MATHT 2301 Day 16 (Mon Feb 8, 2016)

Continuing Section 2.5 the Chain Rule

Example #9 Find the equation of the line tangent to $\sin(\cos(x))$ at $x = \frac{\pi}{2}$.

Solution: We need to build $(y-f(a)) = f'(a)(x-a)$.

Get Parts:

$a = \frac{\pi}{2}$, x coord of point of tangency

$f(a) = f(\frac{\pi}{2}) = \sin(\cos(\frac{\pi}{2})) = \sin(0) = 0$, y coord of point of tangency.

$f'(x) = \frac{d}{dx} \sin(\cos(x))$

$= \text{outer}'(\text{inner}(x)) \cdot \text{inner}'(x)$

$= \cos(\cos(x)) \cdot (-\sin(x))$

$f'(a) = f'(\frac{\pi}{2}) = \cos(\cos(\frac{\pi}{2})) \cdot (-\sin(\frac{\pi}{2}))$

$= \cos(0) \cdot (-1)$

$= (1) \cdot (-1) = -1$, slope of tangent line.

Details:

inner(x) = cos(x)

inner'(x) = -sin(x)

outer(x) = sin( )

outer'(x) = cos( )

empty version
Substitute Parts into Equation

\[(y - 0) = (-1)(x - \frac{\pi}{2})\]

\[y = -x + \frac{\pi}{2}\]

Example #5 Let \( f(x) = \sin(\sqrt{1 + x^2}) \) Find \( f'(x) \)

Solution: Rewrite \( f \) in a more helpful form

\[f(x) = \sin((1 + x^2)^{\frac{1}{2}})\]

(function in a function) In a function will require repeated chain rule
\[ f'(x) = \frac{d}{dx} \sin\left((1+x^2)^{\frac{1}{2}}\right) \]
\[ = \frac{d}{dx} \text{outer}\left(\text{inner}(x)\right) \]
\[ = \text{outer}'(\text{inner}(x)) \cdot \text{inner}'(x) \]
\[ = \cos\left((1+x^2)^{\frac{1}{2}}\right) \cdot \frac{d}{dx}(1+x^2)^{\frac{1}{2}} \]
\[ = \cos\left((1+x^2)^{\frac{1}{2}}\right) \cdot \frac{1}{2(1+x^2)^{\frac{1}{2}}} \cdot 2x \]
\[ = \frac{\cos\left((1+x^2)^{\frac{1}{2}}\right) \cdot 2x}{2(1+x^2)^{\frac{1}{2}}} = \frac{\cos\left(\sqrt{1+x^2}\right) \cdot x}{\sqrt{1+x^2}} \]
Now Work on Class Drill 9
(Two difficult problems involving the Chain Rule)

Tonight’s Math Events:
Calculus Bee!!
Free Pizza
See flyer on next page
CALCULUS BEE

Monday,
February 8,
2016
7:00 pm in
room
313 Morton

FREE PIZZA

The Bee will consist of several rounds, covering limit evaluation, differentiation, integration and the core skills built in a traditional calculus series. Each round, every competitor will be expected to correctly answer one given question, facing elimination for wrong answers.

There will be a first place prize for the highest ranking student that has not yet completed Calculus I and first and second place prizes for those who have.

Hosted by the Math Club

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