AP Calculus AB
Tuesday, October 15, 2013

Return Tests

Find y'

2. $y = (2\sin x)(\cos x + 1)$

$$y' = (2\sin x)(-\sin x) + (2\cos x)(\cos x + 1)$$

$$y' = -2\sin^2 x + 2\cos^2 x + 2\cos x$$

$$y' = 2(\underbrace{\cos^2 x - \sin^2 x}) + 2\cos x$$

$$\boxed{y' = 2\cos 2x + 2\cos x}$$

① $f'(x) = \sin(\frac{1}{2}x)\cos(\frac{1}{2}x)$ OR $\frac{\sin x}{2}$

$$\sin 2\theta = 2\sin\theta\cos\theta$$

$$\frac{\sin 2\theta}{2} = \sin\theta\cos\theta$$

③ $f'(x) = \dfrac{\sec^2 x}{3\sqrt[3]{\tan^2 x}}$

④ $y' = \dfrac{-\cot^2 x \csc x + \csc^2 x + \csc^3 x}{\cot^2 x}$

Section II. (20 points) Find all **points** *(x and y values)* of relative extrema and points of inflection. Fill in the blanks also. Use your own paper to show the work and attach it here. Be sure to justify your responses as we did in class.

$f(x) = \frac{x^3}{3} - x^2 - 15x + 1$

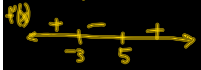
Critical values(points) → values that make $f'(x)=0$ OR make $f'(x)$ undef

$f'(x) = x^2 - 2x - 15$

$x^2 - 2x - 15 = 0$

$(x-5)(x+3) = 0$

$x = 5, -3$ → critical values



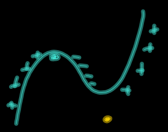
$f'(-4) = (-4)^2 - 2(-4) - 15$
$= 16 + 8 - 15$

$f'(0) = -15$

$f'(6) = 6^2 - 2 \cdot 6 - 15$
$= 36 - 12 - 15$

Since f'(x) <0 on (-3,5), f(x) is decreasing on (-3,5).

Since f'(x) >0 on (-infinity,-3) U (5,infinity), f(x) is increasing on (-infinity,-3) U (5,infinity).



Since $f'(x)$ changes from positive
negative @ $x=-3$, $f(x)$ has a relative
maximum when $x=-3$.

$f(-3) = \frac{(-3)^3}{3} - (-3)^2 - 15(-3) + 1$
$= -9 - 9 + 46$
$= 28$

Relative max: $(-3, 28)$

Since $f'(x)$ goes from negat
to positive @ $x=5$, $f(x)$ has a relative
minimum @ $x=5$.

$f(5) = \frac{5^3}{3} - 5^2 - 15 \cdot 5 + 1$

$= \frac{125}{3} \underbrace{- \frac{75}{3} - \frac{225}{3}} + \frac{3}{3}$

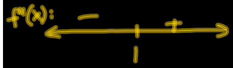
$= \frac{-172}{3}$

Relative min $(5, \frac{-172}{3})$

Point of Inflection → 2nd deriv.

$f''(x) = 2x - 2$

$2x - 2 = 0$
$x = 1$



$f''(0) = -2$

$f''(2) = 2$

At $x=1$, $f(x)$ has
of inflection bc $f''(x)$
signs.

