

Lesson 11

Functions & Transformations

Math SL1 - Santowski

Lesson Objectives

- Given the graph of a function $y = f(x)$, be able to graph the transformed function $y = af(b(x + c)) + d$
- Provide a complete analysis of the following types of graphs: linear, quadratic, root, cubic, reciprocal, exponential, & absolute value
- Given the equation of $y = f(x)$, be able to determine the new equation, new domain, and sketch the transformed function $y = af(b(c + x)) + d$

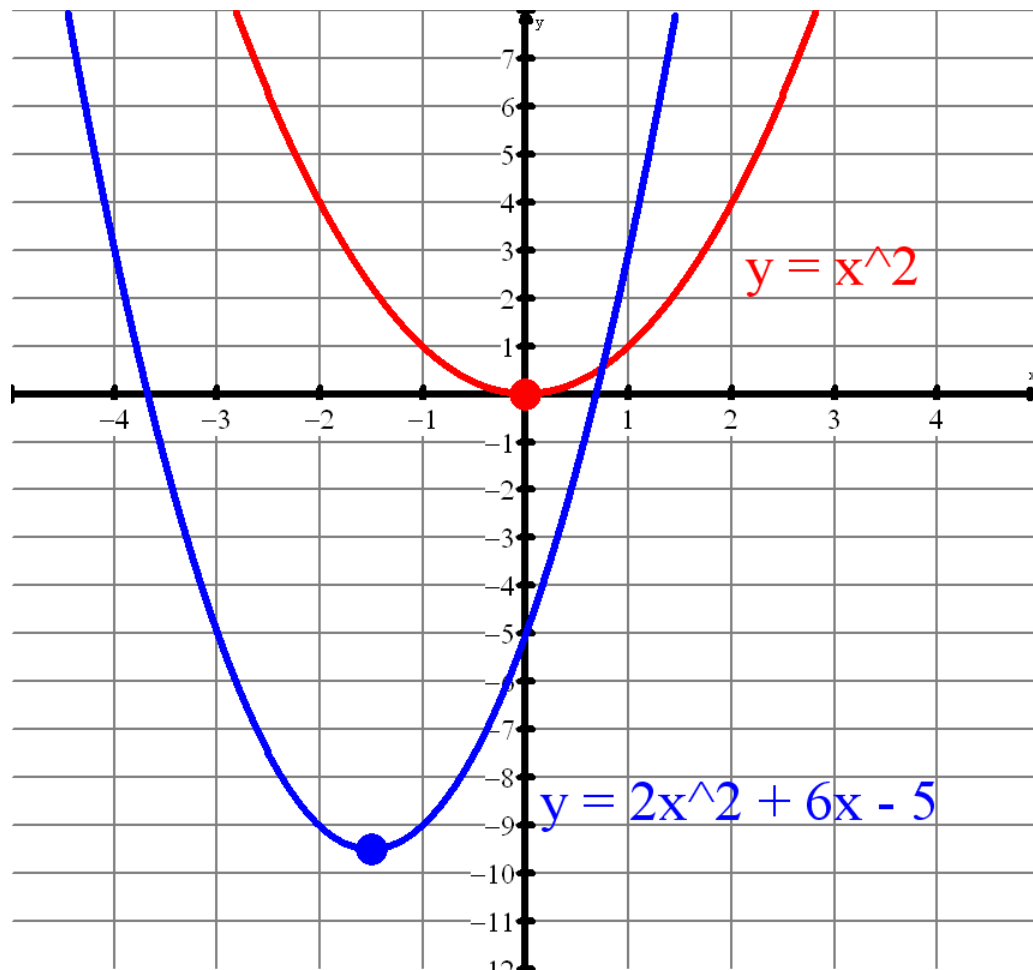
Base Functions

Base Function	Features	Example
$f(x) = x$	Intercepts or pts (1,1) or (-2,-2)	$f(x) = -2x + 3$
$f(x) = x^2$	Vertex & axis of symmetry, pts ($\pm 2, 4$)	$f(x) = 2x^2 + 6x - 5$
$f(x) = \sqrt{x}$	“vertex”, pts of (4,2)	$f(x) = -\sqrt{3-x}$
$f(x) = x^3$	Max & mins	$f(x) = x^3 - 12x$
$f(x) = 1/x$	Asymptotes and pts (1,1) and (-1,-1)	$f(x) = 3 - 1/(x + 2)$
$f(x) = x $	“vertex” and ($\pm 1, 1$)	$f(x) = 2 x - 3 $
$f(x) = 2^x$	Asymptote, pt (0,1)	$f(x) = -2^{x-4} + 3$

Key Features of $f(x) = x^2$

- The key features of a parabola that will be helpful in studying transformations → you should already know the vertex and the axis of symmetry as well as being able to work with any key order pairs (i.e. $(1,1)$ or $(2,4)$)
- And since the vertex is a key point, you should be able to connect the vertex form and the process of completing the square to identifying transformations of $y = x^2$.

