

ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

TEACHER HANDBOOK

GEOMETRY

END-OF-COURSE EXAMINATIONS

2012–2013 ADMINISTRATIONS

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Arkansas Department of Education

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
SCORING STUDENT RESPONSES TO OPEN-RESPONSE ITEMS	2
Reader Training	2
Scoring Procedures.....	2
ITEM A—2013 GEOMETRY	4
Solution and Scoring	5
ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY	7
Score Point: 4	7
Score Point: 3	8
Score Point: 2	9
Score Point: 1	10
Score Point: 0	11
ITEM B—2013 GEOMETRY	12
Solution and Scoring	14
ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY	16
Score Point: 4	16
Score Point: 3	17
Score Point: 2	18
Score Point: 1	19
Score Point: 0	20
ITEM C—2013 GEOMETRY	21
Solution and Scoring	22
ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY	25
Score Point: 4	25
Score Point: 3	26
Score Point: 2	27
Score Point: 1	28
Score Point: 0	29
ITEM D—2013 GEOMETRY	30
Solution and Scoring	31
ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY	33
Score Point: 4	33
Score Point: 3	34
Score Point: 2	35
Score Point: 1	36
Score Point: 0	37

TABLE OF CONTENTS

	PAGE
ITEM E—2013 GEOMETRY	38
Solution and Scoring	39
ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY	41
Score Point: 4	41
Score Point: 3	42
Score Point: 2	43
Score Point: 1	44
Score Point: 0	45

The **Arkansas Comprehensive Testing, Assessment, and Accountability Program** (ACTAAP) includes *Mid-Year* and *Spring Geometry End-of-Course Examinations* for students completing Geometry or the equivalent for high school graduation credit. The examinations consist of multiple-choice and open-response questions that directly assess student knowledge. The development of the Geometry End-of-Course Examinations was based on the *Arkansas Geometry Mathematics Curriculum Framework*.

In January or April 2013, all students who had completed or were completing the required course work for Geometry for high school graduation credit participated in the *Mid-Year* or *Spring Geometry End-of-Course Examination*. Results of the Geometry End-of-Course Examinations will be provided to all students, schools, and districts to be used as the basis for instructional change.

This handbook provides information regarding the scoring of student responses to the Geometry open-response items. It describes the scoring procedures and the scoring criteria (rubrics) used to assess student responses. Copies of actual student responses are provided, along with scores given to those responses, to illustrate how the scoring criteria were applied to Geometry open-response items.

Additional information about the Geometry End-of-Course Examination is available through the Arkansas Department of Education. Questions can be addressed to the Office of Student Assessment at 501-682-4558.

SCORING STUDENT RESPONSES TO OPEN-RESPONSE ITEMS

The multiple-choice and open-response test items for the Geometry End-of-Course Examination are developed with the assistance and approval of the Geometry Content Advisory Committee. This committee comprises active Arkansas educators with expertise in Mathematics education. The Geometry Content Advisory Committee develops and reviews multiple-choice and open-response items to ensure that they reflect the *Arkansas Geometry Mathematics Curriculum Framework*.

While multiple-choice items are scored by machine to determine if the student chose the correct answer from four options, responses to open-response items must be scored by trained “readers” using a pre-established set of scoring criteria.

READER TRAINING

Readers are trained to score only one content area. Qualified readers for the Arkansas scoring will be those with a four-year college degree in mathematics, education, or related fields.

Before readers are allowed to begin assigning scores to any student responses, they go through intensive training. The first step in that training is for the readers to read the Geometry open-response items as they appear in the test booklet and to respond—just as the student test takers are required to do. This step gives the readers some insight into how the students might have responded. The next step is the readers’ introduction to the scoring rubric. All of the specific requirements of the rubric are explained by the Scoring Director who has been specifically trained to lead the scoring group. Then responses (anchor papers) that illustrate the score points of the rubric are presented to the readers and discussed. The goal of this discussion is for the readers to understand why a particular response (or type of response) receives a particular score. After discussion of the rubric and anchor papers, readers practice scoring sets of responses that have been prescored and selected for use as training papers. Detailed discussion of the responses and the scores they receive follows.

After three or four of these practice sets, readers are given “qualifying rounds.” These are additional sets of prescored papers, and, in order to qualify, each reader scoring Geometry responses must score in exact agreement on at least 80% of the responses. Readers who do not score within the required rate of agreement are not allowed to score the Geometry End-of-Course Examination responses.

Once scoring of the actual student responses begins, readers are monitored constantly throughout the project to ensure that they are scoring according to the criteria. Daily and cumulative statistics are posted and analyzed, and Scoring Directors or Team Leaders reread selected responses scored by the readers. These procedures promote reliable and consistent scoring. Any reader who does not maintain an acceptable level of agreement is dismissed from the project.

SCORING PROCEDURES

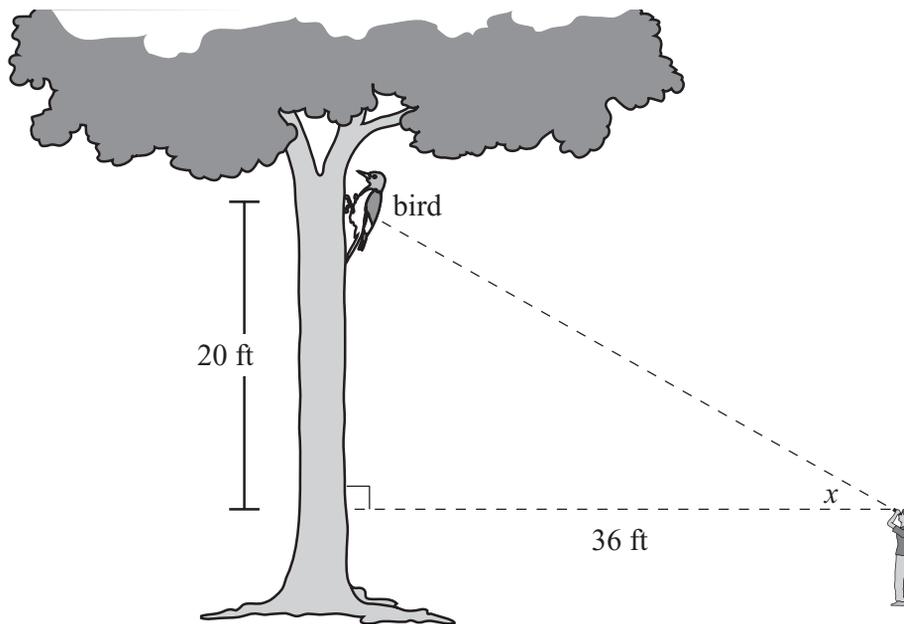
All student responses to the Geometry End-of-Course Examination open-response test items are scored independently by two readers. Those two scores are compared, and responses that receive scores that are non-adjacent (a “1” and a “3,” for example) are scored a third time by a Team Leader or the Scoring Director for resolution.

On the following pages, open-response items are presented as they appeared in the *2013 Mid-Year and Spring Geometry End-of-Course Examinations*. The specific scoring rubric for each item and annotated responses for each score point of the rubric follows. The goal is for classroom teachers and their students to understand how responses are scored. It is hoped that this understanding will help students see what kind of performance is expected of them on the Geometry End-of-Course Examination.

GEOMETRY RESPONSES

ITEM A—2013 GEOMETRY

A. Maria is observing a woodpecker near the top of a tree, as shown in the diagram below.



1. What is the distance between Maria and the woodpecker? Show all of your work, and round to the nearest foot.
2. What is the measure of angle x , the angle of elevation, rounded to the nearest degree? Show all of your work to justify your answer.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

Item A Scoring Rubric—2013 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work.
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns 1 – 1½ points, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

SOLUTION AND SCORING

Do not deduct for early rounding or truncating in internal work that results in the correct answer. Students may write these values for brevity, using the exact calculator value to find their answer.

4 points possible:

Part	Points
1	<p>2 points possible:</p> <p>2 points: Correct distance: 41 (<i>rounded to the nearest foot [foot not needed for a 4]</i>) Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: $d = \sqrt{20^2 + 36^2} = \sqrt{400 + 1296} = \sqrt{1696} = 41.18252\dots \approx 41$</p> <p>Ex: $\tan x = \frac{20}{36} \Rightarrow x = \tan^{-1}\left(\frac{20}{36}\right) \approx 29^\circ \Rightarrow \cos 29 = \frac{36}{h} \Rightarrow h = \frac{36}{\cos 29} \approx 41$ feet</p> <p>Ex: $\tan x = \frac{20}{36} \Rightarrow x = \tan^{-1}\left(\frac{20}{36}\right) \approx 29^\circ \Rightarrow \sin 29 = \frac{20}{h} \Rightarrow h = \frac{20}{\sin 29} \approx 41$ feet</p> <p>OR</p> <p>1½ points: • Distance is correct but is rounded or truncated to a place other than the nearest foot Correct procedure shown and/or explained</p> <p>• Work contains evidence of early rounding(s) that results in an incorrect distance (<i>may or may not be rounded to the nearest foot</i>) Correct procedure shown and/or explained</p> <p>• Distance is correct but procedure has an incorrect use of “$\sqrt{\quad}$” (<i>may or may not be rounded to the nearest foot</i>) Correct procedure is shown and/or explained</p> <p>OR</p> <p>1 point: • Correct distance: 41 (<i>rounded to the nearest foot</i>) Work is incomplete or missing or contains incorrect trig notation</p> <p>• Distance is incorrect due to a calculation, copy or rounding error (<i>may or may not be rounded to the nearest foot</i>) Correct procedure is shown and/or explained</p>

