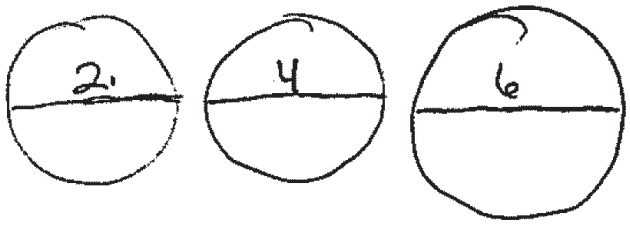
48πft³

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

Question 29

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]



$V = 4/3\pi r^3 + 4/3\pi r^3 + 4/3\pi r^3$
$V = 4/3\pi(1)^3 + 4/3\pi(2)^3 + 4/3\pi(3)^3$
$= 4/3\pi(1) + 4/3\pi(8) + 4/3\pi(27)$
$= 4/3\pi + 32/3\pi + 36\pi$
$= 12\pi + 36\pi$
$V = 48\pi$

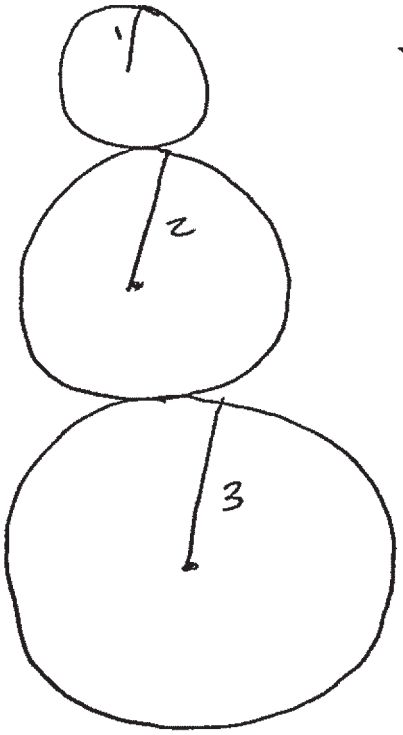
Score 2: The student gave a complete and correct response.

Question 29

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]

$V = \frac{4}{3}\pi 1^3 \quad 1.3\pi$



$V = \frac{4}{3}\pi 2^3 = 10.6\pi$

$V = \frac{4}{3}\pi 3^3 = 36\pi$

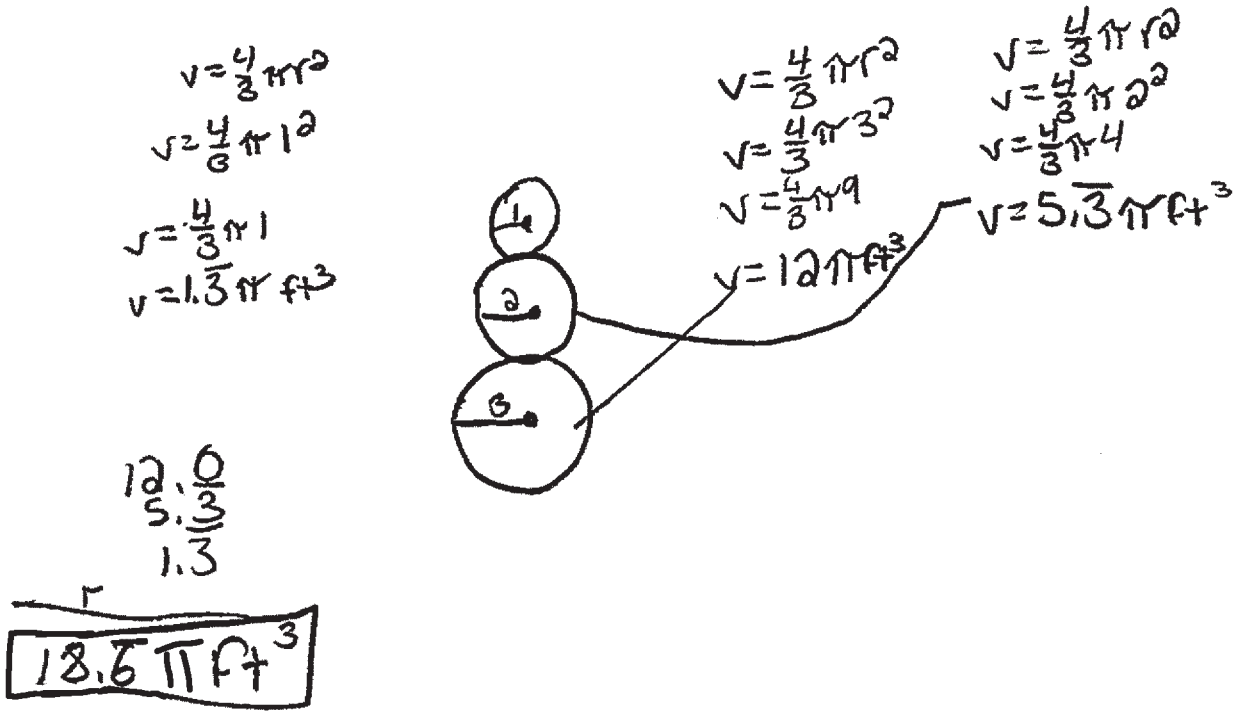
$V = 47.9\pi$

Score 1: The student made a rounding error.

Question 29

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]

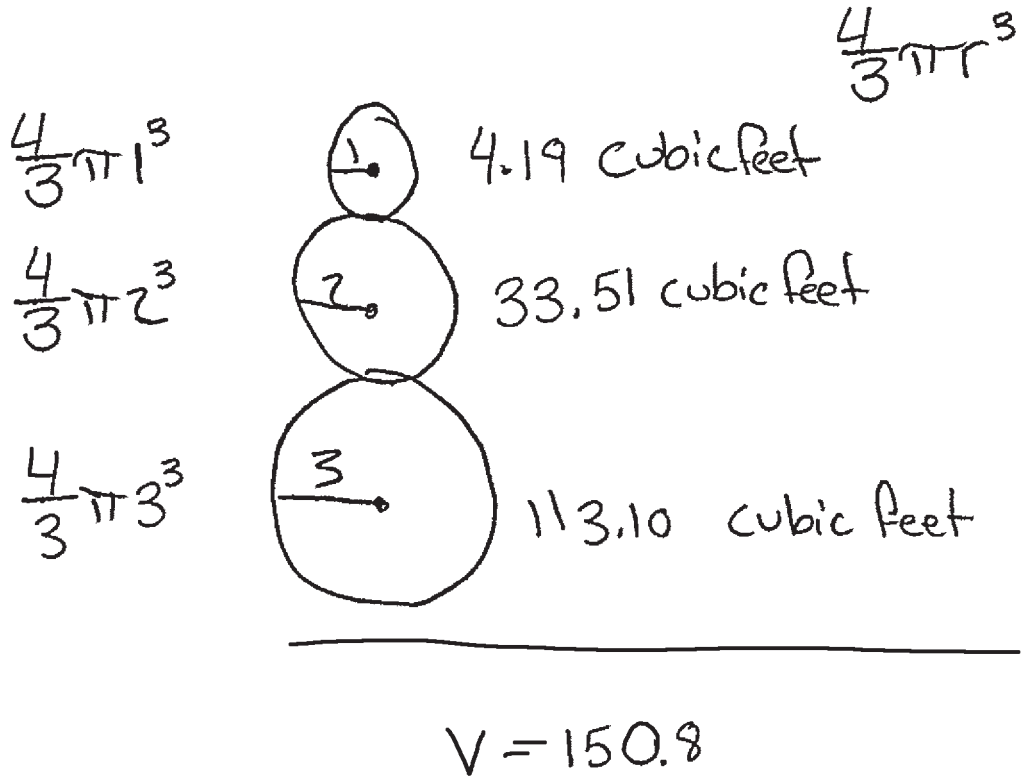


Score 1: The student made an error by squaring the radius when using the volume formula, but found an appropriate answer.

Question 29

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]

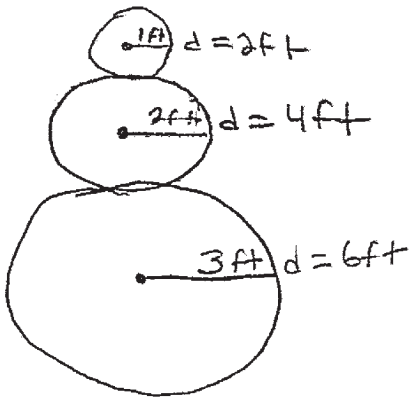


Score 1: The student determined the volume of the snowman, but not in terms of π.

Question 29

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]



$C = \pi d$

$C = 12\pi$

12π

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

Question 29

29 A large snowman is made of three spherical snowballs with radii of 1 foot, 2 feet, and 3 feet, respectively. Determine and state the amount of snow, in cubic feet, that is used to make the snowman.

[Leave your answer in terms of π.]

$V = \pi r^2$

$\pi 1^2 + \pi 2^2 + \pi 3^2$

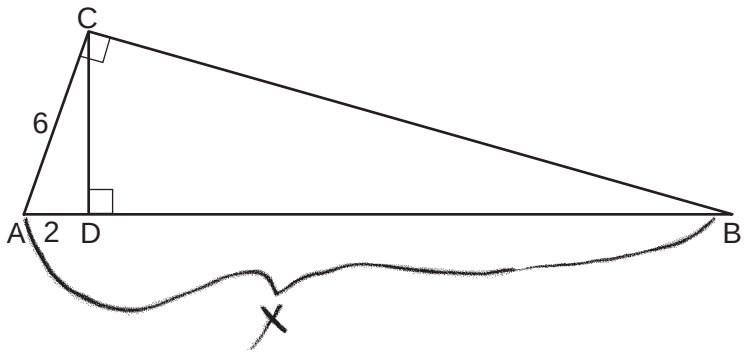
$1\pi + 4\pi + 9\pi$

14 π cubic ft

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

Question 30

30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

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

$2x = 36$

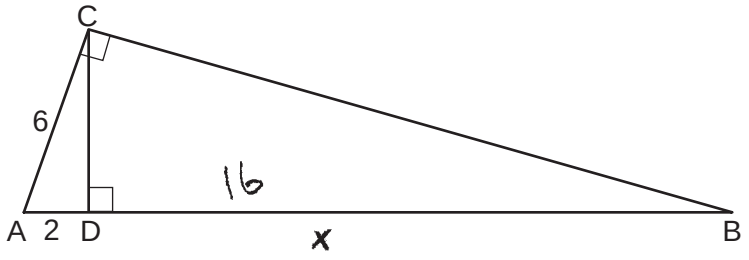
$x = 18$

$AB = 18$

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

Question 30

30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

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

$36 = 2x + 4$
$-4 \quad -4$

$\frac{32}{2} = \frac{2x}{2}$

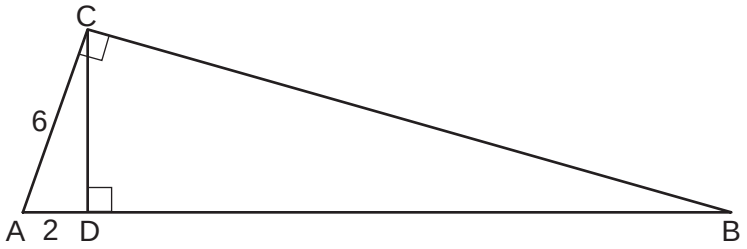
$16 = x$

AB = 18

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

Question 30

30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

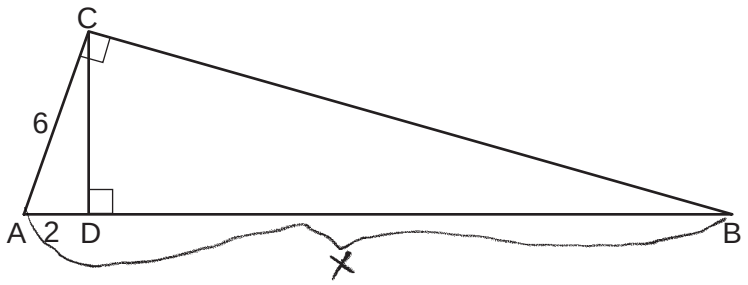
Find CD
$2^2 + (CD)^2 = 6^2$
$(CD)^2 = 36 - 4$
$CD = \sqrt{32}$

$\triangle ADC \sim \triangle CDB$
$\frac{CD}{AD} = \frac{BD}{CD}$
$\frac{\sqrt{32}}{2} = \frac{x}{\sqrt{32}}$
$2x = 32$
$BD = x = 16$
$AB = 16 + 2$
$AB = 18$

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

Question 30

30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

$\frac{\text{Leg}}{\text{Shl}} = \frac{\text{hyp}}{\text{Leg}}$

$\frac{6}{2} = \frac{:X}{6}$

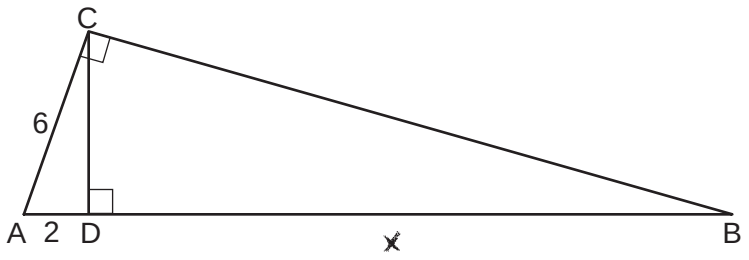
$12 = 2x$

$X = 6$

Score 1: The student made a computational error.

Question 30

30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

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

$4 + 2x = 36$

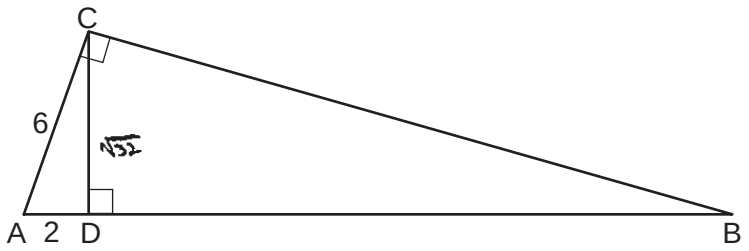
$2x = 32$

$x = 16$

Score 1: The student correctly determined the length of $\overline{DB}$, but did not find the length of $\overline{AB}$.

