


How Many Points is
that Worth?

Assessing Problem
Solving
With Rubrics



Presented by
Dennis C. Runde, Ph.D.
Professor of Mathematics...

At the college formerly known
as...





Manatee Community College

Now known as...



State College of Florida

Manatee-Sarasota

Definition of Rubric

A rubric is a chart composed of criteria for evaluation and levels of fulfillment of those criteria. A rubric allows for standardized evaluation according to specified criteria, making grading simpler and more transparent.

(National Association of Gifted Children)

Research

"The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information" (Miller 1956)

"Measuring problem-solving ability" (Malone, Douglas, Kissane, & Mortlock 1980)

"Research in mathematics learning in a thematic approach: The case of Lake Gibson Middle School" (Austin, Thompson, White 1996)

Rubric

Level	Points	Mark
Non-Commencement	0	x
Approach	1	+1
Substance	2	+2
Progress	3	+3
Result	4	+4
Completion	5	✓

Non-Commencement (x)

Refers to the inability of the student to begin to make meaningful progress towards the solution of a problem

Examples Include:

- Leaving an item blank
- Writing meaningless or inappropriate work
- Recopying the problem without progress toward solution

Approach (+1)

The student shows some legitimate attempt at approaching the problem, but reaches an early impasse

Examples include:



Approach (+1)

- Correctly identifying but failing to implement a formula necessary to solve the problem
- Using inappropriate or trial and error methods that show some understanding of the problem without successfully solving the problem
- Organizing some of the data in the problem in an accurate manner without showing further progress toward solution
- Identifying and labeling a variable correctly.

Substance (+2)

The student provides sufficient evidence of knowledge of the procedure toward a rational solution, but major conceptual errors exist.

Examples include:



Substance (+2)

- Successfully solving the problem using inappropriate or trial and error methods without demonstration of the sought-after process
- Correctly carrying out about 40-60% of the problem without successful completion.

Progress (+3)

The student provides sufficient evidence of knowledge of the procedure toward a rational solution, but minor conceptual errors exist.

The problem is very nearly solved, but minor errors produce an invalid solution.

The types of errors here can be considered computational, not conceptual.

Progress (+3)

Examples include:

- Setting up a correct word problem equation but failing to solve it correctly
- Correctly carrying out about 60-80% of the problem without successful completion.

Result (+4)

The student shows full demonstration of the process used to produce a valid solution but very minor errors exist in either the procedure or in the presentation of the answer.

A score of four generally shows some lack of attention to detail or some "sloppiness".

Examples include:

Result (+4)

- Failure to correctly label a mathematical answer to a word problem
- Failure to solve for a second variable
- Failure to communicate the solution in an unambiguous fashion

Completion (✓)

The student shows complete mastery of the process and presents the solution in an unambiguous fashion.

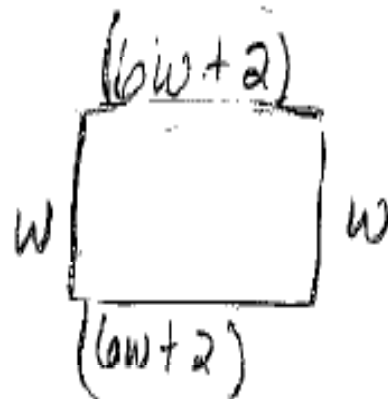


Sample Problem

The length of a rectangular room is 6 feet longer than twice the width. If the room's perimeter is 144 feet, what are the room's dimensions?

- 1) Write a key for this problem—show every step you want the students to show.
- 2) Grade the following problem

7) The length of a rectangular room is 6 feet longer than twice the width. If the room's perimeter is 144 feet, what are the room's dimensions?



$$6w + 2 + w + 6w + 2 + w = 144$$

$$14w + 4 = 144$$

$$- 4 = -4$$

$$\frac{14w}{14} = \frac{140}{14}$$

$$6(10) + 2$$
$$60 + 2 = 62$$

$$w = 10$$
$$L = 62$$

$$10 + 62 + 62 + 10 = 144$$

AIDAN

- 5) A train ticket in a certain city is \$1.50. People who use the train also have the option of purchasing a frequent rider pass for \$17.25 each month. With the pass, each ticket costs only \$0.75. Determine the number of times in a month the train must be used so that the total monthly cost without the pass is the same as the total monthly cost with the pass.

