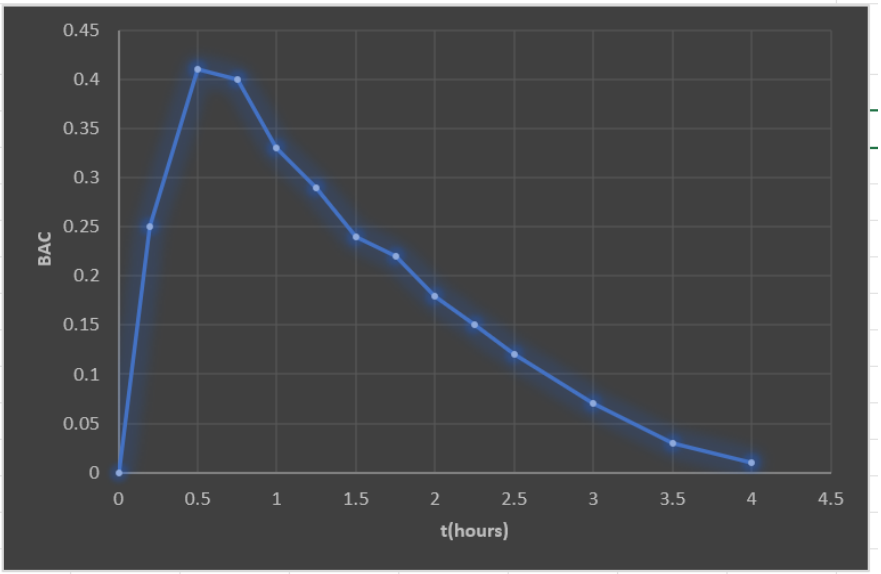
1. Researchers measured the blood alcohol concentration (BAC) of eight adult male subjects after rapid consumption of *30* mL of ethanol (corresponding to two standard alcoholic drinks). The table shows the data they obtained by averaging theBAC (in mg/mL) of the eight men.
    a. Use the readings to sketch the graph of the BAC as a function of *t* in Excel.
    b. Use your graph to describe how the effect of alcohol varies with time.

t **(hours)**	**BAC**
0	0
0.2	0.25
0.5	0.41
0.75	0.40
1	0.33
1.25	0.29
1.5	0.24
1.75	0.22
2.0	0.18
2.25	0.15
2.5	0.12
3.0	0.07
3.5	0.03
4.0	0.01

Answer for 1a

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



Answer of 1b

According to the graph, the blood alcohol concentration (BAC) shows a clear pattern after rapid alcohol consumption. Initially, at the start (t=0 hours), there is no alcohol detected in the blood, indicating a BAC of 0 mg/mL. As time progresses, the BAC gradually increases, with a rapid rise observed in the first few hours. In just 0.5 hours, the BAC reaches its peak at 0.41 mg/mL.

Following this peak, the rate of increase in BAC starts to diminish. Over the next hour (1.5 hours in total), the BAC decreases to 0.24 mg/mL. This suggests that the absorption of alcohol into the bloodstream slows down compared to the initial rapid phase.

Beyond the 1.5-hour mark, the BAC continues to decline, although at a slower rate. This gradual decrease eventually leads to a BAC of 0.01 mg/mL after 4 hours. It is important to note that the rate of elimination becomes less pronounced during this phase compared to the earlier hours.

In summary, after consuming alcohol rapidly, the BAC initially rises quickly, peaks at 0.41 mg/mL within half an hour, and then gradually decreases. The absorption rate slows down, leading to a slower decline in BAC over time until it reaches a negligible level after approximately 4 hours.

2.Find an expression for the function whose graph is the given curve in the tophalf of the circle $x2 + (y — 2)4 = 4$, and then plot it in Excel or any computer language.

→ For finding the expression for function f(x) or we first rearrange the equation.

