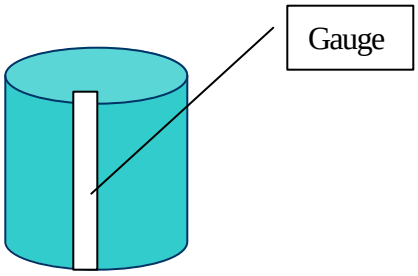
Mathematics Assessment Activity #14:

The Number One Tank Gauge Company



Mathematics Assessed:

- Volume of a cylinder;
- Application of rates;
- Relationships of volumes to dimensions of a cylinder;
- Problem solving; and
- Mathematical communication.

You have been hired by the Number One Tank Gauge Company to provide them with scales to attach to the tanks they sell for holding water. The scales will be transparent glass tubes in which the water in the tube will be at the same level as the water in the tank.

The company has provided you with the following data about the sizes of some of the tanks that they produce.

Tank Number	Radius	Height of Tank
#1	4 ft	6 ft
#2	6 ft	8 ft
#3	8 ft	12 ft

Note: The glass tube is the height of each tank and has a radius of ¼ inch.

Part I: Developing the Scale

For tank # 1:

1. Produce a graph and a data table that shows the relationship between the height of the water in the tank and the gallons of water in the tank that the company can use to build their scales. Height should be calculated to the whole inch and gallons to a tenth of a gallon.

2. Write a summary of your findings that includes any formulas or calculations that you used or created to solve the problem.

Other information needed:

1 Gallon = 231 in^3 = .13 ft^3

$V_{cylinder} = \pi r^2 h$ where $\pi \approx 3.14$, r = radius, and h = height of the tank

Part II: Settle the Argument

3. To the nearest whole inch, what would the height of a tank with a radius of 5 feet be if it held the same amount of water as Tank #1?

4. Two students were arguing about the effect of doubling the radius ***or*** doubling the height of the tanks. One student felt that either doubling the height ***or*** doubling the radius would have the same effect on the amount of water that a tank could hold. Another student felt that doubling the radius would result in a greater volume of water in the tank than just doubling the height. Which student is right? Support your choice with specific calculations and an explanation for why there was or was not a difference in the effect.

Part III: A Rancher's Dilemma

Ranchers are concerned with water tanks as well. You will find two tables on page 3. Table 1 contains the expected daily water consumption by cattle of different weights at different temperatures. Table 2 contains the average temperatures for Casper, Wyoming. Use these tables and the situation described below to devise a plan for the rancher.

The situation: A Casper rancher had 500 growing heifers with a median weight of 600 lbs at the *end* of the grazing period. There was no natural source of water where the heifers were grazing. In order to assure that there was adequate water the rancher decided to purchase #2 tanks from the Number One Water Tank Company. The rancher decided to purchase enough #2 water tanks to have half at the site and to use the other half for transporting the water to the site during the legal grazing period from June 15th through September 15th.

5. **A Plan:** Devise a plan that the rancher can use to assure that there is always at least a day's supply of water at the site. Include in your plan the number of tanks to be purchased and a mathematical justification for your decision that includes how you accounted for body weight and variation of temperature throughout the grazing period.

Optional:

6. The table for water consumption of beef cattle only accounts for temperature variations between 40°F and 90°F. Use the data in the table to estimate the water intake of 400, 600, and 800 lbs if the temperature rose to 100°F and 110°F.

Table 1: Appropriate Total Daily Water Intake (in gallons) of Beef Cattle[1]

Weight	40° F	50° F	60° F	70° F	80° F	90° F
Growing heifers, steers and bulls						
400	4.0	4.3	5.0	5.8	6.7	9.5
600	5.3	5.8	6.6	7.8	8.9	12.7
800	6.3	6.8	7.9	9.2	10.6	15.0
Finishing cattle						
600	6.0	6.5	7.4	8.7	10.0	14.3
800	7.3	7.9	9.1	10.7	12.3	17.4
1000	8.7	9.4	10.8	12.6	14.5	20.8
Wintering pregnant cows						
900	6.7	7.2	8.3	9.7	-	-
1,100	6.0	6.5	7.4	8.7	-	-
Lactating cows						
900	11.4	12.6	14.5	16.9	17.9	16.2
Mature bulls						
1,400	8.0	8.6	9.9	11.7	13.4	19.0
1,600	8.7	9.4	10.8	12.6	14.5	20.6

Table 2: Average Monthly Temperatures In Casper Wyoming

Month	Hi	Low	Month	Hi	Low
January	32.8°	12.0°	July	87.6°	54.0°
February	37.0°	16.0°	August	85.7°	51.8°
March	45.2°	21.8°	September	73.8°	41.6°
April	56.1°	29.5°	October	60.5°	32.2°
May	66.6°	37.9°	November	44.3°	21.8°
June	78.6°	46.9°	December	33.9°	13.7°
Provided by the National Weather Service					

[1] Winchester and Morris (1956)

Teacher Supplement

Mathematics Assessment Activity #14:

The Number One Tank Gauge Company

Description: In this assessment activity students investigate the relationship of height and radius to the volume of a cylindrical tank. Based upon certain data, they will devise a plan to supply adequate water.

Prerequisite skills:

- Converting between units
- Determining the volume of a cylinder
- Using a spreadsheet or graphing utility
- Selecting appropriate tables and graphs to represent situations

Intended Depth of Knowledge:

This is a level 4 because it requires aspects of level 3 and 4 over an extended period of time:

- Planning and reasoning;
- Proving or disproving conjectures;
- Formulating generalizations;
- Developing and explaining arguments; and
- Making connections between findings and related concepts.

Time: 4-5 hours

Note: There are 3 parts to this activity that can be embedded in a unit on volume at different places in the unit.

Suggested Use in the BOE System:

This assessment activity is best used for BOE system for graduation in a course that focuses on Wyoming geometry and measurement standards.

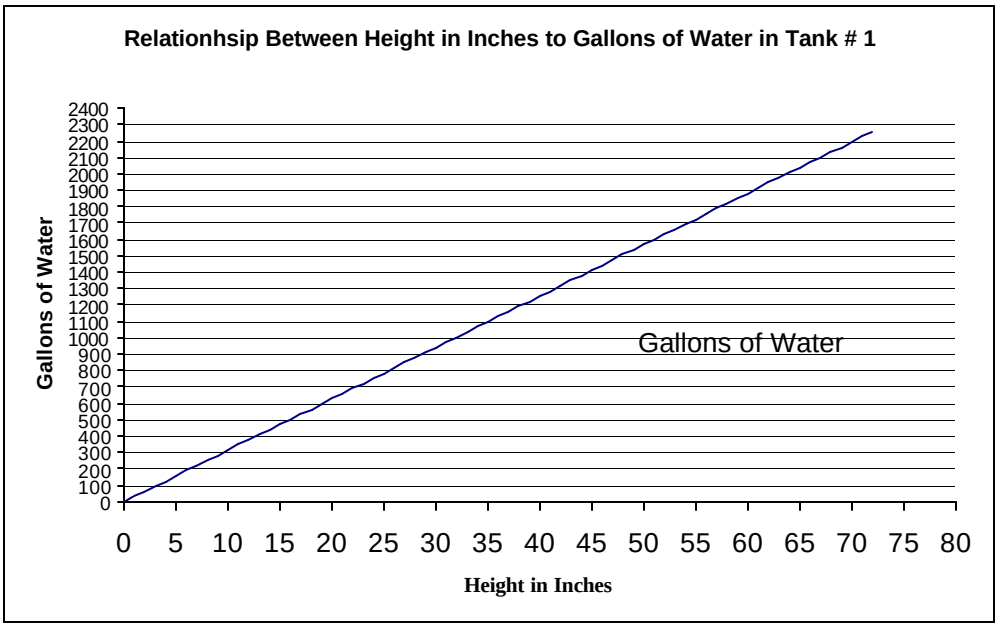
Sample Solution

Mathematics Assessment Activity #14:

The Number One Tank Gauge Company

Part I: Developing the Scale.

1. Produce a Graph and Data Table that show the relation between height of water in the #1 tank and the number of gallons of water in the tank. (See Table 1 for data.)



2. Write a summary of your findings, including any relevant formulas.

Useful in writing the formulas are the formulas:

a) 1 gallon = 231 in^3 = .13 ft^3
b) $V_{cylinder}$ = ? r^2h, where ? ˜ 3.14, r is the radius and h = the height of the tank (or height of the water in the tank). This formula for volume uses r and h in the same linear units (say inches or feet) and gives the volume in cubic units (cubic inches or cubic feet).
c) The formula $V_{cylinder}$ = ? r^2h/ 231, where ? ˜ 3.14, r is the radius in inches and h = the height in inches (or height of the water) gives the volume in gallons.
d) The formula $V_{cylinder}$ = (0.13) ? r^2h, where ? ˜ 3.14, r is the radius in feet and h = the height in feet (or height of the water) gives the volume in gallons.

Part II: Settle the Argument

3. Suppose that another tank with a radius of 5 feet held the same amount of water as Tank #1. Then $V_{cylinder} = ? 4^2 \cdot 6 \text{ ft}^3 = ? 5^2 \cdot h \text{ ft}^3$. Solution of the equation for h gives $h = 4^2 \cdot 6 / 5^2 = 3.78$ ft. To the nearest inch, this is 3.78(12 in), approximately 45 in.
4. The effect of doubling the height or the radius.
   a) **Doubling the height doubles the volume.**
   Using the formula $V_{cylinder} = ? r^2 \cdot h$, (where ? ~ 3.14, r is the radius and h = the height of the tank) Look at $V_{new\ cylinder} = ? r^2 \cdot (2h) = 2 \cdot (? r^2 \cdot h) = 2 \cdot V_{cylinder}$. This shows that doubling the height doubles the volume of the original cylinder.
   Another way to look at it is that doubling the height is like putting one cylinder on top of another. The new cylinder (the original with a copy of it placed on top will have twice the volume of the original.

   b) **Doubling the radius of the cylinder does not double the volume. The new cylinder has four times the volume of the original.**
   For an example showing that the volume does not double, look at the Tank #1. It has volume $V_{cylinder} = ? 4^2 \cdot 6 \text{ ft}^3 = 96 \cdot ? \text{ ft}^3$. Doubling the volume to 8 feet makes the volume $? 8^2 \cdot 6 \text{ ft}^3 = 384 ? \text{ ft}^3$, which is 4 times the original volume.

Another way to look at it is by starting with the original tank of volume $V_{cylinder} = ? r^2 \cdot h$ cubic feet and creating a new tank with twice the radius. $V_{new\ cylinder} = ? (2 \cdot r)^2 \cdot h$ cubic feet = $? 4 \cdot r^2 \cdot h$ cubic feet = $4 \cdot ? r^2 \cdot h$ cubic feet = 4 times the original volume.

Part III: Rancher's Dilemma

A Casper rancher has 500 growing heifers with a median weight of 600 pounds at the end of the grazing period. The rancher wants to have #2 tanks to supply water to the heifers during the legal grazing period from June 15 through September 15. Half of the tanks will be used at the grazing site and half will be used to collect and transport the water.

5. Devise a plan so that the enough water can be stored at the grazing site to supply the heifers through two days.

The information of the tables will be used to allow computation of the maximum storage capacity needed for a day for the 500 heifers. Hotter weather means that the heifers need more water. Also, heavier cattle need more water per day. According to table 2, the hottest days are in July when the average high will be just under 90 degrees Fahrenheit. At that temperature, growing heifers should have a ration of 12.7 gallons of water per heifer. Thus the daily water needs in July of the 500 heifers will be (12.7 gallons/heifer)(500 heifers) = 6350 gallons.

The #2 tank has a radius of 6 feet, height of 8 feet and volume of 904.32 cubic feet, or 6956.3 gallons. (Note: Answers will vary if student uses cubic inches instead of cubic

feet.) Two of these tanks will be required to provide two day's water to the 500 heifers. Since the rancher will use half of the tanks at the grazing site, then the rancher should have four tanks in all.

Table 1: Relationship between Height of # 1 Tank and Gallons of Water.

height in inches	volume in gallons
0	0
1	31.3
2	62.7
3	94.0
4	125.3
5	156.7
6	188.0
7	219.3
8	250.8
9	282.0
10	313.3
11	344.6
12	376.0
13	407.3
14	438.6
15	470.0
16	501.4
17	532.7
18	564.0
19	595.4
20	626.7
21	658.0
22	689.4
23	720.7
24	752.0
25	783.4
26	814.7
27	846.0
28	877.4
29	908.7
30	940.0
31	971.4
32	1002.7
33	1034.0
34	1065.4
35	1096.7
36	1128.0
37	1159.4
38	1190.707
39	1222.0
40	1253.4
41	1284.7
42	1316.0
43	1347.4
44	1378.7
45	1410.0
46	1441.4
47	1472.7
48	1504.1
49	1535.4
50	1566.7
51	1598.1
52	1629.4
53	1660.7
54	1692.1
55	1723.4
56	1754.7
57	1786.1
58	1817.4
59	1848.7
60	1880.1
61	1911.4
62	1942.7
63	1974.1
64	2005.4
65	2036.7
66	2068.1
67	2099.4
68	2130.7
69	2162.1
70	2193.4
71	2224.7
72	2256.1

Mathematics Standards and Benchmarks

An "A" in the table below indicates the standards and benchmarks in this assessment activity that have the potential to elicit evidence of student learning. An "I" indicates that instructional strategy that is assumed, but not assessed. An "A*" indicates the standards and benchmarks that are assessed only by the optional component. This activity has been recoded to the revised Wyoming 2003 Standards by members of the Wyoming Body of Evidence Activities Consortium.

