# IT Maths LAB (Science)- Demo -Batch 1

Maths Lab - Practical Examination - 2024 (Science)

**Q4B** **Lab 4 - Trigonometric Functions** **First Year**

1. Follow the directions given below and construct a GeoGebra applet. (2)
   - Plot the point $O = (0, 0)$
   - Draw the unit circle centred at the origin O
   - Plot the point $A = (1, 0)$
   - Create a number slider **a** with Min=0, Max=$2\pi$ and increment 0.1
   - Using the input command `P=Rotate(A,a,O)` plot the point $P$ on the circle.
   - Join $O$ and $P$ using line segment.
   - Create an input box for the slider **a**
2. Write the method of finding the value of sin(4.5), using this applet. Also find its value. (2)
3. Find the value of sin(−1.4) (Minimum value of the slider **a** is 0. Answer the question without editing the slider) Write the method of finding the value. (2)
4. Write the method of finding the value of tan(4.6).Also find the value. (2)

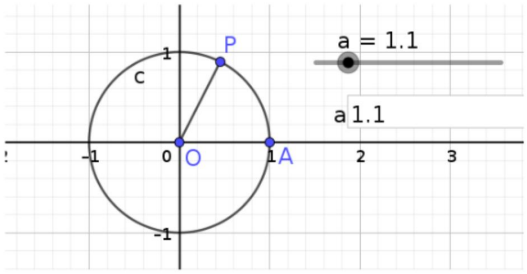
   Hint : You can use a suitable input from the following.
   (a) $\frac{1}{y(P)}$ (b) $\frac{1}{x(P)}$ (c) $\frac{x(P)}{y(P)}$ (d) $\frac{y(P)}{x(P)}$

   [ $x(P)$ gives the $x$ coordinate and $y(P)$ gives the $y$ coordinate of the point $P$]
5. (a) Which of the following is a point on the graph of $\cos x$? (1)
   i) $(a, x(P))$ ii) $(a, y(P))$ iii) $(x(P), a)$ iv) $(y(P), a)$
   (b) Plot the above point, trace it and draw the graph of $\cos x$ by animating the slider. (1)



*Answer key*

*1) Construct the applet* → *(2 Score)*




*2) The y coordinate of P gives the sine value.* → *(2 Score)*

$$\sin(4.5) = -0.98$$

*3) Use the result* $\sin(-x) = -\sin x$ → *(2 Score)*

$$\sin(-1.4) = -0.99$$

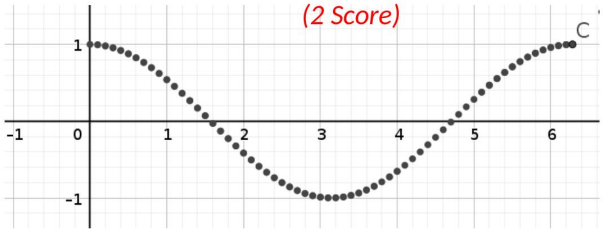
*4)* $\tan x = \dfrac{\sin x}{\cos x}$ *(2 Score)*

*Also* $\cos x = x(P)$ *and* $\sin(x) = y(P)$

*Use* $\dfrac{y(P)}{x(P)}$ *as input command and adjust the value of the slider to 4.6*

$$\tan(4.6) = 8.86$$

*5)* $(a, x(P))$ *(2 Score)*



# IT Maths LAB (Science)- Demo -Batch 1

Maths Lab - Practical Examination - 2024 (Science)

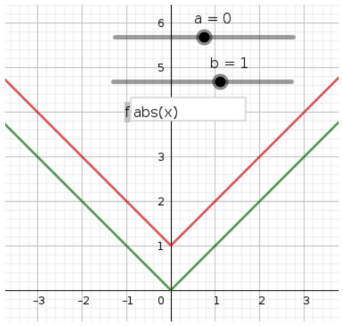
**Q2A** **Lab 2 - Shifting of Graphs** **First Year**

