Math 3 Polynomial Parent Functions
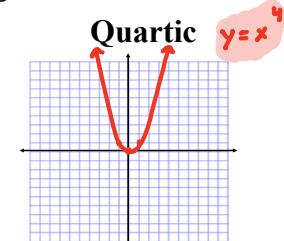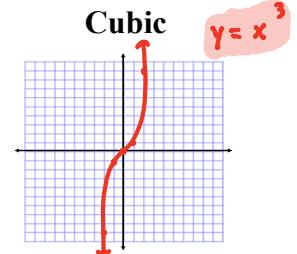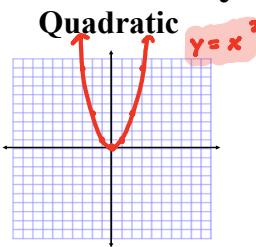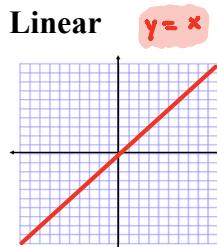
| Linear $y = x$	Quadratic $y = x^2$	Cubic $y = x^3$	Quartic $y = x^4$
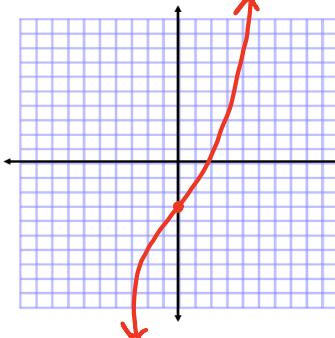
| Function Equation State the type of Function	Sketch the function	Words: The graph moved… (compare to the parent function)
$y = x^3 \overset{K}{-} 3$ Cubic $y = x^3$		shift down 3 units
$y = (x + \overset{h}{5})^2$ Quadratic $y = x^2$		shifts left 5 units
$y = (\overset{b}{-3}x + \overset{h}{1})^4$ Quartic $y = x^4$		(−) reflects over the y-axis (b) horizontal compression by a factor of 3 (h) shifts left 1 unit
$y = -x + 6$ Linear $y = x$		reflected over x-axis shifts up 6 units
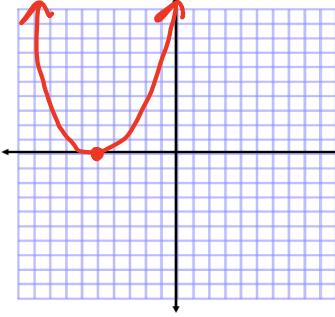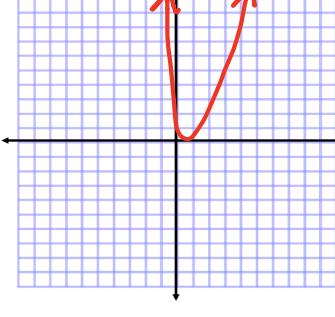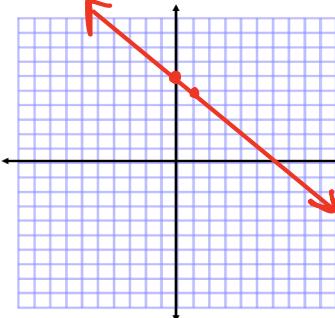
Function Equation State the type of Function	Sketch the function	Words: The graph moved… (compare to the parent function)
$y = -(x + 4)^3$ Cubic $y = x^3$		(-) reflects over the x-axis (h) shifts left 4 units
$y = -x^4 - 2$ Quartic $y = x^4$		reflected over the x-axis shifts down 2 units
$y = -\left(\frac{1}{4}x + 1\right)^2 + 3$ Quadratic $y = x^2$		reflected over x-axis horizontal stretch by a factor of 1/4 shift left 1 unit shift up 3
$y = -2x + 5$ Linear $y = x$		reflected over x-axis vertical stretch by a factor of 2 shift up 5 units
$y = -3x^2$ Quadratic		reflected over x-axis vertical stretch by a factor of 3
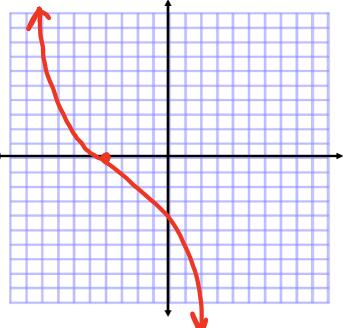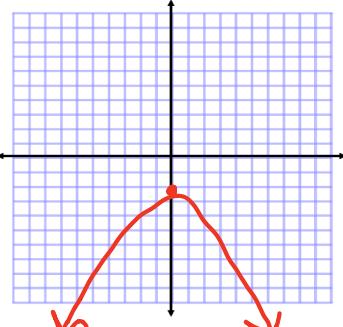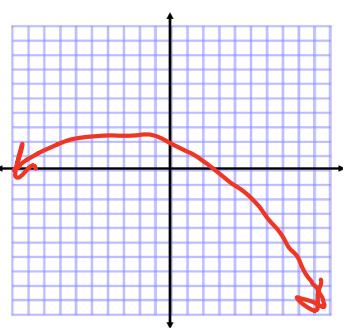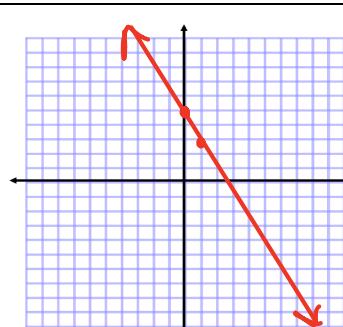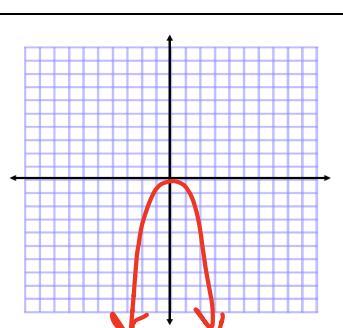
Function Equation Parent Name	Graph the function	Words: The graph moved… (compare to the parent function)
$y = (-2x - 1)^2 + 4$ _Quadratic_ $y = x^2$		reflected over the y-axis horizontal compression by a factor of 2 shifted left 1 unit shifted up 4 units
$y = -(x + 1)^3 + 2$ _Cubic_ $y = x^3$		reflected over the x-axis shifts left 1 unit shifts up 2 units
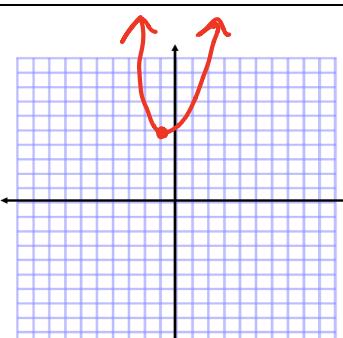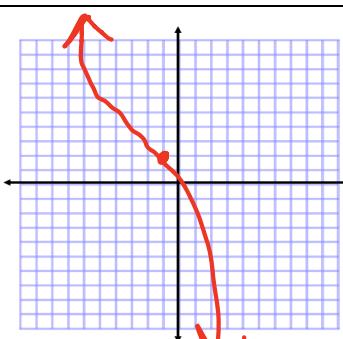
General Form of a function

