The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY (Common Core)

Thursday, January 28, 2016 — 9:15 a.m. to 12:15 p.m., only

Student Name: _____

School Name: _____

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Print your name and the name of your school on the lines above.

A separate answer sheet for Part I has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 36 questions. You must answer all questions in this examination. Record your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in Parts II, III, and IV directly in this booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale.

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

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

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

Notice...
A graphing calculator, a straightedge (ruler), and a compass must be available for you to use while taking this examination.
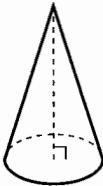
**DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.**

Answer all 24 questions in this part. Each correct answer will receive 2 credits. 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. [48]

**Use this space for computations.**

1 William is drawing pictures of cross sections of the right circular cone below.

Which drawing can *not* be a cross section of a cone?

    (1)

    (3)

    (2)

    (4)
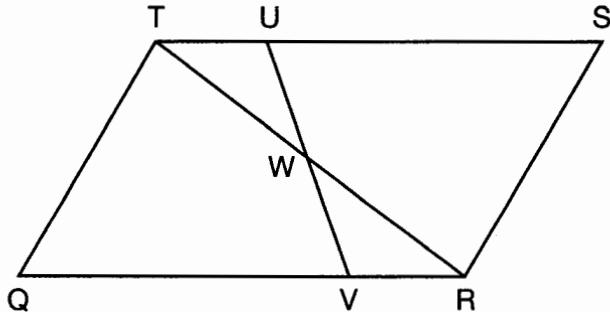
2 An equation of a line perpendicular to the line represented by the equation $y = -\frac{1}{2}x - 5$ and passing through $(6, -4)$ is

(1) $y = -\frac{1}{2}x + 4$ (3) $y = 2x + 14$

(2) $y = -\frac{1}{2}x - 1$ (4) $y = 2x - 16$

3 In parallelogram *QRST* shown below, diagonal $\overline{TR}$ is drawn, *U* and *V* are points on $\overline{TS}$ and $\overline{QR}$, respectively, and $\overline{UV}$ intersects $\overline{TR}$ at *W*.


If m∠*S* = 60°, m∠*SRT* = 83°, and m∠*TWU* = 35°, what is m∠*WVQ?*
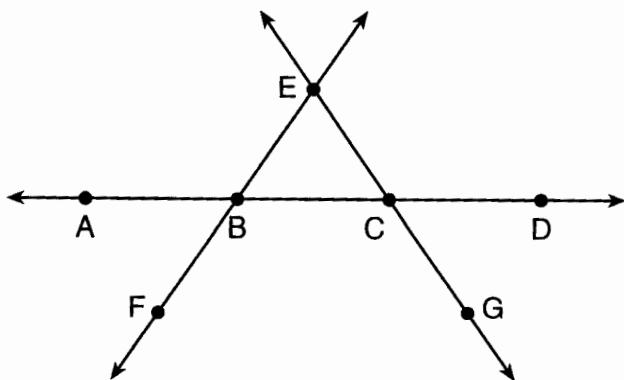
(1) 37°   (3) 72°

(2) 60°   (4) 83°

4 A fish tank in the shape of a rectangular prism has dimensions of 14 inches, 16 inches, and 10 inches. The tank contains 1680 cubic inches of water. What percent of the fish tank is empty?

(1) 10   (3) 50

(2) 25   (4) 75

5 Which transformation would result in the perimeter of a triangle being different from the perimeter of its image?

(1) $(x,y) \rightarrow (y,x)$ (3) $(x,y) \rightarrow (4x,4y)$

(2) $(x,y) \rightarrow (x,-y)$ (4) $(x,y) \rightarrow (x + 2,y - 5)$

6 In the diagram below, $\overleftrightarrow{FE}$ bisects $\overline{AC}$ at B, and $\overleftrightarrow{GE}$ bisects $\overline{BD}$ at C.


Which statement is always true?

(1) $\overline{AB} \cong \overline{DC}$

(2) $\overline{FB} \cong \overline{EB}$

(3) $\overleftrightarrow{BD}$ bisects $\overline{GE}$ at C.

(4) $\overleftrightarrow{AC}$ bisects $\overline{FE}$ at B.

7 As shown in the diagram below, a regular pyramid has a square base whose side measures 6 inches.


6 in
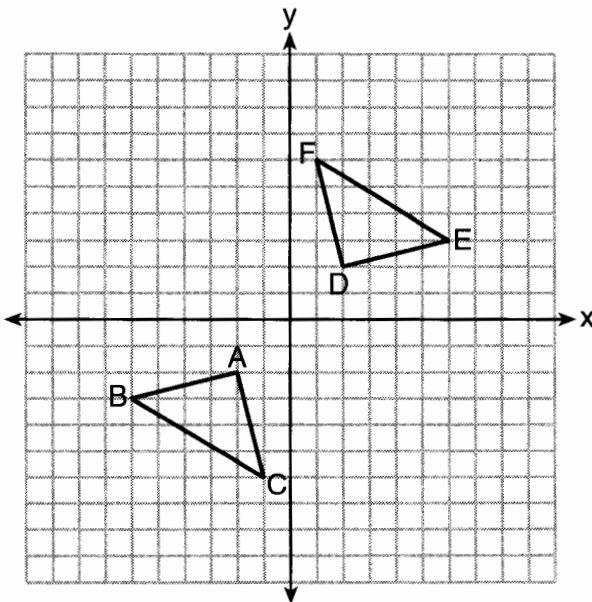
If the altitude of the pyramid measures 12 inches, its volume, in cubic inches, is

(1) 72

(2) 144

(3) 288

(4) 432

8 Triangle *ABC* and triangle *DEF* are graphed on the set of axes below.

Which sequence of transformations maps triangle *ABC* onto triangle *DEF*?

(1) a reflection over the *x*-axis followed by a reflection over the *y*-axis

(2) a 180° rotation about the origin followed by a reflection over the line $y = x$

(3) a 90° clockwise rotation about the origin followed by a reflection over the *y*-axis

(4) a translation 8 units to the right and 1 unit up followed by a 90° counterclockwise rotation about the origin

9 In $\triangle ABC$, the complement of $\angle B$ is $\angle A$. Which statement is always true?

(1) $\tan \angle A = \tan \angle B$ (3) $\cos \angle A = \tan \angle B$

(2) $\sin \angle A = \sin \angle B$ (4) $\sin \angle A = \cos \angle B$

10 A line that passes through the points whose coordinates are $(1,1)$ and $(5,7)$ is dilated by a scale factor of 3 and centered at the origin. The image of the line

(1) is perpendicular to the original line

(2) is parallel to the original line

(3) passes through the origin

(4) is the original line

**11** Quadrilateral $ABCD$ is graphed on the set of axes below.
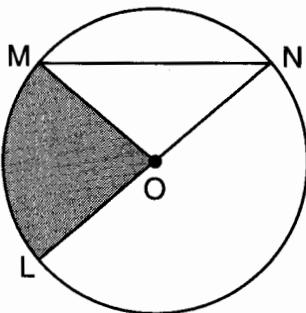
When $ABCD$ is rotated $90°$ in a counterclockwise direction about the origin, its image is quadrilateral $A'B'C'D'$. Is distance preserved under this rotation, and which coordinates are correct for the given vertex?

(1) no and $C'(1,2)$ (3) yes and $A'(6,2)$

(2) no and $D'(2,4)$ (4) yes and $B'(-3,4)$

12 In the diagram below of circle O, the area of the shaded sector LOM is 2π cm^2.
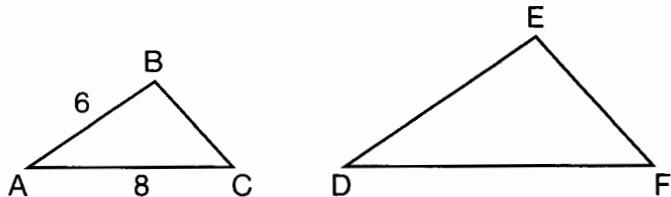
If the length of $\overline{NL}$ is 6 cm, what is m$\angle N$?

(1) 10°   (3) 40°

(2) 20°   (4) 80°

13 In the diagram below, $\triangle ABC \sim \triangle DEF$.

If $AB = 6$ and $AC = 8$, which statement will justify similarity by SAS?
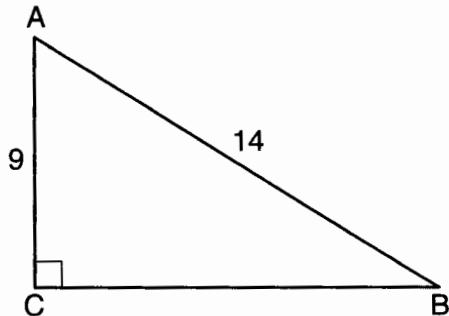
(1) $DE = 9$, $DF = 12$, and $\angle A \cong \angle D$

(2) $DE = 8$, $DF = 10$, and $\angle A \cong \angle D$

(3) $DE = 36$, $DF = 64$, and $\angle C \cong \angle F$

(4) $DE = 15$, $DF = 20$, and $\angle C \cong \angle F$

14 The diameter of a basketball is approximately 9.5 inches and the diameter of a tennis ball is approximately 2.5 inches. The volume of the basketball is about how many times greater than the volume of the tennis ball?

(1) 3591   (3) 55

(2) 65   (4) 4

15 The endpoints of one side of a regular pentagon are $(-1,4)$ and $(2,3)$. What is the perimeter of the pentagon?

(1) $\sqrt{10}$ (3) $5\sqrt{2}$

(2) $5\sqrt{10}$ (4) $25\sqrt{2}$

16 In the diagram of right triangle ABC shown below, $AB = 14$ and $AC = 9$.

What is the measure of $\angle A$, to the *nearest degree*?

(1) 33   (3) 50

(2) 40   (4) 57

17 What are the coordinates of the center and length of the radius of the circle whose equation is $x^2 + 6x + y^2 - 4y = 23$?

(1) $(3,-2)$ and 36   (3) $(-3,2)$ and 36

(2) $(3,-2)$ and 6   (4) $(-3,2)$ and 6

18 The coordinates of the vertices of $\triangle RST$ are $R(-2,-3)$, $S(8,2)$, and $T(4,5)$. Which type of triangle is $\triangle RST$?

(1) right   (3) obtuse

(2) acute   (4) equiangular
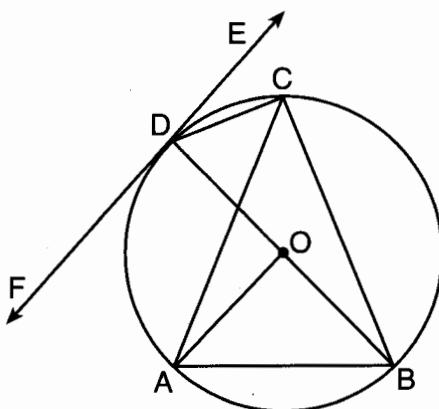
19 Molly wishes to make a lawn ornament in the form of a solid sphere. The clay being used to make the sphere weighs .075 pound per cubic inch. If the sphere's radius is 4 inches, what is the weight of the sphere, to the *nearest pound*?

(1) 34   (3) 15

(2) 20   (4) 4

20 The ratio of similarity of $\triangle BOY$ to $\triangle GRL$ is 1:2. If $BO = x + 3$ and $GR = 3x - 1$, then the length of $\overline{GR}$ is

(1) 5   (3) 10

(2) 7   (4) 20
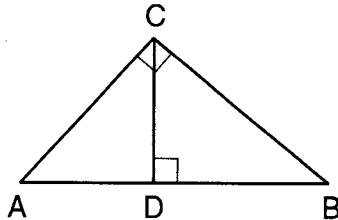
21 In the diagram below, $\overline{DC}$, $\overline{AC}$, $\overline{DOB}$, $\overline{CB}$, and $\overline{AB}$ are chords of circle O, $\overleftrightarrow{FDE}$ is tangent at point D, and radius $\overline{AO}$ is drawn. Sam decides to apply this theorem to the diagram: "An angle inscribed in a semi-circle is a right angle."


Which angle is Sam referring to?

(1) $\angle AOB$ (3) $\angle DCB$

(2) $\angle BAC$ (4) $\angle FDB$

22 In the diagram below, $\overline{CD}$ is the altitude drawn to the hypotenuse $\overline{AB}$ of right triangle ABC.
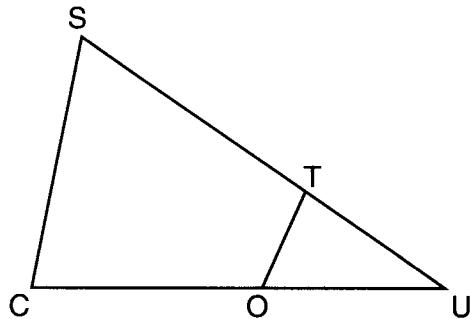
Which lengths would *not* produce an altitude that measures $6\sqrt{2}$?

(1) $AD = 2$ and $DB = 36$ (3) $AD = 6$ and $DB = 12$

(2) $AD = 3$ and $AB = 24$ (4) $AD = 8$ and $AB = 17$

23 A designer needs to create perfectly circular necklaces. The necklaces each need to have a radius of 10 cm. What is the largest number of necklaces that can be made from 1000 cm of wire?

(1) 15   (3) 31

(2) 16   (4) 32

24 In $\triangle SCU$ shown below, points T and O are on $\overline{SU}$ and $\overline{CU}$, respectively. Segment OT is drawn so that $\angle C \cong \angle OTU$.
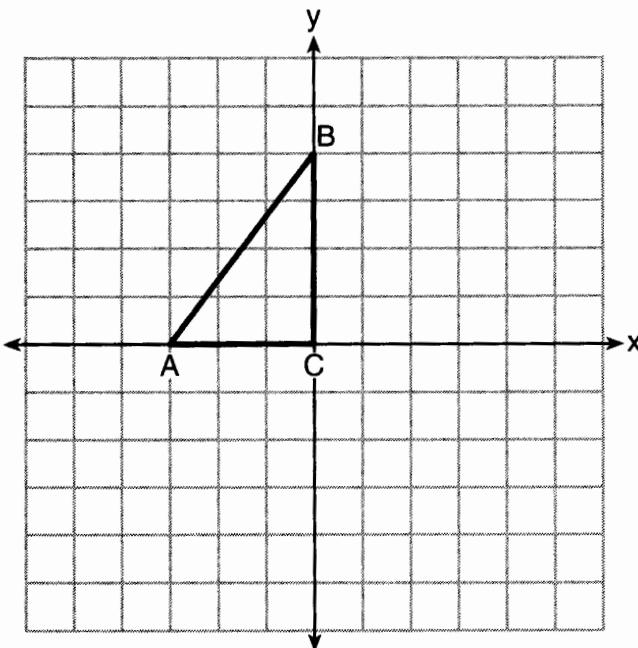

If $TU = 4$, $OU = 5$, and $OC = 7$, what is the length of $\overline{ST}$?

(1) 5.6   (3) 11

(2) 8.75   (4) 15
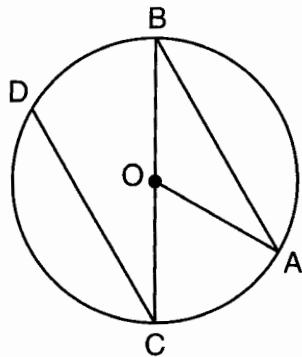
Answer all **7** questions in this part. Each correct answer will receive **2** credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are 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 Triangle *ABC* is graphed on the set of axes below. Graph and label △*A′B′C′*, the image of △*ABC* after a reflection over the line $x = 1$.
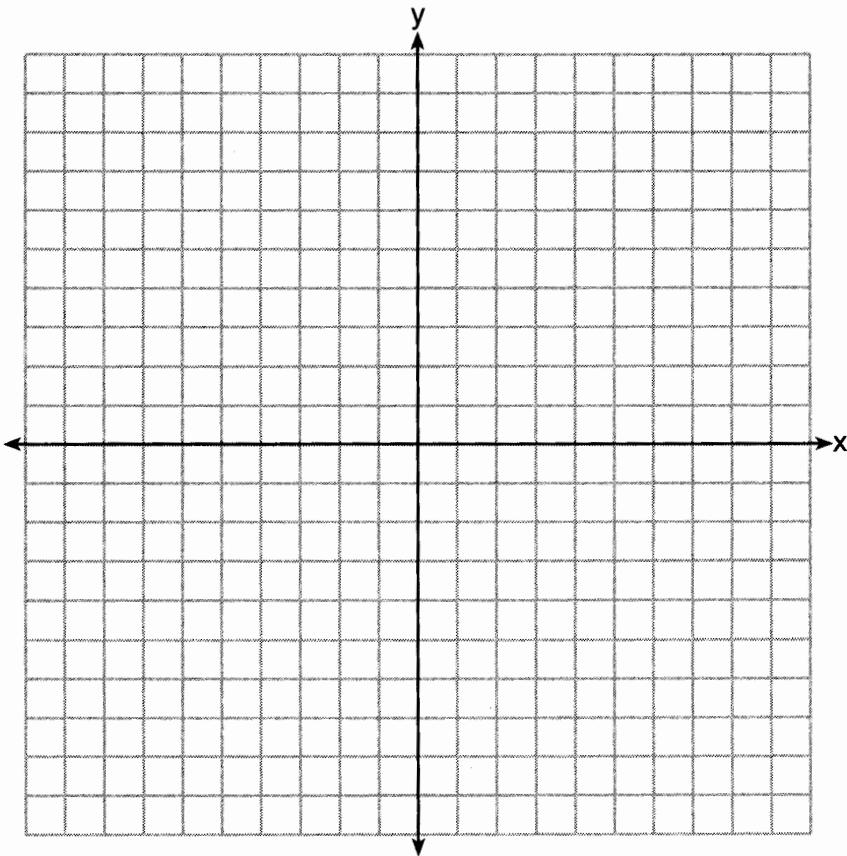
26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.
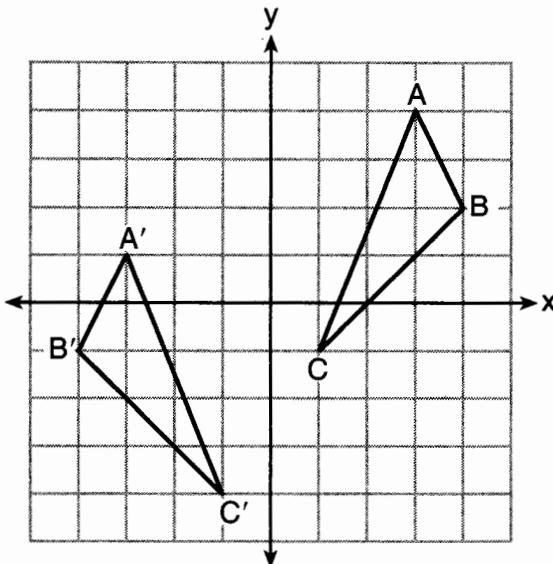


If m∠BCD = 30°, determine and state m∠AOB.