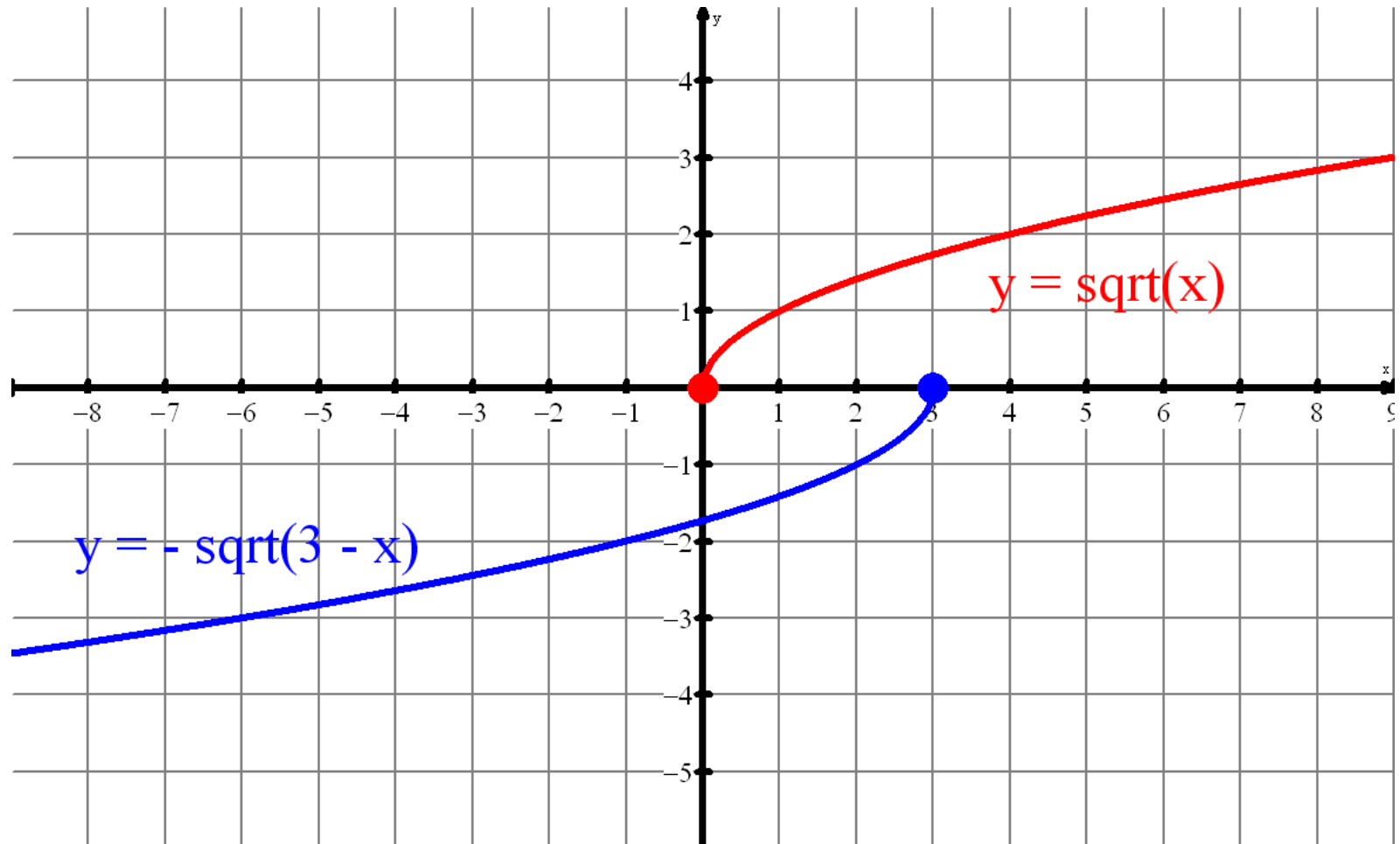
Key Features of $f(x) = x^2$



Key Features of $f(x) = \sqrt{x}$

- The key features of a “sideways” parabola or a root function that will be helpful in studying transformations → the “vertex” as well as being able to work with any key order pairs (i.e. (1,1) or (4,2))
- So work with the function $f(x) = -\sqrt{3-x}$
- PREDICT the transformations of $f(x) = \sqrt{x}$

