

MATH 34A DIFFERENTIATION RULES & TANGENT LINES

I. Differentiation rules.

1. Line: $f(x) = mx + b$

2. Constant: $f(x) = c$

3. Power rule: $f(x) = x^n$

4. Exponential rule: $f(x) = e^{Kx}$

5. Sum: $[f(x) + g(x)]' =$

6. Multiplication by constant: $[cf(x)]' =$

Examples.

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

2. $f(x) = e^{5x}$

3. $f(x) = \sqrt{x}$

4. $f(x) = \frac{x^2}{x^4}$

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

6. $f(x) = \frac{2x^2 + x}{x}$

II. Tangent line approximation.

Main idea:

1. Use tangent line approximation to estimate $\sqrt{9.1}$.

2. Consider $f(x) = e^{2x}$.

a) Find the tangent line to $f(x)$ at $x = 0$.

b) Use your answer in a) to estimate $e^{0.2}$. What is the percentage error?

c) Use your answer in a) to estimate e^4 . What is the percentage error?

III. First derivative (increasing/decreasing).

Main idea:

1. Consider $f(x) = \frac{x^3}{3} - x$. For what values of x is f increasing?

IV. Second derivative (concavity).

Main idea:

1. Consider $f(x) = x^3 + 2x - 1$. For what values of x is f concave down?

V. Maximum/minimum.

Main idea:

1. Find the minimum of $f(x) = 2x^2 - 2x + 1$.

2. A farmer wants to make a rectangular field with a total area of $2000m^2$. It is surrounded by a fence. It is divided into 3 equal areas by fences. What is the shortest total length of fence this can be done with?