hw solutions
section 3.3

2. $f(x) = (1-x)^3$

$f'(x) = 3(1-x)^2(-1)$

$= -3(1-x)^2$

14. $f(x) = \sqrt{2x^2-2x+3} = (2x^2-2x+3)^{1/2}$

$f'(x) = \frac{1}{2}(2x^2-2x+3)^{-1/2}(4x-2)$

$= \dfrac{2x-1}{\sqrt{2x^2-2x+3}}$

31. $f(x) = (x-1)^2(2x+1)^4$

$f'(x) = \frac{d}{dx}\left[(x-1)^2\right](2x+1)^4 + (x-1)^2 \cdot \frac{d}{dx}\left[(2x+1)^4\right]$

$= 2(x-1)^1(1)(2x+1)^4 + (x-1)^2 \cdot 4(2x+1)^3(2)$

$= 2(x-1)(2x+1)^4 + 8(x-1)^2(2x+1)^3$

OR $= 2(x-1)(2x+1)^3(2x+1+4(x-1))$

$= 6(x-1)(2x+1)^3(2x-1)$

33. $f(x) = \left(\dfrac{x+3}{x-2}\right)^3$

$f'(x) = 3 \cdot \left(\dfrac{x+3}{x-2}\right)^2 \cdot \dfrac{d}{dx}\left[\dfrac{x+3}{x-2}\right]$

$= 3\left(\dfrac{x+3}{x-2}\right)^2 \cdot \dfrac{(1)(x-2)-(x+3)(1)}{(x-2)^2}$

$= 3\left(\dfrac{x+3}{x-2}\right)^2 \cdot \dfrac{-5}{(x-2)^2} = \dfrac{-15(x+3)^2}{(x-2)^4}$

41. $h(x) = \dfrac{(3x^2+1)^3}{(x^2-1)^4}$

$h'(x) = \dfrac{\left[3(3x^2+1)^2(6x)\right](x^2-1)^4 - (3x^2+1)^3\left[4(x^2-1)^3 \cdot 2x\right]}{\left[(x^2-1)^4\right]^2}$

$= \dfrac{18x(3x^2+1)^2(x^2-1)^4 - 8x(3x^2+1)^3(x^2-1)^3}{(x^2-1)^8}$

$= \dfrac{2x(3x^2+1)^2(x^2-1)^3(-3x^2-13)}{(x^2-1)^8}$

$= \dfrac{-2x(3x^2+1)^2(3x^2+13)}{(x^2-1)^5}$

49. find $\frac{dy}{du}$, $\frac{du}{dx}$, & $\frac{dy}{dx}$

$y = u^{4/3}$ and $u = 3x^2-1$

$\dfrac{dy}{du} = y' = \frac{4}{3}u^{1/3}$

$\dfrac{du}{dx} = u' = 3(2x) = 6x$

$\dfrac{dy}{dx} = \dfrac{dy}{du} \cdot \dfrac{du}{dx} = y' \cdot u' = \frac{4}{3}u^{1/3} \cdot 6x$

$= \frac{4}{3}(3x^2-1)^{1/3} \cdot 6x$

$= 8x(3x^2-1)^{1/3}$

56. $h = f \circ g$. Find $h'(0)$ if $f(0)=6$, $f'(5)=-2$, $g(0)=5$, $g'(0)=3$.

$h(x) = (f \circ g)(x) = f(g(x))$

$h'(x) = f'(g(x)) \cdot g'(x)$

$h'(0) = f'(g(0)) \cdot g'(0) = f'(5) \cdot 3 = -2 \cdot 3 = -6$

52. find $\frac{dy}{du}$, $\frac{du}{dx}$, $\frac{dy}{dx}$

$y = 2u^2+1$ & $u = x^2+1$

$\dfrac{dy}{du} = y' = 4u$

$\dfrac{du}{dx} = u' = 2x$

$\dfrac{dy}{dx} = y' \cdot u' = 4u \cdot 2x$

$= 8(x^2+1) \cdot x$

or $= 8x^3 + 8x$

57. $F(x) = f(x^2+1)$. find $F'(1)$ if $f'(2) = 3$

$F'(x) = f'(x^2+1) \cdot (2x)$

$F'(1) = f'(1^2+1) \cdot 2 \cdot 1 = 2f'(2) = 2 \cdot 3 = 6$

79. $x = f(t) = 6.25t^2 + 19.75t + 74.75$

$t=0 \Rightarrow 1959$

$S = g(x) = -0.00075x^2 + 67.5$

find S & S' at 1999.

$1999 \Rightarrow t=4$ (in decades)

avg speed of traffic in 1999:

$S = g(f(4)) = g(253.75) =$

$= 19.2$ mph

rate of change:

$S' = g'(f(4))g'(4) = -26.55$ mph/decade