11.1 NUMBER AND OPERATIONS

Students use numbers, number sense, and number relationships in a problem-solving situation.

*Note: Students communicate the reasoning used in solving these problems. They may use tools/technology to support learning.

	Benchmarks
A	11.1.1 Students represent and apply real numbers in a variety of forms.
A	11.1.2 Students apply the structure and properties of the real number system.
A	11.1.3 Students explain their choice of estimation and problem solving strategies and justify results of solutions in problem-solving situations involving real numbers.
A	11.1.4 Students use proportional reasoning to solve problems.

11.2 GEOMETRY

Students apply geometric concepts, properties, and relationships in a problem-solving situation.

*Note: Students communicate the reasoning used in solving these problems. They may use tools/technology to support learning.

	Benchmarks
	11.2.1 Students use transformations, congruency, symmetry, similarity, perpendicularity, parallelism, and the Pythagorean Theorem to solve problems.
A	11.2.2 Students communicate, using mathematical language, to: Interpret, represent or create geometric figures; draw or build figures from a mathematical description; analyze properties and determine attributes of 2- and 3- dimensional objects.
A	11.2.3 Students communicate the reasoning used in identifying geometric relationships in problem-solving situations.
	11.2.4 Students solve problems involving the coordinate plane such as the distance between two points, the midpoint, and slope.
I	11.2.5 Students connect geometry with other mathematical topics.

11.3 MEASUREMENT

Students use a variety of tools and techniques of measurement in a problem-solving situation.

*Note: Students communicate the reasoning used in solving these problems. They may use tools/technology to support learning.

	Benchmarks
A	11.3.1 Students apply estimation and measurement using the appropriate methods and units to solve problems involving length, weight/mass, area, surface area, volume, and angle measure.
A	11.3.2 Students demonstrate an understanding of both metric and U.S customary systems. Students are able to convert within each system.
A	11.3.3 Students identify and apply scale, ratios, and proportions in solving measurement problems.
	11.3.4 Students solve problems of angle measure including those involving polygons or parallel lines cut by a transversal.
	11.3.5 Students solve indirect measurement problems.

11.4 ALGEBRA

Students use algebraic methods to investigate, model, and interpret patterns and functions involving numbers, shapes, data, and graphs in a problem-solving situation.

*Note: Students communicate the reasoning used in solving these problems. They may use tools/technology to support learning.

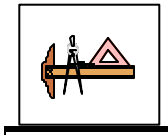
	Benchmarks
A	11.4.1 Students use algebraic concepts, symbols, and skills to represent and solve real-world problems.
A	11.4.2 Students write, model, and evaluate expressions, functions, equations, and inequalities.
	11.4.3 Students graph linear equations and interpret the results in solving algebraic problems.
	11.4.4 Students solve, graph, or interpret systems of linear equations.
I	11.4.5 Students connect algebra with other mathematical topics.

11.5 DATA ANALYSIS AND PROBABILITY

Students use data analysis and probability to analyze given situations and the results of experiments.

*Note: Students communicate the reasoning used in solving these problems. They may use tools/technology to support learning.

	Benchmarks
	11.5.1 Students apply knowledge of mean, median, mode, and range to interpret and evaluate information and data.
	11.5.2 Students draw reasonable inferences from statistical data and/or correlation/best fit line to predict outcomes.
	11.5.3 Students communicate about the likelihood of events using concepts from probability. sample space evaluate simple probabilities evaluate experimental vs. theoretical
	11.5.4 Students determine, collect, organize, and analyze relevant data needed to make conclusions.



Assessment Guide: Mathematics Assessment Activity # 14: The Number One Tank Gauge Company

Problem Solving and Concepts: *Uses appropriate mathematical concepts, properties and relationships to investigate and solve a problem.* **Standards and Benchmarks**: 11.1.1 & 2 & 4 ; 11.2.2 & 3 & 4 **Intended Depth of Knowledge: Level 4**

Level 4	Level 3	Level 2	Level 1
Appropriate mathematical concepts, skills, properties, and/or relationship(s) are selected and accurately applied to all 4 elements required. OR Completely and accurately apply 3 of the 4 elements and successfully complete the optional question.	Mathematical concepts, skills, properties, and/or relationship(s) are selected and applied to all 4 elements listed below, but only 3 of the 4 are complete and appropriately applied. • Effectively determines the relationship between the height of the tank and the gallons of water in the tank (Scale/graph is accurate); AND • Appropriately applies concepts to determining the height of a tank with a radius of 5 feet if it held same amount of water as Tank # 1; AND • Demonstrates the effect of doubling height or radius on the volume of a cylinder; AND • Shows procedure or concept that leads to a solution for watering the heifers. **Support:** The student received no support or minor support.	Appropriate mathematical concept(s), skill(s), property(s) or relationship(s) are selected to at least 3 of the elements of the problem, and there must be success on at least 2, or attempted 4 elements with conceptual flaws in two elements. OR **Support:** Response fulfills requirements of a Level 3, but the student received support without which the work would not be of a Level 3 quality.	An attempt was made to select a mathematical concept, skill(s), property(s), or relationship(s) to solve the problem, but the application of the concepts could not lead to a solution on 1 element of the problem. OR Appropriate skills and concepts were applied for only determining the tank. OR **Support:** Response fulfills the requirements of a Level 2, but the student received support without which the work would not be of a Level 2 quality.

Check the standards in which the concepts, skills, properties, or relationships were used to solve the problem.

____ 11.4 Algebra
____ 11.2 Geometry
____ 11.3 Measurement
____ 11.7 Problem Solving
____
____11.6 Technology

Assessment Guide: Mathematics Assessment Activity # 14: The Number One Tank Gauge Company

Representation – Tables, Graphs, Diagrams, or Models: *Represents data accurately and appropriately.*
Standards: 11.4.3 **Intended Depth of Knowledge**: **Level 2**

Level 4	Level 3	Level 2	Level 1
Representations are accurate, appropriate, can be used effectively for the situation meeting the requirements of level 3, and include other elements such as: • Data set displayed in multiple ways; or • Data represented in multiple ways to make a point; or • Data represented in multiple ways to show a trend; or • Model(s) or diagram(s) used to explain a concept; or • Model(s) or diagram(s) used solve a problem; or • Data represented in multiple ways, models or diagrams that promote an understanding or extension of the problem	Data in tables includes titles, correct values, and labels. (Minor flaws may be present in some of the tables, but they do not negatively impact the understanding of the data displayed.) AND **Data displayed in an appropriate graph to show the relationship between the height of the tank and the number of gallons in the tank with:** o Appropriate titles; o Correct scaling; o Independent and dependent variables labeled correctly; and o Points accurately plotted. There may be some minor flaws, but the flaws do not negatively impact the understanding or use of the data. **Support:** The student received no support or minor support.	Data tables and graphs used have a significant flaw(s) that negatively impacts the understanding or use of the representation, such as: • Data is collected in tables, but is not organized or correctly titled and labeled; or • The graph selected is inappropriate for representing the situation; or • The graph contains errors in conventions (labeling, scaling, or plotting points); or • Application of the conventions of graphing in inconsistent. OR **Support:** Response fulfills requirements of a Level 3, but the student received support without which the work would not be of a Level 3 quality.	An attempt is made to organize or graph the data. OR Some tables and/or graphs are missing. OR There are errors in the conventions of graphing throughout the response. OR **Support:** Response fulfills the requirements of a Level 2, but the student received support without which the work would not be of a Level 2 quality.

Assessment Guide: Mathematics Assessment Activity # 14: The Number One Tank Gauge Company

Number Operations/Calculations*: Accurately uses numbers, number sense, and number relationships in calculating volumes and using the data.* **Standards and Benchmarks**: 11.1.1 & 2 & 4 **Intended Depth of Knowledge: Level 1** **(Note**: If an answer is correct, the assumption is that the underlying calculations are correct.)			
Level 4	**Level 3**	**Level 2**	**Level 1**
There is evidence of calculations from all required elements/questions and the calculations are accurate throughout. (Minor errors may be present, but they not affect the final outcome of the problem.)	Calculations are correct for the evidence provided in the student work. The evidence is sufficient to solve part of the solution. (There may be minor errors.) OR Minor errors are present that do not affect the final outcome/decision. OR Minor flaw consistently carried throughout. OR **Support:** The student received no support or minor support.	Calculations provided are correct, but are insufficient to solve any part of the problem. OR Calculations are correct on some of the parts of the problem. OR **Support:** Response fulfills requirements of a Level 3, but the student received support without which the work would not be of a Level 3 quality.	Calculation errors are found throughout the problem. OR Little or no evidence to support incorrect answers. OR **Support:** Response fulfills the requirements of a Level 2, but the student received support without which the work would not be of a Level 2 quality.

Assessment Guide: Mathematics Assessment Activity # 14: The Number One Tank Gauge Company

Mathematical Communication: *Communicates mathematically to explain reasoning and solution*.

Standards: 11.1.3 ; 11.2 ; 11.3 ; 11.4 **Intended Depth of Knowledge: Level 2**

(Note: This criterion assesses how well a student communicates the solution, not conceptual understanding or the accuracy of the solution.)

Level 4	Level 3	Level 2	Level 1
Response includes the use of consistent, accurate, and appropriate symbolic or formal notation, and the text included enhances the understanding of the mathematics or logic used, while minimizing descriptions of procedures or calculations already evident in the work. AND Includes additional aspects of strong mathematical communication such as: • Clear links between the different parts of the activity; • Accurate and appropriate use of more than one type of representation with a clear linkage between the representation and the text and the representations with each other; or • Clear links between an equation(s) or formula(s) and a model(s), diagram(s), or graph(s) and the text.	Presentation is communicated: • Using mathematical terms or notation that are accurately and appropriately applied (There may be some minor flaws); • With a logical presentation; • Using tables, graphs, models, diagrams, calculations, or text, where appropriate, but the reader may have to make connections between them; and • Using grammar and conventions that do not get in the way of understanding the results of the solution. **Support:** The student received no support or minor support.	Use of accurate and appropriate mathematical terms or notation is inconsistent, or some common terms are used instead of mathematical terms. OR The presentation is not logical. OR The application of grammar and conventions get in the way of understanding reasoning or solution path. OR **Support:** Response fulfills requirements of a Level 3, but the student received support without which the work would not be of a Level 3 quality.	Mathematical terms or notation are used but they are inaccurate throughout the presentation, or common terms are used instead of mathematical terms. OR The application of grammar and conventions make is impossible to understand reasoning or solution path. OR **Support:** Response fulfills the requirements of a Level 2, but the student received support without which the work would not be of a Level 2 quality

Anchors - Mathematics Assessment Activity # 14: Tank Gauge

This section contains sample student work that has been assessed by Wyoming teachers who participated in the Wyoming Activities-Based Consortium. Using the rubrics for this assessment activity, each example has been assigned score levels and includes accompanying annotated student work and "justifications" explaining assignment of scores.

The examples represent a range of student work collected as a result of piloting in Wyoming high schools during the 2000- 2002 school years. In some cases sample student work for particular score points or for particular parts of assessment activities was not available at the date of publication. The BOE Activities Consortium will add sample student work for those parts and at those score points as they become available.

Anchor papers in this set include:

TG2-002
TG2-026
TG2-006
TG2-020
TG2-023

Mathematics Assessment Activity #14:The Number One Tank Gauge

Anchor #: TG2-002

Criterion: Problem Solving and Concepts **Level: 4**

This is a level 4 response because appropriate mathematical concepts, skills, and properties are accurately applied to solve all four elements of the problem. The relationship between the height of the tank and the number of gallons in the tank is determined for all three tanks, the height of a tank with a radius of 5 feet is determined, the relationship between doubling the height and doubling the radius on the volume is determined with a mathematical explanation for impact of doubling the radius compared to doubling the height ("The equation calls to square the radius. The amount of a squared number that has been doubled is much larger than an amount that has just been doubled but not squared."), and there is an effective strategy for determining the number of tanks needed for feeding the heifers. In addition, there was an attempt to solve the optional part of the problem.

Criterion: Representation **Level: 3**

The table shows the relationship between the height of each of the tanks and the number of gallons in the tank at selected heights with accurate and appropriate labels and units. The graph accurately represents the relationship. This is a level 3, not a 4, because the independent and dependent variables are switched on the graph.

