

**Exercise 1**

Compute the following limits or state that they don't exist. Justify your answer by showing your work.

1.  $\lim_{x \rightarrow +\infty} \frac{3x^3 + 4x - 2}{4x^3 + 5x^2 + 2x + 3}$

2.  $\lim_{t \rightarrow -\infty} \frac{5t^5 + 6t + 4}{2t^2 - t^3 + 6}$

3.  $\lim_{x \rightarrow 3^-} \frac{x-3}{\frac{3}{x}-1}$

4.  $\lim_{y \rightarrow +\infty} e^{-y} \cos(y)$

5.  $\lim_{x \rightarrow 0^+} \sin\left(\frac{1}{x}\right)$  (you might want to draw the function on your calculator before answering!)

6.  $\lim_{t \rightarrow -\infty} 3t^3 - 4t + 5t^2 - 1$

7.  $\lim_{t \rightarrow +\infty} \frac{1 - 2t^2 + 6t^7}{-7t - 9t^4 + 12t^2 - 16t^6 - 33t^3 + 4t^7 + 3 + 8t^5}$

8.  $\lim_{x \rightarrow +\infty} \frac{\sqrt{x+1}}{x}$

9.  $\lim_{y \rightarrow +\infty} \frac{\sqrt{7x^3 + 3x^2 - 1}}{\sqrt{2x^3 - 4}}$

10.  $\lim_{y \rightarrow -\infty} \frac{\sqrt{7x^3 + 3x^2 - 1}}{\sqrt{2x^3 - 4}}$

## Exercise 2

For every given situation, draw the graph of the function  $f$  (when it is not already given) and state if the function  $f$  is continuous. If you claim that it's not continuous, tell where it has a point of discontinuity and state which one(s) of the three conditions of the definition is not fulfilled.

1. A man drinks absorbs 250mg of cafeine at 8AM and we suppose that the quantity of cafeine in the human body decays exponentially with a rate of 0.87. At 12PM, he absorbes 100mg of cafeine. The function  $t \mapsto f(t)$  for  $0 \leq t \leq 10$  represents the quantity of cafeine in the man's body  $t$  hours after 8AM.
2. A woman leaves Washington DC by car at 8AM and rides at the constant speed of 50miles/hour to Philadelphia (140 miles away). When she reaches Philadelphia, she makes a pause that lasts until 11AM and then rides to New York City (100 miles away) at the constant speed of 60miles/hour. When she is in New York, she stops. The function  $t \mapsto f(t)$  for  $0 \leq t \leq 5$  represents the number of miles that she has ridden since Washington  $t$  hours after her departure.
3. We are in the same situation as in question 2 but now,  $t \mapsto f(t)$  represents the instantaneous speed of the woman after  $t$  hours.
4. The following graph represents the value of the stock's value of the KaibaCorp after  $t$  months.



5. To clean the dishes, a man filles his sink at constant speed for 1 minute until 10 liters of water are in the sink. Then, for 10 minutes, he cleans the dishes. A little leak in his sink causes 100mL to leak every minute. After he cleanes his dishes, the man drains the water and we suppose that the sink is instaneously empty. The function  $t \mapsto f(t)$  represents the amount of water in the sink after  $t$  minutes.