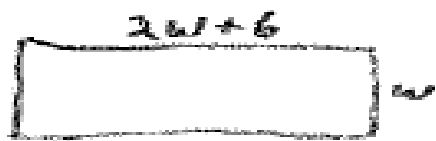
\$ 1.50 per ticket - 20 rides
 \$17.25/month - .75 per ticket - 40 rides

$$\begin{array}{r} 1.5x = 30 \\ \hline 1.5 \quad 1.5 \\ \hline x = 20 \end{array} \qquad \begin{array}{r} .75x = 30 \\ \hline .75 \quad .75 \\ \hline x = 40 \end{array}$$

- 6) After a 14% price reduction, a boat sold for \$28,380. What was the boat's price before the reduction? (Round to the nearest cent, if necessary.)

$$\begin{array}{r} .86x = 28,380 \\ \hline .86 \quad .86 \\ \hline x = \$33,000 \end{array}$$

- 7) The length of a rectangular room is 6 feet longer than twice the width. If the room's perimeter is 144 feet, what are the room's dimensions?



$$\begin{aligned} 2(2w + 6) + 2w &= 144 \\ 4w + 12 + 2w &= 144 \\ 6w + 12 &= 144 \\ -12 & \quad -12 \\ \hline 6w &= 132 \\ \hline w &= 22 \end{aligned}$$

$$\begin{aligned} w &= 24 \\ L &= 54 \\ 24' \times 54' \end{aligned}$$



BELLA

- 5) A train ticket in a certain city is \$1.50. People who use the train also have the option of purchasing a frequent rider pass for \$17.25 each month. With the pass, each ticket costs only \$0.75. Determine the number of times in a month the train must be used so that the total monthly cost without the pass is the same as the total monthly cost with the pass.

$$\$1.50$$

$$\$17.25 + \$0.75x = 1.50x$$

$$17.25 = 0.75x$$

$x = 23$ times in a month the train must be used when total monthly cost without the pass is the same as the total monthly cost with the pass

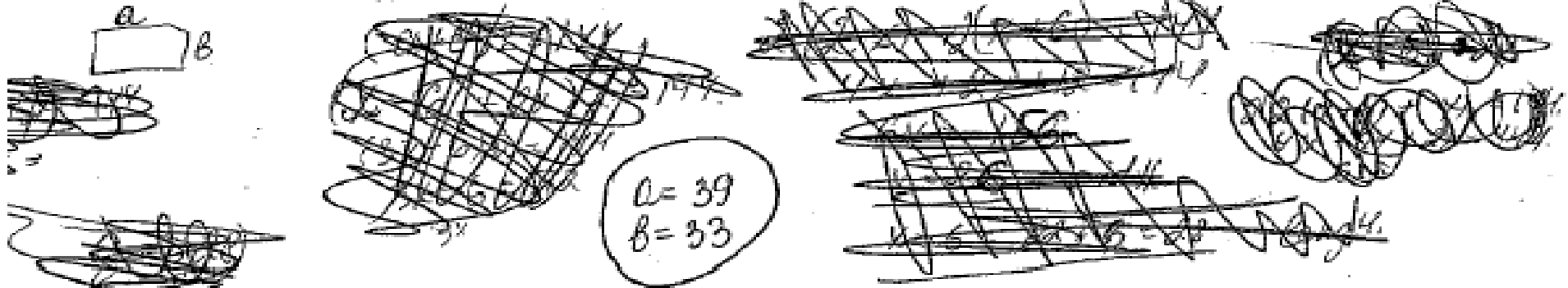
- 6) After a 14% price reduction, a boat sold for \$23,380. What was the boat's price before the reduction? (Round to the nearest cent, if necessary.)

$$x - 0.14x = 23,380$$

$$0.86x = 23,380$$

$$x = 27,186 \text{ - dollars. (the boat price in \$ before reduction)}$$

- 7) The length of a rectangular room is 6 feet longer than twice the width. If the room's perimeter is 144 feet, what are the room's dimensions?



