Mini-Lecture 2.2
An Introduction to Functions
Learning Objectives:

1. Determine whether a relation expressed as a map or ordered pairs represents a function.
2. Determine whether a relation expressed as an equation represents a function.
3. Determine whether a relation expressed as a graph represents a function.
4. Find the value of a function.
5. Graph a function.
6. Work with applications of functions.

Preparing for an Introduction to Functions:
Evaluate the expression $-x^{4}+x^{3}-1$ for:

$$
-(-1)^{4}+(-1)^{3}-1
$$

$$
\begin{gathered}
\text { i) } x=2 \\
-(2)^{4}+(2)^{3}-1 \\
-16+8-1 \\
-8-1=-9
\end{gathered}
$$

DEFINITION
A function is a relation in which each element in the domain (the inputs) of the relation corresponds to exactly one element in the range (the outputs) of the relation.

Examples:

1. Determine whether each relation represents a function. State the domain and the range of each relation.
a) $\{(-1,1),(0,0),(1,-1)\}$
b) $\{(-2,6),(-3,1),(4,5),(-3,-1)\}$

c) $\{(1,4),(-1,1),(4,4),(-3,1)\}$

2. Determine whether each equation represents a function.
a) $4 x-3 y=0$
b) $y= \pm 3 x$

c) $x+y^{2}=1$
d) $x^{2}-2 y=3$

| $x \mid y$ |
| :---: |
| -32 |
| $-3 \mid-2$ |



VERTICAL LINE TEST
A set of points in the $x y$-plane is the graph of a function if and only if every vertical line intersects the graph in at most one point.
3. Determine whether the graph is that of a function.


4. Find the following values for the function:
$f(x)=\frac{x^{2}}{2}+3 \longrightarrow y=\frac{x^{2}}{2}+3$

$$
\begin{aligned}
\text { a) } \begin{array}{rlrl}
f(4) & =\frac{4^{2}}{2}+3 & & \text { b) } f(-x)=\frac{(-x)^{2}}{2}+3=\frac{x^{2}}{2}+3 \\
& =\frac{16}{2}+3 & & f(-x)=\frac{x^{2}}{2}+3 \\
(4, \|) & f(4) & =11 & \\
f(4) & & \\
\text { c) } f(2 a) & =\frac{(2 a)^{2}}{2}+3 & &
\end{array} \quad l(x+4)=\frac{(x+4)^{2}}{2}+3
\end{aligned}
$$

$$
\begin{aligned}
& f(-2)=\frac{(-2)^{2}}{2}+3=\frac{4}{2}+3=2+3=5 \\
& f(-2)=5 \\
& (-2,5)
\end{aligned}
$$

