More differentiation rules

1. Power rule

2. Product rule

3. Exponential rule

4. Logarithm rule

Practice. Compute the derivative of the following functions.

1. $f(x) = (2x^2 - 1)(x^6 + x - 10)$

2. $f(x) = (2x^9 + x)(\ln x - 1)$

3. $f(x) = (\sqrt{x} + x)e^{-7x}$

4. $f(x) = (\ln x - e^{2x})(\sqrt[3]{x} + x^2)$

First derivative

- Increasing/Decreasing?

Second derivative

-Concave up/Concave down?

Practice.

1. Let $f(x) = \frac{1}{3}x^3 - x + 1$

a) When is the rate of chnage of $f(x)$ zero?

b) When is the function increasing?

c) When is the function decreasing?

d) When is the function concave up?

e) When is the function concave down?

Max/Min problems

Practice.

5. Find the maximum of $f(x) = -5x^2 + x + 2$. Explain why your answer really gives you the maximum of the function.

6. (8.13.12) A poster is to have a total area of 500 cm^2. There is a margin round the edges of 6 cm at the top and 4 cm at the sides and bottom where nothing is printed. What width should the poster be in order to have the largest printed area?

Velocity/Acceleration

-If $y = f(x)$ is the height/position function, then the first derivative $f'(x)$ is the velocity, and the second derivative $f''(x)$ is the acceleration.

Practice.

7. (cf. 8.10.1) The height in meters of a rocket above the ground t seconds after lauch is $h(t) = 20t + 5t^2$.

a) Find a formula for the velocity of the rocket t seconds after launch. Give the units.

b) Find a formula for the speed of the rocket t seconds after launch.

c) Find a formula for the acceleration of the rocket t seconds after lauch. Give the units.

d) When will the rocket reach its maximum height? What is this maximum height?