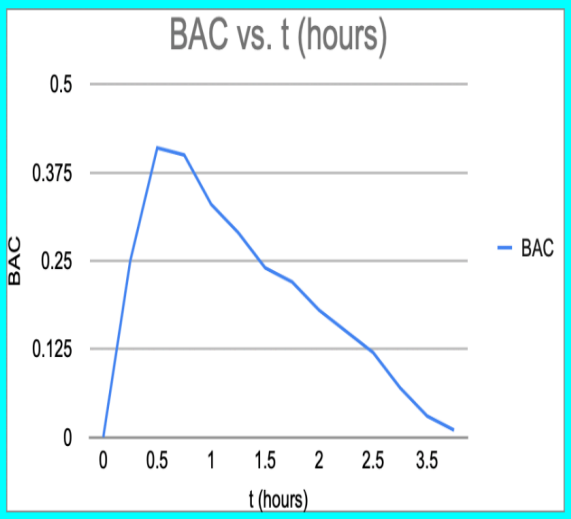
**Samir Khadka**
**Assignment 1**
**Calculus 1**

## Question 1:

## Solution 1a:

Q1

| t (hours) | BAC |
|---|---|
| 0 | 0 |
| 0.2 | 0.25 |
| 0.5 | 0.41 |
| 0.75 | 0.4 |
| 1 | 0.33 |
| 1.25 | 0.29 |
| 1.5 | 0.24 |
| 1.75 | 0.22 |
| 2 | 0.18 |
| 2.25 | 0.15 |
| 2.5 | 0.12 |
| 3 | 0.07 |
| 3.5 | 0.03 |
| 4 | 0.01 |




## Solution 1b:

1. **Initial Increase (0 to 0.5 hours):**

    - The BAC rises sharply from 0 mg/mL to 0.41 mg/mL within the first 0.5 hours. This rapid increase indicates that alcohol is quickly absorbed into the bloodstream shortly after consumption.

2. **Peak BAC (0.5 hours):**

    - The BAC reaches its maximum value of 0.41 mg/mL at 0.5 hours. This peak represents the highest concentration of alcohol in the blood, suggesting that the absorption rate is at its highest.

3. **Gradual Decline (0.5 to 2.0 hours):**

- After reaching the peak, the BAC begins to decrease. By 1 hour, it has dropped to 0.33 mg/mL, and by 1.5 hours, it is down to 0.24 mg/mL.

- This decline continues steadily, reaching 0.18 mg/mL at 2.0 hours. This phase indicates the body's metabolism and elimination of alcohol from the bloodstream.

### 4. Continued Decrease (2.0 to 4.0 hours):

- The BAC continues to decrease gradually over this period, dropping to 0.12 mg/mL at 2.5 hours and further down to 0.07 mg/mL by 3.0 hours.

- By 3.5 hours, the BAC is at 0.03 mg/mL, and by 4.0 hours, it is nearly zero at 0.01 mg/mL.

- This sustained reduction highlights the ongoing process of alcohol elimination, as the liver metabolizes the alcohol and removes it from the body.

## Question 2:
## Solution:

Given equation:

$x^2 + (y - 2)^4 = 4$

To find the expression for function f(x).

Rearranging the equation, we have:

$(y - 2)^4 = 4 - x^2$

$or,\ y - 2 = \pm\sqrt{4 - x^2}$

$or,\ y = 2 \pm \sqrt{4 - x^2}$

Either,

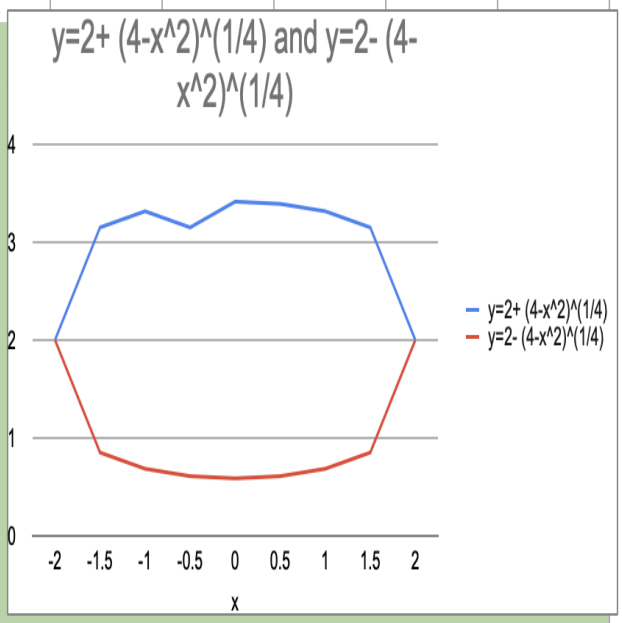
$y = 2 + \sqrt{4 - x^2}$

Or,

$y = 2 - \sqrt{4 - x^2}$

Q2

| x | y=2+ (4-x^2)^(1/4) | y=2- (4-x^2)^(1/4) |
|---|---|---|
| -2 | 2 | 2 |
| -1.5 | 3.1501633168956 | 0.849836683104397 |
| -1 | 3.31607401295249 | 0.683925987047508 |
| -0.5 | 3.1501633168956 | 0.60842115814313 |
| 0 | 3.4142135623731 | 0.585786437626905 |
| 0.5 | 3.39157884185687 | 0.60842115814313 |
| 1 | 3.31607401295249 | 0.683925987047508 |
| 1.5 | 3.1501633168956 | 0.849836683104397 |
| 2 | 2 | 2 |

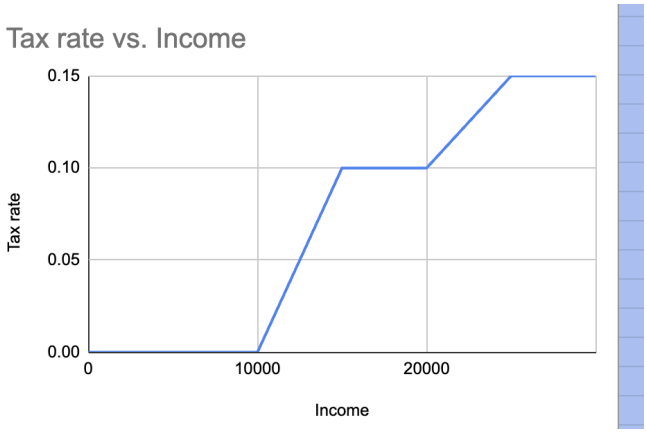



## Question 3:

### a. Solution:

Q3 a

| Income | Tax rate |
|---|---|
| 0 | 0 |
| 5000 | 0 |
| 10000 | 0 |
| 15000 | 0.1 |
| 20000 | 0.1 |
| 25000 | 0.15 |
| 30000 | 0.15 |




### b. Solution:

We need to calculate the tax assessed on an income of $14,000,
To find the taxable amount.
We can subtract the non-taxable portion ($10,000) from the total income($14,000).
We get:

=$(14,000 - 10,000)
=$4,000

Hence, the taxable amount of $4,000 is multiplied by the tax rate of 10% (0.10) to obtain the tax assessed: $4,000 * 0.10 = $400.

Now, for an income of $26,000,
=$(26,000 - 10,000)
=$16,000

The tax assessed for the initial $10,000 taxable amount is equal to $1,000 based on the 10% rate.
$10,000 * 0.10 = $1,000.