ITEM A SOLUTION AND SCORING—2013 GEOMETRY

Part	Points
2	<p>2 points possible:</p> <p>2 points: Correct measure: 29 (rounded to the nearest degree [<i>degree not needed for a 4</i>]) (or correct measure based on an incorrect distance in Part 1) Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: $\tan x = \frac{20}{36} = 0.\bar{5} \Rightarrow x = \tan^{-1}\left(\frac{20}{36}\right) = 29.05460\dots \approx 29^\circ$</p> <p>Ex: $\sin x = \frac{20}{41} = 0.\overline{48780} \Rightarrow x = \sin^{-1}\left(\frac{20}{41}\right) = 29.19640\dots \approx 29^\circ$</p> <p>Ex: $\sin x = \frac{20}{41} = 0.48564\dots \Rightarrow x = \sin^{-1}\left(\frac{20}{41}\right) = 29.05460\dots \approx 29^\circ$ (uses 41.18252... value in calculator from Part 1)</p> <p>Ex: $\cos x = \frac{36}{41} = 0.\overline{87804} \Rightarrow x = \cos^{-1}\left(\frac{36}{41}\right) = 28.59212\dots \approx 29^\circ$</p> <p>Ex: $\cos x = \frac{36}{41} = 0.87415\dots \Rightarrow x = \cos^{-1}\left(\frac{36}{41}\right) = 29.05460\dots \approx 29^\circ$ (uses 41.18252... value in calculator from Part 1)</p> <p>Ex: $\tan x = \frac{20}{36}$ or $\sin x = \frac{20}{41}$ or $\cos x = \frac{36}{41}$ with correct answer of $x = 29^\circ$</p> <p>Ex: Performs at least two guess-and-check trials.</p> <p>OR</p> <p>1½ points: <ul style="list-style-type: none"> • Measure is correct but is rounded or truncated to a place other than the nearest degree Correct procedure is shown and/or explained • Work contains evidence of early rounding(s) that results in an incorrect measure (<i>may or may not be rounded to the nearest degree</i>) Correct procedure is shown and/or explained </p> <p>OR</p> <p>1 point: <ul style="list-style-type: none"> • Correct measure: 29 (rounded to the nearest degree) Work is incomplete or missing or contains incorrect trig notation • Measure is incorrect due to a calculation, copy or rounding error (<i>may or may not be rounded to the nearest degree</i>) Correct procedure is shown and/or explained • $\tan x = \frac{20}{36}$ or $\sin x = \frac{20}{41}$ or $\cos x = \frac{36}{41}$ Measure may be incorrect or missing </p>

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct Distance:	41 ft	2
Correct Procedure:	$20^2 + 36^2 = c^2$; $400 + 1296 = c^2$; $\sqrt{1696} = \sqrt{c^2}$; $41 = c$	
<u>Part 2</u>		Points
Correct Measure:	29°	2
Three Correct Procedures: Any one of these three procedures is sufficient for full credit.	$\sin x = \frac{20}{41} = .487804878$; $x = 29^\circ$; $\cos x = \frac{36}{41} = .8780487805$; $x = 29^\circ$; $\tan x = \frac{20}{36} = .5555555556$; $x = 29^\circ$	
Total Points		4

1.

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

$$20^2 + 36^2 = c^2$$

$$400 + 1296 = c^2$$

$$\sqrt{1696} = \sqrt{c^2}$$

$$41 \text{ ft} = c$$

Maria is 41 ft away from the bird.

2.

$$\sin x = \frac{20}{41}$$

$$\sin x = .487804878$$

$x = 29^\circ$

$$\cos x = \frac{36}{41}$$

$$\cos x = .8780487805$$

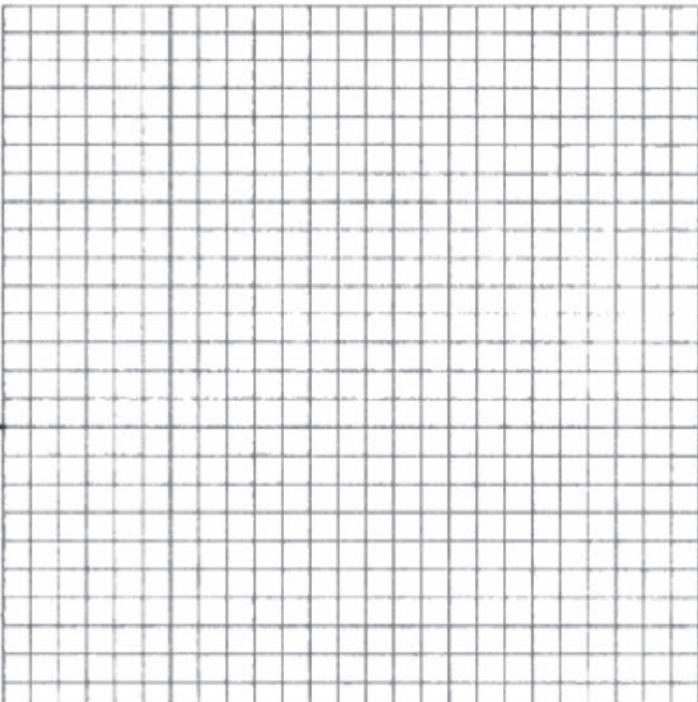
$$x = 29^\circ$$

$$\tan x = \frac{20}{36}$$

$$\tan x = .5555555556$$

$$x = 29^\circ$$

$x = 29^\circ$



ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct Distance:	41.18 Rounded to a place other than the nearest foot.	1½
Correct Procedure:	$20^2 + 36^2 = c^2$; $400 + 1296 = c^2$; $\sqrt{1696} = \sqrt{c^2}$	
<u>Part 2</u>		Points
Correct Measure:	29.05 Rounded to a place other than the nearest degree.	1½
Correct Procedure:	$\tan^{-1}\left(\frac{20}{36}\right) = 29.05$	
Total Points		3

1.

$$20^2 + 36^2 = c^2$$

$$400 + 1296 = c^2$$

$$\sqrt{1696} = \sqrt{c^2}$$

41.18

The Distance Between the Bird and maria is 41.18.

2. S-oh
C-ah
T-oh

$\tan^{-1}\left(\frac{20}{36}\right) = 29.05$

$X^\circ = 29.05$

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 2

Part 1

		Points
Correct Distance:	41	2
Correct Procedure:	$20^2 + 36^2 = 1696$; $\sqrt{1696} = 41$	

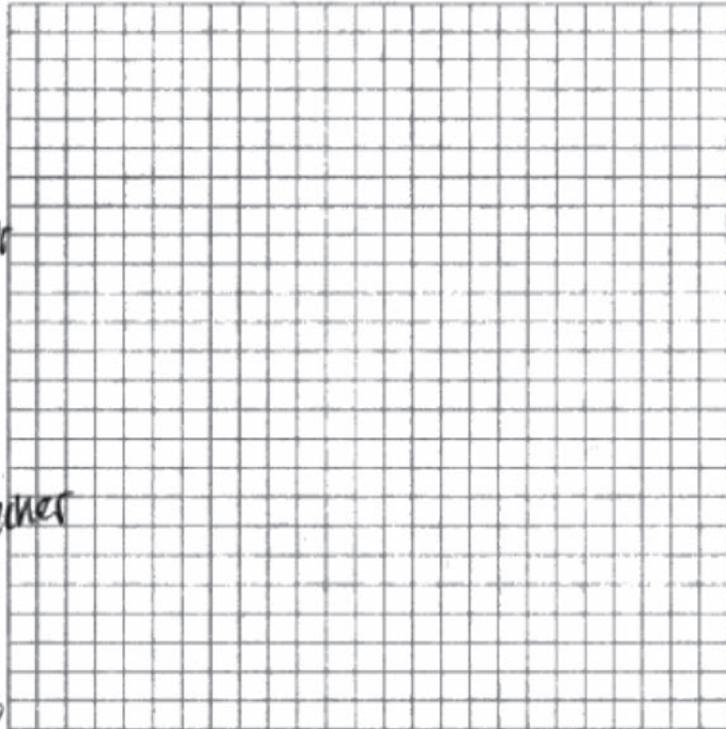
Part 2

		Points
Incorrect Measure:	30	0
Incorrect Procedure:	Presumes a 30°-60°-90° right triangle. This is a common mistake.	

Total Points 2

1. $20^2 + 36^2 = 1696$
 $\sqrt{1696} = 41 \text{ ft.}$
 There is 41 ft between
 Maria & the woodpecker

2. Maria's line of sight
 is 36 ft away from the
 tree. The height of her
 line of sight to the woodpecker
 is 20 ft. When Maria
 tilts her head to see
 the woodpecker, it makes
 a 30-60-90 right
 triangle. $X = 30$.



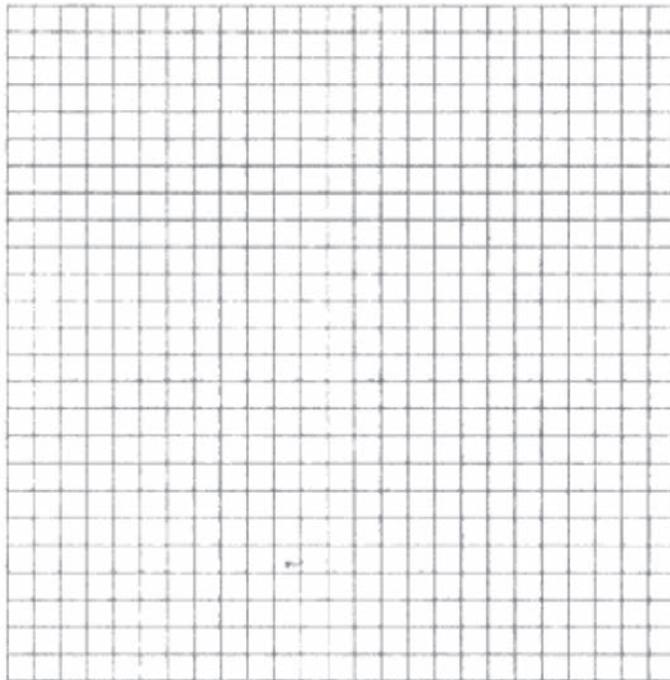
ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect Distance:	42.4 Due to a calculation error	1
Correct Procedure with calculation error:	$20^2 + 36^2 = c^2$; $400 + 1296 = c^2$; $\sqrt{1796} = \sqrt{c^2}$ calculation error: 1796 should be 1696	
<u>Part 2</u>		Points
Incorrect Measure:	30	0
Procedure with two errors:	$\tan x = \frac{20}{36}$; $\tan^{-1} = \left(\frac{20}{36}\right)$ [Incorrect trig notation: should be $\tan^{-1}\left(\frac{20}{36}\right) = x$]; 30° [Calculation error: should be 29]	
Total Points		1

①
 $a^2 + b^2 = c^2$
 $20^2 + 36^2 = c^2$
 $400 + 1296 = c^2$
 $\sqrt{1796} = \sqrt{c^2}$
 $42.4 ft = c$