27 Directed line segment *PT* has endpoints whose coordinates are $P(-2,1)$ and $T(4,7)$. Determine the coordinates of point *J* that divides the segment in the ratio 2 to 1.

[The use of the set of axes below is optional.]
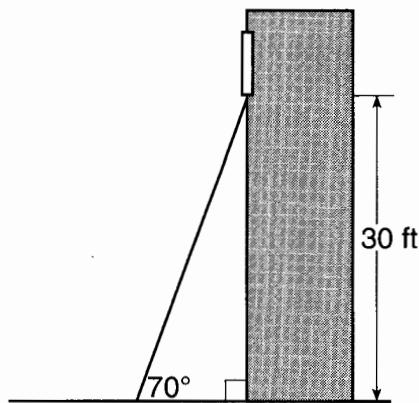
28 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.
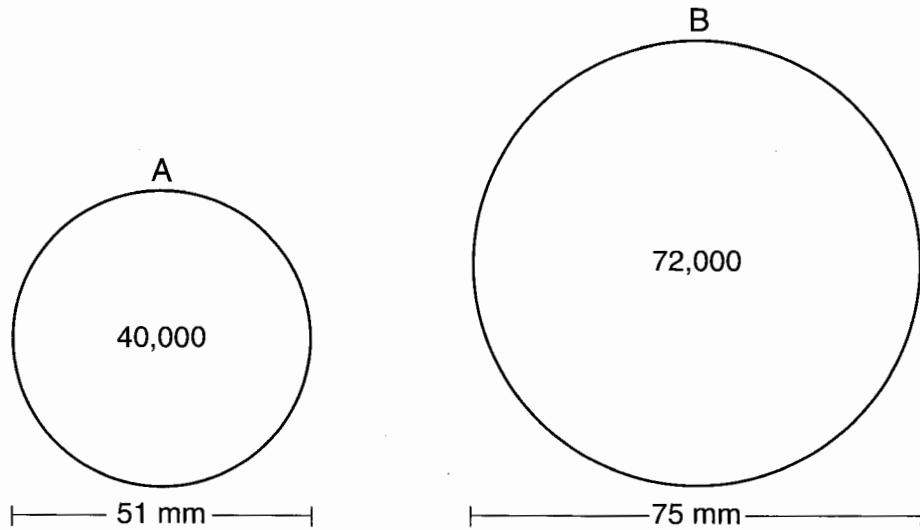
Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

29 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a 70° angle with the ground. To the *nearest foot*, determine and state the length of the ladder.

**30** During an experiment, the same type of bacteria is grown in two petri dishes. Petri dish *A* has a diameter of 51 mm and has approximately 40,000 bacteria after 1 hour. Petri dish *B* has a diameter of 75 mm and has approximately 72,000 bacteria after 1 hour.

A

40,000

├────── 51 mm ──────┤

B

72,000

├──────────75 mm──────────┤

Determine and state which petri dish has the greater population density of bacteria at the end of the first hour.
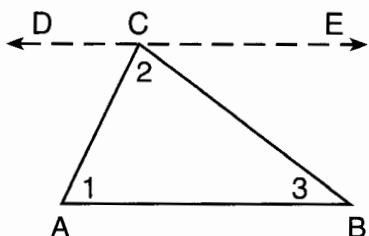
31 Line ℓ is mapped onto line m by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is $3x - y = 4$. Determine and state an equation for line m.

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 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: $\triangle ABC$
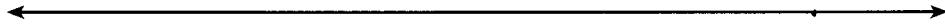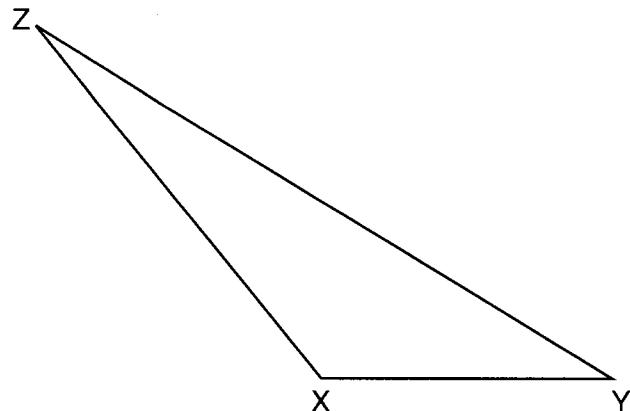
Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180°$

Fill in the missing reasons below.

Statements	Reasons
(1) $\triangle ABC$	(1) Given
(2) Through point C, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) _____ _____ _____
(3) $m\angle 1 = m\angle ACD$, $m\angle 3 = m\angle BCE$	(3) _____ _____ _____
(4) $m\angle ACD + m\angle 2 + m\angle BCE = 180°$	(4) _____ _____ _____
(5) $m\angle 1 + m\angle 2 + m\angle 3 = 180°$	(5) _____ _____ _____

34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]
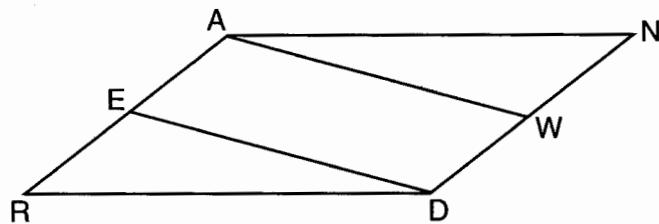
Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.

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

35 Given: Parallelogram $ANDR$ with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points W and E, respectively

Prove that $\triangle ANW \cong \triangle DRE$.

Prove that quadrilateral $AWDE$ is a parallelogram.

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

FOR TEACHERS ONLY

GEOMETRY (Common Core)

SCORING KEY AND RATING GUIDE

Mechanics of Rating

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

Do *not* attempt to correct the student's work by making insertions or changes of any kind. In scoring the open-ended questions, use check marks to indicate student errors. Unless otherwise specified, mathematically correct variations in the answers will be allowed. Units need not be given when the wording of the questions allows such omissions.

Each student's answer paper is to be scored by a minimum of three mathematics teachers. No one teacher is to score more than approximately one-third of the open-ended questions on a student's paper. Teachers may not score their own students' answer papers. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

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

Raters should record the student's scores for all questions and the total raw score on the student's separate answer sheet. Then the student's total raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Thursday, January 28, 2016. Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score. The student's scale score should be entered in the box provided on the student's separate answer sheet. The scale score is the student's final examination score.

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

Part I

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

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

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: http://www.p12.nysed.gov/assessment/ and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

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

General Rules for Applying Mathematics Rubrics

I. General Principles for Rating

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

II. Full-Credit Responses

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

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

III. Appropriate Work

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

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

IV. Multiple Errors

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

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

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

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

Part II

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

(25) **[2]** Triangle $A'B'C'$ is graphed and labeled correctly.

[1] One graphing error is made, but appropriate vertices are graphed and labeled.

or

[1] One conceptual error is made, such as reflecting $\triangle ABC$ over the line $y = 1$, but appropriate vertices are graphed and labeled.

or

[1] The image of $\triangle ABC$ is graphed correctly, but is not labeled or is labeled incorrectly.

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

(26) **[2]** 120 or an equivalent radian measure is found, and appropriate work is shown, such as a labeled diagram.

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

or

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

or

[1] $m\overset{\frown}{DB} = 60°$, $m\overset{\frown}{AC} = 60°$, and $m\overset{\frown}{AB} = 120°$, but no further correct work is shown.

or

[1] $m\angle ABO$ and $m\angle BAO = 30°$, but no further correct work is shown.

or

[1] $m\angle AOB = 120°$, but no work is shown.

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

(27)   **[2]** (2,5), and correct work is shown.

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

<div align="center">*or*</div>

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

<div align="center">*or*</div>

        [1] Appropriate work is shown to find 2 and 5, but the answer is not written as coordinates.

<div align="center">*or*</div>

        [1] Point *J* is graphed correctly, but the coordinates are not stated or are stated incorrectly.

<div align="center">*or*</div>

        [1] (2,5), but no work is shown.

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

(28)   **[2]** Yes, and a correct explanation is written.

        [1] Yes, and an incomplete explanation is stated.

<div align="center">*or*</div>

        [1] Yes, and a correct sequence of transformations is written.

<div align="center">*or*</div>

        [1] Yes, and a statement other than properties of rigid motions is used.

        [0] Yes or an equivalent statement is stated, but no explanation is written.

<div align="center">*or*</div>

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

(29)   **[2]** 32, 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] $\text{Sin } 70 = \frac{30}{x}$ or $\cos 20 = \frac{30}{x}$ is written, but no further correct work is shown.

                 or

       [1] 32, but no work is shown.

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

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

       [1] Appropriate work is shown, but one computational error is made. An appropriate petri dish is stated.

                 or

       [1] Appropriate work is shown, but one conceptual error is made. An appropriate petri dish is stated.

                 or

       [1] Appropriate work is shown to find the population density of each petri dish, but no petri dish or an incorrect petri dish is stated.

       [0] *A*, but no work is shown.

                 or

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

(31) **[2]** $y = 3x - 8$ or an equivalent equation is written, 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] $y = 3x - 8$, but no work is shown.

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

Part III

For each question, use the specific criteria to award a maximum of 4 credits. Unless otherwise specified, mathematically correct alternative solutions should be awarded appropriate credit.

(32)   **[4]** 42, and correct work is shown.

    [3] Appropriate work is shown, but one computational or rounding error is made. An appropriate screen size is found, to the *nearest inch*.

or

    [3] Correct work is shown to find the width. The diagonal 42 is stated, but no work is shown.

or

    [3] Correct work is shown to find the diagonal for 16 by 9 dimensions. The diagonal 42 is stated, but no work is shown.

    [2] Appropriate work is shown, but two or more computational or rounding errors are made. An appropriate screen size is found, to the *nearest inch*.

or

    [2] Appropriate work is shown, but one conceptual error is made. An appropriate screen size is found, to the *nearest inch*.

or

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

or

    [2] Using the aspect ratio 16:9 (w:h), correct work is shown to find the diagonal for 16 by 9 dimensions. No further correct work is shown.

    [1] Appropriate work is shown, but one conceptual error and one computational or rounding error are made. An appropriate screen size is found, to the *nearest inch*.

or

    [1] 42, but no work is shown.

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

(33)   **[4]** All four reasons are correct.

[3] Three reasons are correct.

[2] Two reasons are correct.

[1] One reason is correct.

[0] No reasons are correct.

(34)   **[4]** A correct construction of $\triangle ABC \cong \triangle XYZ$ is drawn showing all construction arcs. A correct theorem is stated to justify why the triangles are congruent.

[3] An appropriate construction of the congruent triangle is drawn, but one construction error is made. A correct theorem is stated to justify why the triangles are congruent.

or

[3] A correct construction of $\triangle ABC \cong \triangle XYZ$ is drawn. No theorem is stated or an incorrect theorem, based upon the construction, is stated.

or

[3] An appropriate construction of a congruent triangle is drawn, but the triangle is not labeled or is labeled incorrectly. A correct theorem is stated to justify why the triangles are congruent.

[2] An appropriate construction of a congruent triangle is drawn, but one construction error is made. No theorem is stated or an incorrect theorem, based upon the construction, is stated.

or

[2] An appropriate construction of a congruent triangle is drawn. The triangle is not labeled or is labeled incorrectly. No theorem is stated or an incorrect theorem, based upon the construction, is stated.

[1] All appropriate construction arcs are drawn, but the triangle is not drawn. No further correct work is shown.

or

[1] An appropriate congruency theorem is stated, but a drawing that is not an appropriate construction is shown.

[0] A triangle congruency theorem is stated, but no work is shown.

or

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

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 concluding statements is written.

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

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

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

or

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

or

[3] A proof is written that shows $\triangle ANW \cong \triangle DRE$, but no further correct work is shown.

or

[3] A proof is written that shows $AWDE$ is a parallelogram, but no further correct work is shown.

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

[1] One correct relevant statement and reason about the proof are written.

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

or

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

(36)   **[6]** 13.6, and correct work is shown.

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

or

[5] Correct work is shown, but the height of the survey instrument is not added to the flagpole height.

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

or

[4] Correct work is shown to find the distance between the second sighting and the flagpole. No further correct work is shown.

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

or

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

or

[3] The equation $(x + 8)(\tan 34.9) = x(\tan 52.8)$ or an equivalent equation is written. No further correct work is shown.

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

or

[2] Equations $\tan 52.8 = \dfrac{h}{x}$ and $\tan 34.9 = \dfrac{h}{x + 8}$ are written. No further correct work is shown.

[1] The equation $\tan 52.8 = \dfrac{h}{x}$ or $\tan 34.9 = \dfrac{h}{x + 8}$ is written. No further correct work is shown.

or

[1] 13.6, but no work is shown.

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

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

January 2016

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

The *Chart for Determining the Final Examination Score for the January 2016 Regents Examination in Geometry (Common Core)* will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Thursday, January 28, 2016. Conversion charts provided for previous administrations of the Regents Examination in Geometry (Common Core) must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.cfm.

2. Select the test title.

3. Complete the required demographic fields.

4. Complete each evaluation question and provide comments in the space provided.

5. Click the SUBMIT button at the bottom of the page to submit the completed form.

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY (COMMON CORE)

Thursday, January 28, 2016 — 9:15 a.m. to 12:15 p.m.

MODEL RESPONSE SET

Table of Contents
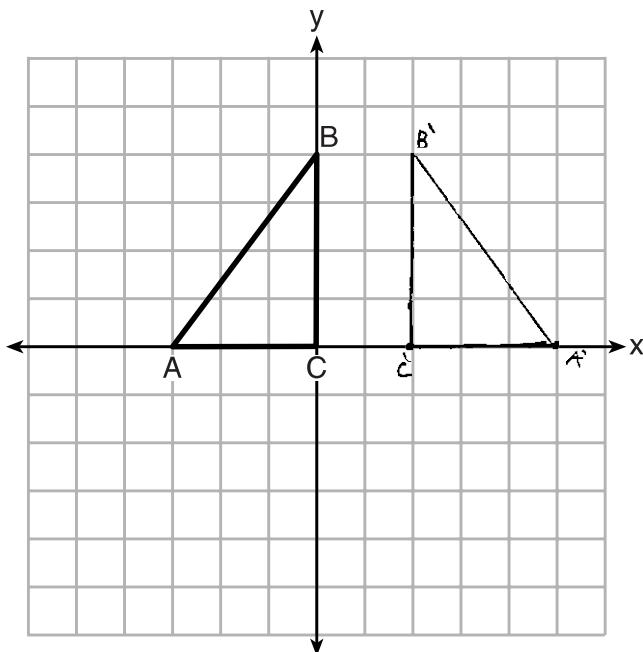
25 Triangle *ABC* is graphed on the set of axes below. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a reflection over the line $x = 1$.
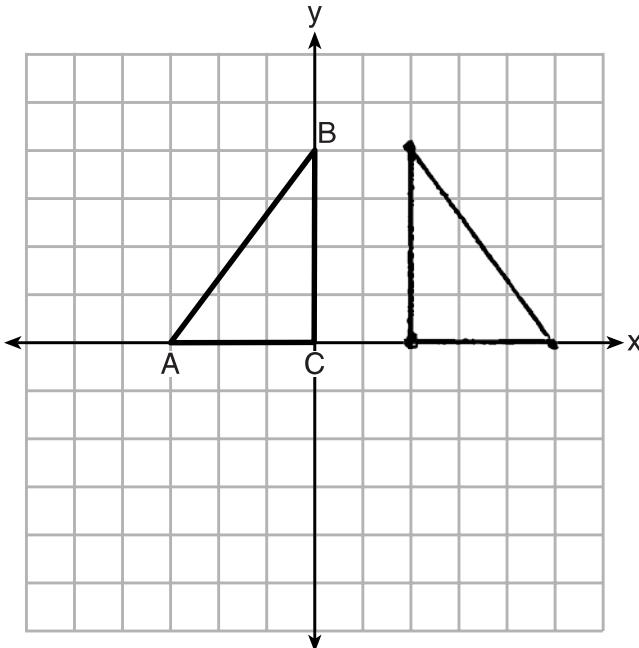
Score 2: The student has a complete and correct response.

25 Triangle *ABC* is graphed on the set of axes below. Graph and label △*A'B'C'*, the image of △*ABC* after a reflection over the line $x = 1$.