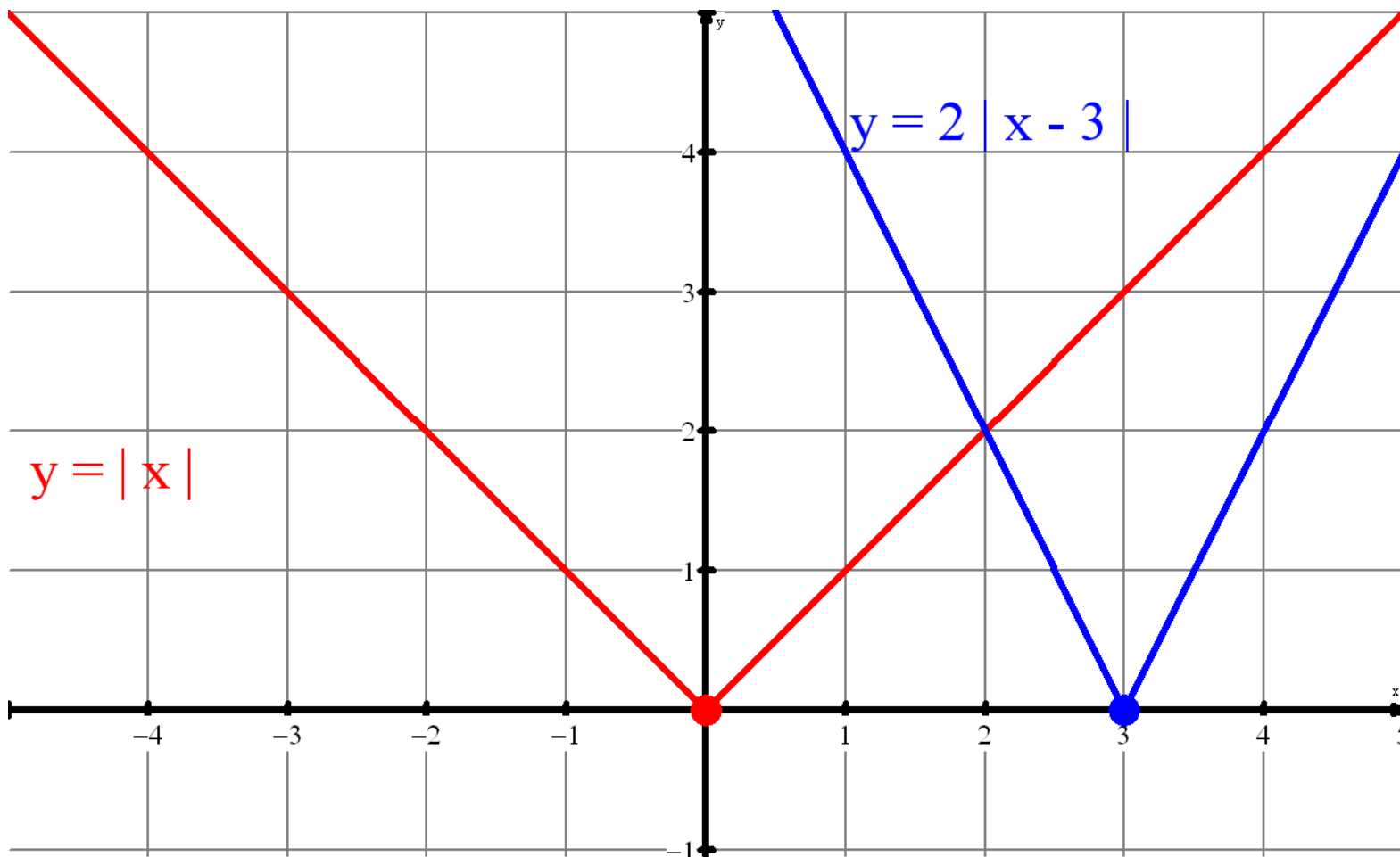
Key Features of $f(x) = \sqrt{x}$



Key Features of $f(x) = |x|$

- The key features of an absolute value function that will be helpful in studying transformations → you should already know the minimum point or turning point or “vertex” as well as being able to work with any key order pairs (i.e. $(1,1)$ or $(-1,1)$)
- So work with the function $f(x) = 2|x - 3|$
- PREDICT the transformations of $f(x) = |x|$