The given equation is: $x^2 + (y-2)^4 = 4$

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

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

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

Therefore,

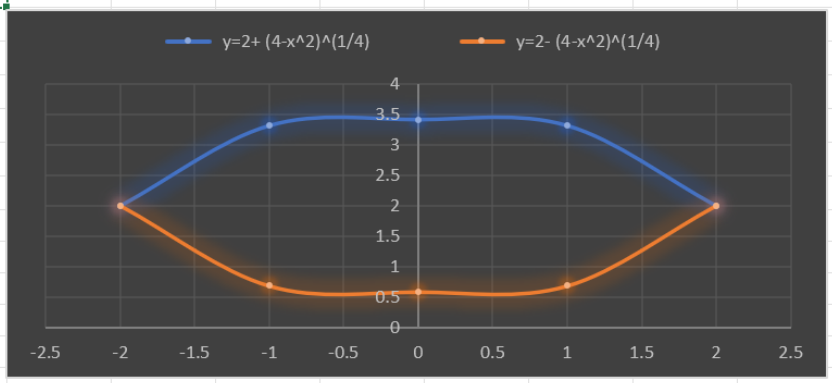
$y = 2 + \sqrt[4]{4 - x^2}$

OR,

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

Answer for no 2

x	-x^2)^(1/	(4-x^2)^(1/4)
-2	2	2
-1	3.31607	0.68393
0	3.41421	0.58579
1	3.31607	0.68393
2	2	2



3. In a certain country, income tax is assessed as follows. There is no tax on income up to *$10,000*. Any income over *$10,000* is taxed at a rate of *10%*, up to an incomeof *$20,000*. Any income over *$20,000* is taxed at *15%*.

a. Sketch the graph of the tax rate *R* as a function of the income *I* in Excel.

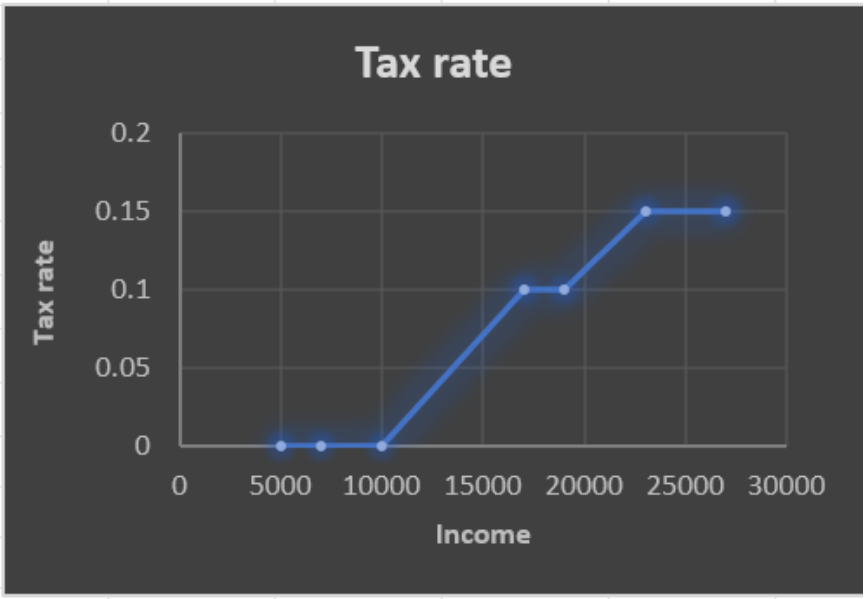
b. How much tax is assessed on an income of *$14,000*? On *$26,000*?

c. Sketch the graph of the total assessed tax *T* as a function of the income *I* in Excel.

