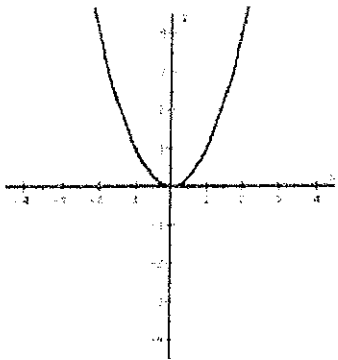
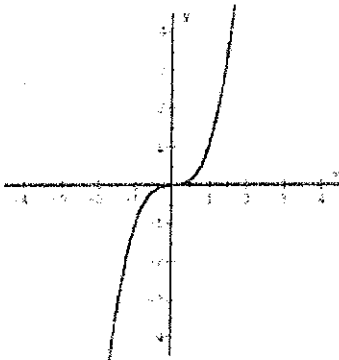


Transformations of Functions

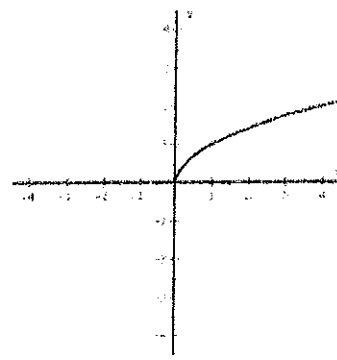
Parent Functions (You should be very familiar with these!)



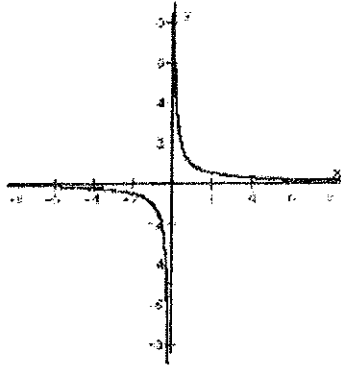
$f(x) = x^2$
Quadratic



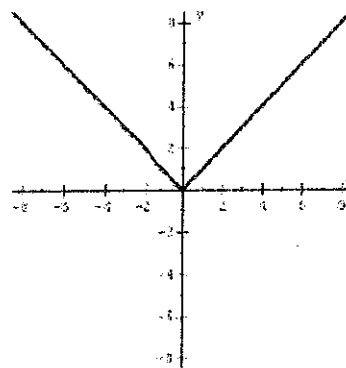
$f(x) = x^3$
Cubic



$f(x) = \sqrt{x}$
Square Root



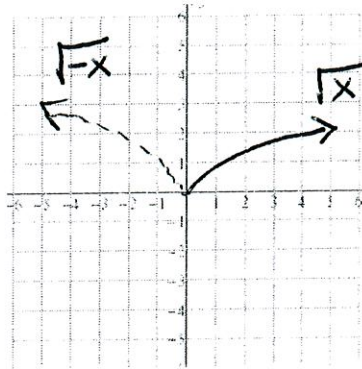
$f(x) = \frac{1}{x}$
Rational



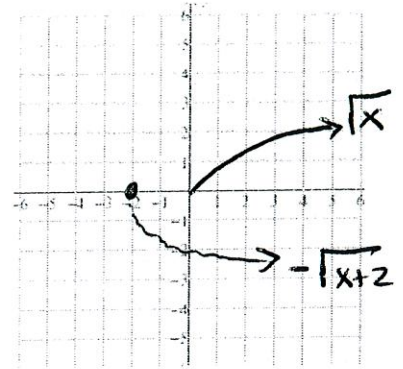
$f(x) = |x|$
Absolute Value

Describe the transformation of the following functions and identify the parent graph. Sketch a graph for each.

