JEFFERSON MATH PROJECT

REGENTS QUESTIONS BY GEOMETRY CONTENT BAND PERFORMANCE INDICATORS

Geometry, Math A/B NY Regents Exam Questions Sorted by Content Band Performance Indicators
(Answer Key)

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Dear Sir

I have to acknolege the reciept of your favor of May 14. in which you mention that you have finished the 6. first books of Euclid, plane trigonometry, surveying & algebra and ask whether I think a further pursuit of that branch of science would be useful to you. there are some propositions in the latter books of Euclid, & some of Archimedes, which are useful, & I have no doubt you have been made acquainted with them. trigonometry, so far as this, is most valuable to every man, there is scarcely a day in which he will not resort to it for some of the purposes of common life. the science of calculation also is indispensible as far as the extraction of the square & cube roots; Algebra as far as the quadratic equation & the use of logarithms are often of value in ordinary cases: but all beyond these is but a luxury; a delicious luxury indeed; but not to be indulged in by one who is to have a profession to follow for his subsistence. in this light I view the conic sections, curves of the higher orders, perhaps even spherical trigonometry, Algebraical operations beyond the 2d dimension, and fluxions.

Letter from Thomas Jefferson to William G. Munford, Monticello, June 18, 1799.

[1] A

[2] A

[3] A

[4] A

[5] C

[6] A

[7] A

[8] A

[9] D

[2] 20, and appropriate work is shown, such as $3,360 \div (14 \times 12)$.
[1] Appropriate work is shown, but one computational error is made.
or [1] 20, 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
[10] incorrect procedure.

[11] D

[3] 3, 12, and 30 and an appropriate arithmetic method or equation is shown, such as $40x^3 = 1080$.
[2] An appropriate equation or method is shown, but not all three dimensions are found.
or [2] An appropriate method is shown, and although one computational mistake is made, the student does find three dimensions based on this mistake, such as dividing 1080 by 40 incorrectly.
[1] The student shows that multiplication is required to find volume but sets up an incorrect method and does not find three dimensions.
or [1] 3, 12, and 30 and no work is shown.
[0] The sum is used instead of the product, or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[12] obviously incorrect procedure.

[13] D

GEOMETRIC RELATIONSHIPS BAND

[4] 11, and appropriate work is shown, such as solving the quadratic equation $3x(x+5) = 150$ or trial and error with at least three trials and appropriate checks.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown to determine that 5 is the shorter side of the box, but the shorter side of the original sheet is not found or is found incorrectly.
or [3] An incorrect quadratic equation of equal difficulty is solved appropriately, and an appropriate shorter side of the original sheet is found.
[2] Appropriate work is shown, but more than one computational error is made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] An incorrect quadratic equation of equal difficulty is solved appropriately, but the shorter side of the original sheet is not found.
or [2] A correct quadratic equation is set equal to zero, but no further correct work is shown.
or [2] The trial-and-error method is used to find a correct solution, but only two trials and appropriate checks are shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] One conceptual error is made in finding the shorter side of the box, and the corresponding shorter side of the original sheet is not found or is found incorrectly.
or [1] A correct quadratic equation is written, but it is not set equal to zero, and no further correct work is shown.
or [1] 11, but no work or only one trial with an appropriate check is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[14] incorrect procedure.

[15]   C

[16]   B

[2] 2016, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 2016, 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
[17] incorrect procedure.

[18]   D

[2] 22.4, and appropriate 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] 22.4, 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
[19] incorrect procedure.

[20]   B

GEOMETRIC RELATIONSHIPS BAND

[3] 5-inch box and appropriate work is shown, including showing a diameter between 4 and 5.

[2] The correct diameter is shown, but the wrong box size is chosen.

or [2] The correct radius is shown, but the 3-inch box is chosen.

[1] The correct diameter or radius is shown, but no box is chosen.

or [1] An appropriate radius between 2 and 3 is shown, using the incorrect formula $A = \pi r^2$, and the 3-inch box is chosen.

or [1] An appropriate diameter, using $A = \pi r^2$, is shown, but the appropriate box is chosen.

or [1] An appropriate radius, using $A = \pi r^2$, is shown, but no box is chosen.

or [1] The 5-inch box is chosen, 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

[21]   incorrect procedure.

[1] D

[2] A correct construction is drawn to find the midpoint of $\overline{BC}$, showing both sets of arcs and a line connecting A with the midpoint.
[1] A correct construction is drawn to find the midpoint of $\overline{BC}$, but the median is not drawn.
or [1] The construction is appropriate, but a compass and a straightedge are not used.
[0] No construction arcs are shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[2] obviously incorrect procedure.

[2] A correct construction is drawn showing all appropriate arcs, and the angle bisector is drawn.
[1] All construction arcs are drawn, but the angle bisector line is not drawn.
or [1] Appropriate work is shown, but one construction error is made, such as not extending the sides of the original angle to show points of intersection of the arc.
[0] A drawing that is not an appropriate construction is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[3] obviously incorrect procedure.

[2] A correct construction is drawn showing all appropriate arcs, and the angle bisector is drawn.
[1] All construction arcs are drawn, but the angle bisector is not drawn.
or [1] The appropriate method is demonstrated, but one construction error is made, such as not extending the sides to show points of intersection by the arc.
[0] A drawing that is not an appropriate construction is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[4] obviously incorrect procedure.

[5] A

[2] A correct construction is drawn, showing the arcs intersecting above and below $\overline{AB}$, and the perpendicular line is drawn.
[1] All of the construction arcs are drawn, but the perpendicular line is not drawn.
[0] A drawing that is not an appropriate construction is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[6] obviously incorrect procedure.

[2] A correct construction is drawn, showing the arcs intersecting above and below $\overline{AB}$, and line c is drawn.
[1] A correct construction is drawn, but line c is not labeled.
[0] A drawing that is not a construction is shown with arc marks sketched.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[7] obviously incorrect procedure.

[8] B

[9] C

[2] A correct construction is drawn, showing all necessary arcs.
[1] All of the construction arcs are drawn, but the perpendicular line is not drawn.
or [1] A line perpendicular to $\overleftrightarrow{AB}$ is constructed correctly, but it does not pass through point P.
[0] A drawing that is not an appropriate construction is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[10] obviously incorrect procedure.

[2] A correct construction is drawn showing all appropriate arcs, and the perpendicular line is drawn.

[1] Appropriate work is shown, but one construction error is made, such as not drawing the perpendicular line.

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

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

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

[11]   obviously incorrect procedure.

[12]   B

[1] D

[2] B

[3] A

[4] C

[5] D

[6] C

[7] A

[8] C

a [3] Two parallel lines, one 3 units above and one 3 units below $\overleftrightarrow{AB}$, and a circle with its center at P with a radius of 5 units are described correctly in words or drawn.
[2] Only one parallel line 3 units above or 3 units below $\overleftrightarrow{AB}$ and a correct circle are described in words or drawn.
or [2] Appropriate parallel lines are shown, but the circle is incomplete.
[1] Both parallel lines and the circle have incomplete descriptions or drawings.
[0] Only one incomplete locus is described or drawn.
b [1] 4, and appropriate work is shown.
or [1] An appropriate answer for an incorrect part a is found.
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct
response that was obtained by an obviously
[9] incorrect procedure.

[4] A correct diagram is drawn, two **X** points are marked, a numerical 2 is given for the places to dig, and appropriate work is shown.
[3] The diagram is correct including two **X** points, but an incorrect answer or no answer is found.
[2] One correct locus situation and one incorrect locus situation are drawn, but the answer is appropriate according to the diagram.
or [2] Each locus situation is correctly drawn, but no **X** points are marked, and no numerical answer is found.
[1] Only one locus situation is correctly drawn and an incorrect conclusion or no conclusion is shown.
or [1] 2 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
[10] incorrect procedure.

[2] 2 and an appropriate sketch of two circles intersecting in two points is shown.
[1] 2 and no sketch is shown.
or [1] An appropriate sketch is shown, without indicating 2 as the possibilities.
or [1] An appropriate number is found, based on an inappropriate sketch.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[11] incorrect procedure.

LOCUS BAND

a [2] A correct sketch is drawn that shows two possible locations, such as parallel lines and a perpendicular bisector. Students can draw their own sketch or use the diagram given.
[1] A correct sketch is drawn, but with no indication of where the treasure is buried.
or [1] A partial sketch is drawn, showing either the distances from the fence or the distance from the trees.
b [1] 5 feet
or [1] An appropriate answer is found for an incorrect part a.
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[12] _____

[4] Two **X**s are indicated at the intersections of the angle bisector and the parallel lines in the correct sketch of the loci.
[3] All loci are drawn correctly, but no **X**s are drawn to indicate the locations, or only one **X** is drawn.
or [3] The angle bisector is drawn correctly, but only one line is drawn parallel to the walkway, but an **X** is indicated appropriately.
[2] Only one correct locus is drawn, but **X**s indicate the two appropriate locations of the intersection of the loci.
[1] **X**s are drawn in the correct locations, but no loci are shown.
or [1] Only one correct locus is drawn, and no **X**s are indicated.
or [1] Both loci are drawn incorrectly, but **X**s are drawn on the appropriate points of intersection.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[13] _____

[3] 4, and an appropriate sketch is drawn that shows a circle with C as its center and a radius of 6 and two parallel lines, one 3 units above and one 3 units below line p.
[2] An appropriate sketch is drawn, but the answer 4 is not found.
or [2] Only one locus is drawn correctly, but the appropriate number of points of intersection is found.
[1] Only one locus is drawn correctly, and no further correct work is shown.
or [1] Both loci are drawn incorrectly, but the appropriate number of points of intersection is found.
or [1] 4, but no work or sketch 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.

[14] _____

[2] Both loci are sketched correctly, and the two points of intersection are labeled with an **X**.
[1] Both loci are sketched correctly, but the points of intersection are not labeled or are labeled incorrectly.
or [1] Appropriate work is shown, but one conceptual error is made, but appropriate points of intersection are labeled.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[15] _____

[4] Both loci are drawn correctly, and the three points of intersection are labeled with an **X**.

[3] Both loci are drawn correctly, but only two points of intersection are labeled.

or [3] Both loci are drawn, but one graphing error is made, but appropriate points of intersection are labeled.

[2] Both loci are drawn correctly, but the points of intersection are not labeled or are labeled incorrectly.

or [2] Both loci are drawn, but two or more graphing errors are made, but appropriate points of intersection are labeled.

or [2] Both loci are drawn, but one conceptual error is made, but appropriate points of intersection are labeled.

[1] One locus is drawn correctly, but no further correct work is shown.

or [1] **X**s are placed appropriately, but no loci are drawn.

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

[16]   incorrect procedure.

[4] Both loci are drawn correctly and the two points of intersection are labeled with an **X**.

[3] Both loci are drawn correctly, but only one correct point of intersection is labeled.

or [3] Both loci are drawn, but one graphing error is made, but appropriate points of intersection are labeled.

[2] Both loci are drawn correctly, but the points of intersection are not labeled or are labeled incorrectly.

or [2] Both loci are drawn, but two or more graphing errors are made, but appropriate points of intersection are labeled.

or [2] One conceptual error is made, such as drawing two parallel lines instead of a circle, but appropriate points of intersection are labeled.

