AP Calculus Name ____________________

2.4 The Chain Rule

Chain Rule – deals with being able to take the derivative of a composite function.

$y=\sqrt{x^2+1}$ $\quad$ y = sin 6x $\quad$ $y = (3x + 2)^5$ $\quad$ $y = x + \tan x^2$

Chain Rule: The derivative of a composite function is the derivative of the outer function times the derivative of the inner function.

$\frac{d}{dx}[f(g(x))]=f'(g(x))\cdot g'(x)$ $\qquad$ $\frac{d}{dx}\left[u^n\right]=n\cdot u^{n-1}\cdot u'$

Find the derivative.

1) $y = (x^2 + 1)^3$

2) $f(x) = (3x - 2x^2)^3$

3) $y=\sqrt[5]{3x^3+4x}$

4) $g(x)=\frac{-7}{(2x-3)^2}$

5) $f(x)=x^2\left(3x^3-5\right)^3$

6) $f(x)= x^2\sqrt{1-x^2}$

7) $f(x)=\frac{x}{\sqrt[3]{x^2+4}}$

8) $f(x)=2x^3\sqrt{1-2x^2}$

9) $g(x)=\frac{5}{(4x^2-3)^3}$

10) $y=\frac{(x^2+1)^2}{\sin x}$

11) Find all points on the graph of $f(x) = \sqrt[3]{(x^2-1)^2}$ for which $f'(x) = 0$ and those for which $f'(x)$ does not exist.

Trigonometric Functions and the Chain Rule

$\frac{d}{dx}[\sin u] = (\cos u)u'$

$\frac{d}{dx}[\cos u] = -(\sin u)u'$

$\frac{d}{dx}[\tan u] = (\sec^2 u)u'$

$\frac{d}{dx}[\cot u] = -(\csc^2 u)u'$

$\frac{d}{dx}[\sec u] = (\sec u \tan u)u'$

$\frac{d}{dx}[\csc u] = -(\csc u \cot u)u'$

12) $y = \sin 2x$

13) $y = \cos(x - 1)$

14) $y = \tan 3x$

15) $y = \cos 3x^2$

16) $y = \cos^2 x$

17) $y = \csc^2 x$

18) $y = \cos^2 (3x)$

19) $y = \sqrt{\cos x}$

20) $f(t) = \sin^3 4t$

21) $f(x) = \sin 3x \cos 3x$

22) Find an equation of the tangent line to the graph of $f(x) = 2\sin x + \cos 2x$ at the point $(\pi,1)$. Then determine all values of x in the interval $(0,2\pi)$ at which the graph of f has a horizontal tangent.

Homework: Page 137 – 139 # 9 – 17 Odd, 21 – 27 Odd, 43 – 53 Odd, 59, 61, 69, 71, 83, 84, 91
(22 Problems)