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**Project:** Industrial Water Bill Rates

**Company:** Blue Ridge Rural Water Company

**Website:** <https://brrwc.org/blue-ridge-rates>

**Objectives:**

- (1.) Calculate the water bill of the industrial water rates of Blue Ridge Rural water company within each range of specific water usage manually using Arithmetic method.
- (2.) Write a piecewise function of the residential rates.
- (3.) Recalculate the *same* water bill of the industrial water rates of Blue Ridge Rural water company within each range of specific water usage algebraically using the Piecewise Function method.

**Information: Industrial Rates**

First 10,000 gallons	\$49.35 Minimum/Month
System Improvement Fee	\$ 3.00/month
Debt Repayment Fee	\$ 1.75/month
10,000 to 60,000 gallons	\$ 5.13/1,000 Gallons
Water over 60,000 gallons	\$ 8.13/1,000 Gallons

I will ignore the System Improvement Fee & Debt repayment Fee in my calculations.

**Conversions:**

$$\frac{\$5.13}{10,000 \text{ Gallon}} = \frac{\$0.00513}{1 \text{ Gallon}}$$

$$\frac{\$8.13}{10000 \text{ Gallons}} = \frac{\$0.00813}{1 \text{ Gallon}}$$

My numbers of gallons of water to test

- (1.) 0 Gallons
- (2.) 4000 Gallons
- (3.) 45000 Gallons
- (4.) 65000 Gallons

**Arithmetic Method:**

- (1.) For the consumption of 0 gallons of water

$$\text{cost} = \$49.35$$

- (2.) For the consumption of 4,000 gallons of water

$$\text{cost} = \$49.35$$

- (3.) For the consumption of 45,000 gallons of water

$$\text{cost} = \$49.35 + \$0.00513(45,000 - 10,000)$$

$$\text{cost} = \$49.35 + \$0.00513(35,000)$$

$$\text{cost} = \$49.35 + \$179.55$$

$$\text{cost} = \$228.90$$

- (4.) For the consumption of 65,000 gallons of water

$$\text{cost} = \$49.35$$

$$+\$0.00513(60,000 - 10,000)$$

$$+\$0.00813(65,000 - 60,000)$$

$$\text{cost} = \$49.35 + \$0.00513(50,000) + \$0.00813(5,000)$$

$$\text{cost} = \$49.35 + \$256.50 + \$40.65$$

$$\text{cost} = \$346.50$$

**Piecewise Function: Define Variables**

Let:  $g$  be the water consumed in gallons

$c(g)$  is the cost per consumption of water

**First piece:** First 10,000 Gallons:  $0 \leq g \leq 10000$

$$c(g) = \$49.35$$

**Second piece:** Next 50,000 Gallons:  $10000 < g \leq 60000$

$$c(g) = \$49.35 + \$0.00513(g - 10,000)$$

$$c(g) = \$49.35 + \$0.00513g - \$51.30$$

$$c(g) = \$0.00513g - \$1.95$$

**Third piece:** Over 60,000 Gallons:  $g > 60000$

$$c(g) = \$49.35$$

$$+\$0.00513(60000 - 10000)$$

$$+\$0.00813(g - 60000)$$

$$c(g) = \$49.35 + \$0.00513(60000 - 10000) + \$0.00813(g - 60000)$$

$$c(g) = \$49.35 + \$256.5 + \$0.00813g - \$487.8$$

$$c(g) = \$0.00813g - \$181.95$$

The Piecewise Function is:

$$c(g) = \begin{cases} \$49.35, & \text{if } 0 \leq g \leq 10000 \\ \$0.00513g - \$1.95, & \text{if } 10000 < g \leq 60000 \\ \$0.00813g - \$181.95, & \text{if } g > 60000 \end{cases}$$

### **Piecewise Function Method (Algebraic Method):**

I will test the same numbers as I did for the Arithmetic Method

(1.) For the consumption of 0 gallons of water

0 gallons falls in the first piece

$$c(0) = \$49.35$$

(2.) For the consumption of 4000 gallons of water

4000 gallons falls in the first piece

$$c(4000) = \$49.35$$

(3.) For the consumption of **45000** gallons of water  
45000 gallons falls in the second piece

$$c(g) = \$0.00513g - \$1.95$$

$$c(45000) = \$0.00513(45000) - \$1.95$$

$$c(45000) = \$230.85 - \$1.95$$

$$c(45000) = \$228.90$$

(4.) For the consumption of **65000** gallons of water  
65000 gallons falls in the third piece

$$c(g) = \$0.00813g - \$181.95$$

$$c(65000) = \$0.00813(65000) - \$181.95$$

$$c(65000) = \$528.45 - \$181.95$$

$$c(65000) = \$346.50$$

The results of the numbers tested using the Arithmetic Method and the Algebraic Method are the same.

**References (MLA):**

“Blue Ridge Rates.” *Blue Ridge Rural Water Company Inc.*, [brrwc.org/blue-ridge-rates](http://brrwc.org/blue-ridge-rates). Accessed 18 Sept. 2024.

Chukwuemeka, Samuel. “Where Is the Water Bill? It Is a Piecewise Function!”  
*Piecewise Function Application: Water Bill*,  
[conferencepresentations.appspot.com/Projects/PreCalculus/PiecewiseFunctions/WaterBill.html](http://conferencepresentations.appspot.com/Projects/PreCalculus/PiecewiseFunctions/WaterBill.html). Accessed 18 Sept. 2024.