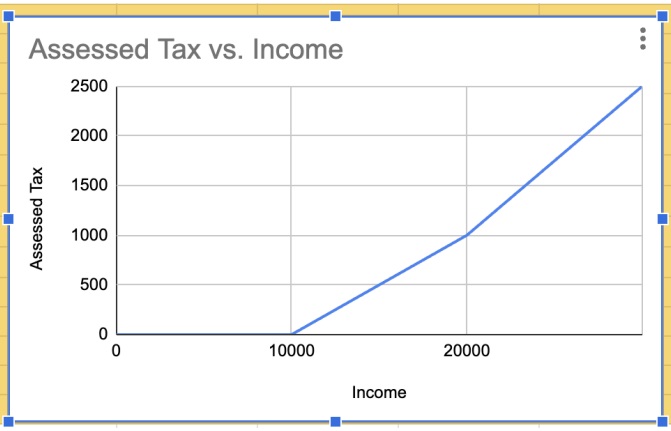
The calculation for tax assessment on $6,000 at 15% requires multiplying $6,000 by 0.15 which results in $900 tax.

The total tax assessment results from adding together the two different tax amounts: $1,000 + $900 = $1,900

### c. Solution:

Q3 c

| Income | Assessed Tax |
|---|---|
| 0 | 0 |
| 10000 | 0 |
| 15000 | 500 |
| 20000 | 1000 |
| 25000 | 1750 |
| 30000 | 2500 |

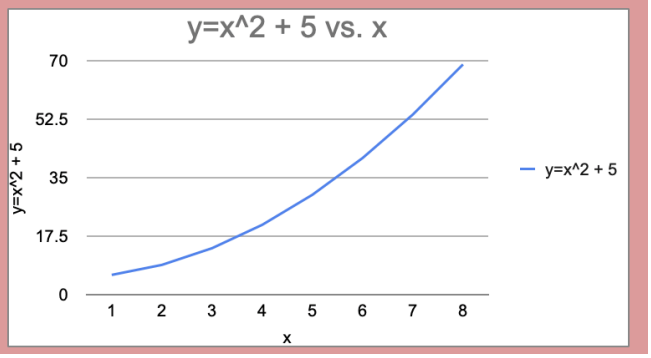



## Question 4:

### a. Solution:

Q4 a

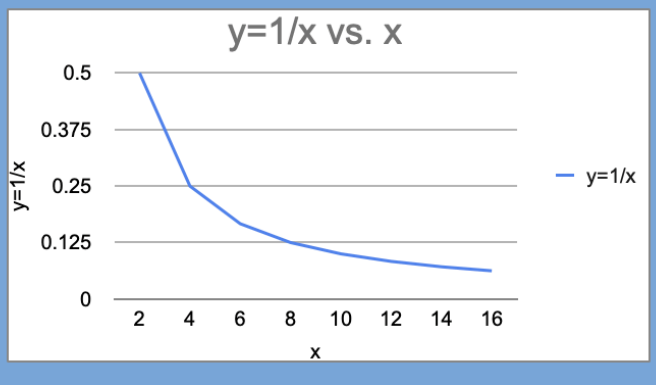
| x | y=x^2 + 5 |
|---|---|
| 1 | 6 |
| 2 | 9 |
| 3 | 14 |
| 4 | 21 |
| 5 | 30 |
| 6 | 41 |
| 7 | 54 |
| 8 | 69 |




**b. Solution:**

Q4 b

| x | y=1/x |
|---|---|
| 2 | 0.5 |
| 4 | 0.25 |
| 6 | 0.166666666666667 |
| 8 | 0.125 |
| 10 | 0.1 |
| 12 | 0.0833333333333333 |
| 14 | 0.0714285714285714 |
| 16 | 0.0625 |