1. Follow the directions given below and construct a GeoGebra applet. (2)
   - Draw the graph of the function $f(x) = |x|$
   - Create two sliders **a** and **b** with Min = -5, Max = 5 and increment 0.01
   - Draw the graph of the function $g(x)$ using the input command `g(x)=f(x+a)+b`
   - Create an input box for the function $f$
2. Answer the following questions
   (a) Fix the values of **a** at 0 and **b** at 4 (2)
      i. Compare the graph of $g(x)$ with the graph of $f(x)$
      ii. What is the domain and range of $g(x)$ ?
   (b) Find approximate values of **a** and **b** so that the graph of $g(x)$ coincides with the graph of $|x - 3|$ (2)
3. Using input box change the definition of the function $f(x)$ to $\sqrt{x}$.
   Find and write the values of **a** and **b** so that the domain and range of $g(x)$ are $[1, \infty)$ and $[2, \infty)$ respectively (2)
4. Let $f(x) = x^2 + 2$. If $g(x)$ is the reflection of $f(x)$ about x axis, then (2)
   a) which among the fllowing is $g(x)$?
      i) $-x^2 + 2$ ii) $x^2 - 2$ iii) $-x^2 - 2$
   b) Write the range of $g(x)$



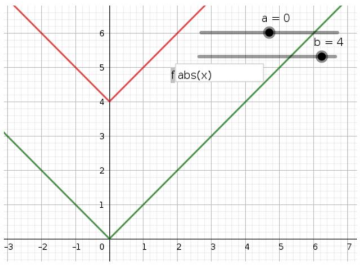
Answer Key

1) Construct the applet (2 Score)



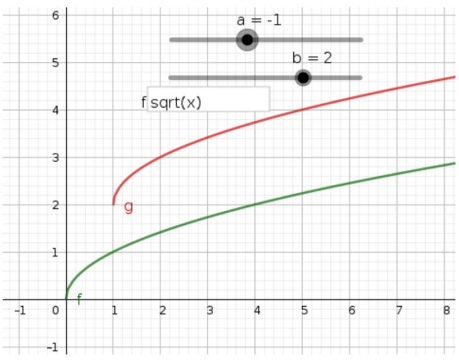

2) a) i) The graph of $g(x)$ is obtained by shifting the graph of $f(x)$ by 4 units upwards (2 Score)

ii) Domain $= R$ , Range $= [4, \infty)$




b) $a = -3,\ b = 0$ (2 Score)

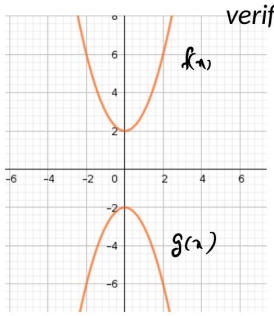
3) $a = -1, b = 2$ (2 Score)




4) a) $-x^2 - 2$

b) Range $= (-\infty, -2]$

(Identify the function and verify by inputting)



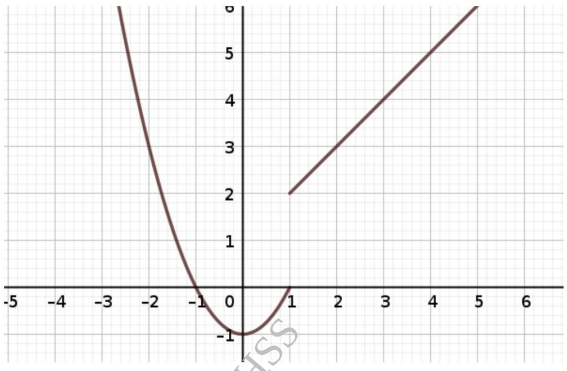

(2 Score)

# IT Maths LAB (Science)- Demo -Batch 1



**Q3D** **Lab 3-Domain and Range** **First Year**

1. Draw the graph of the given functions and find their domain and range.
   (a) $x^2 - 6x + 7$ (2)
   (b) $x - [x]$ (2)
   (c) $\sqrt{4 - x^2}$ (2)
   (d) $\dfrac{1}{x^3 - 7x - 6}$ (2)
2. Identify the function from its graph given below and draw the graph of the function. (2)