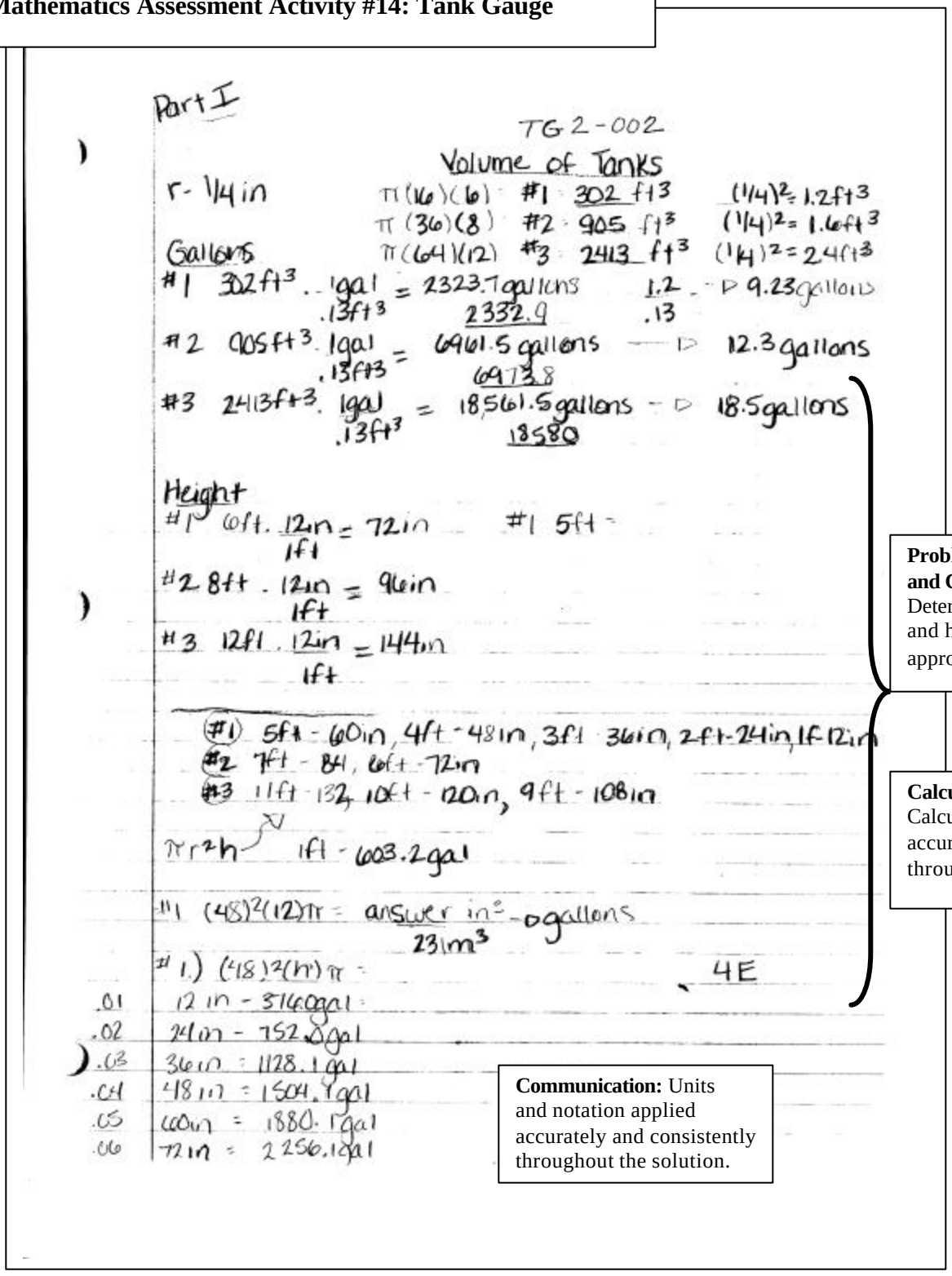
Criterion: Number Operations/Calculation **Level: 4**

This is a level 4 response because calculations of height, volumes, and rates of water consumption by cattle are accurate throughout the response.

Criterion: Mathematical Communication **Level: 3**

The solution is presented logically, and mathematical terms, notation and units are used accurately and appropriately throughout. This is a level 3 response, not 4, because the reader has to make connections between the parts of the solution, and tables, graphs and texts. There are some minor flaws in the explanation of the gallons per foot and gallons per inch ("For every 12 inches or foot of water in tank #1 31.3 gallons of water were in the tank… this means that there were 31.3 gallons of water for every inch").

Anchor #: TG2-002
Mathematics Assessment Activity #14: Tank Gauge



Part I

TG 2-002

Volume of Tanks

r- 1/4 in

Gallons

π(16)(6) #1 302 ft³ (1/4)² = 1.2ft³

π(36)(8) #2 905 ft³ (1/4)² = 1.6ft³

π(64)(12) #3 2413 ft³ (1/4)² = 2.4ft³

#1 302ft³ . 1gal/.13ft³ = 2323.7gallons = 2332.9 → 1.2/.13 → 9.23gallons

#2 905ft³ . 1gal/.13ft³ = 6961.5 gallons = 6973.8 → 12.3gallons

#3 2413ft³ . 1gal/.13ft³ = 18,561.5gallons = 18580 → 18.5gallons

Height

#1 6ft . 12in/1ft = 72in

#2 8ft . 12in/1ft = 96in

#3 12ft . 12in/1ft = 144in

#1 5ft -

#1 5ft - 60in, 4ft - 48in, 3ft 36in, 2ft-24in, 1ft-12in

#2 7ft - 84, 6ft - 72in

#3 11ft 132, 10ft - 120in, 9ft - 108in

πr²h 1ft - 603.2gal

#1 (48)²(12)π = answer in³ - gallons
231in³

#1.) (48)²(h)π = 4E

.01 12 in - 3160gal

.02 24in - 752.8gal

.03 36in = 1128.1gal

.04 48in = 1504.1gal

.05 60in = 1880.1gal

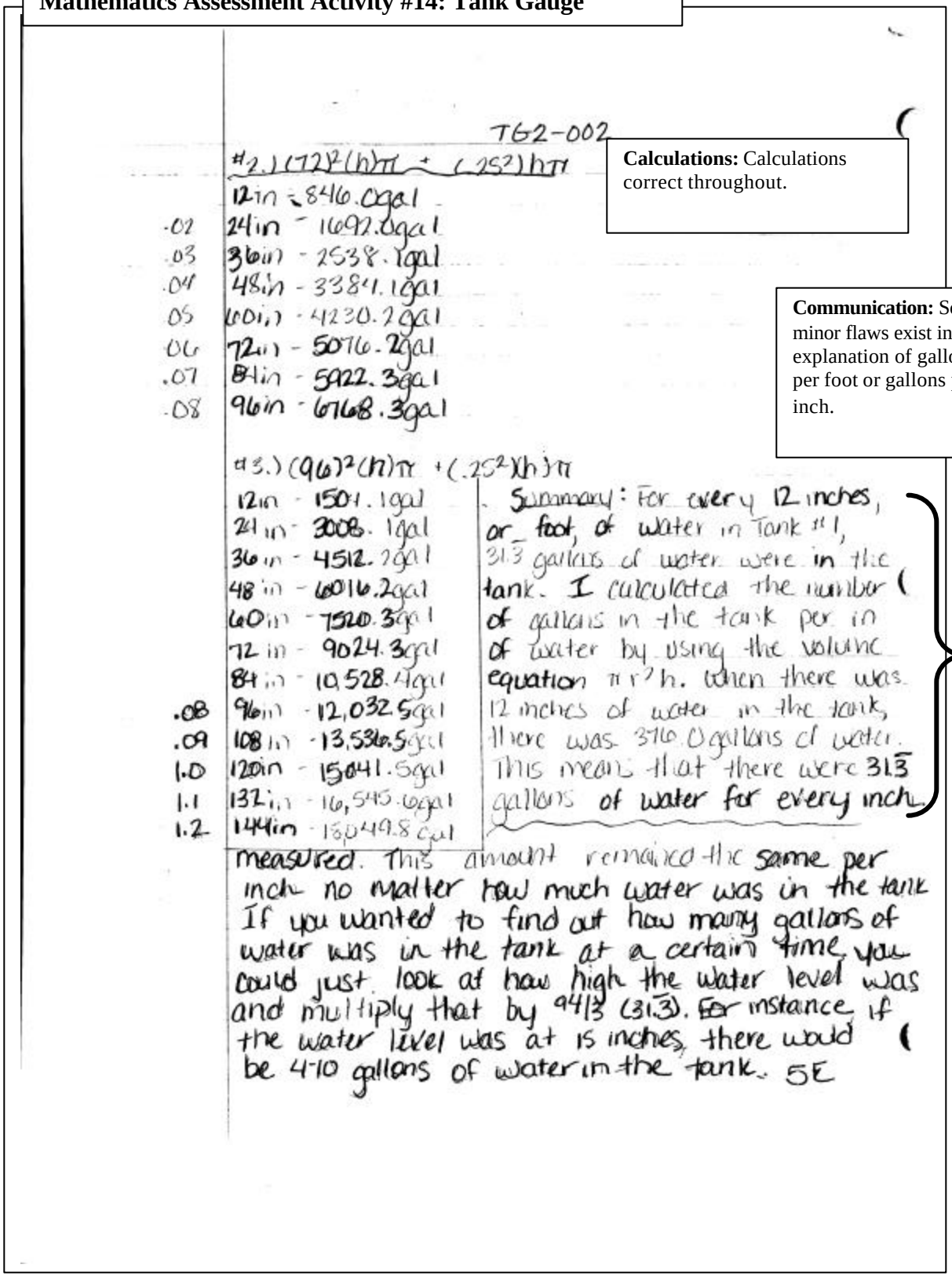
.06 72in = 2256.1gal

Problem Solving and Concepts: Determines volume and height appropriately.

Calculation: Calculations accurate throughout.

Communication: Units and notation applied accurately and consistently throughout the solution.

Anchor #: TG2-002
Mathematics Assessment Activity #14: Tank Gauge



TG2-002

#2.) $(72)^2(h)\pi + (.25^2)h\pi$

12in = 8416.0gal
.02 24in = 16992.0gal
.03 36in = 2538.1gal
.04 48in = 3384.1gal
.05 60in = 4230.2gal
.06 72in = 5076.2gal
.07 84in = 5922.3gal
.08 96in = 6768.3gal

#3.) $(96)^2(h)\pi + (.25^2)(h)\pi$

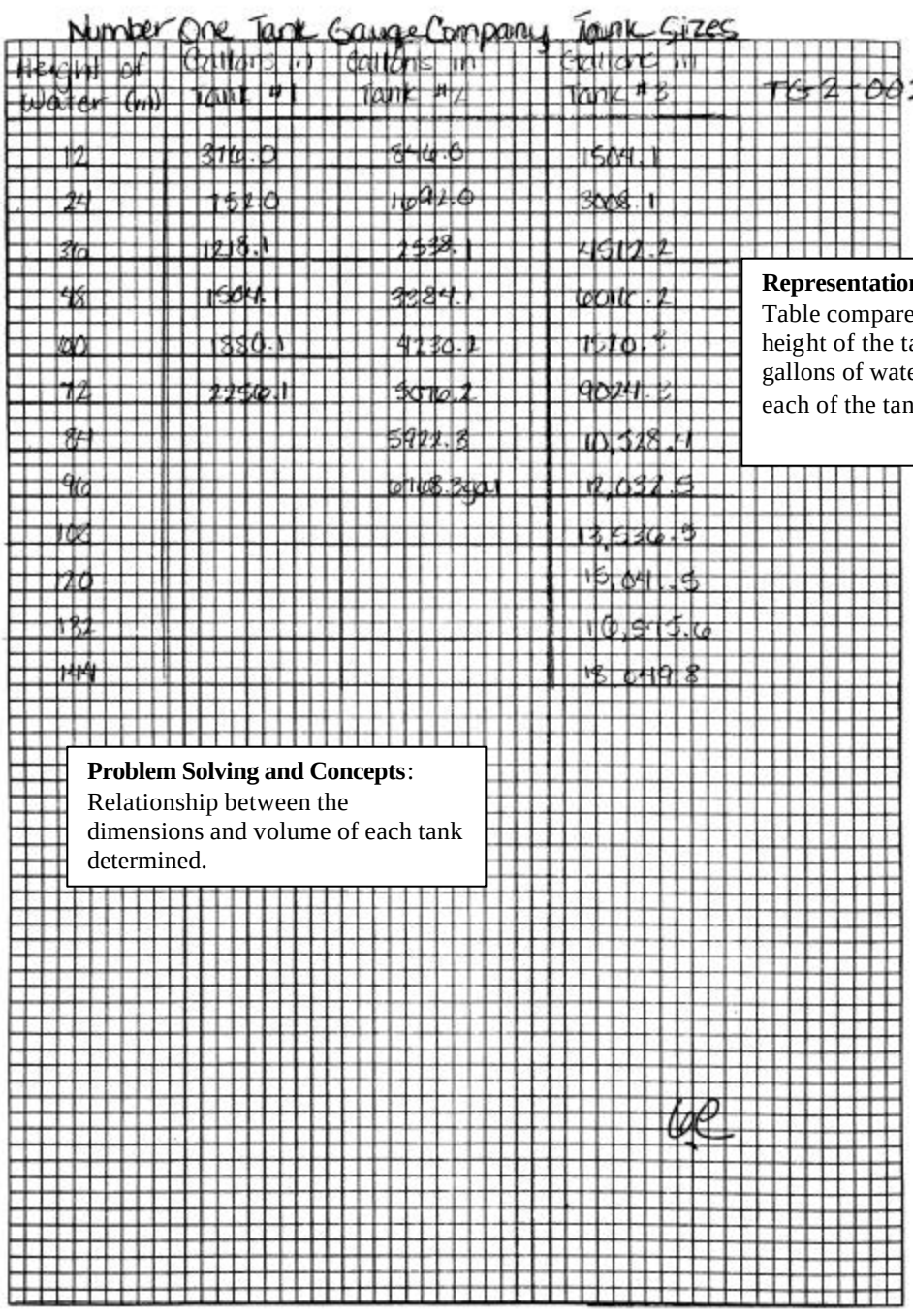
12in = 1504.1gal
24in = 3008.1gal
36in = 4512.2gal
48in = 6016.2gal
60in = 7520.3gal
72in = 9024.3gal
84in = 10,528.4gal
.08 96in = 12,032.5gal
.09 108in = 13,536.5gal
1.0 120in = 15041.5gal
1.1 132in = 16,545.6gal
1.2 144in = 18,049.8gal

Summary: For every 12 inches, or foot, of water in Tank #1, 31.3 gallons of water were in the tank. I calculated the number of gallons in the tank per in of water by using the volume equation $\pi r^2 h$. When there was 12 inches of water in the tank, there was 376.0 gallons of water. This means that there were $31.\overline{3}$ gallons of water for every inch measured. This amount remained the same per inch no matter how much water was in the tank. If you wanted to find out how many gallons of water was in the tank at a certain time, you could just look at how high the water level was and multiply that by $94\frac{1}{3}$ $(31.\overline{3})$. For instance, if the water level was at 15 inches, there would be 470 gallons of water in the tank. 5E

Calculations: Calculations correct throughout.