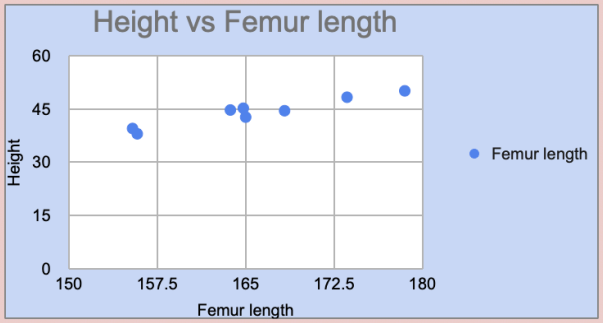



## Question 5:

**a. Solution:**

Q5 a

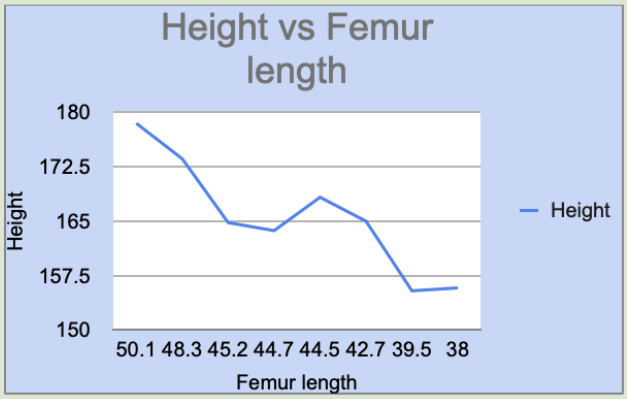
| Femur length | Height |
|---|---|
| 50.1 | 178.5 |
| 48.3 | 173.6 |
| 45.2 | 164.8 |
| 44.7 | 163.7 |
| 44.5 | 168.3 |
| 42.7 | 165 |
| 39.5 | 155.4 |
| 38 | 155.8 |



b. **Solution:**

Q5 b

| Femur length | Height |
|---|---|
| 50.1 | 178.5 |
| 48.3 | 173.6 |
| 45.2 | 164.8 |
| 44.7 | 163.7 |
| 44.5 | 168.3 |
| 42.7 | 165 |
| 39.5 | 155.4 |
| 38 | 155.8 |




c. **Solution**:

Given equation:

y = 1.8807x + 82.65———-(1)

Here, the height is represented by y and the femur length is represented by x.

We have,

Femur length (x) is 53 cm

Replacing the value of femur length in equation 1, we get,

By plugging in x = 53, we get

or, y = 1.8807 * 53 + 82.65

or, y = 99.7871 + 82.65

y = 182.4371 cm

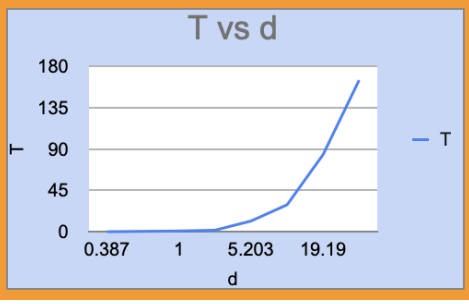
Therefore, the person's height is approximately 182.44 cm.

## Question 6:

### a. Solution:

Q6 a

| Planet | d | T |
|---|---|---|
| Mercury | 0.387 | 0.241 |
| Venus | 0.723 | 0.615 |
| Earth | 1 | 1 |
| Mars | 1.523 | 1.881 |
| Jupiter | 5.203 | 11.861 |
| Saturn | 9.541 | 29.457 |
| Uranus | 19.19 | 84.008 |
| Neptune | 30.086 | 164.784 |



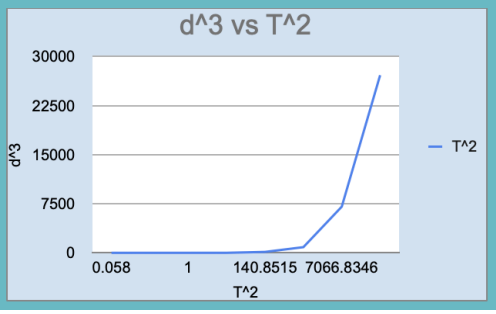

### b. Solution:

Below is the graph that is passing through the origin. By Kepler's Third law of planetary motion, T2 a $d$3. Hence, the law is proven.