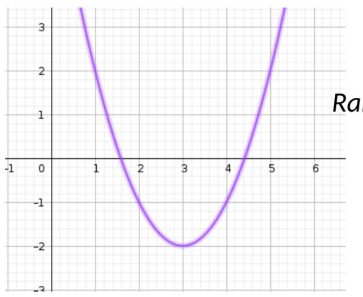
**Input command hint(This is only an example)**

To get the graph of the function $f(x) = \begin{cases} x^2 & \text{if } x \le 2 \\ 2x+1 & \text{if } x > 2 \end{cases}$

give the input command: `if(x<=2,x^2,2x+1)`

*Answer Key*

1) a)

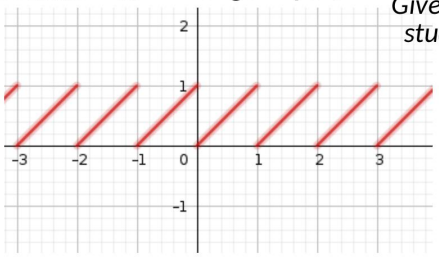


(2 Score)

Domain $= R$

Range $= [-2, \infty)$

b)

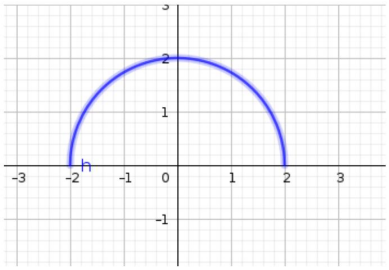


Domain $= R$ Range $= [0, 1)$

Give full score even if student writes $(0, 1)$

(2 Score)

c)

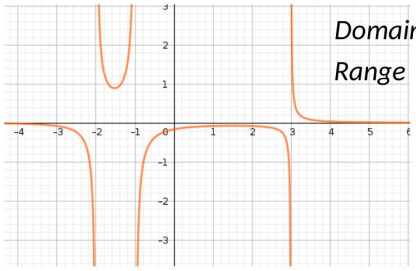


(2 Score)

Domain $= [-2, 2]$

Range $= [0, 2]$

d)



Domain $= R - \{-2, -1, 3\}$

Range $= R - \{0\}$

(2 Score)

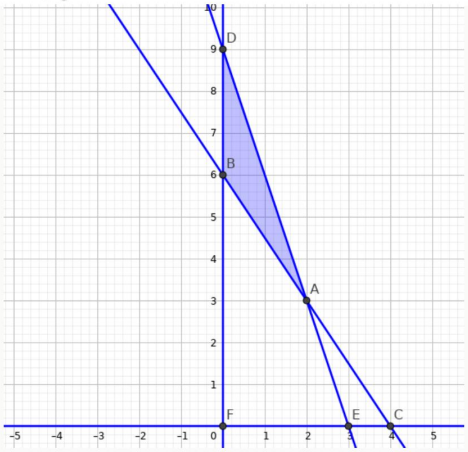
2) $f(x) = \begin{cases} x^2 - 1, & \text{if } x \le 1 \\ x + 1, & \text{if } x > 1 \end{cases}$ (2 Score)

# IT Maths LAB (Science)- Demo -Batch 1

**Q-22 C** **LAB-42 LINEAR PROGRAMMING PROBLEM** **Second year**

**Answer key**

1. Maximise and Minimise Z=5x+2y
   Subject to the constraints:
   $3x + 2y \geq 12$
   $3x + y \leq 9$
   $x, y \geq 0$




feasible region — 2 scores

Corner points
A (2,3), B (0,6), D (0,9)
— 1 score

| Point | Z = 5x+2y |
|---|---|
| A (2,3) | 16 |
| B (0,6) | 12 |
| D (0,9) | 18 |