[1] One locus is drawn correctly, but no further correct work is shown.

or [1] **X**s are placed appropriately, but no loci are drawn.

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

[17]   incorrect procedure.

[1] A

[2] A

[3] A

[4] D

[5] B

[6] B

[7] B

[8] D

[9] B

[10] B

[11] C

[12] C

[13] A

[2] True, and an appropriate justification is written.
[1] True, but the justification is incorrect.
or [1] One conceptual error is made in evaluating the disjunction, but an appropriate justification is written.
[0] True, but no justification is written.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[14] obviously incorrect procedure.

[15] B

[16] D

[17] D

[18] D

[19] A

[20] D

[2] 23, and appropriate work is shown.
[1] Appropriate work is shown, but no answer or an incorrect answer is found.
or [1] 23, 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
[21] incorrect procedure.

[22] D

[23] C

[24] B

[25] D

[3] At least one example is shown that makes the statement true, such as 2, 3, 5, 7, 9, or a defined variable; and one example is shown that makes the statement false, such as any even number other than 2, with a correct explanation that shows that the student can recognize odd numbers and prime numbers. The explanation can be in words or as a Venn diagram.
[2] Two correct examples are shown, one that shows the statement is true and one that shows the statement is false, but no explanation or an inappropriate explanation is given.
or [2] Only one correct example is shown, but an appropriate explanation is given.
[1] Only one correct example is shown, and no explanation or an incorrect explanation is given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[26] incorrect procedure.

[27] C

[28] C

[29] B

[30] C

INFORMAL AND FORMAL PROOFS BAND

[31] A

[32] D

[33] A

[34] A

[35] D

[36] D

[37] A

[38] C

[39] A

[40] D

[41] A

[42] A

[43] D

[44] B

[45] C

[46] A

[47] D

[48] A

[49] B

[50] D

[51] A

[52] D

[53] A

[2] A correct logically equivalent statement is written and identified as the contrapositive.
[1] An incorrect statement is written, but it is identified appropriately.
or [1] Contrapositive is identified, but the statement is missing or incorrect.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[54] incorrect procedure.

[3] Three correct statements are written for the converse, the inverse, and the contrapositive.
[2] Two correct statements are written.
[1] One correct statement is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[55] incorrect procedure.

[4] Contrapositive, and all three statements are written correctly.
[3] Contrapositive, and only two of the statements are written correctly
or [3] All three statements are written correctly, but the contrapositive is not identified.
[2] Contrapositive, and only one statement is written correctly.
or [2] Only two statements are written correctly, and the contrapositive is not identified.
[1] All three statements are written incorrectly, but the contrapositive is identified.
or [1] Only one statement is written correcdy, and the contrapositive is not identified.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[56] incorrect procedure.

INFORMAL AND FORMAL PROOFS BAND

[6] A complete and correct proof 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 is incorrect.
[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements and/or reasons are missing or are incorrect.
[3] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
[2] Some correct relevant statements about the proof are made, but three or four statements and/or reasons are missing or are incorrect.
[1] Only one correct statement and reason are written.
[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[57] obviously incorrect procedure.

[4] The reasons for all four steps are correct, such as:
Step 3: Perpendicular line segments form right angles.
Step 6: If two parallel lines are cut by a transversal, the alternate interior angles are congruent.
Step 8: $AAS \cong AAS$.
Step 9: Corresponding parts of congruent triangles are congruent.
[3] The reasons for only three steps are correct.
[2] The reasons for only two steps are correct.
[1] The reason for only one step is correct.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[58] incorrect procedure.

[6] A complete and correct proof that includes a conclusion 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 is incorrect.

or [5] $\Delta SEP \cong \Delta VEO$ is proven, but no further correct work is shown.

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

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

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

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

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

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

[59]

[6] A complete and correct proof is written.

[5] $\Delta BAM \cong \Delta CDM$ is proven, but no further correct work is shown.

or [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 is incorrect.

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

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

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

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

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

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

[60]

INFORMAL AND FORMAL PROOFS BAND

[6] Either a correct Euclidean proof is written, with a concluding statement that the diagonals bisect each other, or a correct analytic proof using coordinate geometry is written, with a concluding statement that the diagonals bisect each other.

[5] One reason is omitted or incorrect.

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

[4] The appropriate triangles are proven to be congruent, but the corresponding parts and a final statement that indicates why the diagonals are bisected are omitted.

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

or [4] A correct analytic proof using coordinate geometry is written, but no concluding statement is made.

[3] An appropriate conclusion is drawn, including a statement that indicates why the diagonals are bisected; but only a partial proof is written, with two steps missing, and errors in the statements or reasons are made.

or [3] An analytic proof using coordinate geometry with more than two errors is written, but an appropriate concluding statement is made.

or [3] The diagram in an analytic proof is labeled incorrectly or numerically, but the rest of the proof is correct.

[2] Statements for the Euclidean proof are written, but no valid reasons are given.

or [2] A congruence proof is written with some valid statements and reasons, but a concluding statement that the diagonals bisect each other is not made.

[1] A correctly labeled diagram for a Euclidean proof is shown, but no proof is written.

or [1] An analytic proof using coordinate geometry with more than two errors is written, but no concluding statement is made.

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

[61]   incorrect procedure.

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

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

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

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

or [3] $\triangle AFB \cong \triangle CED$ is proven, but no further correct work is shown.

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

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

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

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

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

[62]   obviously incorrect procedure.

INFORMAL AND FORMAL PROOFS BAND

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

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

or [5] $\angle A \cong \angle E$ or $\angle B \cong \angle D$ is proven, but no further correct work is shown.

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

or [4] $\triangle ABC \cong \triangle EDC$ is proven, but no further correct work is shown.

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

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

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

[0] The given and/or the prove statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

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

[63] obviously incorrect procedure. _____

[6] A complete and correct proof that includes a conclusion 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 is incorrect.

or [5] $\triangle BEA \cong \triangle CED$ is proven or $\triangle BEC$ is proven to be isosceles, but no further correct work is shown.

[4] A proof is written that demonstrates a good understanding of the method of proof, but two statements and/or reasons are missing or are incorrect.

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

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

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

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

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

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

[64] obviously incorrect procedure. _____

[65] A _____

INFORMAL AND FORMAL PROOFS BAND

[4] The proof in column or paragraph form explains clearly, by using contradiction or indirect proof, that altitude $\overline{BD}$ does not bisect side $\overline{AC}$.

[3] An appropriate conclusion is shown, without specifying that congruent triangles are actually formed only if a triangle is isosceles.

[2] An appropriate diagram is drawn and some evidence that congruence may be an issue is shown, but no further reasoning is given or no conclusion is drawn.

[1] Circular reasoning is used or the statement is said to be true, but no proof by contradiction or indirect proof is shown.

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

[66] incorrect procedure.

[2] A correct indirect proof is written with appropriate statements and reasons.

[1] The assumption that $\overline{AT}$ is perpendicular to $\overline{CD}$ is written, but no further correct work is shown.

or [1] A method other than an indirect proof is used to show that $\overline{AT}$ is not perpendicular to $\overline{CD}$.

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

[67] incorrect procedure.

[4] An appropriate diagram is drawn, and a correct proof is written in statement-reason or paragraph form, such as stating that ΔAOB cannot have two right angles or that two perpendiculars cannot be drawn to $\overline{PA}$ from point O.

[3] An appropriate diagram is drawn and an appropriate reason is written to show $\overline{OA} \perp \overline{PA}$, but one statement or one reason is incomplete or is incorrect, but an appropriate conclusion is drawn.

or [3] The diagram is not drawn, but a complete and correct proof is written.

[2] An appropriate diagram is drawn, and an appropriate reason is written to show $\overline{OA} \perp \overline{PA}$, but one statement and one reason are incomplete or are incorrect, but an appropriate conclusion is drawn.

[1] An appropriate diagram is drawn, but the proof contains circular reasoning.

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

[68] incorrect procedure.

[6] Complete and correct proof (statement and reason or paragraph form).

[5] 1 statement and/or reason incorrect/incomplete, but leads to the conclusion.

[4] No or incorrect conclusion drawn to correct proof of parallel lines OR and SE.

or [4] 2 statements and/or reasons incorrect/incomplete, but leads to proper conclusion.

[3] Partial proof, missing more than two steps, with correct conclusion.

[2] Assumes bisection and only proves triangles congruent.

[1] Gives proper assumption and conclusion only.

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

[69] incorrect procedure.

[70] D

[71] C

[72] A

[73] A

[74] A

[75] D

[76] C

[77] C

[78] A

[6] A complete and correct proof 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 or reason is missing or is incorrect, or the concluding statement is missing.
[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements or reasons are missing or are incorrect.
[3] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
[2] Some correct relevant statements about the proof are made, but three or four statements or reasons are missing or are incorrect.
[1] Only one correct statement and reason are written.
[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[79] obviously incorrect procedure.

[4] A complete and correct proof that includes a concluding statement is written.
[3] A proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one statement or reason is missing or is incorrect or the concluding statement is missing.
[2] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.
[1] Some correct relevant statements about the proof are made, but two or three statements and/or reasons are missing or are incorrect.
[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[80] obviously incorrect procedure.

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

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

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

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

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

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

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

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

[81]   obviously incorrect procedure. _____

[4] Appropriate work is shown to explain why or prove the triangles are congruent.

[3] An explanation is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one reason is missing or is incorrect.

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

[1] Some correct relevant statements about the method of proof are made, but two or three statements or reasons are missing or are incorrect.

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

[82]   incorrect procedure. _____

[83]   C _____

[84]   D _____

[85]   A _____

[2] 26, and appropriate work is shown.

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

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

or [1] $x + 3x + 5x - 54 = 180$ or an equivalent equation, but no further correct work is shown.

or [1] 26, 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

[86]   incorrect procedure. _____

[87]   C _____

INFORMAL AND FORMAL PROOFS BAND

[3] $m\angle A = 65$ and $m\angle B = 25$, and appropriate work is shown.

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

or [2] Appropriate work is shown to find 65 and 25, but the angles are not labeled or are labeled incorrectly.

or [2] An incorrect expression is written for angle A, but an appropriate equation is solved, and appropriate measures of angle A and angle B are found.

or [2] Appropriate work is shown to find $x = 25$, but no further correct work is shown.

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

or [1] Appropriate work is shown, but one conceptual error is made, such as solving the equation $3x + 15 = 180$ for both the measures of angle A and angle B.

or [1] A correct equation is written, but no further correct work is shown.

or [1] $m\angle A = 65$ and $m\angle B = 25$, but no work is shown.

[0] $m\angle A = 65$ or $m\angle B = 25$, but no work is shown.

or [0] 65 and 25, but no work is shown, and the angles are not labeled or are labeled incorrectly.

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

[4] $m\angle A = 20$, $m\angle B = 59$, and $m\angle C = 101$, and appropriate work is shown.

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

or [3] A correct equation is written and solved, and the correct measures for the angles are found, but they are not labeled or are labeled incorrectly.

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

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

or [2] A correct equation is written and solved for x, but the measures of the angles are not found.

or [2] An incorrect equation of equal difficulty is solved appropriately, and the three angles are found.