A' (5, 0)

B' (2, 4)

C' (2, 0)
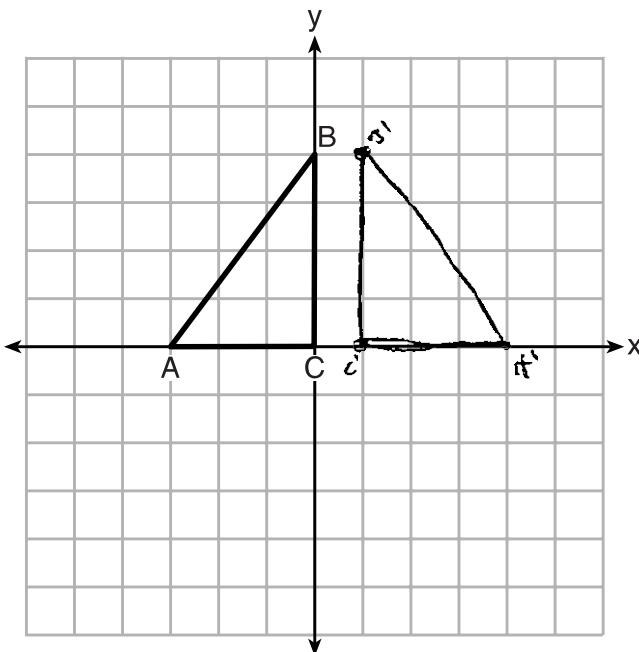
Score 2: The student graphed the image of △*ABC* correctly, then stated and labeled its coordinates.

25 Triangle *ABC* is graphed on the set of axes below. Graph and label △*A'B'C'*, the image of △*ABC* after a reflection over the line $x = 1$.
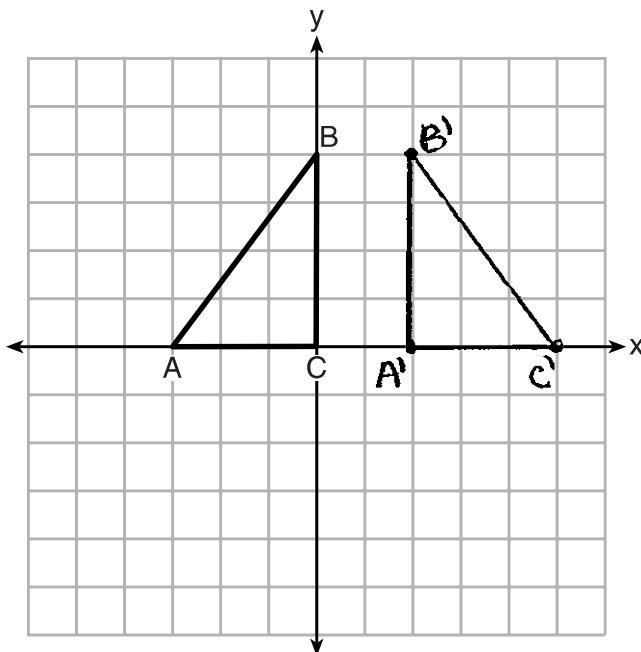
Score 1: The student did a reflection over the line $x = \frac{1}{2}$.

25 Triangle *ABC* is graphed on the set of axes below. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a reflection over the line $x = 1$.
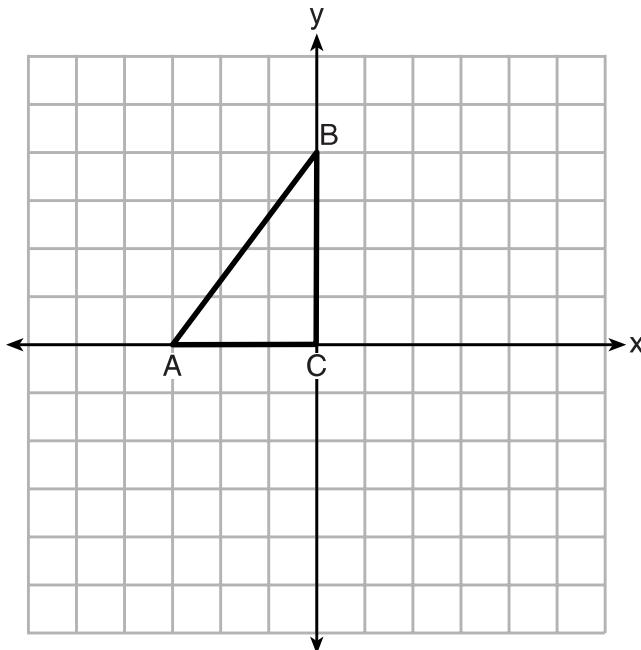
Score 1: The student labeled $\triangle A'B'C'$ incorrectly.

25 Triangle *ABC* is graphed on the set of axes below. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a reflection over the line $x = 1$.

A '(5,0)

B' (2,4)

C' (2,0)
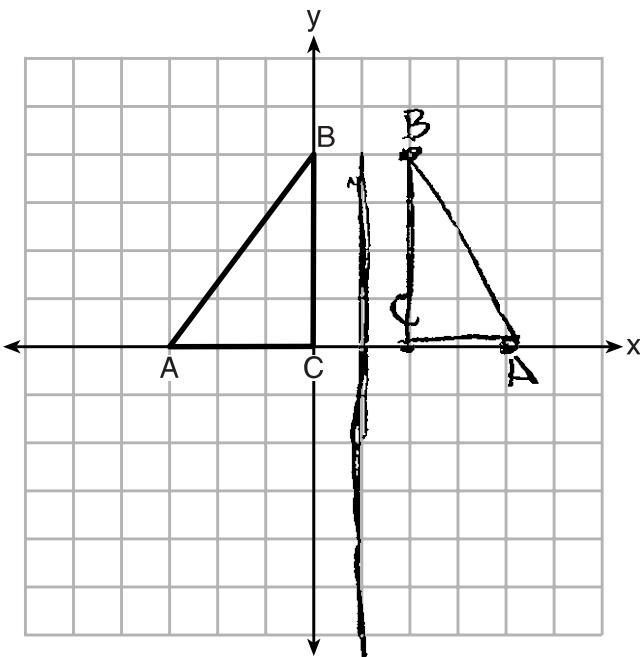
Score 1: The student stated and labeled the correct coordinates for A', B', and C'.

25 Triangle *ABC* is graphed on the set of axes below. Graph and label △*A'B'C'*, the image of △*ABC* after a reflection over the line *x* = 1.
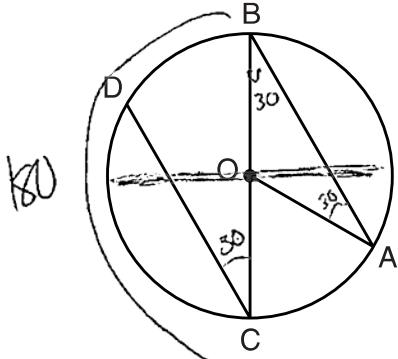
Score 0: The student graphed the image of *A* incorrectly, and labeled the triangle incorrectly.

26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If m∠BCD = 30°, determine and state m∠AOB.

m∠AOB = 120

$$\begin{array}{r} 30 \\ +\ 30 \\ \hline 60 \end{array}$$

$$\begin{array}{r} 180 \\ -\ 60 \\ \hline 120 \end{array}$$
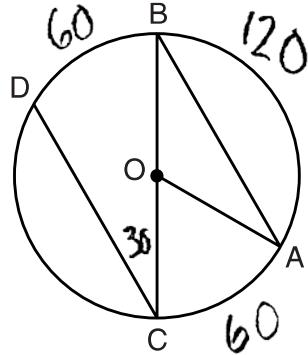
Score 2:   The student has a complete and correct response.

26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If m∠BCD = 30°, determine and state m∠AOB.

$$m \angle AOB = 120$$
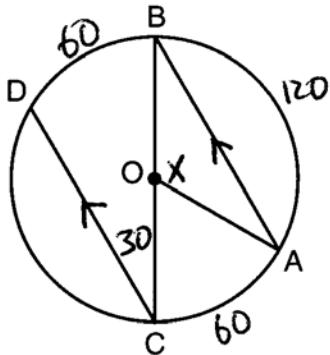
Score 2:   The student has a complete and correct response.

26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If m∠BCD = 30°, determine and state m∠AOB. $360°= 2\pi$ radians

$$\frac{\cancel{120}}{\cancel{360}} = \frac{\cancel{X}}{\cancel{2\pi}}$$

$$\frac{240\,\pi}{360} = \frac{360\,X}{360}$$

$$\frac{240\,\pi}{360} = X$$

$$X = \frac{2\pi}{3}$$

$$\angle AOB = \frac{2\pi}{3} \text{ radians}$$
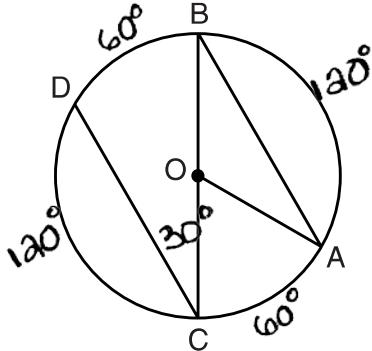
Score 2:   The student has a complete and correct response.

26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If m∠BCD = 30°, determine and state m∠AOB.
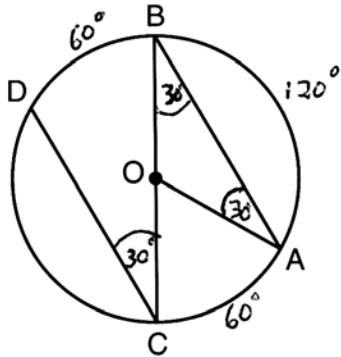
Score 1: The student labeled the arcs correctly, but did not find the angle.

26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If m∠BCD = 30°, determine and state m∠AOB.
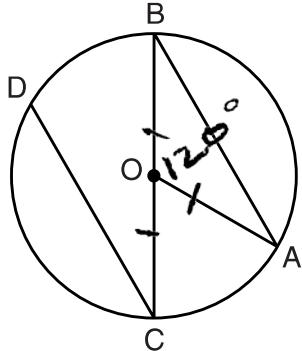
Score 1: The student labeled the angles and arcs correctly, but did not find m∠AOB.

26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If m∠BCD = 30°, determine and state m∠AOB.
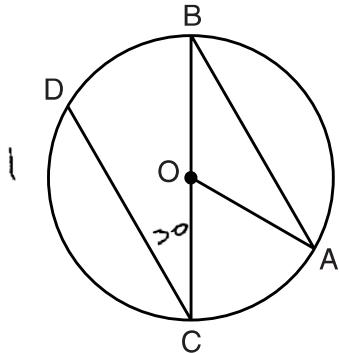
Score 1: The student marked off equal radii, but showed no work to find the angle.

26 In the diagram below of circle O with diameter $\overline{BC}$ and radius $\overline{OA}$, chord $\overline{DC}$ is parallel to chord $\overline{BA}$.

If m∠BCD = 30°, determine and state m∠AOB. Supplementary

∠BCD = 30

180 − 30 = 150

∠AOB = 150°

Score 0: The student had a completely incorrect response.
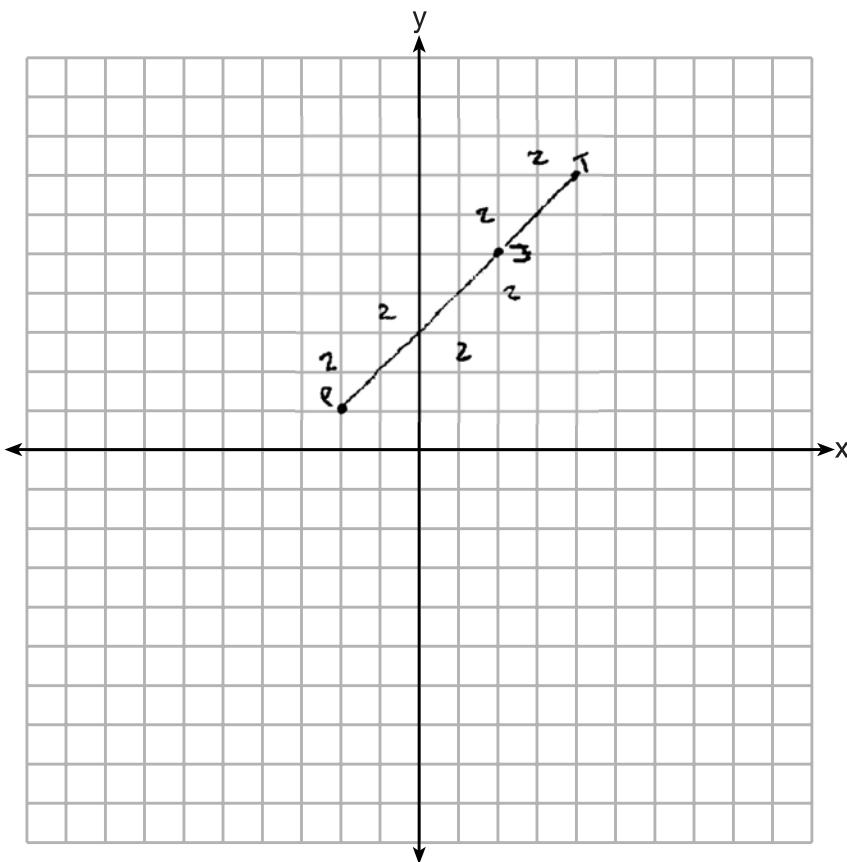
27 Directed line segment *PT* has endpoints whose coordinates are *P*(−2,1) and *T*(4,7). Determine the coordinates of point *J* that divides the segment in the ratio 2 to 1.

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

$J(2,5)$

Score 2: The student has a complete and correct response.
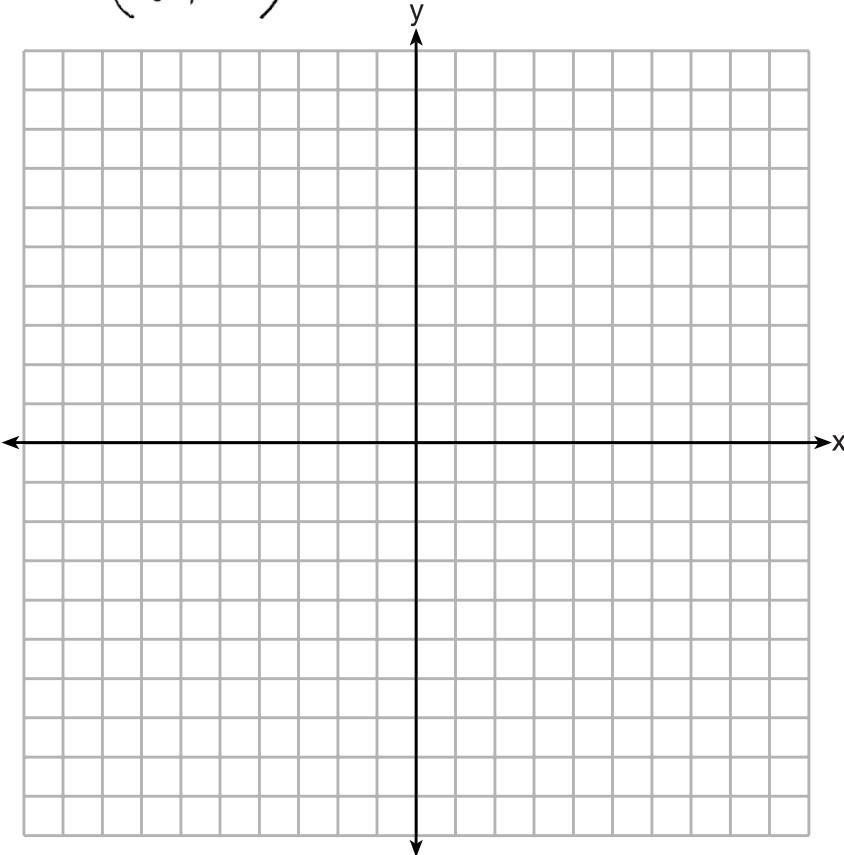
27 Directed line segment *PT* has endpoints whose coordinates are $P(-2,1)$ and $T(4,7)$. Determine the coordinates of point *J* that divides the segment in the ratio 2 to 1.

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

$$J = \left(\frac{2}{3}(4-(-2)) -2, \quad \frac{2}{3}(7-1)+1 \right)$$

$$= \left(\frac{2}{3}(6) -2, \quad \frac{2}{3}(6)+1 \right)$$

$$= \left(4-2, \quad 4+1 \right)$$

$$= \left(2, 5 \right)$$

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

27 Directed line segment *PT* has endpoints whose coordinates are $P(-2,1)$ and $T(4,7)$. Determine the coordinates of point *J* that divides the segment in the ratio 2 to 1.