② $\tan x = \frac{20}{36}$
 $\tan^{-1} = \left(\frac{20}{36}\right)$
 30°



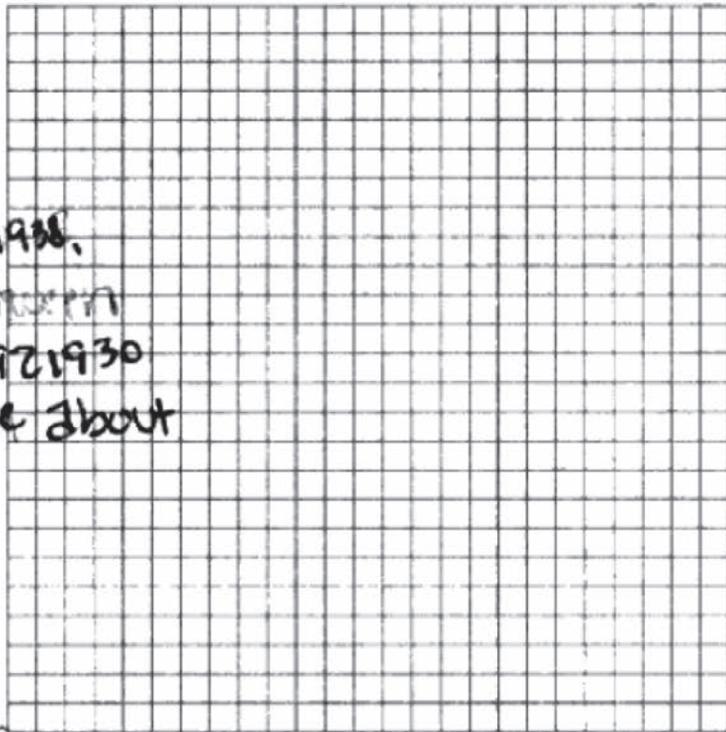
ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect Distance:	42	0
Incorrect Procedure:	$\frac{36}{\sqrt{3}} = 21; 21 \cdot 2 = 42$	
<u>Part 2</u>		Points
Incorrect Measure:	17	0
Incorrect Procedure:	$\tan x = \frac{20}{40} \approx \tan 40 \cdot 20 = x = 17$	
Total Points		0

1. The distance is 42 ft because you find the ~~36~~ divided by the $\sqrt{3}$ and you get 41.56921938. Then you multiply it by two and you get 41.56921938 which would be about 42 feet.

$$\frac{36}{\sqrt{3}} = 21 \text{ ft}$$

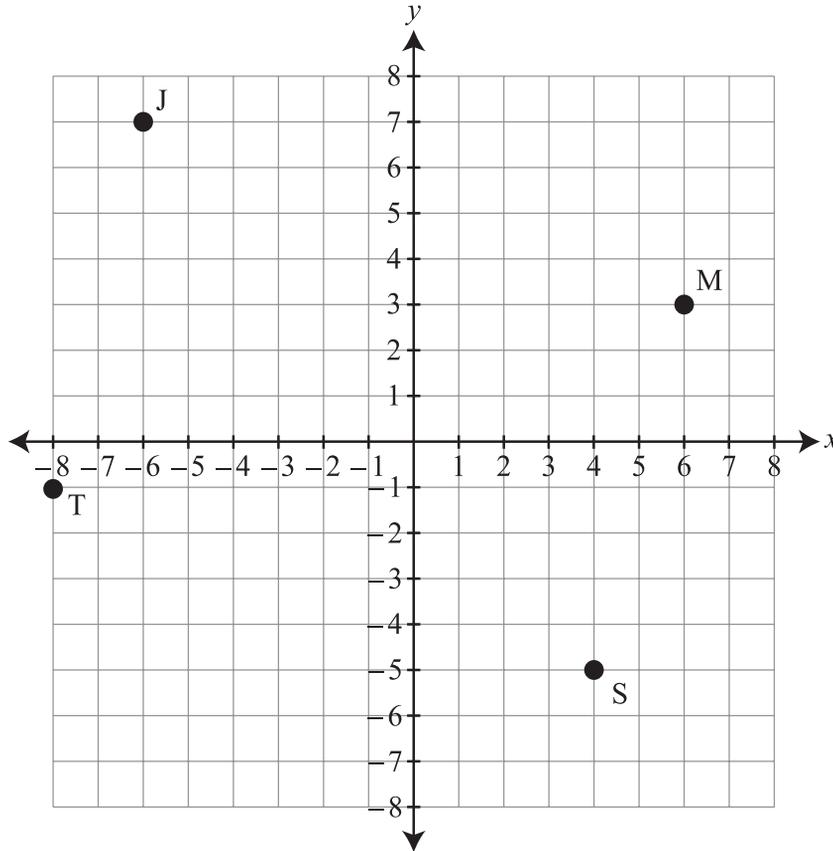
$$21 \cdot 2 = 42 \text{ ft.}$$


2. The measure of angle x is 17°, because you find the tangent of x to get the angle measure.

$$\tan x = \frac{20}{40} \approx \tan 40 \cdot 20 = x = 17^\circ$$

ITEM B—2013 GEOMETRY

- B. The marching band director is using a coordinate grid to help him design a formation for the marching band. He begins by placing the four section leaders, Jodi, Mark, Sandra, and Terrence, at the locations J, M, S, and T, as shown below.



1. The band director wants to place another key band member, Zach, halfway between Sandra (S) and Terrence (T). What will be the coordinates of Zach's location? Show your work or explain how you found your answer.
2. The band director plans to scale the graphic as 1 grid unit = 3 yards. How far, in yards, will Sandra be from Jodi? Round your answer to the nearest tenth of a yard. Show your work and/or explain how you found your answer.
3. Except for Zach, the other band members will be placed along the segments from Jodi to Sandra and from Mark to Terrence. Determine whether these two segments, \overline{JS} and \overline{TM} , are perpendicular. Show your work or explain how you found your answer.

BE SURE TO LABEL YOUR RESPONSES 1, 2, AND 3.

Item B Scoring Rubric—2013 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work.
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown. Ex. Correctly uses the midpoint formula with incorrect points.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

ITEM B SOLUTION AND SCORING—2013 GEOMETRY

SOLUTION AND SCORING

Do not deduct for early rounding or truncating in internal work that results in the correct answer. Students may write these values for brevity, using the exact calculator value to find their answer.

$$\mathbf{J:} (-6, 7) \quad \mathbf{M:} (6, 3) \quad \mathbf{S:} (4, -5) \quad \mathbf{T:} (-8, -1)$$

4 points possible:

Part	Points
1	<p>1 point possible:</p> <p>1 point: 2 Correct coordinates: $(-2, -3)$ Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: $\left(\frac{4+^{-}8}{2}, \frac{^{-}5+^{-}1}{2}\right) = \left(\frac{^{-}4}{2}, \frac{^{-}6}{2}\right) = (-2, -3)$</p> <p>Ex: “From T, I counted two down and six right to Z. From Z, I counted two down and six right to S.”</p> <p>OR</p> <p>½ point: • 2 Correct coordinates: $(-2, -3)$ Work is incomplete or missing</p> <p> • 1 coordinate is correct 1 coordinate is incorrect due to a calculation or copy error Correct procedure is shown and/or explained</p>
2	<p>1½ points possible:</p> <p>1½ points: Correct length: 46.8 or 46.9 (<i>yards not required for a 4</i>) Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: Length = $\sqrt{(4-^{-}6)^2 + (-5-7)^2} = \sqrt{100+144} = \sqrt{244} = 15.62049\dots$ $3 \cdot 15.62049\dots = 46.86149\dots \approx 46.9$</p> <p>OR</p> <p>1 point: • Length is correctly rounded to a place other than nearest tenth of a yard Correct procedure is shown and/or explained</p> <p> • Length is correct but procedure has an incorrect use of “$\sqrt{\quad}$” Otherwise correct procedure is shown and/or explained</p> <p>OR</p> <p>½ point: • Student finds length from Sandra to Jodi but doesn’t multiply by 3 ($3 \cdot \sqrt{244}$ or equivalent) (<i>may or may not be rounded to the nearest tenth of a yard</i>) Correct procedure is shown and/or explained</p> <p> • Answer is incorrect due to a calculation or copy error, or early rounding Correct procedure is shown and/or explained</p> <p> • Correct length: 46.8 or 46.9; Incomplete procedure</p>

ITEM B SOLUTION AND SCORING—2013 GEOMETRY

Part	Points
3	<p>1½ points possible:</p> <p>1½ points: Correct answer: “No, they are not perpendicular.” Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: $m_{\overline{JS}} = \frac{(-5-7)}{(4-6)} = \frac{-12}{-2} = 6$ $m_{\overline{TM}} = \frac{(3-1)}{(6-8)} = \frac{2}{-2} = -1$</p> <p>“The slopes are not negative reciprocals so the segments are not perpendicular.”</p> <p>Ex: Student shows rise over run on diagram to determine slope</p> <p>OR</p> <p>1 point:</p> <ul style="list-style-type: none"> • Both slopes are correctly found Correct procedure is shown and/or explained Answer (“No”) is missing • Correct answer (“No”) Both slopes are correct Work and/or explanation is incomplete, but some correct procedure is shown and/or explained • 1 slope is correct 1 slope is incorrect due to a calculation or copy error Correct procedure is shown and/or explained Answer (“No”) is correct <p>OR</p> <p>½ point:</p> <ul style="list-style-type: none"> • 1 slope is correct 1 slope is incorrect due to a calculation or copy error Correct procedure is shown and/or explained Answer (“No”) is incorrect or missing • Both slopes are correct Work and/or explanation is missing Answer (“No”) may be correct, incorrect or missing • “No, they are not opposite reciprocals.” With or without additional work shown “No” and “opposite (or negative) reciprocals” are both required.