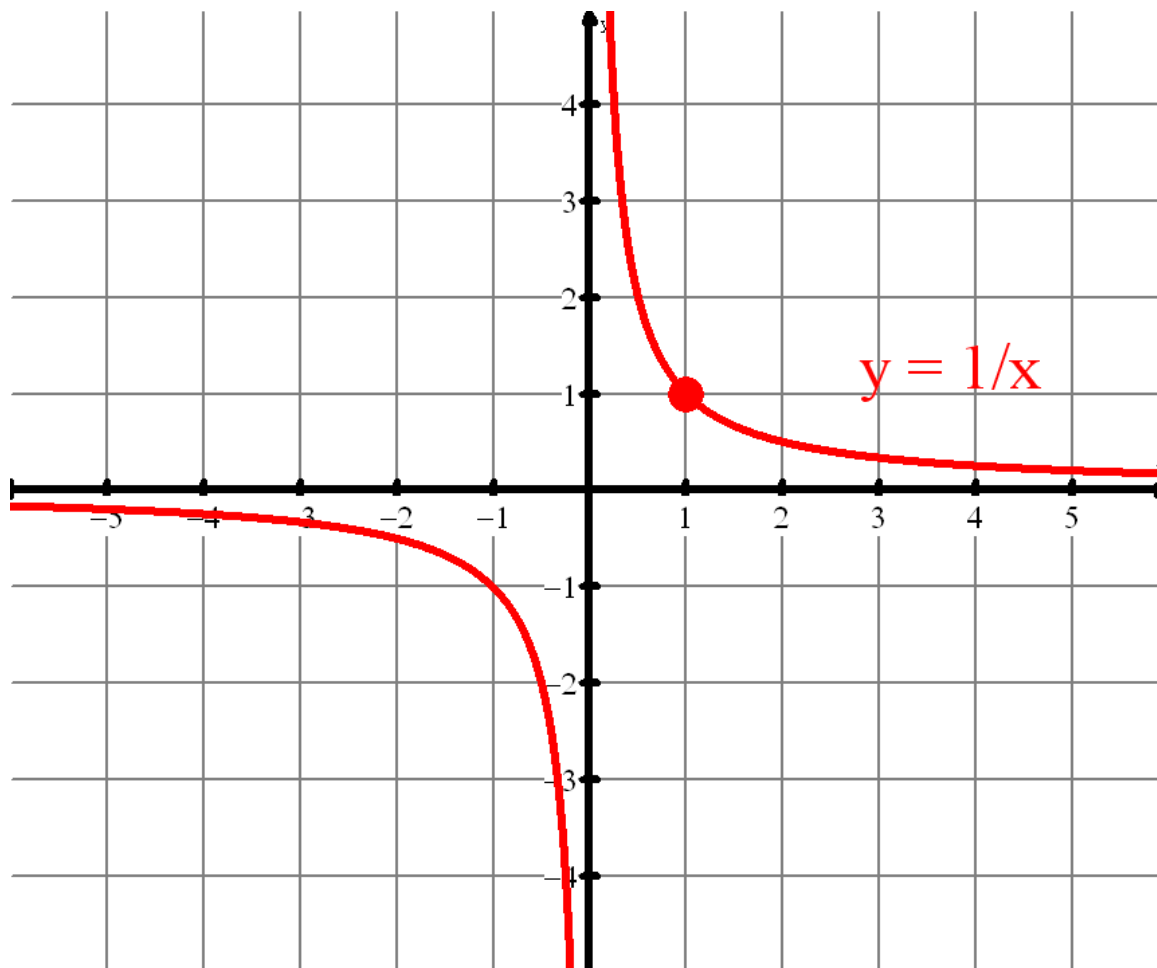
Key Features of $f(x) = |x|$



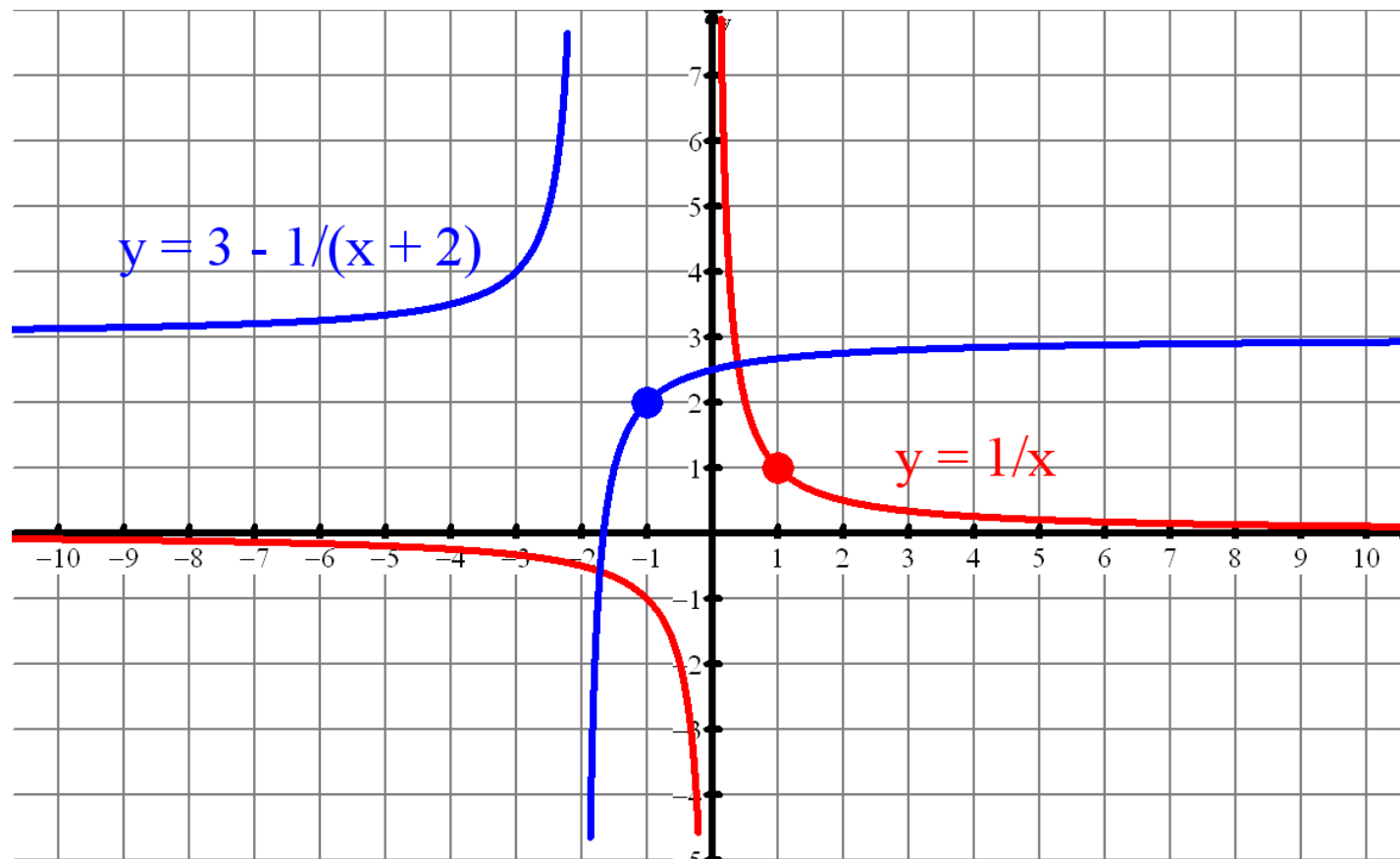
Key Features of $f(x) = 1/x$

- The key features of a rational function that will be helpful in studying transformations → you should already know the asymptotes as well