

Howard University Math Department

1. (10 points) Give a brief (one or two sentences each) answer for the following: How is climate different from weather? What human activities are emitting the gases causing climate change?

Solution:

Climate involves long term patterns and temperature, rain etc., on average and weather is short term conditions.

Greenhouse gases coming from buildings, agriculture, powerplants, factories, automobiles...

2. (12 points) Which of the following are arithmetic sequences? For the ones that are, what is the common difference?

1. 3, -1, -5, -9, -13,....

2. 1.1, 2.2, 3.3, 4.4, 5.5, ...

Solution:

Both are arithmetic. First one has $d = -4$ and second one has $d = 1.1$.

3. (12 points) For the following sequence, find the formula for the n -th term and the value of the 30th term using the formulae for the arithmetic sequence 2, 8, 14, 20, ..., ...

Solution:

This is an arithmetic sequence because each time we are adding the same number 6.

So the common difference is $d = 6$ and the first term $a = 2$.

In $a + d(n - 1) = a_n$ if we put $d = 6, a = 2$ we get $a_n = 2 + 6(n - 1) = 6n - 4$. The 30th term is $6(30) - 4 = 176$.

4. (12 points) Write the following in scientific notation: (a) 170001 (b) 0.00025

Solution

(a) 1.70001×10^5 (b) 2.5×10^{-4}

5. (20 points) (a) Find the base 2 representation of 100. You must write 100 as a sum of powers of 2 first. (b) Write the base 2 number 10010 in the decimal system.

Solution:

$$100 = 64 + 32 + 4 = 2^6 + 2^5 + 2^2 = 1100100_2.$$

$$10010 = 2^4 + 2^1 = 16 + 2 = 18.$$

6. (12 points) Suppose the cost of charging at a charging station is given by a connection charge of 10 dollars and 25 cents per kilowatt. Write down the equation for the function $C(x)$ that gives you the cost for getting x kilowatts. What is the cost of fully charging an electric car that needs 60 kilowatts? What kind of function is $C(x)$ and what would its graph look like? [Note: convert cents to dollars first].

Solution:

$$\begin{aligned}\text{Total charge} &= \text{Fixed charge} + (\text{number of kilowatts}) \times (\text{per kilowatt charge}) \\ &= 10 + (x) \times 0.25 = 10 + 0.25x.\end{aligned}$$

$$\text{If } x = 60, \text{ then } C(60) = 10 + (0.25)(60) = 25 \text{ dollars}$$

it's a linear function and graph is a line.

7. (10 points) Show that the sum of the first n even numbers namely 2, 4, 6, 8, ..., $2n$ is $n^2 + n$. What is the sum of the first 50 even numbers 2, 4, 6, ..., 100?

Solution:

Here it is given that 2 is first term and $2n$ is last term and also that number of terms is n . So we can just put it all into the formula $(\text{first} + \text{last}) (\text{number of terms})/2$:

$$2 + 4 + 6 + \dots + 2n = (2 + (2n)) \times n/2 = n^2 + n.$$

$$\text{Sum of first 50 even numbers } n^2 + n = 50^2 + 50 = 2550.$$

8. (12 points) In a town A near an oil refinery 10 people got cancer and the remaining 190 didn't. In a town B far from the refinery 20 got cancer and the remaining 780 didn't. What was the probability of a person getting cancer in each town? Express each one as a percentage.

Solution:

The probability in A is $10/200$ or $1/20$. As a percentage it is 5 percent chance of getting cancer. In town B it is $20/800$ or $1/40$. As a percentage it is 2.5 percent chance. (To get percentage multiply by 100).