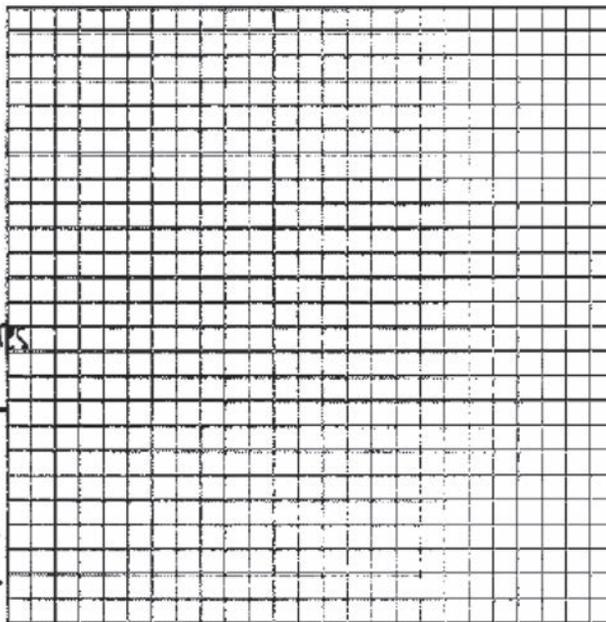
ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct Coordinates:	$(-2, -3)$	1
Correct Procedure:	$\left(\frac{-8+4}{2}, \frac{-1+5}{2}\right)$	
<u>Part 2</u>		Points
Correct Length:	46.9 yds	1½
Correct Procedure:	$\sqrt{(-6-4)^2 + (7+5)^2} = \sqrt{100+144}$; $d = \sqrt{244} \times 3$	
<u>Part 3</u>		Points
Correct Response:	“The two segments ... are not perpendicular. ... the slopes have to be opposite and reciprocals.”	1½
Correct Procedure:	$\overline{JS} = \frac{(7+5)}{(-6-4)} = -\frac{6}{5}$; $\overline{TM} = \frac{(3+1)}{(6+8)} = \frac{2}{7}$	
Total Points		4

① Sandra $(-4, -5)$
 Terrence $(-8, -1)$
 midpoint = $\left(\frac{x_2+x_1}{2}, \frac{y_2+y_1}{2}\right)$
 $= \left(\frac{-8+4}{2}, \frac{-1+5}{2}\right)$
 midpoint = $(-2, -3)$
 Zach will tie at coordinates
 $(-2, -3)$

② Sandra $(-4, -5)$
 Sodi $(-6, 7)$
 distance = $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$
 $= \sqrt{(-6-4)^2 + (7+5)^2}$
 $= \sqrt{100+144}$
 $d = \sqrt{244}$ units
 $\times 3$ yards per unit
 46.9 yds



③ Slope of $\overline{JS} = \frac{7+5}{-6-4}$
 $\overline{JS} = -\frac{6}{5}$
 Slope of $\overline{TM} = \frac{3+1}{6+8}$
 $\overline{TM} = \frac{2}{7}$

The two segments, \overline{JS} & \overline{TM} , are not perpendicular. For lines or segments to be perpendicular, the slopes have to be opposite and reciprocals.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct Coordinates:	$(-2, -3)$	1
Correct Procedure:	$\left(\frac{4 + -8}{2}, \frac{-5 + -1}{2}\right)$	
<u>Part 2</u>		Points
Correct Length:	46.86 (not rounded to the nearest tenth of a yard)	1
Correct Procedure:	$\sqrt{(-6-4)^2 + (7-5)^2} = 100 + 144$ (error) = $\sqrt{244}$ (recovery) = 15.62 ; $15.62 \times 3 = 46.86$	
<u>Part 3</u>		Points
Correct Response:	“No the 2 segments are not perpendicular.”	1
Correct Procedure with calculation error:	$\frac{-5-7}{4-6}; \frac{-12}{10}; -\frac{1}{2}$ [calculation error]; $\frac{3-1}{6-8}; \frac{4}{14} = \frac{2}{7}; \frac{4}{14} = \frac{2}{7}$ Sufficient work shown to determine that error was from miscalculation.	
Total Points		3

1. $\left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2}\right)$
 $T(-8, -1) S(4, -5)$
 $\left(\frac{4 + -8}{2}, \frac{-5 + -1}{2}\right)$
 $(-2, -3)$
 Zach's coordinates are at $(-2, -3)$.

2. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
 $d = \sqrt{(4 - -8)^2 + (7 - -5)^2}$
 $d = 100 + 144$
 $d = \sqrt{244}$
 $d = 15.62$
 $\times 3$
 46.86
 Sandra is 46.86 yds from Jodi

3. $JS: m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - -1}{4 - -6} = \frac{-4}{-10} = \frac{2}{5}$
 $JM: m = \frac{3 - -1}{6 - -8} = \frac{4}{-14} = -\frac{2}{7}$
 $m = \frac{4}{14} = \frac{2}{7}$
 No the 2 segments are not perpendicular

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

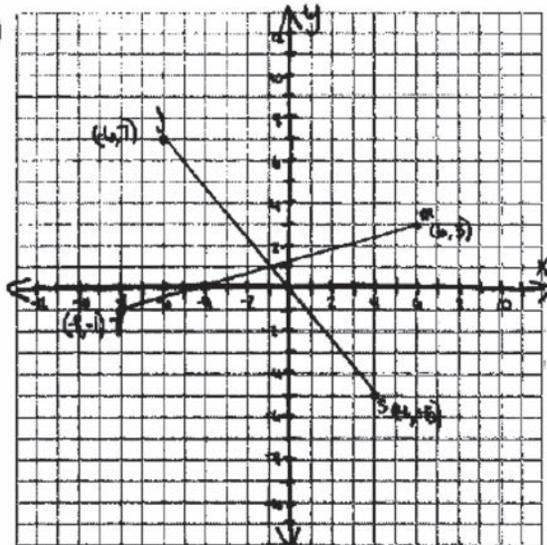
SCORE POINT: 2

<u>Part 1</u>		Points
Correct Coordinates:	$(-2, -3)$	1
Correct Procedure:	$\left(\frac{4+^{-}8}{2}, \frac{^{-}5+^{-}1}{2}\right); \left(\frac{^{-}4}{2}, \frac{^{-}6}{2}\right); (-2, -3)$	
<u>Part 2</u>		Points
Incorrect Length:	15.6	$\frac{1}{2}$
Incomplete Procedure:	$\sqrt{(4-^{-}6)^2 + (-5-7)^2} = \sqrt{(10)^2 + ^{-}12^2} = \sqrt{100+144} = \sqrt{244} = 15.6$ Does not multiply 15.6 by 3. Note: Incorrect notation [$^{-}12^2$] in Part 2 is overlooked because this is not a 4 paper. If this had been a 4 paper, the incorrect notation would have reduced the score to a 3.	
<u>Part 3</u>		Points
Correct Slopes:	$\overline{JS}-y = \frac{^{-}6}{5}x+0; \overline{TM}-y = \frac{2}{7}x+1$	$\frac{1}{2}$
Missing Procedure:	The slopes are correct; the slope intercept equation is incorrect. should be: $\overline{JS}-y = \frac{^{-}6}{5}x + \frac{^{-}1}{5}; \overline{TM}-y = \frac{2}{7}x + \frac{9}{7}$.	
Total Points		2

① Mid point $= \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
 $= \left(\frac{4+^{-}8}{2}, \frac{^{-}5+^{-}1}{2}\right)$
 $= \left(\frac{^{-}4}{2}, \frac{^{-}6}{2}\right)$
 $= (-2, -3)$

Zach would be at point $(-2, -3)$. I used the midpoint formula to find Zach's location.

② $d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$
 $= \sqrt{(4-^{-}6)^2 + (-5-7)^2}$
 $= \sqrt{10^2 + ^{-}12^2}$
 $= \sqrt{100+144}$
 $= \sqrt{244}$
 $= 15.6 \text{ units}$



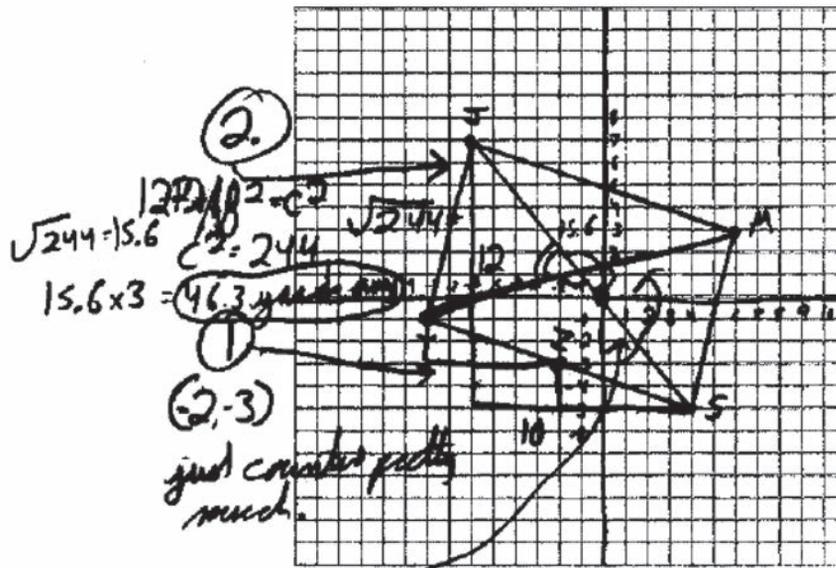
③ $\overline{JS}-y = \frac{^{-}6}{5}x+0$
 $\overline{TM}-y = \frac{2}{7}x+1$

The two lines are not perpendicular because their slopes are not the opposite of the other.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 1

<u>Part 1</u>		Points
Correct Coordinates:	(-2, -3)	1
Correct Procedure:	Indicates on the graph counting down two units from T , then counting to the right six units to Z . Then indicates counting down two units from Z , then counting to the right six units to S .	
<u>Part 2</u>		Points
Incorrect Length due to calculation error:	46.3	½
Correct Procedure with one error:	$12^2 + 10^2 = c^2$; $c^2 = 244$; $\sqrt{244} = 15.6 \times 3 = 46.3$ [<i>calculation error: should be = 46.8</i>] Numbers on diagram show counting indicating where student got 10 and 12 to use in the Pythagorean Theorem.	
<u>Part 3</u>		Points
Incorrect Response:	"No, they make an obtuse \angle and an acute angle and because the starting shape is a rectangle."	0
Missing Procedure:		
Total Points		1½



(3) No, they make an obtuse \angle and an acute angle and because the starting shape is a rectangle.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