as being able to work with any key order pairs (i.e. (1,1) or (-1,-1))
- So work with the function $f(x) = 3 - \frac{1}{x+2}$
- PREDICT the transformations of $f(x) = 1/x$

Key Features of $f(x) = 1/x$

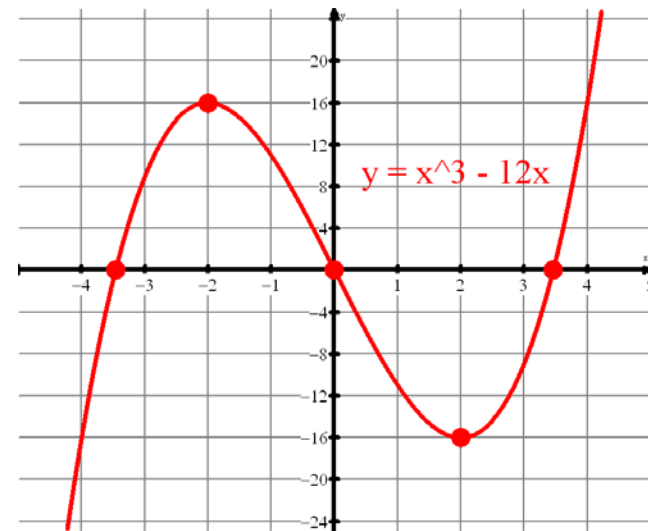
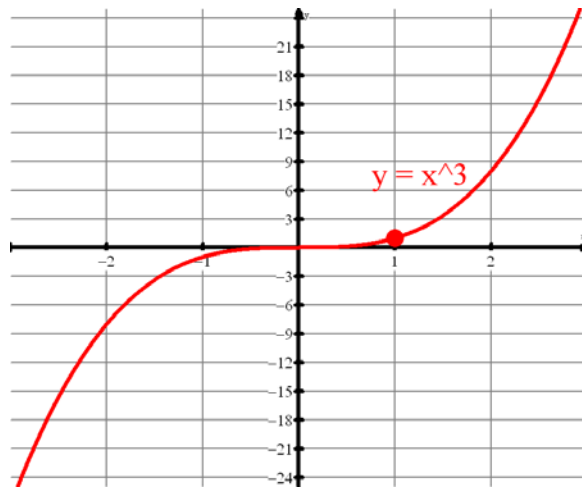