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

or [1] A correct equation is written, but no further correct work is shown.

or [1] $m\angle A = 20$, $m\angle B = 59$, and $m\angle C = 101$, but no work is shown.

[0] $m\angle A = 20$, or $m\angle B = 59$, or $m\angle C = 101$, 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
[89]   obviously incorrect procedure.

[90] A

[91] C

[92] A

[93] C

[94] A

[95] D

[96] D

[97] A

INFORMAL AND FORMAL PROOFS BAND

[98]   B

[2] An isosceles triangle that is not acute is drawn, and its three angles are labeled, such as 20, 20, 140 or 45, 45, 90.
[1] An isosceles triangle is drawn that shows an angle that is not acute, but the base angles are not labeled.
or [1] The three angles are stated correctly, but no triangle is drawn.
[0] The triangle that is drawn and labeled is not isosceles or is acute.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[99]   obviously incorrect procedure.

[3] The student draws an obtuse triangle and all sides and all angles are correctly calculated, such as by using 120°, 30°, and 30° and sides 4, 4, and 10.
[2] The student has the angles correctly indicated and the two congruent sides marked, but the length of the longest side is incorrect or is missing.
or [2] All sides are correctly marked, but the angles do not add to 180°, but an obtuse angle and two congruent angles are shown.
[1] Only the angles are correctly shown.
or [1] Only the sides are correctly shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[100]   incorrect procedure.

[3] 135 and appropriate work is shown.
[2] The two correct angles of 65° and 70° are found, but their sum is not identified as the answer to the question.
or [2] 65° or 70° and an appropriate sum is found.
[1] Either the 65° or the 70° is correctly identified.
or [1] Two incorrect angle measures are found, but they are added correctly.
or [1] 135 and 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
[101]   incorrect procedure.

[2] 30, and appropriate work is shown or an appropriate explanation is given.
[1] Angles of the equilateral triangle are shown to be 60°, but x is not determined or is determined incorrectly.
or [1] 30, but no work is shown or no explanation is given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[102]   incorrect procedure.

INFORMAL AND FORMAL PROOFS BAND

[2] 40, and appropriate work is shown, such as $x = 180 - (70 + 70)$ or correctly labeling all the angles in the 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] A correct equation is written, but no further correct work is shown.
or [1] The measures of $\angle ACB$ and $\angle ABC$ are both found to be 70°, but no further correct work is shown.
or [1] An incorrect equation of equal difficulty is solved appropriately.
or [1] 40, 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
[103]   incorrect procedure.

[4] m$\angle B = 120$ and m$\angle BAG = 150$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but only m$\angle B$ or m$\angle BAG$ is found.
or [3] Appropriate work is shown, and the correct answers are found, but they are not labeled or are labeled incorrectly.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Appropriate work is shown to find $x=6$, but no further correct work is shown.
[1] $5x=2x+18$ is written, but no further correct work is shown.
or [1] m$\angle B = 120$ and m$\angle BAG = 150$, but no work is shown.
[0] m$\angle B = 120$ or m$\angle BAG = 150$, 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
[104]   obviously incorrect procedure.

[2] 32, and appropriate work is shown, such as a diagram or "let" statements and an appropriate equation, such as $5x + 20 = 180$.
or [2] 32, and an appropriate trial-and-error method with at least two trials and appropriate checks are shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] An incorrect equation set equal to 180° is shown, but it is solved appropriately, such as $4x + 20 = 180$; or an incorrect equation set equal to 360° is shown, such as $5x + 20 = 360$.
or [1] 32, and an appropriate trial-and-error method with less than two trials and appropriate checks are 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
[105]   incorrect procedure.

[2] 22, 27 and 24.5, 24.5, *or* 22, 27, and 24.5, 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] Appropriate work is shown, but only one of the two possible sets of numbers is found.
or [1] 22, 27 and 24.5, 24.5, *or* 22, 27, and 24.5, 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
[106]   incorrect procedure.

[4] 287,457, and appropriate work is shown, such as using trigonometry and the area formula or the Law of Sines and the area formula.

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

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

or [2] Appropriate work is shown, but one conceptual error is made, such as using an incorrect trigonometric function.

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

or [1] The length of the altitude or the length of a leg is found correctly, but no further correct work is shown.

or [1] Correct, substitutions are made into the Law of Sines, but no further correct work is shown.

or [1] 287,457, 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

[107] incorrect procedure.

[108] A

[109] D

[110] A

[111] A

[112] B

[2] 29, and appropriate work is shown, such as $92 - 63 = 29$.

[1] The correct application of the exterior angle theorem is shown, but one or more computational errors are made.

or [1] The correct application of supplementary angles and the sum of the angles of a triangle are shown, but one or more computational errors are made.

or [1] m$\angle BCA$ is calculated incorrectly, but the sum of the angles in a triangle is used appropriately.

or [1] 29, 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

[113] incorrect procedure.

[2] 120, and appropriate work is shown, such as m$\angle CDB = 180 - 130 = 50$ and m$\angle CBA = 70 + 50 = 120$ or correctly labeled angles in a 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$\angle CBD = 60$ is found, but no further correct work is shown.

or [1] 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

[114] incorrect procedure.

[115] A

[116] B

[117] B

[118] C

[119] A

[120] B

[121] D

INFORMAL AND FORMAL PROOFS BAND

[122] A

[123] A

[124] C

[125] A

[126] D

[127] C

[2] The statements $7 + 8 = 15$ and "15 is not greater than 16" are written or the explanation is given that the sum of any two sides of a triangle must be greater than the third side.
[1] An explanation is written that includes a reference to the triangle inequality, but the explanation is not complete or an incorrect conclusion is stated.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[128] incorrect procedure.

[3] 7, 11, 16, and yes, and appropriate work is shown, and an appropriate explanation of the Triangle Inequality theorem is given.
[2] 7, 11, 16, and yes, and appropriate work is shown, but no explanation or an incorrect explanation of the Triangle Inequality theorem is given.
or [2] One computational error is made, but appropriate substitution is shown, and an appropriate explanation is given.
or [2] The correct equation is written but not solved, but the Triangle Inequality theorem is stated correctly.
[1] Appropriate work is shown, and $x = 4$ is determined, but no further work is shown.
or [1] The Triangle Inequality theorem is stated correctly but not evaluated for the sides, or the correct equation is written, but no further work is shown.
or [1] 7, 11, 16, and yes, 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

[129] incorrect procedure.

[130] B

[131] D

[132] A

INFORMAL AND FORMAL PROOFS BAND

[2] $\overline{AC}$, and an appropriate justification is given, and appropriate work is shown, such as a correctly 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] All angle measures are identified correctly, but no further correct work is shown.
or [1] $\overline{AC}$, but no work is shown, and no justification is given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[133] incorrect procedure.

[134] B

[135] D

[136] C

[137] C

[138] A

[139] C

[140] C

[141] D

[142] D

[143] D

[144] D

[145] D

[146] D

[147] A

[3] 102, and appropriate work is shown, such as using the equation $2x + 10 + 3x = 180$ or an equivalent equation.
[2] The equation $2x + 10 + 3x = 180$ is solved correctly for x, but $m\angle B$ is not determined or is determined incorrectly.
[1] Appropriate work is shown, but one computational error is made or x is not determined.
or [1] The equation $2x + 10 + 3x = 360$ is solved correctly, and an answer of 210 is found.
or [1] 102, but no work is shown.
[0] The equation $2x + 10 = 3x$ where $x = 10$ is given.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[148] obviously incorrect procedure.

[3] 120, and appropriate work is shown, such as solving the equation $5x + 2x + 12 = 180$.
[2] Appropriate work is shown, but one computational error is made.
or [2] The correct equation is solved for x, but no further correct work is shown.
[1] Appropriate work is shown, but two or more computational errors are made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct equation is written, but no further correct work is shown.
or [1] An incorrect equation of equal difficulty is solved appropriately, and an appropriate measure is found for $\angle D$.
or [1] 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
[149] incorrect procedure.

[150] D

[151] A

[152] A

INFORMAL AND FORMAL PROOFS BAND

[2] The student draws a parallelogram, which is not a rectangle, with four sides and four angles labeled, such as angles of 60, 120, 60, and 120 and sides of 4, 6, 4, and 6.
[1] A parallelogram or rhombus, not a square, is drawn, which does not have measures for all lengths or angles.
[0] Angles and/or lengths are not appropriate for a parallelogram.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[153]   obviously incorrect procedure.

[3] $14\sqrt{2}$, and appropriate work is shown, such as using the Pythagorean theorem or drawing a correctly labeled diagram that shows the isosceles right triangle.
[2] Appropriate work is shown, but one computational error is made.
or [2] Appropriate work is shown, but the answer is expressed as a decimal or the radical is not simplified.
[1] Appropriate work is shown, but two or more computational errors are made.
or [1] Appropriate work is shown, but one computational error is made, and the answer is not expressed as a radical in simplest form.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 14, the side of the square is found correctly, but no further correct work is shown.
or [1] $14\sqrt{2}$, 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

[154]   incorrect procedure.

[2] 17, and appropriate work is shown, such as solving the equation $x + 12 = 3x + 2$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct equation is written and solved for x, but no further correct work is shown.
or [1] 17, 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

[155]   incorrect procedure.

[2] 75, and appropriate work is shown, such as $3x + 15 = 4x - 5$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as showing $\overline{AC}$ and $\overline{BD}$ as congruent opposite sides.
or [1] A correct equation is written, but no further correct work is shown.
or [1] A correct equation is written and solved for x, but the length of $\overline{AC}$ is not found.
or [1] An incorrect equation of equal difficulty, such as $3x + 15 + 4x - 5 = 180$, is solved appropriately, and an appropriate length of $\overline{AC}$ is found.
or [1] 75, 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

[156]   incorrect procedure.

[157]   A

[158]   A

[2] 96, and appropriate work is shown, such as an algebraic solution or a correctly 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] 96, 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
[159] incorrect procedure.

[2] 3, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 3, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[160] incorrect procedure.

[161]   B

[4] 12 and an appropriate method is shown, such as $(AB)^2 = 9^2 + 8^2$.
[3] An incorrect length is found for AE, but then it is used to correctly complete the problem.
or [3] An appropriate method is shown, but one computational mistake is made.
or [3] An appropriate method is shown, but the answer is not given to the nearest foot, such as $\sqrt{145}$.
[2] AE = 8 and one computational mistake is made using the Pythagorean theorem.
or [2] An incorrect length is found for AE, but then it is used to complete the problem correctly, but the answer is not rounded.
[1] AE = 8 is found, but the Pythagorean theorem is not used.
or [1] 12 and 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
[162] incorrect procedure.

[2] An appropriate explanation is written, such as defining special isosceles right triangles, or appropriate work is shown, such as using legs of six and finding the hypotenuse.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[163] incorrect procedure.

[164]   D

[165]   D

[166]   D

INFORMAL AND FORMAL PROOFS BAND

[2] 20, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 20, 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
[167]　incorrect procedure.