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

$$D = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)^2}$$

$$D = \sqrt{(-2 - 4)^2 + (1 - 7)^2}$$
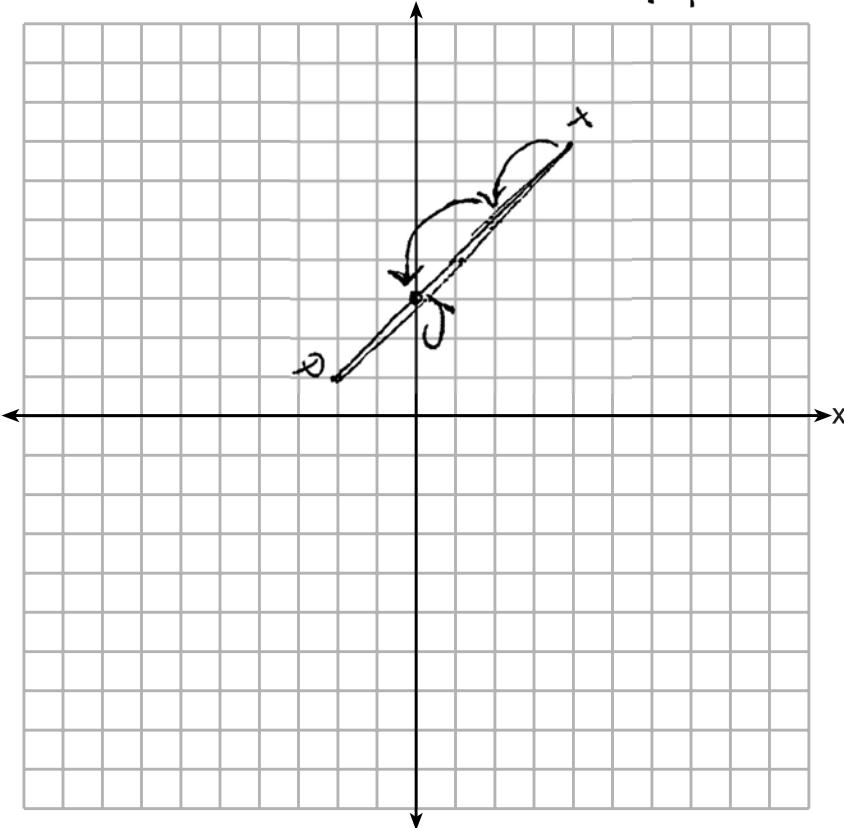
$$D = \sqrt{(-6)^2 + (-6)^2}$$

$$D = \sqrt{36 + 36}$$

$$D = \sqrt{72}$$

$(0,3)$

$2:1$

Score 1: The student graphed *PJ:JT* = 1:2 instead of *PJ:JT* = 2:1. Unnecessary correct work was shown.
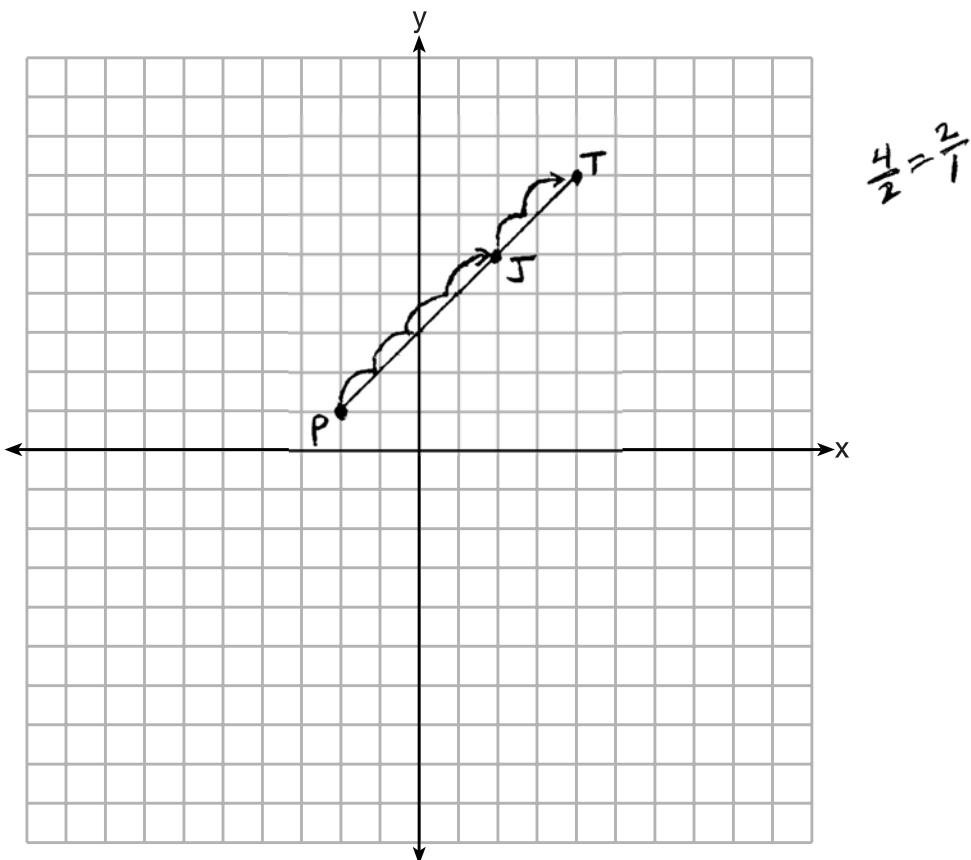
27 Directed line segment *PT* has endpoints whose coordinates are $P(-2,1)$ and $T(4,7)$. Determine the coordinates of point *J* that divides the segment in the ratio 2 to 1.

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

$\frac{4}{2} = \frac{2}{1}$

Score 1: The student located point *J* graphically, but did not state its coordinates.
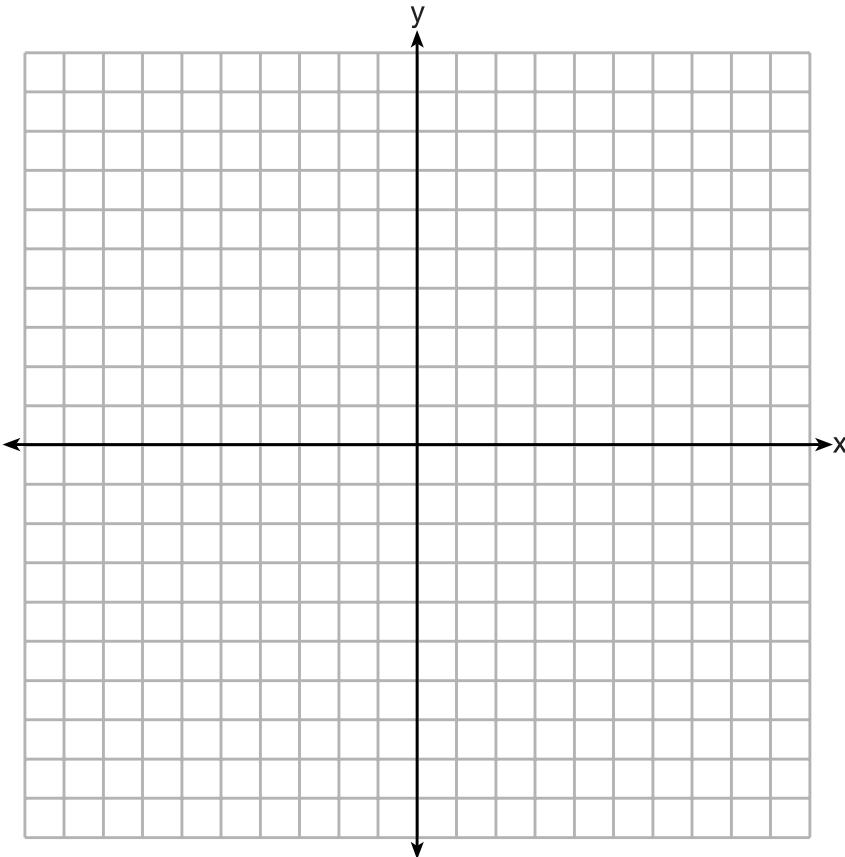
27 Directed line segment *PT* has endpoints whose coordinates are *P*(−2,1) and *T*(4,7). Determine the coordinates of point *J* that divides the segment in the ratio 2 to 1.

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

$$\frac{PJ}{PT} = \frac{2}{3}$$

$$-2-4 \qquad 1-7$$

$$\frac{2}{3} \cdot -6 \qquad \frac{2}{3} \cdot -6$$

$$-4 \qquad -4$$

P(−2,1)

$$-2 - ^-4 \qquad 1 - ^-4$$

$$^-2 + 4 \qquad 1 + 4$$

$$2 \qquad 5$$

J

Score 1: The student did not write the solution as coordinates.
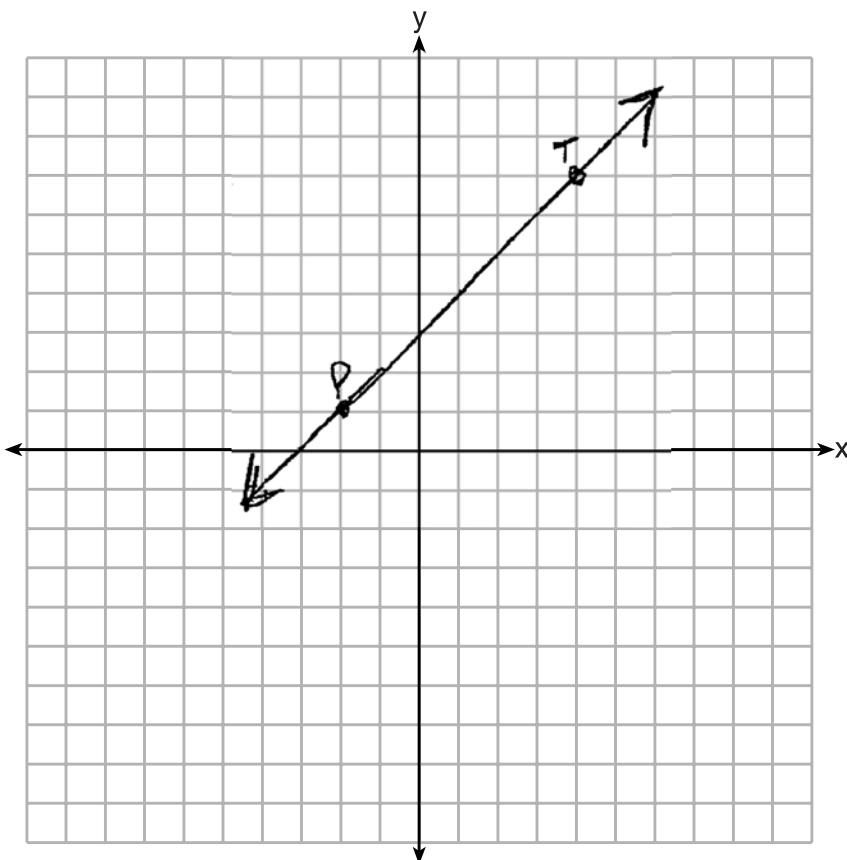
27 Directed line segment PT has endpoints whose coordinates are $P(-2,1)$ and $T(4,7)$. Determine the coordinates of point J that divides the segment in the ratio 2 to 1.

[The use of the set of axes below is optional.]
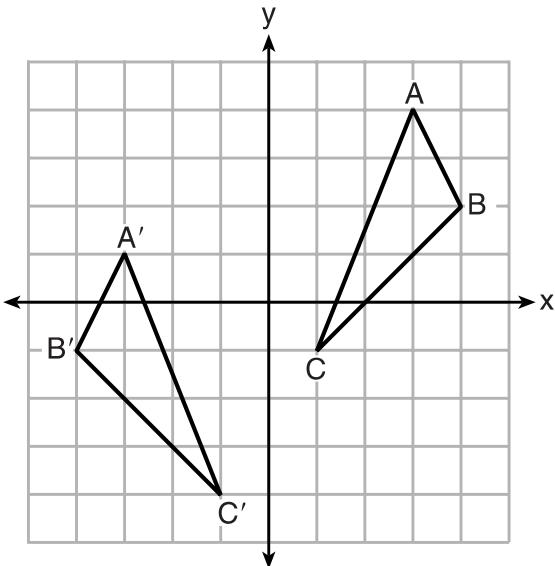
Score 0: The student only graphed $\overrightarrow{PT}$.

28 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.

Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

Yes.

$\triangle ABC$ is reflected over the y-axis and then translated down 3. These are rigid motions and in rigid motions distance stays the same.
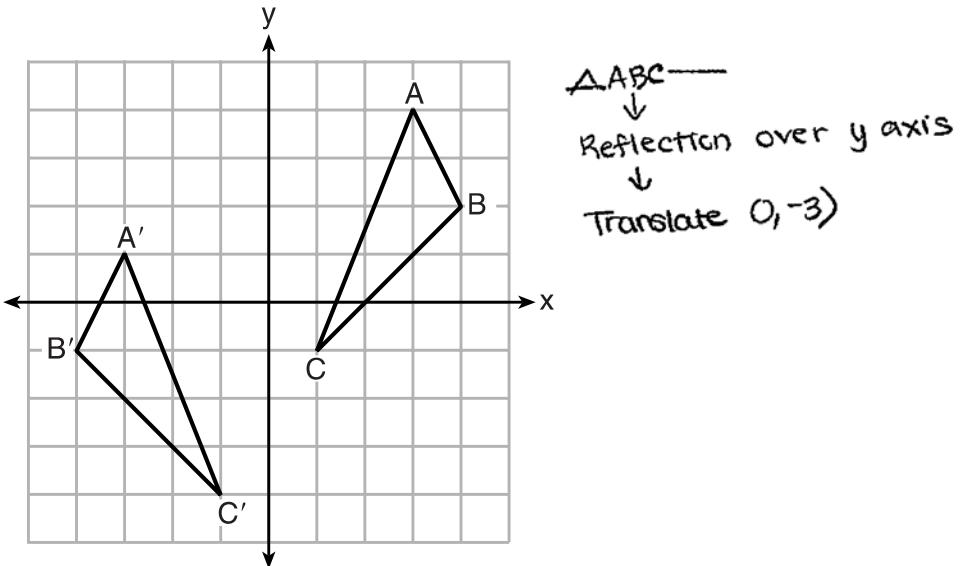
Score 2: The student has a complete and correct response.

28 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.

$\triangle ABC$ ——
↓
Reflection over y axis
↓
Translate 0, -3)

Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

△A'B'C' is congruent to △ABC because △ABC reflected across the y-axis then translates by (0,-3). This is considered to by an isometry because the size stays the same.
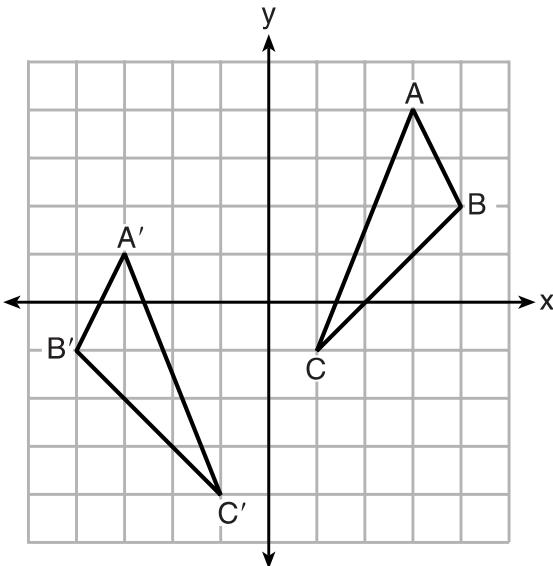
Score 2: The student has a complete and correct response.

28 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.

Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

yes because no dilation or change was done to the shape, it was reflected over the y-axis and then translated (0,-3)
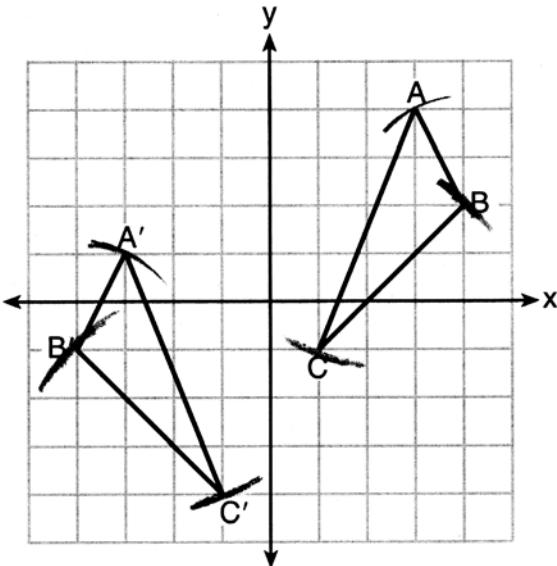
Score 1: The student correctly described the transformation, but the explanation was not complete for congruence.

28 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.

Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

Yes $AB = A'B'$

$BC = B'C'$ $\cong$ By SSS

$AC = A'C'$
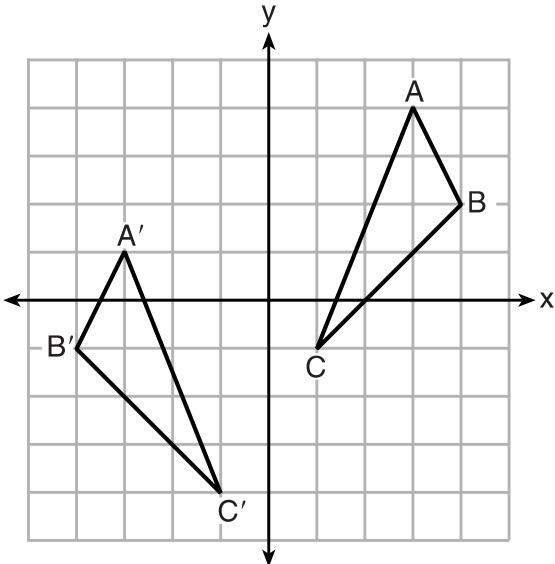
Score 1: The student wrote an appropriate explanation about congruency, but not based on rigid motions.

28 As graphed on the set of axes below, $\triangle A'B'C'$ is the image of $\triangle ABC$ after a sequence of transformations.

Is $\triangle A'B'C'$ congruent to $\triangle ABC$? Use the properties of rigid motion to explain your answer.

Yes, because triangles are congruent.
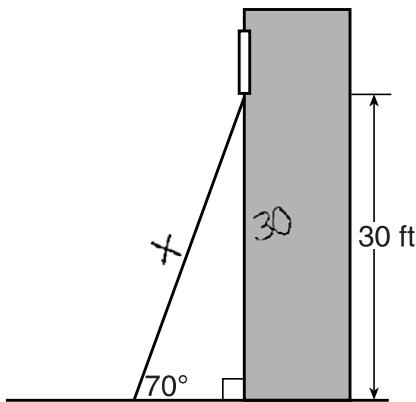
Score 0: The student had no correct explanation.