Communication: Some minor flaws exist in explanation of gallons per foot or gallons per inch.

Anchor #: TG2-002
Mathematics Assessment Activity # 14: Tank Gauge



Number One Tank Gauge Company Tank Sizes

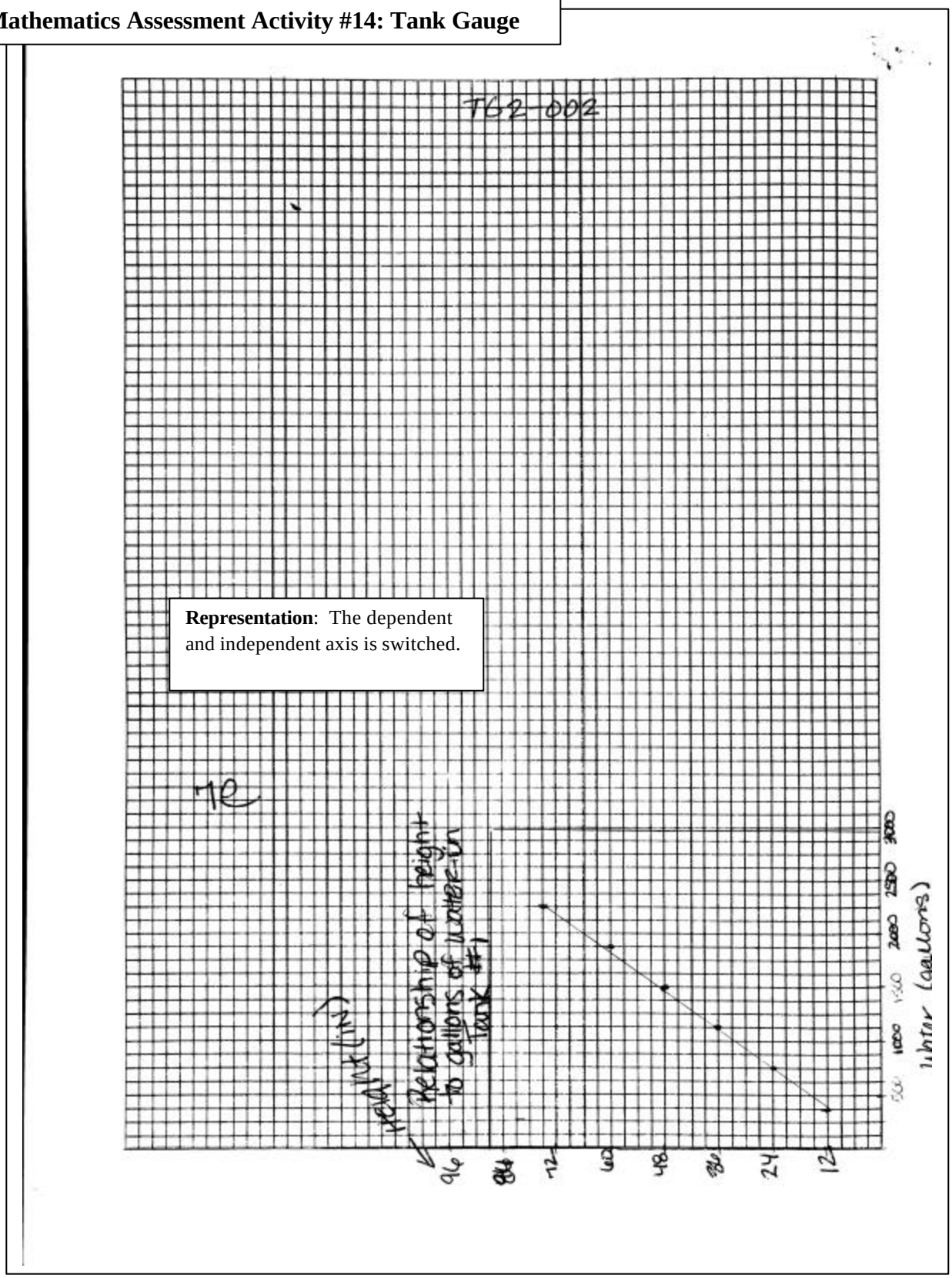
TG2-002

Height of water (in)	Gallons in Tank #1	Gallons in Tank #2	Gallons in Tank #3
12	376.0	846.6	1504.1
24	752.0	1692.0	3008.1
36	1218.1	2538.1	4512.2
48	1504.1	3384.1	6016.2
60	1880.1	4230.2	7520.3
72	2256.1	5076.2	9024.4
84		5922.3	10,528.4
96		6768.3 gal	12,032.5
108			13,536.5
120			15,041.5
132			16,545.6
144			18,049.8

Representation:
Table compares the height of the tanks and gallons of water in each of the tanks.

Problem Solving and Concepts:
Relationship between the dimensions and volume of each tank determined.

Anchor #: TG2-002
Mathematics Assessment Activity #14: Tank Gauge



Anchor #: TG2-002
Mathematics Assessment Activity # 14: Tank Gauge

TG

Part 2

3) $r^2(h)\pi$ $(48^2)(72)\pi$ 2256.1 gal
(100)hπ height 46 in
(60²)16π

4.) Tank #1 radius 48in height 72in
2r = $(96)^2(72)\pi$ 9024.3 gal
2h = $(48)^2(144)\pi$ 4512.1 gal

Tank #2 radius 72in height 96in
2r = $(144^2)(96)\pi$ = 27,072.9 gal
2h = $(72^2)(192)\pi$ = 13,536.4 gal

Tank #3 radius 96in height 144in
2r = $(192^2)(144)\pi$ = 72,194.3 gal
2h = $(96^2)(288)\pi$ = 36,097 gal

Doubling the radius would result in a greater volume of water than doubling the height. In fact, doubling the radius would allow the tank to hold TWICE as much water as just doubling the height. When the radius was doubled for Tank #1, it could hold 9,024.3 gallons of water. This is 4 times as much water as the tank with the original radius could hold. When the height of Tank #1 was doubled, it could hold only 4,512.1 gal. While this is twice as much as the original height of the tank could sustain, it is only half the amount of water a tank with a doubled radius could hold.

The equation calls to square the radius. The amount of a squared number that has been doubled is much larger than an amount that has just been doubled but not squared BE

Problem Solving and Concepts: Height of tank with a radius of 5 ft and the same volume of a # 1 tank.

Problem Solving and Concepts: Demonstrated understanding between changing the height and radius of a cylinder and which dimensions will have the biggest impact on volume using all three tanks.

Communication: Explanation of work shown to compare the effect of doubling the height or the radius. Links are made between text and calculations.

Anchor #: TG2-002
Mathematics Assessment Activity #14: Tank Gauge

TG2-002

Part III

June-15 days	8.9(15)	133.5 · 500	=	66,750
July-31 days	12.7(31)	393.7 · 500		196,850
August-31 days	12.7(31)	393.7 · 500		196,850
Sept. 15 days	8.9(15)	133.5 · 500		66,750
3.1	92 days 77.89 tanks	40,113.		527,200 / 67683

Because each #2 tank from the Number One Water Tank Company can hold up to 67683.2 gallons of water, 500 cattle would drink enough water during the grazing season to fill nearly 78 #2 tanks.

If the rancher deciding to haul water (once) every week during the grazing season, he would he would need enough tanks to hold 40,113 gallons of water. This means he would have to purchase six (7 for backup) #2 tanks in order to have enough water at the site. You would also need to buy 6 more tanks to transport the water. 12 tanks total

$\frac{527,200}{92} = 40,113$ $\frac{40,113}{67683.2} = 5.9 = 6$ tanks

9E

Communication: Clear explanation of decision related to calculations.

Problem Solving and Concepts: Calculated water use by heifers through the entire grazing period accurately taking into account their water needs.

Anchor #: TG2-002
Mathematics Assessment Activity # 14: Tank Gauge

TG2-002

6.) .3, .7, .8, .9, 2.8 — 9.5-4.0 = 5.5 ÷ 5 = 1.1
.5, .8, 1.2, 1.1, 3.8 — 12.7-5.3 = 7.4 ÷ 5 = 1.5
.5, 1.1, 1.3, 1.4, 4.4 — 15.0-6.3 = 8.7 ÷ 5 = 1.7

400 lbs - 10.6 → 100° — 11.7 → 110°
1000 pts - 14.2 → 100° — 15.7 → 110°
800 lbs - 16.7 → 100° — 18.4 → 110°

By calculating the average increase of water intake for a 400 lb cow for every 10° raise in temperature, I approximated that a 400lb cow would consume 10.6 gallons of water at 100° and 11.7 gallons of water at 110°. A 1000lb cow consume 14.2 gallons of water at 100° or 15.7 gallons at 110°. An 800lb cow would consume 16.7 gallons at 100° or 18.4 gallons at 110°

Problem Solving and Concepts: Attempted optional component.

IDE

Mathematics Assessment Activity #14: The Number One Tank Gauge

Anchor #: TG2-026

Criterion: Problem Solving and Concepts **Level: 3**

All 4 elements of the problem are attempted. This is a level 3, not a 4, because the approach to compare the impact of doubling the volume or doubling the height of the tank was inappropriate. Both the radius and the height were doubled instead of investigating the impact of doubling the height on the volume, and then the impact of doubling the radius on the volume. Accurate and appropriate skills and concepts were applied to the other aspects of the problem.

Criterion: Representation **Level: 3**

While there are two graphs that show the relationship between the height and the number of gallons of water in the tank and an example of a gauge is present that shows gallons to the hundredths, this is a level 3 response because the electronically done graph is 3-D graph which is inappropriate and the secondary graph, that indicates specific gallon amounts, does not have a title or labels. The data is correct and organized in a spreadsheet with accurate labels and title. (Note: It is difficult to interpolate using a 3-D graph because the depth of a 3-D graph skews the range values.)

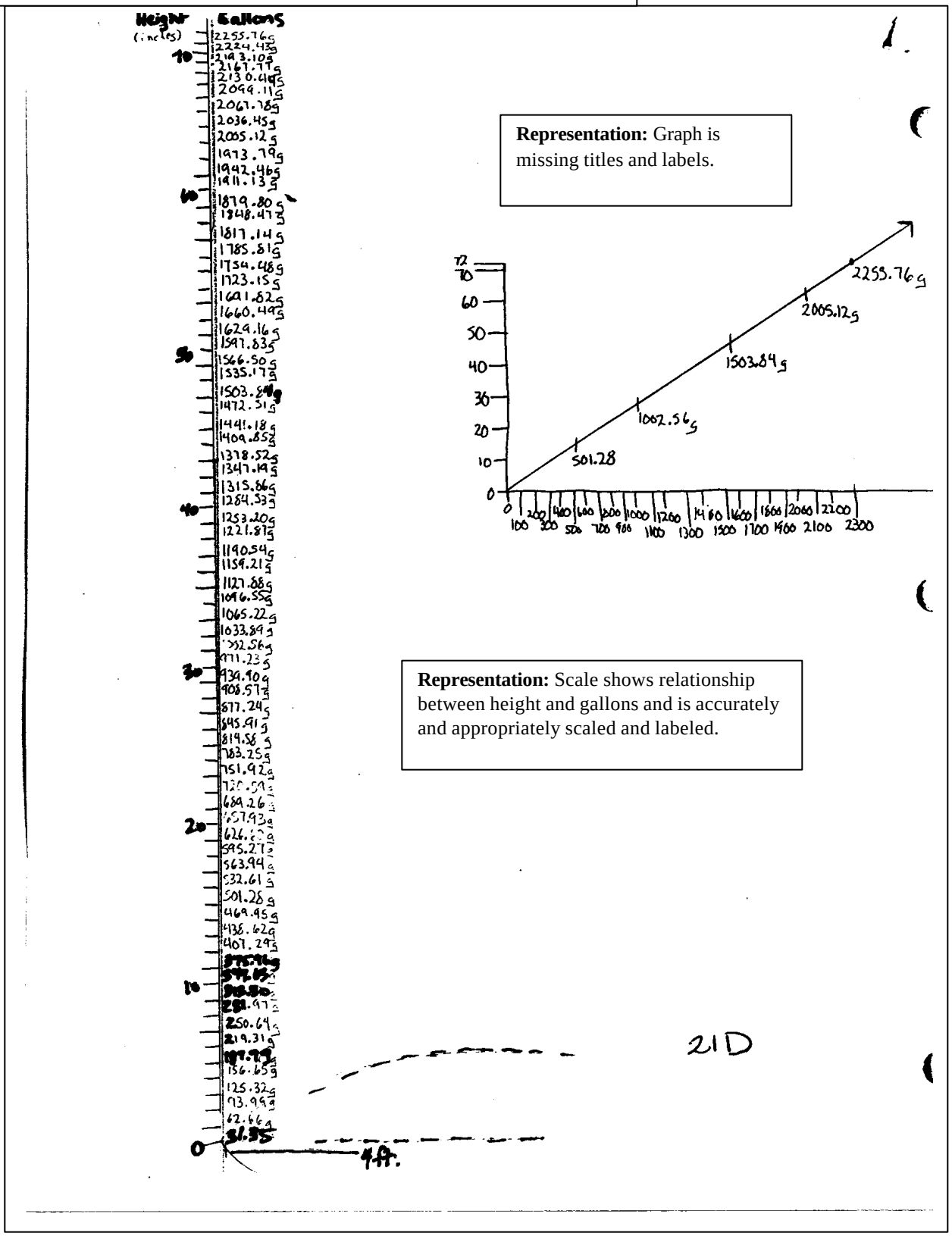
Criterion: Calculation **Level: 4**

Although the solution is calculated to the hundredth instead of tenths, all related calculations are accurate.