Answer for a

Answer of 3A and 3C

Income	Tax rate
5000	0
7000	0
10000	0
17000	0.1
19000	0.1
23000	0.15
27000	0.15



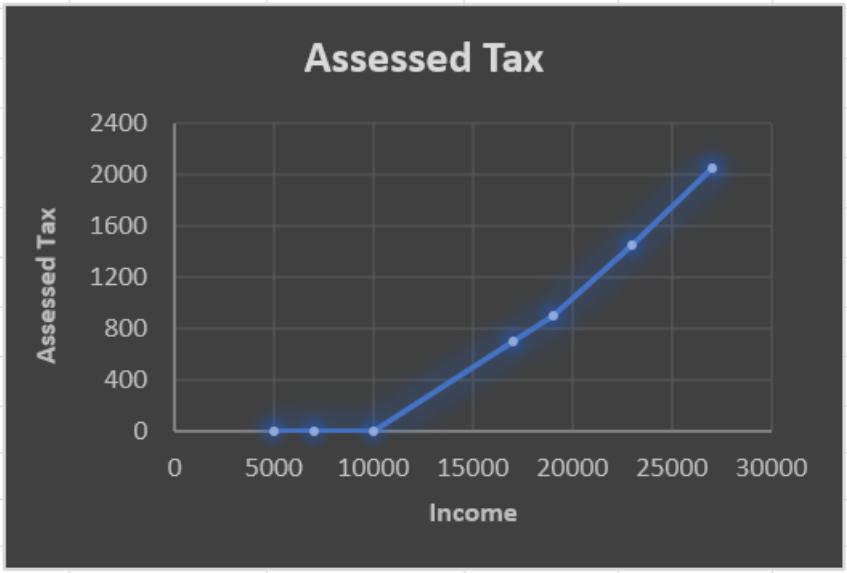
Answer for 3b

To calculate the tax assessed on an income of $14,000, we first determine the taxable amount by subtracting the non-taxable portion ($10,000) from the total income ($14,000 - $10,000 = $4,000). The taxable amount of $4,000 is then multiplied by the tax rate of 10% (0.10) to obtain the tax assessed: $4,000 * 0.10 = $400.

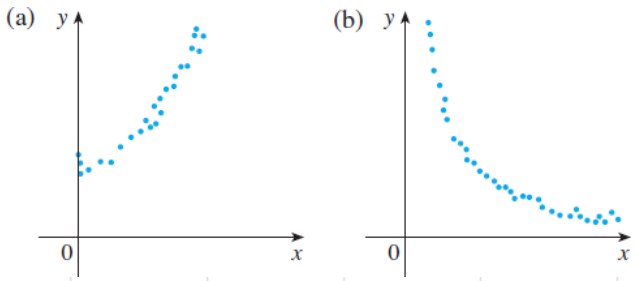
For an income of $26,000, we follow a similar approach. The non-taxable portion remains $10,000, so we subtract this from the total income to determine the taxable amount: $26,000 - $10,000 = $16,000. For the first portion of $10,000, taxed at a rate of 10%, the tax assessed is calculated as $10,000 * 0.10 = $1,000. For the remaining amount of $6,000, taxed at a rate of 15%, the tax assessed is obtained by multiplying $6,000 by 0.15: $6,000 * 0.15 = $900. Finally, we sum up the two tax amounts to get the total tax assessed: $1,000 + $900 = $1,900.

Answer for 3c

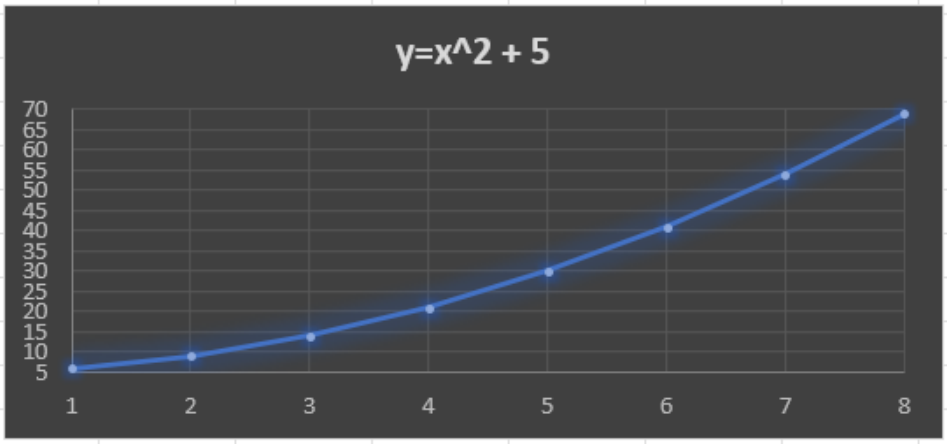
Income	ssessed Tax
5000	0
7000	0
10000	0
17000	700
19000	900
23000	1450
27000	2050



4. Decide what type of function you might choose as a model for the given data as follows by selecting fitting function in Excel. Of course, before fitting, the x-y values should be created based on your observation.

