Powers and Influence

1. What is the effect of lesser powers in the numerator?

   (a) Consider the following limit: $\lim_{t\to\infty} \dfrac{5t+3}{3t^2-4t+7}$.

      i. Evaluate $\lim_{t\to\infty} 5t+3$.

      ii. Evaluate $\lim_{t\to\infty} 3t^2-4t+7$.

      iii. Based **only on the previous two limits**, can you determine which is growing faster?

      iv. Despite the lack of **current** evidence do you have a guess about which will end up growing faster? If so write your reason why. Next identify the calculus concept in your statement (there is one). Keep this in mind as you continue.

      v. Apply L'Hôpital's Rule once to $\lim_{t\to\infty} \dfrac{5t+3}{3t^2-4t+7}$.

      vi. Finish evaluating the limit.

      vii. Considering the value of the limit, was the numerator or the denominator of the original limit more influential in the answer?

   (b) Consider the following limit: $\lim_{t\to\infty} \dfrac{3t^2+17t-5}{5t^3-6t+43}$.

      i. Evaluate $\lim_{t\to\infty} 3t^2+17t-5$.

      ii. Evaluate $\lim_{t\to\infty} 5t^3-6t+43$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. Apply L'Hôpital's Rule once to $\lim_{t\to\infty} \dfrac{3t^2+17t-5}{5t^3-6t+43}$.

      v. Can the value of the limit be determined yet? Based on the previous problem what do you guess?

      vi. Apply L'Hôpital's Rule once more.

      vii. Finish evaluating the limit.

      viii. Considering the value of the limit, was the numerator or the denominator of the original limit more influential in the answer?

   (c) Consider the following limit: $\lim_{t\to\infty} \dfrac{t^m+t^{m-1}+\ldots+1}{t^n+t^{n-1}+\ldots+1}$ where $n > m$. n and m are finite numbers.

      i. Evaluate $\lim_{t\to\infty} t^m+t^{m-1}+\ldots+1$.

      ii. Evaluate $\lim_{t\to\infty} t^n+t^{n-1}+\ldots+1$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. How many times would you need to apply L'Hôpital's Rule before you can determine the value of the limit?

      v. What is the value of the limit? Why?

2. What is the effect of less powers in the denominator?

   (a) Consider the following limit: $\lim_{t\to\infty} \dfrac{3t^2-4t+7}{5t+3}$.

      i. Evaluate $\lim_{t\to\infty} 3t^2-4t+7$.

      ii. Evaluate $\lim_{t\to\infty} 5t+3$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. Apply L'Hôpital's Rule once to $\lim_{t\to\infty} \dfrac{3t^2-4t+7}{5t+3}$.

      v. Finish evaluating the limit.

      vi. Considering the value of the limit, was the numerator or the denominator of the original limit more influential in the answer?

   (b) Consider the following limit: $\lim_{t\to\infty} \dfrac{5t^3-6t+43}{3t^2+17t-5}$.

      i. Evaluate $\lim_{t\to\infty} 5t^3-6t+43$.

      ii. Evaluate $\lim_{t\to\infty} 3t^2+17t-5$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. Apply L'Hôpital's Rule once to $\lim_{t\to\infty} \dfrac{5t^3-6t+43}{3t^2+17t-5}$.

      v. Can the value of the limit be determined yet? Based on the previous problem what do you guess?

      vi. Apply L'Hôpital's Rule once more.

      vii. Finish evaluating the limit.

      viii. Considering the value of the limit, was the numerator or the denominator of the original limit more influential in the answer?

   (c) Consider the following limit: $\lim_{t\to\infty} \dfrac{t^n+t^{n-1}+\ldots+1}{t^m+t^{m-1}+\ldots+1}$ where $n > m$. n and m are finite numbers.

      i. Evaluate $\lim_{t\to\infty} t^n+t^{n-1}+\ldots+1$.

      ii. Evaluate $\lim_{t\to\infty} t^m+t^{m-1}+\ldots+1$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. How many times would you need to apply L'Hôpital's Rule before you can determine the value of the limit?

      v. What is the value of the limit? Why?

3. What is the effect of equal powers?

   (a) Consider the following limit: $\lim_{t\to\infty} \dfrac{12t+7}{4t-16}$.

      i. Evaluate $\lim_{t\to\infty} 12t+7$.

      ii. Evaluate $\lim_{t\to\infty} 4t-16$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. Apply L'Hôpital's Rule once to $\lim_{t\to\infty} \dfrac{12t+7}{4t-16}$.

      v. Finish evaluating the limit.

      vi. Considering the value of the limit, was the numerator or the denominator of the original limit more influential in the answer?

   (b) Consider the following limit: $\lim_{t\to\infty} \dfrac{9t^2+3t-1}{16t^2+4t-1}$.

      i. Evaluate $\lim_{t\to\infty} 9t^2+3t-1$.

      ii. Evaluate $\lim_{t\to\infty} 16t^2+4t-1$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. Apply L'Hôpital's Rule once to $\lim_{t\to\infty} \dfrac{9t^2+3t-1}{16t^2+4t-1}$.

      v. Can the value of the limit be determined yet? Based on the previous problem what do you guess?

      vi. Apply L'Hôpital's Rule once more.

      vii. Finish evaluating the limit.

      viii. Considering the value of the limit, was the numerator or the denominator of the original limit more influential in the answer?

   (c) Consider the following limit: $\lim_{t\to\infty} \dfrac{t^n+t^{n-1}+\ldots+1}{t^n+2t^{n-1}+\ldots+2}$. n is a finite numbers.

      i. Evaluate $\lim_{t\to\infty} t^n+t^{n-1}+\ldots+1$.

      ii. Evaluate $\lim_{t\to\infty} t^n+2t^{n-1}+\ldots+2$.

      iii. Based only on the previous two limits, can you determine which is growing faster?

      iv. How many times would you need to apply L'Hôpital's Rule before you can determine the value of the limit?

      v. What is the value of the limit? Why?

4. Determine whether the numerator or denominator is more influential in

$$\lim_{t\to\infty} \frac{e^t}{t^9}.$$