Question 30

30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

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

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

$4+x^2=36$

$-4 \quad -4$

$\sqrt{x^2}=\sqrt{32}$

$x=\sqrt{32}$

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

$x^2+x^2=\sqrt{32}$

$\frac{2x^2}{2}=\frac{\sqrt{32}}{2}$

$x^2=\sqrt{16}$

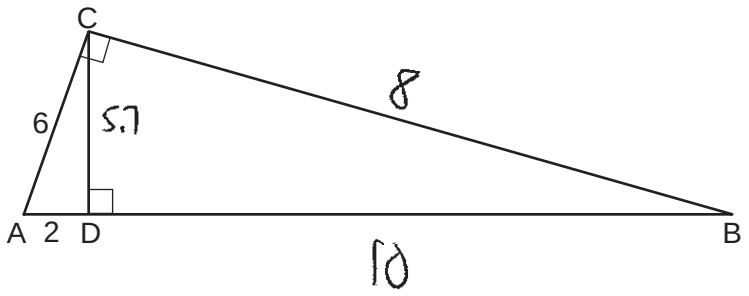
$x=4$

$AB=6$

Score 0: The student made a conceptual error and a computational error in determining the length of $\overline{DB}$.

Question 30

30 In the diagram below of right triangle ACB, altitude $\overline{CD}$ is drawn to hypotenuse $\overline{AB}$, $AD = 2$ and $AC = 6$.



Determine and state the length of $\overline{AB}$.

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

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

$4+x^2=36$

$-4 \quad -4$

$\sqrt{x^2}=\sqrt{32}$

$x=5.7$

$\sqrt{38+x^2}=\sqrt{y^2}$

$6^2+x^2=y^2-2$ $\quad \sqrt{38}+x=y$

$36+x^2=y^2-2$

$6^2+8^2=10^2$

$36+64=100$

$\overline{AB}=10$

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

Question 31

31 Triangle RST has vertices with coordinates $R(-3,-2)$, $S(3,2)$ and $T(4,-4)$. Determine and state an equation of the line parallel to $\overline{RT}$ that passes through point S.

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

$\frac{y_2 - y_1}{x_2 - x_1}$ $\quad \frac{-4+2}{4+3} = -\frac{2}{7}$

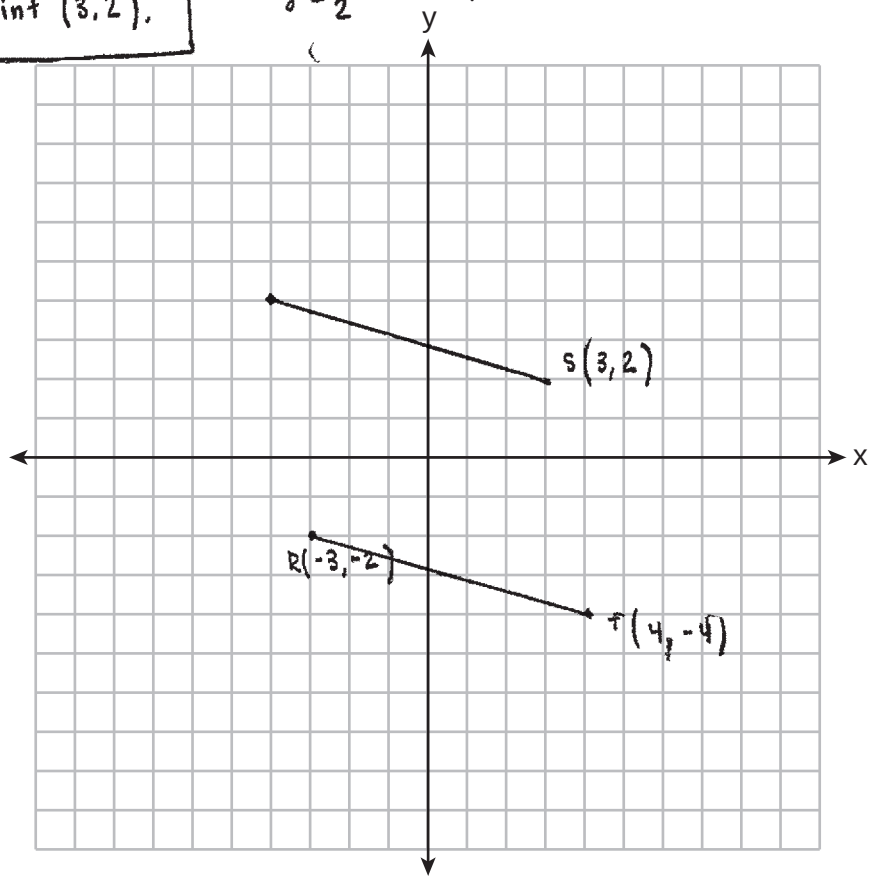
$y - 2 = -\frac{2}{7}(x - 3)$

For a line segment to be parallel, it must have the same slope, and pass through the point (3, 2).

$y - 2 = -\frac{2}{7}(x - 3)$ $\quad y = \left(-\frac{2}{7}\right)x + \frac{20}{7}$

$y - 2 = \left(-\frac{2}{7}\right)x + \frac{6}{7}$

$+2 \quad +2$



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

Question 31

31 Triangle RST has vertices with coordinates $R(-3,-2)$, $S(3,2)$ and $T(4,-4)$. Determine and state an equation of the line parallel to $\overline{RT}$ that passes through point S.

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

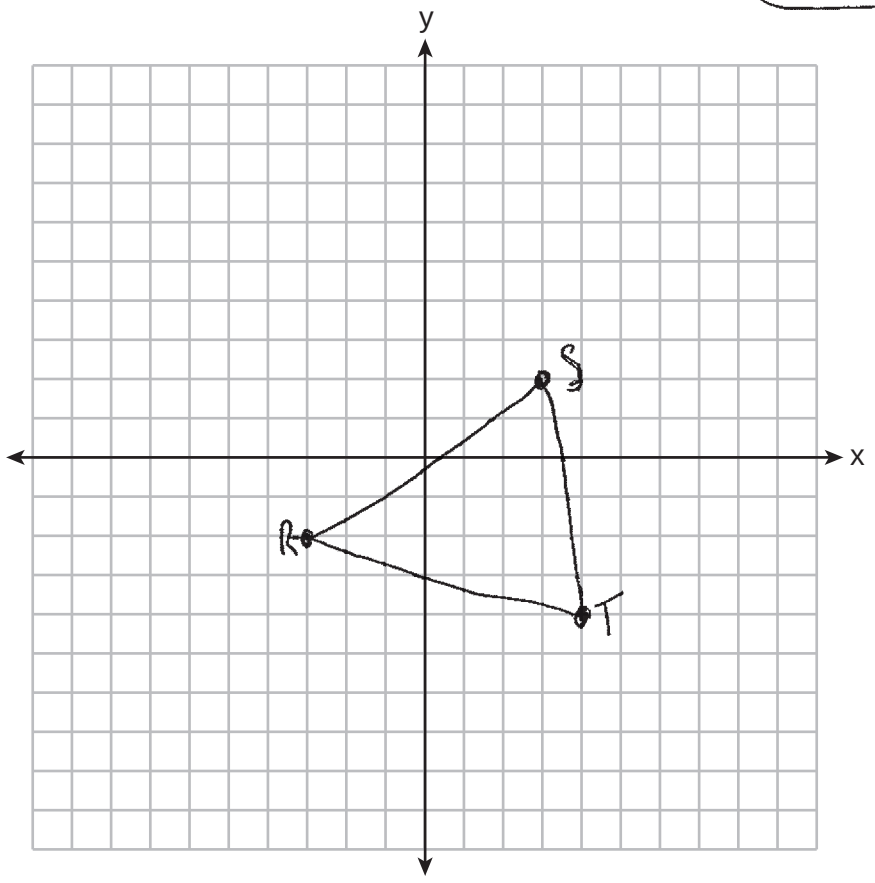
Slope of $\overline{RT} = \frac{-4+2}{4+3} = \frac{-2}{7}$

$y-2=\frac{-2}{7}(x-3)$

$y-2=\frac{-2}{7}x+\frac{6}{7}$

$+2 \quad +2$

$y=\frac{-2}{7}x+\frac{20}{7}$



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

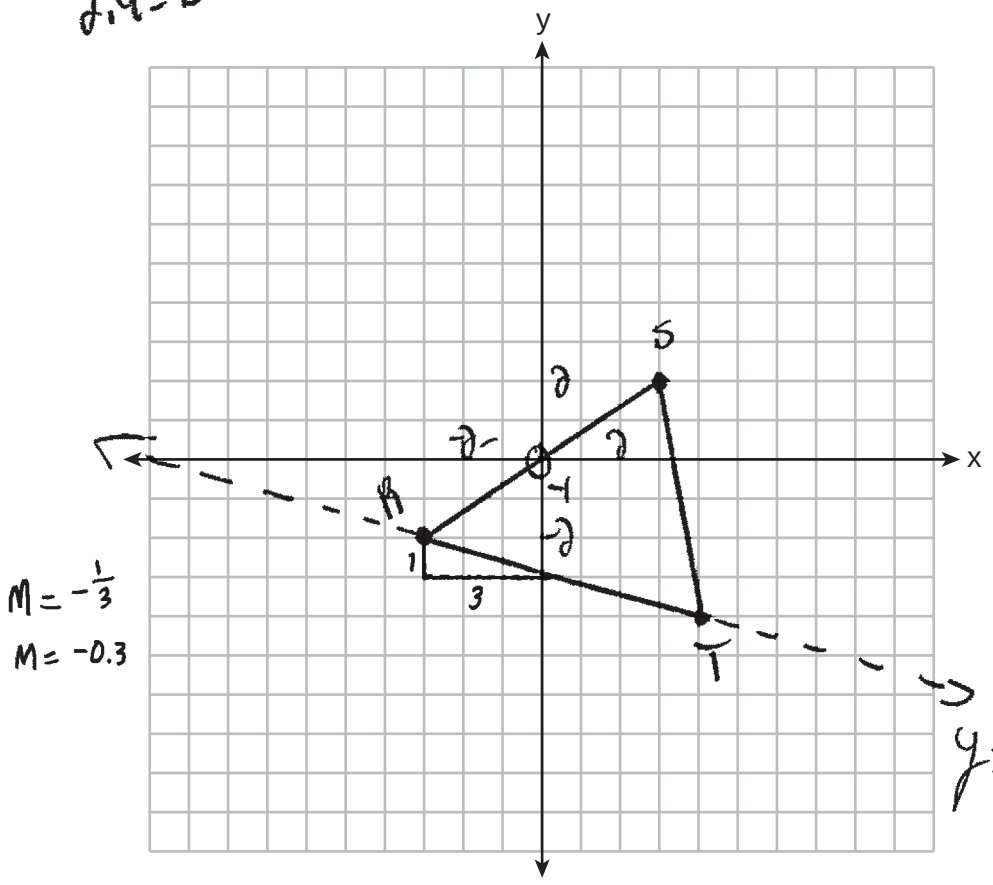
Question 31

31 Triangle RST has vertices with coordinates $R(-3,-2)$, $S(3,2)$ and $T(4,-4)$. Determine and state an equation of the line parallel to $\overline{RT}$ that passes through point S.

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

$y = -0.3x + b$
$2 = -0.3(3) + b$
$2 = -0.9 + b$
$+0.9 \quad +0.9$
$2.9 = b$

$y = -0.3x + 2.9$



$M = -\frac{1}{3}$
$M = -0.3$

$y = -0.3x + -2.9$

Score 1: The student made an error when determining the slope of $\overline{RT}$.

Question 31

31 Triangle RST has vertices with coordinates $R(-3,-2)$, $S(3,2)$ and $T(4,-4)$. Determine and state an equation of the line parallel to $\overline{RT}$ that passes through point S.

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

$m_{RT} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4+2}{4+3} = \frac{-2}{7} = -\frac{2}{7}$

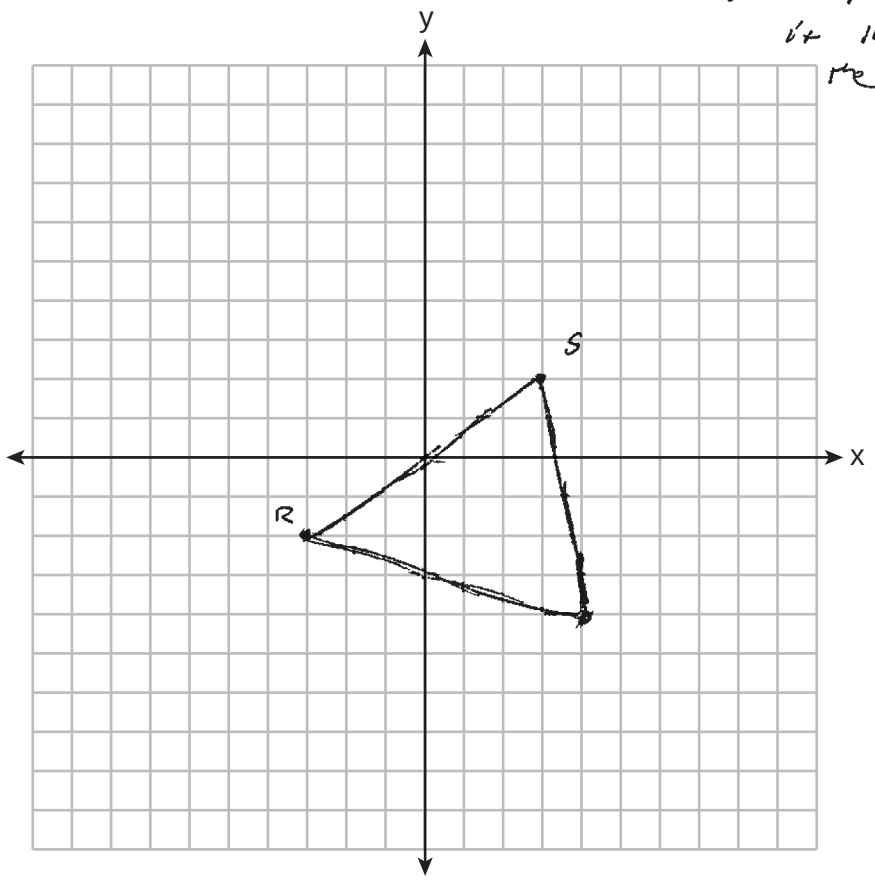
↓ Negative reciprocal

$\frac{7}{2}$

$y = \frac{7}{2}x + b$ $\quad y = \frac{7}{2}(3) + b$ $\quad y = \frac{7}{2}x - 8.5$ is the equation because the slope is a negative reciprocal and it intersects the point S.

$2 = 10.5 + b$

$-8.5 = b$



Score 1: The student wrote an equation of the line perpendicular to $\overline{RT}$ through point S.