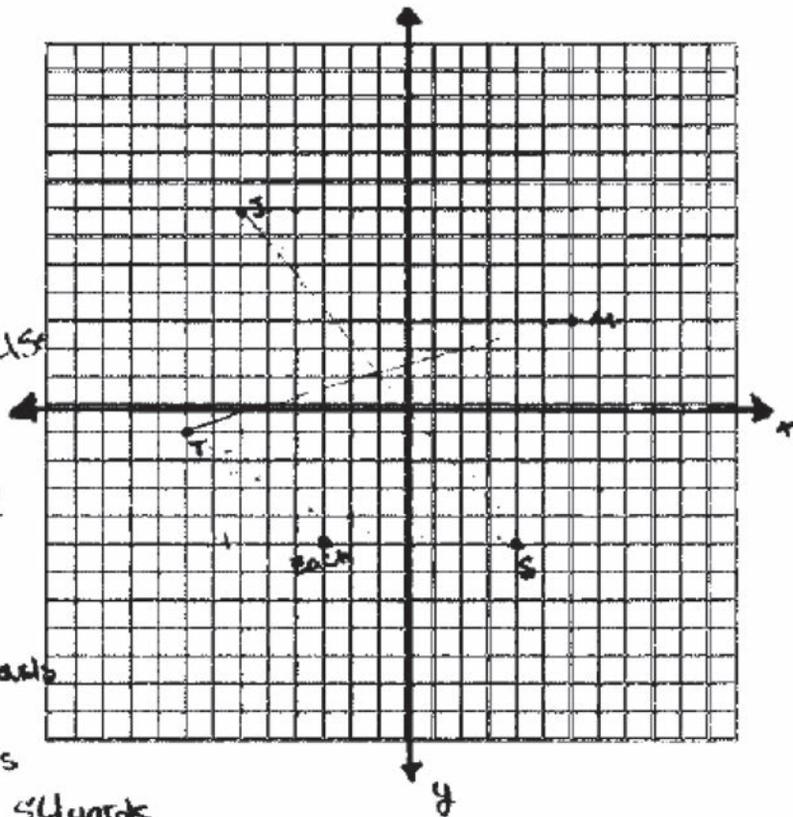
SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect Coordinates:	$(-3, -5)$	0
Incorrect Procedure:	"... because its between (T) and (S) right in the middle."	
<u>Part 2</u>		Points
Incorrect Length:	54	0
Incorrect Procedure:	$18 \times 3 = 54$	
<u>Part 3</u>		Points
Incorrect Response:	"They are perpendicular because they cross each other and make a "x" in almost the middle."	0
Missing Procedure		
Total Points		0

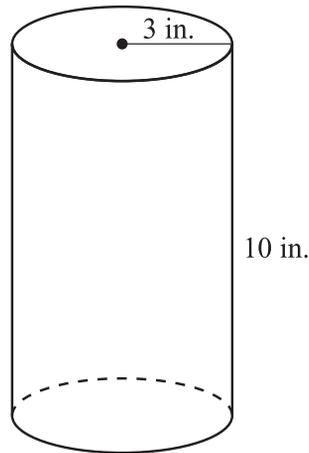
1. Zach would be $(-3, -5)$ because its between (T) and (S) right in the middle.

2. 1 grid unit = 3 yards
 18 grid unit
 $18 \times 3 = 54$ yards
 Sandra will be 54 yards from Josi.

3. They are perpendicular because they cross each other and make a "x" in almost the middle.



- C. Ike’s Ice Cream Company sells its ice cream in cylindrical containers, with the dimensions shown below.



Ike’s Ice Cream Company plans to create a new container by decreasing the volume of its current ice cream containers by 20%.

1. Find the volume of the new container. Leave your answer in terms of pi or round to the nearest hundredth of a cubic inch. Show your work.
2. If Ike’s Ice Cream Company decides to change the height of the current container but keep the radius the same, what will be the height of the new container whose volume was found in Part 1? Show your work or explain how you found your answer.
3. If Ike’s Ice Cream Company decides to change the radius of the current container but keep the height the same, what will be the radius of the new container whose volume was found in Part 1? Show your work or explain how you found your answer.

BE SURE TO LABEL YOUR RESPONSES 1, 2, AND 3.

Item C Scoring Rubric—2013 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work. Correct label of “inches” in Parts 2 and 3.
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

ITEM C SOLUTION AND SCORING—2013 GEOMETRY

SOLUTION AND SCORING

Do not deduct for early rounding or truncating in internal work that results in the correct answer. Students may write these values for brevity, using the exact calculator value to find their answer.

4 points possible:

Part	Points
1	<p>2 points possible:</p> <p>2 points: Correct volume: 72π or 226.08 or 226.19 (<i>cubic inches not required</i>) Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: $V = \pi r^2 h = \pi(3^2)10 = \pi(9)10 = 90\pi = 282.74333\dots$ $.8V = .8 \cdot 90\pi = 72\pi = 226.19467\dots \approx 226.19$</p> <p>Ex: $V = \pi r^2 h = \pi(3^2)10 = \pi(9)10 = 90\pi = 282.74333\dots$ $.2 \cdot 282.74333\dots = 56.54866\dots$ $282.74333\dots - 56.54866\dots = 226.19467\dots \approx 226.19$</p> <p>Ex: $V = \pi r^2 h = \pi(3^2)10 = \pi(9)10 = 3.14 \cdot 90 = 282.6$ $.8V = .8 \cdot 282.6 = 226.08$</p> <p>Ex: $V = \pi r^2 h = \pi(3^2)10 = \pi(9)10 = 3.14 \cdot 90 = 282.6$ $.2 \cdot 282.6 = 56.52$ $282.6 - 56.52 = 226.08$</p> <p>OR</p> <p>1½ points: • Volume is correctly rounded or truncated to a place other than the nearest 100th or work contains evidence of early rounding(s) that results in an incorrect answer Correct procedure shown and/or explained</p> <p>OR</p> <p>1 point: • Correct volume Procedures are missing or incomplete</p> <p>• Incorrect or missing volume Correct procedure is shown and/or explained Work may have a calculation, copy, or rounding error, or the label exponent is attached to the numerical value.</p>

Part	Points
2	<p>1 point possible:</p> <p>1 point: Correct height: 8 (<i>inches required for a 4</i>) <i>(or correct height based on an incorrect volume in Part 1)</i> Because the prompt does not specify rounding, correct answers correctly rounded to any position are acceptable. Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: $.8h = .8 \cdot 10 = 8$</p> <p>Ex: $V = \pi r^2 h \Rightarrow h = \frac{V}{\pi r^2} = \frac{72\pi}{\pi(3)^2} = \frac{72\pi}{9\pi} = 8$</p> <p>Ex: $V = \pi r^2 h \Rightarrow h = \frac{V}{\pi r^2} = \frac{226.19}{9\pi} = 7.99983\dots$</p> <p>Ex: $V = \pi r^2 h \Rightarrow h = \frac{V}{\pi r^2} = \frac{226.19}{9 \cdot 3.14} = 8.00389\dots$</p> <p>Ex: $V = \pi r^2 h \Rightarrow h = \frac{V}{\pi r^2} = \frac{226.08}{9 \cdot 3.14} = 8$</p> <p>Ex: Guess-and-Check with correct answer</p> <p>OR</p> <p>½ point:</p> <ul style="list-style-type: none"> • Correct height Procedure is missing or incomplete • Correct height Procedure contains an incorrect use of “$\sqrt{\quad}$” • Incorrect or missing height Correct procedure shown and/or explained Work may have a calculation, copy, or rounding error, or is truncated or work contains evidence of early rounding(s) that results in an incorrect answer

ITEM C SOLUTION AND SCORING—2013 GEOMETRY

Part	Points
3	<p>1 point possible:</p> <p>1 point: Correct radius: 2.68 (<i>inches required for a 4</i>) <i>(or correct radius based on an incorrect volume in Part 1)</i> Because the prompt does not specify rounding, correct answers correctly rounded to any position are acceptable. Correct procedure shown and/or explained Give credit for the following or equivalent:</p> <p>Ex: $V = \pi r^2 h \Rightarrow 72\pi = \pi r^2 10 \Rightarrow r^2 = \frac{72\pi}{10\pi} = 7.2 \Rightarrow r = \sqrt{7.2} = 2.68328\dots$</p> <p>Ex: $V = \pi r^2 h \Rightarrow r^2 = \frac{226.19}{10\pi} = 7.19985\dots \Rightarrow r = \sqrt{7.19985\dots} = 2.68325\dots$</p> <p>Ex: $V = \pi r^2 h \Rightarrow r^2 = \frac{226.19}{10 \cdot 3.14} = 7.20350\dots \Rightarrow r = \sqrt{7.20350\dots} = 2.68393\dots$</p> <p>Ex: $V = \pi r^2 h \Rightarrow r^2 = \frac{226.08}{10 \cdot 3.14} = 7.2 \Rightarrow r = \sqrt{7.2} = 2.68328\dots$</p> <p>Ex: Guess-and-Check with correct answer</p> <p>OR</p> <p>½ point: <ul style="list-style-type: none"> • Correct radius <i>(or correct radius based on an incorrect volume in Part 1)</i> Procedure is missing or incomplete • Correct radius Procedure contains an incorrect use of “$\sqrt{\quad}$” • Incorrect or missing radius Correct procedure shown and/or explained Work may have a calculation, copy, or rounding error, or is truncated or work contains evidence of early rounding(s) that results in an incorrect answer </p>

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 4

Part 1		Points
Two Correct Volumes:	226.19 and 72π [<i>cubic inches not required</i>]	2
Two Correct Procedures: Either procedure alone is sufficient for full credit	$\pi(3^2)10$; $282.74 \cdot 20 = 56.55$; $282.74 - 56.55 = 226.19$ $\pi(3^2)10 = 90\pi$; 18π ; $90\pi - 18\pi$; 72π	
Part 2		Points
Correct Height:	8 in.	1
Two Correct Procedures: Either procedure alone is sufficient for full credit	$\frac{226.19}{\pi(9)} = \frac{\pi(3)^2(h)}{\pi(9)}$; $h = \frac{226.19}{\pi(9)}$; 7.99984; 8 $\frac{72\pi}{\pi(9)} = \frac{\pi(3)^2 h}{\pi(9)}$; $h = 8$	
Part 3		Points
Correct Radius:	2.7 in.	1
Correct Procedure:	$\frac{226.19}{10(\pi)} = \frac{\pi(r)^2(10)}{10(\pi)}$; $r^2 = \frac{226.19}{10(\pi)}$; $\sqrt{r^2} = \sqrt{7.199857}$; $r = 2.6833$	
Total Points		4

