

A Level H2 Math

Equations and Inequalities Test 5

Q1

The Singapore Utility Board charges the residential users based on the usage for electricity, water and gas. Electricity and gas are charged by kilowatt hour (kWh) used while water usage is charged by cubic meters (CuM). Below are the monthly utility statements for Mr Pandy from May to August 2017.

SP Utility Bill (May 2017)		
Mr Pandy Blk 20 Marine ...		
Current month charges		
Electricity	514 kWh	*** **
Water	18.8 CuM	*** **
Gas	134 kWh	** **
Total		\$155.54

SP Utility Bill (June 2017)		
Mr Pandy Blk 20 Marine ...		
Current month charges		
Electricity	309 kWh	*** **
Water	11.3 CuM	*** **
Gas	89 kWh	** **
Total		\$ 94.99

SP Utility Bill (July 2017)		
Mr Pandy Blk 20 Marine ...		
Current month charges		
Electricity	639 kWh	*** **
Water	21.7 CuM	** **
Gas	108 kWh	** **
Total		\$ 208.40

SP Utility Bill (August 2017)		
Mr Pandy Blk 20 Marine ...		
Current month charges		
Electricity	555 kWh	*** **
Water	??? CuM	** **
Gas	128 kWh	** **
Total		\$ 184.84

It is known that the unit costs for electricity, water and gas remain unchanged for May and June. The unit cost for electricity was increased by 20% with effect from July 2017, while the unit cost for gas and water remain unchanged.

- (i) Calculate the unit cost for electricity, water and gas for June 2017, giving your answers correct to the nearest 4 decimal places. [3]
- (ii) The water usage for August 2017 was not clearly printed on the bill. Using your answers in part (i), calculate the water usage for August 2017 to the nearest CuM. [2]

Q2

Without using a calculator, solve the inequality

$$\frac{x}{x-1} \leq \frac{4}{x+2}. \quad [5]$$

Q3

(i) Without using a calculator, solve the inequality $\frac{x}{x^2-5} \leq 0$, giving your answer in exact form. [2]

(ii) Hence, find the set of values of x for which $\frac{\sqrt{x}}{x-5} \leq 0$. [2]

Answers

Equations and Inequalities Test 5

Q1

- i Let $\$E$, $\$W$ and $\$G$ be the unit cost of electricity, water and gas, respectively.

$$514E + 18.8W + 134G = 155.54$$

$$309E + 11.3W + 89G = 94.99$$

$$639(1.2)E + 21.7W + 108G = 208.40$$

Using G.C,

$$E = 0.2137, W = 1.1749, G = 0.1761.$$

- ii Let w be the water usage for August 2017

$$(0.2137)(1.2)(555) + 1.1749w + 0.1761(128) = 184.84$$

$$w = 17$$

Q2

$$\frac{x}{x-1} \leq \frac{4}{x+2}$$

$$\frac{x}{x-1} - \frac{4}{x+2} \leq 0$$

$$\frac{x(x+2) - 4(x-1)}{(x-1)(x+2)} \leq 0$$

$$\frac{x^2 + 2x - 4x + 4}{(x-1)(x+2)} \leq 0$$

$$\frac{x^2 - 2x + 4}{(x-1)(x+2)} \leq 0$$

$$\frac{(x-1)^2 + 3}{(x-1)(x+2)} \leq 0$$

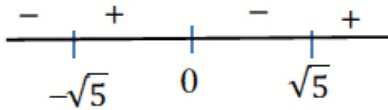
Since $(x-1)^2 + 3 > 0$ for all $x \in \mathbb{R}$,

$$(x-1)(x+2) < 0$$

$$-2 < x < 1$$

Q3

(i) $\frac{x}{x^2 - 5} \leq 0$

$$\frac{x}{(x - \sqrt{5})(x + \sqrt{5})} \leq 0$$


$$\therefore x < -\sqrt{5} \text{ or } 0 \leq x < \sqrt{5}$$

ii) $\frac{\sqrt{x}}{x - 5} \leq 0$

$$\frac{\sqrt{x}}{(\sqrt{x})^2 - 5} \leq 0$$

Replace x by \sqrt{x} in the result from (i),

$$\sqrt{x} < -\sqrt{5} \quad \text{or} \quad 0 \leq \sqrt{x} < \sqrt{5}$$

$$\text{(Reject } \because \sqrt{x} \geq 0) \quad \text{or} \quad 0 \leq x < 5$$

$$\text{Required set} = \{x \in \mathbb{R} : 0 \leq x < 5\}$$