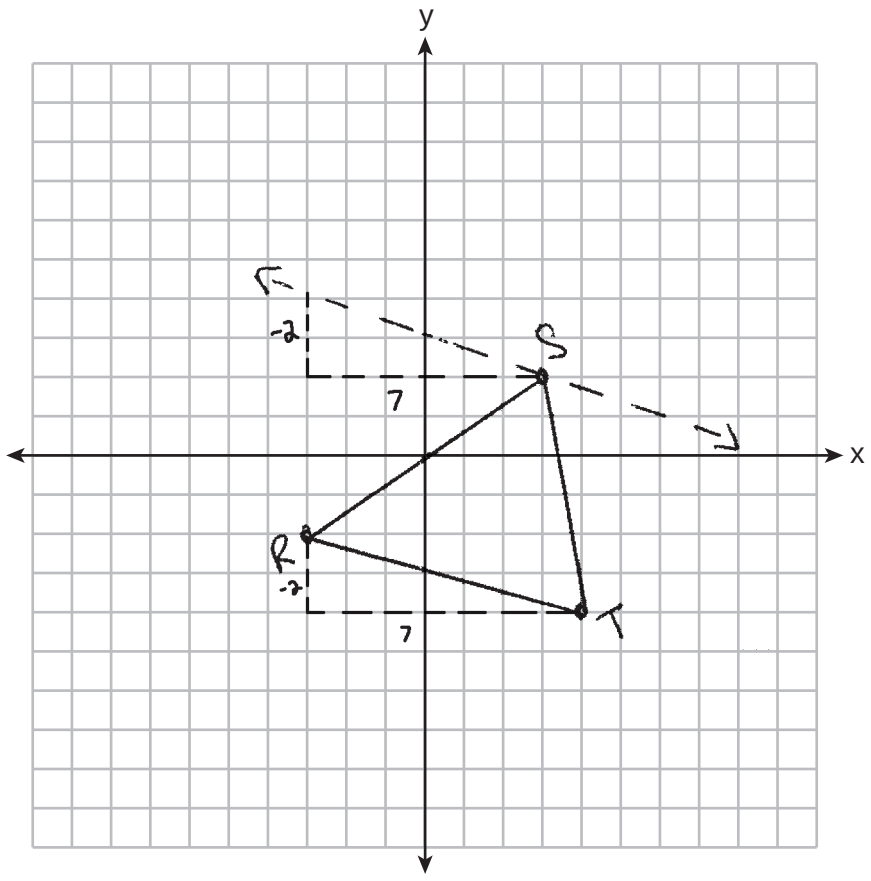
Question 31

31 Triangle RST has vertices with coordinates $R(-3,-2)$, $S(3,2)$ and $T(4,-4)$. Determine and state an equation of the line parallel to $\overline{RT}$ that passes through point S.

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

$m = \frac{-2}{7}$

$y = \frac{-2}{7}x + 3$



Score 1: The student correctly determined the slope of the line parallel to $\overline{RT}$, but no further correct work was shown.

Question 31

31 Triangle RST has vertices with coordinates $R(-3,-2)$, $S(3,2)$ and $T(4,-4)$. Determine and state an equation of the line parallel to $\overline{RT}$ that passes through point S.

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

(3,2) $y = mx + b$

$2 = m(3) + b$

$2 = 1/6(3) + b$

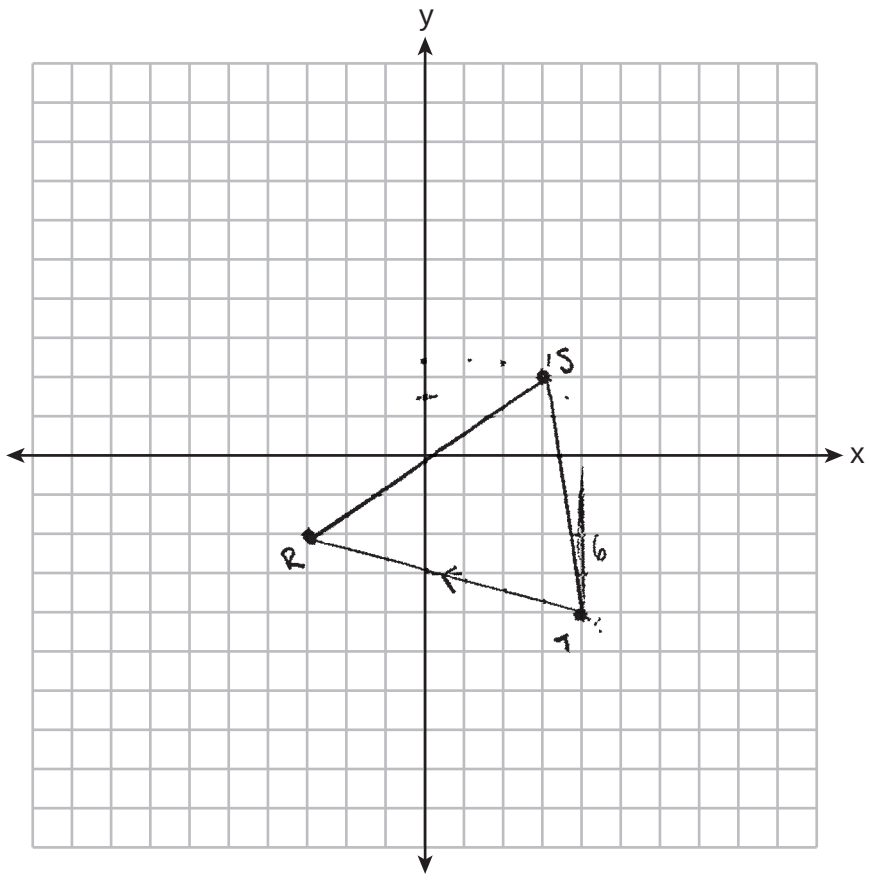
$2 = .5 + b$

$-.5 \quad -.5$

$1.5 = b$

$y = 5x + 1.5$

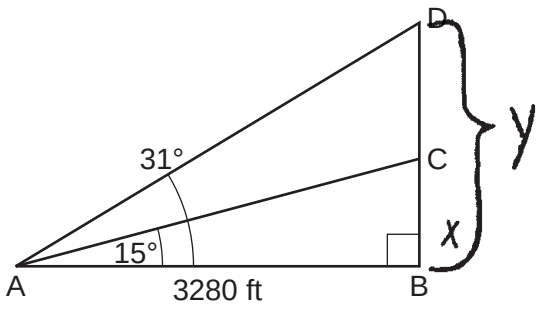
passes through point S and is ll to $\overline{RT}$.



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

Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.



Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

$\frac{\tan 15}{1} = \frac{x}{3280}$ $\frac{\tan 31}{1} = \frac{y}{3280}$

$x = \tan 15(3280$ $y = \tan 31(3280)$

B-C $x = 878.873$ B-D $y = 1970.822$

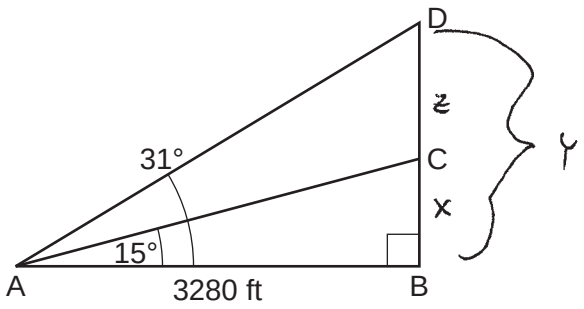
1970.822
-878.873
1091.949 ft

Distance traveled between: 1092 ft

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

Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.



Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

$\tan 15° = \frac{x}{3280}$ | $\tan 31° = \frac{y}{3280}$

$x = 3280 \tan 15°$ | $y = 3280 \tan 31°$

$z = y - x$

$z = 3280 \tan 31° - 3280 \tan 15°$

$= 3280 (\tan 31° - \tan 15°)$

$= 3280 (.3329114266)$

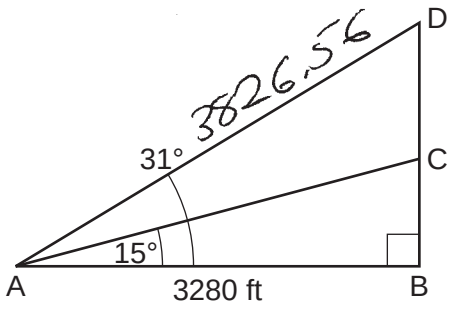
$= 1091.949479$

$= \boxed{1092}$

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

Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.



Find AD

$\cos 31 = \frac{3280}{(AD)}$

$3280 \div (\cos 31) = AD$

$AD = 3826.56$

3826.56

Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

Find CB

$\tan 15 = \frac{CB}{3280}$

$CB = 878.87$

Find BD

$3280^2 + (BD)^2 = (3826.6)^2$

1970.91

$BD - CB =$

$-878.87 + 1970.9$

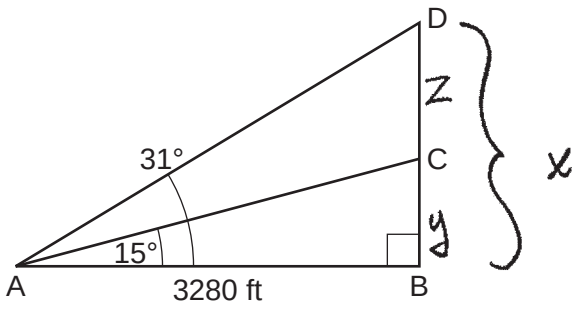
1092.03

1092 ft. Ans

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

Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.



Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

$\tan\theta = \frac{opp}{adj}$

$\tan(31°) = \frac{x}{3280}$

$x = (3280)(\tan(31°))$

$x = 1970.82283$

$\tan(15°) = \frac{y}{3280}$

$y = (3280)(\tan 15)$

$y = 878.8733512$

$x - y = z$

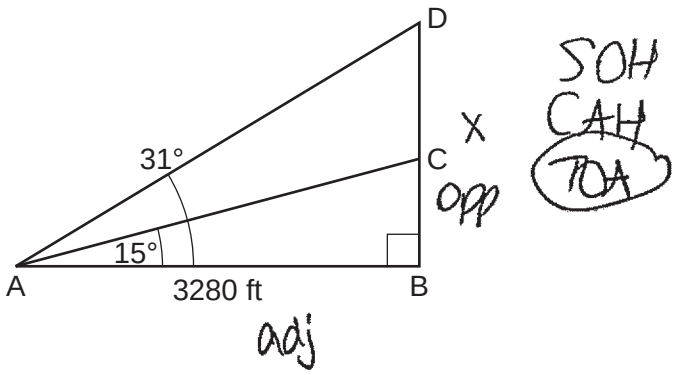
$1970.82283 - 878.8733512 =$

1091.949479ft.

Score 3: The student made a rounding error when determining the length of $\overline{DC}$.

Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.



Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

$\tan 31 = \frac{X}{3280} =$

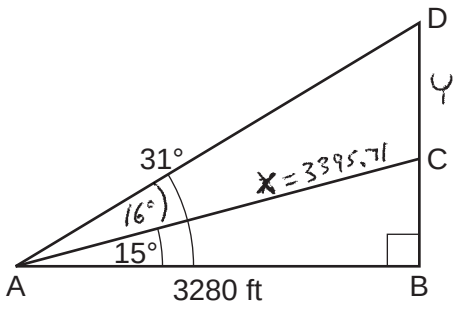
1971 ft = DB

distance rocket traveled was 1971 ft.

Score 2: The student correctly determined the length of $\overline{DB}$.

Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.



Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

$\cos 15° = \frac{3280}{x}$

$\frac{x \cos 15}{\cos 15} = \frac{3280}{\cos 15}$

$x = 3395.705872$

$\tan 16° = \frac{y}{3395.71}$

$y = 973.70417$

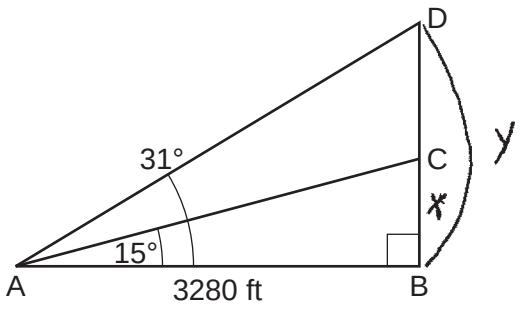
$y = 974$ ft

Score 2: The student made a conceptual error in using the tangent function in a non-right triangle.

Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.

S tan



Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

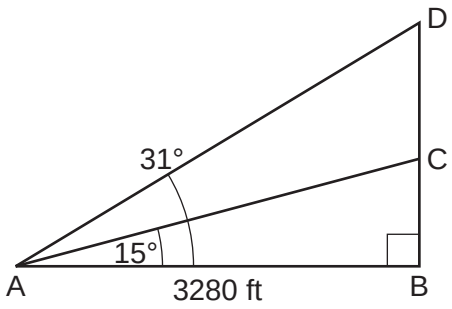
$\tan 15° = \frac{x}{3280}$

$\tan 31° = \frac{y}{3280}$

Score 1: The student wrote two correct relevant trigonometric equations, but no further correct work was shown.

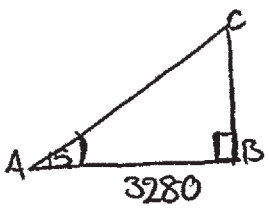
Question 32

32 Cape Canaveral, Florida is where NASA launches rockets into space. As modeled in the diagram below, a person views the launch of a rocket from observation area *A*, 3280 feet away from launch pad *B*. After launch, the rocket was sighted at *C* with an angle of elevation of 15°. The rocket was later sighted at *D* with an angle of elevation of 31°.

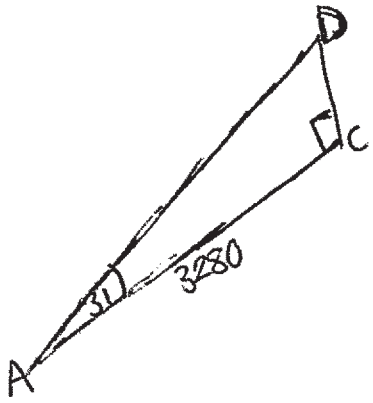


Determine and state, to the *nearest foot*, the distance the rocket traveled between the two sightings, *C* and *D*.

sohcahtoa



x · cos15° = 3280



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

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.