Criterion: Communication **Level: 3**

Although mathematical vocabulary (radius, height, and volume) and notation are accurately and appropriately used throughout, this is a level 3, not a 4, because there are no links between text and tables or between parts of the activity. The reader must make the connections.

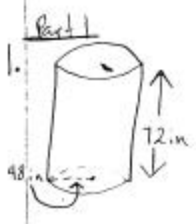
Anchor #: TG2-026
Mathematics Assessment Activity #14: Tank Gauge



Representation: Graph is missing titles and labels.

Representation: Scale shows relationship between height and gallons and is accurately and appropriately scaled and labeled.

Anchor #: TG2-026
Mathematics Assessment Activity # 14: Tank Gauge



TG2-026

$V=(\pi r^2)h$
$V=(\pi 4^2)72$
$V=521152.52\ in^3$

521152.52 ÷ 231.00 = 2256.07 g

2256.07 ÷ 72.00 = 31.33

I used the volume for a cylinder formula ($V=(\pi r^2)h$). When I got the volume I divided it by 231 which is how many cubic inches it takes to make up 1 gallon. After that I divided the gallon amount by the inches amount (72) which came out to 31.33 gallons per every 1 inch.

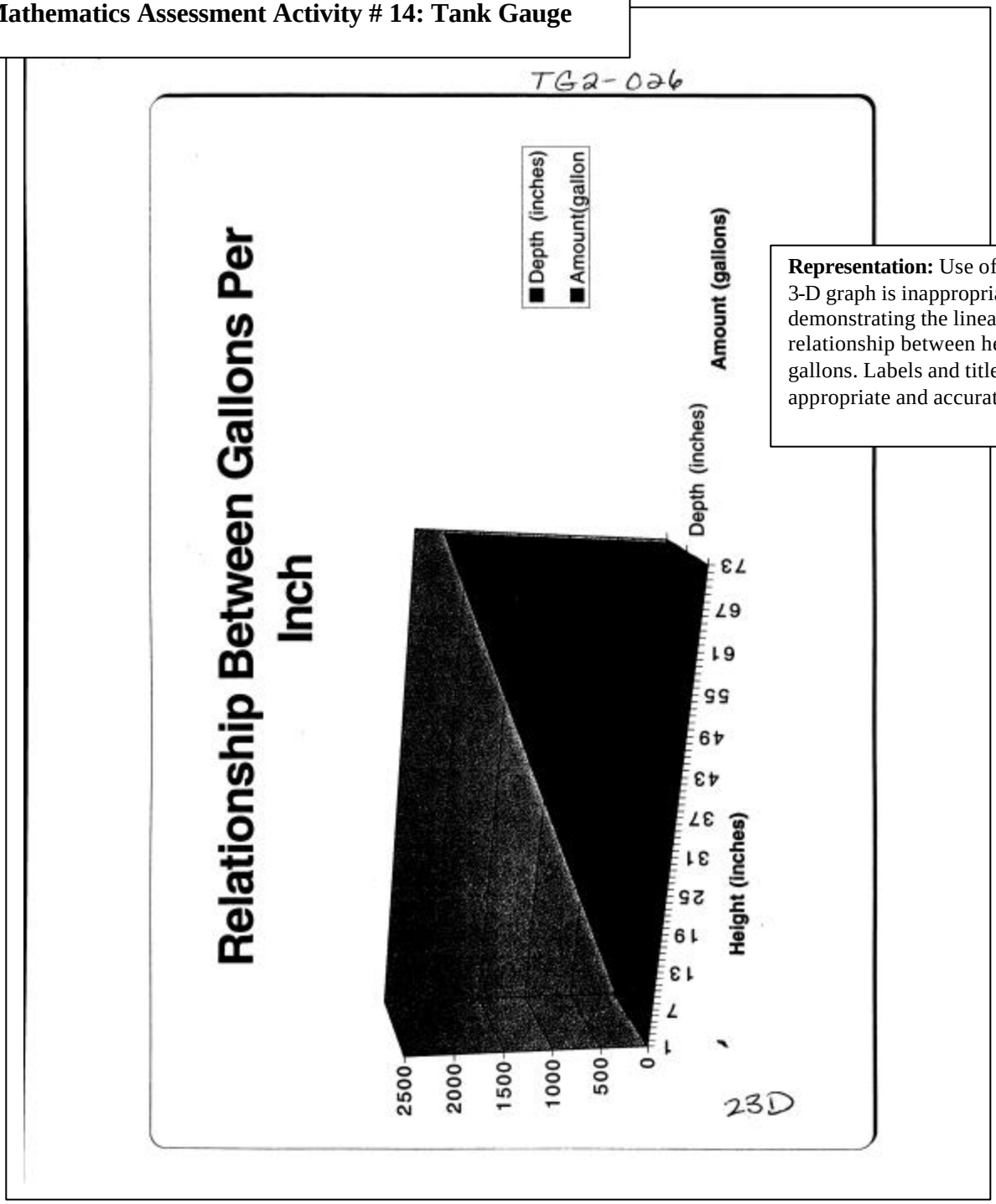
22-D

Problem Solving and Concepts: Correct use of volume formula and conversion to determine the relationship between the height of the tank and the gallons.

Communication: The work explains the values shown in the tables.

Calculation: All calculators are correct. Gallons are in hundredths instead of tenths.

Anchor #: TG2-026
Mathematics Assessment Activity # 14: Tank Gauge



Representation: Use of a 3-D graph is inappropriate for demonstrating the linear relationship between height and gallons. Labels and titles are appropriate and accurate.

Anchor #: TG2-026
Mathematics Assessment Activity #14: Tank Gauge

TG2-026

Depth (inches)	Amount(gallons)
0	0
1	31.33
2	62.66
3	93.99
4	125.32
5	156.65
6	187.98
7	219.31
8	250.64
9	281.97
10	313.3
11	344.63
12	375.96
13	407.29
14	438.62
15	469.95
16	501.28
17	532.61
18	563.94
19	595.27
20	626.6
21	657.93
22	689.26
23	720.59
24	751.92
25	783.25
26	814.58
27	845.91
28	877.24
29	908.57
30	939.9
31	971.23
32	1002.56
33	1033.89
34	1065.22
35	1096.55
36	1127.88
37	1159.21
38	1190.54
39	1221.87
40	1253.2
41	1284.53
42	1315.86
43	1347.19
44	1378.52

Representation: Data is displayed in 1-inch increments. Table correctly labeled and titled.

Communication: There isn't a summary following the table or graph that explains any findings or links it to other parts of the solution.

24 D

Anchor #: TG2-026
Mathematics Assessment Activity # 14: Tank Gauge

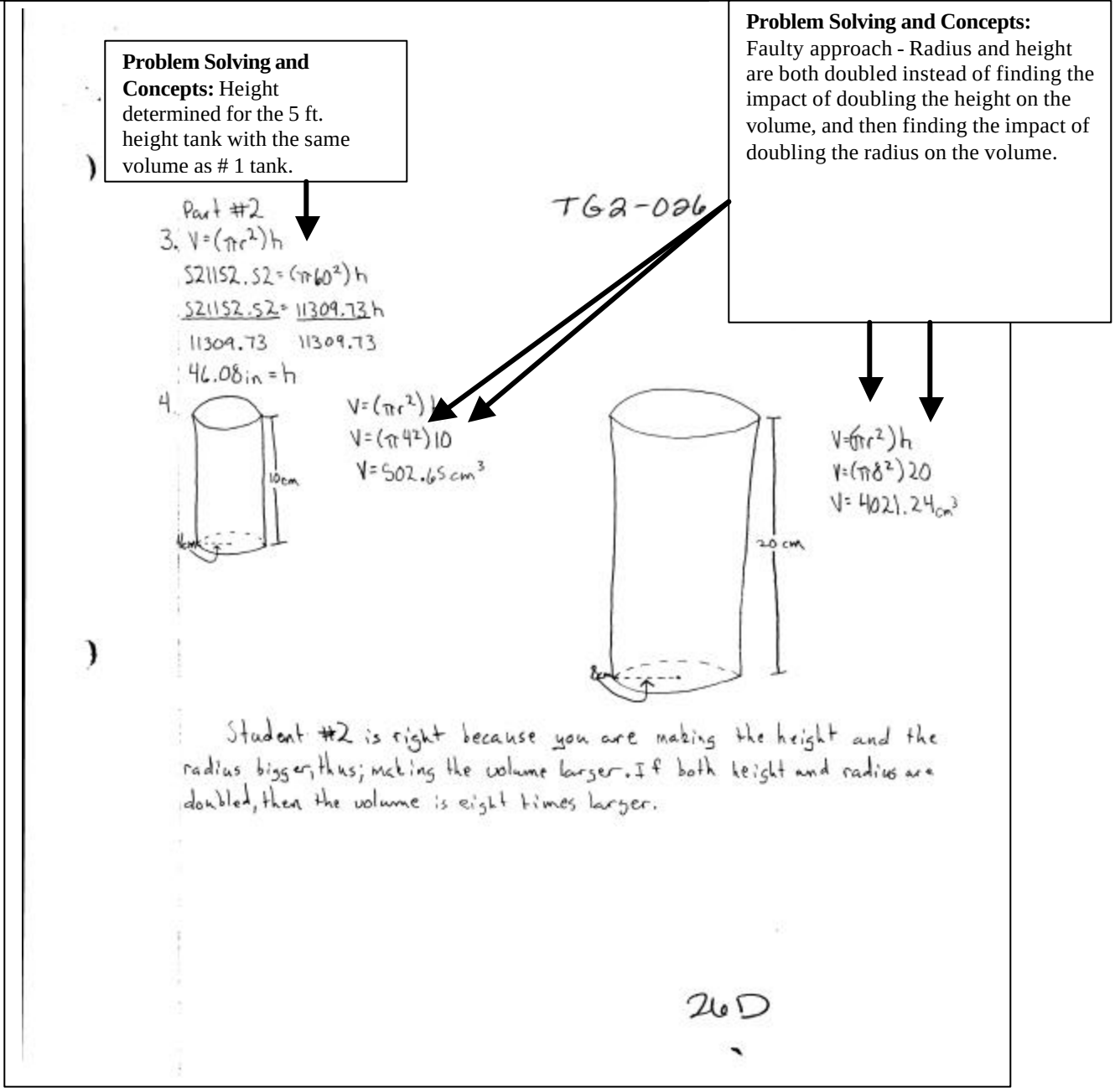
TG2-026

45	1409.85
46	1441.18
47	1472.51
48	1503.84
49	1535.17
50	1566.5
51	1597.83
52	1629.16
53	1660.49
54	1691.82
55	1723.15
56	1754.48
57	1785.81
58	1817.14
59	1848.47
60	1879.8
61	1911.13
62	1942.46
63	1973.79
64	2005.12
65	2036.45
66	2067.78
67	2099.11
68	2130.44
69	2161.77
70	2193.1
71	2224.43
72	2255.76

Anchor #: TG2-026
Mathematics Assessment Activity #14: Tank Gauge

Problem Solving and Concepts: Height determined for the 5 ft. height tank with the same volume as # 1 tank.

Problem Solving and Concepts:
Faulty approach - Radius and height are both doubled instead of finding the impact of doubling the height on the volume, and then finding the impact of doubling the radius on the volume.



Anchor #: TG2-026
Mathematics Assessment Activity #14: Tank Gauge

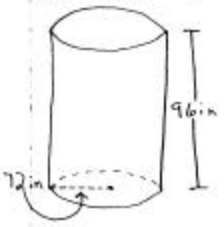
Problem Solving and Concepts: Gallons needed based on temperature and weight are determined for every month.

Problem Solving and Concepts: Logical procedure to find a solution for watering the heifers.

5. Part 3

TG2-026

	40°F	50°F	60°F	70°F	80°F	90°F
January	5.3→2650					
February	5.3→2650					
March	5.3→2650					
April		5.8→2900				
May			6.6→3300			
June				7.8→3900		
July					8.9→4450	
August					8.9→4450	
September				7.8→3900		
October			6.6→3300			
November	5.3→2650					
December	5.3→2650					



$V = (\pi r^2)h$
$V = (\pi 72^2)96$
$V = 1563457.57 in.^3$

$1563457.57 in.^3 \div 231.00 = 6768.21$ gallons / tank

Volume ÷ Gallons per day = # of days

January: 6768.21 / 2650 = 2.55 days
February: 6768.21 / 2650 = 2.55 days
March: 6768.21 / 2650 = 2.55 days
April: 6768.21 / 2900 = 2.33 days
May: 6768.21 / 3300 = 2.05 days
June: 6768.21 / 3900 = 1.74 days
July: 6768.21 / 4450 = 1.52 days
August: 6768.21 / 4450 = 1.52 days
September: 6768.21 / 3900 = 1.74 days
October: 6768.21 / 3300 = 2.05 days
November: 6768.21 / 2650 = 2.55 days
December: 6768.21 / 2650 = 2.55 days

I first figured how much water was drunk each month. After that I found the volume of the tank and converted it into gallons. I used th formula (volume ÷ gallons per day = # of days which 1 tank will last). Turn to the be of this page to view the rancher's schedule. 27D

Anchor #: TG2-026
Math Assessment Activity #14: Tank Gauge

TG2-026

Month	: When to check / fill water tank
January	: Every 2 days
February	: Every 2 days
March	: Every 2 days
April	: Every 2 days
May	: Every 2 days
June	: Every 1 day
July	: Every 1 day
August	: Every 1 day
September	: Every 1 day
October	: Every 2 days
November	: Every 2 days
December	: Every 2 days

Problem Solving and Concepts:
Provides solution for full year.