29 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a 70° angle with the ground. To the *nearest foot*, determine and state the length of the ladder.

$$x \cdot \sin 70 = \frac{30}{x} \cdot x$$

$$x \frac{\sin 70}{\sin 70} = \frac{30}{\sin 70}$$

$$x = \frac{30}{\sin 70}$$

$$x = 32 \text{ ft}$$

The length of the ladder is 32 feet.

Score 2: The student has a complete and correct response.
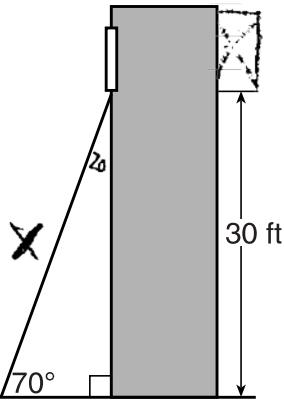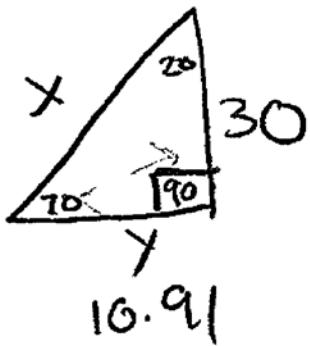
29 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a 70° angle with the ground. To the *nearest foot*, determine and state the length of the ladder.

$30^2 + 10.91^2 = c^2$

$900 + 119.0281 = c^2$

$\sqrt{1019.0281} = \sqrt{c^2}$

$c = 31.922$

X

30 ft

20

70°

Length of the ladder = 32 ftt
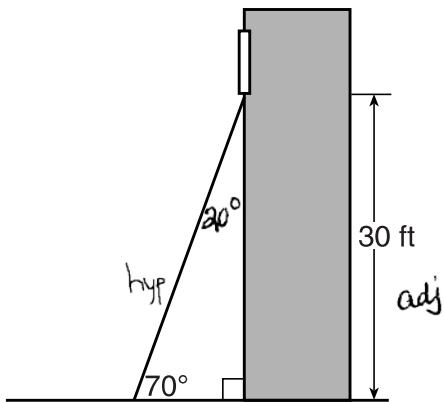
X

20

30

70

90

Y

10.91

$\dfrac{\tan 70}{1} = \dfrac{30}{y}$

$\dfrac{30}{2.75} = \dfrac{2.75\,y}{2.75}$

$y = 10.91$

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

29 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a 70° angle with the ground. To the *nearest foot*, determine and state the length of the ladder.

$$\frac{\cos 20}{1} = \frac{30}{X}$$

$$X \cos 20 = 30$$
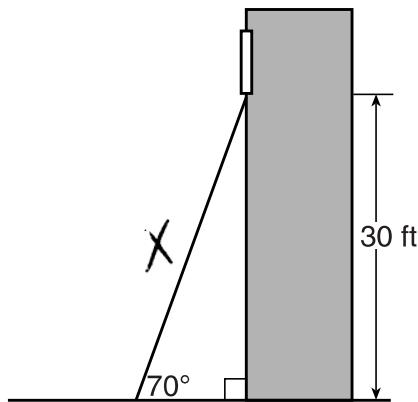
Score 1: The student wrote a correct trigonometric equation, but no further correct work was shown.

29 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a 70° angle with the ground. To the *nearest foot*, determine and state the length of the ladder.

$$\text{Sin } 70 = \frac{X}{30}$$

$$30 \sin 70 = X$$

$$28.19... = X$$

$$\boxed{28 \text{ feet}}$$
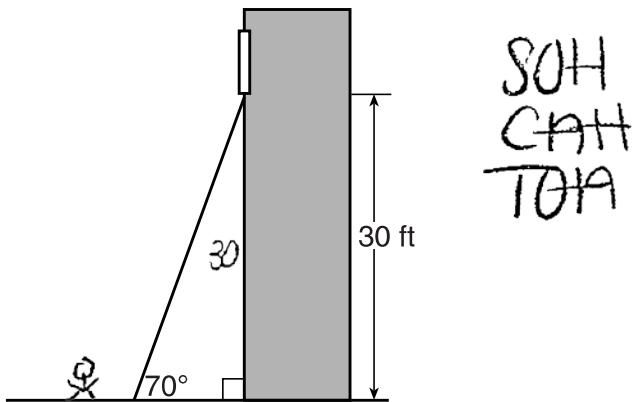
Score 1: The student wrote an incorrect trigonometric equation.

29 A carpenter leans an extension ladder against a house to reach the bottom of a window 30 feet above the ground. As shown in the diagram below, the ladder makes a 70° angle with the ground. To the *nearest foot*, determine and state the length of the ladder.

SOH
CAH
TOA
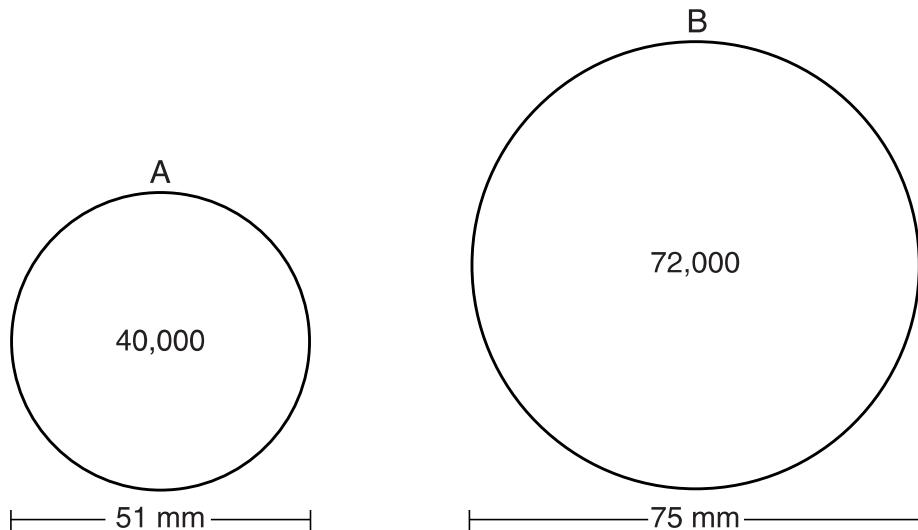
30

30 ft

70°

$\tan 70 = \frac{30}{x}$

$x = \tan(70) * 30 = 36.6$ or $\boxed{37 \text{ feet}}$

Score 0:   The student's work was completely incorrect.

30 During an experiment, the same type of bacteria is grown in two petri dishes. Petri dish *A* has a diameter of 51 mm and has approximately 40,000 bacteria after 1 hour. Petri dish *B* has a diameter of 75 mm and has approximately 72,000 bacteria after 1 hour.

B

A

72,000

40,000

|———— 51 mm ————| |————————75 mm————————|

Determine and state which petri dish has the greater population density of bacteria at the end of the first hour.

$A_= \pi r^2$ $A = \pi r^2$

$A = \pi 25.5^2$ $A = \pi 37.5^2$

$A \doteq 2042.820623$ $A = 4417.864669$
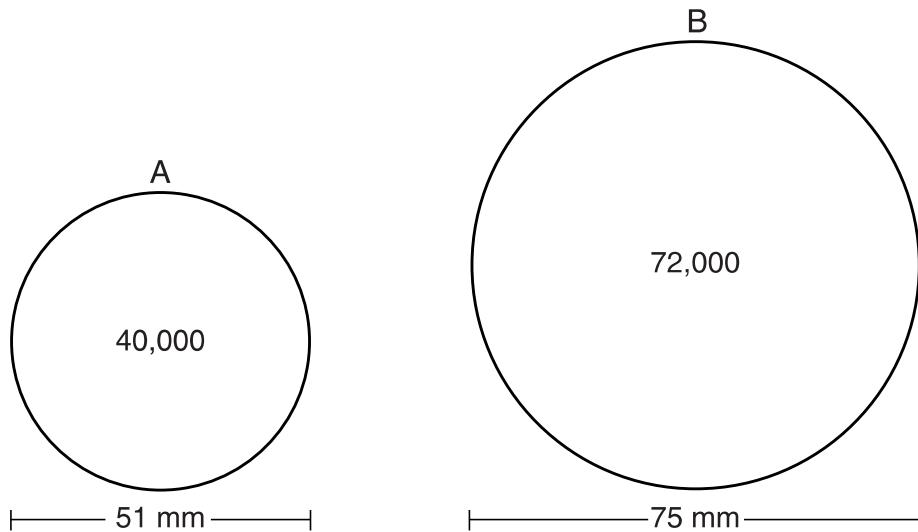
                    19.58076962   16.29746617

2042.820623/40000   4417.864669/72000

Petri dish A

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

30 During an experiment, the same type of bacteria is grown in two petri dishes. Petri dish *A* has a diameter of 51 mm and has approximately 40,000 bacteria after 1 hour. Petri dish *B* has a diameter of 75 mm and has approximately 72,000 bacteria after 1 hour.

B

72,000

A

40,000

$\longmapsto$ 51 mm $\longrightarrow$ $\longmapsto$ 75 mm $\longrightarrow$

Determine and state which petri dish has the greater population density of bacteria at the end of the first hour.

$$\frac{d}{bact\cdot} = \frac{1}{x}$$

$$\frac{75}{72,000} = \frac{1}{x}$$

$$\frac{51}{40,000} = \frac{1}{x}$$

$$\frac{51}{51}x = \frac{40,000}{51}$$

$$\frac{75x}{75} = \frac{72000}{75}$$

$$x = 784.31$$

$$x = 960$$

Petri dish B had the greater Population density at the end of the first hour.
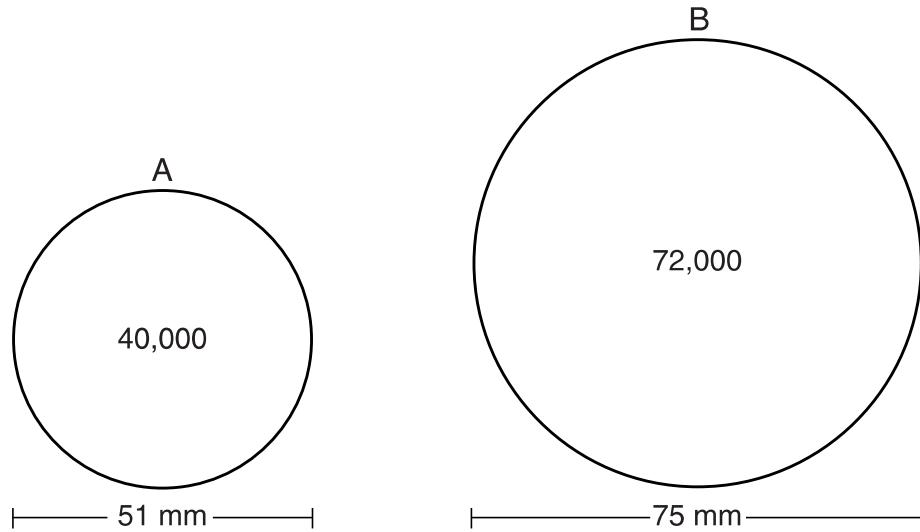
Score 1: The student calculated density based on the diameter of the petri dish and chose an appropriate dish.

30 During an experiment, the same type of bacteria is grown in two petri dishes. Petri dish *A* has a diameter of 51 mm and has approximately 40,000 bacteria after 1 hour. Petri dish *B* has a diameter of 75 mm and has approximately 72,000 bacteria after 1 hour.

B

72,000

A

40,000

├───── 51 mm ─────┤   ├─────── 75 mm ───────┤

Determine and state which petri dish has the greater population density of bacteria at the end of the first hour.

$$\underline{A}$$
$$A = \pi r^2$$
$$A = \pi\ 25.5^2$$
$$A = 650.25\pi$$

$$\underline{B}$$
$$A = \pi r^2$$
$$A = \pi\ 37.5^2$$
$$A = 1406.25\pi$$

Petri dish B has a greater population Density.

Score 0: The student found the area of both petri dishes, but did not calculate a density to compare them.

31 Line ℓ is mapped onto line m by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is $3x - y = 4$. Determine and state an equation for line m.

$$3x - y = 4$$
$$-3x \qquad -3x$$
$$\frac{-y}{-1} = \frac{-3x + 4}{-1}$$
$$y = 3x - 4$$

$$\boxed{y = 3x - 8}$$

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

31 Line ℓ is mapped onto line m by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is $3x - y = 4$. Determine and state an equation for line m.

$y = -3x + 4$

$y = 3x - 4$

$(2, 2) \xrightarrow{D_2} (4, 4)$

$(3, 5) \xrightarrow{D_2} (6, 10)$

$m = \dfrac{10-4}{6-4} = \dfrac{6}{2} = 3$

$y = 3x + b$

$10 = 3(6) + b$

$10 = 18 + b$

$-18 \quad -18$

_____

$-8 = b$

$\boxed{y = 3x - 8}$

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

31 Line ℓ is mapped onto line m by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is $3x - y = 4$. Determine and state an equation for line m.

$$3x - y = 4$$

$$-y = -3x + 4$$

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

$$y = 3x - 4$$

$$y = 6x - 8$$

line m

Score 1: The student multiplied both the slope and y-intercept by a scale factor of 2.

31 Line ℓ is mapped onto line m by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is $3x - y = 4$. Determine and state an equation for line m.

$$3x - y = 4$$
$$-3x = -3x$$

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

$$y = \frac{3}{1}x - 4$$

$$y = -\frac{1}{3}x - 4$$

Score 0: The student found an equation for $m \perp \ell$, which is not relevant to the problem.

31 Line ℓ is mapped onto line *m* by a dilation centered at the origin with a scale factor of 2. The equation of line ℓ is $3x - y = 4$. Determine and state an equation for line *m*.

$$3x - y = 4$$
$$-3x \qquad -3x$$
$$\frac{-y}{-1} = \frac{-3x}{-1} + \frac{4}{-1}$$
$$y = 3x - 4$$

Score 0: The student solved the given equation for *y*, but made no attempt to do a dilation.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

$$\frac{16}{9} = \frac{x}{20.6}$$

$$\frac{9x}{9} = \frac{329.6}{9}$$

$$x = 36.6$$

$$9^2 + b^2 = c^2$$

$$36.6^2 + 20.6^2 = c^2$$

$$1339.56 + 424.36 = c^2$$

$$1339.56 + 424.36 = 1763.42$$

$$42$$

$$\boxed{42 \text{ inch}}$$

Score 4: The student has complete and correct work.
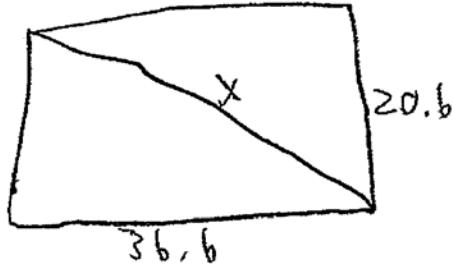
32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

$20.6^2 + 36.6^2 = c^2$

20.6

36.6

$x = 42$
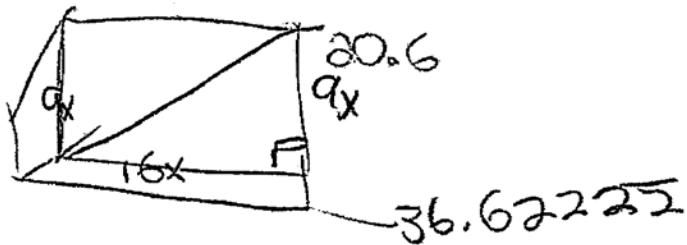
Score 3: The student showed no work to find the width, but used the Pythagorean Theorem to find the screen size.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

$$\frac{9x}{9} = \frac{20.6}{9}$$

$$x \approx 2.3$$

$$\approx 42 \text{ inches}$$
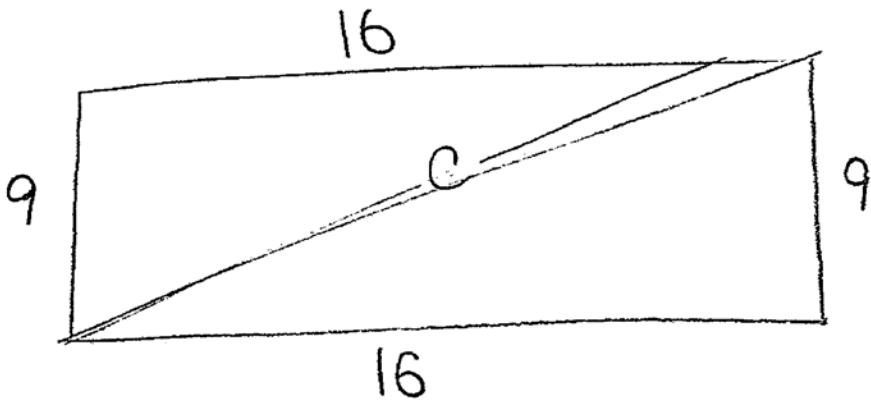
Score 3: The student showed correct work to find the width, but no work to find 42.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.