$\pi r^2 h$
$\pi(3.5)^2 9$
$\pi 110.25$
346.360
$\approx 346 cm^3$

$\pi r^2 h$
$\pi(4.5)^2 13$
$\pi 263.25$
827.024
$\approx 827 cm^3$

What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

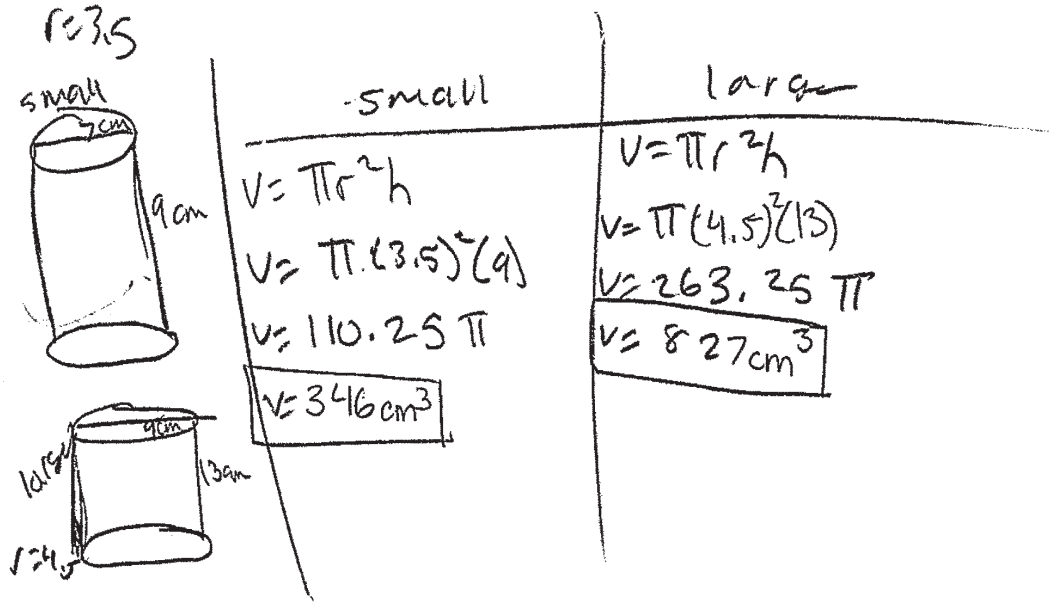
3 cans. $827 \div 346 \approx 2.39$ but. You need 3 cans to fill the larger container

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

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.



What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

$\frac{827}{346} = 2$

about 2.4 small cans are needed to fill the large container.

Score 3: The student made an error in determining the number of small cans needed.

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.

$V = \pi r^2 h$

Small $= \pi 3.5^2 9$ Large $= \pi 4.5^2 13$

Small $= 110\,cm^3$ Large $= 827\,cm^3$

What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

About 8

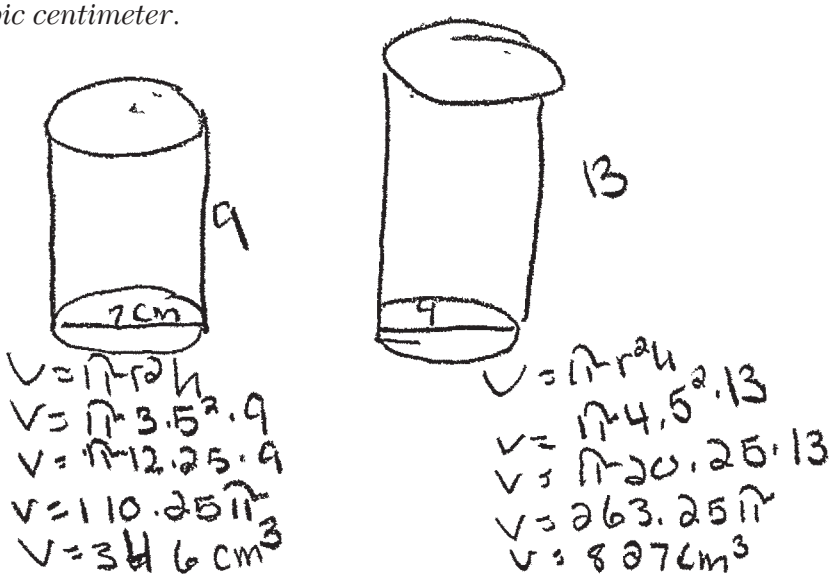
$\frac{827.0242}{110.25} = 7.5$

Score 3: The student made an error in determining the volume of the small can.

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.



What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

Score 2: The student determined the volume of the small can and large container, but no further correct work was shown.

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.

$V_{small} = \pi(7)^2 9$ $\quad$ $V_{large} = \pi(9)^2 13$

$= 441\pi$ $\quad$ $= 1053\pi$

≈ 1385 $\quad$ ≈ 3308

What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

$\frac{V_{large}}{V_{small}} = \frac{3308}{1385} \approx 2.388$

2

Score 2: The student made an error by using diameter for the volume of both cylinders and made an error in determining the number of small cans needed.

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.

$V = \pi r^2 h$

$V = \pi\ 3.5^2 (9)$

$V = \pi\ (7)(9)$

$V = 63\pi$

$V = 197.920$

$V = 198$

$V = \pi r^2 h$

$V = \pi\ (4.5)^2 (13)$

$V = \pi\ (20.25)(13)$

$V = 263.25\pi$

$V = 827.024$

$V = 827$

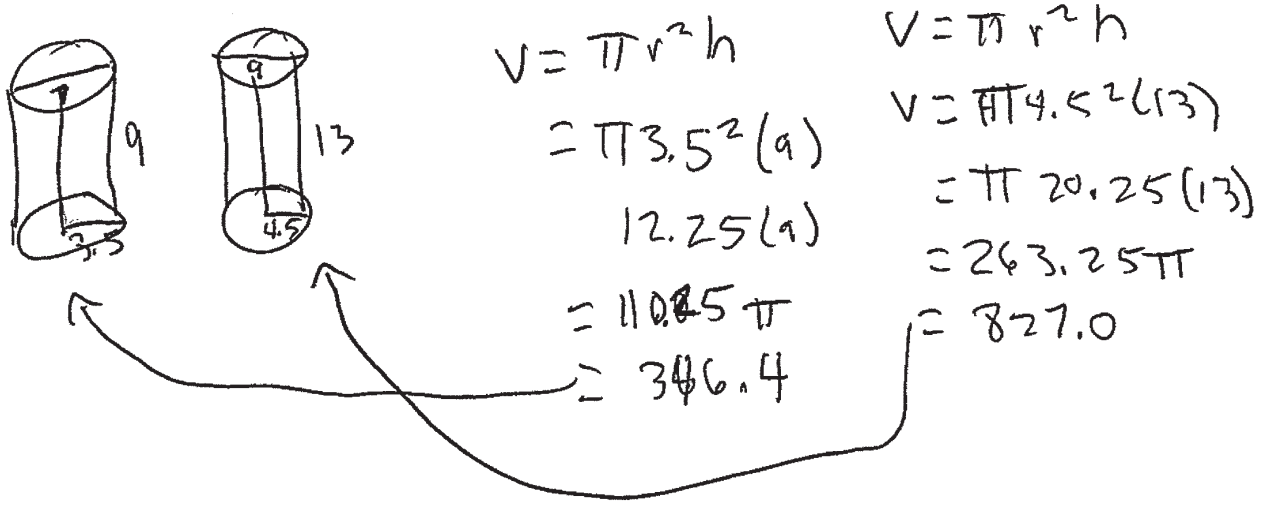
What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

Score 1: The student determined the correct volume of the large container, but no further correct work was shown.

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.



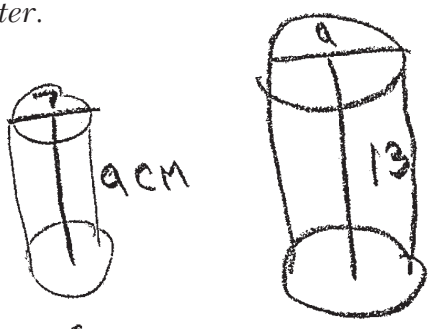
What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

Score 1: The student found the volumes of the small can and large container, but rounded to the nearest tenth of a cubic centimeter. No further correct work was shown.

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.



$V = \pi r^2 h$

$V = \pi (3.5)^2 (9)$

$V = \pi 12.(9)$

$V = 108\pi \text{cm}^3$

$V = 339.29 \text{cm}^3$

$V = \pi (4.5)^2 (13)$

$V = \pi 81.5(13)$

$V = 256.5\pi$

$V = 805.78 \text{cm}^3$

What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

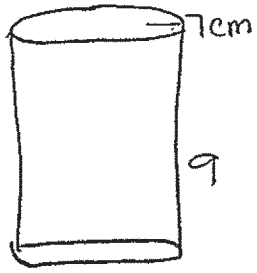
2

Score 0: The student made errors in determining the volumes of both cylinders and did not show enough correct relevant work to receive additional credit.

Question 33

33 A small can of soup is a right circular cylinder with a base diameter of 7 cm and a height of 9 cm. A large container is also a right circular cylinder with a base diameter of 9 cm and a height of 13 cm.

Determine and state the volume of the small can and the volume of the large container to the *nearest cubic centimeter*.



$7^2 \cdot 3.14$
$153.86 \cdot 9$
1384.74 LA

1384.74 + 49
1433.74 S.A

$49 \div 9 =$
58 = V

What is the minimum number of small cans that must be opened to fill the large container? Justify your answer.

58 small cans of soup are needed to fill the container because if you do $7^2 \cdot 3.14$ that gave you 153.86 multiply that by 9 you got 1384.74 then you add that up by 49 to get 1433.74 then you do 49. added by your height to get 58.

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

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

$MA = \sqrt{7^2+6^2} = \sqrt{85}$
$AT = \sqrt{9^2+2^2} = \sqrt{85}$
$TH = \sqrt{7^2+6^2} = \sqrt{85}$
$MH = \sqrt{9^2+2^2} = \sqrt{85}$

$\square MATH$ is a rhombus because all side lengths are equal, therefore all sides are $\cong$ to each other

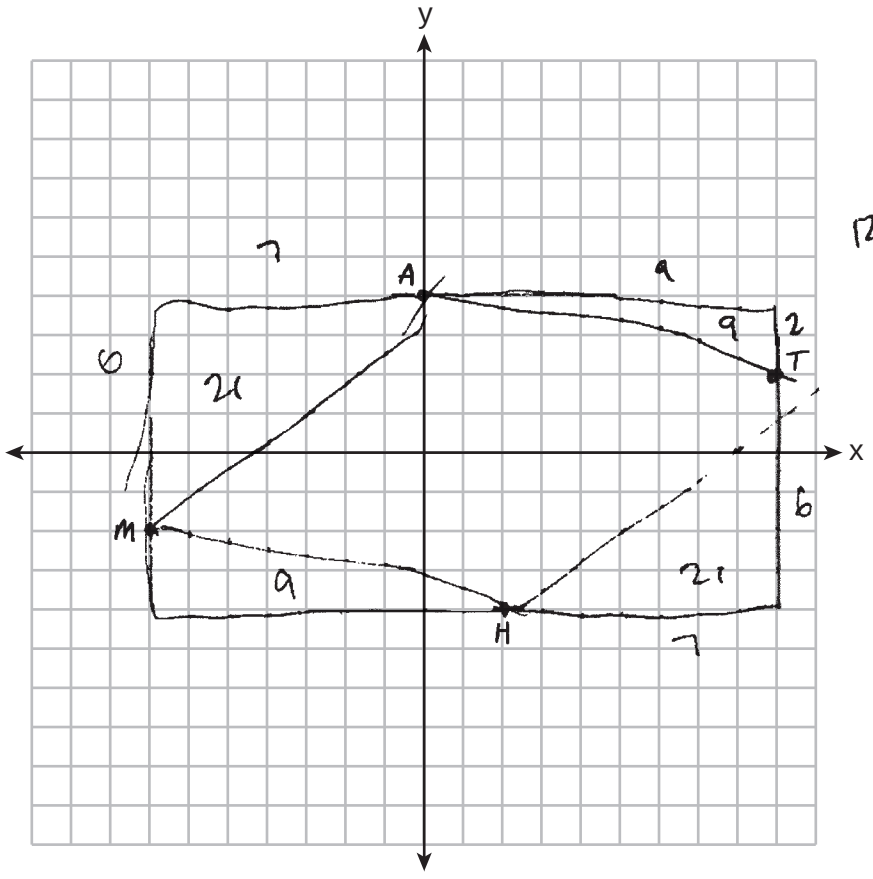
Determine and state the area of *MATH*.

$A = 16(8) = 128$

$A = \frac{1}{2}(6)(7) = 21$

$A = \frac{1}{2}(2)(9) = 9$

$128 - 2(9+21) = \boxed{68}$



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

Question 34

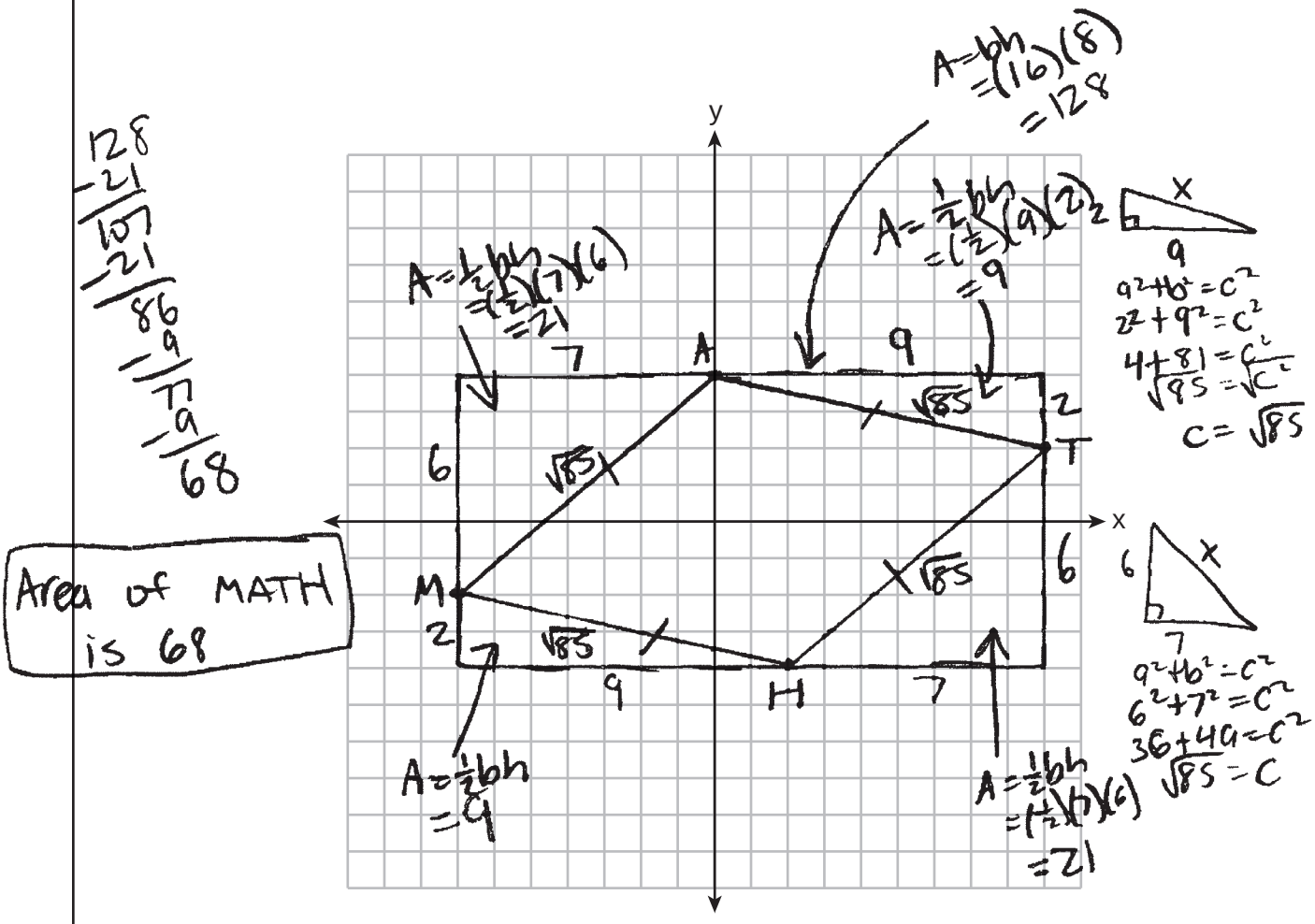
34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

All four sides are $\cong$ ($\overline{MA} \cong \overline{AT} \cong \overline{TH} \cong \overline{HM}$)
therefore, MATH is a rhombus

Determine and state the area of *MATH*.



