Chapter 1. Functions and Limits

1.1 Four ways to Represent a Function

(1) Functions

① Definition : A Function f is a rule that assigns each element x in the set D to exactly one element , called $f(x)$ in set E

In order to be a function , below two condition are satisfied

ⓐ All elements in set D participate in mapping

ⓑ Each element in set D assigns to only one in set E

② Domain : The set D is called Domain

③ Range : The set E is called Range

④ Independent variable : Each element in set D

⑤ Dependent variable : Each element in set E

⑥ Rule : The law , which show relation Independent variable and Dependent variable

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ex) Sketch graph and find Domain and Range below curve

$f(x) = 2x - 1$, $g(x) = x^2$, $f(x) = \sqrt{x+2}$, $g(x) = \frac{1}{x^2 - x}$

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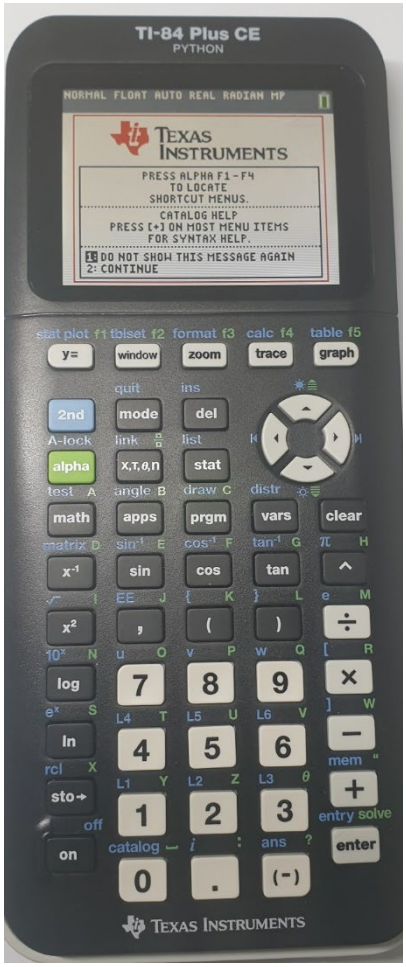