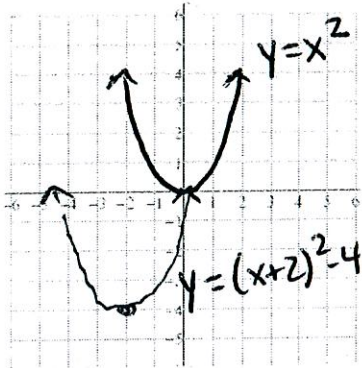
1. $\sqrt{-x}$
Reflect over the y axis



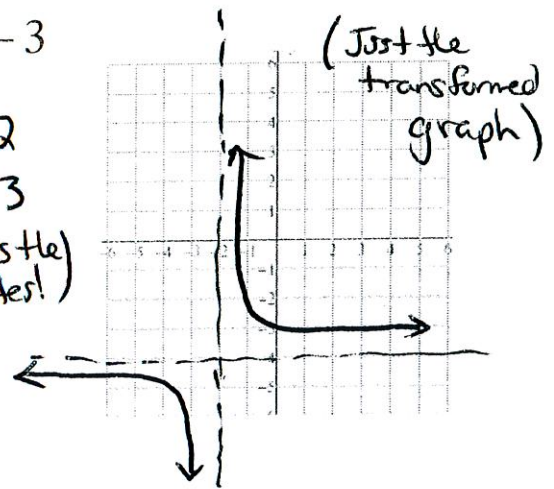
5. $-\sqrt{x+2}$
Reflect over the x axis
left 2



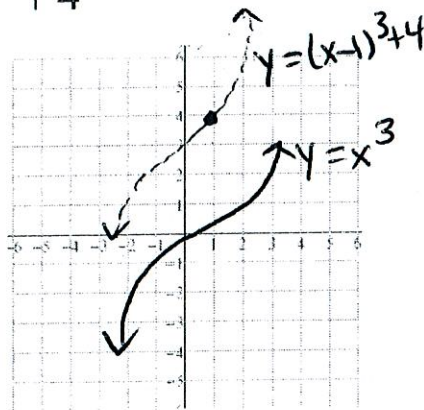
2. $(x+2)^2 - 4$
left 2
down 4



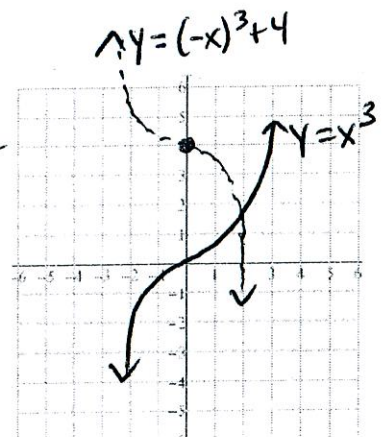
6. $\frac{1}{x+2} - 3$
left 2
down 3
(this moves the asymptotes!)



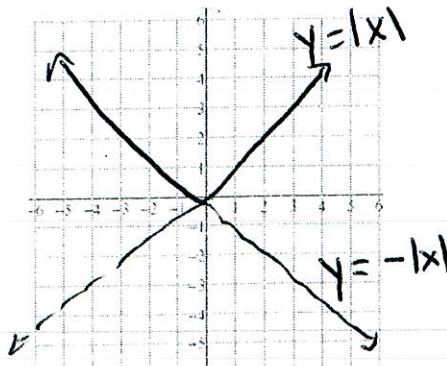
3. $(x-1)^3 + 4$
Right 1
Up 4



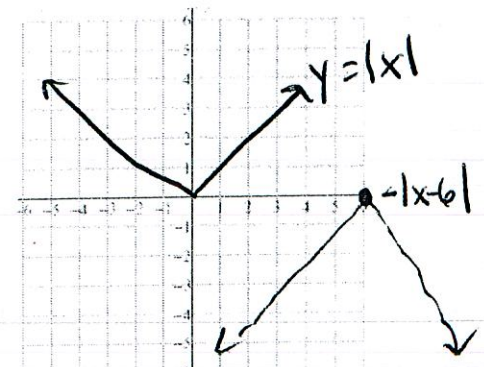
7. $(-x)^3 + 4$
Reflect over the y axis
up 4



4. $-|x|$
Reflect over the x axis



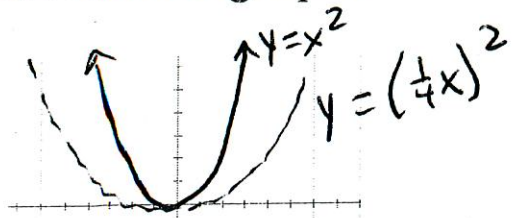
8. $-|x-6|$
- Reflect over the x axis
- Right 6



Describe the transformation. Sketch the parent function as well as the newly transformed graph.