[168]　D

[4] ΔDEF is graphed and labeled correctly, $G(3,0)$ and $H(2,-3)$ are stated and labeled correctly, and an appropriate explanation is written, such as the slopes are congruent or the midsegment theorem.
[3] Appropriate work is shown, but one computational, graphing, or labeling error is made.
or [3] Appropriate work is shown, and an appropriate explanation is written, but the coordinates of G and H are missing or incorrect.
or [3] ΔDEF is graphed and labeled correctly, $G(3,0)$ and $H(2,-3)$ are stated and labeled correctly, appropriate work is shown to find the slopes of $\overline{GH}$ and $\overline{ED}$, but the explanation is missing or incorrect.
[2] Appropriate work is shown, but two or more computational, graphing, or labeling errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] ΔDEF is graphed and labeled correctly, $G(3,0)$ and $H(2,-3)$ are stated and labeled correctly, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational, graphing, or labeling error are made.
or [1] The midsegment theorem is written, but no work is shown.
or [1] $G(3,0)$ and $H(2,-3)$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[169]　incorrect procedure.

[170]　B

[171]　C

[172]　A

INFORMAL AND FORMAL PROOFS BAND

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

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

or [5] $\dfrac{WT}{HT} = \dfrac{AT}{CT}$ or an equivalent proportion is proven, but no further correct work is shown.

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

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

or [3] $\Delta WAT \sim \Delta HCT$ is proven, but no further correct work is shown.

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

[1] Only one correct statement and reason are written, other than the given and/or the prove statements.

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

[173]   incorrect procedure.

[4] A complete and correct proof that includes a concluding statement is written.

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

or [3] Two pairs of angles are proven congruent, but the triangles are not proven similar.

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

or [2] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made, such as using an incorrect method to prove that two angles are congruent.

or [2] $\angle E$ and $\angle ABC$ are proven congruent, but the remainder of the proof is missing or is incorrect.

[1] Some correct relevant statements about the proof are made, such as showing that $\angle CAB$ and $\angle ABE$ are congruent, but the remainder of the proof is missing or is incorrect.

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

[174]   incorrect procedure.

[6] A complete and correct proof is shown, such as the example below:

Statements	Reasons
1 Chords $\overline{AB}$ and $\overline{CD}$ of circle O intersect at E, and chords $\overline{AB}$ and $\overline{CD}$ are drawn.	1 Given
2 $\angle A \cong \angle C$	2 Inscribed angles of a circle that intercept the same arc are congruent.
3 $\angle AED \cong \angle CEB$	3 Vertical angles are congruent.
4 $\triangle AED \sim \triangle CEB$	4 AA $\cong$ AA
5 $\frac{AE}{CE} = \frac{ED}{EB}$	5 Corresponding sides of similar triangles are in proportion.
6 $(AE)(EB) = (CE)(ED)$	6 In a proportion, the product of the means equals the product of the extremes.

[5] $\triangle AED$ and $\triangle CEB$ are correctly proved to be similar, and the appropriate proportion is written with justification.
or [5] A correct proof is shown, but one of the justifications is missing or is incorrect.
[4] $\triangle AED$ and $\triangle CEB$ are correctly proved to be similar, but no further work is shown.
[3] A correct proof is shown, but more than one justification is missing or is incorrect.
[2] The triangles are said to be similar, and the conclusion is written.
[1] Only one correct statement and justification are given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[175] incorrect procedure.

[176] B

[3] 3, and appropriate work is shown, such as using a 3:4:5 right triangle, correct proportions, or the Pythagorean theorem with a proportion.
[2] Appropriate work is shown, and the value of the side is determined to be 5, but $n = 3$ is not found.
[1] A correct proportion is set up, but no answer or an incorrect answer is found.
or [1] 3, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[177] incorrect procedure.

[2] 10, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as writing an incorrect proportion.
or [1] A correct proportion is written, but no further correct work is shown.
or [1] 10, 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
[178] incorrect procedure.

[2] 24 feet and appropriate work is shown, such as $\frac{10}{15} = \frac{16}{x}$ or $= \frac{10}{16} = \frac{15}{x}$.
[1] An appropriate proportion is shown, but an incorrect solution or no solution is found.
or [1] An incorrect proportion of equal difficulty is shown, but an appropriate solution for the proportion written is found.
or [1] 24 feet 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
[179] incorrect procedure.

[2] 24 miles and appropriate work is shown, such as using a proportion, showing doubling of the sides, or using any other appropriate method.
[1] Appropriate work is shown, but one computational or substitution error is made.
or [1] An incorrect proportion is appropriately solved.
or [1] 24 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
[180] incorrect procedure.

[181]   B

[2] 20, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 20, 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
[182]   incorrect procedure.

[183]   D

[184]   A

[185]   A

[186]   C

[187]   A

[188]   C

[189]   C

[190]   B

[191]   A

[192]   B

[193]   D

[2] $2\sqrt{3}$, and appropriate work is shown.
[1] Appropriate work is shown, but the answer is not written in simplest radical form.
or [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] $2\sqrt{3}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[194]   incorrect procedure.

[195]   D

[196]   A

[4] 8, and appropriate work is shown, such as solving the proportion $\frac{10+x}{12} = \frac{12}{x}$.
[3] Appropriate work is shown, but one computational error is made.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] The proportion $\frac{10+x}{12} = \frac{12}{x}$ is written, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] 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
[197]   incorrect procedure.

INFORMAL AND FORMAL PROOFS BAND

[4] 10, and appropriate work is shown, such as solving $\frac{x}{4} = \frac{4}{x+6}$.

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

or [3] Appropriate work is shown to find $x = 2$, but no further correct work is shown.

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

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

or [2] Appropriate work is shown to find 2 and -8, but the negative value is not rejected, and no further correct work is shown.

or [2] A correct right triangle proportion is written, but no further correct work is shown.

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

or [1] 10, 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
[198] incorrect procedure.

[199] A

[200] C

[201] B

[4] 9.4, and appropriate work is shown, such as the use of the Pythagorean theorem.

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

[2] Appropriate work is shown, but more than one computational or rounding error is made.

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

or [2] An incorrect diagonal of the base is found, but an appropriate solution is found.

or [2] Only the diagonal of the base is found correctly, but appropriate work is shown, such as $3^2 + 4^2 = d^2$ or use of 3–4–5 right triangles.

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

or [1] The Pythagorean theorem is used to find the length of the straw, but the appropriate legs are not used.

or [1] 9.4, 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
[202] incorrect procedure.

[203] D

[2] $\sqrt{171}$ or 13 or 13.1 or 13.08 or an equivalent answer, and appropriate work is shown, such as the use of the equation of a circle $(x^2 + y^2 = r^2)$ or the Pythagorean theorem.

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

or [1] Incorrect analysis is shown, such as $x = 5$ and $y = 14$, but the work is concluded appropriately.

or [1] A correct answer is found, 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
[204] incorrect procedure.

[205] A

INFORMAL AND FORMAL PROOFS BAND

[206] B

[207] B

[208] B

[2] 282.8 using an appropriate method such as law of cosines, Pythagorean Theorem, right triangle trig or special right triangle 45, 45, 90.
[1] Gives a correct answer of 282.8 with no work shown.
or [1] Gives an incorrectly rounded answer such as 283, or 282.84, or 282.
or [1] Uses the Pythagorean Theorem correctly, but makes an incorrect substitution for one of the sides, and then rounds correctly.
or [1] Uses an appropriate method, but makes a calculation mistake and then rounds answer correctly.
[0] A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously
[209] incorrect procedure.

[4] 18, and appropriate work is shown, such as $3x + x = 24$.
[3] Appropriate work is shown, but one computational error is made.
or [3] $x = 6$, and appropriate work is shown, but $\overline{SE}$ is not found or is found incorrectly.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] 18, 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
[210] incorrect procedure.

[211] D

[2] 40, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 40, 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
[212] incorrect procedure.

[213] B

[214] C

[215] A

[216] D

[4] $\angle D$ and $\angle G$ and 24, or $\angle E$ and $\angle F$ and 84, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] The measure of at least one inscribed angle is found correctly, and appropriate work is shown, but a pair of angles is not identified or is identified incorrectly.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Appropriate work is shown to find the measures of all four arcs, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] One pair of inscribed angles is correctly identified, but no further correct work is shown.
or [1] Appropriate work is shown to find $x = 24$, the measure of $\overset{\frown}{EG}$, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[217] incorrect procedure.

INFORMAL AND FORMAL PROOFS BAND

[218]   B

[4] 6.8, and appropriate work is shown, such
as using the Law of Cosines or the Law of
Sines or right triangle trigonometry.
[3] Appropriate work is shown, but one
computational or rounding error is made.
or [3] 3.4, and appropriate work is shown,

such as $\cos 70 = \dfrac{x}{10}$ or $\sin 20 = \dfrac{x}{10}$.

[2] Appropriate work is shown, but two or
more computational or rounding errors are
made.
or [2] Appropriate work is shown, but one
conceptual error is made, such as using an
incorrect trigonometric function.
or [2] Correct substitution is made into the
Law of Sines or the Law of Cosines, but no
further correct work is shown.
[1] Appropriate work is shown, but one
conceptual error and one computational or
rounding error are made.
or [1] The measures of $\overset{\frown}{EA}$ and $\overset{\frown}{SA}$ are found
correctly, but no further correct work is
shown.
or [1] The measures of the three angles of
triangle *SEA* are found correctly, but no
further correct work is shown.
or [1] 6.8, 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
[219]   incorrect procedure.

[2] 68, and appropriate work is shown.
[1] Appropriate work is shown, but one
computational error is made.
or [1] Appropriate work is shown, but one
conceptual error is made.
or [1] 68, 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
[220]   incorrect procedure.

[2] 50, and appropriate work is shown, such
as $m\overset{\frown}{AC} = 140$, $m\overset{\frown}{BC} = 40$, and

$m\angle CPA = \dfrac{1}{2}(140 - 40)$.

[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] $m\overset{\frown}{AC}$ and $m\overset{\frown}{BC}$ are found correctly,
but no further correct work is shown.
or [1] 50, 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
[221]   incorrect procedure.

[4] 60°, and an appropriate sketch is drawn,
and appropriate work is shown.
[3] A correct sketch is shown, and $m\overset{\frown}{AB}$ is
correct.
or [3] A correct sketch is shown, but one
computational error is made, leading to an
incorrect $m\overset{\frown}{AB}$, but $m\overset{\frown}{CB}$ is appropriate,
based on the incorrect $m\overset{\frown}{AB}$.
[2] A correct sketch is shown, but an incorrect
procedure is used to find either the correct or
incorrect $m\overset{\frown}{AB}$, but $m\overset{\frown}{CB}$ is appropriate,
based on the incorrect $m\overset{\frown}{AB}$.
or [2] An incorrect sketch is shown, but an
appropriate $m\overset{\frown}{CB}$ is found, based on the
incorrect sketch.
[1] Only a correct sketch is shown.
or [1] 60°, 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
[222]   incorrect procedure.

[223]   D

[6] $\frac{2}{1}$ or 2:1 or an equivalent ratio, and appropriate work is shown.

[5] Appropriate work is shown, but one computational error is made, but an appropriate ratio is found.

or [5] Appropriate work is shown, but the answer is not written as a ratio.

or [5] Appropriate work is shown, but the ratio is reversed or is simplified incorrectly.