1. $V = \pi(3)^2(10)$
 $V = 282.74 \cdot 20$
 $= 56.55$
 $\begin{array}{r} 282.74 \\ - 56.55 \\ \hline 226.19 \end{array}$ or $\begin{array}{r} V = \pi(3)^2(10) \\ V = 90\pi \\ 18\pi \\ \hline 90\pi \\ - 18\pi \\ \hline 72\pi \end{array}$

2. $\frac{226.19}{\pi(9)} = \frac{\pi(3)^2(h)}{\pi(9)}$
 $h = \frac{226.19}{\pi(9)}$
 height = 7.99984
 $\approx 8 \text{ in.}$

3. $\frac{226.19}{10(\pi)} = \frac{\pi(r)^2(10)}{10(\pi)}$
 $r^2 = \frac{226.19}{10\pi}$
 $\sqrt{r^2} = \sqrt{7.199857}$
 $r = 2.6833$
 $\approx 2.7 \text{ in.}$

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct Volume:	226.19	2
Correct Procedure:	$\pi \cdot 3^2 \cdot 10 = 282.74$; $282.74 \cdot 0.20 = 56.55$; $282.74 - 56.55 = 226.19$	
<u>Part 2</u>		Points
Correct Height:	8 inches	1
Correct Procedure:	$\pi \cdot 3^2 \cdot 8 = 226.19$ Guess-and-Check with correct answer	
<u>Part 3</u>		Points
Incorrect Radius:	4.76	0
Incorrect Procedure:	$\pi \cdot r^2 \cdot 10 \div 10 = 226.19 \div 10$; $\pi \cdot r^2 = 22.619$ $\sqrt{22.619} = 4.76$ [incorrect procedure: did not divide by π]	
Total Points		3

1. $V = \pi r^2 h$
 $\pi \cdot 3^2 \cdot 10 = 282.74 \text{ in}^3$
 $282.74 \cdot 0.20 = 56.55 \text{ in}$
 $282.74 - 56.55 = 226.19 \text{ in}^3$

The new Volume would be 226.19 in^3 .

2. $V = \pi r^2 h$
 $\pi \cdot 3^2 \cdot 8 = 226.19 \text{ in}^3$ The height would be 8 inches.

3. $\pi \cdot r^2 \cdot 10 = 226.19$
 $\div 10 \quad \div 10$
 $\pi \cdot r^2 = 22.619$
 $\sqrt{22.619} = 4.76$
 $r = 4.76 \text{ in}$

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 2

<u>Part 1</u>		Points
Correct Volume:	226.19	1
Incomplete Procedure:	$\pi 3^2(10)$; $\pi 90$; 282.74; 226.19 [incomplete procedure: does not show how 226.19 was derived from 282.74]	
<u>Part 2</u>		Points
Correct Height:	8 in.	1
Correct Procedure:	$\pi 3^2(8)$; $\pi(72)$; 226.19; 10-20%=	
<u>Part 3</u>		Points
Incorrect Radius due to two errors:	3.6	0
Incorrect Procedure with two errors:	$3+20\%=3.6$ [incorrect procedure; this alone dictates 0 points]; $\pi 3.6^2(8)$; $\pi 12.96(8)$; $\pi 133.68$ [calculation error: 133.68 should be 103.68]; 419.9 [does not explain 419.9; 226.19 is the desired volume]	
Total Points		2

1, $\pi r^2 h$
 $\pi 3^2(10)$
 $\pi 90$
 282.74
 The volume of the new container is 226.19 in

2, $\pi 3^2(8)$ 10-20%=
 $\pi(72)$
 226.19
 The new height will be 8 in

3, $\pi 3.6^2(8)$ 3+20%=3.6
 $\pi 12.96(8)$
 $\pi 133.68$
 419.9
 The radius of the new container will be 3.6 in

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect Volume due to calculation error:	226.92	1
Correct Procedure with calculation error:	$\pi 3^2 \cdot 10$; $\frac{282.74}{100} \cdot \frac{x}{20}$; $x = 56.548$; $282.74 - 56.548 = 226.92$ [calculation error: 226.92 SB 226.192]	
<u>Part 2</u>		Points
Correct truncated Height:	8.02	$\frac{1}{2}$
Correct Procedure with truncation:	$226.92 = \pi 3^2 \cdot x$; $\frac{226.92}{28.27} = \frac{28.27 \cdot x}{28.27}$; $8.02 = x$ [truncated: $\frac{226.92}{28.27} = 8.02688\dots$]	
<u>Part 3</u>		Points
Incorrect Radius:	1.52	0
Incorrect Procedure:	$\frac{226.92}{10} = \pi x^2 \cdot \frac{10}{10}$; $\sqrt{22.692} = \sqrt{\pi x^2}$ [incorrect procedure: should be $22.692 = \pi x^2$ or $\frac{22.692}{\pi} = x^2$]; $\frac{4.79}{\pi} = \frac{\pi x}{\pi}$ [calculation error: $\sqrt{22.692} = 4.76361\dots$]; $1.52 = x$	
Total Points		$\frac{1}{2}$

1. $V = \pi 3^2 \cdot 10$
 $v = 282.74$
 $- 56.548$
 New Volume is 226.92
 $\frac{282.74}{100} \cdot \frac{x}{20}$
 $x = 56.548$

2. $226.92 = \pi 3^2 \cdot x$ $v = \pi 3^2 \cdot 8.02$
 $\frac{226.92}{28.27} = \frac{28.27 \cdot x}{28.27}$ $v = 226.92$
 $8.02 = x$ $226.92 = 226.92$
 8.02 is new height

3. $\frac{226.92}{10} = \pi x^2 \cdot \frac{10}{10}$
 $\sqrt{22.692} = \sqrt{\pi x^2}$
 $\frac{4.79}{\pi} = \frac{\pi x}{\pi}$
 $1.52 = x$
 1.52 is new radius

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect Volume:	56.52	0
Incorrect Procedure:	$(3.14)(3^2)(10)$; $282.6 \times .20$; 56.52 [does not subtract 56.52 from 282.6]	
<u>Part 2</u>		Points
Incorrect Height:	18.84	0
Incorrect Procedure:	$56.52 \div 3 = 18.84$ [does not divide by 3^2 or by π]	
<u>Part 3</u>		Points
Incorrect Radius:	5.7	0
Incorrect Procedure:	$56.52 \div 10 = 5.652$ [does not divide by π]	
Total Points		0

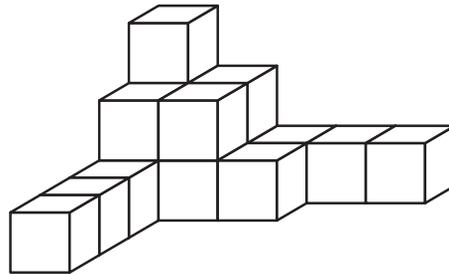
$\textcircled{1} (3.14)(3^2)(10)$
 $282.6 \times .20$
 volume = 56.52 in.^3

$\textcircled{2}$ radius = 3 in
 volume = 56.52 in.^3
 $56.52 \div 3 = 18.84 \text{ in.}$
 height = 18.84 in.

$\textcircled{3}$ height = 10 in.
 volume = 56.52 in.^3
 $56.52 \text{ in.}^3 \div 10 = 5.652 \text{ in}$
 radius = 5.7 in.

ITEM D—2013 GEOMETRY

- D. An arrangement of blocks sitting on a surface is shown below.



Front

1. Draw the view of the blocks from the right side.
2. Draw the view of the blocks from the top.
3. How many blocks in all are in the arrangement?
4. The length of each side of the cube-shaped blocks is 3 cm. What is the volume of the arrangement of blocks? Show your work.

BE SURE TO LABEL YOUR RESPONSES 1, 2, 3, AND 4.

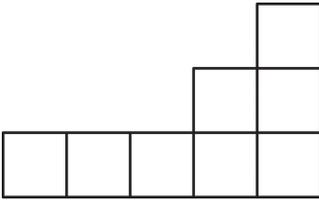
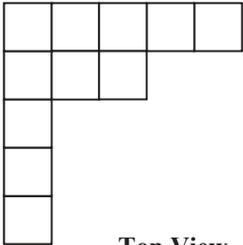
Item D Scoring Rubric—2013 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work. Correct label of “cubic centimeters” in Part 4.
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

SOLUTION AND SCORING

4 points possible:

- Notes:**
- Labels of “**Right-side View**” and “**Top View**” are not required if diagrams are in the correct order. If they are not in order, they must be labeled in order to receive credit.
 - Diagrams must delineate the correct number of blocks in the correct configuration. Blocks may be inconsistent in size and shape.
 - Diagrams showing change in depth (by shading, etc.; **not 3-D**) are acceptable.

Part	Points
1	<p>1 point possible:</p> <p>1 point: Correct view:</p> <div style="text-align: center;">  <p>Right Side View</p> </div>
2	<p>1 point possible:</p> <p>1 point: Correct view:</p> <div style="text-align: center;">  <p>Top View</p> </div>
3	<p>1 point possible:</p> <p>1 point: Correct number of blocks: 16</p>

ITEM D SOLUTION AND SCORING—2013 GEOMETRY

Part	Points																																										
4	<p>1 point possible:</p> <p>1 point: Correct volume: 432 cm³ (<i>cubic centimeters required for a 4</i>) <i>(or correct volume for an incorrect number of blocks in Part 3)</i> Give credit for the following or equivalent: Ex: $V = 3 \cdot 3 \cdot 3 \cdot 16 = 27 \cdot 16 = 432$</p> <p>OR</p> <p>½ point: Correct volume Procedures are missing or incomplete or Incorrect or missing volume Correct procedure is shown and/or explained Work may have a calculation error.</p> <table border="1" data-bbox="495 766 722 1442"> <thead> <tr> <th>Blocks</th> <th>Volume</th> </tr> </thead> <tbody> <tr><td>1</td><td>27</td></tr> <tr><td>2</td><td>54</td></tr> <tr><td>3</td><td>81</td></tr> <tr><td>4</td><td>108</td></tr> <tr><td>5</td><td>135</td></tr> <tr><td>6</td><td>162</td></tr> <tr><td>7</td><td>189</td></tr> <tr><td>8</td><td>216</td></tr> <tr><td>9</td><td>243</td></tr> <tr><td>10</td><td>270</td></tr> <tr><td>11</td><td>297</td></tr> <tr><td>12</td><td>324</td></tr> <tr><td>13</td><td>351</td></tr> <tr><td>14</td><td>378</td></tr> <tr><td>15</td><td>405</td></tr> <tr><td>16</td><td>432</td></tr> <tr><td>17</td><td>459</td></tr> <tr><td>18</td><td>486</td></tr> <tr><td>19</td><td>513</td></tr> <tr><td>20</td><td>540</td></tr> </tbody> </table>	Blocks	Volume	1	27	2	54	3	81	4	108	5	135	6	162	7	189	8	216	9	243	10	270	11	297	12	324	13	351	14	378	15	405	16	432	17	459	18	486	19	513	20	540
Blocks	Volume																																										
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18	486																																										
19	513																																										
20	540																																										

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct View:	All blocks correctly depicted and labeled.	1
<u>Part 2</u>		Points
Correct View:	All blocks correctly depicted and labeled.	1
<u>Part 3</u>		Points
Correct Number:	16	1
<u>Part 4</u>		Points
Correct Volume:	432 cm^3	1
Correct Procedure:	$3 \cdot 3 \cdot 3 = x \cdot 16$; $3 \cdot 3 \cdot 3 = 27 \cdot 16 = 432$ Running equal signs OK.	1
Total Points		4

1. Right View of the Blocks

2. Top View of the Blocks

3. 16 Blocks. There are 16 blocks in the arrangement of blocks shown.

