Equivalent Algebraic Expressions Tasks

DEPRECIATION OF A VEHICLE

A vehicle was purchased for 10,000$ at time t = 0 years. The vehicle depreciates (loses value) according to the function:

$$V(t) = 10000(1-r)^t$$

where V(t) is the value of the vehicle in dollars over time t in years. How much is the vehicle worth at t=7 years?

ELECTRICAL ENGINEERING DESIGN TASK

While doing a lab in physics, Mr. Mick smashes Abby's phone to show the use of parallel circuits. He finds that there are three main resistors R_1, R_2 and R_3 which he expresses in relation below:

$$\frac{1}{R} = \frac{3x-5}{12x^2-26x+10} + \frac{5x+6}{75x^2-108} + \frac{5x-2}{100x^2-80x+16}$$

He asks you to recall that the total resistance R given a parallel circuit is given by:

$$\frac{1}{R} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$$

He then asks you to find the value of each resistor R_1, R_2 and R_3.(6 marks)

What are the domain restrictions on each individual resistor? (3 marks)

BUSINESS PROFIT TASK

The profit function P(x), in dollars, is related to the revenue function R(x), in dollars, and the cost function, C(x) in dollars, in the following manner, where x is the price of the lunch in dollars.

$$P(x) = R(x) – C(x)$$

Molly has a business where she sells healthy brown bag lunches to students and teachers. She finds that her revenue and cost function is modeled by:

$$R(x) = -27x^2 + 416x$$

$$C(x) = 7x^2 - 400x + 2720$$

Write the equation that models the profit function. (3 marks)

Instead of advertizing, Molly made a free brown bag lunch for everyone on her first day of business. Using the functions above, how much did this cost her? (2 marks)

Molly thinks that charging 5$ for each brown bag lunch is a good idea. How much profit (if any) will she make at this price? (2 marks)

At what price can Molly sell her brown bags to break-even? That is to say, to make no profit. (3 marks)

CHEMISTRY ACID-BASE TITRATION LAB DAY!!!

In preparation for a formal lab in Chemistry, Rolanda has decided she needs some caffeine to stay awake. She finds that once the consumed caffeine has taken effect it at time t = 0, it will dissipate from her bloodstream according to the function,

$$C(t) = \frac{8.5}{t+1}$$

where c(t) is the concentration of caffeine in (mg/mL) in her blood and t is the time after the caffeine has taken effect in hours.

When will the caffeine completely leave her body? (2 marks)

Through experience, Rolanda has noticed that she desires another coffee, as its effect is no longer keeping her alert, exactly two hours after the caffeine has taken effect. What is the concentration of the caffeine in her body at that particular time? (2 marks)

Rolanda must be careful as she has noticed that once she has completed her homework or studied for her tests, she will not be able to sleep if the concentration of caffeine in her bloodstream exceeds 1mg/mL. If she wishes to go to bed at 01h00 in the morning, at what time should she have her last coffee? (2 marks)

State the domain and range of this situation. (2 marks)

While trying to resolve an ACID-BASE TIRTRATION question, her lab partner sends her the following solution with the below calculation.

$$\_ \text{ g } H_2C_2O_4 = \frac{(0.03447\text{L})(0.100\text{mol NaOH})(1\text{ mol } H_2C_2O_4)(90.04\text{ g } H_2C_2O_4)}{(1\text{ L NaOH})\quad(2\text{ mol NaOH})\quad(1\text{ mol } H_2C_2O_4)}$$

$$0.1552\text{L (mol NaOH)}(\text{g*mol } H_2C_2O_4)(\text{L}^{-1})(\text{mol}^{-1}\text{ NaOH})(\text{mol}^{-1}\ H_2C_2O_4)$$

What correction must the lab partner make? (2 marks)