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

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

$MA = \sqrt{(0-(-7))^2+(4-(-2))^2}$
$= \sqrt{7^2+6^2}$
$= \sqrt{49+36}$
$= \sqrt{85}$

$AT = \sqrt{(9-0)^2+(2-4)^2}$
$= \sqrt{9^2+(-2)^2}$
$= \sqrt{81+4}$
$= \sqrt{85}$

$TH = \sqrt{(2-9)^2+(-4-2)^2}$
$= \sqrt{(-7)^2+(-6)^2}$
$= \sqrt{49+36}$
$= \sqrt{85}$

$MH = \sqrt{(2-(-7))^2+(-4-(-2))^2}$
$= \sqrt{9^2+(-2)^2}$
$= \sqrt{81+4}$
$= \sqrt{85}$

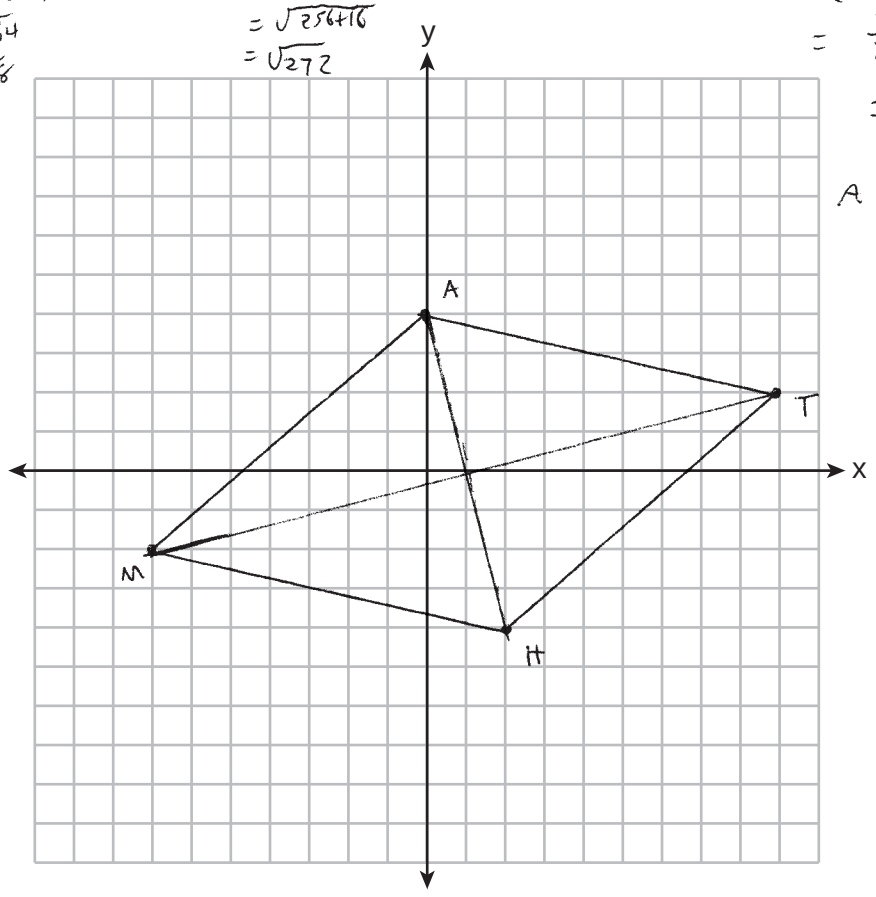
MATH is a rhombus since the opposite sides are $\cong$

Determine and state the area of *MATH*.

$AH = \sqrt{(2-0)^2+(-4-4)^2}$
$= \sqrt{2^2+(-8)^2}$
$= \sqrt{4+64}$
$= \sqrt{68}$

$MT = \sqrt{(9-(-7))^2+(2-(-2))^2}$
$= \sqrt{16^2+4^2}$
$= \sqrt{256+16}$
$= \sqrt{272}$

$A = \frac{1}{2} d_1 \cdot d_2$
$= \frac{1}{2}(\sqrt{68} \cdot \sqrt{272})$
$= \frac{1}{2}\sqrt{18496}$
$= \frac{1}{2}(136)$
$A = 68$



Score 3: The student wrote an incorrect concluding statement when proving the rhombus.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

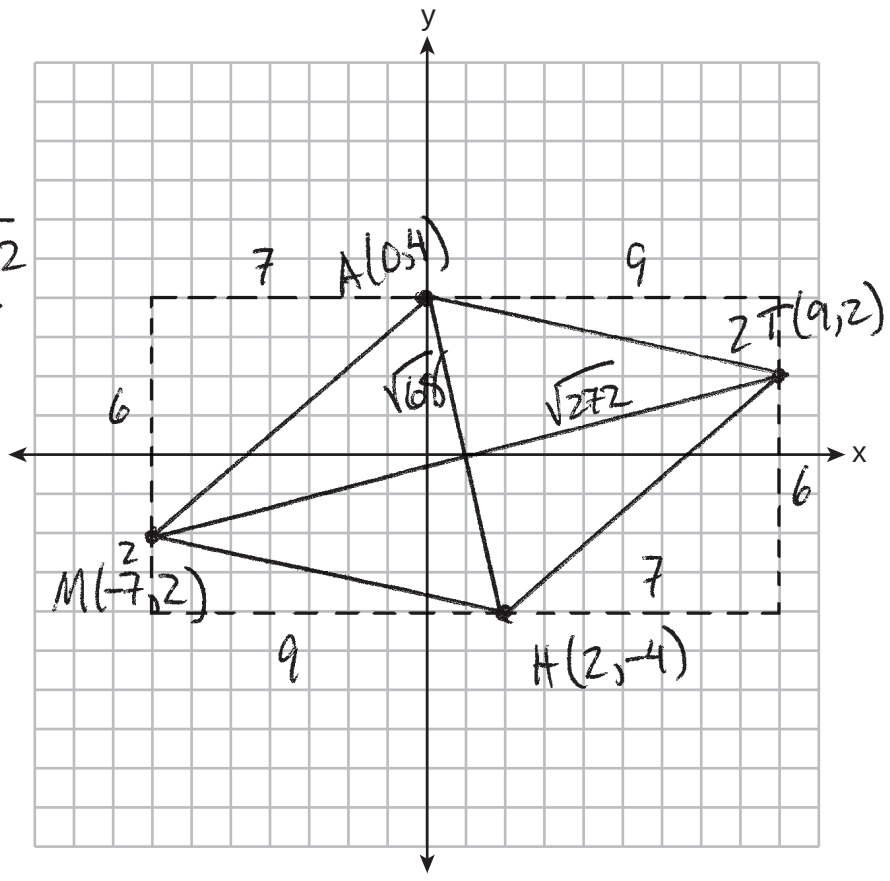
[The use of the set of axes below is optional.]

$d(M,A) = \sqrt{7^2+6^2} = \sqrt{85}$
$d(A,T) = \sqrt{9^2+2^2} = \sqrt{85}$
$d(T,H) = \sqrt{7^2+6^2} = \sqrt{85}$
$d(H,M) = \sqrt{9^2+2^2} = \sqrt{85}$

$d(A,H) = \sqrt{8^2+2^2} = \sqrt{68}$
$d(M,T) = \sqrt{16^2+4^2} = \sqrt{272}$

Determine and state the area of *MATH*.

$A = \frac{1}{2}\sqrt{68} \cdot \sqrt{272}$
$= \frac{1}{2}\sqrt{18496}$
$= 68$



Score 3: The student did not write a concluding statement when proving the rhombus.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

$(a_{AM})^2 = 6^2 + 7^2$

$a^2 = 36 + 49$

$a = \sqrt{85}$

$(a_{AT})^2 = 9^2 + 2^2$

$a^2 = 81 + 4$

$a = \sqrt{85}$

A parallelogram with a pair of consecutive sides equal is a rhombus.

So $\square$ Math is a rhombus

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

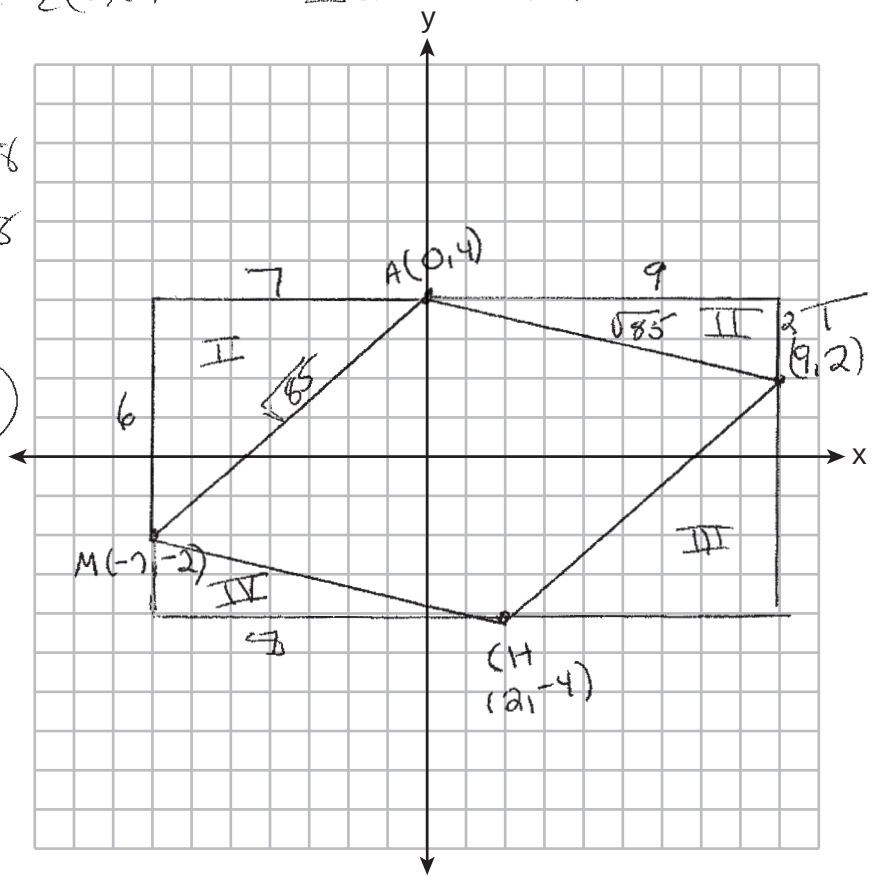
Determine and state the area of *MATH*.

$\triangle I = \frac{1}{2}(6)(7) = 21$

$\triangle II = \frac{1}{2}(2)(9) = 9$

$\triangle IV = \frac{7}{2}(2)(9) = 9$

$\triangle III = \frac{1}{2}(7)(6) = 21$



$\square = 16 \times 8$

$\square = 128$

$128 - (21 + 9 + 8 + 21)$

69

area

Score 3: The student made an error in computing the area of triangle IV.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

$\overline{MA}$ $\sqrt{(-7-0)^2+(-2-4)^2} = \sqrt{85}$

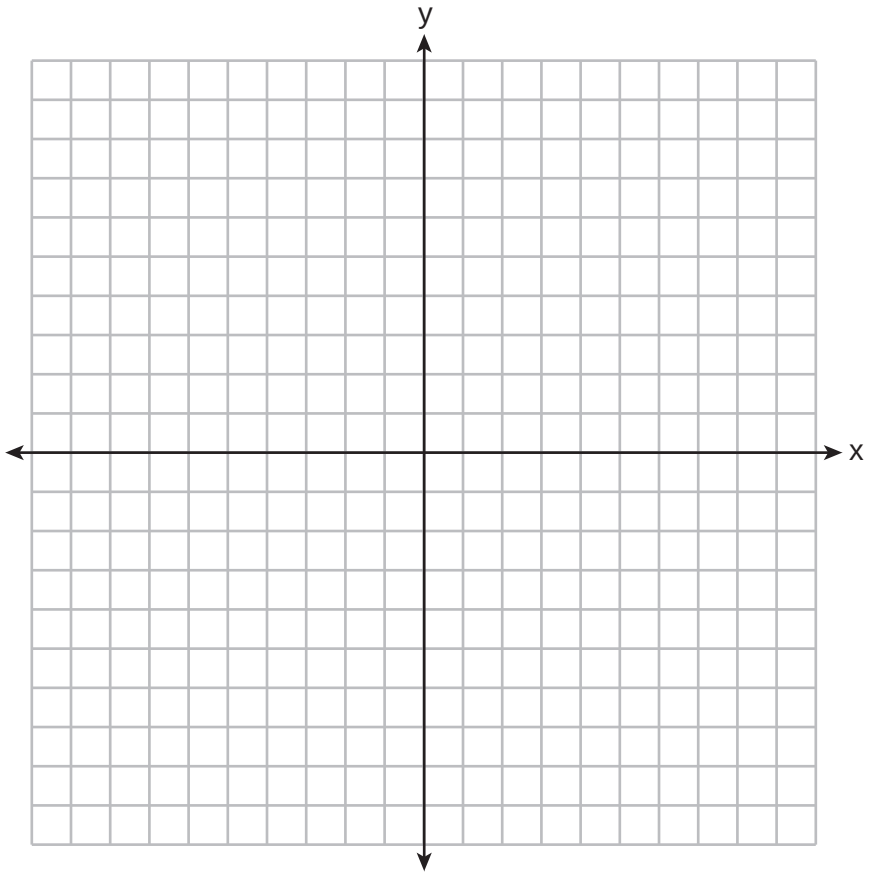
$\overline{AT}$ $\sqrt{(0-9)^2+(4-2)^2} = \sqrt{85}$

$\overline{TH}$ $\sqrt{(9-2)^2+(2--4)^2} = \sqrt{85}$

$\overline{MH}$ $\sqrt{(-7-2)^2+(-2--4)^2} = \sqrt{85}$

☐ Math is a rhombus because all the sides are congruent

Determine and state the area of *MATH*.