[4] Appropriate work is shown, but two or more computational errors are made, but an appropriate ratio is found.

or [4] Correct measures are found for all the arcs and the angles, and appropriate work is shown, but no ratio is found.

or [4] Correct measures are found for all the arcs, but the measure of one angle is found incorrectly, but an appropriate ratio is found.

[3] One conceptual error is made, but appropriate work is shown, and an appropriate ratio is found.

or [3] Correct measures are found for all the arcs, but the measures of both angles are found incorrectly, but an appropriate ratio is found.

[2] Correct measures are found for all the arcs, but no further correct work is shown.

[1] Only the value of x is found correctly, and appropriate work is shown.

or [1] $\frac{2}{1}$ or 2:1 or an equivalent ratio, 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

[224] incorrect procedure.

[6] $m\overarc{GF} = 30$, $m\angle BHD = 65$, $m\angle BDG = 75$, $m\angle GDE = 55$, $m\angle C = 35$, and $m\angle BOD = 100$, and appropriate work is shown.

[5] $m\overarc{GF}$ is determined correctly, but $m\overarc{BD}$ is determined incorrectly, but all five of the angle measures are determined appropriately.

or [5] $m\overarc{GF}$ is determined incorrectly, but all five of the angle measures are determined appropriately, based on the incorrect arc measure.

or [5] $m\overarc{GF}$ is determined correctly, but only four of the angle measures are determined correctly.

[4] $m\overarc{GF}$ is determined incorrectly, and only four of the angle measures are determined appropriately, based on the incorrect arc measure.

or [4] $m\overarc{GF}$ is determined correctly, but only three of the angle measures are determined correctly.

[3] $m\overarc{GF}$ is determined incorrectly, and only three of the angle measures are determined appropriately, based on the incorrect arc measure.

or [3] $m\overarc{GF}$ is determined correctly, but only two of the angle measures are determined correctly.

[2] $m\overarc{GF}$ is determined incorrectly, and only two of the angle measures are determined appropriately, based on the incorrect arc measure.

or [2] $m\overarc{GF}$ is determined correctly, but only one angle measure is determined correctly.

[1] $m\overarc{GF}$ is determined incorrectly, and only one angle measure is determined appropriately.

or [1] $m\overarc{GF}$ is determined correctly, but no further correct work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct

[225] response that was obtained by an obviously

incorrect procedure.

[226] C

[227] B

[228] B

[229] D

[230] A

[231] [2] 6, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Appropriate work is shown, but the negative root is not rejected.
or [1] A correct equation is written, but no further correct work is shown.
or [1] An incorrect equation of equal difficulty is solved appropriately.
or [1] 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.

[232] [2] 1.5 and a correct diagram is drawn, and appropriate work is shown.
[1] Appropriate work is shown and a correct answer is found, but an incorrect diagram is drawn.
or [1] A correct diagram is drawn, but no further correct work is shown.
or [1] An incorrect diagram is drawn, but an appropriate answer is found.
or [1] 1.5, 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.

[233] C

[234] C

[235] [2] 8, and appropriate work is shown, such as $(PA)^2 = 4 \times 16 = 64$.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as failing to reject the negative root.
or [1] 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.

[236] [2] 20, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] A correct equation is written, but no further correct work is shown.
or [1] 20, 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.

[237] B

[238] D

[6] 80 and 9.2, and appropriate work is shown.
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
or [4] Appropriate work is shown, but one conceptual error is made in solving for one of the values.
or [4] 80, and appropriate work is shown, but the length of $\overline{PT}$ is not found or is found incorrectly.
or [4] The measure of all three arcs and the length of $\overline{PT}$ are found correctly, but the measure of $\angle P$ is not found or is found incorrectly.
[3] Appropriate work is shown, but one conceptual error and one computational or rounding error are made.
[2] Appropriate work is shown, but one conceptual error is made in solving for each value.
or [2] 80 and 9.2, but no work is shown.
or [2] 9.2, and appropriate work is shown, but no further correct work is shown.
or [2] The measures of all three arcs are found correctly, but no further correct work is shown.
[1] 80 or 9.2, 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
[239]　incorrect procedure.

[6] m$\angle ACB = 36$ and $DOE = 39$, and appropriate work is shown. [If trigonometry is used to find that m$\angle ACB = 35.98138002$, allow full credit for the full display of the calculator or any correctly rounded response.]
[5] Appropriate work is shown, but one computational or rounding error is made.
[4] Appropriate work is shown, but two or more computational or rounding errors are made.
[3] Appropriate work is shown, but one conceptual error is made.
or [3] m$\angle ACB = 36$, and appropriate work is shown, but no further correct work is shown.
or [3] $DOE = 39$, and appropriate work is shown, but 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] m$\angle ACB = 36$ and $DOE = 39$, but no work is shown.
[1] The measures of the arcs are found correctly, but no further correct work is shown.
or [1] m$\angle ACB = 36$ or $DOE = 39$, but no work is shown.
[0] 36 and 39, but no work is shown and the answers are not labeled.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[240]　obviously incorrect procedure.

[1] B _____

[2] C _____

[3] C _____

[4] C _____

[5] D _____

[6] C _____

[7] B _____

[8] D _____

[9] A _____

[10] B _____

[11] D _____

[12] B _____

[13] B _____

[14] B _____

[15] D _____

[16] A _____

[17] C _____

[18] A _____

[2] Δ HOC and opposite, and an appropriate explanation is written.
[1] The image of Δ EOA is identified incorrectly, but the type of isometry is appropriate, and an appropriate explanation is written.
or [1] The difference between a direct and opposite isometry is explained correctly, but no further correct work is shown.
or [1] Δ HOC, but no explanation or an incorrect explanation is written.
[0] Opposite, but no further correct work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[19] obviously incorrect procedure. _____

[3] The figure is drawn accurately and the new coordinates are labeled and stated as J'(7,-2), B'(2,-1), C'(3,-2), and D'(2,-4).
[2] One error is made in drawing the figure, such as misplotting one point, but the new coordinates are labeled and stated appropriately, based on that figure.
or [2] The figure is drawn and labeled accurately, but the new coordinates are not stated or are stated incorrectly.
or [2] The new coordinates are labeled and stated correctly, but the figure is not drawn.
[1] Two errors are made in drawing the reflected figure, but the new coordinates are labeled and stated appropriately, based on that figure.
or [1] Appropriate work is shown, but one conceptual error is made, such as reflecting the figure in the x-axis or the origin.
or [1] Correct points are plotted and labeled, but the figure is not drawn, and the coordinates are not stated.
or [1] The figure is drawn correctly, but the new coordinates are not labeled or stated.
[0] An appropriate reflection in the x-axis is drawn, and the coordinates are not labeled or stated.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[20] obviously incorrect procedure.

[3] A' (-2,0), B' (-1,7), and C' (-5,1) are graphed, labeled, and stated correctly.
[2] Appropriate work is shown, but one graphing or labeling error is made.
or [2] A' (-2,0), B' (-1,7), and C' (-5,1), but no graph is drawn.
[1] Appropriate work is shown, but two or more graphing or labeling errors are made.
or [1] Appropriate work is shown, but one conceptual error is made, such as reflecting over the x-axis.
or [1] The three points are plotted correctly, but the coordinates A', B', and C' are not stated.
[0] (-2,0), (-1,7), and (-5,1), but no further correct work is shown.
or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[21] obviously incorrect procedure.

[2] A' (0,-2) and B' (4,-6) are stated, and an appropriate graph is drawn.
[1] Only one endpoint, A' or B', is graphed and stated correctly.
or [1] Both endpoints are reflected in other than the x-axis, and the coordinates are graphed and stated correctly, such as:
y-axis A' (0,2) and B' (-4,6)
y = x A' (2,0) and B' (6,4)
Origin A' (0,-2) and B' (-4,-6)
or [1] Both points A' and B' are stated correctly, but no graph is drawn.
or [1] An appropriate graph is drawn, but no coordinates or incorrect coordinates are labeled.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[22] incorrect procedure.

TRANSFORMATIONAL GEOMETRY BAND

[4] $S'(0,6)$, $U'(-3,5)$, $N'(-3,0)$, and the correct graphs of both triangles are shown.
[3] The correct graphs of both triangles are shown, but the coordinates of $\Delta S'U'N'$ are not stated correctly.
or [3] ΔSUN is graphed and labeled correctly, and the coordinates of $\Delta S'U'N'$ are stated correctly but not graphed correctly.
or [3] The coordinates of $\Delta S'U'N'$ are graphed and stated correctly, but ΔSUN is not graphed or labeled.
or [3] ΔSUN is graphed incorrectly, but the graph and the coordinates of $\Delta S'U'N'$ are appropriate, based on that error.
[2] $\Delta S'U'N'$ is graphed correctly, but the coordinates of $\Delta S'U'N'$ are not stated, and ΔSUN is not graphed.
or [2] ΔSUN is graphed and labeled correctly, but $\Delta S'U'N'$ is reflected in the x-axis, and the coordinates $S'(0,-6), U'(3,-5), N'(3,0)$ are stated.
or [2] ΔSUN is graphed incorrectly, but $\Delta S'U'N'$ is graphed appropriately, based on that error, but the coordinates of $\Delta S'U'N'$ are not stated.
[1] ΔSUN is graphed and labeled correctly, but no other work or completely incorrect work for $\Delta S'U'N'$ is shown.
or [1] $\Delta S'U'N'$ is graphed correctly, but the coordinates of $\Delta S'U'N'$ are not stated, and ΔSUN is not graphed or is graphed incorrectly.
or [1] $S'(0,6)$, $U'(-3,5)$, $N'(-3,0)$, but no work or graph is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[23] incorrect procedure.

[4] $ABCD$ and its image $A'B'C'D'$ are graphed and labeled correctly and 29, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or graphing error is made.
or [3] $A'B'C'D'$ is graphed and labeled correctly and 29, but $ABCD$ is not graphed.
or [3] $ABCD$ is graphed incorrectly, but an appropriate image is graphed and labeled, and an appropriate area is found.
or [3] $ABCD$ and $A'B'C'D'$ are graphed correctly and 29, but neither quadrilateral is labeled.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as an incorrect transformation, but the graphs are labeled, and an appropriate area is found.
or [2] Both $ABCD$ and $A'B'C'D'$ are graphed and labeled correctly, but the area is not found.
or [2] 29, and appropriate work is shown, such as using the distance formula and finding the area, but neither $ABCD$ nor $A'B'C'D'$ is graphed.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] Either $ABCD$ or $A'B'C'D'$ is graphed and labeled correctly, but no further correct work is shown.
or [1] 29, but no work is shown and no graph is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[24] incorrect procedure.

TRANSFORMATIONAL GEOMETRY BAND

[4] Quadrilaterals *ABCD* and *A'B'C'D'* are drawn and labeled correctly and 24 is found as the area, and appropriate work is shown.

[3] One graphing error is made in the transformation, but an appropriate area of *A'B'C'D'* is found.

or [3] Correct quadrilaterals are drawn and labeled, but one computational error is made in determining the area.

or [3] Quadrilaterals *ABCD* and *A'B'C'D'* are drawn correctly and 24 is found as the area, but the vertices are not labeled.

[2] Correct quadrilaterals are drawn and labeled, but no further correct work is shown.

or [2] One conceptual error is made, such as reflecting in the *x*-axis, but the correct area is found.