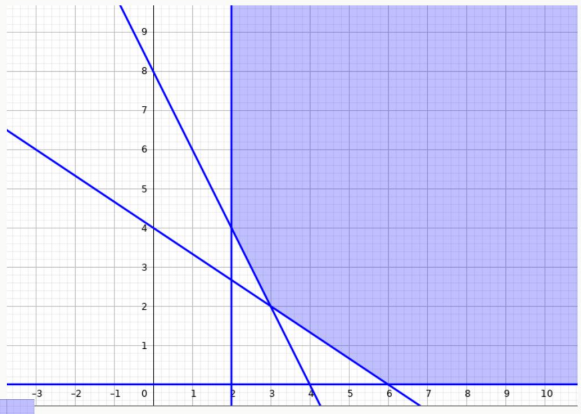
— 1 score



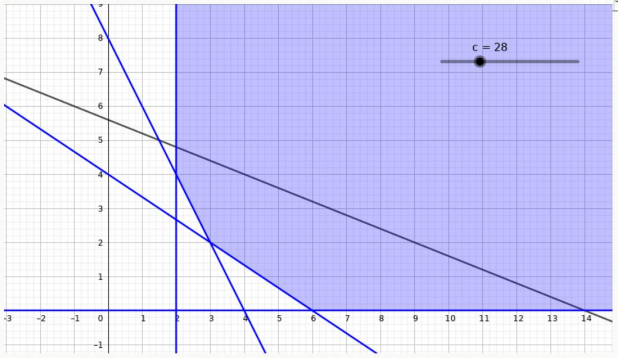
Maximum = 18

Minimum = 12 — 1 score

2. Objective function: z = 2x + 5y
   Subject to the constraints:
   $x \geq 2$
   $2x + 3y \geq 12$
   $2x + y \geq 8$
   $y \geq 0$



(2 scores)




(2 scores)

No maximum (1 score)

Minimum value of Z = 12
at (6,0)

# IT Maths LAB (Science)- Demo -Batch 1

Maths Lab - Practical Examination Model - 2025 (Science)

**Q15B** **Lab 30 - Maxima and Minima** **Second Year**

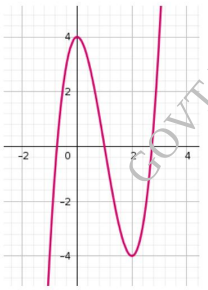
ANSWER KEY

1. Draw the graph of the function $f(x) = f(x) = 2x^3 - 6x^2 + 4$. Observe the graph and find points of local maxima and minima. Also find local maximum and local minimum values. (2)
2. Change the distance on $x$ axis in terms of $\frac{\pi}{4}$. Draw the graph of the function $f(x) = |\cos(2x)|$. Find the points of local maxima and local minima in $(0, \pi)$ (2)
3. Draw the graph of the function $f(x) = 2x^3 + 3x^2 - 36x + 10$ .Draw the graph of and $f'(x)$ plot its points of intersection with the x axis.
   (a) Find the points of local maxima and minima of the function $f(x)$ (2)
   (b) Find local maximum and local minimum values (1)
4. Draw the graph of the function $f(x) = x^3 - 3x^2 - 9x + 11$ and find its absolute maximum and absolute minimum values in the interval $[-2, 4]$. (3)

1

$x = 0$ point of local max

$f(0) = 4$ local max value (1)

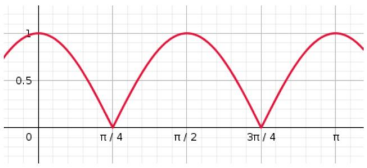


$x = 2$ point of local min

$f(2) = -4$ local min value (1)

2

$x = \pi/4$ , $3\pi/4$ are points of local minima (2)



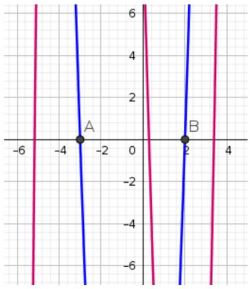
$x = \pi/2$ point of local maximum

3

$A(-3,0)$ $B(2,0)$

$x = -3$ is a point of local maximum

$x = 2$ is a point of local minimum (2)