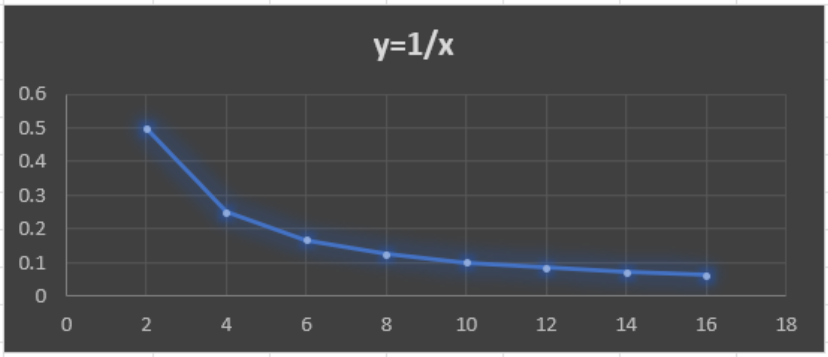


x	y=x^2 + 5
1	6
2	9
3	14
4	21
5	30
6	41
7	54
8	69



For b

x	y=1/x
2	0.5
4	0.25
6	0.16667
8	0.125
10	0.1
12	0.08333
14	0.07143
16	0.0625



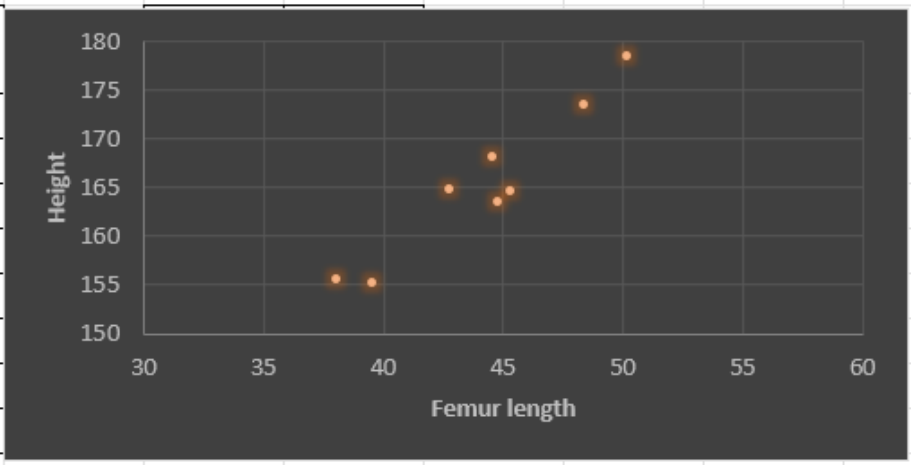
5. Anthropologists use a linear model that relates human femur (thighbone) length to height. The model allows an anthropologist to determine the height of an individual when only a partial skeleton (including the femur) is found. Here we find the model by analyzing the data on femur length and height for the eight males given in the following table.

a. Make a scatter plot of the data in Excel.
b. Find and graph the regression line that models the data.
c. An anthropologist finds a human femur of length *53* cm. How tall was the person?

Femur length (cm)	Height (cm)
50.1	178.5
48.3	173.6
45.2	164.8
44.7	163.7
44.5	168.3
42.7	165.0
39.5	155.4
38.0	155.8

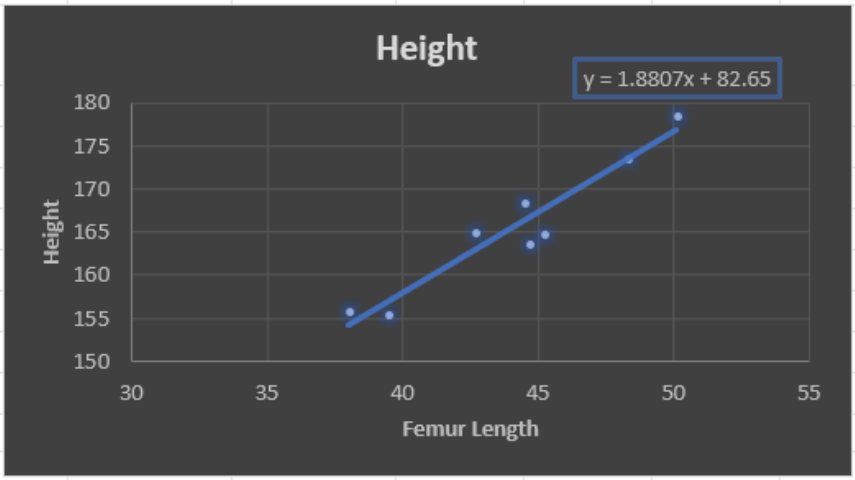
Answer of 5A

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



Answer of 5B

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



Based on the graph, the regression equation is y=1.8807x + 82.65.