4. Each block is a $3 \cdot 3 \cdot 3$. There are 16 blocks in the arrangement, so, $3 \cdot 3 \cdot 3 = x \cdot 16$.

$3 \cdot 3 \cdot 3 = 27 \cdot 16 = 432 \text{ cm}^3$

each side length
↓ volume of one cube
↓ number of cubes in the arrangement
→ total volume of the arrangement

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct View:	All blocks correctly depicted and labeled.	1
<u>Part 2</u>		Points
Correct View:	All blocks correctly depicted and labeled.	1
<u>Part 3</u>		Points
Incorrect Number:	15	0
<u>Part 4</u>		Points
Correct Volume for incorrect Part 3:	405 cm^3	1
Correct Procedure:	$3 \cdot 3 \cdot 3 = 27$; $27 \cdot 15 = 405$	
Total Points		3

①



right side view

②



TOP view

③



15 blocks are in the arrangement

④



volume of 1 block = $3_{\text{cm}} \cdot 3_{\text{cm}} \cdot 3_{\text{cm}} = 27 \text{ cm}^3$
 volume of 15 blocks = $27 \text{ cm}^3 \cdot 15 = 405 \text{ cm}^3$
volume of the arrangement of blocks = 405 cm^3

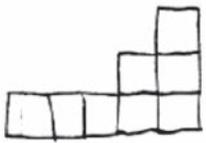
ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 2

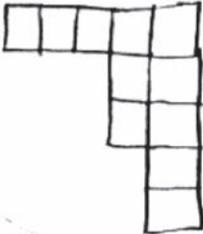
<u>Part 1</u>		Points
Correct View:	All blocks correctly depicted and labeled.	1
<u>Part 2</u>		Points
Incorrect View:	Correct view rotated 90° clockwise.	0
<u>Part 3</u>		Points
Correct Number:	16	1
<u>Part 4</u>		Points
Incorrect Volume:	144 cm ³	½
Correct Procedure with calculation error:	3 × 3 × 3 = 9 × 16 = 144 [3 × 3 × 3 = 9 should be 3 × 3 × 3 = 27]	
Total Points		2½

D

① right side view



② top view



③ 16 blocks are in the arrangement.

④ $3 \times 3 \times 3 = 9 \text{ m}^3$
 $\times 16 \text{ blocks}$
144 cm³ = volume

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 1

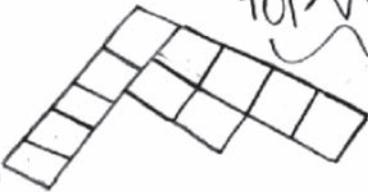
<u>Part 1</u>		Points
Incorrect View:	Left view shown.	0
<u>Part 2</u>		Points
Incorrect View:	View rotated 45° clockwise.	0
<u>Part 3</u>		Points
Correct Number:	16	1
<u>Part 4</u>		Points
Incorrect Volume:	576 cm	0
Incorrect Procedure:	$12 \cdot 3 = 36$; $36 \cdot 16 = 576$	
Total Points		1

1



Right view

2



top view

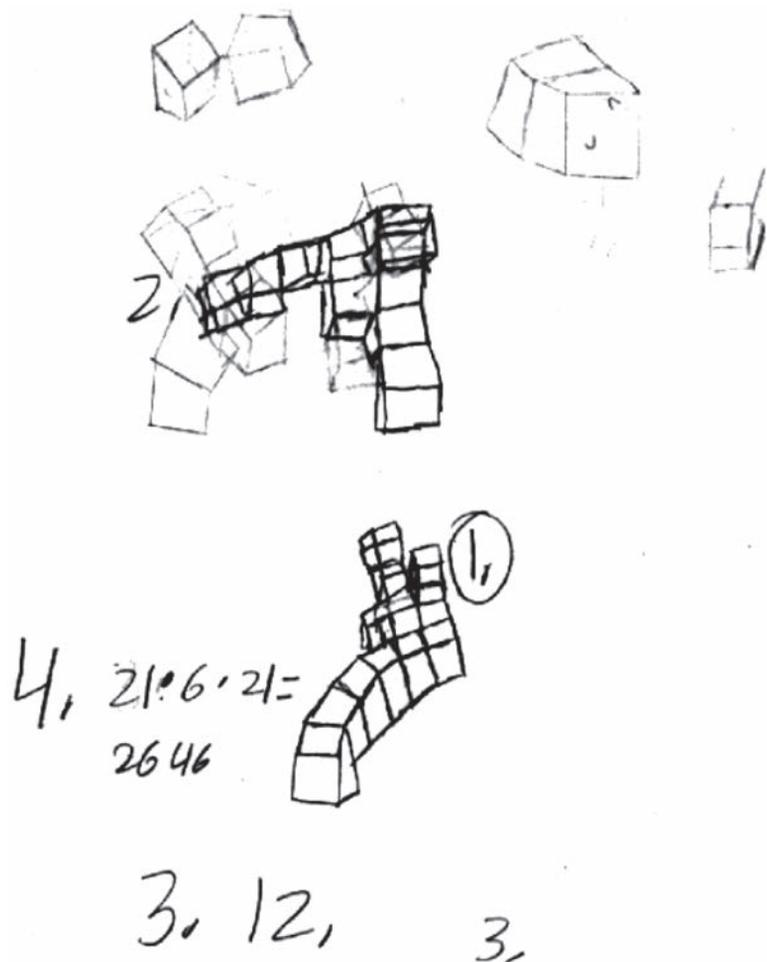
3 There 16 blocks in this Arrangement.

4 #sides on 1 cube = 12
 $12 \cdot 3 = 36$
 $36 \cdot 16 = 576 \text{ cm.}$
 Volume of Arrangement = 576cm

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 0

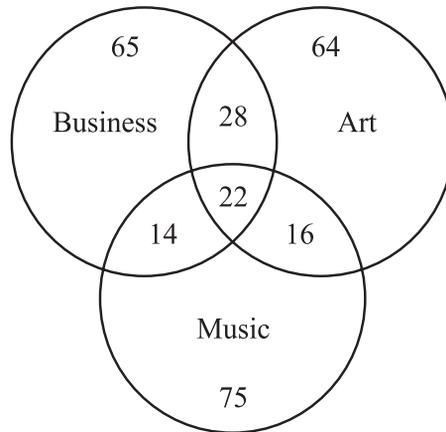
<u>Part 1</u>		Points
Incorrect View:	Attempts a 3-D depiction.	0
<u>Part 2</u>		Points
Incorrect View:	Attempts a 3-D depiction.	0
<u>Part 3</u>		Points
Incorrect Number:	12	0
<u>Part 4</u>		Points
Incorrect Volume:	2646	0
Incorrect Procedure:	$21 \cdot 6 \cdot 21 = 2646$	0
Total Points		0



ITEM E—2013 GEOMETRY

- E. A school requires all students to take an elective in Business, Art, and/or Music. The diagram below shows the distribution of students in the electives.

Student Enrollment in Electives



Four claims listed below are made about the distribution of students in the electives. For each claim, determine whether it is true or false. Justify your decision with mathematical reasoning.

1. More students signed up for Music electives than for Business electives.
2. More students are enrolled in two or more electives than are enrolled in only one elective.
3. More students are not enrolled in Music electives than are not enrolled in Art electives.
4. More students are in Art electives but not Business than are in Music but not Business.

BE SURE TO LABEL YOUR RESPONSES 1, 2, 3, AND 4.

