Mini-Lecture 2.5
Graphing Techniques: Transformations

Learning Objectives:

1. Graph functions using vertical and horizontal shifts
2. Graph functions using compressions and stretches
3. Graph functions using reflections about the *x*-axis and the *y*-axis

Examples:

1. Sketch the graph of each function.

$(a)\ f(x)=x^2-2$ $(b)\ f(x)=x^3+3$ $(c)\ f(x)=\sqrt{x+5}$ $(d)\ f(x)=|x-2|$

$(e)\ f(x)=2x^2$ $(f)\ f(x)=\frac{1}{2}x^3$ $(g)\ f(x)=-\frac{1}{x}$ $(h)\ f(x)=\sqrt{3-x}$

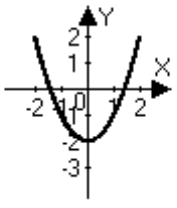
$(i)\ f(x)=(x-1)^2+2$ $(j)\ f(x)=-\sqrt{2-x}+1$

Teaching Notes:

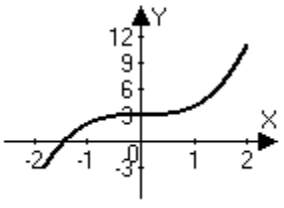
- If you can use a graphing calculator or computer projection with Mathematica or Maple, it is easy to show the transformations with multiple examples. The more examples the better.
- Using a table and plotting points can be helpful, but is too time-consuming to use on most graphs.
- Take just one of the functions, such as $f(x)=x^2$, and do all of the transformations. Then do the other functions.
- Problems like #63-66 are excellent ways to see if students understand the concept.

Answers:

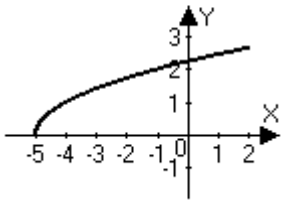
(a)



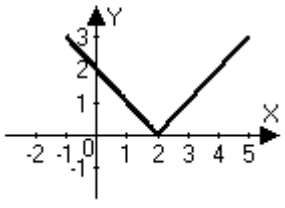
(b)



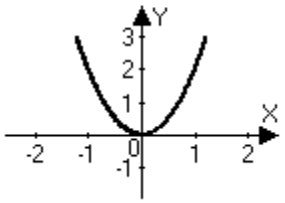
(c)



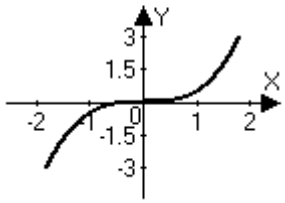
(d)



(e)


Y
X
3
2
1
-1
-2
-1
0
1
2

(f)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X
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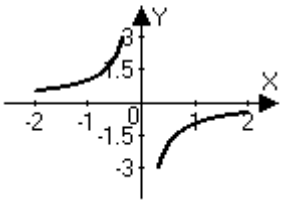
1.5
-1.5
-3
-2
-1
0
1
2

(g)


Y
X
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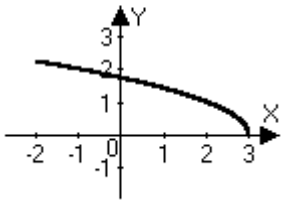
1.5
-1.5
-3
-2
-1
0
1
2

(h)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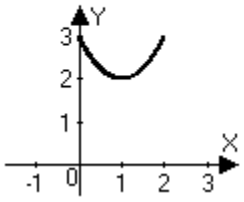
2
1
-1
-2
-1
0
1
2
3

(i)


Y
X
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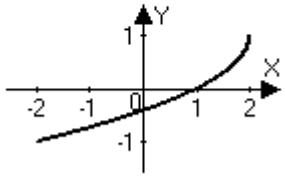
1
-1
0
1
2
3

(j)


Y
X
1
-1
-2
-1
0
1
2