The Standard Deviants Presents

The Candy-Coated World of Calculus (Part 2)

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I. Formula Review Time
   A. Definition of the Derivative
   B. Power Rule
   C. Product Rule
   D. Quotient Rule
   E. e^x
   F. Natural Logarithms

II. Applications of the Derivative
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   F. Two Sample Minimum/Maximum Problems
      1. With e^x
      2. Uncle Skippy's Minimum Surface Area
   G. Derivatives and distance, motion, velocity, and acceleration
      1. Position function
      2. Velocity function
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II. The Antiderivative and the Definite Integral
   A. The Definition and the Antiderivative
   B. Integration Rules
      1. Power Rule for Integration
      2. Natural Log Rule for Integration
      3. Exponential Rule for Integration
   C. The Definite Integral
   D. Riemann Sums
   E. The Fundamental Theorem of Calculus
   F. Area
   G. Substitution (Change of Variables)

Formulas

Definition of the Derivative:

$$f\ (x) = \lim_{h \quad 0} \frac{f(x+h) - f(x)}{h}$$

Power Rule:

If $f(x) = x^n$, then $f\ (x) = nx^{n-1}$

Exponential Rule:

If $f(x) = e^x$, then $f\ (x) = e^x$

Natural Logarithms Rule:

If $f(x) = 1n(x)$, then $f\ \ (\mathrm{x}) = \frac{1}{x}$

Product Rule:

If $f(x) = g(x) \bullet h(x)$, then
$f\ (x) = g\ (x) \bullet h(x) + h\ (x) \bullet g(x)$

Quotient Rule:

If $f(x) = \frac{g\ (x)}{h(x)}$, then

$$f\ (x) = \frac{g\ (x) \bullet h\ (x) - h\ \ (x) \quad \mathrm{g(x)}}{[h(x)]^2}$$

Critical Points:

points where f (x)=0 or does not exist

Increasing/Decreasing Functions:

f(x) is increasing over an interval if f (x) > 0 in that interval

f (x) is decreasing over an interval if f (x) < 0 in that interval

First Derivative Test for Local Extrema:

if f (x) changes from positive on the left of a point
to negative on the right, that point is a local maximum

if f (x) changes from negative on the left of a point
to positive on the right, that point is a local minimum

Second Derivative Test for Local Extrema:

if f (x) = 0 and f (x) > 0 at a point, that point is a local minimum
if f (x) = 0 and f (x) < 0 at a point, that point is a local maximum

Concavity:

f(x) is a concave up in an interval if f (x) > 0 in that interval

f(x) is concave down in an interval if f (x) < 0 in that interval

Position:

Distance = s(t)

Velocity Function:

Velocity = v(t) = s (t)

Acceleration Function:

Acceleration = a(t) = v (t) = s (t)

Notation for Antiderivative:

$$F(x) = \quad f(x)dx$$

Integration Formula for a Constant:

$$kdx = kx + C$$

Power Rule for Integration:

$$x^n dx = \frac{1}{n}(x^{n+1}) + C$$

Natural Logarithms Rule for Integration:

$$\frac{1}{x}\, dx = 1n\Omega x\Omega + C$$

Exponential Rule for Integration:

$$e^x dx = e^x + C$$

The Fundamental Theorem of Calculus:

$$_a^b\ f(x)dx = F(b) - F(a)$$