

$$(6) g(x) = \sqrt{x} \cdot \sin x$$

$$g'(x) = \sqrt{x} \cdot \cos x + \sin x \cdot \frac{1}{2} x^{-1/2} = \sqrt{x} \cos x + \frac{1}{2\sqrt{x}} \sin x$$

$$(12) f(t) = \frac{\cos t}{t^3}$$

$$f'(t) = \frac{t^3(-\sin t) - \cos t \cdot 3t^2}{(t^3)^2} = \frac{-t^3 \sin t - 3t^2 \cos t}{t^6} = \frac{-t \sin t - 3 \cos t}{t^4}$$

$$(34) g(x) = x^2 \left( \frac{2}{x} - \frac{1}{x+1} \right) \rightarrow \frac{x^2 \cdot 2x - x^2}{x+1}$$

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

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

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

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

$$(28) f(x) = x^4 \left( 1 - \frac{2}{x+1} \right) = x^4 - \frac{2x^4}{x+1}$$

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

$$(36) f(x) = (x^2 - x)(x^2 + 1)(x^2 + x + 1) = (x^4 - x^3 + x^2 - x)(x^2 + x + 1)$$

$$f'(x) = (x^4 - x^3 + x^2 - x)(2x + 1) + (x^2 + x + 1)(4x^3 - 3x^2 + 2x - 1)$$

$$= 2x^5 - 2x^4 + 2x^3 - 2x^2 + x^4 - x^3 + x^2 - x + 4x^5 + 4x^4 + 4x^3 - 3x^4 - 3x^3 - 3x^2 + 2x^3 + 2x^2 + 2x - x^2 - x - 1 = 6x^5 + 4x^3 - 2x^2 - 1$$

$$(38) f(x) = \frac{c^2 - x^2}{c^2 + x^2}$$

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

- Chain Rule  $\Rightarrow$  If  $y=f(u)$  is differentiable, and  $u=g(x)$  is a differentiable function of  $x$ , then  $y=f(g(x))$  is a differentiable function of  $x$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} \quad \underline{\text{OR}} \quad \frac{dy}{dx} = f'(g(x)) \cdot g'(x)$$

EX 1  $\rightarrow y = (x^3 - 3x^2 + 7)^4$

$$y' = 4(x^3 - 3x^2 + 7)^3 \cdot (3x^2 - 6x) = \boxed{(x^3 - 3x^2 + 7)^3 (12x^2 - 24x)}$$

EX 2  $\rightarrow y = \sin 5x$

$$y' = \cos 5x \cdot 5 = \boxed{5 \cos 5x}$$

EX 3  $\rightarrow y = \frac{8}{\sqrt{x^2+1}} = 8(x^2+1)^{-1/2}$

$$y' = 8 \cdot -\frac{1}{2} (x^2+1)^{-3/2} \cdot 2x = \boxed{-8x(x^2+1)^{-3/2}}$$

HW: p. 126 → 39-54, 64-78 even,  
93-102