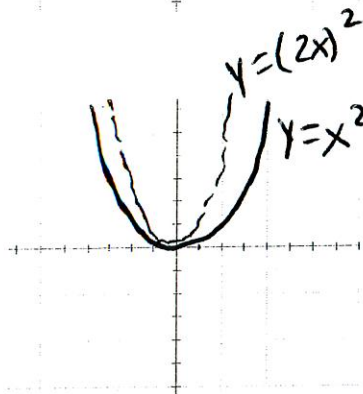
$$f(x) = \left(\frac{1}{4}x\right)^2$$

Horizontal Stretch by 4
(parabola gets wider)



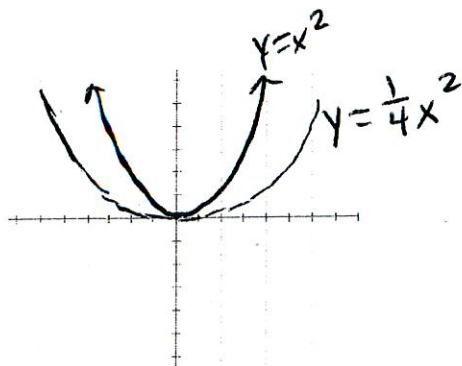
$$f(x) = (2x)^2$$

Horizontal compression by 2
(parabola gets skinnier)



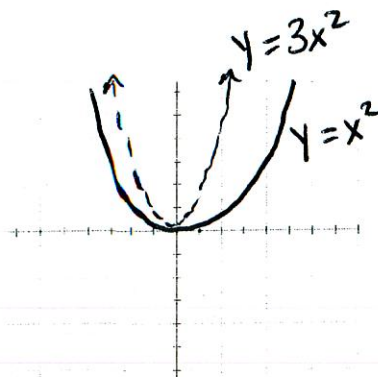
$$f(x) = \frac{1}{4}x^2$$

Vertical Compression by 4
(parabola gets wider)



$$f(x) = 3x^2$$

Vertical Stretch
by 3
(Parabola gets skinnier)



Write the following transformations using the parent function $y = |x|$

- 1) Reflect about the y axis and shift up 4 $y = |-x| + 4$
- 2) Reflect about the x axis and shift right 3 $y = -|x-3|$
- 3) Vertically compressed by a factor of 3 and shift down 6 $y = \frac{1}{3}|x| - 6$
- 4) Horizontally compressed by a factor of 5 and shift up 2 $y = |5x| + 2$

Write the following using the parent function $y = x^2$

* Notice
the square
()²
is outside
the parentheses
when you have
them!

- 5) Horizontally compressed by a factor of 2 and shift up 9 $y = (2x)^2 + 9$
- 6) Vertically stretched by a factor of 2 and reflected over the x axis $y = -2x^2$
- 7) Vertically compressed by a factor of 4 and reflected about the y axis and shifted down 3 units $y = \frac{1}{4}(-x)^2 - 3$

Write an equation that represents the following transformations of $y = \sqrt{x}$

- 8) Horizontally stretched by a factor of 3 and up 6 $y = \sqrt{\frac{1}{3}x} + 6$
- 9) Vertically compressed by a factor of 4 and left 7 $y = \frac{1}{4}\sqrt{x+7}$
- 10) Vertically stretched by a factor of 2 and reflected about the x axis $y = -2\sqrt{x}$
- 11) Horizontally compressed by a factor of 3, reflected about the y axis and shifted down 2 units $y = \sqrt{-3x} - 2$

Describe the transformation:

1. $f(x) - 7$ down 7
2. $f(x + 4)$ left 4
3. $f(x - 3)$ right 3
4. $f(-x) - 1$ reflect y-axis, down 1
5. $f(x) + 5$ up 5
6. $-f(x) - 2$ reflect x-axis, down 2
7. $2f(x)$ V. stretch by 2
8. $\frac{1}{2} f(x)$ V. Compress by 2
9. $f(3x)$ H. Compress by 3
10. $f(\frac{1}{4} x)$ H. stretch by 4
11. $2f(x) - 3$ V. stretch by 2, down 3
12. $\frac{1}{2} f(x - 4)$ V. Compress. by 2, right 4
13. $-3f(x)$ V. stretch by 3, reflect x-axis

Write the following using the parent function $y = f(x)$

1) Horizontally compressed by a factor of 2 $f(2x)$

2) Vertically stretched by a factor of 2 $2f(x)$

3) Horizontally stretched by a factor of 3 $f(\frac{1}{3}x)$

4) Vertically compressed by a factor of 4 $\frac{1}{4}f(x)$

5) Vertically stretched by a factor of 2 and reflected about the x axis $-2f(x)$

6) Horizontally compressed by a factor of 3 and reflected about the y axis $f(-3x)$

7) Vertically compressed by a factor of 4 and reflected about the y axis $\frac{1}{4}f(-x)$