C COMBINED POWER FUNCTIONS

A **power function** is a function of the form $y = kx^n$ where $k \neq 0$ and n is a non-zero rational number.

INVESTIGATION 1 GRAPHS OF POWER FUNCTIONS

In this investigation we explore the graphs of simple power functions of the form $y = x^n$, $n \in \mathbb{Z}$, $n \neq 0$.

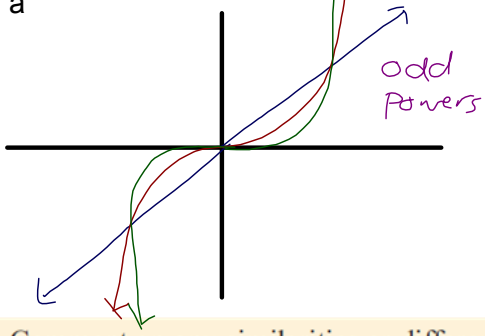
What to do:

1 Use technology to sketch the following sets of functions. Sketch each set on its own set of axes.

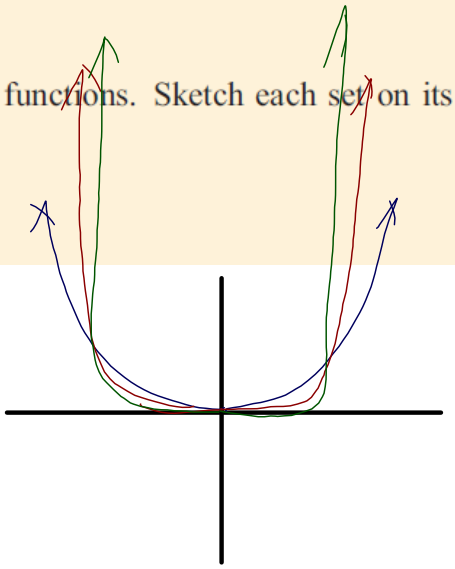
a $y = x$, $y = x^3$, $y = x^5$, $y = x^7$

b $y = x^2$, $y = x^4$, $y = x^6$, $y = x^8$

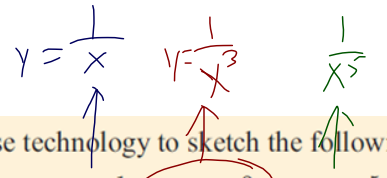
a



b



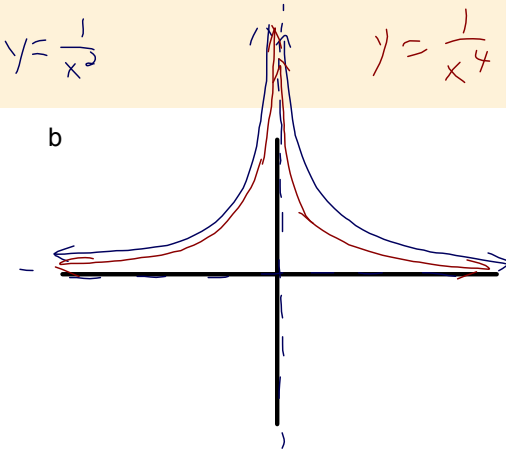
Comment on any similarities or differences between the graphs in each set and between the sets of graphs.



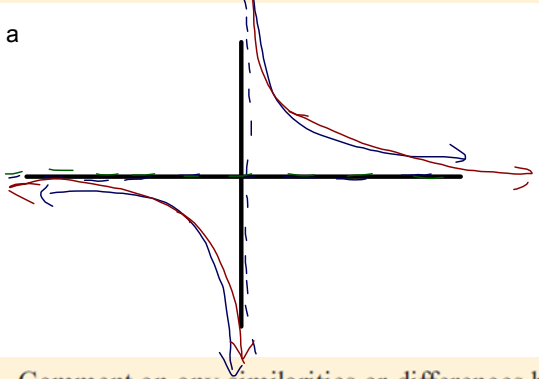
2 Use technology to sketch the following sets of functions. Sketch each set on its own set of axes.

a $y = x^{-1}$, $y = x^{-3}$, $y = x^{-5}$, $y = x^{-7}$

b $y = x^{-2}$, $y = x^{-4}$, $y = x^{-6}$, $y = x^{-8}$



a



b

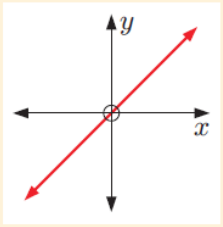
Comment on any similarities or differences between the graphs in each set and between the sets of graphs.

3 What graphical features are found in the graphs in **2** but *not* in the graphs in **1**? Explain this difference.

INVESTIGATION 2 COMBINED POWER FUNCTIONS

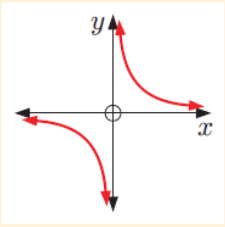
In this investigation we observe the features of the graph when two power functions are added together.

Consider the *linear* function $y = x$ and the *reciprocal* function $y = \frac{1}{x}$.



The graph of $y = x$ has:

- one section
- x-intercept 0
- y-intercept 0
- no asymptotes



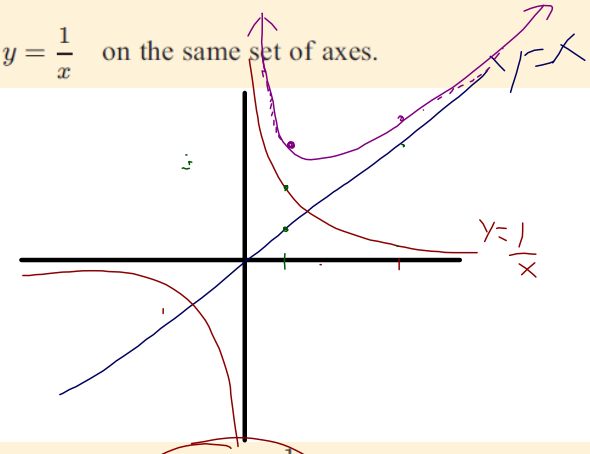
The graph of $y = \frac{1}{x}$ has:

- two sections
- no axes intercepts
- a vertical asymptote $x = 0$
- a horizontal asymptote $y = 0$

What to do:

1 Graph $y = x$ and $y = \frac{1}{x}$ on the same set of axes.

$X = \frac{1}{X}$ has two solutions



2 Think about the combined function $y = x + \frac{1}{x}$. Predict whether the graph of this function will have:

a one or two sections

b any axes intercepts NO

c a vertical asymptote $X = 0$

d a horizontal asymptote. NO

3 Use technology to sketch $y = x + \frac{1}{x}$. Discuss the features of this graph with your class.