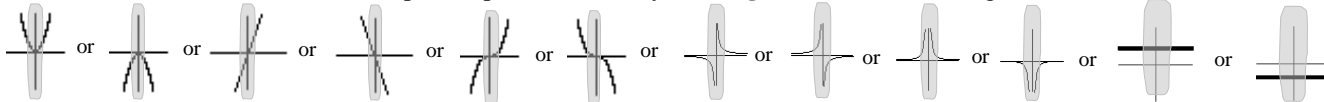# Long Run Behavior and Horizontal Asymptotes

For each rational function in Questions 1-5,
a. Find the power function it most closely resembles for very large values of x.
b. Describe the **long run** behavior by completing the boxes:

As $x \to -\infty$, then $y \to \boxed{}$; as $x \to \infty$, then $y \to \boxed{}$

c. Sketch the power function which has the same **long run** behavior. Pick from these choices:
   The *short run* behavior is covered up to emphasize that only the **long run** behavior is being mirrored.

d. Find the horizontal asymptote, if there is one. If none, state so.

1. $f(x) = \dfrac{8x^3 + 5x - 9}{4x^7 + 200x^2 - 6}$

   a. Power function model: $y = $ _____ (simplify)
   b. As $x \to -\infty$, then $y \to \boxed{}$; as $x \to \infty$, then $y \to \boxed{}$
   c. Graph of power function with same long run behavior:
   d. horizontal asymptote:

2. $f(x) = \dfrac{36x^3 + 3x - 7}{x^2 - 4x^3}$

   a. Power function model: $y = $ _____ (simplify)
   b. As $x \to -\infty$, then $y \to \boxed{}$; as $x \to \infty$, then $y \to \boxed{}$
   c. Graph of power function with same long run behavior:
   d. horizontal asymptote:

3. $f(x) = \dfrac{3 + 4x}{2 + 7x}$

   a. Power function model: $y = $ _____ (simplify)
   b. As $x \to -\infty$, then $y \to \boxed{}$; as $x \to \infty$, then $y \to \boxed{}$
   c. Graph of power function with same long run behavior:
   d. horizontal asymptote:

4. $f(x) = \dfrac{10x^6 - 4x}{(x-3)(x-4)}$

   a. Power function model: $y = $ _____ (simplify)
   b. As $x \to -\infty$, then $y \to \boxed{}$; as $x \to \infty$, then $y \to \boxed{}$
   c. Graph of power function with same long run behavior:
   d. horizontal asymptote:

5. $f(x) = \dfrac{2(x-2)^2(x-6)}{9(x-5)^3}$

   a. Power function model: $y = $ _____ (simplify)
   b. As $x \to -\infty$, then $y \to \boxed{}$; as $x \to \infty$, then $y \to \boxed{}$
   c. Graph of power function with same long run behavior:
   d. horizontal asymptote:

For the functions below, report the horizontal asymptote, if there is one. If none, state so.

6. $f(x) = \dfrac{7(x+2)(x+5)}{11(x-5)}$

7. $f(x) = \dfrac{12x^2 + 1}{3x^2 + 2} + 3$

8. $f(x) = \dfrac{25x^2 + 38}{x(1 + 0.02x)}$

9. $f(x) = \dfrac{6x}{3x^2 + 10} + 2$

10. $f(x) = \dfrac{3(x+5)^2(x-4)}{4(x-6)^3(x-1)}$