

Basic Concepts

Aim

- To familiarise the GeoGebra interface and Toolbar.
- To familiarise the concept of domain, range and graphs of standard functions.

Concepts

- Domain, range and graphs of functions.

Activity 0.1 GeoGebra Interface

Procedure:

- Familiarise the interfaces of GeoGebra
- Familiarise the Toolbar and some important tools of GeoGebra.

Activity 0.2 Graph of a function

Procedure:

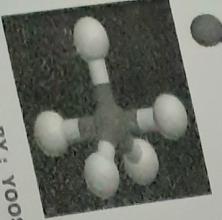
- Create a slider a with increment 1 as follows.

Using Slider tool click anywhere on the Graphics View. We get a window in which we can edit the name, minimum

value, maximum value, and increment of the slider.

- Plot the point $A(a, a^2)$. (Input: $A = (a, a^2)$)
 - Change the value of the slider and observe the movement of A .
- We can change the value of a slider in different ways.
- Click and drag the slider point.
 - Using Move tool click on the slider point and then use arrow key to change the value.
 - Right click on the slider and select Animation On.
 - Create an input box for the slider and change the value.

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- Q₁) Observe the curve traced. What does it represent?
- It represents the graph of $y = x^2$
- Q₂) Observe the curve traced. What does it represent?
- It represents the graph of $y = x^3$

- Q₁) Observe the curve traced. What does it represent?
- Change the increment of the slider to 0.01.
(Right click on the slider → object properties → Slider → Enter 0.01 in the Increment box.)
 - Observe the movement of the point.
 - Trace the point A. (Right click on the point, Trace on.)

- Q₂) Observe the curve traced. What does it represent?
- Create an Input Box for the point A.
 - Change the definition of the point A as (α, α^3) . (In the Input Box enter (α, α^3))
- Q₃) Observe the curve traced. What does it represent?
- The definition become $A = (\alpha, \alpha^3)$
- Q₃) What should be the definition of the point A, so that the curve represents the graph of the function $f(x) = x^4$?

Activity 0.3 Standard Functions

Procedure :

- Draw the graphs of standard functions using inputs

Functions	Input	Domain	Range
x	x	\mathbb{R}	\mathbb{R}
x^2	x^2	\mathbb{R}	$[0, \infty)$
$ x $	$\text{abs}(x)$	\mathbb{R}	$[0, \infty)$
\sqrt{x}	$\text{sqr}(x)$	$[0, \infty)$	$[0, \infty)$
x^3	x^3	\mathbb{R}	\mathbb{R}
$[x]$	$\text{floor}(x)$	\mathbb{R}	\mathbb{Z}
$\frac{1}{x}$	$\frac{1}{x}$	$\mathbb{R} - \{0\}$	$\mathbb{R} - \{0\}$
Signum function	$\text{Sign}(x)$	\mathbb{R}	$\{-1, 0, 1\}$

- Q4) Observe the graph and find its domain and range.

Activity 0.4 Domain and Range

Procedure:

- Create an integer slider n
(Using Slider tool click anywhere on the Graphics → Select Integer → click OK. If we want we can change the minimum, maximum and increment of the slider.)
- Draw the graph of $f(x) = x^n$
[Input : $f(x) = x^n$]

- ⑤ Observe the graph of the function x^n and find the domain and range for different values of n
- ⑥ What happens to the graph of the function x^n between -1 and 1 as n becomes larger and larger? why?

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Q) As ' n ' increases, portion of the graph in -1 and 1 approaches more and more close to x -axis

n	Function	Domain	Range
1	x	R	R
2	x^2	R	$[0, \infty)$
3	x^3	R	R
4	x^4	R	$[0, \infty)$
5	x^5	R	R

Lab 1

Activity 1.1 Functions

Procedure

- Draw the graph of $f(x) = x^0$.
- Create a number slider α with increment 0.01.
- Plot the points $A(\alpha, 0)$, $B(\alpha, f(\alpha))$, $C(0, f(\alpha))$.
(Give inputs like $A = (\alpha, 0)$).
- Draw the line segments AB and BC using Segment tool.
- Show the coordinates of A, B and C .
- Now drag the point A along the x axis (either click and drag the point or using slider - click and drag the slider point to change the value of α) and observe the movement of C on the y axis.

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Ans:-

	$3^{\frac{1}{3}}$	$\sqrt[3]{8}$	$2^{\frac{3}{2}}$	$\sqrt{5}$	$(3 \cdot 46)^{-\frac{1}{2}}$
Function	$x^{\frac{1}{3}}$	\sqrt{x}	$x^{\frac{3}{2}}$	\sqrt{x}	$x^{-\frac{1}{2}}$
Input(x)	3	1.8	2	$\sqrt{5}$	0.155
Value $f(x)$	1.442	1.342	1.587	1.495	3.46

Activity 1.2 Values of Function

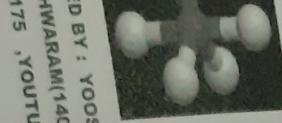
Procedure :

- Open the file Activity 1.1 and save as Activity 1.2

- Create an Input Box for f and change the function using it.

(Select Input Box tool, → Click on Graphics View
 → give a suitable caption (say function) →
 Linked Object → $f(x) = x^0 \rightarrow$ OK)
 Similarly create an Input Box for the Slider

- Change the functions accordingly and find the approximate values correct to 3 decimal places of the following.



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Q) $(2 \cdot 3)^3 = 41.28$ 5.29

$$(-1.8)^3 = -5.832$$

$$(0.9)^8 = 0.81$$

$$(2.9)^3 = 8.41$$

FOCUS 1

FOCUS 2

Ans ⁿ balance	$\sin x$	$\log x$	e^x
5	4	3	
0.959	0.602	20.086	

Ansⁿ) The point A approaches to 0 from the

- right of the origin. The point C tends to infinity & the point A approaches to 0 from the left of the origin the point C tends to $-\infty$

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Ansⁿ) C moves from integer to integer.

range of the function = Z

- Three switches are provided on the machine
- GREEN :- Click to start the machine
- RED :- Click to stop the machine
- BLUE :- Click to reset,

(a) Change the function to $f(x) = \frac{1}{x}$, and observe how the point C moves as the point A approaches the origin from either side

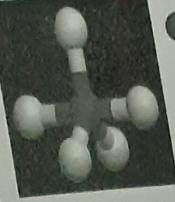
Activity 1.3 Function Machine

Procedure:

Use Applet ML 1.3

About the Applet

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Answ(i) $\sqrt{2} = 1.41$

ii) $\sqrt{-8}$ = +16 1.34

iii) $\sqrt{\frac{2}{3}} = 0.81$ 0.82

Ans⁻) $f(x)$ is not defined, because, domain

is $[0, \infty)$

Answ(i) i) $\frac{2}{3} = 0.67$

ii) $\frac{-3}{7} = -0.43$

iii) $\sqrt{\frac{2}{3}} = 0.82$

Using Input Boxes we can change the function and the input number.

The warning light provided on the machine turns red if the input number is out of the domain of the function.

Q₁) Change the function to $f(x) = \sqrt{x}$ and find the values of the following.

i) $\sqrt{2}$ ii) $\sqrt{-8}$ iii) $\sqrt{\frac{2}{3}}$

Q₂) What happens if we give a -ve number as the input?

Q₃) Change the function to $f(x) = \frac{1}{x}$ and find the values of the following.

i) $\frac{2}{3}$ ii) $\frac{-3}{4}$ iii) $\sqrt{\frac{2}{3}}$

• What happens if the input is 0?

Ans⁻ • Input is 0

function is not defined. Because,

domain = $R - \{0\}$

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Lab 2

Shifting of Graphs

Aim

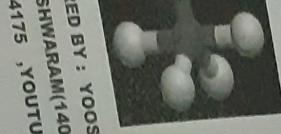
To analyse the changes in the graph of a function according to some slight changes in the definition.

Concepts

- Graph of a function

Q) Observe how the graph of $g(x) = f(x) + a$ changes according to a .

- Create Input Boxes for editing function and slider 'a'
- Save this as Activity 2.1



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Activity 2.1 Shifting of graphs : $f(x)+a$

Procedure :

- Draw the graph of $f(x) = x^a$
- Create a number slider 'a' with range -1 to 1.
- Draw the graph of $g(x) = f(x) + a$
(Input: $f+a$)

FOCUS 1

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Ans₁) The graph of $g(x)$ moves upward, if a is +ve

by a unit, if $g(x)$ moves vertically

downwards by a unit, if a is -ve

shifting vertically

Function	Domain	Range	Shifting
$f(x)$	R	$[0, \infty)$	vertical
$[x]$	R	Z	vertical
x^3	R	R	vertical
x^2	R	$[0, \infty)$	vertical

The graph shift horizontally a unit toward left of the origin when a is +ve and toward right when a is -ve

Activity 2.2 Shifting of graphs: $f(x+a)$

Procedure :

- Open a new GeoGebra window.

- Draw the graph of $f(x) = x^3$.

- Create a number slider 'a' with increment 0.1

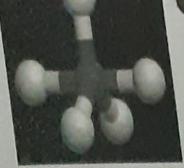
- Draw the graph of $g(x) = f(x+a)$.
(Input : $f(x+a)$)

Q₆) Observe how the graph of $g(x)$ changes according to 'a'.

- Create Input Boxes for the function 'f' and slider 'a'.

Q₇) Generalise the above observations with different functions such as $|x|$, $[x]$, x^3 etc.

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Activity 2.3 Reflection of a graph

- You may use the animation option to change the slider
 - Save this as Activity 2.2
- Procedure :
- Open a new Geogebra window.
 - Draw the graph of $f(x) = x^a$.
 - Draw the graph of $g(x) = -f(x)$ and $g(x)$ (Input : $-f$)
 - Save this file as Activity 2.3

- Q_(b)) Compare the graph of $f(x)$ and $g(x)$
- Create an Input Box for f and change the function to .

$$(i) x^2+2 \quad (ii) x^3-1 \quad (iii) |x|-1$$

$$(iv) |x-1| \quad (v) [x] \quad (vi) x^3+2x+1$$

$$(vii) \frac{1}{x}$$

- Q_(c)) Compare the graph of 'f' and 'g' in each case. Write your findings.

(Ans Q₁₉) $f(x)$ and $g(x)$ are reflection about x -axis

Activity 2.4 Reflection of a graph: $f(-x)$

Procedure :

- Open a new GeoGebra window
- Draw the graph of $f(x) = x^3$
- Draw the graph of $g(x) = f(-x)$
(Input: $f(-x)$)

(Q) Compare the graph of $f(x)$ and $g(x)$

• Create an Input Box for f and

change the function

- (i) $\frac{1}{x}$
- (ii) $[x]$
- (iii) $|x|$
- (iv) x^2
- (v) $(x-2)^2$

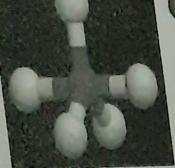
Ans
(Q) $f(x)$ and $g(x)$ are reflection on y -axis

(Q₂₁) Compare the graph of f and g in each case. Write your findings.

Function	Domain	Range	Domain of $g(x)$	Range of $g(x)$
x^2	R	$[0, \infty)$	R	$(-\infty, -x]$
x^{-1}	R	$(1, \infty)$	R	$(-\infty, 1]$
$ x $	R	$[0, \infty)$	R	$(-\infty, 0]$
$ x $	R	$[0, \infty)$	R	$(-\infty, 0]$
x^3	R	Z	R	Z
$x^3 + 2x + 1$	R	$[0, \infty)$	R	$(-\infty, 0]$
$\frac{1}{x}$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$



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Q2)	Function	Domain	Range	Range in $f(x)$	Range in $g(x)$
	$\frac{1}{x}$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$
	$ x $	R	R^2	R	R
	x^2	R	$[0, \infty)$	R	$[0, \infty)$
	x^n	R	$[0, \infty)$	$[0, \infty)$	$[0, \infty)$
	even	R	$[0, \infty)$	$[0, \infty)$	$[0, \infty)$
	odd	R	R	R	R
	neither	R	$[0, \infty)$	R	$[0, \infty)$
	$(x-2)^2$	R	R	R	R

- 27) x^2 for even function reflection is same
- 28) $|x|$ & x^2 are even functions
- 29) $\frac{1}{x}$ & $|x|$ are odd functions
- 30) $(x-2)^2$

Q22) What is the speciality of the graph of odd and even functions?

Q23) Identify odd and even functions discussed in this lab.

Q24) Is there any function which is neither odd nor even?

• Save this file as Activity 2.4.

Lab 4

Trigonometric Function

Activity 4.1 - Values of Trigonometric Function

Procedure :

Open a new Geogebra window, do some initial settings as follows

Options → Advanced → Angle unit → Radian.

Plot the point $O(0,0)$ (input $O = (0,0)$)

Draw a unit circle centred at the origin O

Plot the point $A(1,0)$ (input $A = (1,0)$)

Create a number slider α with min = -10, max = 10 and increment 0.01. While

creating the slider, set its animation as increasing

Plot another point A' such that $\angle AOA' = \alpha$ radial

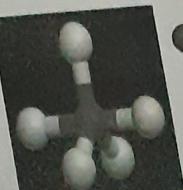
Rename the point A' as P (right click → Rename)

Show the coordinates of P

Join OP using a line segment

PLUS ONE

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Concepts

- To create an applet to find the values of trigonometric functions and plot their graphs
- To establish some behaviours of trigonometric functions in different quadrants.

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Create an input box for the slider α .

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Q.) Domain of $\sin x = \mathbb{R}$

Range of $\sin x = [-1, 1]$

Q.) Domain of $\cos x = \mathbb{R}$

Range of $\cos x = [-1, 1]$

Q.) Values of x for $\sin x = 0$

$$\sin x = 0, x = \pi, 2\pi, 3\pi, 4\pi, -\pi, -2\pi$$

$$\sin x = 1,$$

$$x = -\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, \frac{5\pi}{2}, \dots$$

$$\sin x = -1,$$

$$x = -\frac{5\pi}{2}, -\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{3\pi}{2}, \frac{7\pi}{2}, \dots$$

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Q.) Animate the slider, observe the coordinates of the point P, hence find the domain and range of $\sin x$ and $\cos x$

Q.) Find the values of $\sin x$ and $\cos x$ for the given values of x .

x	$\frac{\pi}{3}$	$\frac{\pi}{4}$	$\frac{\pi}{6}$	$\frac{\pi}{2}$	0.3	0.6	0.9	-1.5	-3.1	-7.5
$\sin x$	0.87	0.71	0.5	1	0.3	0.5	0.9	-1	-0.04	0.94
$\cos x$	0.5	0.71	0.87	0	0.96	0.83	0.4	0.09	-1	0.35

Q.) Identify the values of x for which $\sin x$ and $\cos x$ become 0, 1, -1.

Save this file as Activity 4.1

$$\cos x = 0, x = -\frac{5\pi}{2}, -\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, \frac{3\pi}{2}, \dots$$

$$\cos x = 1, x = -2\pi, 0, 2\pi, \dots$$

$$\cos x = -1, x = -3\pi, -\pi, \pi, 3\pi, \dots$$

Activity 4.2 - Graphs of Trigonometric Functions - 1

Q) The path of B represent the graph of $\sin x$

Procedure :

- Save file Activity 4.1 as Activity 4.2 using save as option
- Open Graphics & [view → Graphics 2]
- Plot the point $B(a, y(p))$, $[y(p)]$ gives the y coordinate of P]
- Give trace to this point and animate the slider.
- Q) Observe the path of this point. What does this path represent?
- Save the file

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Q56) The path represent the graph of $\cos x$.

Q7) Redefine B as $(a, \frac{1}{y(p)})$, the path of B represent the

graph of $\operatorname{cosec} x$

Redefine B as $(a, \frac{y(p)}{x(p)})$. The path of B represent the graph of $\tan x$.

Activity 4.3 - Graphs of Trigonometric functions II

Procedure :

- Open Activity 4.2 and save as Activity 4.3 using save as option

- Create an input box for the point B

- Change the definition of B as $(a, x(p))$

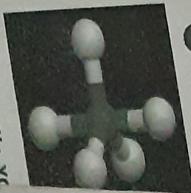
Q8) Observe the path of this point

Q9) What does this path represent?

Q10) Redefine B as $(a, \frac{1}{y(p)})$ and $(a, \frac{y(p)}{x(p)})$, observe the path of P and identify the functions

Q11) What should be the definition of B for getting the graphs of $\sec x$ and $\operatorname{cosec} x$?

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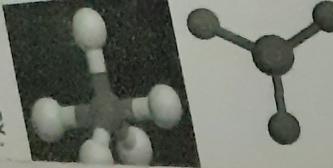


Q) Observe the values of trigonometric functions, write their domain, range and complete the following table

function	$(0, \frac{\pi}{2})$	$(\frac{\pi}{2}, \pi)$	$(\pi, \frac{3\pi}{2})$	$(\frac{3\pi}{2}, 2\pi)$
$\sin x$	Positive	Positive	Negative	Negative
	Increasing from 0 to 1	Decreases from 1 to 0	Decreases from 0 to -1	Increases from -1 to 0
$\cos x$	Positive	Negative	Negative	Positive
	Decrease from 1 to 0	Decreases from 0 to -1	Increases from -1 to 0	Increases from 0 to 1
$\tan x$	Positive	Negative	Positive	Negative
	Increases from 0 to ∞	Decreasing from 0 to $-\infty$	Increasing from $-\infty$ to 0	Decreasing from 0 to $-\infty$
$\sec x$				
$\csc x$				

$\cot x$	0 & $\pi/2$	$\pi/2$	$3\pi/2$	2π
$\operatorname{cosec} x$				

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**PLUS ON
FOCUS**PREPARED BY:
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9947444175, Y**Lab 10****Circle and Parabola**Ans

To explore different methods of drawing Circles and Parabolas using Geogebra tools and commands

Concepts

- Definitions of Circle and Parabola

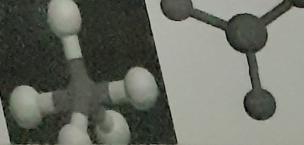
- Equations of Circle and Parabola

Activity 10.1 - Circle

We can draw a circle in different ways

- Centre and a point on the circle are given
 - Using **Circle with Centre through Point** tool, click on the centre and then on the point
- Give input in the following manner,
Circle (centre point, point)
- Centre and radius are given
 - Using **Circle with Centre and Radius** tool, click on the centre and enter radius
- Give input in the following manner,
Circle (Point, Radius)

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Q) 1) $(x+5)^2 + (y-3)^2 = 36$

Centre
 $= (-5, 3)$

Radius
 $= 6$

2) $x^2 + y^2 - 4x - 8y - 45 = 0$

$$\begin{aligned} x^2 - 4x + 4 + y^2 - 8y + 16 &= 45 + 16 + 4 \\ (x-2)^2 + (y-4)^2 &= \sqrt{65} \end{aligned}$$

Centre
 $= (2, 4)$

Radius
 $= \sqrt{65} = \sqrt{5}$

3) $2x^2 + 2y^2 - 8 = 0$

Centre
 $= (0, 0)$

Radius
 $= 2$

- Three points on the circle are given

- Using Circle through 3 points tool,

- Click on the points

- Give input in the following manner.

Circle (Point, Point, Point)

- Reput the equation of the circle

For example: $(x-1)^2 + (y-2)^2 = 4$ gives

$$\text{the circle } (x-1)^2 + (y-2)^2 = 4$$

- Q) Find the centre and radius of the following circles. Draw the circle and verify your answer. You can do it in any of the following ways.

- Draw the circle by direct input of the equation, find its centre and radius.

Compare with your answer.

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(Q) 1) Centre $(-2, 3)$, radius = 4

$$C: (x+2)^2 + (y-3)^2 = 16$$

2) Centre $(2, 2)$ and passing through the point $(4, 5)$

$$C: (x-2)^2 + (y-2)^2 = 13$$

$$(Q) 3) C: (x-3.5)^2 + (y+2.5)^2 = 32.5$$

$$2) C: (x-2.67)^2 + (y-3.67)^2 = 5.56$$

$$\begin{aligned} 1, (x+5)^2 + (y-3)^2 &= 36 \\ 2, x^2 + y^2 - 4x - 8y - 45 &= 0 \\ 3, 2x^2 + 2y^2 - 8 &= 0 \end{aligned}$$

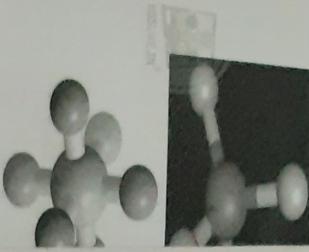
Q) Find the equations of the following circles
Input the equations obtained, draw the circles and verify your answer.

1, centre $(-2, 3)$ and radius 4

2, centre $(2, 2)$ and passing through the point $(4, 5)$

Q) Construct the following circles without using Circle through 3 Points tool or input commands

- Find the point of intersection of perpen-



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diagonals bisectors.

- Point of intersection of the centre of the circle
- Using centre point tool; draw the circle

- Passing through the points $(2,3)$ and $(-1,1)$ and with centre on the line $x-3y-11=0$
- Passing through the points $(1,2)$, $(5,4)$ and $(3,6)$
- If three points are given, how can we find the equation of the circle passing through them (without using GeoGebra)
Hint: above problem

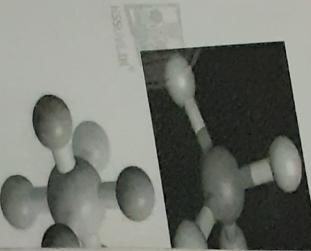
Activity 10.2 - Parabola 1

Procedure:

- Using the tool `Parabola` select a line and a point to get a parabola with the line as director and the point as focus.
- We can also draw a parabola using input command, for example, the input command `Parabola[(2,0), x+2=0]` gives

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Q) i) $y^2 = 8x$ focus = $(2, 0)$
 $y^2 = 4ax$ directrix $x + 2 = 0$

$$4a = 8$$

$$a = 2$$

$\Rightarrow c: y^2 - 8x = 0$

ii) $x^2 = 4y$

Focus, $(0, 1)$
 directrix, $y + 1 = 0$

$$4a = 4$$

$$a = 1$$

$\boxed{\text{directrix } y = 0}$ SOL ~~parabola~~

the parabola with focus $(a, 0)$ and directrix $x + 2 = 0$

~~• If A represents a point and f represents a line then the command Parabola [A, f] gives the parabola with focus A and directrix f~~

~~• Draw a line and plot a point. Draw the corresponding parabola. Change the distance between the line and the point, observe the corresponding change in the shape of the parabola.~~

Q) Find the focus and directrix of the following parabolas. Using Parabola tool, draw them. Check whether the equations of the parabola that you have drawn is same as the given

i) $y^2 = 8x$

ii) $x^2 = 4y$

iii) $x^2 = -4y$

iv) $y^2 = -10x$

Activity 10.3 - Parabola 2

Procedure :

- By giving the equation of the parabola directly in the input bar, we can draw the parabola
- Create a slider a and give the input $y^2 = 4ax$ and $x^2 = 4ay$
- Q) Change the value of a and observe the shape of the parabolas
- Q) Find the focus and length of latus rectum of the following parabolas. Verify your answer geometrically as follows:

Solved Ex 3.01 (Parabola)

Input the equation and draw the parabola. Using focus command (`Focus[Name of parabola]`), we can find its focus. Draw the line through the focus and perpendicular to the axis of the parabola. Mark the points of intersection of this line with the parabola and join them with a line segment. Hide the line and measure the length of the latus rectum.

$$\begin{array}{ll} \text{i) } y^2 = 6x & \text{ii) } x^2 = -8y \\ \text{iii) } x^2 = 10y & \text{iv) } y^2 = -4x \end{array}$$

19/06/23

LAB - 0 BASIC CONCEPTS

Aim :

- To familiarise the Geogebra interface and Toolbar.
- To familiarise the concepts of domain, range and graphs of standard functions.

Concepts

- Domain, range and graphs of functions.

> Activity 0.1 Geogebra Theory

Procedure :

- Familiarise the interface of Geogebra.
- Familiarise the Toolbar and some important tools of Geogebra.

> Activity 0.2 Graph of a function

Procedure :

- Create a slider 'a' with increment 1 as follows.
Using Slider tool click anywhere on the Graphics view. We get a window in which we can edit the name, minimum value, maximum value, and increment of the slider.

• Plot the point $A(a,a)$, $(\text{Input : } A(a,a))$ on (a,a^2) .

- Change the value of the slider and observe the change of A.
We can change the value of a slider in different ways.

- Click and drag the slider point.
- Using Move tool click on the slider point and then use arrow key to change the value.

- Right click on the slider and select Animation On

- Create an input box for the slider and change the value

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- Change the increment of the slider to 0.1.
(Right click on the slider → object properties → Slider → Enter 0.01 in the Increment box)
- Observe the movement of the point.
- Trace the point A (Right click on the point → Trace on)
- Q) Observe the curve traced. What does it represent?

It represents the graph of $y = x^2$.

- Create an Input Box for the point A
- Change the definition of the point A as (a, a^2) (In the Input Box enter (a, a^2))
- Observe the curve traced. What does it represent?

It represents the graph of $y = x^3$.

- QH** Q) What should be the definition of the point A, so that the curve represents the graph of the function $f(x) = x^n$?
- ANSWER** The definition become $A = (a, a^n)$.

Activity 0.3 Standard Functions

Procedure:

- Draw the graph of standard functions using inputs

Functions	Input	Domain	Range
x^2	x^2	\mathbb{R}	$[0, \infty)$
x	x	\mathbb{R}	\mathbb{R}
$ x $	$abs(x)$	\mathbb{R}	$[0, \infty)$
\sqrt{x}	$sqrt(x)$	$[0, \infty)$	$[0, \infty)$
x^3	x^3	\mathbb{R}	\mathbb{R}
$\frac{1}{x}$	$float(x)$	\mathbb{R}	\mathbb{Z}
Signum Function	$Sign(x)$	$\mathbb{R} - \{0\}$	$\mathbb{R} - \{0\}$
Signum Function	$Sign(x)$	\mathbb{R}	$[-1, 0, 1]$

- 3
- Q) Observe the graph and find its domain and range.

> Activity 0.4 Domain and Range

Procedure:

- Create an integer slider n (Using Sliders tool click anywhere on the Graphics → Select, Integer → click OK. If we want we can change the minimum, maximum and increment of the slider)
- Draw the graph of $f(x) = x^n$ [Input : $f(x) = x^n$]
- Observe the graph of the function x^n and find the domain and range for different values of n

n	Function	Domain	Range
1	x	R	R
2	x^2	R	$[0, \infty)$
3	x^3	R	R
4	x^4	R	$[0, \infty)$
5	x^5	R	R

- Q) What happens to the graph of the function x^n between -1 and 1 as n becomes large and negative?
- As n increases, position of the graph in -1 and 1 approaches more and more close to x-axis.

36/112

ONE CHEMISTRY S 2022, Session

LAB - 1 VALUE OF FUNCTION



JTKG
KASARA
CHANNEL

Aim : To construct an applet to establish geometrically the correspondence of a number and its image under a function.

To use this applet to find the images of numbers under various functions.

To use an applet to visualise the comparison of a function with an input-output machine.

Concepts

- Image of a number a under a function f is denoted by $f(a)$
- Graph of the function f is the collection of points $(a, f(a))$

> Activity 1.1 Function

Procedure :

Draw the graph of $f(x) = x^2$
Create a number slider a with increment 0.01

Plot the points $A(a, 0)$, $B(a, f(a))$, $C(0, f(a))$. (Give inputs like $A(-a, 0)$)

Draw the line segments AB and BC using Segment tool

Show the coordinates of A , B and C .
Now drag the point A along the x -axis (either click and drag the point or using slider-click and drag the slider point to change the value of a) and observe the movement of C on the y -axis

Function	$3^{\frac{1}{a}}$	$\sqrt[3]{8}$	$a^{\frac{1}{3}}$	$\sqrt[3]{x}$	$(3-x)^{\frac{1}{3}}$	$\sin x$	$\log x$	e^x
Print(x)	3	1.8	2	$\sqrt[3]{x}$	$x^{\frac{1}{3}}$	$\sin x$	$\log x$	e^x
Value($f(a)$)	1.442	1.342	1.587	1.495	3.146	5	4	3

• B1

• B2

• C1

• C2

• D1

• D2

• E1

• E2

• F1

• F2

• G1

• G2

• H1

• H2

• I1

• I2

• J1

• J2

• K1

• K2

• L1

• L2

• M1

• M2

• N1

• N2

• O1

• O2

• P1

• P2

• Q1

• Q2

• R1

• R2

• S1

• S2

• T1

• T2

• U1

• U2

• V1

• V2

• W1

• W2

• X1

• X2

• Y1

• Y2

• Z1

• Z2

03/07/23

Q) Using this, find the values of $(-2 \cdot 3)^2$, $(-1 \cdot 8)^2$, $(0 \cdot 9)^2$ & 9^2 .

$$(-2 \cdot 3)^2 = 5 \cdot 36, (-1 \cdot 8)^2 = 2 \cdot 64, (0 \cdot 9)^2 = 0 \cdot 81, (2 \cdot 9)^2 = 8 \cdot 81$$

Success Function

Procedure:
1. Open the file Activity 1.1 and save as Activity 1.2

- Create an Input Box for a and change the function using it.
- Select Input Box tool \Rightarrow Click on Graphics View \Rightarrow give a suitable Caption (say function) \Rightarrow Linked Object \Rightarrow $f(a)=a^2 \Rightarrow$ OK

- Similarly, create an Input Box for the slider

- Q) Change the function to $f(x) = \frac{1}{x}$, and observe how the point C moves as the point A approaches the origin from either side.
The point A approaches 0 from the right
The point C tends to infinity and the point A approaches 0 from the left of the origin the point C tends to $-\infty$

- Q) Change the function to $f(x) = [x]$ and observe the movement of C according to A.

C moves from integer to integer. Reason

range of the function = \mathbb{Z}

Activity 1.3 Function Machine

Procedure:

Use Applet ML 1.3

About the Applet

Three switches are provided on the machine.

- GREEN : Click to start the machine
- RED : Click to stop the machine
- BLUE : Click to reset.

4

Activity 1.2 Values of Function

Procedure:
1. Open the file Activity 1.1 and save as Activity 1.2

- Create an Input Box for a and change the function using it.
- Select Input Box tool \Rightarrow Click on Graphics View \Rightarrow give a suitable Caption (say function) \Rightarrow Linked Object \Rightarrow $f(a)=a^2 \Rightarrow$ OK

- Similarly, create an Input Box for the slider

- Q) Change the function to $f(x) = \frac{1}{x}$, and observe how the point C moves as the point A approaches the origin from either side.
The point A approaches 0 from the right
The point C tends to infinity and the point A approaches 0 from the left of the origin the point C tends to $-\infty$

- Q) Change the function to $f(x) = [x]$ and observe the movement of C according to A.