Score 2: The student proved parallelogram *MATH* is a rhombus, but no further correct work was shown.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

MATH is a rhombus due to $\overline{MA} \parallel \overline{HT}$ & $\overline{AT} \parallel \overline{MH}$,

Determine and state the area of *MATH*.

$16 \cdot 8 = 128$

$\Delta_1 \frac{1}{2} \cdot 7 \cdot 6 = 21$

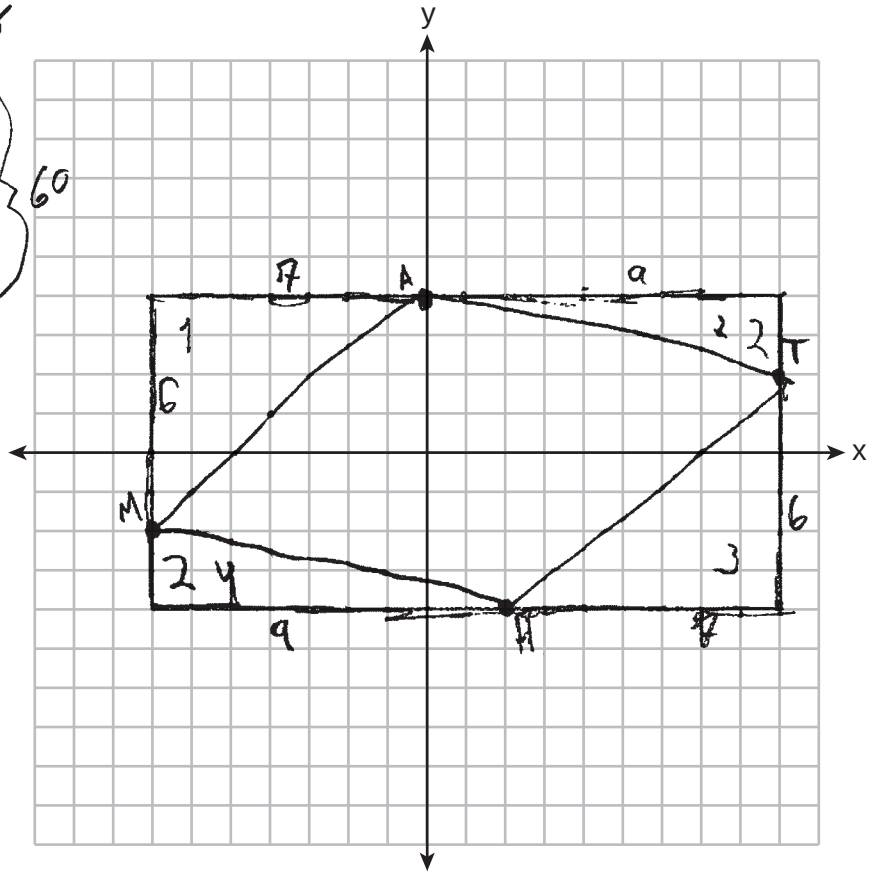
$\Delta_2 \frac{1}{2} \cdot 9 \cdot 2 = 9$

$\Delta_3 \frac{1}{2} \cdot 7 \cdot 6 = 21$

$\Delta_4 \frac{1}{2} \cdot 9 \cdot 2 = 9$

60

$128 - 60 = 68$



Score 2: The student determined the area of *MATH*, but no further correct work was shown.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

slope of $\overline{AH} = \frac{8}{2} \rightarrow -\frac{4}{1}$

slope of $\overline{MT} = \frac{4}{16} \rightarrow \frac{1}{4}$

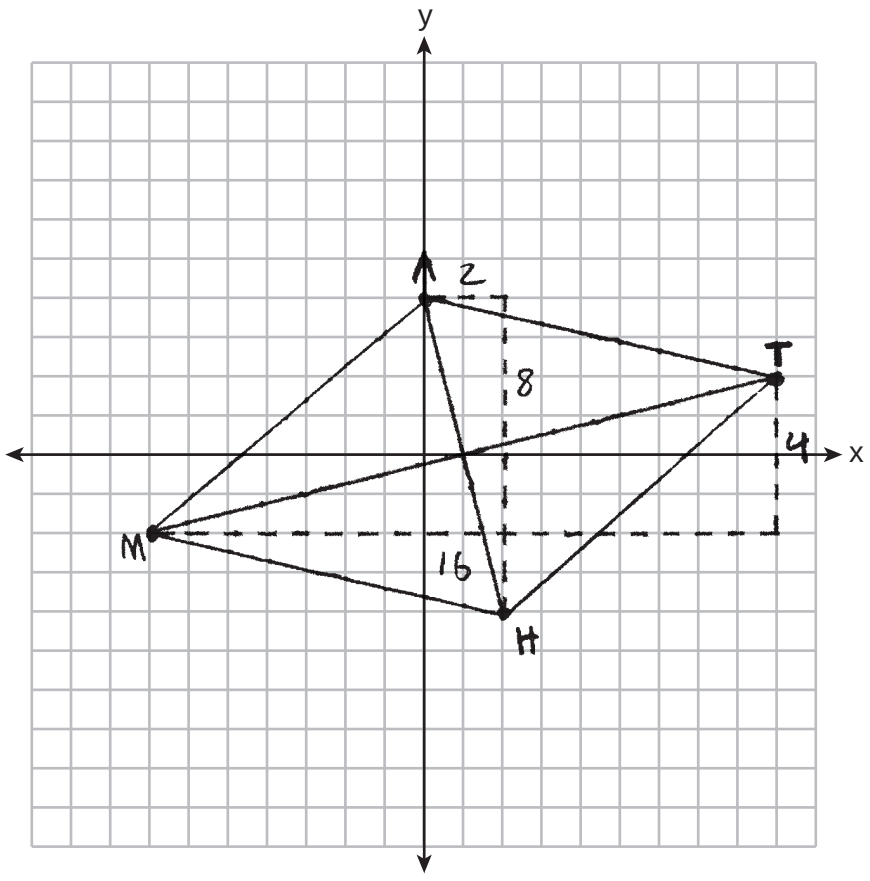
$\overline{AH}$ is perpendicular to $\overline{MT}$ (perpendicular lines have opposite reciprocal slopes)

Parallelogram MATH is a rhombus because its diagonals are perpendicular to each other.

Determine and state the area of *MATH*.

$\frac{8}{2}$

$\frac{4}{16}$ $\frac{1}{4}$



Score 2: The student proved parallelogram *MATH* is a rhombus, but no further correct work was shown.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

Statement	Reasoning
Parallelogram MATH has vertices M(-7, -2), A(0,4), T(9, 2) and H(2, -4)	Given
$\overline{MA} \cong \overline{HT}$ and $\overline{AT} \cong \overline{MH}$	distance formula
MATH is a rhombus	both pairs of opposite sides are congruent

MA $D=\sqrt{(0+7)^2+(4+2)^2}$
$D=\sqrt{(7)^2+(6)^2}$
$D=\sqrt{49+36}$
$D=\sqrt{85}$

HT $D=\sqrt{(2-9)^2+(-4-2)^2}$
$D=\sqrt{(-7)^2+(-6)^2}$
$D=\sqrt{49+36}$
$D=\sqrt{85}$

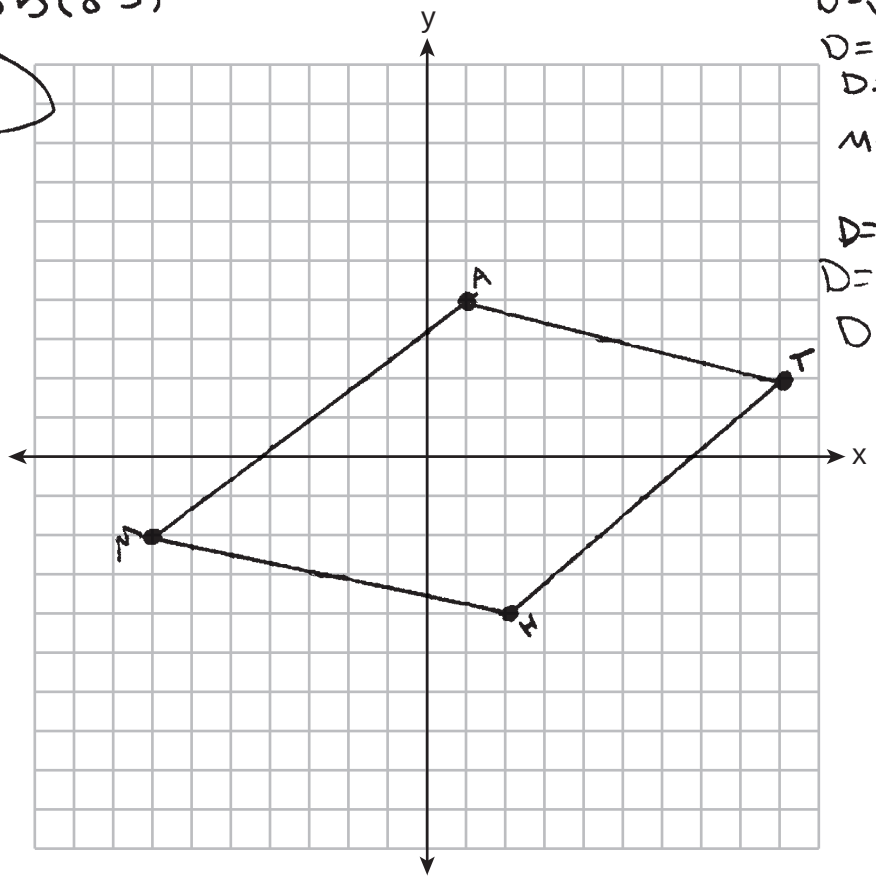
AT $D=\sqrt{(9-0)^2+(2-4)^2}$
$D=\sqrt{(9)^2+(-2)^2}$
$D=\sqrt{(81)+(4)}$
$D=\sqrt{85}$

MH $D=\sqrt{(2+7)^2+(-4+2)^2}$
$D=\sqrt{(9)^2+(-2)^2}$
$D=\sqrt{81+4}$
$D=\sqrt{85}$

Determine and state the area of *MATH*.

$A=85(85)$

$A=7225$



Score 1: The student found the lengths of the sides of *MATH*, but the concluding statement was incorrect. No further correct work was shown.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

$MA = \left(\frac{4--2}{0--7}\right) = \frac{6}{7}$

$AT = \left(\frac{2-4}{9-0}\right) = \frac{-2}{9}$

$TH = \left(\frac{-4-2}{2-9}\right) = \frac{-6}{-7} = \frac{6}{7}$

$MH = \left(\frac{-4--2}{2--7}\right) = \frac{-2}{9}$

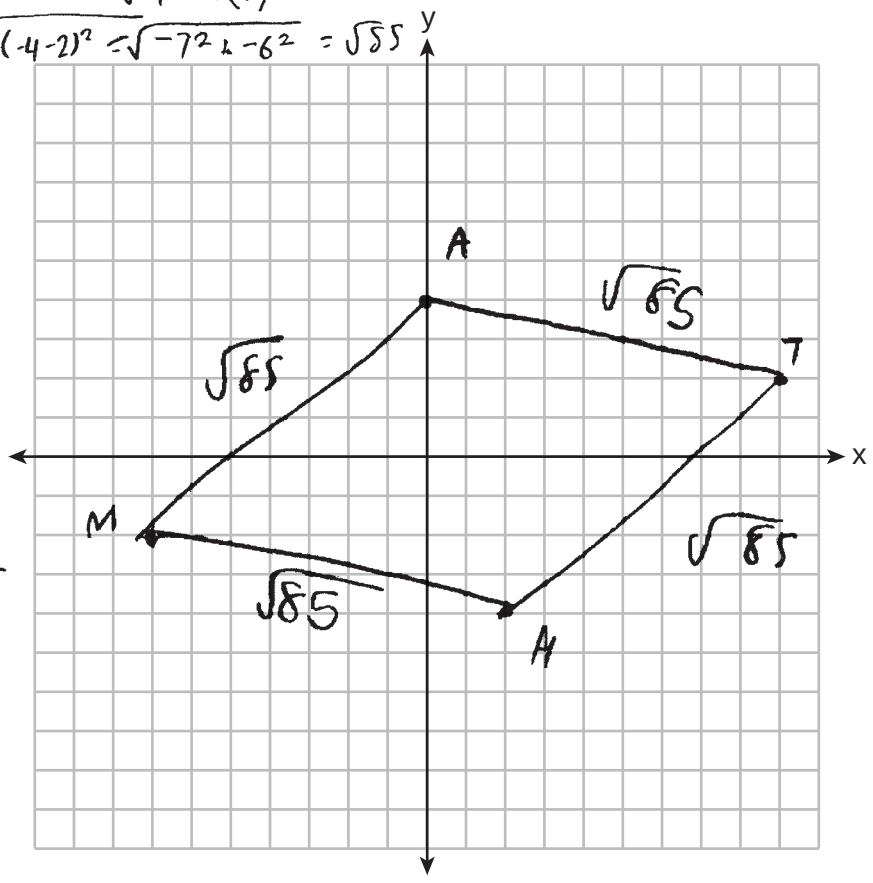
Parallelogram MATH is not a rhombus because the diagonals do not have negative reciprocal slopes

Determine and state the area of *MATH*.