$f(1) = \frac{1^3}{3} - 1^2 - 15 \cdot 1 +$

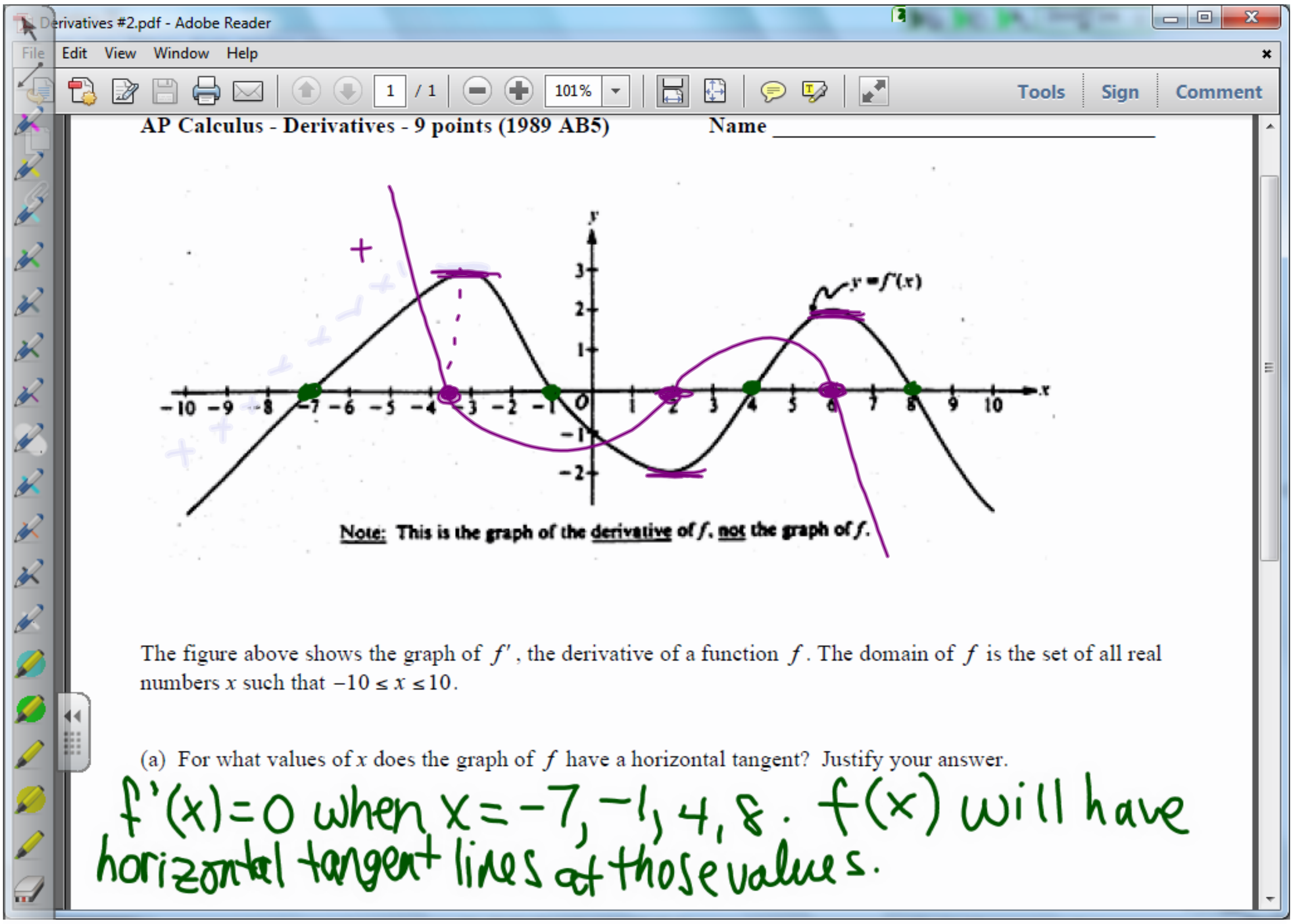
$= \frac{1}{3} - \frac{45}{3}$

$= -\frac{44}{3}$

f(x) is
concave down
on $(-\infty, 1)$ bc
$f''(x) < 0$ on
$(-\infty, 1)$.

Point of inflection: $(1, \frac{-44}{3})$

$f''(x) > 0$ on $(1, \infty)$ ∴ $f(x)$



AP Calculus - Derivatives - 9 points (1989 AB5) **Name** ______________________

Note: This is the graph of the derivative of f, not the graph of f.

The figure above shows the graph of f', the derivative of a function f. The domain of f is the set of all real numbers x such that $-10 \le x \le 10$.

(a) For what values of x does the graph of f have a horizontal tangent? Justify your answer.

$f'(x)=0$ when $x=-7,-1,4,8$. $f(x)$ will have horizontal tangent lines at those values.

(b) For what values of x in the interval (-10, 10) does f have a relative maximum? Justify your answer.

f has relative maxima @ $x=-1$ & $x=8$ because $f'(x)$ goes from positive to negative at those x-values.

(c) For what values of x is the graph of f concave downward? Justify your answer.

f is concave downward when f'(x) is decreasing which is on (-3,2).