[1] 24, 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
[25]   incorrect procedure.

[26]   B

[27]   B

[28]   D

[29]   D

[30]   [2] Answers of *B*(-6,4) and *D'*(-5,-4).
       [1] One of the correct answers listed above.

[31]   B

[32]   D

[33]   B

[4] Both parabolas are graphed correctly with the line of symmetry $x = 3.5$ drawn and labeled as $x = 3.5$.

[3] $y = -x^2 + 9$ is graphed incorrectly, but an appropriate translation is drawn, and an appropriate line of symmetry is drawn and labeled correctly.

or [3] $y = -x^2 + 9$ and its translation are graphed correctly, but no line of symmetry or an incorrect line of symmetry is drawn for the translation or no equation or an incorrect equation is shown for the line of symmetry.

[2] $y = -x^2 + 9$ is graphed correctly, but its translation is graphed incorrectly, but an appropriate line of symmetry is drawn and labeled correctly.

or [2] $y = -x^2 + 9$ is graphed incorrectly, but an appropriate translation is graphed, but an incorrect line of symmetry is drawn.

[1] $y = -x^2 + 9$ and its translation are graphed incorrectly, but an appropriate line of symmetry is drawn and labeled correctly.

or [1] $y = -x^2 + 9$ is graphed correctly, but an incorrect translation and line of symmetry are drawn.

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

[2] A correct transformation is stated and drawn, such as a translation, a dilation, a reflection through the origin, a rotation of 180° around the origin, or any description of a transformation.

[1] A correct transformation is stated, but the graph is missing or incorrect.

or [1] A correct graph is drawn, but a transformation is not stated or is stated incorrectly.

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

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

[35] incorrect procedure.

[4] $D'(-1,1)$, $E'(-1,5)$, $G'(-4,5)$, ΔDEG and $\Delta D'\,E'\,G'$ are graphed and labeled correctly, and an appropriate justification is given, such as showing congruent segments or stating that all rotations preserve distance.

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

or [3] Appropriate work is shown, but no justification is given.

or [3] Appropriate work is shown, but the coordinates are not stated or are stated incorrectly.

[2] Appropriate work is shown, but one computational, graphing, or labeling error is made, and no justification is given.

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

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

or [2] Both triangles are graphed and labeled correctly, but no further correct work is shown.

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

or [1] Both triangles are graphed correctly, but no further correct work is shown.

or [1] $D'(-1,1)$, $E'(-1,5)$, $G'(-4,5)$, but no work is shown.

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

[36] incorrect procedure.

[37] B

[38] C

[39] B

[40] D

[41] B

[42] B

TRANSFORMATIONAL GEOMETRY BAND

[43] C _____

[44] D _____

[45] D _____

[46] A _____

[47] B _____

[48] B _____

[49] C _____

[50] C _____

[51] D _____

[52] B _____

[53] C _____

[54] A _____

[55] B _____

[56] D _____

[57] A _____

[3] ΔABC and $\Delta A'B'C'$, A'(–2,4), B'(0,12), C'(10,8), are graphed correctly.
[2] ΔABC is graphed correctly, but only two image points are graphed correctly.
or [2] ΔABC is graphed incorrectly, but $\Delta A'B'C'$, is graphed appropriately, based on an incorrect ΔABC.
[1] Only ΔABC is graphed correctly.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[58] incorrect procedure. _____

[3] Quadrilateral $ABCD$ and its image are graphed and labeled correctly, and the coordinates of $A'B'C'D'$ are stated as (-2,6), (4,0), (4,-2), and (-6,-2).
[2] Appropriate work is shown, but one computational or graphing error is made.
or [2] Quadrilateral $A'B'C'D'$ is graphed and labeled correctly, and its coordinates are stated correctly, but quadrilateral $ABCD$ is not graphed.
[2] Quadrilateral $ABCD$ is graphed incorrectly, but an appropriate image is graphed and labeled, and the appropriate coordinates of $A'B'C'D'$ are stated.
or [2] Both quadrilaterals are graphed correctly, and the coordinates of $A'B'C'D'$ are stated correctly, but one or both of the quadrilaterals are not labeled.
or [2] Both quadrilaterals are graphed and labeled correctly, but the coordinates of $A'B'C'D'$ are not stated or are stated incorrectly.
[1] Appropriate work is shown, but two or more computational or graphing errors are made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] Both quadrilaterals are graphed correctly but neither is labeled, and the coordinates of $A'B'C'D'$ are not stated or are stated incorrectly.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[59] incorrect procedure. _____

TRANSFORMATIONAL GEOMETRY BAND

[4] (-8, 4) and 18, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as using an incorrect dilation.
or [2] The center and radius are found appropriately for an incorrect center and radius of the original equation.
or [2] (-8, 4), and appropriate work is shown, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] 18, and appropriate work is shown, but no further correct work is shown.
or [1] (-8, 4) and 18, but no work is shown.
[0] (-8, 4) or 18, 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
[60] obviously incorrect procedure.

[61] B

[2] 16, and appropriate work is shown, such as $\dfrac{6}{4} = \dfrac{24}{x}$ or 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] An incorrect proportion is written, but it is solved appropriately.
or [1] 16, 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
[62] incorrect procedure.

[63] B

[2] 160, and appropriate work is shown, such as the proportion $\dfrac{25}{16} = \dfrac{250}{x}$.
[1] Appropriate work is shown, but one computational error or one conceptual error is made, such as $\dfrac{5}{4} = \dfrac{250}{x}$.
or [1] 160, 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
[64] incorrect procedure.

[4] $A''(0,-1), B''(-5,2), C''(-6,-1),$ and $D''(-1,-4),$ and appropriate work is shown.
[3] The composite transformation is graphed and labeled correctly, but the coordinates are not stated or are stated incorrectly.
or [3] Appropriate work is shown, but one computational or graphing error is made.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as performing the reflection before the translation.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] $A''(0,-1), B''(-5,2), C''(-6,-1),$ and $D''(-1,-4),$ 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
[65] incorrect procedure.

TRANSFORMATIONAL GEOMETRY BAND

[4] Both $\triangle ABC$ and $\triangle A''B''C''$ are graphed and labeled correctly.
[3] Appropriate work is shown, but one graphing or labeling error is made.
or [3] Appropriate work is shown, but only $\triangle A''B''C''$ is graphed and labeled correctly.
[2] Appropriate work is shown, but two or more graphing or labeling errors are made.
or [2] Appropriate work is shown, but one conceptual error is made, such as reflecting over the *x*-axis before reflecting over the line $y = x$.
[1] Appropriate work is shown, but one conceptual error and one graphing or labeling error are made.
or [1] $A''(1,-3)$, $B''(4,0)$, and $C''(3,5)$ are stated, but no work is shown.
or [1] $\triangle ABC$ is graphed and labeled correctly, but only $r_{y=x}$ or $r_{x-\text{axis}}$ is graphed correctly.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[66]   incorrect procedure.

[4] Triangles ABC and $A''B''C''$ are graphed and labeled correctly. [Students are not required to state the coordinates $A''(6,-6)$, $B''(-4,-10)$, and $C''(-2,6)$.]
[3] Appropriate work is shown, but one computational or graphing error is made.
or [3] Only triangle $A''B''C''$ is graphed and labeled correctly.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Triangle ABC is graphed and labeled correctly, and either the rotation or dilation is graphed and labeled correctly.
or [2] The coordinates $A''(6,-6)$, $B''(-4,-10)$, and $C''(-2,6)$ are stated, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] Triangle ABC is graphed and labeled correctly, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[67]   incorrect procedure.

[68]   B

[69]   C

[2] (-5,-7), and appropriate work is shown, such as stating the coordinates of each transformation or graphing each transformation.
[1] Appropriate work is shown, but one computational or graphing error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as performing the translation before the reflection.
or [1] Only one of the transformations is performed correctly.
or [1] (-5,-7), but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[70] incorrect procedure.

[71] C

[72] C

[73] D

[4] $\overline{AB}$ and $\overline{A''B''}$ are graphed and labeled correctly, $A''(0,-5)$ and $B''(-2,0)$, and a correct transformation is identified, such as $R_{180°}$, $R_{-180°}$, or $r_{(0,0)}$.

[3] One error is made in graphing $\overline{AB}$, but $\overline{A''B''}$ is graphed and labeled appropriately, and an appropriate transformation is identified.

[2] $\overline{AB}$ is graphed and labeled correctly but one mistake is made in finding $\overline{A''B''}$, but an appropriate transformation is identified.
or [2] Both $\overline{AB}$ and $\overline{A''B''}$ are graphed and labeled correctly, but the transformation is missing or is incorrect.

[1] $\overline{AB}$ is graphed and labeled correctly, but one mistake is made in finding $\overline{A''B''}$, and the transformation is missing or is incorrect.
or [1] One error is made in graphing $\overline{AB}$, but $\overline{A''B''}$ is graphed and labeled appropriately, but the transformation is missing or is incorrect.
or [1] $R_{180°}$, $R_{-180°}$, or $r_{(0,0)}$, but no graph is drawn.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[74] incorrect procedure.

TRANSFORMATIONAL GEOMETRY BAND

[4] Both equations are graphed correctly and the description of the transformation $a \rightarrow b$ is correct, such as $T_{(4,3)} \circ r_{x-axis}$ or $r_{y=3} \circ T_{(4,3)}$ or $T_{(4,3)} \circ R_{180°}$ or an equivalent explanation, such as a shift right of 4 followed by a reflection over the *x*-axis followed by a shift up of 3.
[3] Both equations are graphed correctly, but only one transformation is shown or described correctly.
[2] Both equations are graphed correctly, but no further correct work is shown.
[1] Only one equation is graphed correctly, and no composition formula or explanation is shown.
or [1] The correct composition formula or explanation is shown, but no graphs or incorrect graphs are drawn.
or [1] Both equations are graphed incorrectly, but an appropriate composition formula or explanation is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[75] incorrect procedure.

[76] A _____

a [2] The equation $2y = 2x^2 - 4$ is graphed correctly over the required interval and labeled.
[1] An appropriate graph is shown, but less than the required interval is drawn.
or [1] An appropriate graph is shown, but one coordinate is calculated incorrectly.
b [2] A correct composition of transformations of the graph drawn in part a is sketched and labeled.
[1] Only one of the transformations is correct.
or [1] The composition of transformations is correct, but done in reverse order.
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an
[77] obviously incorrect procedure.

[3] Yes, A'' is $(1,-3)$ and B'' is $(2,-1)$ and appropriate work is shown, algebraically or graphically.
[2] Correct coordinates for A'' and B'' are found, but no conclusion is shown.
or [2] Either A'' or B'' is correct, and an appropriate conclusion is shown.
or [2] One transformation is correct and one is incorrect, such as the reflection in y, but an appropriate conclusion is shown.
[1] Neither transformation is correct, but an appropriate conclusion is shown.
or [1] One transformation is correct.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[78] incorrect procedure.