MA $d = \sqrt{(0--7)^2+(4--2)^2} = \sqrt{7^2+6^2} = \sqrt{85}$

AT $d = \sqrt{(9-0)^2+(2-4)^2} = \sqrt{9^2+(-2)^2} = \sqrt{85}$

TH $d = \sqrt{(2-9)^2+(-4-2)^2} = \sqrt{-7^2+-6^2} = \sqrt{85}$



A= 85

Score 1: The student found the length of at least two consecutive sides of *MATH*. No further correct relevant work was shown.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

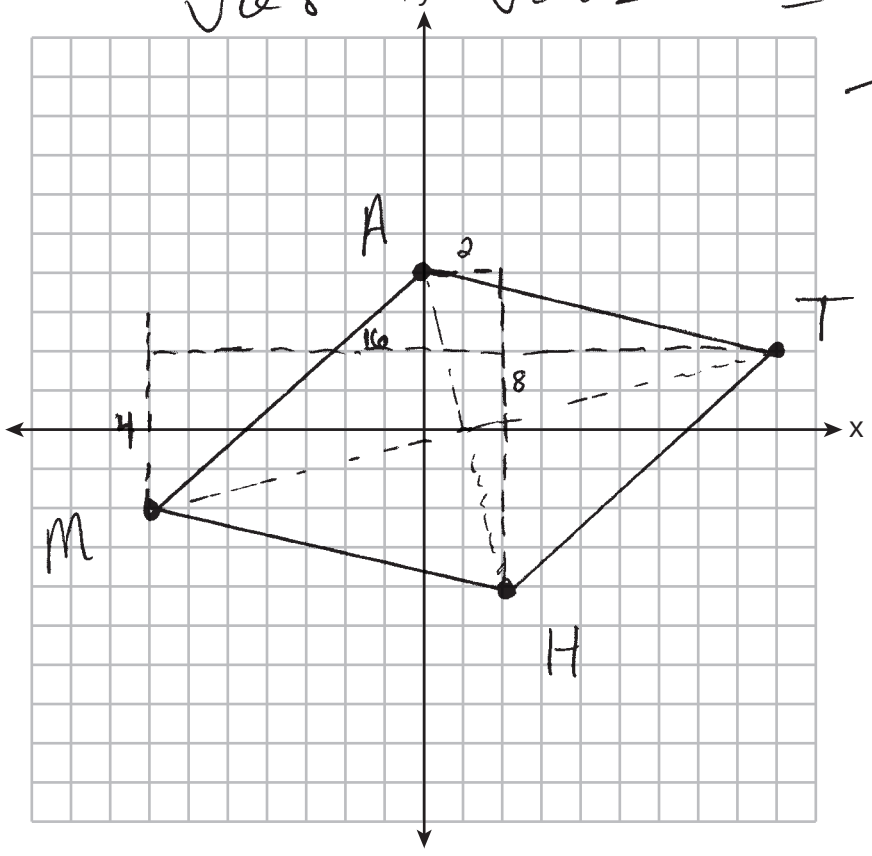
$AH = \sqrt{(8)^2+(2)^2}$ $\quad$ $MT = \sqrt{(16)^2+(4)^2}$

$\sqrt{68}$ $\quad$ $\sqrt{272}$

Determine and state the area of *MATH*.

Area = diagonal × diagonal

$\sqrt{68} \times \sqrt{272} = 136$



Score 1: The student made an error in determining the area of *MATH*. No further correct relevant work was shown.

Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

MA AT TH

$\frac{x_2-x_1}{y_2-y_1}$ $\frac{4-0}{2-4}$ $\frac{2-9}{-4-}$

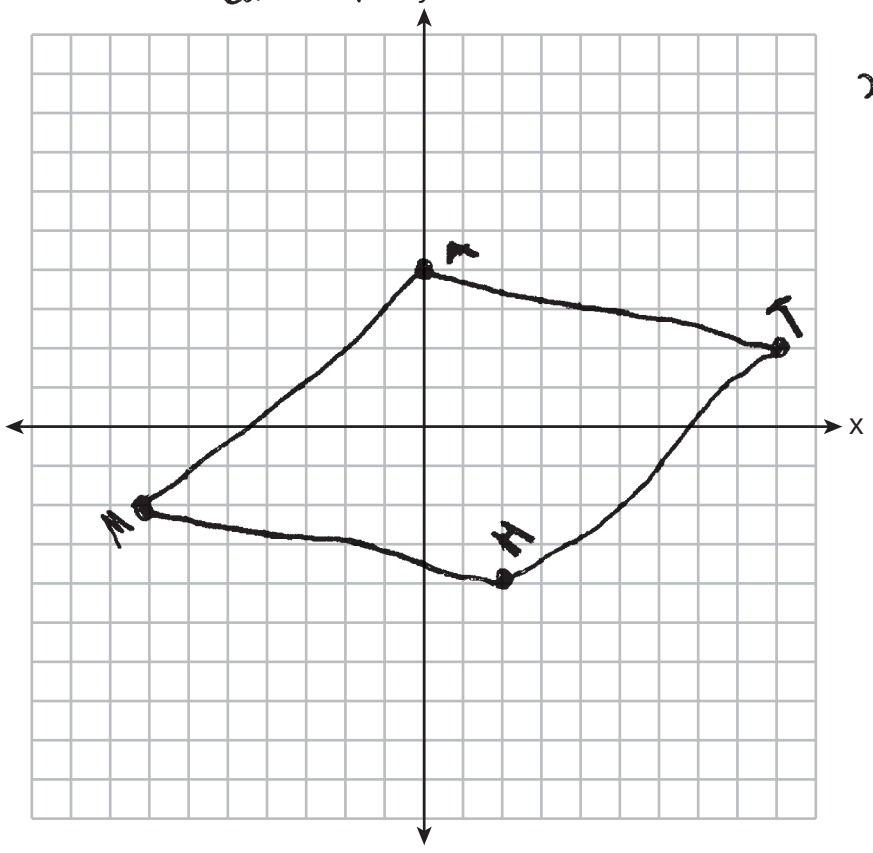
$\frac{9}{2}$ $\frac{-11}{-6}$

Since two angle measures are congruent I know that this is a rhombus

$\frac{0+7}{4+2}$ $\frac{7}{6}$

MH

$\frac{2+7}{-4-2-}$ $\frac{7}{6}$



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

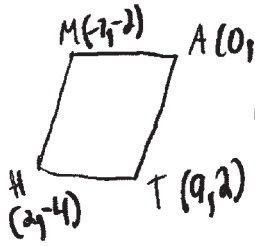
Question 34

34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

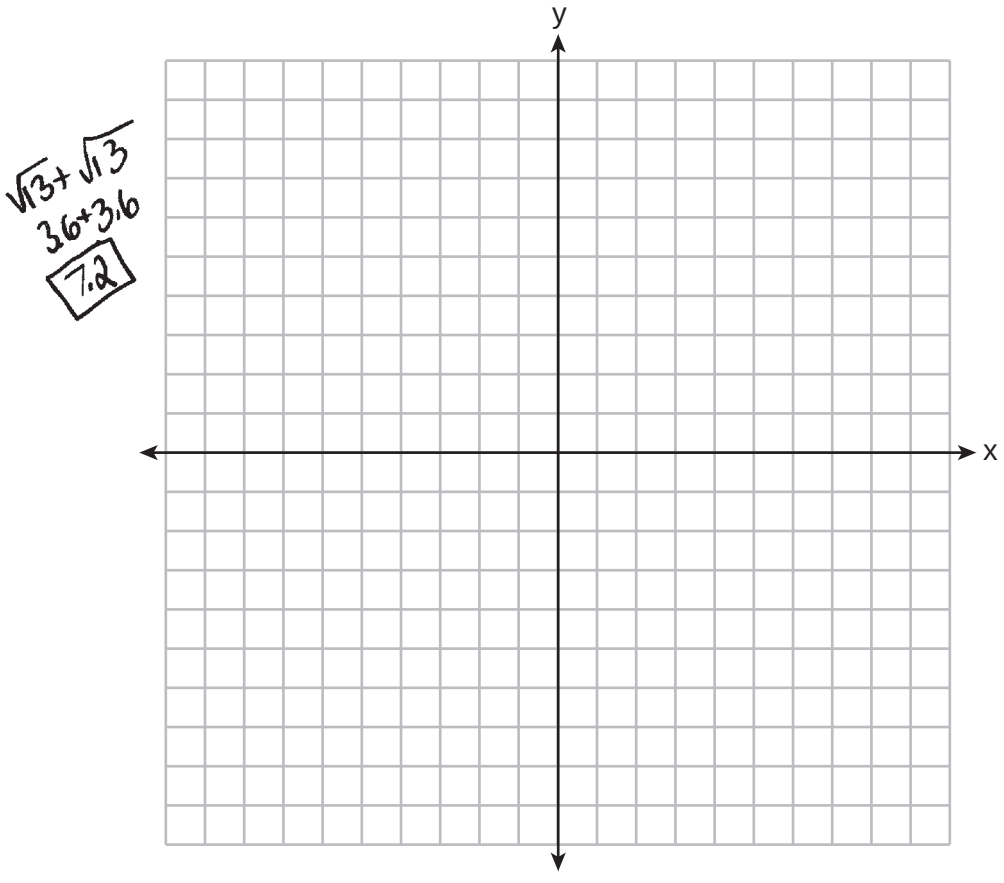
[The use of the set of axes below is optional.]

It has distances of $\sqrt{13}$ which is equal on all sides and rhombuses have equal sides.



$d^2 = \sqrt{(x_2-x_1)+(y_2-2}$
$d^2 = \sqrt{(9-2)+(2+}$
$d^2 = \sqrt{(7)+(}$
$\sqrt{d^2} = \sqrt{13}$
$d = \sqrt{13}$

Determine and state the area of *MATH*.



$\sqrt{13} + \sqrt{13}$
$3.6 + 3.6$
7.2

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

Question 34

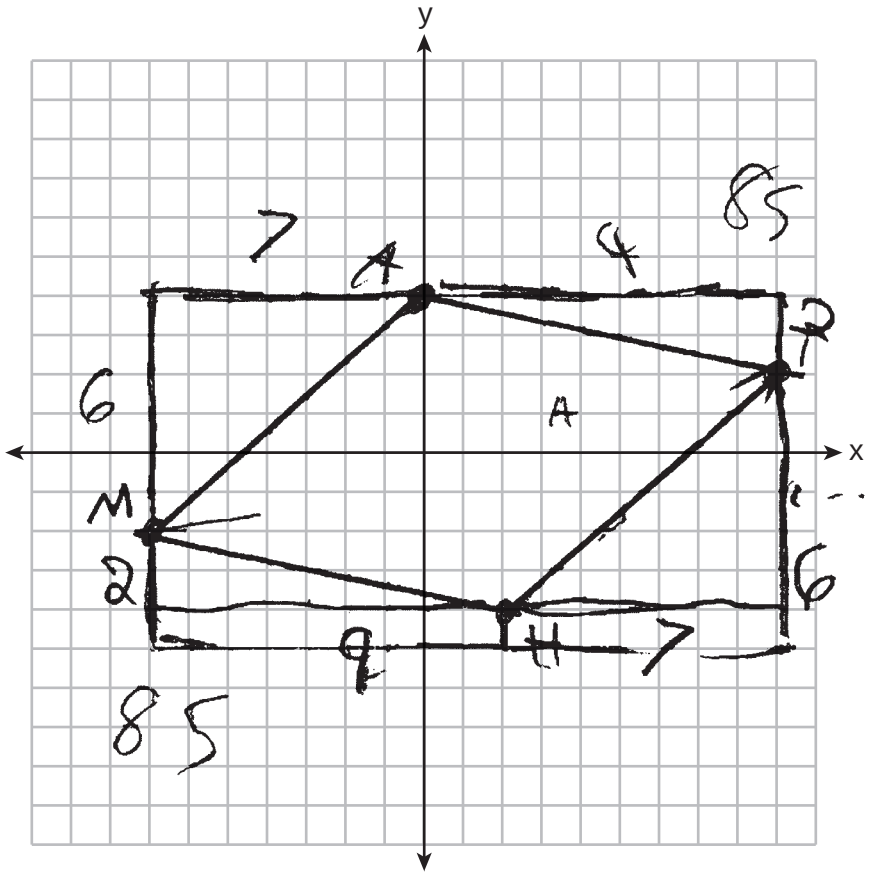
34 Parallelogram *MATH* has vertices $M(-7,-2)$, $A(0,4)$, $T(9,2)$, and $H(2,-4)$.

Prove that parallelogram *MATH* is a rhombus.

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

Parallelogram MATH is a rhombus because all sides are congruent.

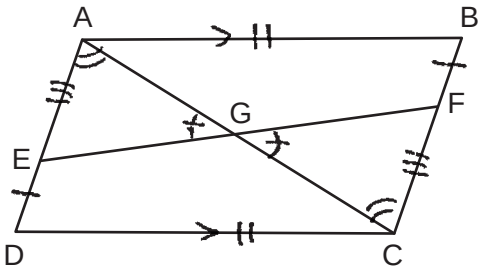
Determine and state the area of *MATH*.



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

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



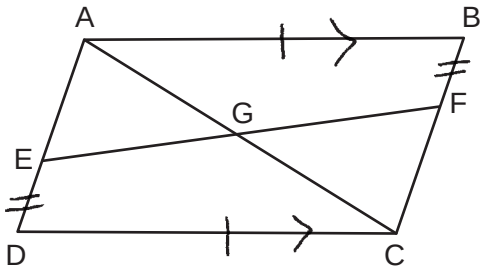
Prove: G is the midpoint of $\overline{EF}$

STATEMENT	REASONS
1. quadrilateral ABCD $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$	1. Given
2. ABCD is a parallelogram	2. If a quadrilateral has a pair of opposite sides that are parallel and congruent then it is a parallelogram
3. $\overline{DE} \cong \overline{BF}$	3. Given
4. $\overline{AD} \cong \overline{CB}$	4. Opposite sides of a parallelogram are congruent
5. $\overline{AE} \cong \overline{CF}$	5. Subtraction Postulate
6. $\overline{AD} \parallel \overline{CB}$	6. Opposite sides of a parallelogram are parallel
7. $\angle EAG \cong \angle FCG$	7. If two parallel lines are cut by a transversal, then the alternate interior angles are congruent
8. $\angle AGE \cong \angle CGF$	8. If two lines intersect, they form vertical angles that are congruent
9. $\triangle AEG \cong \triangle CFG$	9. AAS Postulate
10. $\overline{EG} \cong \overline{FG}$	10. CPCTC
11. G is the midpoint of $\overline{EF}$	11. If a point divides a segment into two congruent segments then it is the midpoint of the segment

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

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



Prove: G is the midpoint of $\overline{EF}$

Since quad. ABCD has one set of opposite sides $\cong$ and $\parallel$, it is a parallelogram. Then $\overline{AD} \cong \overline{BC}$ and $\overline{AD} \parallel \overline{BC}$ b/c opposite sides of a p-gram are $\cong$ and $\parallel$.

Since $\overline{AD} \cong \overline{BC}$ and $\overline{ED} \cong \overline{BF}$ (given), $\overline{AE} \cong \overline{CF}$ by the Subtraction property.