28D

Mathematics Assessment Activity # 14: The Number One Tank Gauge

Anchor #: TG2-006

Criterion: Problem Solving and Concepts **Level: 3**

All four elements of the problem were attempted. This is level 3, not a 4, because the doubling effect of the height was incorrectly squared. Appropriate skills and concepts were applied in all other aspects of this problem. The relationship between the height of the tank and the number of gallons in the tank are determined for tank # 1, the height of a tank with a radius of 5 feet is determined, and there is an effective strategy for determining the number of tanks needed for feeding the heifers. The response includes an analysis of the graph to show that the relationship between the height and the number of gallons is directly proportional ("…graph was linear…directly proportional…slope is constant…k=y/x").

Criterion: Representation **Level: 3**

The data in the tables are organized with correct values and labels. The graph clearly shows the relationship of the data. This is a level 3 response, not a 4, because there is no title or x-axis label on the graph.

Criterion: Number Operations/Calculation **Level: 4**

This is a level 4 response because calculations are correct and lead to a correct solution as evident in height/volume table and total volume of tank 2 to solve the heifer-watering problem. A minor error in Part II, #3 is the tank height calculation to the nearest whole inch.

Criterion: Mathematical Communication **Level: 4**

This is a level 4 because the notations and use of units is consistent throughout and there is an analysis of the graph in the text to show that the relationship between the height and the number of gallons is directly proportional ("…graph was linear…directly proportional…slope is constant…k=y/x."). This would be a stronger 4 if unnecessary text that describes procedures ("then I found the volume by squaring the radius and multiplying by Pi.") were not included.

Anchor #: TG2-006
Math Assessment Activity #14: Tank Gauge

Calculation: Calculations correct throughout.

Representation: Data in table organized, column headings labeled and values accurate.

Communication: Unnecessary text.

Problem Solving and Concepts: Applies concepts of volume and rates to show relationship between height and volume.

Communication: Links graph, text and concept.

Activity #17 TG2-006

1) $48^2\pi(6) = 43429.38 \div 231 = 188.01$ $48^2\pi(24) = 173717.51 \div 231 = 752.02$
$.25^2\pi(6) = 1.18 \div 231 = .01 + 188.01$ $.25^2\pi(24) = 4.71 \div 231 = .02 + 752.02$
$48^2\pi(12) = 86858.75 \div 231 = 376.01$ $48^2\pi(30) = 217146.88 \div 231 = 940.03$
$.25^2\pi(12) = 2.36 \div 231 = .01 + 376.01$ $.25^2\pi(30) = 5.89 \div 231 = .03 + 940.03$
$48^2\pi(18) = 130288.13 \div 231 = 564.02$ $48^2\pi(36) = 260576.26 \div 231 = 1128.04$
$.25^2\pi(18) = 3.53 \div 231 = .02 + 564.02$ $.25^2\pi(36) = 7.07 \div 231 = .03 + 1128.04$
$48^2\pi(42) = 304005.64 \div 231 = 1316.04$
$.25^2\pi(42) = 8.25 \div 231 = .04 + 1316.04$
$48^2\pi(48) = 347435.01 = 1504.05$
$.25^2\pi(48) = 9.42 = .04 + 1504.05$
$48^2\pi(54) = 390864.39 = 1692.05$
$.25^2\pi(54) = 10.6 = .05 + 1692.05$
$48^2\pi(60) = 434293.77 = 1880.06$
$.25^2\pi(60) = 11.8 = .05 + 1880.06$
$48^2\pi(66) = 477728.15 = 2068.07$
$.25^2\pi(66) = 13.0 = .06 + 2068.07$
$48^2\pi(72) = 521152.52 = 2256.07$
$.25^2\pi(72) = 14.1 = .06 + 2256.07$

Height (in)	Volume (Gallons)
6	188.02
12	376.02
18	564.04
24	752.04
30	940.06
36	1128.07
42	1316.08
48	1504.09
54	1692.10
60	1881.11
66	2068.13
72	2256.13

2) First, to make the original calculations, I took the radius of the first tank and converted it from feet to inches. Then, I found the of the tank by squaring the radius (48in) and then multiplying it by pi Then I plugged that into an equation to find the volume in terms of gallons. That equation was: (Area of tank)(Height) ÷ 231. I did this starting with six and going up to seventy-two in increments of six. Then, since there is a cylinder in the middle, I had to account for th so I squared the radius of it, multiplied it by pi, multiplied it by every height, just as with the whole tank's volume, then divi. it by 231 to convert it to gallons. With these values, I added them to the volumes of the Tank #1 and the sum was use as the y-axis points on the graph. The x-axis points were the heights of Tank #1. The graph was linear that went

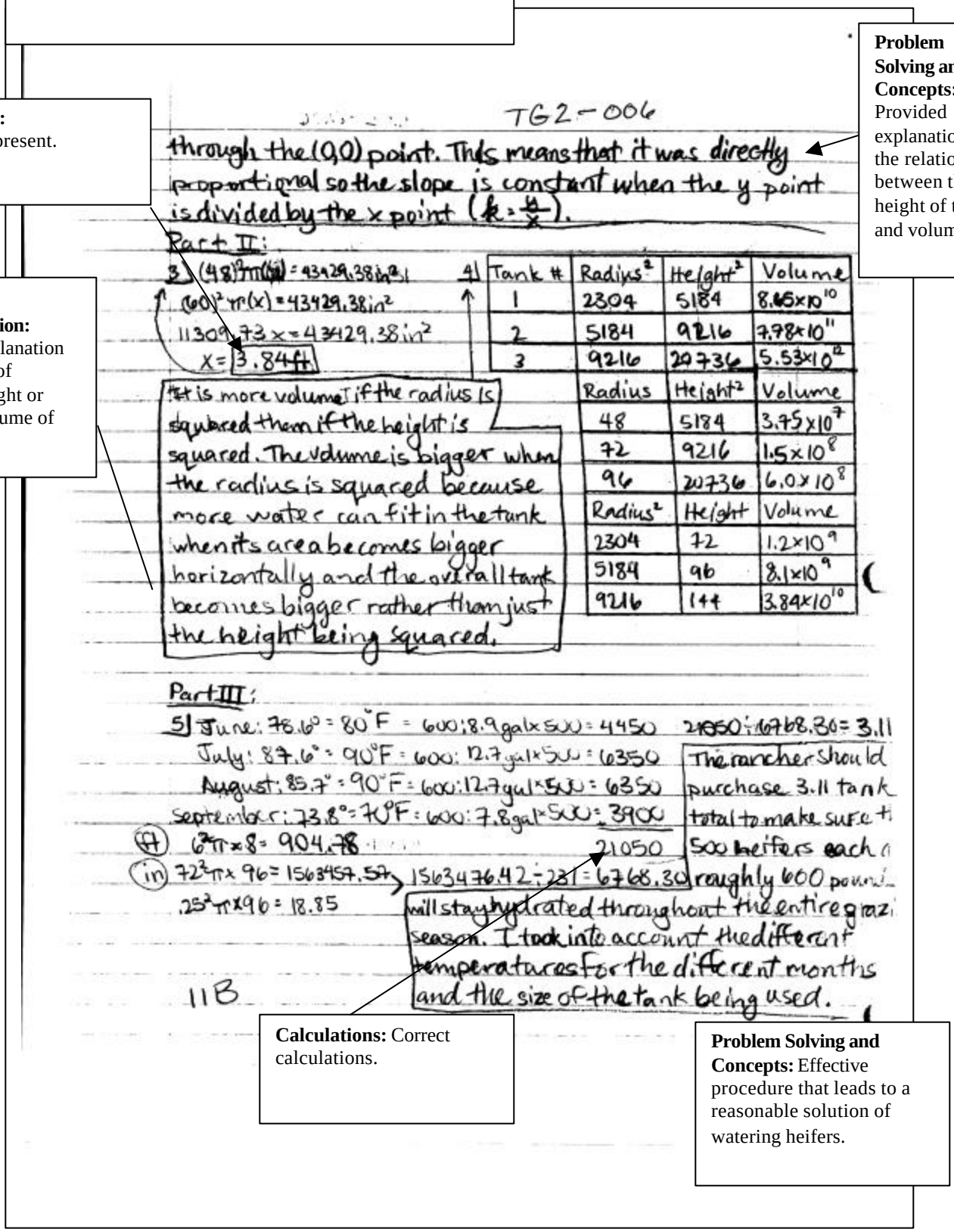
108

Anchor #: TG2-006
Math Assessment Activity#14: Tank Gauge

Problem Solving and Concepts: Provided explanation of the relationship between the height of tank and volume.

Calculations: Minor error present.

Communication: Provided explanation of the effect of doubling height or radius on volume of cylinder.



TG2-006

through the (0,0) point. This means that it was directly proportional so the slope is constant when the y point is divided by the x point ($k = \frac{y}{x}$).

Part II:

3) $(48)^2\pi(x) = 43429.38\,in^3$

$60^2\pi(x) = 43429.38\,in^2$

$11309.73x = 43429.38\,in^2$

$x = 3.84\,ft$

4)

Tank #	Radius^2	Height^2	Volume
1	2304	5184	8.65×10^{10}
2	5184	9216	7.78×10^{11}
3	9216	20736	5.53×10^{12}

Radius	Height^2	Volume
48	5184	3.75×10^{7}
72	9216	1.5×10^{8}
96	20736	6.0×10^{8}

Radius^2	Height	Volume
2304	72	1.2×10^{9}
5184	96	8.1×10^{9}
9216	144	3.84×10^{10}

It is more volume if the radius is squared than if the height is squared. The volume is bigger when the radius is squared because more water can fit in the tank when its area becomes bigger horizontally and the overall tank becomes bigger rather than just the height being squared.

Part III:

5) June: $78.6° = 80°F = 600 : 8.9\,gal \times 500 = 4450$

July: $87.6° = 90°F = 600 : 12.7\,gal \times 500 = 6350$

August: $85.7° = 90°F = 600 : 12.7\,gal \times 500 = 6350$

September: $73.8° = 70°F = 600 : 7.8\,gal \times 500 = 3900$

(ft) $6^2\pi \times 8 = 904.78$

(in) $72^2\pi \times 96 = 1563457.57$

$.25^2\pi \times 96 = 18.85$

21050

$1563476.42 \div 231 = 6768.30$

$21050 \div 6768.30 = 3.11$

The rancher should purchase 3.11 tank total to make sure th 500 heifers each a roughly 600 pound will stay hydrated throughout the entire grazi season. I took into account the different temperatures for the different months and the size of the tank being used.

11B

Calculations: Correct calculations.

Problem Solving and Concepts: Effective procedure that leads to a reasonable solution of watering heifers.

Anchor #: TG2-006
Mathematics Assessment Activity #14: Tank Gauge

TG2-006

Weight: Rose by:

6) 400: .3, .7, .8, .9, 2.8, 3.4, 4.0
600: .5, .8, 1.2, 1.1, 3.8, 4.1, 4.8
800: .5, 1.1, 1.3, 1.4, 4.4, 4.9, 5.3

