

What you should know before taking *Math 231 (calculus 2)*

Students planning to enroll in Math 231 should be familiar with the following concepts covered in calculus 1:

Examples:

- Limits such as:

$$\lim_{x \rightarrow \infty} \frac{3x^5 - 100x^2}{x^2 + x}, \quad \lim_{x \rightarrow \infty} \frac{x^{1000}}{e^{0.001x}} \quad \lim_{x \rightarrow \infty} \frac{-x}{\text{Ln}(100x) + e^{-5x}}$$

- Derivatives and general rules for taking derivatives.
- Definition of the derivative and its geometrical interpretation.
- Using the derivative to find local minimum and maximum for a given function.
- Using the derivative to find a good representative plot of a function.
- Derivatives of well-known functions like e^x , $\text{Ln}[x]$, $\text{Sin}[x]$, $\text{Cos}[x]$, and polynomials.
- Chain rule and product rule for taking derivatives.
- Intervals where a function is increasing or decreasing.
- What does the sign of the second derivative tell you about the behavior of a function?

Examples:

1) Find derivatives of the following functions:

a) $f(x) = e^{3x}$

b) $f(x) = \text{Cos}(x^2)$

c) $f(x) = 2 \text{Ln}(x^2)$

d) $f(x) = (4x^2 + 12x)e^{x^2}$

e) $f(x) = \frac{\text{Ln}(2x+3)}{x^5}$

f) $f(x) = [\text{Sin}(3x)]^{10}$

g) $f(x) = \sqrt{x^3}$

h) $f(x) = \frac{1}{x}$

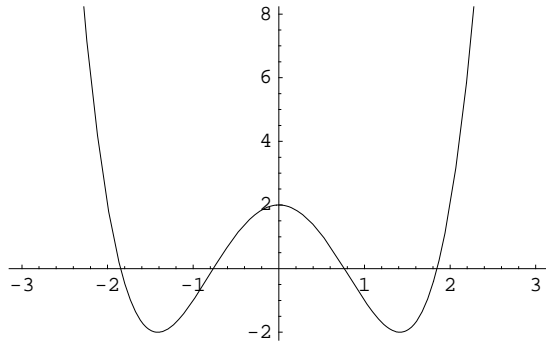
2) Find the maximum and minimum of the function $f(x) = x^3 - 6x^2$ on the interval $[-1, 3]$.

3) Without looking at the function plot, decide whether the function $f(x) = x^3 - 3x$ has a local maximum or local minimum at $x = 1$?

(Hint: use second derivative)

4) Plot a function $f(x) = (x^2 - 1)e^{-x}$ (your plot should show function's max/min, where it is increasing/decreasing and the global behavior).

5) Sketch the derivative of the following function:



- * Definition of the integral, it's basic properties and geometric interpretation.
- Definite vs. Indefinite integral
- Recognize and be able to use the Fundamental Theorem of Calculus. If

$$f[x] = \int_a^x g[t] dt ,$$

then

$$f'[x] = g[x] .$$

Examples:

1) Calculate the following integrals:

a) $\int_1^t e^{3x} dx$

b) $\int_1^2 (3x^2 - x) dx$

c) $\int_0^{-1} 1 dx$

d) $\int_0^t e^{-x} dx$

e) $\int_{-3}^3 \sqrt{9 - x^2} dx$

2) Calculate the area enclosed by the function plots of $f(t) = t$ and $f(t) = t^2$.