### c. Solution:

Q6 c

| d | T | T^2 | d^3 |
|---|---|---|---|
| 0.387 | 0.241 | 0.0581 | 0.058 |
| 0.723 | 0.615 | 0.3782 | 0.3779 |
| 1 | 1 | 1 | 1 |
| 1.523 | 1.881 | 3.5382 | 3.5326 |
| 5.203 | 11.861 | 140.6833 | 140.8515 |
| 9.541 | 29.457 | 867.7148 | 868.5237 |
| 19.19 | 84.008 | 7057.3441 | 7066.8346 |
| 30.086 | 164.784 | 27153.7667 | 27232.8663 |




## Question 7:

### a. Solution:

We can get the graph of y = f(|x|) when the absolute value of the x-values in the function f(x) are taken.

The portion of the graph of f(x) that lies in the positive x-axis to the negative x-axis is shown.

When x is positive, the coordinate point becomes (x, y).

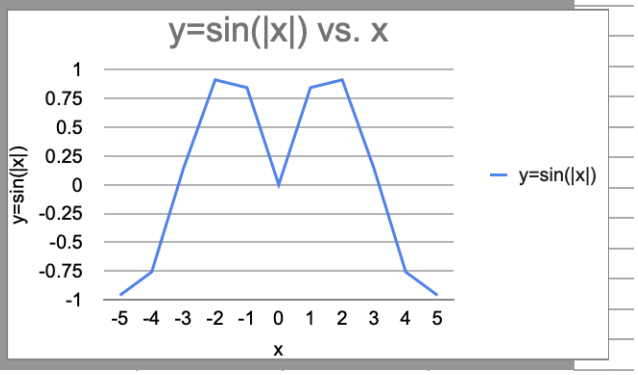
On the other hand, when x is negative, the coordinate becomes(-x,y). The absolute function is related equatorially by;

**y = f(|x|) = f(x) if x is positive.**

So, the graph of an absolute function is a reflection of the graph of f(x) at the y-axis when the value of x < 0 or negative.

Q7 a

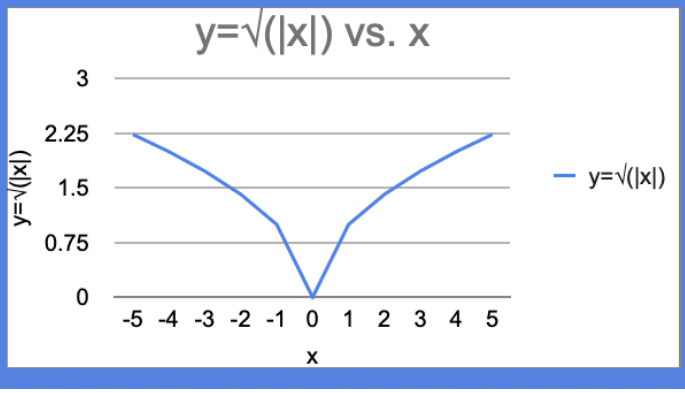
| x | y=sin(\|x\|) |
|---|---|
| -5 | -0.9589 |
| -4 | -0.7568 |
| -3 | 0.1411 |
| -2 | 0.9093 |
| -1 | 0.8415 |
| 0 | 0 |
| 1 | 0.8415 |
| 2 | 0.9093 |
| 3 | 0.1411 |
| 4 | -0.7568 |
| 5 | -0.9589 |




**b. Solution:**

Q7 b

| x | y=√(\|x\|) |
|---|---|
| -5 | 2.236067977499 |
| -4 | 2 |
| -3 | 1.732050807568 |
| -2 | 1.414213562373 |
| -1 | 1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 1.414213562373 |
| 3 | 1.732050807568 |
| 4 | 2 |
| 5 | 2.236067977499 |




## Question 8:

## Solution:

**a.** ***(g ∘ f) (6)***

=g (f(6))

= g(6)

It is undefined because g is not defined at 6.

**b.** ***(g ∘ g)(−2)***

= g (g(-2))

= g(1)

= 4

**c.** ***(f ∘ f) (4)***

= f (f(4))

= f (2)

= −2