Sec 3.2 page 188 (1-9)

① $f(x) = (1+2x^2)(x-x^2)$

multiplication

$x - x^2 + 2x^3 - 2x^4$

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

product rule

$f = 1+2x^2 \quad g = x-x^2$

$f' = 4x \quad g' = 1-2x$

$4x(x-x^2) + (1-2x)(1+2x^2)$

$4x^2 - 4x^3 + 1 + 2x^2 - 2x - 4x^3$

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

Same

② $F(x) = \dfrac{x^4 - 5x^3 + \sqrt{x}}{x^2}$

simplify

$F(x) = x^2 - 5x + x^{-3/2}$

$F'(x) = 2x - 5 - \frac{3}{2}x^{-5/2}$

quotient rule

$f = x^4 - 5x^3 + x^{1/2} \quad g = x^2$

$f' = 4x^3 - 15x^2 + \frac{1}{2}x^{-1/2} \quad g' = 2x$

$\dfrac{x^2(4x^3 - 15x^2 + \frac{1}{2}x^{-1/2}) - 2x(x^4 - 5x^3 + x^{1/2})}{(x^2)^2}$

$\dfrac{4x^5 - 15x^4 + \frac{1}{2}x^{3/2} - 2x^5 + 10x^4 - 2x^{3/2}}{x^4}$

$= \dfrac{2x^5 - 5x^4 - \frac{3}{2}x^{3/2}}{x^4} = \boxed{2x - 5 - \frac{3}{2}x^{-5/2}}$

Same

③ $f(x) = (x^3 + 2x)e^x$

$f = x^3 + 2x \quad g = e^x$

$f' = 3x^2 + 2 \quad g' = e^x$

$3x^2 e^x + 2e^x + e^x x^3 + 2xe^x$

$= \boxed{e^x(x^3 + 3x^2 + 2x + 2)}$

④ $\sqrt{x}\, e^x = g(x)$

$f = x^{1/2} \quad g = e^x$

$f' = \frac{1}{2}x^{-1/2} \quad g' = e^x$

$\dfrac{e^x}{2\sqrt{x}} + e^x\sqrt{x} = \boxed{\dfrac{e^x}{2\sqrt{x}}(1 + 2x)}$

⑤ $\frac{e^x}{x^2} = y$

$f = e^x \quad g = x^2$

$f' = e^x \quad g' = 2x$

$\frac{x^2e^x - 2xe^x}{x^4} = \boxed{\frac{e^x(x-2)}{x^3}}$

⑥ $y = \frac{e^x}{1+x}$

$f = e^x \quad g = 1+x$

$f' = e^x \quad g' = 1$

$\frac{e^x + xe^x - e^x}{(1+x)^2} = \boxed{\frac{xe^x}{(1+x)^2}}$

⑦ $g(x) = \frac{3x-1}{2x+1}$

$f = 3x-1 \quad g = 2x+1$

$f' = 3 \quad g' = 2$

$\frac{6x+3-6x+2}{(2x+1)^2} = \boxed{\frac{5}{(2x+1)^2}}$

⑧ $f(t) = \frac{2t}{4+t^2}$

$f = 2t \quad g = 4+t^2$

$f' = 2 \quad g' = 2t$

$\frac{8+2t^2-4t^2}{(4+t^2)^2} = \boxed{\frac{8-2t^2}{(4+t^2)^2}}$

⑨ $F(y) = (y^{-2}-3y^{-4})(y+5y^3)$

$F(y) = y^{-1} + 5y - 3y^{-3} - 15y^{-1}$

$F(y) = -14y^{-1} + 5y - 3y^{-3}$

$F'(y) = 14y^{-2} + 5 + 9y^{-4}$

or $\boxed{\frac{14}{y^2} + \frac{9}{y^4} + 5}$