**Activity 4.1.5 – Evaluating and Graphing** $f\left(x\right)=kx^{-p}$ **for *p* a**

**Rational Number**

In **Activity 4.1.2** we graphed $f\left(x\right)=kx^{-n}$ for *n* a natural number. We will now investigate this function when *x* is raised to a rational number. We will investigate how the value of *p* (a rational number) affects the graph of $f\left(x\right)=kx^{-p}$.

Use your calculator to sketch the following functions. Identify the domain of each function.

 1. $f\left(x\right)=3x^{-\frac{1}{4}}$2. $f\left(x\right)=3x^{-\frac{1}{3}}$



Domain: Domain:

3. $f\left(x\right)=3x^{-\frac{3}{4}}$ 4. $f\left(x\right)=3x^{-\frac{2}{3}}$



Domain: Domain

5. $ f\left(x\right)=3x^{-\frac{1}{6}}$ 6. $f\left(x\right)=3x^{-\frac{1}{5}}$



Domain: Domain:

7. $ f\left(x\right)=3x^{-\frac{5}{6}}$ 8. $f\left(x\right)=3x^{-\frac{2}{5}}$



Domain: Domain:

1. Now graph all eight functions on the same screen. What are the coordinates of the one point they have in common?
2. Deselect the graphs 1, 2, 3, 5, 6 and 7 and only show graphs 4 and 8. How are graphs 4 and 8 like graphs 1, 2, 3, 5, 6 and 7? How are they different?
3. Do graphs 4 and 8 exhibit symmetry? Explain.
4. Why are the domains of the functions in 2, 4, 6 and 8 different from the domains of functions 1, 3, 5 and 7?
5. Graph the following functions:
6. $y= 4x^{\frac{-3}{5}}$ and $y= 4x^{\frac{-1}{3}}$ b) $y= -4x^{\frac{-3}{5}}$ and $y= -4x^{\frac{-1}{3}}$



1. $y= 5x^{\frac{-2}{5}}$ and $y= 5x^{\frac{-2}{3}}$ d) $y= -5x^{\frac{-2}{5}}$ and $y= -5x^{\frac{-2}{3}}$



In answering the next four questions, be sure to consider symmetry, even or odd, domain, common points, where the function is increasing or decreasing, concavity, and end behavior.

1. What generalizations can you make about the graphs of the functions that satisfy the conditions in part a?
2. What generalizations can you make about the graphs of the functions that satisfy the conditions in part b? Also why should you have been able to predict the graphical behavior of the functions from part b once you had the graphs of the functions from part a?
3. What generalizations can you make about the graphs of the functions that satisfy the conditions in part c?
4. What generalizations can you make about the graphs of the functions that satisfy the conditions in part d? Also why should you have been able to predict the graphical behavior of the functions from part d once you had the graphs of the functions from part c?

**Graphing Functions**

1. Use your calculator if needed to sketch the following graphs. If you use transformations you may be able to graph the functions without your graphing calculator. After you have sketched each graph on the grid provided, graph each parent function, and explain in words how the transformations let you easily sketch the new function from the graph of the parent function. Also, identify the domain and end behavior of each function.

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| --- | --- | --- |
| a) $y=-4x+2$Transformation: Domain: End behavior: | b) $y=-4x^{2}+2$Transformation: Domain:End behavior: | c) $y=\frac{-4}{x}+2$Transformation: Domain:End behavior:  |

|  |  |  |
| --- | --- | --- |
| d) $y=-4x^{-2}+2$Transformation: Domain: End behavior: | e) $y=\frac{1}{5}x^{3}+2$Transformation: Domain: End behavior:  | f) $y=-3^{x}+2$Transformation: Domain: End behavior:  |