3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

1) $y = (x^2+1)(x^3+1)$

product rule: $y' = 2x(x^3+1) + (x^2+1)(3x^2)$

$= 2x^4 + 2x + 3x^4 + 3x^2$

$y' = \boxed{5x^4 + 3x^2 + 2x}$

expand: $y = x^5 + x^3 + x^2 + 1$

$y' = \boxed{5x^4 + 3x^2 + 2x}$

Both agree.

2) $F(x) = \dfrac{x - 3x\sqrt{x}}{\sqrt{x}}$

quotient rule: $y' = \dfrac{\sqrt{x}\,(x - 3x\sqrt{x})' - (\sqrt{x})'\,(x - 3x\sqrt{x})}{(\sqrt{x})^2}$

$= \dfrac{x^{1/2}(1 - \frac{9}{2}x^{1/2}) - \frac{1}{2}x^{-1/2}(x - 3x^{3/2})}{x}$

$= \dfrac{x^{1/2} - 9/2\,x - \frac{1}{2}x^{1/2} + \frac{3}{2}x}{x}$

$= \boxed{\frac{1}{2}x^{-1/2} - 3}$

Simplify: $y = \dfrac{x - 3x\sqrt{x}}{\sqrt{x}} = \dfrac{x - 3x^{3/2}}{x^{1/2}}$

$= x^{1/2} - 3x$

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

4) $g(x) = \sqrt{x}\,e^x = x^{1/2}e^x$

$g'(x) = \frac{1}{2}x^{-1/2}e^x + x^{1/2}e^x$

$= \boxed{e^x\left(\frac{1}{2\sqrt{x}} + \sqrt{x}\right)}$

5) $y = \dfrac{e^x}{x^2}$ $\quad y' = \dfrac{x^2(e^x)' - (x^2)'e^x}{x^4} = \dfrac{x^2e^x - 2xe^x}{x^4}$

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

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

9) $V(x) = (2x^3+3)(x^4-2x)$

$$V'(x) = 6x^2(x^4-2x) + (2x^3+3)(4x^2-2)$$

$$= \boxed{14x^6 - 4x^3 - 6}$$

18) $y = \dfrac{1}{s+ke^s}$

$$y' = \frac{(s+ke^s)(1)' - (s+ke^s)'\cdot(1)}{(s+ke^s)^2}$$

$$= \frac{0-(1+ke^s)}{(s+ke^s)^2}$$

$$= \boxed{-\frac{1+ke^s}{(s+ke^s)^2}}$$

26) $f(x) = \dfrac{ax+b}{cx+d}$

$$f'(x) = \frac{(cx+d)(ax+b)' - (cx+d)'(ax+b)}{(cx+d)^2}$$

$$= \frac{(cx+d)(a) - (c)(ax+b)}{(cx+d)^2} = \frac{acx+ad-acx+bc}{(cx+d)^2}$$

$$= \boxed{\frac{ad-bc}{(cx+d)^2}}$$

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

33) $y = 2xe^x$, Find tangent line + normal line at $(0,0)$

$y' = 2e^x + 2xe^x$

$y'(0) = 2$ ← slope of tangent line

$y - y_1 = m(x - x_1)$

$y - 0 = 2(x - 0)$

$\boxed{y = 2x \quad \text{Eqn of tangent line}}$

Slope of normal $= -1/2$

$y - y_1 = m(x - x_1)$

$y - 0 = -1/2(x - 0)$

$\boxed{y = -1/2\, x \quad \text{Eqn of normal line}}$

43) $f(5) = 1 \quad f'(5) = 6 \quad g(5) = -3 \quad g'(5) = 2$

a) $(fg)'(5) = f'(5)g(5) + f(5)g'(5)$

$= 6 \cdot (-3) + 1 \cdot (2)$

$= -18 + 2$

$\boxed{= -16}$

b) $\left(\frac{f}{g}\right)'(5) = \dfrac{g(5)f'(5) - g'(5)f(5)}{g(5)^2}$

$= \dfrac{(-3)(6) - (2)(1)}{(-3)^2}$

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

c) $\left(\frac{g}{f}\right)'(5) = \dfrac{f(5)g'(5) - f'(5)g(5)}{f(5)^2}$

$= \dfrac{(1)(2) - (6)(-3)}{(1)^2}$

$= \dfrac{2 + 18}{1} = \boxed{20}$

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

47) $f(1)=2 \quad g(1)=1 \quad f'(1)=2 \quad g'(1)=-1$

a. $u(x) = f(x)\,g(x)$

$u'(x) = f'g + g'f$

$u'(1) = (2)(1) + (-1)(2)$

$= 2 - 2 = \boxed{0}$

b. $v(x) = \dfrac{f(x)}{g(x)} \qquad g(5)=2 \quad g'(5)=\frac{2}{3} \quad f(5)=3 \quad f'(5)=-\frac{1}{3}$

$v'(x) = \dfrac{g f' - f g'}{g^2}$

$v'(5) = \dfrac{(2)(-1/3) - (3)(\frac{2}{3})}{2^2} = \dfrac{-\frac{2}{3} - 2}{4}$

$= \dfrac{-2/3 - \frac{6}{3}}{4} = \dfrac{-8/3}{4} = \boxed{-\frac{2}{3}}$

56) a) $F'' = f''g + 2f'g' + fg''$

b) $F''' = f'''g + f''g' + 2(f''g' + f'g'') + f'g'' + fg'''$

$= f'''g + 3f''g' + 3f'g'' + fg'''$

$F^{(4)} = f^{(4)}g + 4f'''g' + 6f''g'' + 4f'g''' + fg^{(4)}$

c) $F^{n} = f^{(n)}g + nf^{(n-1)}g' + \binom{n}{2}f^{n-2}g'' + \dots + \binom{n}{k}f^{n-k}g^{k}$

$+ \dots + nf'g^{n-1} + fg^{(n)}$

$\binom{n}{k} = \dfrac{n!}{k!(n-k)!}$ Binomial Coefficient.

k object selected from group of n. order doesn't matter