lbs.	100°F	110°F
400	12.9	16.9
600	16.8	21.6
800	19.9	25.2

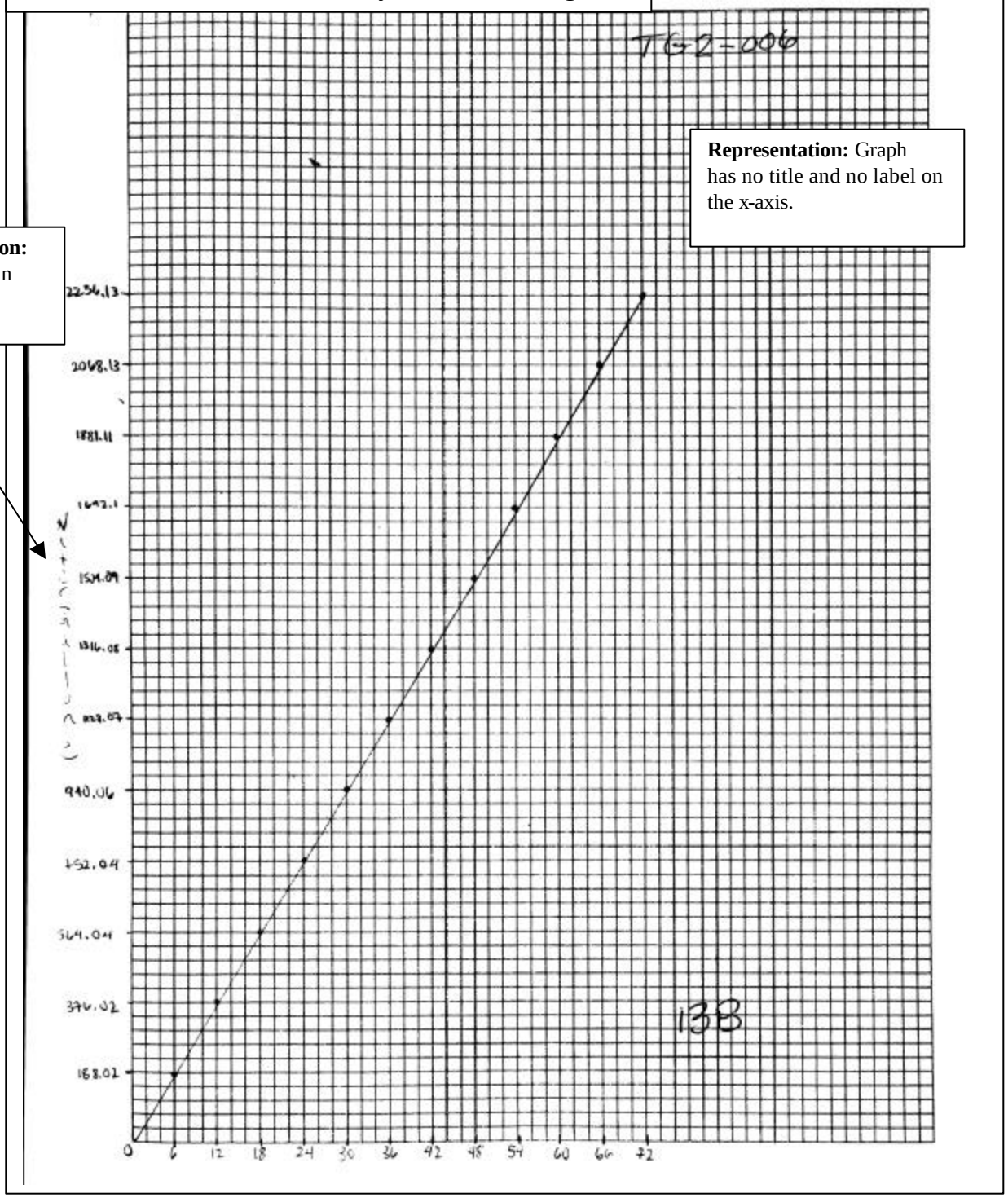
9.5 12.9 12.7 16.8 15.0 19.9
+3.4 +4.0 +4.1 +4.8 −4.9 +5.3
12.9 16.9 16.8 21.6 19.9 25.2

The only real pattern I could find was in the jumps. I broke down by how much each value of gallons jumped. In each situation, the first jump was rather small, then it made a significant jump. Next there was a cluster of the next three values not having a drastic change in their jumps. Then, there was another large jump to the final value provided. I concluded that the next two values would be very close to the final value given, just as the previous threesome was clustered with mostly unvaried values.

12B

Communication: Discusses the relationship in terms of "jumps," instead of identifying a pattern.

Anchor #: TG2-006
Mathematics Assessment Activity #14: Tank Gauge



Representation: Graph has no title and no label on the x-axis.

Representation: Axis=Water in gallons.

Mathematics Assessment Activity # 14: The Number One Tank Gauge

Anchor #: TG2-020

Criterion: Problem Solving and Concepts **Level: 2**

Although the solution includes the total number of gallons in the tank, includes part of a strategy for determining the number of tanks needed, and demonstrated the relationship of the number of gallons in the tank to its height in a graph, this is a Level 2 because there are some conceptual flaws in the solution. The explanation about the effect of doubling the radius or height on the volume of the tank is not mathematically justified ("the second because making the tank bigger would double its volume."), and the strategy for determining the number of tanks is incomplete. The volume of the # 2 tank was determined accurately to cubic feet. However, the wrong values for both temperature (70 degrees) and weight of the heifer (800 lbs instead of 600 lbs) are used, and the approach could not lead to a solution.

Criterion: Representation **Level: 2**

Although the graph accurately compares the height and volume, *this is a level 2 response because* there is not a complete data table as required in the task.

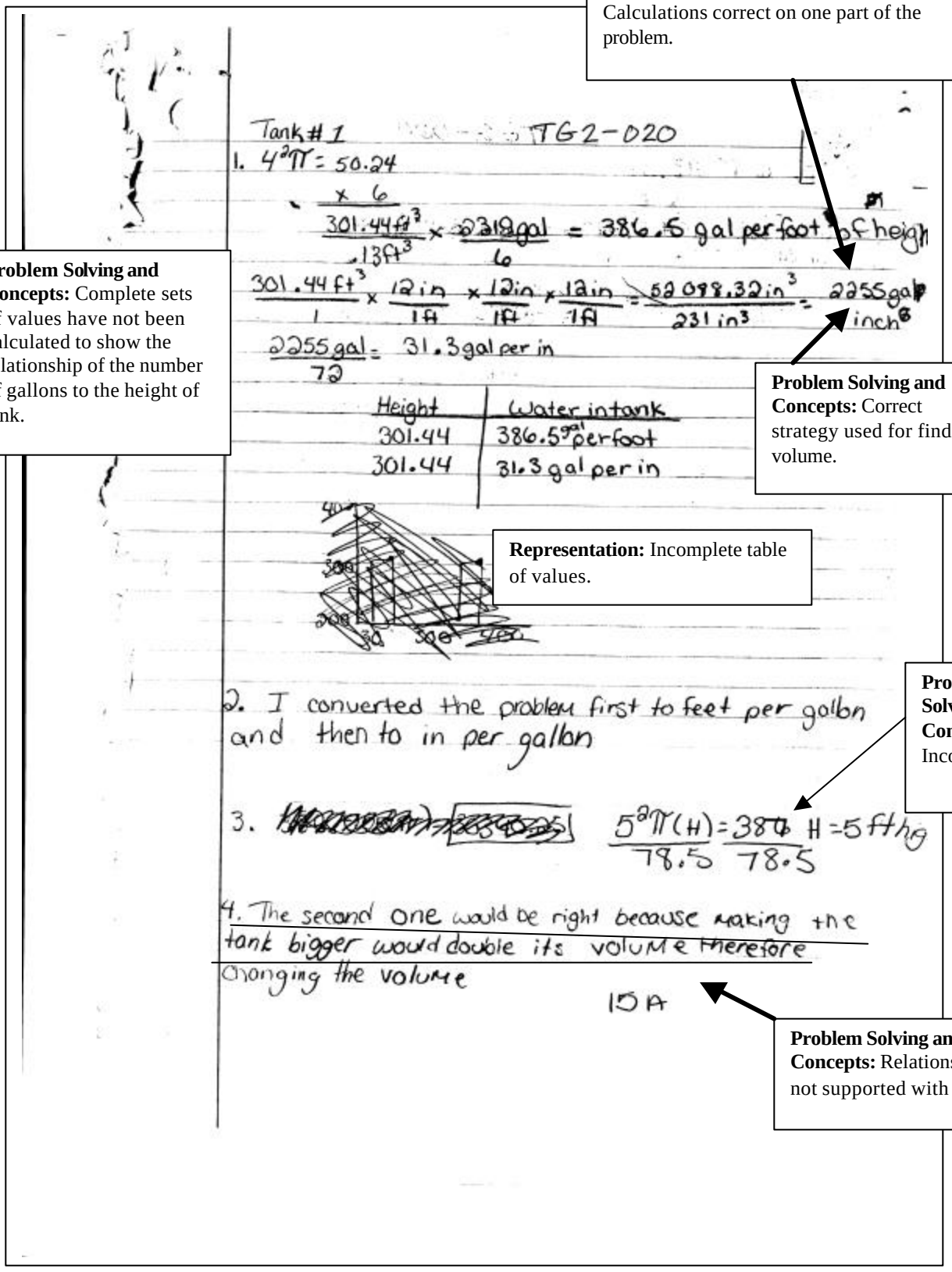
Criterion: Number Operations/Calculation **Level: 2**

Calculations are correct for total gallons in tank 1 in part I. However, this is a level 2 response because basic calculation errors lead to a wrong conclusion in finding the height of the #3 tank and in finding the total number of tanks needed to water the heifers.

Criterion: Mathematical Communication **Level: 2**

This is a level 2 response because some mathematical terms ("…..tank bigger….double its volume….") are used correctly , but the overall presentation is not logical. The summary for Part I does not summarize the findings from #1.

Anchor #: TG2-020
Mathematics Assessment Activity #14: Tank Gauge



Tank #1 TG2-020

1. $4^2\pi = 50.24$

$\times 6$

$\frac{301.44 ft^3}{.13 ft^3} \times \frac{2318 gal}{6} = 386.5$ gal per foot of height

$\frac{301.44 ft^3}{1} \times \frac{12 in}{1 ft} \times \frac{12 in}{1 ft} \times \frac{12 in}{1 ft} = \frac{52098.32 in^3}{231 in^3} = 2255 gal$

$\frac{2255 gal}{72} = 31.3$ gal per in

Height	Water in tank
301.44	386.5 gal per foot
301.44	31.3 gal per in

2. I converted the problem first to feet per gallon and then to in per gallon

3. $\frac{5^2\pi(H)}{78.5} = \frac{386}{78.5}$ H = 5 ft high

4. The second one would be right because making the tank bigger would double its volume therefore changing the volume

15 A

Calculation: Calculations correct on one part of the problem.

Problem Solving and Concepts: Complete sets of values have not been calculated to show the relationship of the number of gallons to the height of tank.

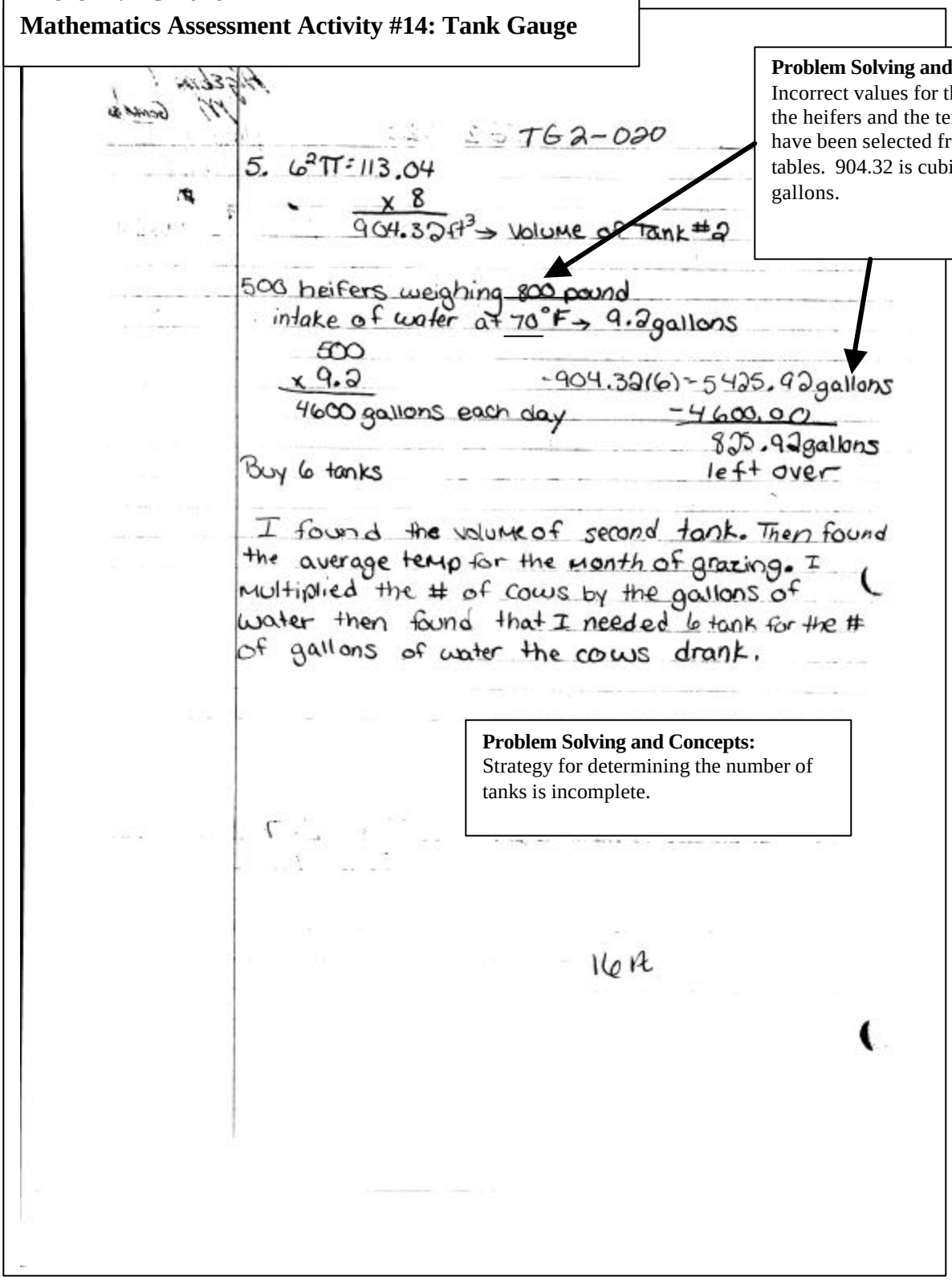
Problem Solving and Concepts: Correct strategy used for finding volume.

Representation: Incomplete table of values.

Problem Solving and Concepts: Incorrect value.

Problem Solving and Concepts: Relationship not supported with data.