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

$$16^2 + 9^2 = c^2$$

$$256 + 81 = c^2$$

$$337 = c^2$$

$$18.4 = c$$
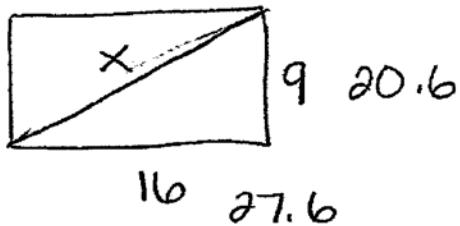
Score 2: The student used the aspect ratio to find the diagonal, but did not find the screen size.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

$$27.6^2 + 20.6^2 = x^2$$
$$761.76 + 424.36 = x^2$$
$$\sqrt{1186.12} = \sqrt{x^2}$$
$$x = 34 \text{ in}$$

Screen size is 34in
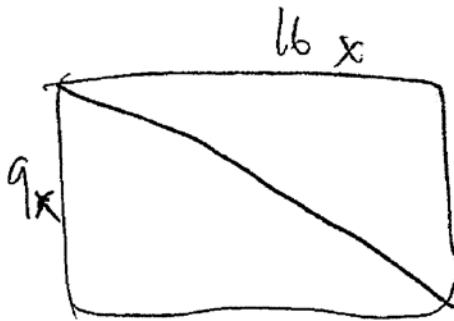
Score 2: The student made a conceptual error in finding the width, but found an appropriate screen size.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

$$16 \; x$$

$$9x$$

$$9x = 20.6 \qquad 16x$$

$$\cdot x = 2.28 \qquad 16 \cdot 2.28 = 36.68$$

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

$$20.6^2 + 36.68 = 49.5990123$$

$$\sqrt{49.5990123} \approx 20.726$$

$$20.726 \approx 21$$

$$\boxed{diagonal \approx 21 \; in}$$
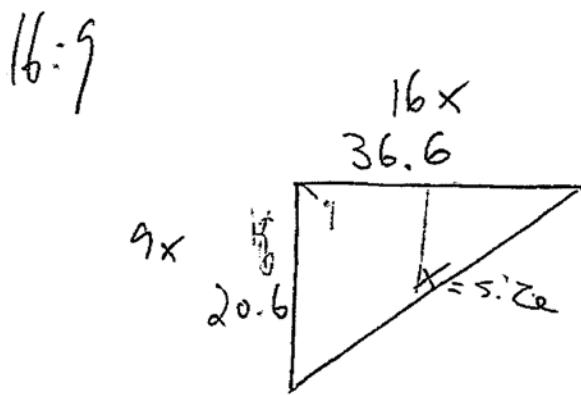
Score 2: The student showed correct work to find the width, but no further correct work was shown.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

16:9

16x
36.6

9x

20.6

X= 5.72

X = 42 inches
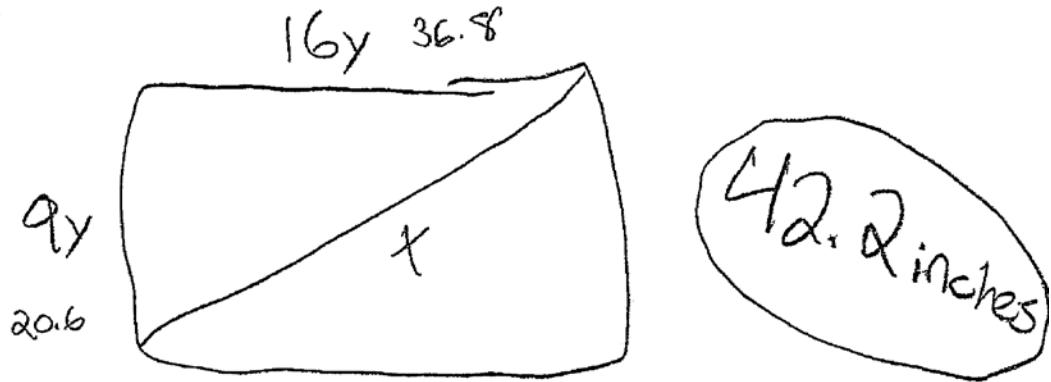
Score 2: The student stated a correct width and screen size, but did not show work.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

16y   36.8

9y

20.6

x

42.2 inches

$20.6^2 + 36.8^2 = x^2$

$\sqrt{1778.6} = \sqrt{x^2}$

42.2

$y = 2.3$
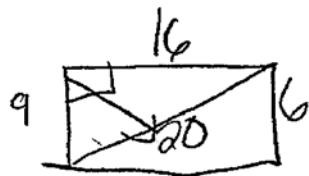
Score 1:   The student showed no work to find an incorrect width, but used it appropriately to find the screen size. The screen size was not stated to the nearest inch.

32 The aspect ratio (the ratio of screen width to height) of a rectangular flat-screen television is 16:9. The length of the diagonal of the screen is the television's screen size. Determine and state, to the *nearest inch*, the screen size (diagonal) of this flat-screen television with a screen height of 20.6 inches.

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

$$9^2 + 16^2 = 20^2$$

$$81 + 256 = 400$$

$$337 = 400$$
$$-337 \quad -337$$

$$\boxed{63}$$
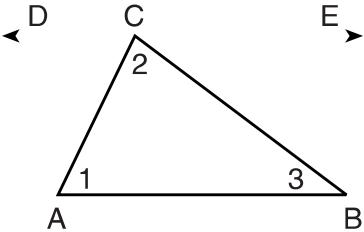
Score 0: The student had no correct work.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: △ABC

Prove: m∠1 + m∠2 + m∠3 = 180°
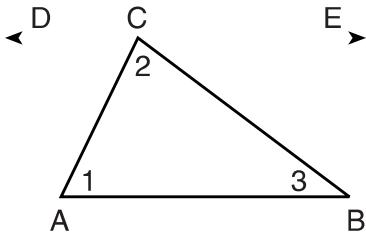
Fill in the missing reasons below.

Statements	Reasons
(1) △ABC	(1) Given
(2) Through point C, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) To a given line there is only one parallel line that can be drawn through a given point not on the line.
(3) m∠1 = m∠ACD, m∠3 = m∠BCE	(3) when two ‖ lines are cut by a transversal alternate interior ∡'s are ≅.
(4) m∠ACD + m∠2 + m∠BCE = 180°	(4) The sum of the angles on one side of a line is equal to 180°.
(5) m∠1 + m∠2 + m∠3 = 180°	(5) substitution

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

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: △ABC

Prove: m∠1 + m∠2 + m∠3 = 180°
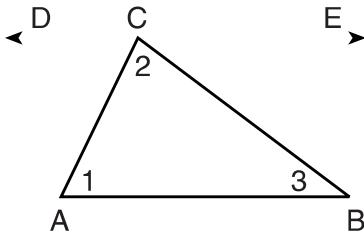
Fill in the missing reasons below.

Statements	Reasons
(1) △ABC	(1) Given
(2) Through point C, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) Euclid's Parallel Postulate
(3) m∠1 = m∠ACD, m∠3 = m∠BCE	(3) If // lines, then alternate interior ∠s ≅ (2).
(4) m∠ACD + m∠2 + m∠BCE = 180°	(4) If 3 ∠s form a line, then they are supplementary.
(5) m∠1 + m∠2 + m∠3 = 180°	(5) Substitution Property (3,4)

Score 3: The student had three correct reasons.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: $\triangle ABC$

Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180°$
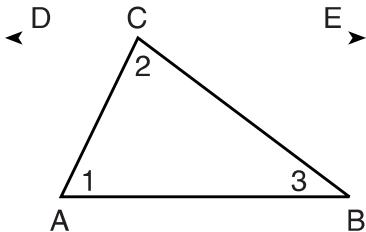
Fill in the missing reasons below.

Statements	Reasons
(1) $\triangle ABC$	(1) Given
(2) Through point C, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) an auxiliary line can be drawn
(3) $m\angle 1 = m\angle ACD$, $m\angle 3 = m\angle BCE$	(3) if lines are parallel, alternate interior angles are congruent
(4) $m\angle ACD + m\angle 2 + m\angle BCE = 180°$	(4) if angles form a straight line it equals 180°
(5) $m\angle 1 + m\angle 2 + m\angle 3 = 180°$	(5) sum of angles in a triangle equals 180

Score 3: The student had three correct reasons.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: $\triangle ABC$

Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180°$
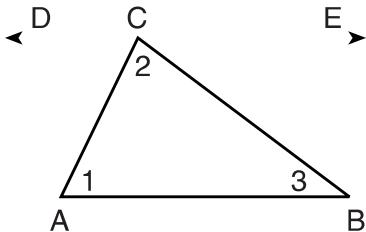
Fill in the missing reasons below.

Statements	Reasons
(1) $\triangle ABC$	(1) Given
(2) Through point C, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) Draw parallel lines
(3) $m\angle 1 = m\angle ACD$, $m\angle 3 = m\angle BCE$	(3) Opposite interior $\angle$s are congruent.
(4) $m\angle ACD + m\angle 2 + m\angle BCE = 180°$	(4) $\overleftrightarrow{DCE}$ is a straign $\angle$ therefore = to 180°
(5) $m\angle 1 + m\angle 2 + m\angle 3 = 180°$	(5) Substitution property

Score 2:   The student had two correct reasons.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: △ABC

Prove: m∠1 + m∠2 + m∠3 = 180°
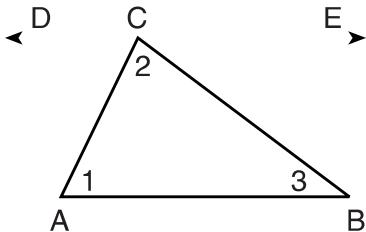
Fill in the missing reasons below.

Statements	Reasons
(1) △ABC	(1) Given
(2) Through point C, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) A line can be drawn ∥ to a given line through a point not on the line
(3) m∠1 = m∠ACD, m∠3 = m∠BCE	(3) If lines ∥ ⇒ Alternate interior ∠s are ≅
(4) m∠ACD + m∠2 + m∠BCE = 180°	(4) Addition Property
(5) m∠1 + m∠2 + m∠3 = 180°	(5) Transitive Property

Score 2:   The student had two correct reasons.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: △*ABC*

Prove: m∠1 + m∠2 + m∠3 = 180°
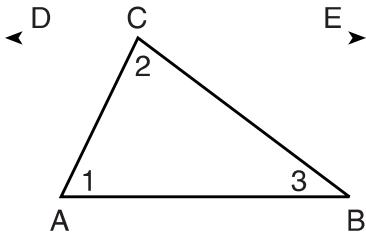
Fill in the missing reasons below.

Statements	Reasons
(1) △*ABC*	(1) Given
(2) Through point *C*, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) 2 parallel lines intersected by a transversal
(3) m∠1 = m∠*ACD*, m∠3 = m∠*BCE*	(3) alt. int. angles theorem
(4) m∠*ACD* + m∠2 + m∠*BCE* = 180°	(4) sum of the parts = the whole
(5) m∠1 + m∠2 + m∠3 = 180°	(5) Substitution

Score 1: The student had one correct reason.

33 Given the theorem, "The sum of the measures of the interior angles of a triangle is 180°," complete the proof for this theorem.

Given: △*ABC*

Prove: m∠1 + m∠2 + m∠3 = 180°

Fill in the missing reasons below.

Statements	Reasons
(1) △*ABC*	(1) Given
(2) Through point *C*, draw $\overleftrightarrow{DCE}$ parallel to $\overline{AB}$.	(2) A 2 line that are transversal and pare parallel
(3) m∠1 = m∠*ACD*, m∠3 = m∠*BCE*	(3) Interior angle (2 paronell line cut by transversal are Congruent)
(4) m∠*ACD* + m∠2 + m∠*BCE* = 180°	(4) Addition postulate
(5) m∠1 + m∠2 + m∠3 = 180°	(5) 2 paralle line cut by 2 transversal that make triangle are 180°

Score 0: The student had no correct reasons.
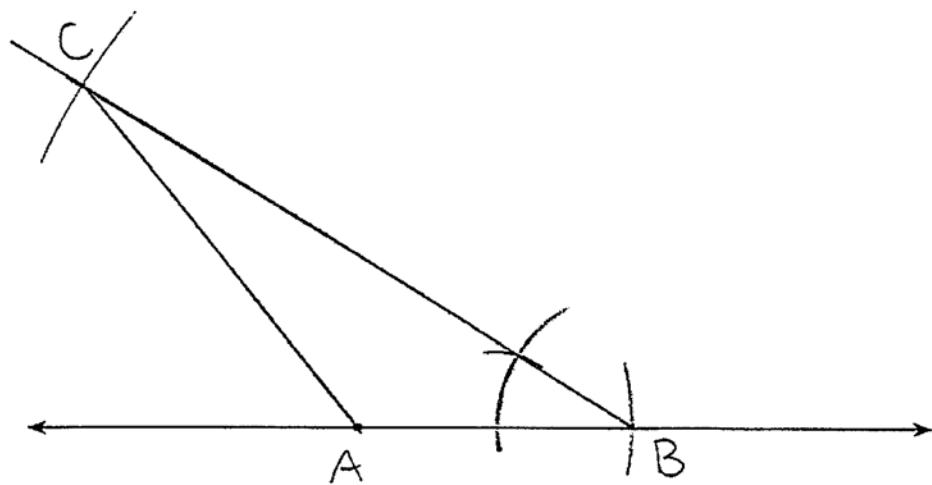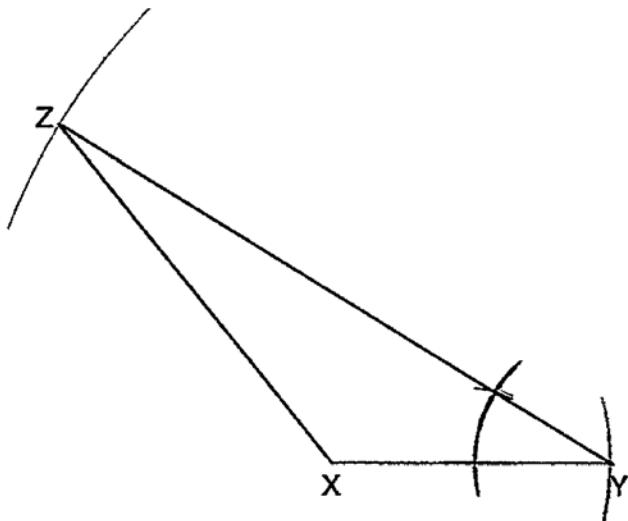
34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]

Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.

SAS theorem of congruent triangles.

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

34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]

Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.

SSS ≅ Theorem

Score 4: The student has a complete and correct response.
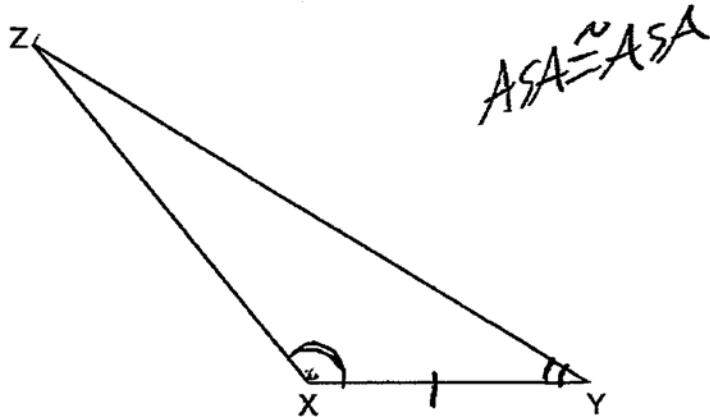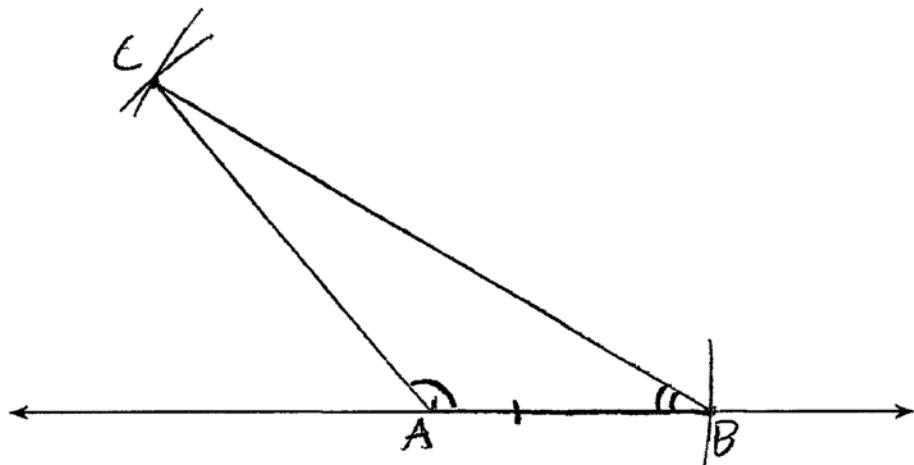
34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]

Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.