[79] A _____

[80] B _____

[81] D _____

[82] B _____

[83] B _____

[84] D _____

[85] B _____

[86] B _____

[87] B _____

[88] C _____

[89] B _____

[90] B _____

[91] C _____

[92] A _____

[93] D _____

[94] C _____

[95] A _____

TRANSFORMATIONAL GEOMETRY BAND

[96]   C

[97]   A

[98]   C

[99]   C

[4] ΔABC and $\Delta A'B'C'$ are graphed and labeled correctly, and the coordinates of $\Delta A'B'C'$ are stated as $A'(7,-9)$, $B'(2,-8)$, and $C'(3,-4)$, and point reflection or dilation with a factor of -1. (Note: rotation or rotation of 180° is an acceptable answer.)

[3] ΔABC and $\Delta A'B'C'$ are graphed and labeled correctly, but the coordinates of $\Delta A'B'C'$ are not stated or are stated incorrectly but a correct transformation is stated.

or [3] ΔABC and $\Delta A'B'C'$ are graphed and labeled correctly, and the coordinates of $\Delta A'B'C'$ are stated correctly, but the type of transformation is not stated or is stated incorrectly.

or [3] ΔABC is not graphed, but $\Delta A'B'C'$ is graphed and labeled correctly, and its coordinates are stated correctly, and a correct transformation is stated.

or [3] ΔABC is graphed incorrectly, but $\Delta A'B'C'$ is graphed and labeled appropriately, its coordinates are stated appropriately, and an appropriate type of transformation is stated.

[2] ΔABC is graphed correctly, but one conceptual error is made, such as graphing an incorrect transformation, but the points are labeled appropriately, its coordinates are stated appropriately, and an appropriate type of transformation is stated.

or [2] ΔABC is not graphed, but $\Delta A'B'C'$ is graphed and labeled correctly, and its coordinates are stated correctly, but the type of transformation is not stated or is stated incorrectly.

or [2] ΔABC and $\Delta A'B'C'$ are graphed and labeled correctly, but the coordinates of and the type of transformation are not stated or are

[100]

stated incorrectly

or [2] ΔABC and $\Delta A'B'C'$ are not graphed, but the correct coordinates of $\Delta A'B'C'$ and a correct transformation are stated.

[1] Either ΔABC or $\Delta A'B'C'$ is graphed correctly, but the coordinates of $\Delta A'B'C'$ and the type of transformation are not stated or are stated incorrectly.

or [1] $A'(7,-9)$, $B'(2,-8)$, and $C'(3,-4)$, but no further correct work is shown.

or [1] A correct transformation is stated, 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.

TRANSFORMATIONAL GEOMETRY BAND

[1] B

[2] B

[3] A

[4] D

[5] C

[6] A

[7] B

[8] B

[9] [3] Three correct equations are shown, such as $y = x + 7$, $y = -x - 6$, and $2y = 2x - 12$.
[2] Only two correct equations are shown.
[1] Only one correct equation 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.

[10] [2] $b = 6$ by determining the slopes of both lines, sets $\dfrac{2}{b}$ = negative reciprocal slope of -3 (i.e. $\dfrac{1}{3}$).
or [2] $b = 6$ by determining the product of the slopes = -1.
[1] Sets $\dfrac{2}{b} = -3$ and solves for $b = \dfrac{-2}{3}$.
or [1] Finds slope of perpendicular as $\dfrac{1}{3}$, but does not solve b.
or [1] $b = 6$ and no work shown.
[0] Does not identify slopes.
or [0] A zero response is completely incorrect, irrelevant, or incoherent; or is a correct response that was obtained by an obviously incorrect procedure.

[11] D

[12] [2] A correct equation is written, such as
$$y = -\frac{3}{2}x + 4 \text{ or } (y - 4) = -\frac{3}{2}(x - 0).$$
[1] An appropriate equation is written, but one computational error is made or one incorrect substitution is made.
[1] An appropriate equation is written, but one conceptual error is made, such as writing an equation for a parallel line going through (0,4) or for a perpendicular line that does not go through (0,4).
or [1] The slope is identified correctly as $-\dfrac{3}{2}$
or the y-intercept as 4, but no equation or an incorrect equation is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[13] [2] $y + 5 = \dfrac{2}{3}(x - 6)$ or an equivalent linear equation, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] $y + 5 = \dfrac{2}{3}(x - 6)$ or an equivalent linear equation, 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.

[14] D

[2] $y - 4 = -2(x - 5)$ or an equivalent equation, and appropriate work is shown.
[1] Appropriate work is shown, but one computational error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as leaving the answer as $\dfrac{y-4}{x-5} = \dfrac{-2}{1}$, which has a domain restriction.
or [1] $y - 4 = -2(x - 5)$ or an equivalent equation, 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
[15] incorrect procedure.

[16] D

[17] A

[18] A

[19] C

[20] D

[21] B

[22] D

[23] A

[24] A

[2] (1,1), and appropriate work is shown, such as a correct graph of $\overline{AB}$ and an appropriate explanation of how point A is found or the use of the midpoint formula.
[1] Appropriate work is shown, but one computational or graphing error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as finding the midpoint of the given coordinates.
or [1] The midpoint and points A and B are graphed correctly, but the coordinates of point A are not stated or are stated incorrectly.
or [1] (1,1), 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
[25] incorrect procedure.

[2] (-2,-2), and appropriate work is shown, such as the use of the midpoint formula, a correct graph of the line segment showing the slope, or an appropriate explanation of how the missing endpoint is found.
[1] Appropriate work is shown, but one computational or graphing error is made.
or [1] Appropriate work is shown, but one conceptual error is made, such as finding (4,1), the midpoint of the given points.
or [1] A correct graph of the line segment is drawn, but the coordinates are not stated.
or [1] (-2,-2), 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
[26] incorrect procedure.

COORDINATE GEOMETRY BAND

[2] (-6,8) or -6,8 or $x = -6$ and $y = 8$ and an appropriate explanation is given, such as graphing the line or doubling the coordinates.
[1] One correct coordinate and one incorrect coordinate are found.
or [1] An appropriate method is shown, such as algebraic or graphing, but computational mistakes are made.
or [1] (-6,8) or -6,8 or $x = -6$ and $y = 8$ and no explanation is given.
or [1] Substitutions are correct for the midpoint formula, but computational mistakes are made.
or [1] The student properly locates point B on the graph but does not state its coordinates.
or [1] Point A and point M are reversed, resulting in B(3,-4), and an explanation is given.

[0] Only the midpoint of $\overline{AM}$ $(-\frac{3}{2}, 2)$ is found.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[27] incorrect procedure. _____

[28] D _____

[29] D _____

[30] D _____

[2] 25, and appropriate work is shown.
[1] Appropriate work is shown, but one computational or simplification error is made.
or [1] Appropriate work is shown, but one conceptual error is made.
or [1] 25, 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
[31] incorrect procedure. _____

[4] $y + 2 = \frac{4}{3}(x - 3)$ or an equivalent linear equation, and appropriate work is shown.
[3] Appropriate work is shown, but one computational or graphing error is made.
or [3] The correct slope and midpoint of the segment and the slope of the perpendicular bisector are found, but no equation or an incorrect equation is written.
[2] Appropriate work is shown, but two or more computational or graphing errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Appropriate work is shown to find the correct slope and midpoint of the segment, but no further correct work is shown.
or [2] Appropriate work is shown to find the slope of the original segment and the slope of the perpendicular bisector, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [1] Appropriate work is shown to find the correct slope or midpoint of the segment, but no further correct work is shown.
or [1] $y + 2 = \frac{4}{3}(x - 3)$ or an equivalent linear equation, 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
[32] incorrect procedure. _____

[4] 10 and $y - 1 = -\dfrac{3}{4}(x - 2)$ or an equivalent

equation, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
[2] Appropriate work is shown, but more than one computational error is made.
or [2] Appropriate work is shown, but one conceptual error is made in determining the distance or the equation of the line.
or [2] The length, the midpoint, and the slope of $\overline{AB}$ are found correctly, but no equation or an incorrect equation is given for the perpendicular bisector.
or [2] Only a correct equation of the perpendicular bisector is found.
[1] The correct distance is found, but no attempt is made to find the equation of the perpendicular bisector.
or [1] The midpoint and slope of $\overline{AB}$ are found correctly, but no further correct work is shown.
or [1] The slope of $\overline{AB}$ and the slope of the perpendicular bisector are calculated correctly.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[33]   incorrect procedure.

[4] $15 + 5\sqrt{5}$, and appropriate work is shown.
[3] Appropriate work is shown, but one computational error is made.
or [3] Appropriate work is shown, but the perimeter is not expressed in simplest radical form.
or [3] Appropriate work is shown to find the length of all three sides, but the perimeter is not found.
[2] Appropriate work is shown, but two or more computational errors are made.
or [2] Appropriate work is shown, but one conceptual error is made.
or [2] Appropriate work is shown to find the lengths of two sides, but no further correct work is shown.
[1] Appropriate work is shown, but one conceptual error and one computational error are made.
or [1] Appropriate work is shown to find the length of one side, but no further correct work is shown.
or [1] $15 + 5\sqrt{5}$, but no work is shown.
[0] A zero response is completely incorrect, irrelevant, or is a correct response that was obtained by an obviously
[34]   incorrect procedure.

[2] The slopes of $\overline{RA}$ and $\overline{PT}$ are calculated correctly, and appropriate work is shown, and the statement is made that since their slopes are equal, the lines are parallel.
[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] Appropriate work is shown, and the slopes are shown to be equal, but no concluding statement is written.
[0] A statement is written that lines with equal slopes are parallel, 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
[35]   obviously incorrect procedure.

COORDINATE GEOMETRY BAND

[4] The student draws parallelogram *ABCD* correctly, identifies *D*(1,3), and justifies the coordinates of *D* by using any appropriate method to show *ABCD* is a parallelogram.
[3] The student draws parallelogram *ABCD* incorrectly but justifies *D* appropriately.
or [3] The student draws parallelogram *ABCD* correctly and identifies *D*(1,3), but the justification is incomplete.
[2] The student draws parallelogram *ABCD* correctly and identifies *D*(1,3), but no justification is shown.
[1] The student either draws parallelogram *ABCD* correctly or identifies *D*(1,3) correctly.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[36] incorrect procedure. _____

[4] Appropriate work is shown, and an appropriate concluding statement is made to prove quadrilateral *ABCD* is a rhombus.
[3] The proof is completed appropriately, but one computational error is made, but an appropriate concluding statement is made.
or [3] Appropriate work is shown to prove quadrilateral *ABCD* is a rhombus, but the concluding statement is missing, incomplete, or incorrect.
[2] The proof is completed appropriately, but more than one computational error is made, but an appropriate concluding statement is made.
or [2] Appropriate work is shown, but one of the formulas used is incorrect.
or [2] Appropriate work is shown to prove quadrilateral *ABCD* is a parallelogram, and an appropriate concluding statement is made, but the sides are not proved to be equal.
or [2] Quadrilateral *ABCD* is proved to be a rhombus by assuming quadrilateral *ABCD* is a parallelogram.
[1] Appropriate work is shown to prove quadrilateral *ABCD* is a parallelogram, and the concluding statement is missing, incomplete, or incorrect.
or [1] The definition of a rhombus is stated, but no proof is given.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[37] incorrect procedure. _____

[6] A complete and correct proof is shown.
[5] Appropriate work is shown, but one computational error is made.
or [5] Appropriate work is shown, but the final conclusion is not justified or is justified incorrectly.
[4] Appropriate work is shown, but two or more computational errors are made.
or [4] Appropriate work is shown to prove TEAM is a parallelogram and not a square, but no work is shown to prove it is a rhombus.
or [4] Appropriate work is shown to prove TEAM is a rhombus, and partial work is shown to prove TEAM is not a square, but the conclusion is not adequately justified.
[3] Appropriate work is shown to prove TEAM is a rhombus, but no further correct work is shown.
or [3] Appropriate work is shown to prove TEAM is not a square, but an incorrect method is used to prove TEAM is a rhombus.
or [3] An accurate explanation of the process required to complete the proof is stated, and needed formulas are given, but no further correct work is shown.
[2] Appropriate work is shown to prove TEAM is a parallelogram, but no further correct work is shown.
[1] A complete explanation of the method of the proof is written, but no further correct work is shown.
or [1] A statement that TEAM is not a square and a correct reason are written, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[38] incorrect procedure.

