2. $y = \cos(\tan x) \quad \Rightarrow \quad y' = -\sin(\tan x)\,\dfrac{d}{dx}\,(\tan x) = -\sin(\tan x)(\sec^2 x)$

4. $y = \dfrac{3x-2}{\sqrt{2x+1}} \quad \Rightarrow$

$$y' = \frac{\sqrt{2x+1}\,(3) - (3x-2)\frac{1}{2}(2x+1)^{-1/2}(2)}{\left(\sqrt{2x+1}\right)^2} \cdot \frac{(2x+1)^{1/2}}{(2x+1)^{1/2}} = \frac{3(2x+1)-(3x-2)}{(2x+1)^{3/2}} = \frac{3x+5}{(2x+1)^{3/2}}$$

6. $y = \dfrac{e^x}{1+x^2} \quad \Rightarrow \quad y' = \dfrac{(1+x^2)e^x - e^x(2x)}{(1+x^2)^2} = \dfrac{e^x(x^2-2x+1)}{(1+x^2)^2} = \dfrac{e^x(x-1)^2}{(1+x^2)^2}$

8. $y = e^{-t}(t^2-2t+2) \quad \Rightarrow \quad y' = e^{-t}(2t-2) + (t^2-2t+2)(-e^{-t}) = e^{-t}(2t-2-t^2+2t-2) = e^{-t}(-t^2+4t-4)$

11. $y = xe^{-1/x} \quad \Rightarrow \quad y' = xe^{-1/x}(1/x^2) + e^{-1/x}\cdot 1 = e^{-1/x}(1/x+1)$

41. $y = (2+x)e^{-x} \quad \Rightarrow \quad y' = (2+x)(-e^{-x}) + e^{-x}\cdot 1 = e^{-x}[-(2+x)+1] = e^{-x}(-x-1)$.

At $(0,2)$, $y' = 1(-1) = -1$, so an equation of the tangent line is $y-2 = -1(x-0)$, or $y = -x+2$.

The slope of the normal line is 1, so an equation of the normal line is $y-2 = 1(x-0)$, or $y = x+2$.

48. (a) $P(x) = f(x)g(x) \quad \Rightarrow \quad P'(x) = f(x)g'(x) + g(x)f'(x) \quad \Rightarrow$

$P'(2) = f(2)g'(2) + g(2)f'(2) = (1)\left(\frac{6-0}{3-0}\right) + (4)\left(\frac{0-3}{3-0}\right) = (1)(2) + (4)(-1) = 2-4 = -2$

(b) $Q(x) = \dfrac{f(x)}{g(x)} \quad \Rightarrow \quad Q'(x) = \dfrac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2} \quad \Rightarrow$

$Q'(2) = \dfrac{g(2)f'(2) - f(2)g'(2)}{[g(2)]^2} = \dfrac{(4)(-1)-(1)(2)}{4^2} = \dfrac{-6}{16} = -\dfrac{3}{8}$

(c) $C(x) = f(g(x)) \quad \Rightarrow \quad C'(x) = f'(g(x))g'(x) \quad \Rightarrow$

$C'(2) = f'(g(2))g'(2) = f'(4)g'(2) = \left(\frac{6-0}{5-3}\right)(2) = (3)(2) = 6$

53. $f(x) = g(e^x) \quad \Rightarrow \quad f'(x) = g'(e^x)e^x$

54. $f(x) = e^{g(x)} \quad \Rightarrow \quad f'(x) = e^{g(x)}g'(x)$

60. (a) The line $x - 4y = 1$ has slope $\frac{1}{4}$. A tangent to $y = e^x$ has slope $\frac{1}{4}$ when $y' = e^x = \frac{1}{4} \quad \Rightarrow \quad x = \ln\frac{1}{4} = -\ln 4$.
Since $y = e^x$, the y-coordinate is $\frac{1}{4}$ and the point of tangency is $\left(-\ln 4, \frac{1}{4}\right)$. Thus, an equation of the tangent line is $y - \frac{1}{4} = \frac{1}{4}(x + \ln 4)$ or $y = \frac{1}{4}x + \frac{1}{4}(\ln 4 + 1)$.

(b) The slope of the tangent at the point (a, e^a) is $\dfrac{d}{dx}\,e^x\Big|_{x=a} = e^a$. Thus, an equation of the tangent line is
$y - e^a = e^a(x-a)$. We substitute $x = 0$, $y = 0$ into this equation, since we want the line to pass through the origin:
$0 - e^a = e^a(0-a) \quad \Leftrightarrow \quad -e^a = e^a(-a) \quad \Leftrightarrow \quad a = 1$. So an equation of the tangent line at the point $(a, e^a) = (1, e)$ is $y - e = e(x-1)$ or $y = ex$.