Key Features of $f(x) = 1/x$



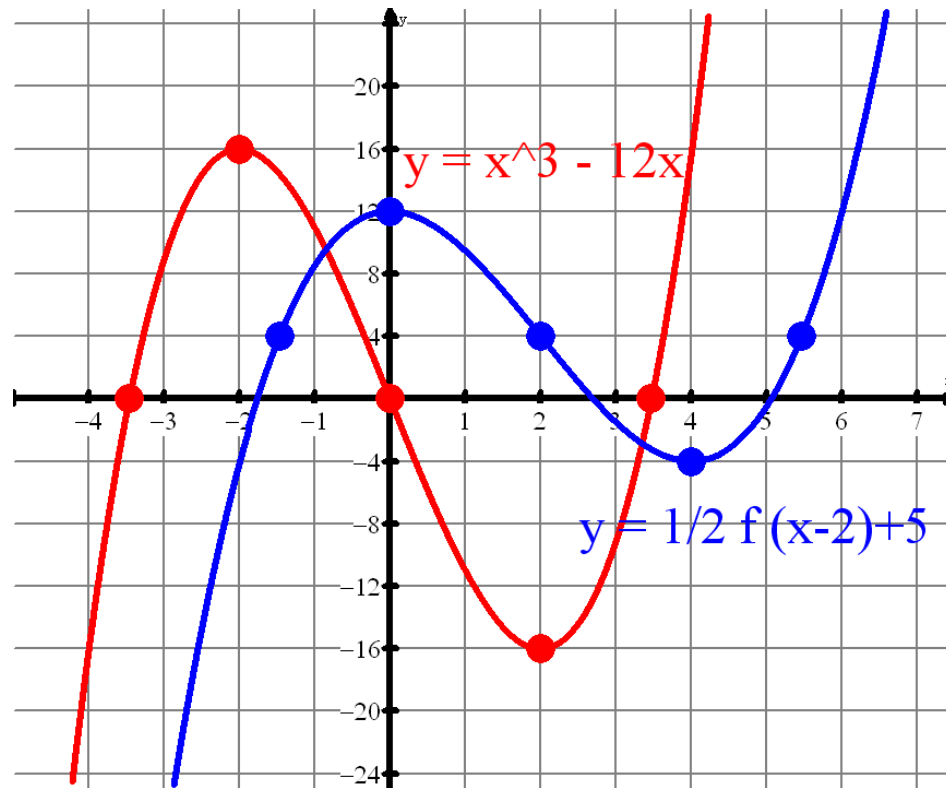
Key Features of $f(x) = x^3$

- The key features of a cubic function that will be helpful in studying transformations → you should know the maximums & minimum (extrema, turning points) and roots as well as being able to work with any key order pairs (i.e. (1,1) or (-1,-1))



Key Features of $f(x) = x^3$

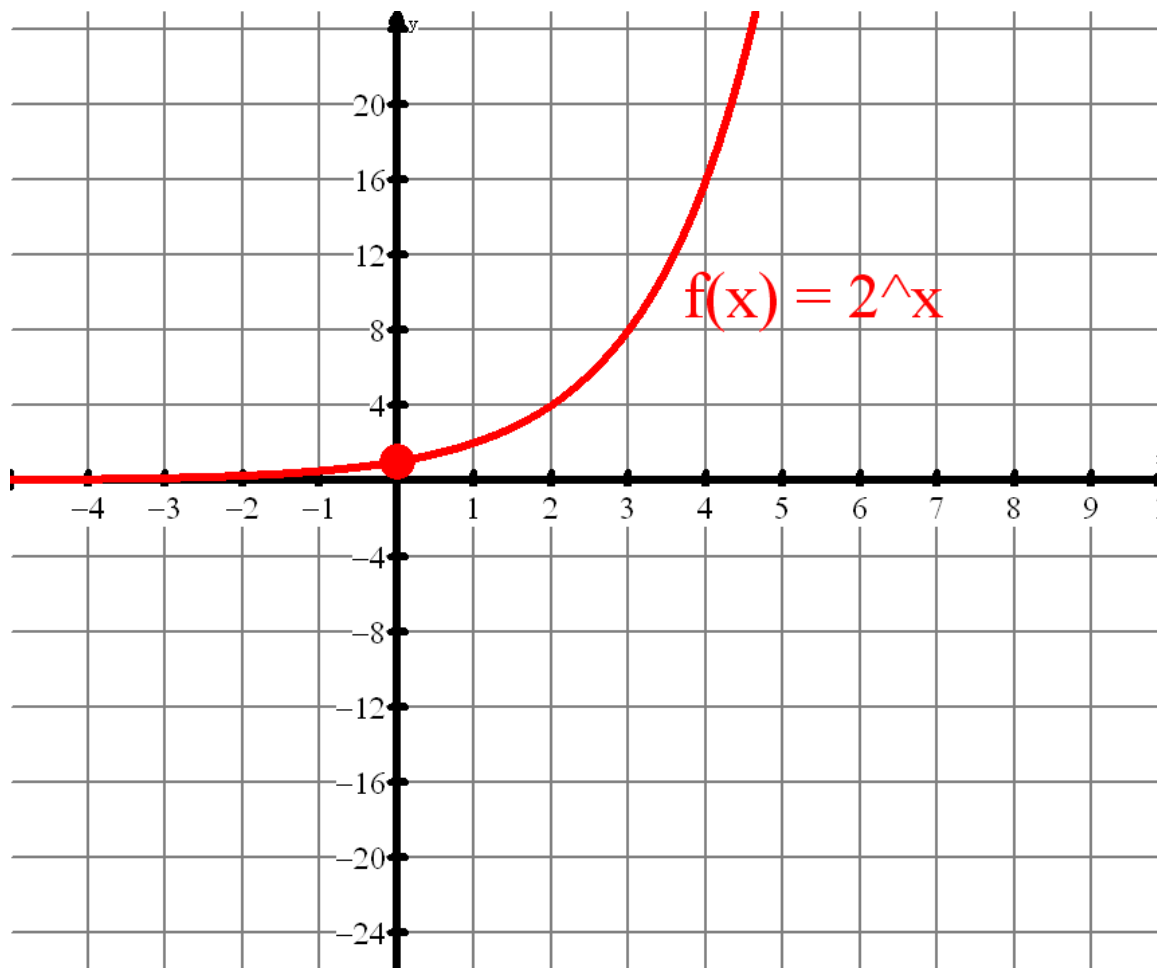
- So if $f(x) = x^3 - 12x$, then graph $g(x) = \frac{1}{2} f(x - 2) + 4$