Item E Scoring Rubric—2013 Geometry

Score	Description
4	The student earns 4 points. The response contains no incorrect work.
3	The student earns 3 – 3½ points.
2	The student earns 2 – 2½ points.
1	The student earns ½ – 1½ points, or some minimal understanding is shown. Ex. Finds the correct number of students in one of the categories in one of the four prompts, with work.
0	The student earns 0 points. No understanding is shown.
B	Blank — No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

ITEM E SOLUTION AND SCORING—2013 GEOMETRY

SOLUTION AND SCORING

4 points possible:

Part	Points
1	<p>1 point possible:</p> <p>1 point: Correct conclusion: False Correct procedure is shown and/or explained Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> • Music: $75 + 14 + 22 + 16 = 127$ and Business: $65 + 28 + 22 + 14 = 129$ “Since $129 > 127$, there are more students in Business electives than in Music electives.” <i>(not required)</i> or Music: $75 + 14 + 16 = 105$ and Business: $65 + 28 + 14 = 107$ or Music: $75 + 22 + 16 = 113$ and Business: $65 + 28 + 22 = 115$ or Music: $75 + 16 = 91$ and Business: $65 + 28 = 93$ [Ignores 14 and/or 22, which are common to Music and Business] • Finds any of the above correct number of students in Business and in Music Correct conclusion: False Work is incomplete or missing <p style="text-align: center;">OR</p> <p>½ point: • Correct, incorrect, or missing conclusion Correct procedure is shown and/or explained May have one calculation or copy error Conclusion based on the error if there is an error</p> <ul style="list-style-type: none"> • Finds any of the above correct number of students in Business and in Music Incorrect or missing conclusion Work is incomplete or missing
2	<p>1 point possible:</p> <p>1 point: Correct conclusion: False Correct procedure is shown and/or explained Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> • Students enrolled in two or more electives: $28 + 22 + 14 + 16 = 80$ Students enrolled in only one elective: $65 + 64 + 75 = 204$ “Since $80 < 204$, there are more enrolled in a single elective than in two or more electives.” <i>(not required)</i> • Finds correct number of students enrolled in only one and in two or more electives Correct conclusion: False Work is incomplete or missing <p style="text-align: center;">OR</p> <p>½ point: • Correct, incorrect, or missing conclusion Correct procedure is shown and/or explained May have one calculation or copy error Conclusion based on the error if there is an error</p> <ul style="list-style-type: none"> • Finds correct number of students enrolled in only one and in two or more electives Incorrect or missing conclusion Work is incomplete or missing

ITEM E SOLUTION AND SCORING—2013 GEOMETRY

Part	Points
3	<p>1 point possible:</p> <p>1 point: Correct conclusion: True Correct procedure is shown and/or explained Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> • Not taking Music: $65 + 28 + 64 = 157$ and Not taking Art $75 + 65 + 14 = 154$ “Since $157 > 154$, there are more students not taking Music than there are that are not taking Art.” (<i>not required</i>) or Not taking Music: $28 + 64 = 92$ and Not taking Art $75 + 14 = 89$ [Ignores 65, which is common to not-Music and not-Art] • Finds any of the above correct number not taking Music and not taking Art Correct conclusion: True Work is incomplete or missing <p style="text-align: center;">OR</p> <p>½ point: • Correct, incorrect, or missing conclusion Correct procedure is shown and/or explained May have one calculation or copy error Conclusion based on the error if there is an error</p> <ul style="list-style-type: none"> • Finds any of the above correct number not taking Music and not taking Art Incorrect or missing conclusion Work is incomplete or missing
4	<p>1 point possible:</p> <p>1 point: Correct conclusion: False Correct procedure is shown and/or explained Give credit for the following or equivalent:</p> <ul style="list-style-type: none"> • Art but not in Business: $64 + 16 = 80$ and Music but not in Business: $75 + 16 = 91$ “Since $91 > 80$, more students are enrolled in Music but not in Business.” (<i>not required</i>) or Art but not in Business: 64 and Music but not in Business: 75 [Ignores 16, which is common to Art and Music and references that the students are not enrolled in Business for both Art and Music] • Finds any of the above correct number enrolled in Art but not in Business, and in Music but not in Business Correct conclusion: False Work is incomplete or missing <p style="text-align: center;">OR</p> <p>½ point: • Correct, incorrect, or missing conclusion Correct procedure is shown and/or explained May have one calculation or copy error Conclusion based on the error if there is an error</p> <ul style="list-style-type: none"> • Finds any of the above correct number enrolled in Art but not in Business, and in Music but not in Business Incorrect or missing conclusion Work is incomplete or missing

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct Conclusion:	false	1
Correct Procedure:	Music $\rightarrow 75 + 14 + 16 + 22 = 127$; Business $\rightarrow 65 + 14 + 28 + 22 = 129$; $127 < 129$	
<u>Part 2</u>		Points
Correct Conclusion:	false	1
Correct Procedure:	Two or more $\rightarrow 28 + 16 + 14 + 22 = 80$; one elective $\rightarrow 65 + 64 + 75 = 204$; $80 < 204$	
<u>Part 3</u>		Points
Correct Conclusion:	true	1
Correct Procedure:	Not in Music $\rightarrow 65 + 28 + 64 = 157$; Not in Art $\rightarrow 65 + 14 + 75 = 154$; $157 > 154$	
<u>Part 4</u>		Points
Correct Conclusion:	false	1
Correct Procedure:	Art, not business $\rightarrow 64 + 16 = 80$; Music, not business $\rightarrow 75 + 16 = 91$; $80 < 91$	
Total Points		4

statement: Music > Business

1. Music $\rightarrow 75 + 14 + 16 + 22 = 127$ students
Business $\rightarrow 65 + 14 + 28 + 22 = 129$ students

The statement is false. There are 127 students in music, and 129 students in business. $127 < 129$.

2. two or more $\rightarrow 28 + 16 + 14 + 22 = 80$ students
one elective $\rightarrow 65 + 64 + 75 = 204$ students

The statement is false. There are 80 students in two or more electives, and 204 in one elective class. $80 < 204$.

3. Not in Music $\rightarrow 65 + 28 + 64 = 157$ students
Not in Art $\rightarrow 65 + 14 + 75 = 154$ students

This statement is true. There are 157 students not in Music, and 154 students not in Art. $157 > 154$.

4. Art, not business $\rightarrow 64 + 16 = 80$ students
Music, not business $\rightarrow 75 + 16 = 91$ students

The statement is false there are 80 students in Art, but not business, and 91 students in Music, but not business. $80 < 91$.

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct Conclusion:	False	1
Correct Procedure:	Music - $75 + 14 + 22 + 16 = 127$; Business - $65 + 14 + 28 + 22 = 129$	
<u>Part 2</u>		Points
Correct Conclusion:	False	1
Correct Procedure:	two(+) - $14 + 22 + 28 + 16 = 80$; one(-) - $65 + 75 + 64 = 204$	
<u>Part 3</u>		Points
Incorrect Conclusion:	False	0
Incorrect Procedure:	Music - $75 + 14 + 22 + 16 = 127$ [should be $65 + 28 + 64 = 157$]; Not Art - $75 + 14 + 65 = 154$	
<u>Part 4</u>		Points
Correct Conclusion:	False	1
Correct Procedure:	Art not business - $64 + 16 = 80$; music not business - $75 + 16 = 91$	
Total Points		3

- ①
 music - $75 + 14 + 22 + 16 = 127$
 Business - $65 + 14 + 28 + 22 = 129$
 • False more people chose business! (2 more)
-
- ②
 two(+) - $14 + 22 + 28 + 16 = 80$
 one(-) - $65 + 75 + 64 = 204$
 • False more enrolled in one (124 more)
-
- ③
 music - $75 + 14 + 22 + 16 = 127$
 Not Art - $75 + 14 + 65 = 154$
 • False more people aren't in an art elective (27 more)
-
- ④
 Art not business - $64 + 16 = 80$
 music not business - $75 + 16 = 91$
 • False more people are in music not business (11 more)

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 2

<u>Part 1</u>		Points
Correct Conclusion:	False	1
Correct Procedure:	Business $65 + 28 + 22 + 14 = 129$; Music $75 + 16 + 22 + 14 = 127$; $129 > 127$	
<u>Part 2</u>		Points
Correct Conclusion:	False	1
Correct Procedure:	two or more $28 + 22 + 16 + 14 = 80$; one $75 + 65 + 64 = 204$; $80 < 204$	
<u>Part 3</u>		Points
Correct Conclusion:	True	0
Missing Procedure:	No credit for a 50-50 guess.	
<u>Part 4</u>		Points
Correct Conclusion:	False	0
Incorrect Procedure:	Subtracted Art from Business and Music.	
Total Points		2

Handwritten student work for Part 1 and Part 2:

1.) False

<u>Business</u>	<u>Music</u>
65 28 22 +14 ----- 129	75 16 22 +14 ----- 127

$129 > 127$

2.) False two or more one elective

28 22 16 +14 ----- 80	75 65 +64 ----- 204
--------------------------------------	---------------------------------

$80 < 204$

3.) True.

4.) False.

<u>Music</u>	<u>Art</u>
75 -64 ----- 11	65 -64 ----- 1

$11 > 1$

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect Conclusion:	True	0
Incorrect Procedure:	65 for Business; 75 for Music. This is a common procedural error.	
<u>Part 2</u>		Points
Correct Conclusion:	False	1
Correct Procedure:	28 + 22 + 14 + 16 = 80 2 or more elective; 65 + 64 + 75 = 204 1 elective	
<u>Part 3</u>		Points
Incorrect Conclusion:	False	0
Incorrect Procedure:	Music = 75 ; Art = 64 Listed the students that took only that elective.	
<u>Part 4</u>		Points
Two Conclusions:	True and False	0
Incorrect Procedure:	Art = 64 ; Music = 75 ; Business = 65 [found number of students only in each class]	
Total Points		1

1 True because 65 students sing up for Business and 75 students sing up for music

$\begin{array}{r} 28 \\ 22 \\ + 14 \\ \hline 80 \\ \text{2 or more} \\ \text{elective} \end{array}$	$\begin{array}{r} 65 \\ 64 \\ + 75 \\ \hline 204 \\ \text{1 elective} \end{array}$	False about 80 students sing up for 2 or more elective, while 204 students sing up for only 1 elective
---	--	--

3 False there are more students in Music than in art

Music = 75 students

Art = 64 students

4. True and False there are more students in Business than in Art class and yes there are more students in Music than in Business class.
Art = 64 students MUSIC = 75 students
Business = 65 students

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 GEOMETRY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect Conclusion:	True	0
Incorrect Procedure:	Music has 75 students and business has 65 students	
<u>Part 2</u>		Points
Incorrect Conclusion:	True	0
Incorrect Procedure:	two or more electives have 80, beating business by 15, art by 16, and music by 5.	
<u>Part 3</u>		Points
Correct Conclusion:	True	0
Incorrect Procedure:	Students that didn't take Music are 173. [incorrect procedure] Students that didn't take art are 154.	
<u>Part 4</u>		Points
Correct Conclusion:	False	0
Incorrect Procedure:	Business beats art by 1 student.	
Total Points		0

<p>1. music has 75 students, and business has 65 students.</p> <p style="text-align: center;">True</p>	<p>2. Students that enrolled in two or more electives have 80, beating business by 15, art by 16, and music by 5.</p> <p style="text-align: center;">True</p>
<p>3. The students that didn't take Music are 173. Students that didn't take art are 154.</p> <p style="text-align: center;">True</p>	<p>4. Business beats art by 1 student.</p> <p style="text-align: center;">False</p>

ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

DEVELOPED FOR THE ARKANSAS DEPARTMENT OF EDUCATION, LITTLE ROCK, AR 72201

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