201 §2.3 II. #s 1-15 odds, 17, 19, 23-35 odds.

#s 1-22 Differentiate.

(1) $f(x) = 2^{40} \Longrightarrow \boxed{f'(x) = 0}$

(3) $f(t) = 2 - \frac{2}{3}t \Longrightarrow \boxed{f'(t) = -\frac{2}{3}}$

(5) $f(x) = x^3 - 4x + 6 \Longrightarrow \boxed{f'(x) = 3x^2 - 4}$

(7) $g(x) = x^2(1-2x) \Longrightarrow \boxed{g'(x) = 2x(1-2x) + x^2(-2)}$

OR $2x(1-2x) - 2x^2$

either way

OR $2x - 4x^2 - 2x^2 = -6x^2 + 2x$

OR $g(x) = x^2 - 2x^3 = -2x^3 + x^2 \Longrightarrow \boxed{g'(x) = -6x^2 + 2x}$

(9) $g(t) = 2t^{-3/4} \Longrightarrow \boxed{g'(t) = \left(-\frac{3}{4}\right)(2)t^{-7/4}}$

OR $\boxed{g'(t) = -\frac{3}{2}t^{-7/4}}$

(11) $A(s) = -\frac{12}{s^5} = -12s^{-5} \Longrightarrow \boxed{A'(s) = 60s^{-6}}$

(13) $S(p) = \sqrt{p} - p \Longrightarrow \boxed{S'(p) = \frac{1}{2}p^{-1/2} - 1}$ OR $\frac{1}{2\sqrt{p}} - 1$

$\sqrt{p} = p^{1/2}$

(15) $R(a) = (3a+1)^2 = 9a^2 + 6a + 1 \Longrightarrow$

$\boxed{R'(a) = 18a + 6}$

201 §2.3 I #s 17, 19, 23–35 ODDS

17 $y = \dfrac{x^2+4x+3}{\sqrt{x}} = \dfrac{x^2+4x+3}{x^{1/2}} = x^{3/2} + 4x^{1/2} + 3x^{-1/2}$

$y' = \frac{3}{2}x^{\frac{1}{2}} + 2x^{-\frac{1}{2}} - \frac{3}{2}x^{-\frac{3}{2}}$

Quick & Slick

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

$= \dfrac{2x^{3/2} + 4x^{1/2} - \frac{1}{2}x^{3/2} - 2x^{1/2} - \frac{3}{2}x^{-1/2}}{x}$

$= \dfrac{(3/2)\,x^{3/2} + 2x^{1/2} - \frac{3}{2}x^{-\frac{1}{2}}}{x}$

$= \frac{3}{2}x^{\frac{1}{2}} + 2x^{-\frac{1}{2}} - \frac{3}{2}x^{-\frac{3}{2}}$ Lengthy but same finish

19 $H(x) = (x + x^{-1})^3 = x^3 + 3x^2x^{-1} + 3x \cdot x^{-2} + x^{-3}$

$= x^3 + 3x + 3x^{-1} + x^{-3} \longrightarrow$

$H'(x) = 3x^2 + 3 - 3x^{-2} - 3x^{-4}$

§2.5 method: $3(x+x^{-1})^2(1-x^{-2})$ STOP

$= 3(x^2 + 2x\,x^{-1} + x^{-2})(1 - x^{-2})$ check

$= 3[x^2 - 1 + 2 - 2x^{-2} + x^{-2} - x^{-4}]$

$= 3x^2 + 3 - 3x^{-2} - 3x^{-4}$

23 Find $\frac{d}{dx}[(1+2x^2)(x-x^2)]$ in 2 ways ① Product Rule ② Old-School

(1) $f'(x) = 4x(x-x^2) + (1+2x^2)(1-2x) \longrightarrow$ $= 4x^2 - 4x^3 + 1 - 2x + 2x^2 - 4x^3$ $= 6x^2 - 8x^3 - 2x + 1$

(2) $f(x) = x - x^2 + 2x^3 - 2x^4$

$\boxed{f'(x) = 1 - 2x + 6x^2 - 8x^3}$

Yes, they agree.

201 § 2.3 #s 25–35 odds

#s 25–44 Differentiate

25 $v(x) = (2x^3+3)(x^4-2x)$

$\Rightarrow \boxed{v'(x) = (6x^2)(x^4-2x) + (2x^3+3)(4x^3-2)}$ Stop!

$= 6x^6 - 12x^3 + 8x^6 - 4x^3 + 12x^3 - 6$

$= 14x^6 - 4x^3 - 6$

27 $F(y) = \left(\frac{1}{y^2} - \frac{1}{y^4}\right)(y+5y^3) \Leftrightarrow$

$\cancel{F(y)} = (y^{-2} - y^{-4})(y+5y^3) \Rightarrow$

$\boxed{F'(y) = (-2y^{-3}+4y^{-5})(y+5y^3) + (y^{-2}-y^{-4})(1+15y^2)}$ Stop!

$= -2y^{-2} - 10 + 4y^{-4} + 20y^{-2} + y^{-2} + 15 - y^{-4} - 15y^{-2}$

$= 4y^{-2} + 5 + 3y^{-4}$

29 $g(x) = \frac{1+2x}{3-4x} \Rightarrow \boxed{g'(x) = \frac{2(3-4x) - (1+2x)(-4)}{(3-4x)^2}}$ Stop!

$= \frac{6-8x-4-8x}{(3-4x)^2} = \frac{-16x+2}{(3-4x)^2} = \frac{2(-8x+1)}{(3-4x)^2}$

201 #s 31–35 odd's §2.3 I

(31) $y = \dfrac{x^3}{1-x^2}$

$$\boxed{y' = \frac{3x^2(1-x^2) - (x^3)(-2x)}{(1-x^2)^2}}$$ STOP!

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

(33) $y = \dfrac{v^3 - 2v\sqrt{v}}{v} = \dfrac{v^3 - 2v^{3/2}}{v} = v^2 - 2v^{1/2}$

$$\boxed{y' = 2v - v^{-1/2}}$$

(35) $y = \dfrac{t^2+2}{t^4-3t^2+1}$

$$y' = \frac{2t(t^4-3t^2+1) - (t^2+2)(4t^3-6t)}{(t^4-3t^2+1)^2}$$ STOP! Relax!

$$= \frac{2t^5 - 6t^3 + 2t - 4t^5 - 6t^3 + 8t^3 - 12t}{(t^4-3t^2+1)^2}$$

$$= \frac{-2t^5 - 4t^3 - 10t}{(t^4-3t^2+1)^2} = \frac{-2t(t^4 + 2t + 5)}{(t^4-3t^2+1)^2}$$