C moves from integer to integer. Reason

range of the function = \mathbb{Z}

Activity 1.3 Function Machine

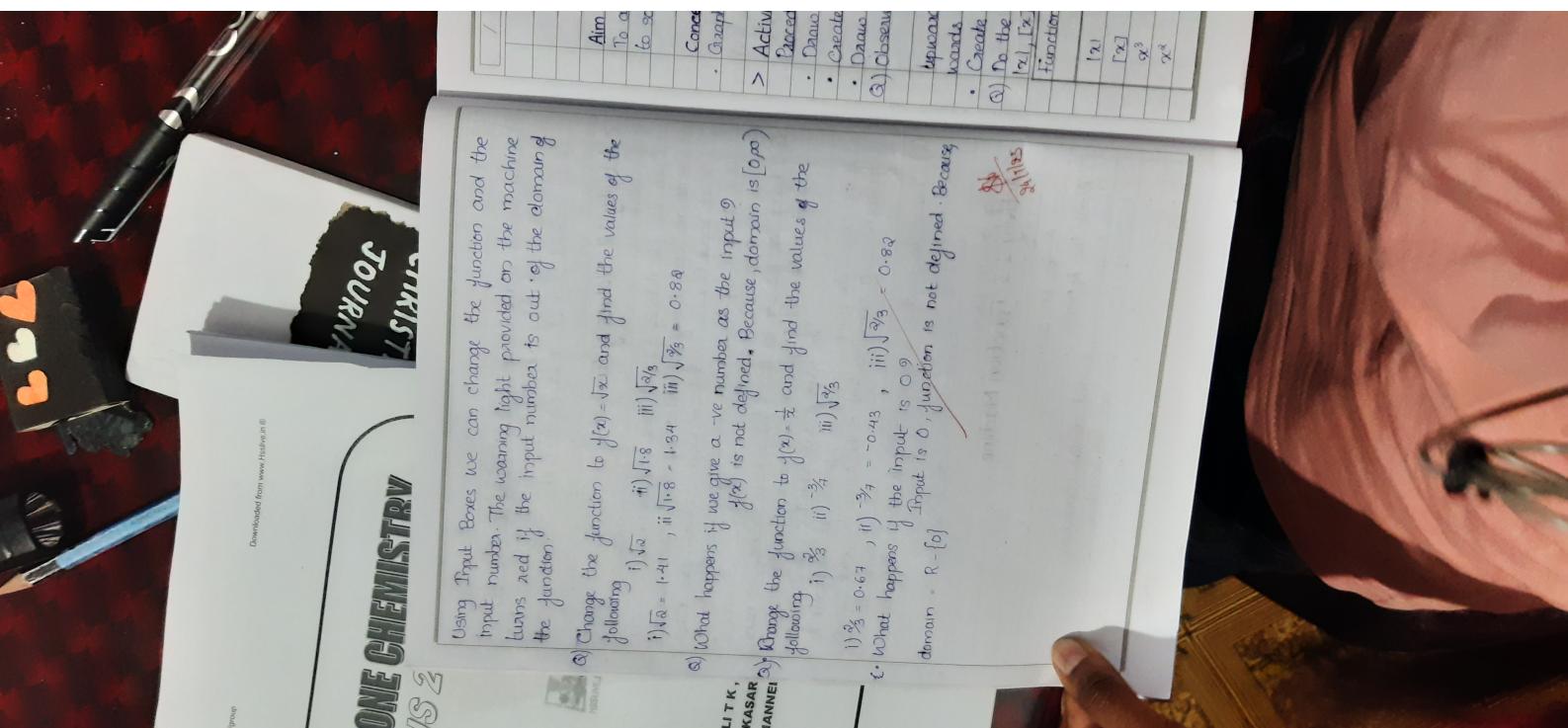
Procedure:

Use Applet ML 1.3

About the Applet

Three switches are provided on the machine.

- GREEN : Click to start the machine
- RED : Click to stop the machine
- BLUE : Click to reset.



AB - 2

SHIFTING OF GRAPHS

the
of

Ann To analyse the change in the graph of a function according to some slight changes in the definition.

Activity 2.1 Shifting of graphs : $f(x) + a$

the

- Draw the graph of $f(x) = -x^2$
 - Create a number grid in a , with increment 0.1
 - Draw the graph of $g(x) = f(x+1)$ (Input : $f(a)$)
 - Observe how the graph of $g(x)$ changes according to a transformation by a unit. If a is $f(a)$ moves vertically downwards by a unit, if a is $-ve$.
 - Create Input Boxes for editing function and slides 'a'.
 - Do the above observations for different functions such as
 - $|x|$
 - x^3
 - x^4
 - x^5

Because

Function	Domain	Range	Shifting
$ x $	\mathbb{R}	$[0, \infty)$	Vertical
$[x]$	\mathbb{R}	\mathbb{Z}	Vertical
x^3	\mathbb{R}	\mathbb{R}	Vertical
x^4	\mathbb{R}	$[0, \infty)$	Vertical

6

$$\begin{array}{|c|c|c|c|c|} \hline & / & / & / & / \\ \hline x & R - \{0\} & R - \{0\} & R - \{0\} & R - \{0\} \\ \hline \end{array}$$

$y(x)$ and $g(x)$ are reflection above x axis.

> Activity 2.4: Reflection of a graph: $f(-x)$

Procedure:

- Open a new GeoGebra window

- Draw the graph of $f(x) = x^3$

- Draw the graph of $g(x) = f(-x)$ (Input: $f(-x)$)

Q) Compare the graph of $f(x)$ and $g(x)$

- Create an Input Box for f and change the function

- i) $y = x$ ii) $y = x^3$ iii) $y = x^2$ iv) $y = (x-2)^2$.

	Function	Domain	Range	Domain in $ y $	Range in $ y $
Odd function	$y = x$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$
Odd function	$ x $	R	2	R	Z
Even function	$ x $	R	$[0, \infty)$	R	$[0, \infty)$
Even function	x^2	R	$[0, \infty)$	R	$[0, \infty)$
Even function	$(x-a)^2$	R	$[0, \infty)$	R	$[0, \infty)$
Neither odd nor even function	$\frac{1}{x}$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$	$R - \{0\}$

Q) What is the specialty of the graph of odd and even functions?

For even function, reflection is same.

Q) Identify odd and even functions discussed in this lab

$|x|$ and x^2 are even function.

$\frac{1}{x}$ and x^3 are odd function.

Q) Is there any function which is neither odd nor even?

- Save this file as Activity 2.4.

~~Save this~~