



## ALGEBRA II ACTIVITY 4: TRANSFORMING POLYNOMIAL FUNCTIONS

### ACTIVITY OVERVIEW:

In this activity we will

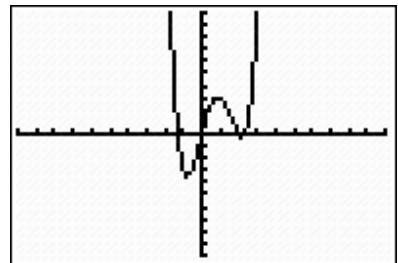
- Graph a polynomial function in  $Y_1$ .
- Use a variation of function notation in the  $Y=$  register to perform transformations on  $Y_1$ , including vertical and horizontal shifts and reflections across  $x$ - and  $y$ -axes.
- Examine the table of the original function compared to the transformation to articulate how the function changed

Press  $Y=$ . Enter the polynomial function as shown.

```

Plot1 Plot2 Plot3
\Y1 X^4-3X^3-X^2+6
X
\Y2 =
\Y3 =
\Y4 =
\Y5 =
\Y6 =
  
```

Press  $\text{GRAPH}$ , making sure the window is the standard window. Trace the function if desired to examine the locations of its critical points and intercepts.

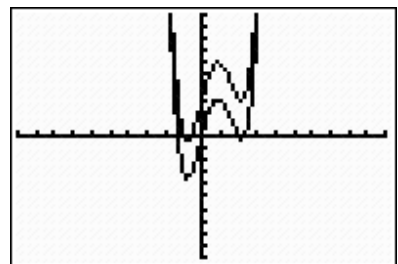


Press  $Y=$ . Down arrow to  $Y_2$ . Press  $\text{VAR}$  to  $\text{Y-VARS}$ . Select **1:Function...** then select **1:  $Y_1$** . Use function notation to instruct the calculator to evaluate  $Y_1(x)$  and add 3 before graphing, as shown.

```

Plot1 Plot2 Plot3
\Y1 X^4-3X^3-X^2+6
X
\Y2 Y1(X)+3
\Y3 =
\Y4 =
\Y5 =
\Y6 =
  
```

Press  $\text{GRAPH}$ . Examine the shift. What direction was the function shifted? How far? How would you shift it in the opposite direction?

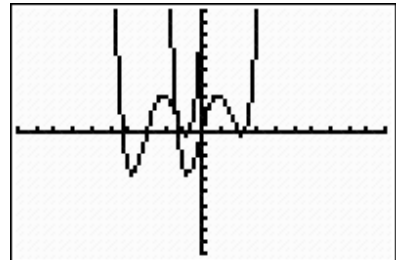


Press  $\boxed{Y=}$ . Down arrow to  $Y_2$ , move onto the = sign and press  $\boxed{ENTER}$  to turn off  $Y_2$ . Down arrow to  $Y_3$ . Press  $\boxed{VARS}$   $\boxed{\blacktriangleright}$  to **Y-VARS**. Select **1:Function...** then select **1:  $Y_1$** . Use function notation to instruct the calculator to evaluate and graph  $Y_1(x+3)$  as shown.

```

Plot1 Plot2 Plot3
Y1 X^4-3X^3-X^2+6
Y2 =
Y3 Y1(X+3)
Y4 =
Y5 =
Y6 =
  
```

Press  $\boxed{GRAPH}$ . Examine the shift. Discuss the difference between the notation of  $Y_1(x) +3$  versus  $Y_1(x+3)$ .



Press  $\boxed{2nd}$  $\boxed{GRAPH}$ . Examine the table. Why do you think adding three in  $Y_3=Y_1(x+3)$  shifted the graph to the left instead of the right? How would you shift it right?

X	Y1	Y3
0	0	9
1	3	72
2	0	255
3	9	648
4	72	1365
5	255	2544
6	648	4347

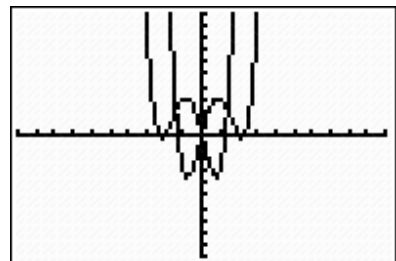
X=0

Press  $\boxed{Y=}$ . Turn off  $Y_3$ . Down arrow to  $Y_4$ . Press  $\boxed{VARS}$   $\boxed{\blacktriangleright}$  to **Y-VARS**. Select **1:Function...** then select **1:  $Y_1$** . Use function notation to instruct the calculator to evaluate and graph  $Y_1(-x)$  as shown. This can be thought of as  $Y_1$ (the opposite of  $x$ ).

```

Plot1 Plot2 Plot3
Y1 X^4-3X^3-X^2+6
Y2 =
Y3 =
Y4 Y1(-X)
Y5 =
Y6 =
  
```

Press  $\boxed{GRAPH}$ . Examine the reflection. The function was reflected across which axis?



Press  $\boxed{2nd}$  $\boxed{GRAPH}$ . Examine the table. What do you think was done to produce this result?

X	Y1	Y4
-3	135	9
-2	24	0
-1	-3	3
0	0	0
1	3	-3
2	0	24
3	9	135

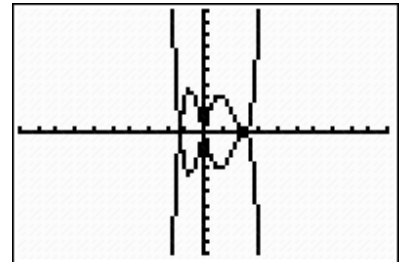
X= -3

Press  $\boxed{Y=}$ . Turn off  $Y_4$ . Down arrow to  $Y_5$ . Press  $\boxed{(-)}$ , then press  $\boxed{\text{VAR}}\boxed{\blacktriangleright}$  to **Y-VARS**. Select **1:Function...** then select **1:  $Y_1$** . Use function notation to instruct the calculator to evaluate and graph the opposite of  $Y_1(x)$  as shown.

```

Plot1 Plot2 Plot3
Y1 X^4-3X^3-X^2+6
Y2 =Y1(X)+3
Y3 =Y1(X+3)
Y4 =Y1(-X)
Y5 =-Y1(X)
Y6 =
  
```

Press  $\boxed{\text{GRAPH}}$ . Examine the reflection. The function was reflected across which axis?



Press  $\boxed{2\text{nd}}\boxed{\text{GRAPH}}$ . Examine the table. What do you think was done to produce this result? Discuss the difference between the notation of  $Y_1(-x)$  versus  $-Y_1(x)$ .

X	Y1	Y5
-3	135	-135
-2	24	-24
-1	-3	3
0	0	0
1	3	-3
2	0	0
3	9	-9

X = -3