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Project: Residential Water Bill Rates

Company: City of Yuma, Arizona Water Rates

Website:

https://www.yumaaz.gov/home/showpublisheddocument/8396/638538607053800000

Objectives:

For the City of Yuma residents: Residential Inside the City: 1" meter: I will

1.) Calculate the water bill of the residents in the city of Yuma, Arizona 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 residents in the city of Yuma, Arizona within each range of specific water usage algebraically using the piecewise function method

Information:

Schedule Of Water Rates

Effective As Follows: August 2024: $/Mo

Inside The City : Base Charge: 1” meter: $22.21

Residential Inside The City ($ per hundred cubic feet)

Usage Charge:

$0 - 10\ hcf$	$1.61
$11 - 30\ hcf$	$1.88
$31\ hcf\ and\ above$	$2.16

hcf means hundred cubic feet

Number of hcf to test:

I will test the following consumptions of water:

(1) 0 hcf

(2) 4 hcf

(3) 12 Hcf

(4) 32 hcf

Arithmetic Method:

(1.) For the consumption of 0 hcf:

$Cost = \$22.21$

(2.) For the consumption of 4 hcf:

$Base\ Charge = \$22.21$

$In\ 1st\ Piece: 1.61 * 4 = \$6.44$

$Cost = 22.21 + 6.44$

$Cost = \$28.65$

(3.) For the consumption of 12 hcf:

$Base\ Charge = \$22.21$

$1st\ Piece: 1.61 * 10 = \$16.1$

$Remaining\ in\ 2nd\ Piece: 1.88 * (12 - 10) = 1.88 * 2 = \$3.76$

$Cost = 22.21 + 16.1 + 3.76$

$Cost = \$42.07$

(4.) For the consumption of 32 hcf

$Base\ Charge = \$22.21$

$1st\ Piece: 1.61 * 10 = \$16.1$

$2nd\ Piece: 1.88 * (30 - 10) = 37.6$

$Remaining\ in\ 3rd\ piece: 22.21 + 16.1 + 37.6 + 2.16(32 - 30)$

$Cost = \$80.23$

Piecewise Function:

Let us define variables that we shall use:

Let: w be the power consumed in hcf

$c(w)$ is the cost per consumption of power in $

$Base\ Charge = \$22.21$

First Piece: (First Tier): $0 - 10\ hcf: 0 \leq w \leq 10$

$c(w) = 1.61 * w + 22.21$

$c(w) = 1.61w + 22.21$

Second Piece: (Second Tier): $11 - 30\ hcf$: $11\ \leq w \leq 30$

$c(w) = 22.21 + 16.1 + 1.88(w - 10)$

$c(w) = 22.21 + 16.1 + 1.88w - 18.8$

$c(w) = 1.88w + 19.51$

Third piece (Third Tier): $31\ hcf\ and\ above$: $w \geq 31$

$c(w) = 22.21 + 16.1 + 37.6 + 2.16(w - 30)$

$c(w) = 22.21 + 16.1 + 37.6 + 2.16w - 64.8$

$c(w) = 2.16w + 11.11$

The piecewise function is:

$$c(w) = \begin{cases} 1.16w + 22.21; & 0 \leq w \leq 10 \\ 1.88w + 19.51; & 11 \leq w \leq 30 \\ 2.16w + 11.11; & w \geq 31 \end{cases}$$

Piecewise Function Method (Algebraic Method):

I will test the same numbers as I did with the Arithmetic Method.

(1.) For the consumption of 0 hcf:

0 hcf falls in the first piece

$c(w) = 1.61w + 22.21$

$c(0) = 1.61(0) + 22.21$

$c(0) = 0 + 22.21$

$c(0) = \$22.21$

(2.) For the consumption of 4 hcf:

4 hcf falls in the first piece

$c(w) = 1.61w + 22.21$

$c(4) = 1.61(4) + 22.21$

$c(4) = 6.64 + 22.21$

$c(4) = \$28.65$

(3.) For the consumption of 12 hcf:

12 hcf falls in the second piece

$c(w) = 1.88w + 19.51$

$c(12) = 1.88(12) + 19.51$

$c(12) = 22.56 + 19.51$

$c(12) = \$42.07$

(4.) For the consumption of 32 hcf:

32 hcf falls in the third piece

$c(w) = 2.16w + 11.11$

$c(32) = 2.16(32) + 11.11$

$c(32) = 69.12 + 11.11$

$c(32) = \$80.23$

Reference (MLA 8)

Chukwuemeka, Samuel. “Piecewise Function Application: Water Bill.” *Where Is the Water Bill? It Is a Piecewise Function!*, conferencepresentations.appspot.com/Projects/PreCalculus/PiecewiseFunctions/WaterBill.html. Accessed 3 Dec. 2024.

Schedule of Water Rates, City of Yuma, Schedule of Water Rates, June 2024, www.yumaaz.gov/home/showpublisheddocument/8396/638538607053800000. Accessed 3 Dec. 2024.