Anchor #: TG2-020
Mathematics Assessment Activity #14: Tank Gauge



TG2-020

5. $6^2\pi = 113.04$

x 8

$904.32 ft^3$ → Volume of Tank #2

500 heifers weighing ~~800~~ pound

intake of water at 70°F → 9.2 gallons

500

x 9.2

4600 gallons each day

$904.32(6) = 5425.92$ gallons

-4600.00

825.92 gallons left over

Buy 6 tanks

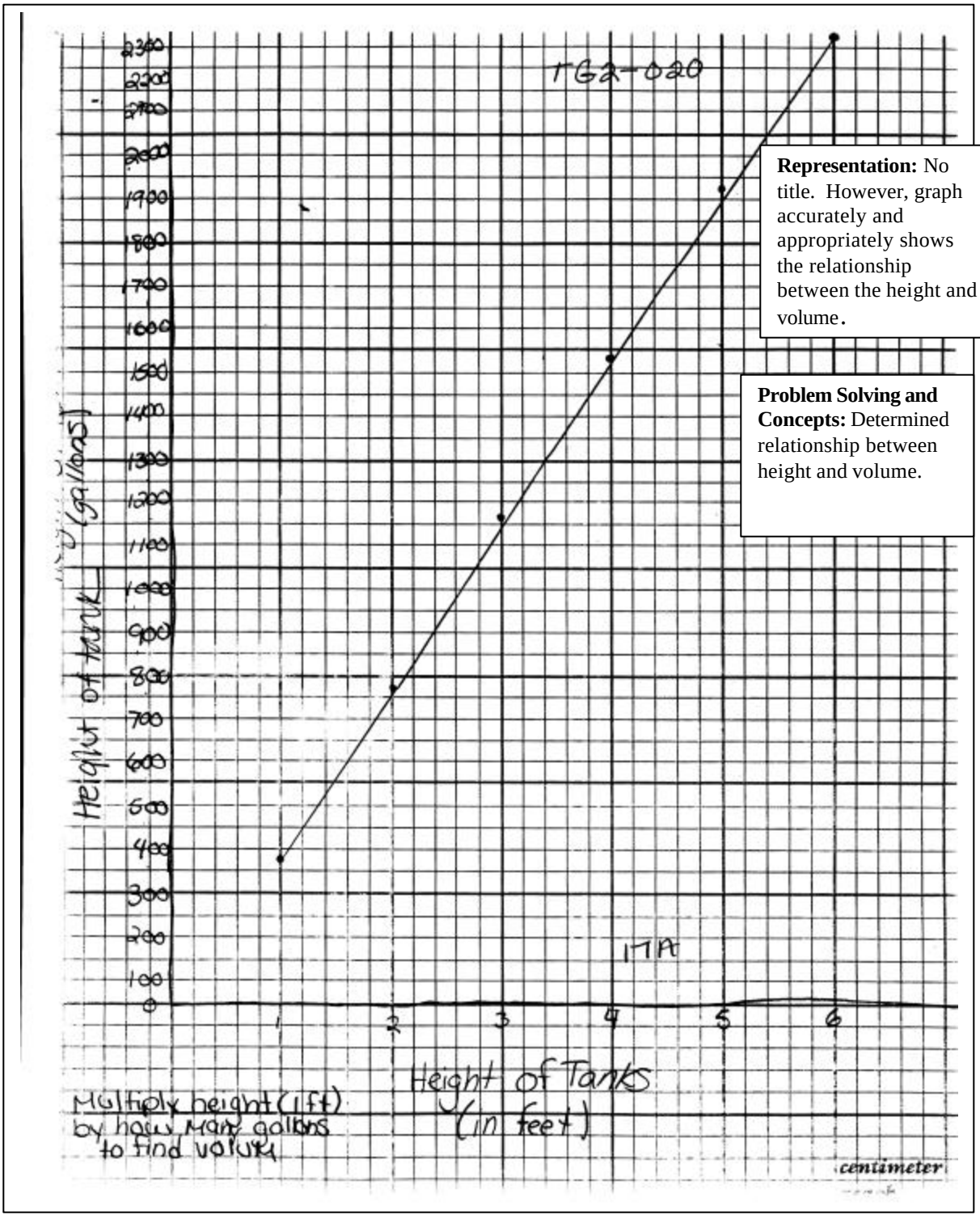
I found the volume of second tank. Then found the average temp for the month of grazing. I multiplied the # of cows by the gallons of water then found that I needed 6 tank for the # of gallons of water the cows drank.

16 ft

Problem Solving and Concepts:
Incorrect values for the weight of the heifers and the temperatures have been selected from the tables. 904.32 is cubic feet not gallons.

Problem Solving and Concepts:
Strategy for determining the number of tanks is incomplete.

Anchor #: TG2-020
Mathematics Assessment Activity #14: Tank Gauge



Representation: No title. However, graph accurately and appropriately shows the relationship between the height and volume.

Problem Solving and Concepts: Determined relationship between height and volume.

Mathematics Assessment Activity # 14: The Number One Tank Gauge

Anchor #: TG2-023

Criterion: Problem Solving and Concepts **Level: 1**

Although the volume of Tank # 1 is computed accurately (in cubic feet, instead of cubic inches) this is a level 1 because there were major conceptual flaws in the response as well as incomplete parts. The method to convert from cubic feet to gallons is incorrect. The method to compare the doubling of the radius and/or height is missing; and there is no response to the watering of heifers problem.

Criterion: Representation **Level: 2**

This is a level 2 response because the data is not organized. A graph does follow from the data with axes labeled.

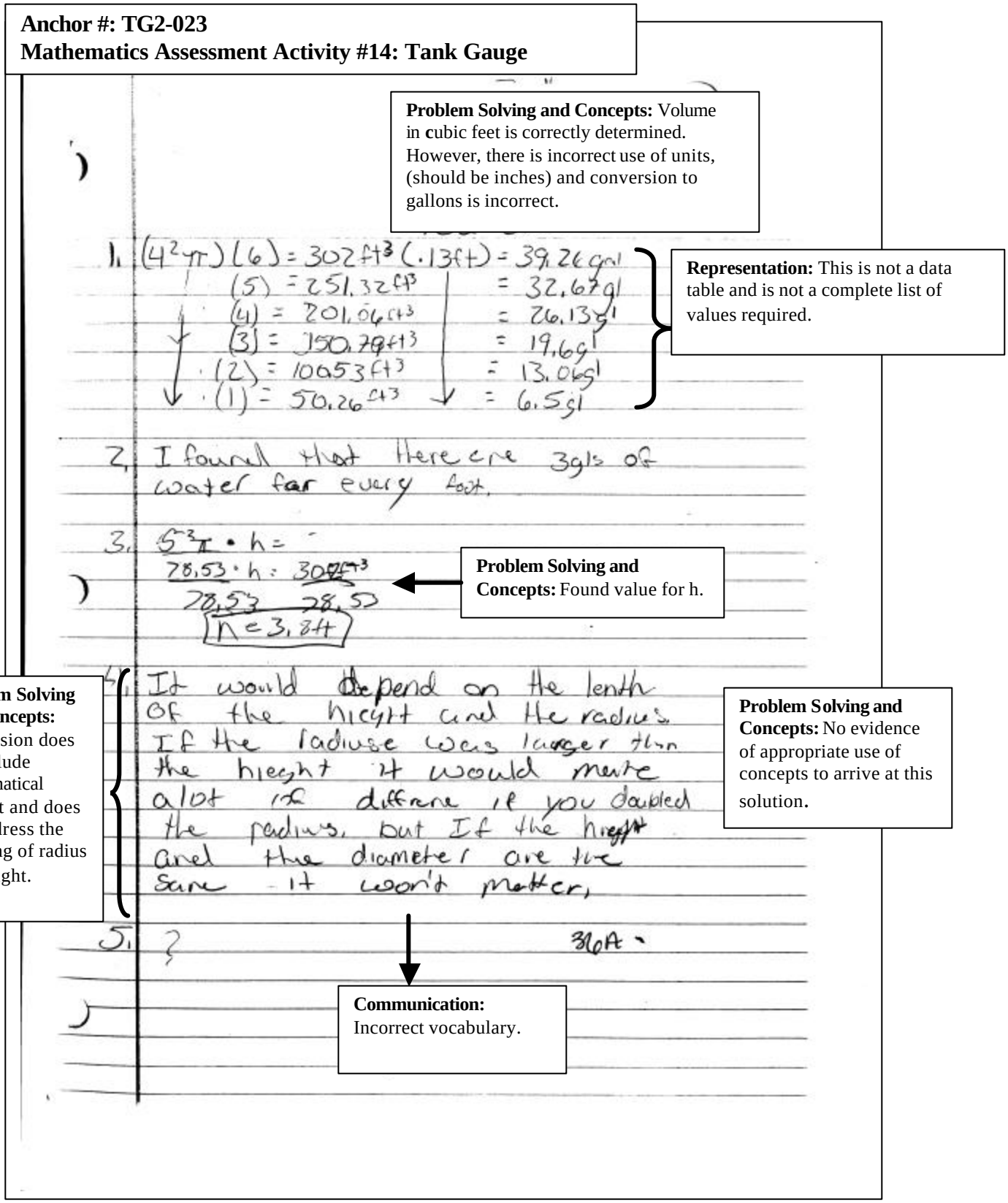
Criterion: Calculation **Level: 3**

Calculations are correct for the evidence provided.

Criterion: Communication **Level: 1**

This is a level 1 response because mathematical terms or notation are used but they are inaccurate and/or not supported. In addition, there is not a summary that neither explains Part I, #1 nor is there any work that supports the assertion for the doubling questions.

Anchor #: TG2-023
Mathematics Assessment Activity #14: Tank Gauge



Problem Solving and Concepts: Volume in **c**ubic feet is correctly determined. However, there is incorrect use of units, (should be inches) and conversion to gallons is incorrect.

Representation: This is not a data table and is not a complete list of values required.

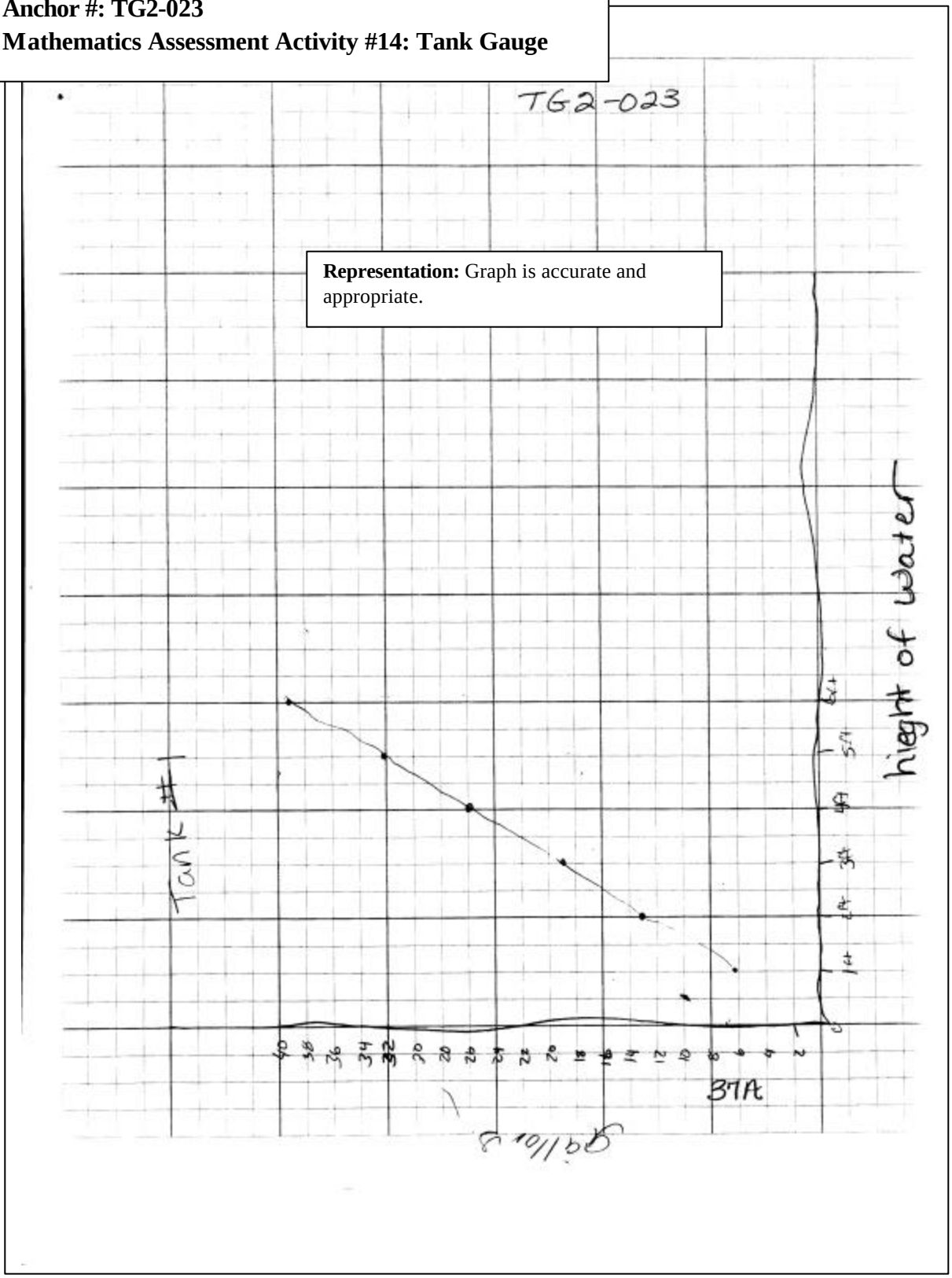
Problem Solving and Concepts: Found value for h.

Problem Solving and Concepts: Conclusion does not include mathematical support and does not address the doubling of radius and height.

Problem Solving and Concepts: No evidence of appropriate use of concepts to arrive at this solution.

Communication: Incorrect vocabulary.

Anchor #: TG2-023
Mathematics Assessment Activity #14: Tank Gauge



Representation: Graph is accurate and appropriate.