$f(-3) = 91$ is local max value

$f(2) = -34$ is local min value (1)

4

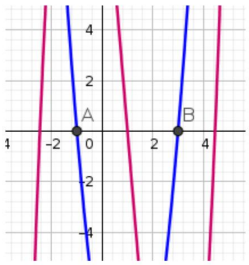
$A(-1,0)$ $B(3,0)$ (1)

$f(-1) = 16$

$f(3) = -16$ (1)

$f(-2) = 9$

$f(4) = -9$



Absolute max value is 16 at $x = -1$ (1)

Absolute min value is $-16$ at $x = 3$

# IT Maths LAB (Science)- Demo -Batch 1

Maths Lab - Practical Examination Model - 2025 (Science)

**Q14D** **Lab 27 - Increasing and Decreasing Functions** **Second Year**

ANSWER KEY

1. Draw the graph of the function $f(x) = 3 - x^3 + 3x$, observe the graph and find the intervals in which the function is increasing or decreasing. (2)
2. Make the distance on $x$ axis in terms of $\frac{\pi}{4}$. Draw the graph of $f(x) = |\sin(2x)|$. Observe the graph and find the intervals in which the function is increasing or decreasing in $[0, \pi]$. (2)
3. Do the following instructions and create an applet.
   - Draw the graph of the function $f(x) = 4x - x^2$
   - Plot a point A on the graph
   - Draw the tangent to the curve at A and find its slope
   (a) Find the intervals in which the slope of the tangent is positive or negative (2)
   (b) Edit the function $f(x)$ to $2x + x^3$ (Double click on the graph and edit). (2)
   What is the peculiarity of the slope of the tangent? What does it infer ?
4. Draw the graph of the function $f(x) = 5x^3 - 9x^2 - 12x$ (2)

   Draw the graph of $f'(x)$ and hence find the intervals in which $f(x)$ is increasing or decreasing.

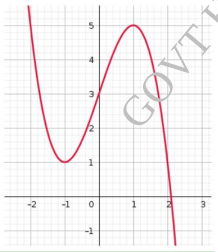


1

Decreasing in $(-\infty, -1)$

Increasing in $(-1, 1)$ (2)

Decreasing in $(1, \infty)$

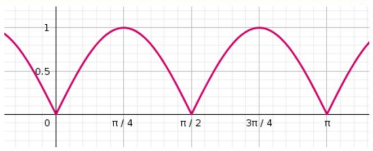


2

Increasing in

$(0, \pi/4)$, $(\pi/2, 3\pi/4)$

Decreasing in $(\pi/4, \pi/2)$, $(3\pi/4, \pi)$

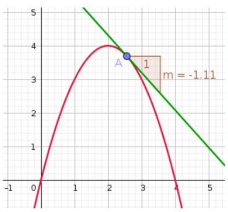


3 Applet construction (1)

a) Slope of tangent is (1)

+ve in $(-\infty, 2)$

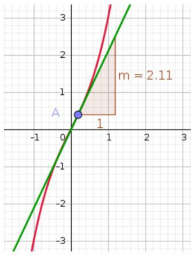
-ve in $(2, \infty)$




b) Slope of tangent is always +ve (2)

$\Rightarrow$

$f$ is increasing in $\mathbb{R}$



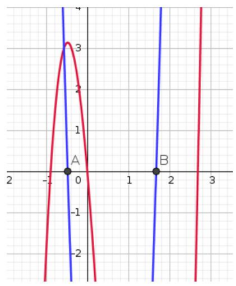

4 A $(-0.48, 0)$, B $(1.68, 0)$

$f$ is (2)

Increasing in $(-\infty, -0.48)$

Decreasing in $(-0.48, 1.68)$

Increasing in $(1.68, \infty)$




Student can identify the nature of the function either by observing the graph of $f(x)$ or by observing whether the graph of $f'(x)$ is above / below the $x$ axis.