- 5) A train ticket in a certain city is \$1.50. People who use the train also have the option of purchasing a frequent rider pass for \$17.25 each month. With the pass, each ticket costs only \$0.75. Determine the number of times in a month the train must be used so that the total monthly cost without the pass is the same as the total monthly cost with the pass.

$$\begin{aligned} \text{ticket w/o pass} &= \$1.50 \\ \text{ticket with pass} &= \$0.75 \\ \text{pass} &= \$17.25 \\ x &= \text{rides} \\ 1.50x &= 0.75x + 17.25 \end{aligned}$$

$$\boxed{x = 23 \text{ rides}}$$

$$\begin{array}{r} .75x = 17.25 \\ \underline{-.75} \quad \underline{.75} \end{array}$$

- 6) After a 14% price reduction, a boat sold for \$28,380. What was the boat's price before the reduction? (Round to the nearest cent, if necessary.)

$$x = \text{boat's price before reduction} \quad 28380 = x \cdot 0.86$$

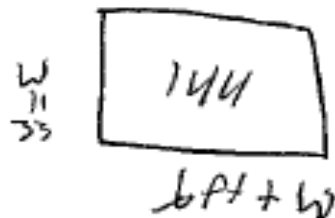
$$\frac{28380}{.86} = \frac{.86x}{.86}$$

$$\boxed{33000 = x}$$

- 7) The length of a rectangular room is 6 feet longer than twice the width. If the room's perimeter is 144 feet, what are the room's dimensions?

$$\boxed{\begin{array}{l} L = 39 \text{ ft} \\ W = 33 \text{ ft} \end{array}}$$

$$b + 33 = 39$$



$$2w + 12 + 2w = 144$$

$$\begin{array}{r} 4w + 12 = 144 \\ \underline{-12} \quad \underline{-12} \end{array}$$

$$\frac{4w = 132}{4}$$

$$w = 33$$

DOMINIC

5) A train ticket in a certain city is \$1.50. People who use the train also have the option of purchasing a frequent rider pass for \$17.25 each month. With the pass, each ticket costs only \$0.75. Determine the number of times in a month the train must be used so that the total monthly cost without the pass is the same as the total monthly cost with the pass

6) After a 14% price reduction, a boat sold for \$28,380. What was the boat's price before the reduction? (Round to the nearest cent, if necessary.)

39,732

7) The length of a rectangular room is 6 feet longer than twice the width. If the room's perimeter is 144 feet, what are the room's dimensions?

$$l = 50 \text{ ft}$$

$$w = 22 \text{ ft}$$

EMMA

- 5) A train ticket in a certain city is \$1.50. People who use the train also have the option of purchasing a frequent rider pass for \$17.25 each month. With the pass, each ticket costs only \$0.75. Determine the number of times in a month the train must be used so that the total monthly cost without the pass is the same as the total monthly cost with the pass.

$$\begin{array}{r} 1.50x = 17.25 + 0.75x \\ - 0.75x \end{array}$$

$$\begin{array}{r} .75x = 17.25 \\ \hline .75 \end{array}$$

$$x = 23$$

- 6) After a 14% price reduction, a boat sold for \$28,380. What was the boat's price before the reduction? (Round to the nearest cent, if necessary.)

$$\begin{aligned} 28,380(.14) &= 3,973 \\ = 3973 \\ 28,380 + 3973 &= 32,353 \end{aligned}$$

- 7) The length of a rectangular room is 6 feet longer than twice the width. If the room's perimeter is 144 feet, what are the room's dimensions?

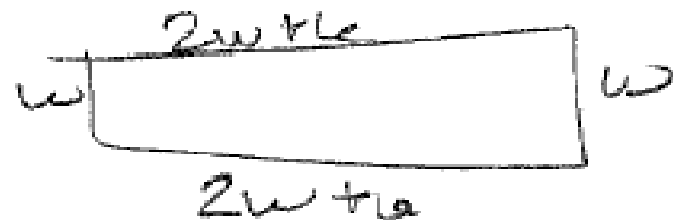
$$2l + 2w + 2w + 2l$$

$$2l + 12 = 144$$

$$-12 \quad -12$$

$$2l = 132$$

$$\begin{array}{l} l = 22 \\ l = 50 \end{array}$$



$$2(22) + l$$

Website Resources

- www.google.com
- www.rubrician.com/math.htm
- www.nden.k12.wi.us/tlcf/prob3.htm
- www.teach-nology.com/web_tools/rubrics/
- www.exemplars.com/

To receive an e-copy of
this presentation, send
me an email at:

runded@scf.edu

Summary

- MCC/SCF (blah, blah, blah, ...)
- Rubric (blah, blah, blah, ...)
- Now you grade some problems (buzz, buzz, buzz, ...)
- Websites (blah, blah, blah, ...)
- **The End** (clap, clap, clap, ... 😊)