

4.149) a)  $f'(x) = -\sin(e^x) e^x$

b)  $f'(x) = -\cos(3^x) \cdot \ln(3) \cdot 3^x$

c)  $f'(x) = -\sin(\ln(x)) \cdot \frac{1}{x}$

4.162) a)  $f(t) = \frac{(t^2 + 3t)^2}{t+1}$

$$f' = \frac{u'v - v'u}{v^2}$$

$$u = (t^2 + 3t)^2$$

$$v = t+1$$

$$u' = 2(t^2 + 3t)(2t+3)$$

$$v' = 1$$

$$f'(t) = \frac{2(t^2 + 3t)(2t+3)(t+1) - (t^2 + 3t)^2}{(t+1)^2}$$

$$= \frac{(4t^3 + 6t^2 + 12t^2 + 18t)(t+1) - t^4 - 6t^3 - 9t^2}{(t+1)^2}$$

$$= \frac{4t^4 + 6t^3 + 12t^3 + 18t^2 + 4t^3 + 6t^2 + 12t^2 + 18t - t^4 - 6t^3 - 9t^2}{(t+1)^2}$$

$$= \frac{3t^4 + 16t^3 + 27t^2 + 18t}{(t+1)^2}$$

b)  $f(t) = \frac{3t^2}{(t+3)^3}$

$$u = 3t^2$$

$$v = (t+3)^3$$

$$u' = 6t$$

$$v' = 3(t+3)^2$$

~~$$f'(t) = \frac{3(t+3)^2 \cdot 3t^2 - 6t(t+3)^3}{(t+3)^6}$$~~

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

$$= \frac{6t^2 + 18t - 9t^2}{(t+3)^4}$$

$$= \frac{-3t^2 + 18t}{(t+3)^4}$$



4.165 b)  $y = x \sqrt[3]{x+2} = \sqrt[3]{x^4 + 2x^3} = (x^4 + 2x^3)^{\frac{1}{3}}$

$$f'(x) = \frac{x^4 + 2x^3}{3 \sqrt[3]{x^4 + 2x^3}}$$

c)  $f(x) = \ln \left( \sqrt[5]{x^2} \cdot \sqrt[3]{x^5} \right)$   
 $= \ln \left( x^{\frac{2}{5}} \cdot x^{\frac{5}{3}} \right) = \ln \left( x^{\frac{24}{15}} \right) = \frac{24}{15} \cdot \ln(x)$

$$f'(x) = \frac{24}{15x}$$

4.168 a)  $f(x) = \sqrt{\frac{x+2}{2-x}}$   
 $= \left( \frac{x+2}{2-x} \right)^{\frac{1}{2}}$

$$u = x+2$$

$$v = 2-x$$

$$u' = 1$$

$$v' = -1$$

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

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

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

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

$$v = \cos(3x) \quad v' = -3 \sin(3x)$$

$$u = \sin(x) \quad u' = +\cos(x)$$

4.169 c)  $y = \sqrt{\sin(x) \cdot \cos(3x)}$

$$f'(x) = \frac{1}{2} (\sin(x) \cdot \cos(3x))^{-\frac{1}{2}} (\cos(x) + \cos(x) \cos(3x) + -3 \sin(3x) \cdot \sin(x))$$

$$= \frac{\cos(x) \cos(3x) - 3 \sin(3x) \sin(x)}{2 \sqrt{\sin(x) \cdot \cos(3x)}}$$

4.170 a)  $f(x) = \ln(x^3 - 2x^2 + 1) \quad f'(x) = \frac{3x^2 - 4x}{x^3 - 2x^2 + 1}$

c)  $f(x) = \ln(2^x - 1) \quad f'(x) = \frac{\ln(2) \cdot 2^x}{2^x - 1}$