AP Calculus AB
Monday, November 18, 2013

1. If $y = (x)\sin x$, then $\frac{dy}{dx} =$

$\sin x + \cos x \cdot x$

2. Let f be the function given by $f(x) = 300x - x^3$. ~~On which of the following intervals is the~~ function f increasing?

On what intervals is $f(x)$ increasing?

$300 - 3x^2$

$300 - 3x^2 = 0$
$3x^2 = -300$
$x^2 = 100$
$x = \pm 10$

$- \quad + \quad -$
$-10 \quad 10$

$(-10, 10)$

f'(x) is positive on (-10,10); therefore, f(x) is increasing on (-10,10).

Example 4) Find the equation of the tangent line to the graph of $f(x) = 2x + \sin x + 1$ on $(0, \pi)$ at the point which is the solution of the mean-value theorem. Confirm by calculator.

1st slope of secant line:

$$m_{sec} = \frac{f(\pi) - f(0)}{\pi - 0}$$

$$m_{sec} = \frac{2\pi + 1 - (1)}{\pi}$$

$m_{sec} = 2$

2nd: Find $f'(x)$.

$f(x) = 2x + \sin x + 1$

$f'(x) = 2 + \cos x$

3rd: set $f'(x) = m_{sec}$ & solve for x.

$2 + \cos x = 2$

$\cos x = 0$

Remember, we are using interval $(0, \pi)$.

$x = \frac{\pi}{2}$

Now, write eqn of tangent line.

$f'\left(\frac{\pi}{2}\right) = 2 + \cos\frac{\pi}{2} = 2$

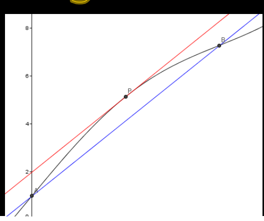
$f\left(\frac{\pi}{2}\right) = 2\left(\frac{\pi}{2}\right) + \sin\frac{\pi}{2} + 1$

$f\left(\frac{\pi}{2}\right) = \pi + 2$

$y - (\pi + 2) = 2\left(x - \frac{\pi}{2}\right)$

$y - \pi - 2 = 2x - \pi$

$y = 2x + 2$



What is the relationship between Rolle's Theorem and the MVT?

Rolle's Theorem is a specific case of the MVT where $f'(x) = 0$.

For the exercises below, determine whether Rolle's theorem can be applied to the function in the indicated interval. If Rolle's Theorem can be applied, find all values of x that satisfy Rolle's Theorem.

1. $f(x) = x^2 - 4x$ on $[0,4]$

Is $f(x)$ cont & diff on $[0,4]$?

Yes bc polynomial.

$f(4) = 4^2 - 4 \cdot 4 = 0$ ✓

$f(0) = 0$ ✓

2. $f(x) = x^2 - 11x + 30$ on $[5,6]$

yes C & D everywhere bc polynomial ✓

$f(6) = 36 - 66 + 30 = 0$ ✓

$f(5) = 25 - 55 + 30 = 0$ ✓

$f(x) = 4 - |x-2|$ on $[-2,2]$

$f(x)$ is continuous on $[-2,2]$.

$f(x)$ is diff. on $(-2,2)$. (Not diff. @ $x=2$).

But $f(2) \neq f(-2)$ Not use Rolle's Thm.

14 rolles and the mean value theorem.pdf - Adobe Reader

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3. $f(x)=(x-2)(x-3)(x-4)$ on $[2,4]$

4. $f(x)=(x+4)^2(x-3)$ on $[-4,3]$

5. $f(x)=4-|x-2|$ on $[-2,2]$

6. $f(x)=\sin x$ on $[0,2\pi]$

7. $f(x)=\cos 2x$ on $\left[\frac{\pi}{3},\frac{2\pi}{3}\right]$ ✓

$\cos\frac{2\pi}{3}$ $\quad \cos\frac{4\pi}{3}$

$-\frac{1}{2}$ $\quad -\frac{1}{2}$

8. $f(x)=\frac{6x}{\pi}-4\sin^2 x$ on $\left[0,\frac{\pi}{6}\right]$ ✓

$f(0)=0$

$f(\pi/6)=\frac{6}{\pi}\left(\frac{\pi}{6}\right)-4\left(\sin\frac{\pi}{6}\right)^2$

$=1-1$

$=0$

For the exercises below, apply the mean value theorem to $f(x)$ on the indicated interval. Find all values of c which satisfy the mean value theorem.

9. $f(x)=x^2$ on $[-1,2]$

10. $f(x)=x^3-x^2-2x$ on $[-1,1]$

Do EVENS 2-18