[6] Appropriate work is shown, such as using slopes to prove *ABCD* is a parallelogram but not a rectangle, and an appropriate concluding statement is made.
[5] Appropriate work is shown, but one computational or graphing error is made.
[4] Appropriate work is shown, but two or more computational or graphing errors are made.
or [4] Appropriate work is shown, but one conceptual error is made, such as using an incorrect formula.
or [4] A proof is written that correctly shows either *ABCD* is a parallelogram or it is not a rectangle, but not both.
[3] Appropriate work is shown, but two or more computational or graphing errors are made, and the concluding statement is incomplete.
[2] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.
or [2] All four slopes are found correctly or the lengths of all four sides are found correctly, and appropriate work is shown, but no further correct work is shown.
[1] The slopes of all four sides are identified or the lengths of all four lines are identified, but no work is shown and no proof is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[39] incorrect procedure.

[6] The vertices $A'(-1,1)$, $B'(4,-2)$, $C'(3,-5)$, and $D'(-2,-2)$ are stated and a complete and correct proof that includes a conclusion is written.

[5] The vertices are stated, and a proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one reason is missing or is incorrect.

or [5] A complete proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but the vertices of $A'B'C'D'$ are not stated.

[4] The vertices are stated, and a proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.

[3] The vertices are stated, and a proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two reasons are missing or are incorrect.

[2] The vertices are stated, and some correct relevant statements about the proof are made, but three or four statements or reasons are missing or are incorrect.

[1] The vertices $A'(-1,1)$, $B'(4,-2)$, $C'(3,-5)$, and $D'(-2,-2)$ are stated, but no proof is written.

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

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

[40] obviously incorrect procedure.

[6] The correct slopes of $AB = \dfrac{1}{2}$ and $CD = \dfrac{1}{2}$ are found, $\overline{AB} \| \overline{CD}$ is stated, and an explanation of why they are parallel is given. The correct slopes of $AD = -\dfrac{5}{2}$ and $BC = -\dfrac{1}{2}$ are found, $\overline{AD}$ is not parallel to $\overline{BC}$ is stated, and an explanation of why they are not parallel is given. An explanation that $ABCD$ is a trapezoid is given.

[5] The correct slopes of $\overline{AB}, \overline{CD}, \overline{AD},$ and $\overline{BC}$ are found, and $\overline{AB} \| \overline{CD}$ and $\overline{AD}$ not $\| \overline{BC}$ are stated, but an explanation that $ABCD$ is a trapezoid is not given.

or [5] One computational error is made in finding the slopes, but all further work is appropriate, based on the calculated slopes.

[4] The correct slope of $\overline{AB}$ and $\overline{CD}$ are found, and $\overline{AB} \| \overline{CD}$ is stated, but incorrect slopes of $\overline{AD}$ and $\overline{BC}$ are found, but an explanation of why they are not parallel is given, but an explanation that $ABCD$ is a trapezoid is not given.

or [4] More than one computational error is made in finding the slopes, but $\overline{AB}$ and $\overline{CD}$ are found to have equal slopes and $\overline{AD}$ and $\overline{BC}$ to have different slopes, but an explanation that $ABCD$ is a trapezoid is given.

[3] Incorrect slopes of $\overline{AB}, \overline{CD}, \overline{AD},$ and $\overline{BC}$ are found, such as by using an incorrect formula, $\overline{AB}$ and $\overline{CD}$ are found to have equal slopes and $\overline{AD}$ and $\overline{BC}$ to have different slopes, but an explanation that $ABCD$ is a trapezoid is given.

[2] Only the correct slopes of $\overline{AB}, \overline{CD}, \overline{AD},$ and $\overline{BC}$ are found, and appropriate work is shown.

[41] [1] Only two correct slopes are found, and

appropriate work is shown.

or [1] $AB = \dfrac{1}{2}$, $CD = \dfrac{1}{2}$, $AD = -\dfrac{5}{2}$, and

$BC = -\dfrac{1}{2}$, 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.

[6] $\overline{KA} \parallel \overline{ET}$, $\overline{AT}$ not $\parallel \overline{KE}$, and $\overline{KE} \neq \overline{AT}$, and appropriate work is shown.

[5] Appropriate work is shown, but one computational error leads to incorrect conclusions that are appropriate, based on that error.

[4] Appropriate work is shown to find $\overline{KA} \parallel \overline{ET}$ or $\overline{AT}$ not $\parallel \overline{KE}$ and $\overline{KE} \neq \overline{AT}$, but no further correct work is shown.

[3] Appropriate work is shown to find $\overline{KE} \neq \overline{AT}$, and at least three of the four slopes are found correctly, but no statement regarding parallelism is made.

or [3] Appropriate work is shown to find the four slopes, and correct statements of parallelism are made, but no further correct work is shown.

[2] Appropriate work is shown to find unequal sides, but no further correct work is shown.

or [2] Appropriate work is shown to find the four slopes, but no conclusion is drawn.

or [2] The four slopes are correct, but no work is shown, but appropriate opposite sides are stated to be parallel and nonparallel.

or [2] The slope and distance formulas are used, but more than one computational error is made, but one accurate conclusion is drawn.

[1] Only two correct slopes or distances are found.

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

[42]

COORDINATE GEOMETRY BAND

[6] $\overline{JK} \parallel \overline{ML}, \overline{MJ}$ not $\parallel \overline{KL}, \overline{MJ} \neq \overline{KL}$, and

appropriate work is shown or a complete and correct proof is written, and a concluding statement is written.
[5] Appropriate work is shown and a correct concluding statement is written, but one computational error is made in determining the slopes or the lengths of the legs.
or [5] Appropriate work is shown, but the concluding statement is missing or is incomplete.
[4] Appropriate work is shown and a correct concluding statement is written, but two or more computational errors are made.
or [4] The quadrilateral is proved to be a trapezoid, but the two nonparallel sides are not proved to be unequal.
or [4] A proof is written that shows that $\overline{JK} \parallel \overline{ML}$ and $\overline{MJ} \neq \overline{KL}$, but the difference

between a quadrilateral and a trapezoid is not addressed.
[3] Appropriate work is shown, but one conceptual error is made.
[2] The quadrilateral is proved to be a trapezoid, but one conceptual error is made, and the two nonparallel sides are not proved to be unequal.
or [2] The lengths of all four sides are found correctly, but no further correct work is shown.
or [2] The two nonparallel sides are proved to be unequal, but no further correct work is shown.
[1] The proof shows that the first set of sides is parallel, but no further correct work is shown.
or [1] JKLM is graphed correctly and the definition of an isosceles trapezoid is written, but no proof is written.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[43] incorrect procedure.

[6] A complete and correct proof with an appropriate concluding statement is written.
[5] Appropriate work is shown, but one computational or graphing error is made.
or [5] Appropriate work is shown to prove *TRAP* is a trapezoid and the lengths of the sides are found, but no concluding statement is made regarding it not being isosceles.
or [5] All calculations necessary to prove *TRAP* is a trapezoid but not isosceles are made, but one statement or reason is missing or is incorrect.
[4] Appropriate work is shown, but two or more computational or graphing errors are made.
or [4] Appropriate work is shown, but one conceptual error is made.
or [4] Appropriate work is shown to prove *TRAP* is a trapezoid with an appropriate concluding statement, but no further correct work is shown.
[3] Appropriate work is shown to find *TP*, *RA*, and the slopes of all four sides, but no conclusions are written.
[2] Appropriate work is shown, but one conceptual error and one computational, graphing, or justification error are made.
or [2] Appropriate work is shown to prove $\overline{TR} \parallel \overline{PA}$ with appropriate justification, but no further correct work is shown.
or [2] Appropriate work is shown to find the slopes of all four sides and either *TP* or *RA*, but no conclusions are written.
[1] Appropriate work is shown to find the slopes of all four sides, but no further correct work is shown.
or [1] Appropriate work is shown to find *TP* and *RA*, but no further correct work is shown.
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously
[44] incorrect procedure.

COORDINATE GEOMETRY BAND

[6] A complete and correct proof that includes a concluding statement is written, such as showing that $\overline{AB}$ is parallel to $\overline{CD}$ and that $\overline{BC}$ is not parallel to $\overline{AD}$ by finding their slopes and using the distance formula to show that the two nonparallel sides are equal.

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

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

or [4] Appropriate work is shown, but one conceptual error is made, such as using an incorrect formula.

or [4] The slopes of all four sides are found correctly and the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, and appropriate work is shown, but no conclusion is stated.

or [4] A proof is written that correctly shows *ABCD* is a trapezoid, but it is not proved to be isosceles.

[3] The slopes of only one pair of sides are found correctly, but the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, and appropriate work is shown, and an appropriate conclusion is stated.

or [3] A correct numerical illustration is given in lieu of a proof of the general case.

[2] The slopes of only one pair of sides are found correctly, but the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, and appropriate work is shown, but no conclusion is stated.

[1] Either the slopes or the lengths of $\overline{AD}$ and $\overline{BC}$ are found correctly, but no conclusion is stated.

or [1] The correct definition of an isosceles trapezoid is written, but no further correct work is shown.

[0] The slopes of $\overline{AB}$ and $\overline{DC}$ are found correctly, but no further correct work is shown.

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

[45] incorrect procedure. _____

[46]   A   _____

[47]   C   _____

[48]   C   _____

[49]   A   _____

[50]   A   _____

[51]   A   _____

[52]   A   _____

[53]   A   _____

[54]   D   _____

[55]   A   _____

[56]   B   _____

[57]   D   _____

[58]   B   _____

[59]   D   _____

[60]   C   _____

[61]   C   _____

[62]   A   _____

[63]   C   _____

[64]   B   _____

[65]   C   _____

COORDINATE GEOMETRY BAND

a [2] The student draws a circle with its center at (0,0) and a radius of 3.
[1] The student draws a circle, but it has an incorrect center or radius.
b [2] 28, and appropriate work or the expression 9π is shown, which rounds to 28.
or [2] An appropriate area is shown for the incorrect figure in part a.
[1] The correct expression is shown, but the answer is left as 9π, not rounded, or not rounded correctly.
or [1] An incorrect radius is used, but the area is rounded appropriately.
a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[66] obviously incorrect procedure.