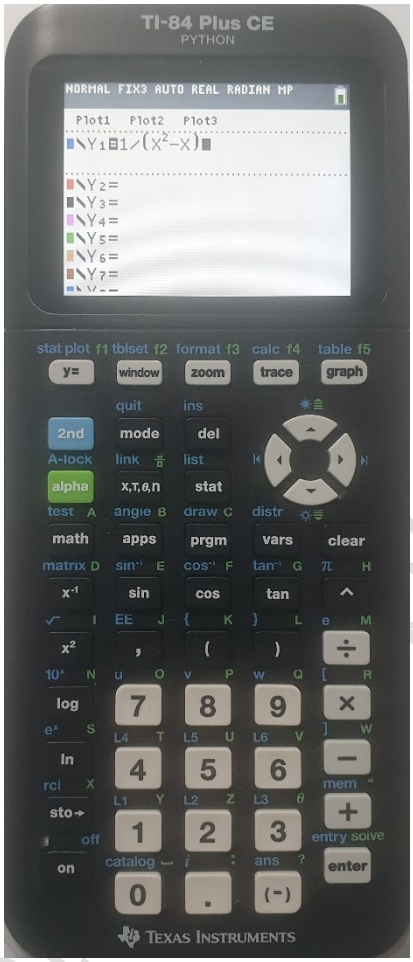

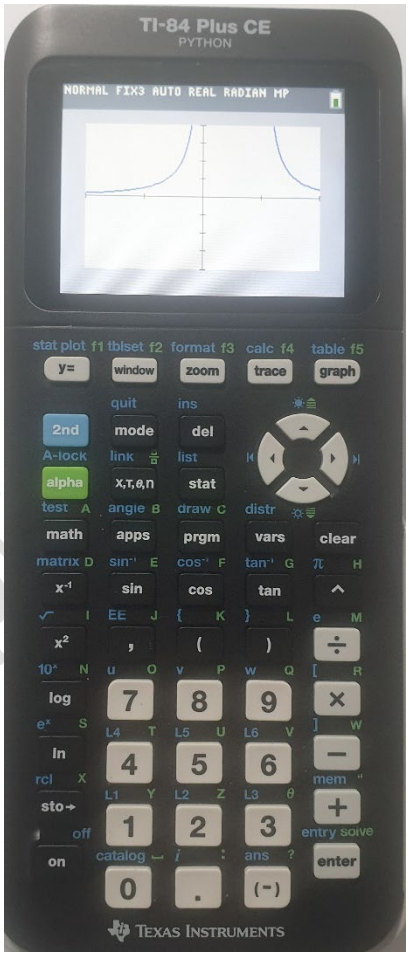

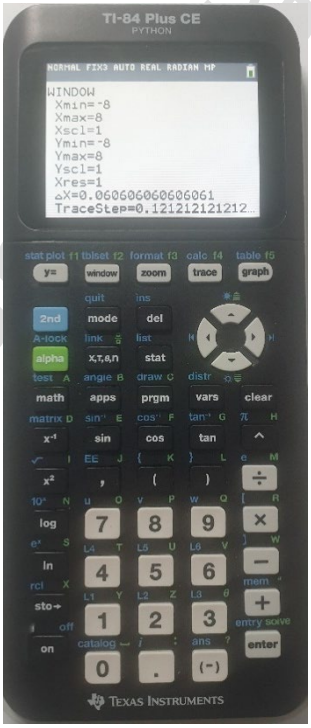

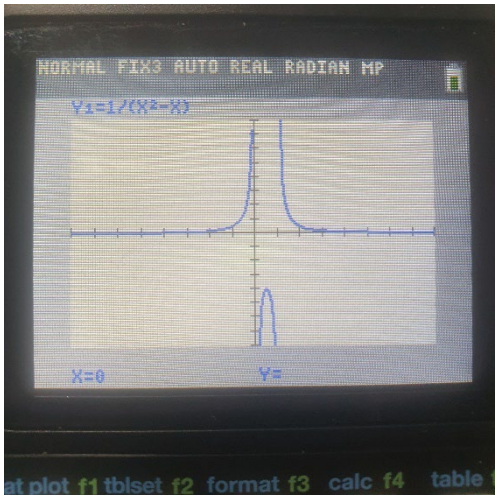

(2) Representation of Functions

① Verbally(by description in words)

Ex) When you turn on a hot-water faucet, the temperature T of water depends on how long the water has been running. Draw a rough graph of T as a function of time that has elapsed since the faucet was turned on

② Numerically(By a table of values)

③ Visually(By a Graph)

④ Algebraically(By an explicit formula)

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$ex)$ $A\ rectangular\ storage\ container\ with\ open\ top\ has\ volume\ of\ 10[m^3].$
$Material\ cost\ for\ base\ per\ area\ is\ 10\ dollars\ ,Material\ cost\ per\ area\ for\ side\ is\ 6\ dollars$
$lenth\ is\ 2w\ ,width\ is\ w\ ,height\ is\ h.\ What\ is\ total\ cost?$

(3) Which rules define function

In order to know whether a curve is a function or not , the vertical Line Test is available.

The vertical Line Test : A curve in the xy plane is the graph of a function of x if and only if no vertical line intersect the curve more than once

(4) Piecewise Defined Functions

Functions, which is defined by different formulas in different domain

(5) Even and Odd Functions

① Even Function : $f(x) = f(-x)$, reflected by $y - axis$

② Odd Function : $f(-x) = -f(x)$, reflected by origin

③ $Even + Even = Even$, $Even + Odd =?$, $Odd + Odd = Odd$

$Even \times Even = Even$, $Even \times Odd = Odd$, $Odd \times Odd = Even$

(6) Increasing and Decreasing Functions

① Whenever $x_1 < x_2$, $f(x_1) < f(x_2)$: Increasing Function

② Whenever $x_1 > x_2$, $f(x_1) < f(x_2)$: Decreasing Function