Sec 3.2 day 2 page 188 (10-12, 25, 35, 41, 42, 45, 51-53)

(10) $R(t) = (t+e^t)(3-\sqrt{t})$

$R(t) = 3t - t^{3/2} + 3e^t - \sqrt{t}e^t$

$R'(t) = 3 - \frac{3}{2}t^{1/2} + 3e^t - \left(\frac{1}{2\sqrt{t}}e^t + \sqrt{t}e^t\right)$

$\boxed{R'(t) = 3 - \frac{3\sqrt{t}}{2} + 3e^t - \frac{e^t}{2\sqrt{t}} - \sqrt{t}e^t}$

(11) $y = \frac{x^3}{1-x^2}$

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

$f' = 3x^2 \quad g' = -2x$

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

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

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

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

$f' = 1 \quad g' = 3x^2+1$

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

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

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

(25) $f(x) = x^4e^x$

$f'(x) = 4x^3e^x + x^4e^x$

$= \boxed{e^x(4x^3+x^4) \text{ or } x^3e^x(4+x)}$

$f''(x) = 12x^2e^x + 4x^3e^x + 4x^3e^x + x^4e^x$

$= \boxed{x^2e^x(12+8x+x^2)}$

35 a) $f(x) = (x^3 - x)e^x$

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

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

41 a) $f'g + g'f$

$6(-3) + (2)(1)$

$-18 + 2$

$= -16$

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

$= \frac{-18 - 2}{9} = \frac{-20}{9}$

c) $\frac{g'f - f'g}{f^2} = \frac{2(1) - (6)(-3)}{(1)^2} = \frac{2 + 18}{1} = 20$

42 a) $h'(x) = 5f' - 4g' =$

$= 5(-2) - 4(7)$

$= -10 - 28 = -38$

b) $h'(x) = f'g + g'f$

$= -2(4) + 7(-3)$

$= -8 + -21 = -29$

c) $h'(x) = \frac{f'g - g'f}{g^2}$

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

$= \frac{-8 + 21}{16} = \frac{13}{16}$

d) $h'(x) = \frac{(g')(1+f) - (1+f)'(g)}{(1+f)^2}$

$= \frac{(-2)(7) - 4(-2)}{4}$

$= \frac{-14 + 8}{4} \frac{-6}{4} = \frac{-3}{2}$

45 a) $f = 2$ $g = 1$

$f' = 2$ $g' = -1$

$2 - 2 = 0$

b) $f = 3$ $g = 2$

$f' = -1/3$ $g' = 2/3$

$\frac{-\frac{2}{3} - 2}{4} = \frac{1}{4}\left(\frac{-2}{3} - 2\right)$

$= -\frac{1}{6} - \frac{1}{2} = -2/3$

(51) $f \uparrow \quad f' +$

$f(x) = x^3 e^x$

$f'(x) = 3x^2 e^x + x^3 e^x$

$f'(x) = \underset{\text{always}+}{e^x} \underbrace{(3x^2 + x^3)} > 0$

always+ when $3x^2 + x^3 > 0 \Rightarrow \underset{\text{always}+}{x^2}(3+x) > 0$

$x > -3$

$\therefore$ on $(-3, \infty)$

(52) $f(x) = x^2 e^x \qquad CU \quad f'' +$

$f'(x) = 2xe^x + x^2 e^x$

$f''(x) = 2e^x + 2xe^x + 2xe^x + x^2 e^x$

$f''(x) = e^x (2 + 4x + x^2) > 0 \quad \Rightarrow x^2 + 4x + 2 > 0$

always+

$$\frac{-4 \pm \sqrt{16 - 4(2)}}{2} = \frac{-4 \pm \sqrt{8}}{2}$$

$$= \boxed{-2 \pm \sqrt{2}}$$

$\therefore (-2-\sqrt{2}, -2+\sqrt{2})$ ca

(53) $y = \dfrac{x}{x+1} \qquad \begin{matrix} f = x \\ f' = 1 \end{matrix} \qquad \begin{matrix} g = x+1 \\ g' = 1 \end{matrix} \qquad \dfrac{x+1-x}{(x+1)^2} = \dfrac{1}{(x+1)^2} = m$

$f'(a) = \dfrac{1}{(a+1)^2}$ and point $y(a) = \dfrac{a}{a+1}$

$\therefore \; y - \dfrac{a}{a+1} = \dfrac{1}{(a+1)^2}(x - a)$ using $(1, 2)$

we have $2 - \dfrac{a}{a+1} = \dfrac{(1-a)}{(a+1)^2} \Rightarrow 2(a+1)^2 - a(a+1) = 1 - a$

$= 2a^2 + 4a + 2 - a^2 - a - 1 + a = 0 \qquad a = -2 \pm \sqrt{3}$

$a^2 + 4a + 1 = 0$

So points $(-.27, -.37)$ $(-3.73, 1.37)$