ASA≅ASA

Score 3: The student showed a correct construction, but stated an incorrect theorem.
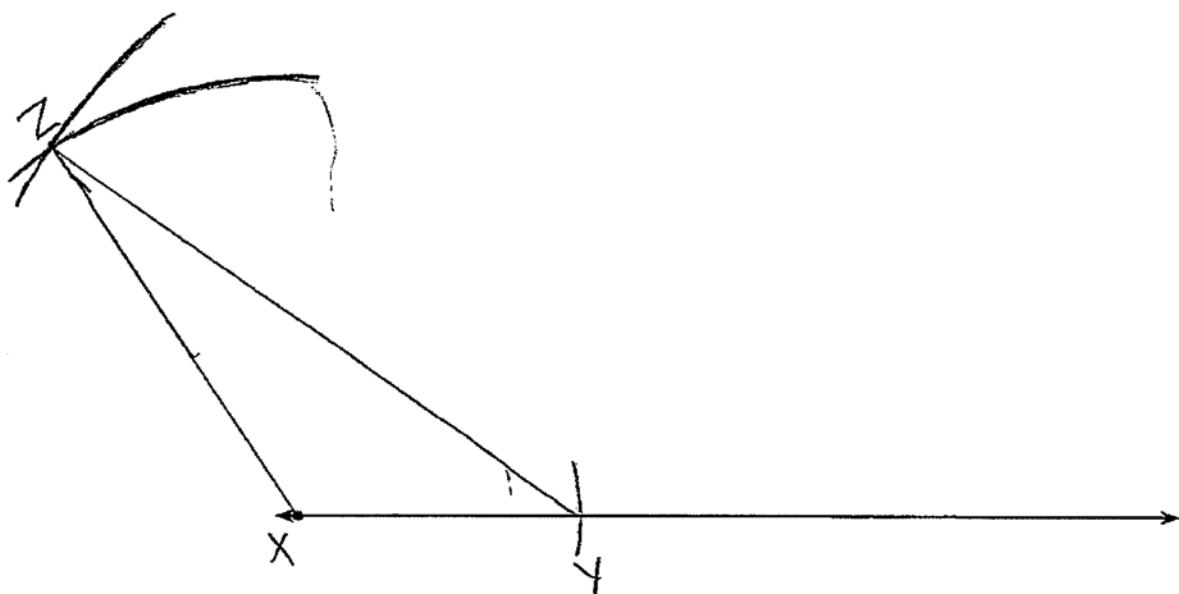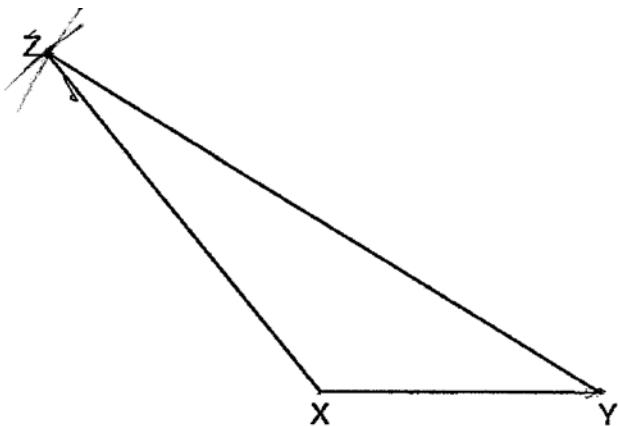
34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]

Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.
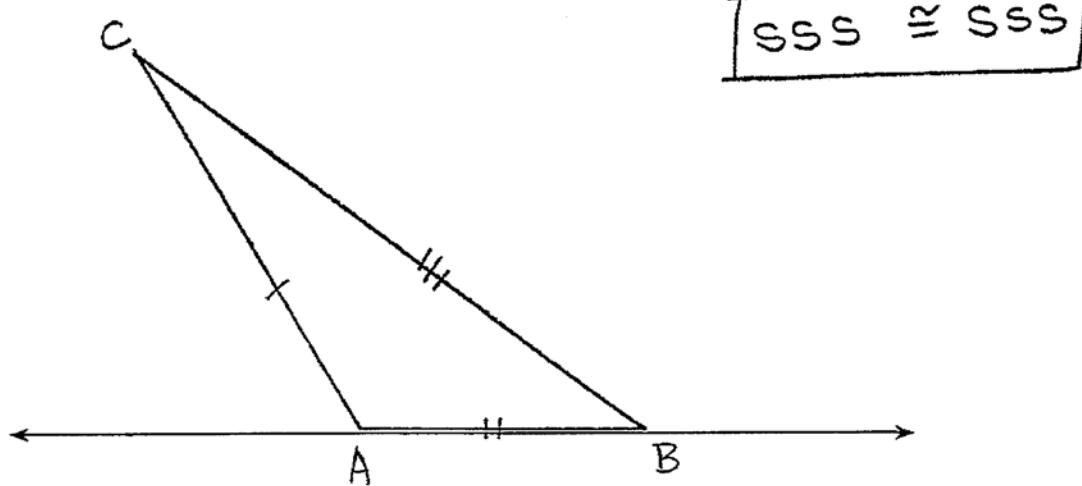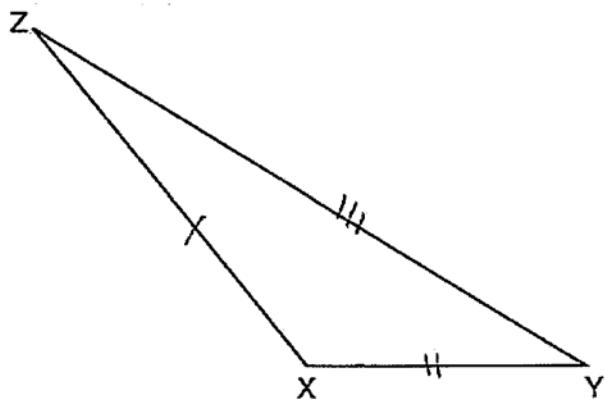
Score 2: The student had an appropriate construction of a congruent triangle, but the triangle was not labeled correctly and no theorem was stated.

34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]

Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.

SSS ≅ SSS

**Score 1:** The student made a drawing that was not a construction, but stated an appropriate theorem.
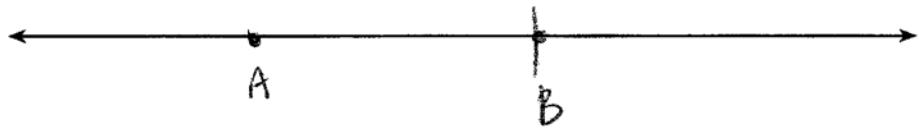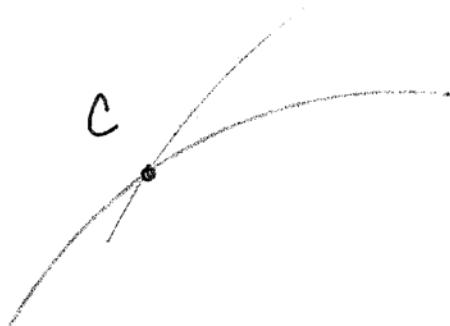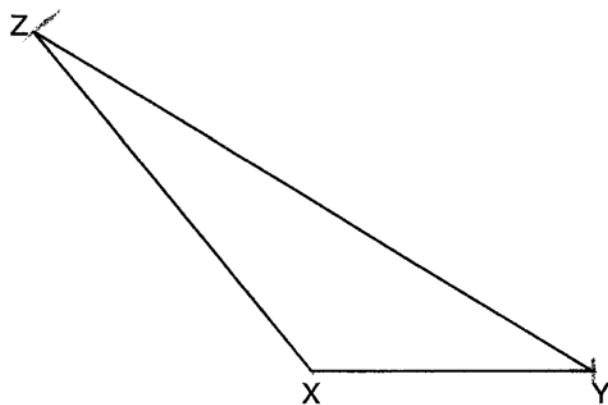
34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]

Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.

Score 1: The student made correct construction marks, but showed no further work.
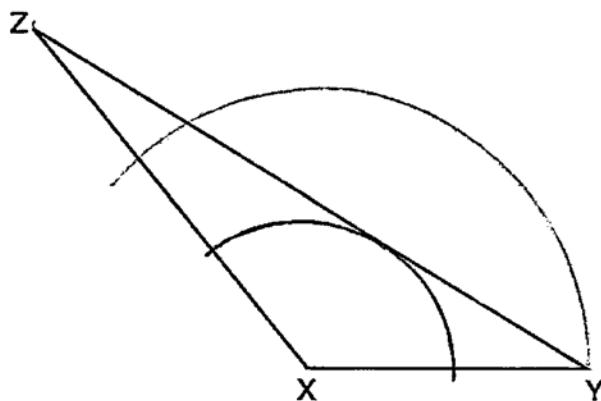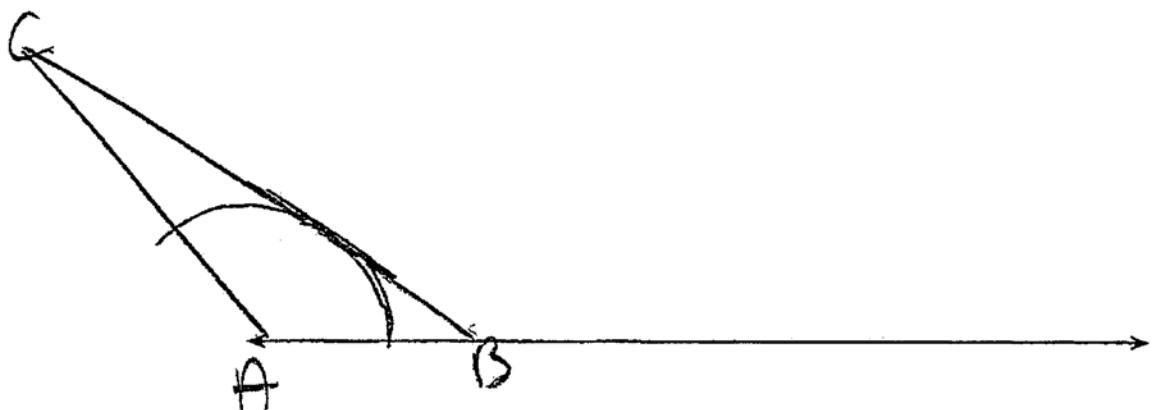
34 Triangle *XYZ* is shown below. Using a compass and straightedge, on the line below, construct and label △*ABC*, such that △*ABC* ≅ △*XYZ*. [Leave all construction marks.]

Based on your construction, state the theorem that justifies why △*ABC* is congruent to △*XYZ*.

$\triangle ABC \cong \triangle XYZ$ because they have the same exact arc.
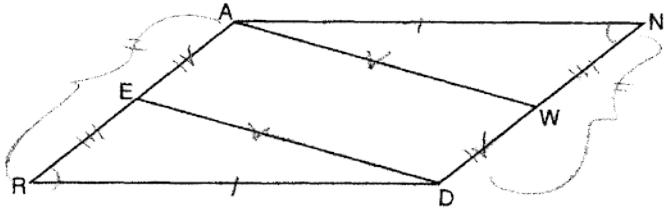
Score 0: The student's work was completely incorrect.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively

Prove that $\triangle ANW \cong \triangle DRE$.
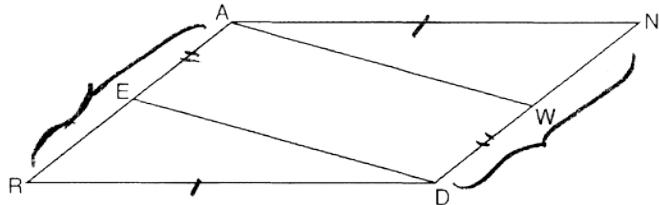
Prove that quadrilateral *AWDE* is a parallelogram.

Statements	Reasons
① Parallelogram ANDR with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points W and E respectively.	① Given
② $\overline{AE} \cong \overline{RE}$, $\overline{DW} \cong \overline{NW}$	② A segment bisector cuts a segment into two $\cong$ parts
③ $\overline{RA} \cong \overline{DN}$, $\overline{RD} \cong \overline{NA}$	③ In a parallelogram, opposite sides are $\cong$
④ $\overline{RE} \cong \overline{NW}$	④ Halves of $\cong$ segments are $\cong$
⑤ $\angle R \cong \angle N$	⑤ In a parallelogram, opposite angles are $\cong$.
⑥ $\triangle DRE \cong \triangle ANW$	⑥ SAS $\cong$ SAS
⑦ $\overline{ED} \cong \overline{WA}$	⑦ CPCTC
⑧ $\overline{AE} \cong \overline{DW}$	⑧ Halves of $\cong$ segments are $\cong$
⑨ Quad. AWDE is a parallelogram	⑨ If both pairs of opposite sides are $\cong$, the quad is a parallelogram.

Score 6: The student has a complete and correct proof.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively

Prove that △*ANW* ≅ △*DRE*.
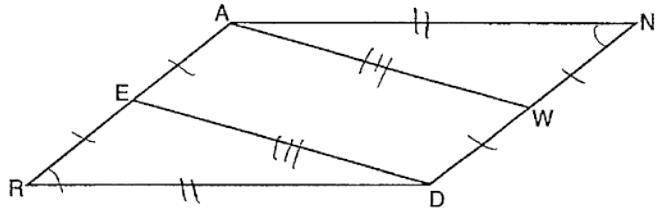
Prove that quadrilateral *AWDE* is a parallelogram.

Statements	Reasons
1. ☐ANDR $\overline{AW}$ bisects $\overline{NWD}$ $\overline{DE}$ bisects $\overline{REA}$	1. given
2. $\overline{AN} \cong \overline{RD}$, $\overline{AER} \cong \overline{DWN}$	2. opp. sides of a ☐ are ≅
3. $AE = \frac{1}{2}AR$ $WD = \frac{1}{2}DN$ ∴ $\overline{AE} \cong \overline{WD}$	3. def. of bisect + div. prop. of =
4. $\overline{REA} \parallel \overline{DWN}$	4. opp. sides of a ☐ are ∥
5. AWDE is a ☐	5. if one pair of sides of a quad. are ∥ and ≅, it is a ☐
6. $RE = \frac{1}{2}AR$, $NW = \frac{1}{2}DN$ ∴ $\overline{RE} \cong \overline{NW}$	6. reason 3
7. $\overline{ED} \cong \overline{AW}$	7. reason 2
8. △ANW ≅ △DRE	8. SSS

Score 6: The student has a complete and correct proof.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively
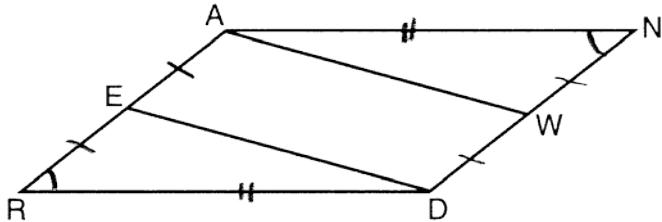
Prove that $\triangle ANW \cong \triangle DRE$.

Prove that quadrilateral *AWDE* is a parallelogram.

Statements	Reasons
1) ANDR is a ▱, $\overline{AW}$ & $\overline{DE}$ bisect $\overline{NWD}$ and $\overline{REA}$ at W & E	1) given
2) $\overline{REA} \cong \overline{NWD}$	2) opp sides of a ▱ are ≅
3) $\overline{NW} \cong \overline{WD} \cong \overline{EA} \cong \overline{ER}$ (s)	3) To bisect is to ÷ into 2 ≅ parts
4) $\overline{RD} \cong \overline{AN}$	4) opp. sides of a ▱ are ≅
5) ∡ ERD ≅ ∡ NAW	5) opp. ∡s of a ▱ are ≅
6) △ANW ≅ △DRE	6) SAS
7) $\overline{AW} \cong \overline{ED}$	7) corresp. parts of ≅ △'s are ≅
8) quad AWDE is a ▱	8) if a quad has both pairs of opp. sides ≅, it's a ▱

Score 5: The student had one incomplete reason.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively

Prove that △*ANW* ≅ △*DRE*.
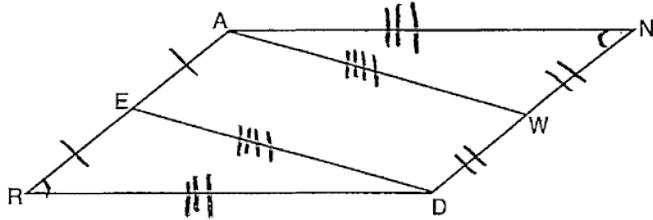
Prove that quadrilateral *AWDE* is a parallelogram.

Statement	Reason
① ▱*ANDR*, $\overline{AW}$ and $\overline{DE}$ bisect $\overline{NWD}$ and $\overline{REA}$ at points W and E, respectively	① Given
② $\overline{AR} \cong \overline{ND}$ $\overline{RD} \cong \overline{NA}$ ∠R ≅ ∠N	② ▱ properties
③ E is the midpoint of $\overline{RA}$ W is the midpoint of $\overline{ND}$	③ Definition of segment bisector
④ $\overline{AE} \cong \overline{RE}$ $\overline{DW} \cong \overline{NW}$	④ Definition of midpoint
⑤ △ANW ≅ △DRE	⑤ SAS
⑥ $\overline{DE} \cong \overline{AW}$	⑥ CPCTC
⑦ AWDE is a ▱	⑦ In a parallelogram, both pairs of opposite sides are ≅

Score 5: The student had one missing statement and reason.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively
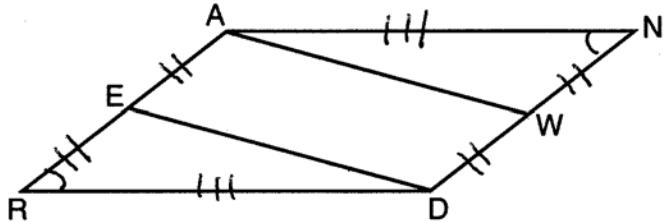

Prove that $\triangle ANW \cong \triangle DRE$.

Prove that quadrilateral *AWDE* is a parallelogram.

S

R

1.) ANOR is a parallelogram, $\overline{AW}$ + $\overline{DE}$ bisect $\overline{NWD}$ and $\overline{REA}$ at points W and E

2.) E and W are midpoints

3.) $\overline{RE} \cong \overline{AE}$
   $\overline{DW} \cong \overline{WN}$

4.) $\overline{AN} \cong \overline{RD}$, $\overline{AR} \cong \overline{ND}$

5.) $\angle ANO \cong \angle ARD$

6.) $\triangle ANW \cong \triangle DRE$

7.) $\overline{ED} \cong \overline{AW}$

8.) AEDW is a parallelogram

1.) Given

2.) Def of a bisector

3.) Def of a midpoint

4.) Opposite sides of a parallelogram are $\cong$

5.) Opposite $\angle$'s of a parallelogram are $\cong$

6.) SAS $\cong$ SAS

7.) CPCTC

8.) Opposite sides are $\cong$

Score 4: The student had a missing statement and reason and also an incomplete reason.

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35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively


Prove that △*ANW* ≅ △*DRE*.

Prove that quadrilateral *AWDE* is a parallelogram.

