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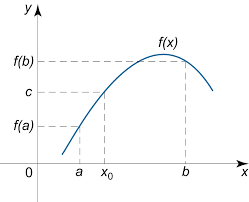
Math 31A Lecture Notes: Intermediate Value Theorem

Example 1:

Compute =

= =

Theorem 1; *Intermediate Value Theorem*: ; an, bm ≠ 0 =

Average rate of change of f(x) in [a, x]

tan

= = (difference quotient)

= slope of the secant line (x, f(x)) to (a, f(a))

Instantaneous rate of change of f(x) at x = a

=  =

= slope of tangent line (a, f(a))

sec

Definition; *Definition of a Derivative*: The derivative of f at a point a is the limit of the difference quotient (if it exists).

f '(a) =

If the limit exists, then we say f is differentiable at a.

Definition; *Equation of the Tangent Line*: Assume that f is differentiable at a. The tangent line of y = f(x) at P(a, f(x)) has the equation:

y – f(a) = f '(a)(x - a)

Example 2: Find the equation of the tangent line of f(x) = x2 at x = 5.

Solution: = = 10 + h

So, f '(5) = = = 10

Hence, the tangent line of a is given by y – 25 = 10(x - 5)

Theorem 2:

If f(x) = mx + b then f '(a) = m for all a

If f(x) = b then f '(a) = 0

Proof:

=

= = m

Remember: We can interpret

f '(x) = as a function in x, called the derivative of f, which is defined for all x where f(x) is differentiable.

Example 3: Prove that y = is differentiable for x ≠ 0 and compute y '.

y ' = = = = for all x ≠ 0

Leibniz notation: