MA104 - Differential Calculus
Lesson 7: The Derivative as a Function

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1. Suppose $f(x) = x^2 - 3x + 5$.

   (a) Using the definition of the derivative, find a formula for $f'(x)$. (**Note**: If you have read ahead or already know the power rule from a previous calculus class, only use the rule to *check* your work!!)

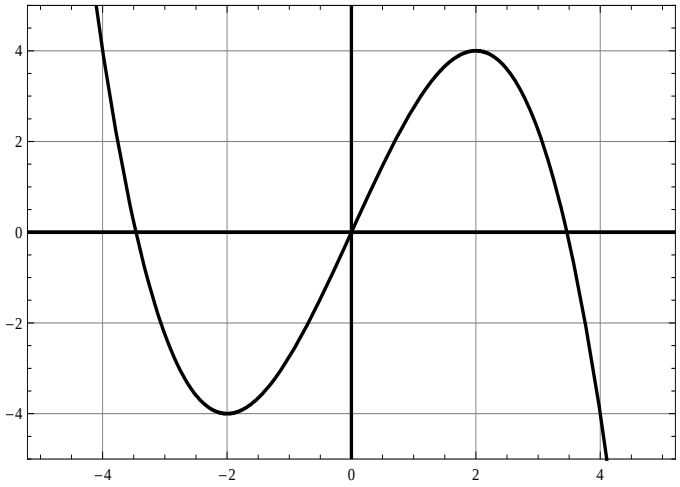
   (b) Using your derivative function, compute the instantaneous rate of change of f at $x = 3$.

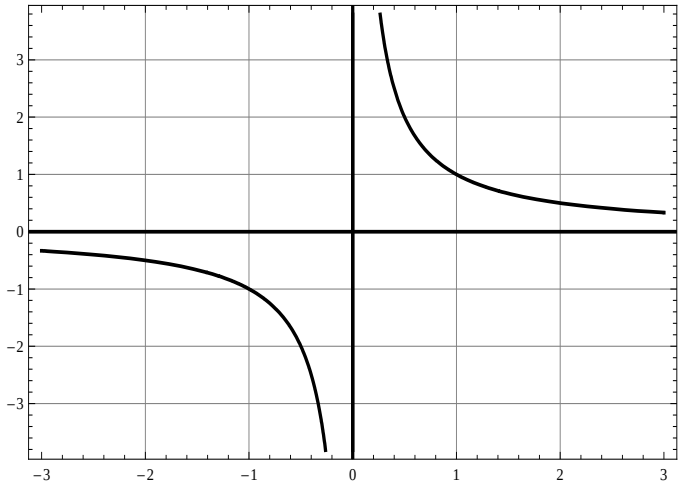
   (c) Using your derivative function, for what values of x does f have a horizontal tangent line?

2. Sketch a function with all of the following properties:

$$f'(0) = -1, \quad f(-1) = 1, \quad f'(-1) = 0, \quad f'(1) = 0, \quad f'(-2) = 5, \quad f(1) = -2.$$

3. On the same axes as the graph of each function, draw a rough sketch of the derivative of the function.
Tip: start by finding where the derivative is zero, then find where it is positive and negative.





4. The height in feet of a potato is given by the formula $f(t) = -16t^2 + 132t$, where t is measured in seconds.

   (a) Using the *definition* of the derivative, calculate the function $f'(t)$.

   (b) Using your derivative function, when is the *velocity* of the potato equal to zero?

   (c) What is the velocity at $t = 3$? Use it to find the equation of the tangent line to $f(t)$ when $t = 3$.

   (d) Graph the function and the tangent line on the same graph in Mathematica to check your work.