Section 4.3

1.) $f(x) = (x+5)(x^2-3) \xrightarrow{D}$
$f'(x) = (x+5)(2x) + (1)(x^2-3)$

4.) $f(x) = (3x^4 - x^2+1)(2x^2 - 5x^3) \xrightarrow{D}$
$f'(x) = (3x^4 - x^2 + 1)(4x - 15x^2)$
$+ (12x^3 - 2x)(2x^2 - 5x^3)$

6.) $f(x) = 2(3x^2 - 2x^3)(1-5x^2) \xrightarrow{D}$
$f'(x) = 2(3x^2 - 2x^3)(-10x)$
$+ 2(6x - 6x^2)(1 - 5x^2)$

9.) $f(x) = (3x-1)^2 = (3x-1)(3x-1) \xrightarrow{D}$
$f'(x) = (3x-1)(3) + (3)(3x-1)$

17.) $f(x) = (3x^2-2)(x-1) \xrightarrow{D}$
$f'(x) = (3x^2-2)(1) + (6x)(x-1)$ and
pt. $x=1$, $y=0$ so slope of tangent line is $m = f'(1) = 1$ and line is
$y - 0 = (1)\cdot(x-1) \rightarrow y = x-1$

23.) $f(x) = 5(1-2x)(x+1) - 3 \xrightarrow{D}$
$f'(x) = 5(1-2x)(1) + 5(-2)(x+1) - 0$ and
pt. $x=0$, $y=2$ so slope of tangent line is $f'(0) = 5 - 10 = -5$, slope of $\perp$ is $m = 1/5$ and $\perp$ line is
$y - 2 = \frac{1}{5}(x-0) \rightarrow y = \frac{1}{5}x + 2$

26.) $f(x) = (x-3)(2-3x)(5-x) \xrightarrow{D}$
$f'(x) = (1)(2-3x)(5-x) + (x-3)(-3)(5-x)$
$+ (x-3)(2-3x)(-1)$

28.) $f(x) = (2x+1)(4-x^2)(1+x^2) \xrightarrow{D}$
$f'(x) = (2)(4-x^2)(1+x^2) + (2x+1)(-2x)(1+x^2)$
$+ (2x+1)(4-x^2)(2x)$

35.) $D(f \cdot g)(2) = f(2) \cdot g'(2) + f'(2) \cdot g(2)$
$= (-4)(-2) + (1)(3) = 11$

36.) $D(f \cdot f + g \cdot g)(2)$
$= f(2) \cdot f'(2) + f'(2) \cdot f(2)$
$+ g(2) \cdot g'(2) + g'(2) \cdot g(2)$
$= (-4)(1) + (1)(-4) + (3)(-2) + (-2)(3)$
$= -8 - 12 = -20$

38.) $y = 3x^2 \cdot f(x) \xrightarrow{D} y' = 3x^2 \cdot f'(x) + 6x \cdot f(x)$
(let $x = 1$) $\rightarrow y' = 3(1)^2 f'(1) + 6(1) f(1)$
$= 3 \cdot (-1) + 6 \cdot (2) = 9$

43.) $Y = (f(x) + 2g(x)) \cdot g(x) \xrightarrow{D}$
$Y' = (f(x) + 2g(x)) \cdot g'(x)$
$+ (f'(x) + 2g'(x)) \cdot g(x)$

47.) $f(N) = r(aN - N^2)(1 - \frac{1}{K}N) \xrightarrow{D}$
$f'(N) = r(aN - N^2) \cdot \left(\frac{-1}{K}\right) + r(a - 2N) \cdot \left(1 - \frac{1}{K} \cdot N\right)$

48.) $R(x) = k(a-x)\cdot(b-x) \xrightarrow{D}$
$R'(x) = k(a-x)\cdot(-1) + k(-1)\cdot(b-x)$

49.) $f(x) = \dfrac{3x-1}{x+1} \xrightarrow{D} f'(x) = \dfrac{(x+1)(3)-(3x-1)(1)}{(x+1)^2}$

52.) $f(x) = \dfrac{x^4+2x-1}{5x^2-2x+1} \xrightarrow{D}$

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

65.) $f(x) = 2x^2 - \dfrac{3x-1}{x^3} \xrightarrow{D}$

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

72.) $f(x) = 3\cdot x^{-1} - 4x^{-1/2} + 2x^{-2} \xrightarrow{D}$
$f'(x) = -3x^{-2} + 2x^{-3/2} - 4x^{-3}$ and $x=1, Y=1 \rightarrow$
slope $m = f'(1) = -5$ so line is
$Y-1 = -5(x-1) \rightarrow Y-1 = -5x+5 \rightarrow Y = -5x+6$

73.) $f(x) = \dfrac{2x-5}{x^3} \xrightarrow{D} f'(x) = \dfrac{x^3\cdot(2)-(2x-5)\cdot 3x^2}{x^6}$

and $x=2, Y = \frac{-1}{8} \rightarrow$ slope
$m = f'(2) = \dfrac{16-(-12)}{64} = \dfrac{28}{64} = \dfrac{7}{16}$ so line

is $Y - \left(\frac{-1}{8}\right) = \frac{7}{16}(x-2) \rightarrow Y + \frac{1}{8} = \frac{7}{16}x - \frac{7}{8} \rightarrow$

$Y = \frac{7}{16}x - 1$

83.) $$D\left(\frac{f}{2g}\right)(2) = \frac{2g(2)\cdot f'(2) - f(2)\cdot 2g'(2)}{(2g(2))^2}$$

$$= \frac{2(3)(1) - (-4)(2)(-2)}{(2(3))^2} = \frac{6-16}{36} = \frac{-10}{36} = \frac{-5}{18}$$

87.) $$Y = \frac{f(x)}{f(x)+x} \xrightarrow{D}$$

$$Y' = \frac{(f(x)+x)\cdot f'(x) - f(x)\cdot(f'(x)+1)}{(f(x)+x)^2}$$

$$= \frac{\cancel{f(x)f'(x)} + x f'(x) - \cancel{f(x)f'(x)} - f(x)}{(f(x)+x)^2}$$

$$= \frac{x\cdot f'(x) - f(x)}{(f(x)+x)^2}$$

94.) $$w(t) = \frac{f(t)}{c+t} \xrightarrow{D}$$

$$w'(t) = \frac{(c+t)\cdot f'(t) - f(t)\cdot(1)}{(c+t)^2}$$