$$f(x) = \mathbf{a}f(\mathbf{b}x - \mathbf{h}) + \mathbf{k}$$

1, 2, 3, 4

Summarize the different types of transformations

When a > 1: _Vertical stretch by a factor of a_

When 0 < a < 1: _Vertical compression by a factor of a_

When a is negative: _reflects over the x-axis_

When b > 1: _horizontal compression by a factor of b._

When 0 < b < 1: _horizontal stretch by a factor of b._

When b is negative: _reflects over the y-axis_

When h is added: _shifts left h units_ +

When h is subtracted: _shifts right h units_ −

When k is added: _shift up k units_ +

When k is subtracted: _shift down k units_ −

WRITING FUNCTIONS GIVEN TRANSFORMATIONS:

Examples:

1). reflected over x-axis $\underset{\text{outside}}{(-)}$

$\boxed{y=x^3}$ left 3 units $\underset{\text{inside}}{(h)}$

down 4 units $\underset{\text{outside}}{(K)}$

$$y = -(x + 3)^3 - 4$$

2). vertical compression

$\boxed{y=x^4}$ by $\frac{1}{4}$ (a) outside

horizontal compression

by 3   (b) inside

right 5 units (h) inside

up 3 units (K) outside

$$y = \frac{1}{4}(3x - 5) + 3$$