Since $\overline{AD} \parallel \overline{BC}$, transversals $\overline{AC}$ and $\overline{EF}$ will make $\cong$ alternate interior angles, so $\angle EAG \cong \angle FCG$ and $\angle AEG \cong \angle CFG$.

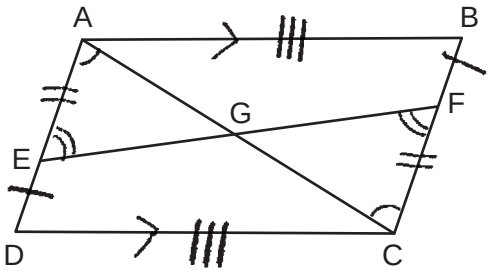
Therefore $\triangle AEG \cong \triangle CFG$ by ASA $\cong$.

Then $\overline{EG} \cong \overline{FG}$ by CPCTC. So, since G is a point on $\overline{EF}$ and is dividing it into 2 $\cong$ parts, G must be a midpoint.

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

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



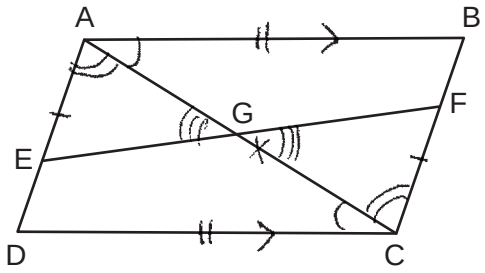
Prove: G is the midpoint of $\overline{EF}$

Statement	Reason
1. Quadrilateral ABCD, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, and $\overline{DE} \cong \overline{BF}$	1. Given
2. Quadrilateral ABCD is a parallelogram	2. If a set of opposite sides of a quadrilateral are $\cong$ and $\parallel$ it is a parallelogram
3. $\overline{AD}$ is $\parallel$ and $\cong$ to $\overline{CB}$	3. Opposite sides of a parallelogram are $\cong$ and $\parallel$.
4. $\angle EAG \cong \angle FCG$ $\angle AEG \cong \angle CFG$	4. When lines are $\parallel$ Alt. interior $\angle$'s are $\cong$
5. $\overline{AD} - \overline{ED} \cong \overline{CB} - \overline{FB}$ or $\overline{AE} \cong \overline{CF}$	5. Subtraction
6. $\triangle AEG \cong \triangle CFG$	6. ASA $\cong$
7. $\overline{EG} \cong \overline{FG}$	7. CPCTC
8. G is the midpoint of $\overline{EF}$	8. If a point splits a segment into two $\cong$ segments, it is a midpoint.

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

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



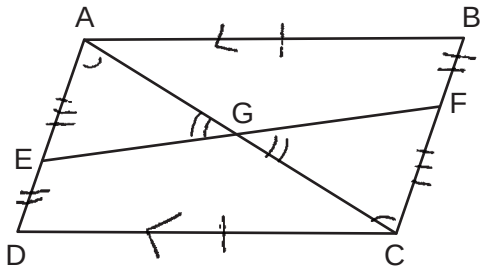
Prove: G is the midpoint of $\overline{EF}$

1. Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, $\overline{DE} \cong \overline{BF}$	1. Given
2. $\angle BAC \cong \angle DCA$	2. If 2 parallel lines are cut by a transversal, the alternate interior angles are $\cong$.
3. $\overline{AC} \cong \overline{AC}$	3. Reflexive
4. $\triangle ABC \cong \triangle CDA$	4. SAS $\cong$ SAS
5. $\angle EAG \cong \angle FCG$, $\overline{AD} \cong \overline{BC}$	5. CPCTC
6. $\overline{AD} - \overline{DE} \cong \overline{BC} - \overline{BF}$ or $\overline{AE} \cong \overline{FC}$	6. Subtraction
7. $\angle AGE \cong \angle CGF$	7. Vertical $\angle$'s are $\cong$.
8. $\triangle AGE \cong \triangle CGF$	8. AAS $\cong$ AAS
9. $\overline{EG} \cong \overline{FG}$	9. CPCTC

Score 5: The student had a missing concluding statement and reason after step 9.

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



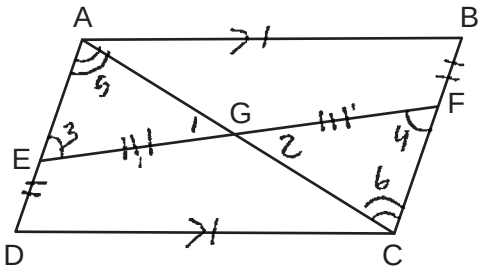
Prove: G is the midpoint of $\overline{EF}$

1. Quadrilateral ABCD, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, and $\overline{DE} \cong \overline{BF}$	1. Given
2. Quadrilateral ABCD is a parallelogram	2. When one pair of opposite sides is congruent and parallel, a quadrilateral is a parallelogram.
3. $\angle AGE \cong \angle FGC$	3. Vertical angles are congruent.
4. $\overline{AD} - \overline{ED} \cong \overline{BC} - \overline{BF}$ or $\overline{AE} \cong \overline{FC}$	4. Subtraction postulate
5. $\angle EAG \cong \angle FCG$	5. When lines are parallel, alternate interior angles are congruent.
6. $\triangle AEG \cong \triangle CFG$	6. AAS $\cong$ AAS
7. $\overline{EG} \cong \overline{FG}$	7. CPCTC
8. G is the midpoint of $\overline{EF}$	8. When two segments on a line segment are congruent, the point intersecting them is the midpoint.

Score 4: The student had a missing statement and reason to prove step 4 and a missing statement and reason to prove step 5.

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



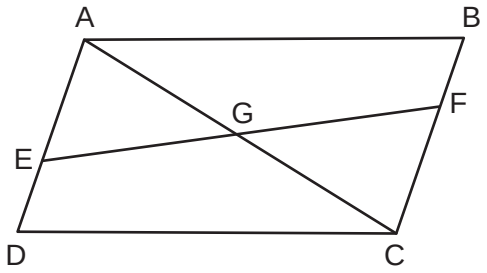
Prove: G is the midpoint of $\overline{EF}$

S	R
1) Quad ABCD, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, $\overline{DE} \cong \overline{BF}$	1) Given
2) $\angle 1 \cong \angle 2$	2) Vert. $\angle$s $\cong$
3) ABCD is a parallelogram	3) If opposite sides $\cong$ and $\parallel$, then the quad is a parallelogram.
4) $\overline{DA} \parallel \overline{CB}$	4) A parallelogram has opp sides parallel
5) $\angle 3 \cong \angle 4$, $\angle 5 \cong \angle 6$	5) when two lines are cut by a transversal, alt. int. $\angle$s $\cong$
6) $\triangle EAG \cong \triangle FCG$	6) AAA
7) $\overline{EG} \cong \overline{GF}$	7) CPCTC
8) G is midpoint of $\overline{EF}$	8) if G cuts $\overline{EF}$ into two equal parts it is a midpoint.

Score 4: The student made a conceptual error in proving $\triangle EAG \cong \triangle FCG$.

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



Prove: G is the midpoint of $\overline{EF}$

Statements

1) Quad $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, $\overline{DE} \cong \overline{BF}$
2) Quad $ABCD$ is a $\square$
3) $\overline{AD} - \overline{ED} \cong \overline{BC} - \overline{BF}$ $\overline{AE} \cong \overline{FC}$
4) $\overline{AD} \parallel \overline{BC}$
5) $\angle EAG \cong \angle FCG$ $\angle AEG \cong \angle CFG$
6) $\triangle AGE \cong \triangle CGF$
7) $\overline{EG} \cong \overline{FG}$

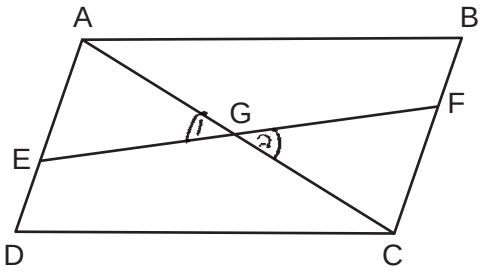
Reasons

1) Given
2) when one pr of opp sides is $\parallel$ and $\cong$, a Quad is a $\square$
3) Subtraction Post.
4) A $\square$ has opp sides $\parallel$
5) alt int $\angle$'s are $\cong$
6) ASA
7) CPCTC

Score 3: The student had a missing statement and reason to prove step 3, an incomplete reason in step 5, and a missing concluding statement and reason after step 7.

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



Prove: G is the midpoint of $\overline{EF}$

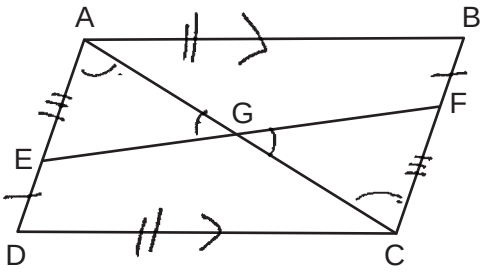
Quadrilateral ABCD

1. $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$	1. Given
2. Quadrilateral ABCD is a parallelogram	2. A quad with one pair of opp sides $\cong$ + $\parallel$ is a parallelogram
3. $\angle 1$ and $\angle 2$ are $\cong$	3. vert. $\angle$s $\cong$
4. $\angle EAG \cong \angle GCF$ $\angle AEG \cong \angle CFG$	4. If 2 lines are parallel, then alt. int $\angle$s are $\cong$.
5. $\triangle AEG \cong \triangle CFG$	5. AAA~
6. G is the midpoint of $\overline{EF}$	6. CPCTC

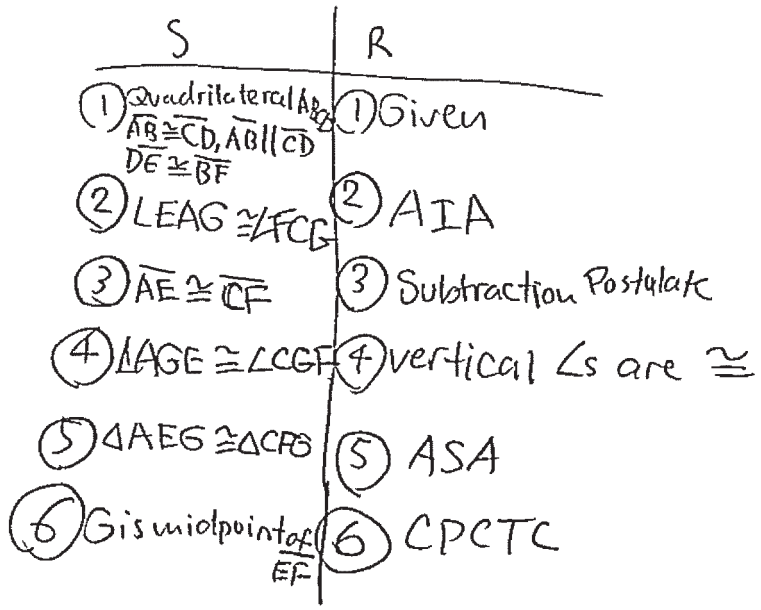
Score 2: The student made some correct relevant statements and reasons about the proof.

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



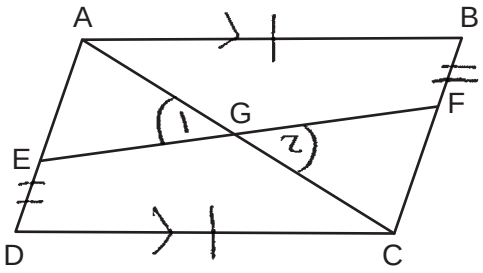
Prove: G is the midpoint of $\overline{EF}$



Score 1: The student had only one correct relevant statement and reason in step 4.

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



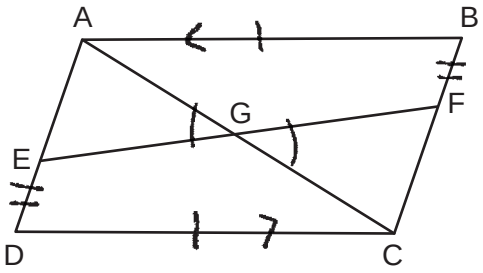
Prove: G is the midpoint of $\overline{EF}$

S	R
$\overline{AB} \cong \overline{CD}$ $\overline{AB} \parallel \overline{CD}$ $\overline{DE} \cong \overline{BF}$	Given
$\angle 1 \cong \angle 2$	vertical $\angle$s are $\cong$

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

Question 35

35 Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$



Prove: G is the midpoint of $\overline{EF}$

Statements	Reasons
1) Quad ABCD, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, and $\overline{DE} \cong \overline{BF}$	1) Given
2) $\angle G \cong \angle G$	2) Reflexive prop
3)	3)

Score 0: The student had a completely incorrect response.

The State Education Department / The University of the State of New York

Regents Examination in Geometry – June 2023

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

(Use for the June 2023 exam only.)

Raw Score	Scale Score	Performance Level
80	**100**	5
79	**99**	5
78	**97**	5
77	**96**	5
76	**95**	5
75	**94**	5
74	**93**	5
73	**92**	5
72	**92**	5
71	**91**	5
70	**90**	5
69	**89**	5
68	**88**	5
67	**88**	5
66	**87**	5
65	**86**	5
64	**86**	5
63	**85**	5
62	**84**	4
61	**84**	4
60	**83**	4
59	**83**	4
58	**82**	4
57	**82**	4
56	**81**	4
55	**81**	4
54	**80**	4

Raw Score	Scale Score	Performance Level
53	**80**	4
52	**79**	3
51	**79**	3
50	**78**	3
49	**78**	3
48	**77**	3
47	**77**	3
46	**76**	3
45	**76**	3
44	**75**	3
43	**74**	3
42	**74**	3
41	**73**	3
40	**73**	3
39	**72**	3
38	**71**	3
37	**71**	3
36	**70**	3
35	**69**	3
34	**69**	3
33	**68**	3
32	**67**	3
31	**66**	3
30	**65**	3
29	**64**	2
28	**63**	2
27	**62**	2

Raw Score	Scale Score	Performance Level
26	**61**	2
25	**60**	2
24	**58**	2
23	**57**	2
22	**55**	2
21	**54**	1
20	**52**	1
19	**51**	1
18	**49**	1
17	**47**	1
16	**45**	1
15	**43**	1
14	**41**	1
13	**39**	1
12	**36**	1
11	**34**	1
10	**31**	1
9	**29**	1
8	**26**	1
7	**23**	1
6	**20**	1
5	**17**	1
4	**14**	1
3	**11**	1
2	**7**	1
1	**4**	1
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.