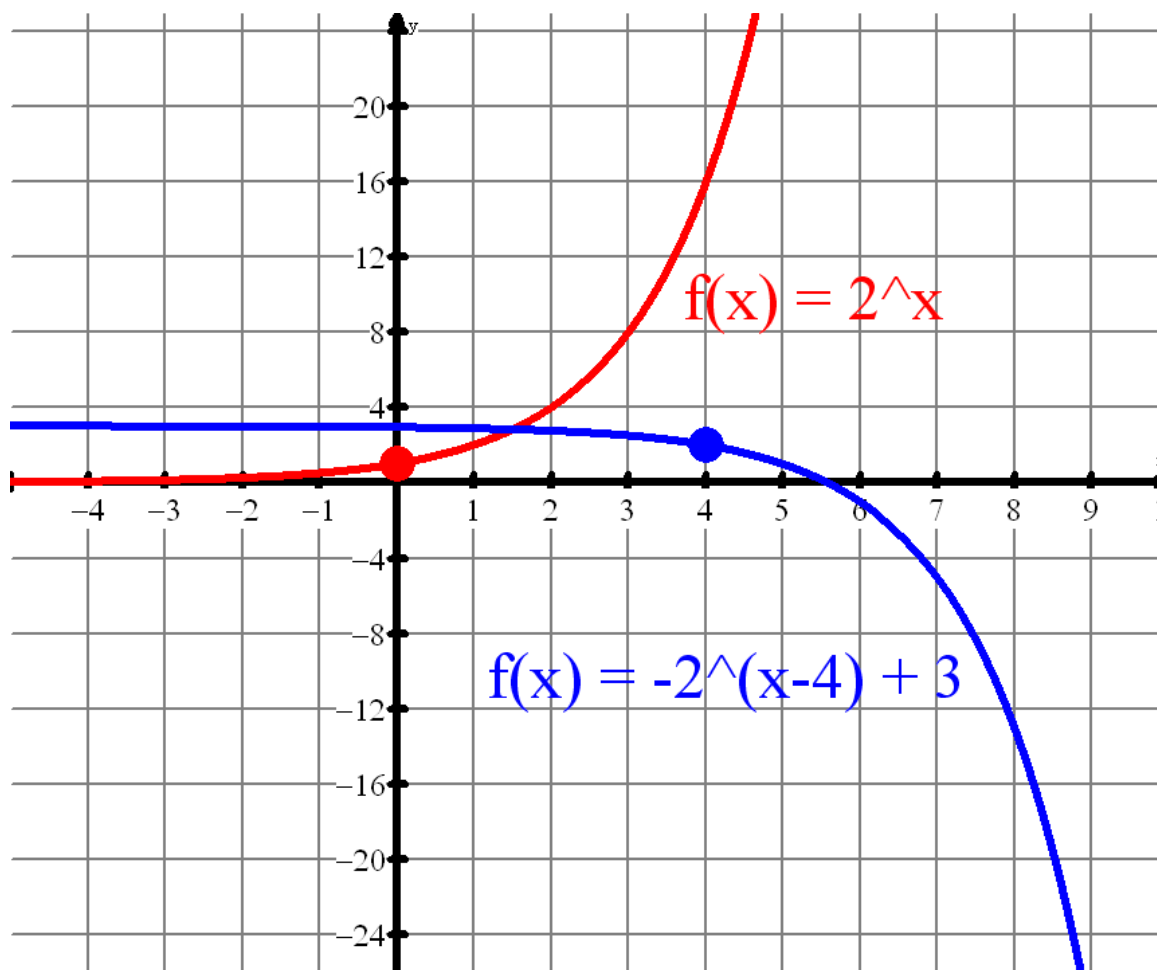
Key Features of $f(x) = 2^x$

- The key features of an exponential function that will be helpful in studying transformations → you should know the asymptote and y-intercept as well as being able to work with any key order pairs → i.e. $(1,2)$ or $(-1, \frac{1}{2})$ or $(2,4)$
- So work with the function $y = -2^{x-4} + 3$
- PREDICT the transformations of $f(x) = 2^x$

Key Features of $f(x) = 2^x$



Key Features of $f(x) = 2^x$



Culminating Assessment

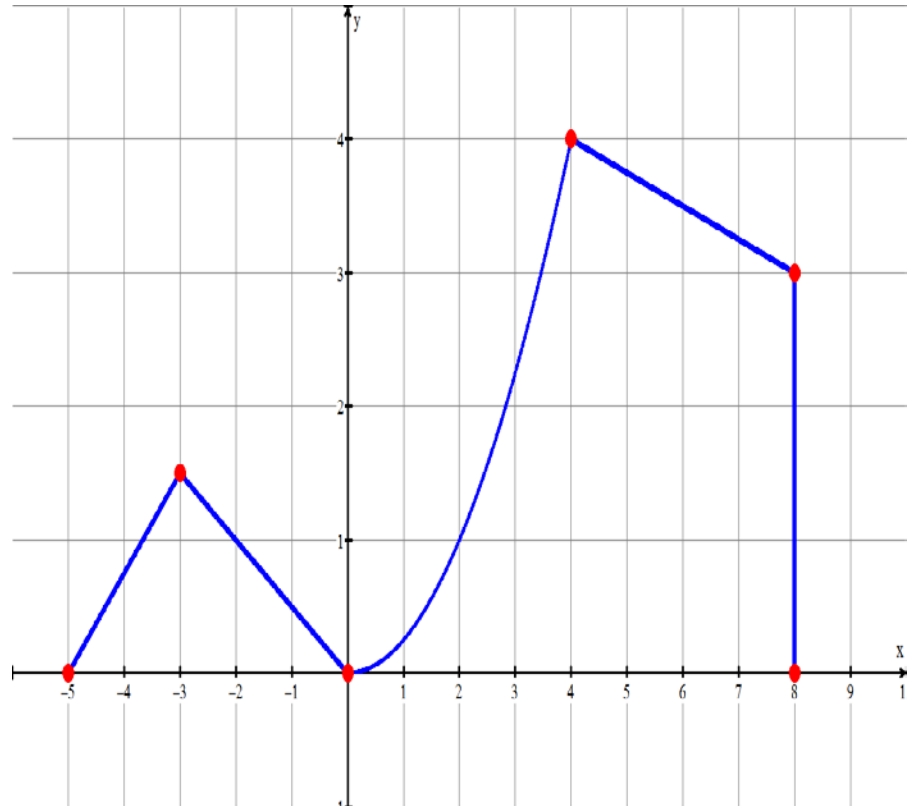
- Of course, you may have the skill set from your previous math studies to demonstrate the required skills & concepts
- Complete the following calculator inactive “quiz”

Q1

- Sketch the graph of $f(x) = 1/x$ and then sketch a graph of $g(x) = -2f(3x - 6) + 4$ and provide a complete functional analysis of $g(x)$.

Q2

- Given the following graph of $h(x)$, graph $k(x)$ if $k(x)$ is defined as follows:
- $4k(x) + 0.5 = h(4 - 0.5x)$
- Show a detailed “sample calculation” of how you transformed the point $A(2, 1)$ onto its image point



Homework

- The following Textbook exercises will develop your skill and understanding with the 2 key concepts of this lesson (features of base functions and transforming base functions)
- Ex 6A, p 121, Q1d,2d,3d,4d,5c,6d
- Ex 6B, p122, Q3,4,5,7
- Ex 6C.1, p124, Q5bc, 6d
- Ex 6C.2, p125, Q8
- Ex 6C.3, p125, Q3