Answer of 5c

Let's consider the given equation: y = 1.8807x + 82.65, where y represents the height and x represents the femur length.

Given that the femur length (x) is 53 cm, we can substitute this value into the equation to find the corresponding height (y). By plugging in x = 53, we get:

y = 1.8807 * 53 + 82.65
y = 99.7871 + 82.65
y = 182.4371 cm

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

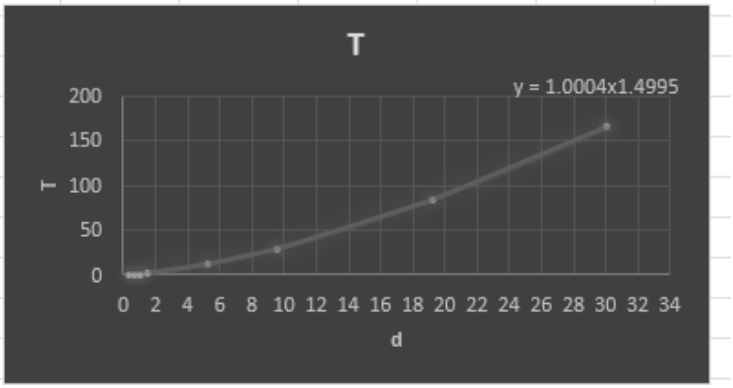
6. The table shows the mean (average) distances *d* of the planets from the sun (taking the unit of measurement to be the distance from the earth to the sun) and their periods *T (*time of revolution in years).

a. Fit a power model to the data in Excel
b. Kepler's Third Law of Planetary Motion states that "The square of the period of revolution of a planet is proportional to the cube of its mean distance from the sun."
c. Does your model corroborate Kepler's Third Law?

Planet	**d**	**T**
Mercury	0.387	0.241
Venus	0.723	0.615
Earth	1.000	1.000
Mars	1.523	1.881
Jupiter	5.203	11.861
Saturn	9.541	29.457
Uranus	19.190	84.008
Neptune	30.086	164.784

Ans of a

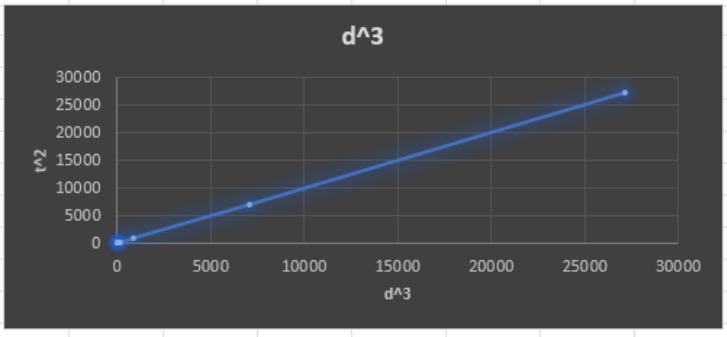
	Planet	d	T
76			
77	**Planet**	**d**	**T**
78	Mercury	0.387	0.241
79	Venus	0.723	0.615
80	Earth	1	1
81	Mars	1.523	1.881
82	Jupiter	5.203	11.861
83	Saturn	9.541	29.457
84	Uranus	19.19	84.008
85	Neptune	30.086	164.784



Ans of b and c

By Kepler's Third law of planetory motion, T2 a *d*3. Here, the graph is of straight line passing through the origin. Hence, the law is proven.

d	T	T^2	d^3
0.387	0.241	0.0581	0.0580
0.723	0.615	0.3782	0.3779
1	1	1.0000	1.0000
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



7. How is the graph of $y = f(|x|)$ related to the graph of *f(x)?*

a. Sketch the graph of $y = sin(|x|)$ in Excel.

b. Sketch the graph of $y = \sqrt{|x|}$ in Excel.