1. ▱ABCD, $\overline{AW}$ + $\overline{DE}$ bisect $\overline{NWD}$ + $\overline{REA}$ | 1- Given
   at points W and E respectively
2. $\overline{AN} \cong \overline{RD}$, $\overline{AR} \cong \overline{ND}$ (S≅S) | 2. opposite sides of a ▱ are ≅.
3. $\overline{AE} \cong \overline{ER}$ or $ER = \frac{1}{2} AR$ | 3. A bisector divides a line segment
   $\overline{NW} \cong \overline{WD}$ or $NW = \frac{1}{2} ND$ | into 2 ≅ segments.
4. $\overline{ER} \cong \overline{NW}$ (S≅S) | 4. Halves of ≅ quantities are ≅.
5. ∡R ≅ ∡N (a≅a) | 5. opposite angles of a ▱ are ≅.
6. △ANW ≅ △DRE | 6. SAS ≅ SAS
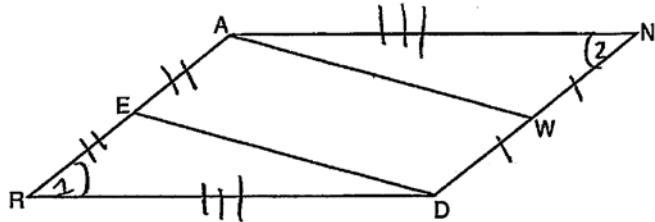
Score 3: The student proved △*ANW* ≅ △*DRE*, but did no further work.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively
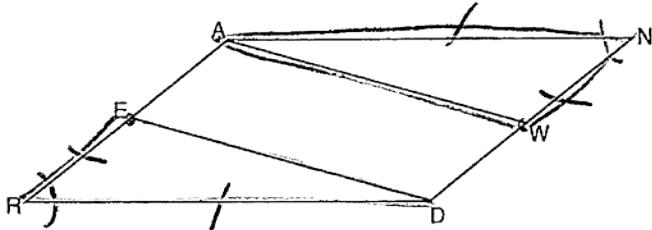
Prove that △*ANW* ≅ △*DRE*.

Prove that quadrilateral *AWDE* is a parallelogram.

Statement	Reason
1. ▱ ANDR	1. given
2. ∡1 ≅ ∡2	2. opposite ∡s of a ▱ are ≅
3. $\overline{AE} \cong \overline{ER}$, $\overline{NW} \cong \overline{WD}$	3. def bisector is to ÷ into 2 ≅ parts
4. $\overline{AR} \cong \overline{ND}$, $\overline{RD} \cong \overline{AN}$	4. opp. sides of a ▱ are ≅
5. $\overline{ER} \cong \overline{NW}$	5. halves of ≅ line segs are ≅
6. △ANW ≅ △DRE	6. SAS

Score 2: The student proved △*ANW* ≅ △*DRE*, but the given was incomplete and no further work was shown.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively
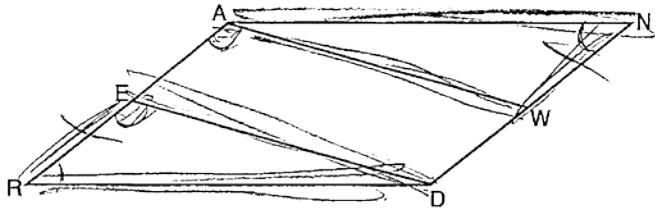

Prove that $\triangle ANW \cong \triangle DRE$.

Prove that quadrilateral *AWDE* is a parallelogram.

Statements	reasons
① [P] ANDR w/ AW&DE bisecting NWD&RE+h@pts W&E	① Given
② RD ≅ AN	② opposite side of a [P] ≅
③ AR ≅ ND	③ opposite sides of a [P] ≅
④ NW ≅ WD ≅ RE ≅ FE	④ subtraction
⑤ <N ≅ <R	⑤ opp. X's of a [P] are ≅
⑥ §△ANW ≅ △DRE	⑥ SAS

Score 2: The student had four statements and/or reasons missing or incorrect.

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively

Prove that △*ANW* ≅ △*DRE*.
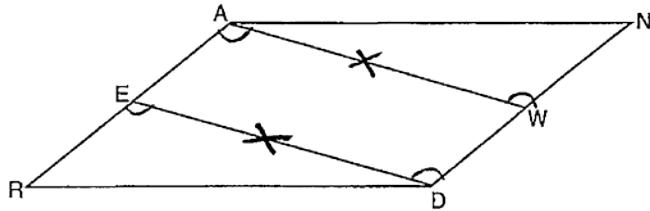
Prove that quadrilateral *AWDE* is a parallelogram.

Statement	Reason
① ▱ ANDR	① given
② $\overline{AW}$ and $\overline{PE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points W and E respectively	② given
③ ∡P ≅ ∡N	③ IN a ▱ oppisate angles are ≅
④ ∡E ≅ ∡A	④ In a ▱ corresponding angies are ≅
⑤ $\overline{RE}$ ≅ $\overline{WN}$	⑤ In a ▱ oppisate sides are ≅
⑥ △ANW ≅ △DRE	⑥ ASA ≅ ASA

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

35 Given: Parallelogram *ANDR* with $\overline{AW}$ and $\overline{DE}$ bisecting $\overline{NWD}$ and $\overline{REA}$ at points *W* and *E*, respectively
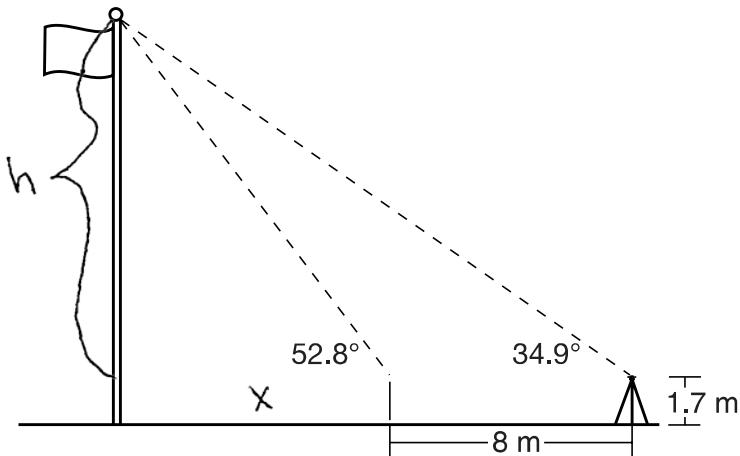
Prove that $\triangle ANW \cong \triangle DRE$.

Prove that quadrilateral *AWDE* is a parallelogram.

Statement	Reason
① $\overline{AW}$ and $\overline{DE}$ are & bisectors	① Given
② $\overline{AW} \cong \overline{AW}$	② reflexive property
③ $\overline{ED} \cong \overline{ED}$	③ reflexive postulate
④ $\angle D \cong \angle W$	④ Bisector's Split angle's into Congruent ∡'s.
⑤ $\angle E \cong \angle A$	⑤ Same as Statement 4
⑥ $\triangle ANW \cong \triangle DRE$	⑥ ASA ≅ ASA

Score 0: The student's proof was completely incorrect.
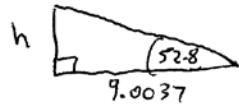
36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$$\tan 52.8 = \frac{h}{x} \qquad \tan 34.9 = \frac{h}{x+8}$$

$$x \tan 52.8 = h \qquad (x+8)\tan 34.9 = h$$

$$x \tan 52.8 = x \tan 34.9 + 8 \tan 34.9$$
$$- x \tan 34.9 \qquad - x \tan 34.9$$

$$x \tan 52.8 - x \tan 34.9 = 8 \tan 34.9$$

$$x(\tan 52.8 - \tan 34.9) = 8 \tan 34.9$$

$$\frac{.6198416839 \, x}{.6198416839} = \frac{8 \tan 34.9}{.6198416839}$$

$$x = 9.003714087$$

$$\tan 52.8 = \frac{h}{9.003714087}$$

$$h = 9.003714087 \tan 52.8$$

$$h = 11.86195525$$
$$+ 1.7$$

$$\text{height} = 13.56195525$$

height = 13.6 m

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

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$\tan 52.8 = \dfrac{h}{b}$

$\dfrac{b \tan 52.8}{\tan 52.8} = \dfrac{h}{\tan 52.8}$

$b = \dfrac{h}{\tan 52.8}$

$\tan 34.9 = \dfrac{h}{b+8}$

$(b+8)\tan 34.9 = h$

$b \tan 34.9 + 8 \tan 34.9 = h$

$ -8 \tan 34.9 \quad -8 \tan 34.9$

$\dfrac{b \tan 34.9}{\tan 34.9} = \dfrac{h - 8 \tan 34.9}{\tan 34.9}$

$b = \dfrac{h - 8 \tan 34.9}{\tan 34.9}$

$\dfrac{h}{\tan 52.8} = \dfrac{h - 8 \tan 34.9}{\tan 34.9}$

$h \tan 34.9 = h \tan 52.8 - 8 \tan 34.9 \tan 52.8$

$-h \tan 52.8 \qquad -h \tan 52.8$

$\overline{h \tan 34.9 - h \tan 52.8 = {}^-8 \tan 34.9 \tan 52.8}$

$\dfrac{h(\tan 34.9 - \tan 52.8)}{(\tan 34.9 - \tan 52.8)} = \dfrac{{}^-8 \tan 34.9 \tan 52.8}{(\tan 34.9 - \tan 52.8)}$

$h = \dfrac{{}^-8 \tan 34.9 \tan 52.8}{(\tan 34.9 - \tan 52.8)}$

$h = 11.86195525$

$ 11.86195525$
$ + 1.7$
$ \overline{13.56195525}$

$\boxed{\text{height} = 13.6_m}$

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

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$$\tan 34.9 = \frac{y}{x+8} \qquad \tan 52.8 = \frac{y}{x}$$

$$x\tan 34.9 + 8\tan 34.9 = x\tan 52.8$$
$$-x\tan 34.9 \qquad\qquad -x\tan 34.9$$

$$\frac{8\tan 34.9}{0.6198} = \frac{0.6198\, x}{0.6198}$$

$$x = 9.0037$$

$$9.0037(\tan 52.8) = y$$

$$\boxed{11.9}$$

$$y = 11.862$$
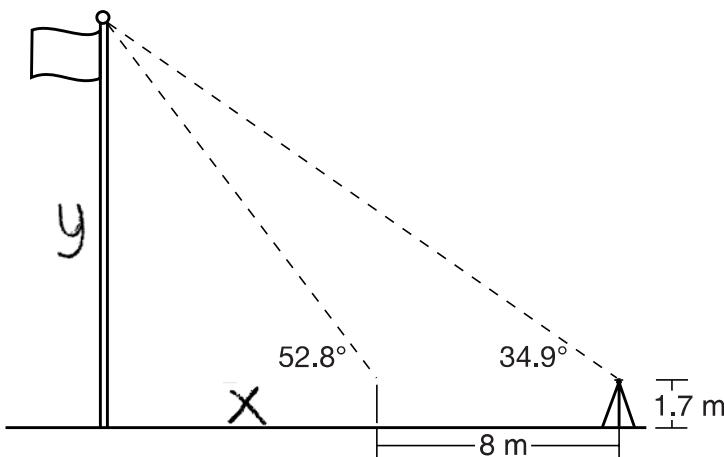
Score 5:   The student only found the vertical distance between the top of the flagpole to the top of the survey instrument.

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$$\tan 34.9 = \frac{y}{x+8} \qquad \tan 52.8 = \frac{y}{x}$$

$$x\tan 34.9 + 8\tan 34.9 = x\tan 52.8$$
$$x\tan 34.9 \qquad\qquad - x\tan 34.9$$

$$\frac{8\tan 34.9}{0.6198} = \frac{0.6198x}{0.6198}$$

$$x = 9.0037$$

$$\boxed{x = 9.0}$$

Score 4: The student only found the distance between the second measurement and the flagpole.

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$$\tan 34.9 = \frac{x}{y} \qquad \tan 52.8 = \frac{x}{y-8}$$

$$y \tan 34.9 = x$$

$$\tan 52.8 = \frac{y \tan 34.9}{y-8}$$
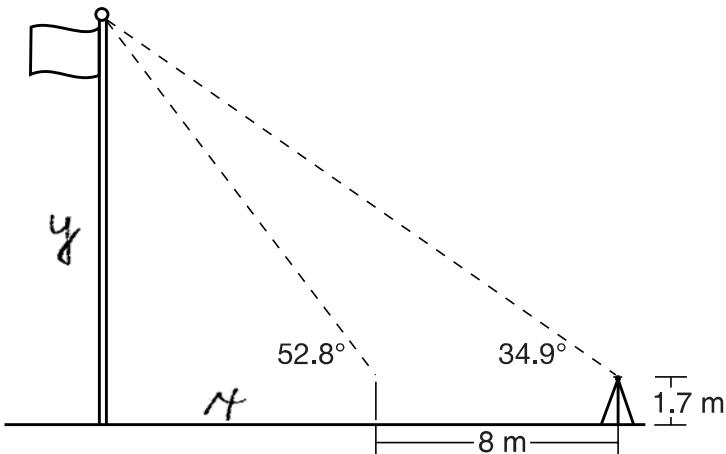
Score 3: The student wrote both trigonometric equations correctly and substituted correctly.

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$$\tan 52.8 = \frac{y}{x}$$

$$\tan 34.9 = \frac{y}{x+8}$$
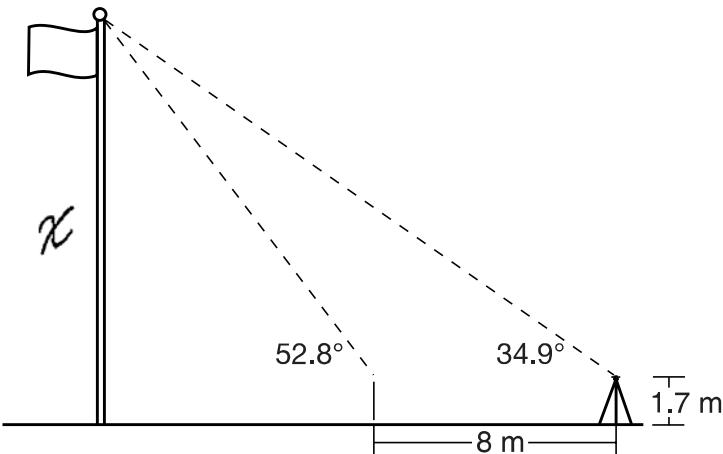
Score 2: The student wrote a correct system of trigonometric equations to find the height of the flagpole.

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$$\tan(34.9) = \frac{x}{16}$$

$$16(.69760) = \frac{x}{16} \times 16$$

$$11.1617546 = x + 1.7 = 12.8617546$$

$$\approx 12.9$$

The height of the flagpole is approx. 12.9 m.
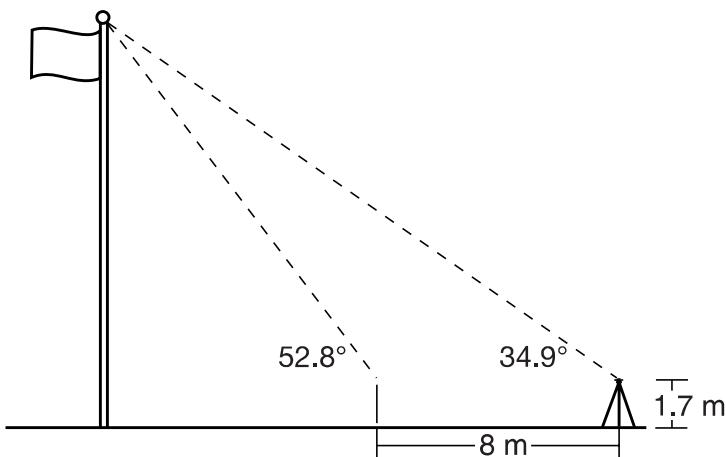
Score 1:   The student made a critical error by assuming the distance between the survey instrument and the flagpole is 16 meters. This significantly reduced the level of difficulty of the question.

36 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9°. She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8°. At each measurement, the survey instrument is 1.7 meters above the ground.

Determine and state, to the *nearest tenth of a meter*, the height of the flagpole.

$8 \times 1.7 = \boxed{13.6}$

Score 0:   The student found the correct answer by an obviously incorrect procedure.

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

Regents Examination in Geometry (Common Core) – January 2016

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

(Use for the January 2016 exam only.)

Raw Score	Scale Score	Performance Level	Raw Score	Scale Score	Performance Level	Raw Score	Scale Score	Performance Level
86	100	5	57	79	3	28	59	2
85	99	5	56	78	3	27	58	2
84	98	5	55	78	3	26	57	2
83	97	5	54	77	3	25	56	2
82	96	5	53	77	3	24	55	2
81	95	5	52	76	3	23	53	1
80	94	5	51	76	3	22	52	1
79	93	5	50	75	3	21	50	1
78	92	5	49	75	3	20	49	1
77	91	5	48	74	3	19	48	1
76	91	5	47	73	3	18	46	1
75	90	5	46	73	3	17	44	1
74	89	5	45	72	3	16	43	1
73	88	5	44	72	3	15	41	1
72	87	5	43	71	3	14	39	1
71	87	5	42	71	3	13	37	1
70	86	5	41	70	3	12	35	1
69	86	5	40	69	3	11	33	1
68	85	5	39	68	3	10	31	1
67	84	4	38	68	3	9	29	1
66	83	4	37	67	3	8	27	1
65	83	4	36	66	3	7	24	1
64	82	4	35	66	3	6	22	1
63	82	4	34	65	3	5	19	1
62	81	4	33	64	2	4	16	1
61	81	4	32	63	2	3	13	1
60	80	4	31	62	2	2	9	1
59	80	4	30	61	2	1	5	1
58	79	3	29	60	2	0	0	1

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

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

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