Ans:

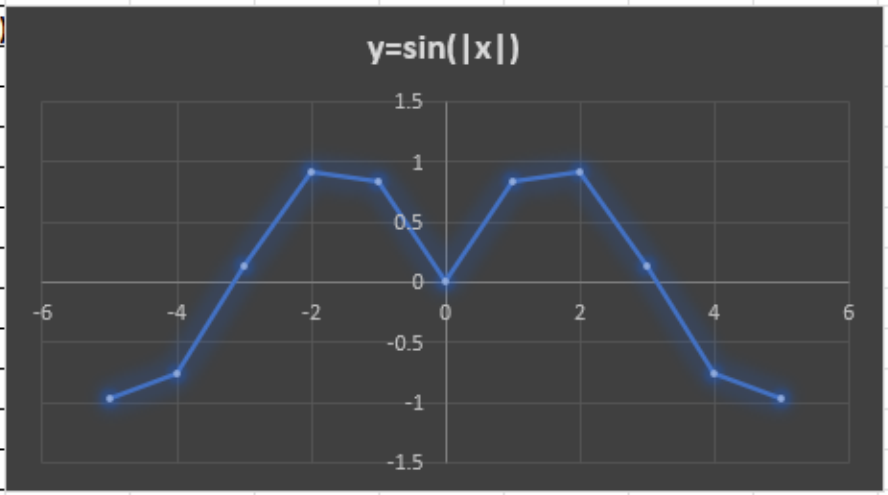
The graph of y = f(|x|) is obtained by taking the absolute value of the x-values in thefunction f(x). It reflects the portion of the graph of f(x) that lies in the positive x-axis to the negative x-axis.If x is positive , the coordinate point becomes (x, y). However, if x is negative, the coordinate becomes(-x,y).

The absolute function is related equationally by:

y = f(|x|) = f(x) if x is positive . So, the graph of absolute function is areflection the graph of f(x) at y-axis when the value of x < 0 or negative.

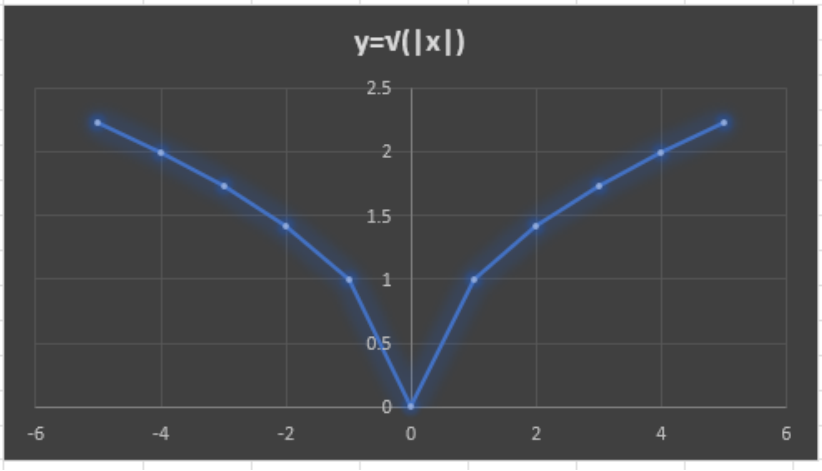
Ans of a

x	y=sin(|x|)
-5	-0.9589
-4	-0.7568
-3	0.1411
-2	0.9093
-1	0.8415
0	0.0000
1	0.8415
2	0.9093
3	0.1411
4	-0.7568
5	-0.9589



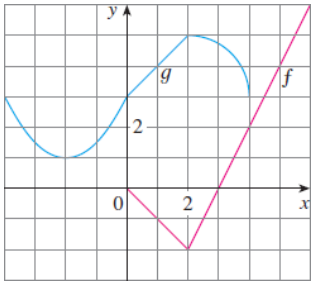
Ans of b

x	y=√(|x|)
-5	2.23607
-4	2
-3	1.73205
-2	1.41421
-1	1
0	0
1	1
2	1.41421
3	1.73205
4	2
5	2.23607



8. Use the given graphs of f and g to evaluate each expression or explain why it is undefined.

a. $(g \circ f)(6)$ b. $(g \circ g)(-2)$ c. $(f \circ f)(4)$



a. $(g \circ f)(6)$
=g (f(6))
= g(6)
It is undefined because g is not defined at 6.

b.$(g \circ g)(-2)$
= g (g(-2))
= g(1)
= 4

c. $(f \circ f)(4)$
= f (f(4))
= f (2)
= −2