3.5

3. Let $u = g(x) = 1 - x^2$ and $y = f(u) = u^{10}$. Then $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx} = (10u^9)(-2x) = -20x(1-x^2)^9$.

6. Let $u = g(x) = e^x$ and $y = f(u) = \sin u$. Then $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx} = (\cos u)(e^x) = e^x \cos e^x$.

17. $G(x) = (3x-2)^{10}(5x^2 - x + 1)^{12} \quad \Rightarrow$

$$\begin{aligned} G'(x) &= (3x-2)^{10}(12)(5x^2-x+1)^{11}(10x-1) + (5x^2-x+1)^{12}(10)(3x-2)^9(3) \\ &= 6(3x-2)^9(5x^2-x+1)^{11}[2(3x-2)(10x-1) + 5(5x^2-x+1)] \\ &= 6(3x-2)^9(5x^2-x+1)^{11}[(60x^2-46x+4) + (25x^2-5x+5)] \\ &= 6(3x-2)^9(5x^2-x+1)^{11}(85x^2-51x+9) \end{aligned}$$

27. $y = \cot^2(\sin\theta) = [\cot(\sin\theta)]^2 \quad \Rightarrow$

$y' = 2[\cot(\sin\theta)] \cdot \frac{d}{d\theta}[\cot(\sin\theta)] = 2\cot(\sin\theta) \cdot [-\csc^2(\sin\theta)\cdot\cos\theta] = -2\cos\theta\,\cot(\sin\theta)\,\csc^2(\sin\theta)$

31. $y = \sin(\sin x) \quad \Rightarrow \quad y' = \cos(\sin x)\cdot\cos x$. At $(\pi, 0)$, $y' = \cos(\sin\pi)\cdot\cos\pi = \cos(0)\cdot(-1) = 1(-1) = -1$, and an equation of the tangent line is $y - 0 = -1(x-\pi)$, or $y = -x + \pi$.

38. $w = u \circ v \quad \Rightarrow \quad w(x) = u(v(x)) \quad \Rightarrow \quad w'(x) = u'(v(x))\cdot v'(x)$, so $w'(0) = u'(v(0))\cdot v'(0) = u'(2)\cdot v'(0) = 4\cdot 5 = 20$. The other pieces of information, $u(0) = 1$, $u'(0) = 3$, and $v'(2) = 6$, were not needed.

42. (a) $h(x) = f(f(x)) \quad \Rightarrow \quad h'(x) = f'(f(x))f'(x)$.
So $h'(2) = f'(f(2))f'(2) = f'(1)f'(2) \approx (-1)(-1) = 1$.

(b) $g(x) = f(x^2) \quad \Rightarrow \quad g'(x) = f'(x^2)\cdot\frac{d}{dx}(x^2) = f'(x^2)(2x)$.
So $g'(2) = f'(2^2)(2\cdot 2) = 4f'(4) \approx 4(1.5) = 6$.

44. $g(x) = f(f(x)) \quad \Rightarrow \quad g'(x) = f'(f(x))f'(x)$. So $g'(1) = f'(f(1))f'(1) = f'(2)f'(1)$.

For $f'(2)$: $m_1 = \frac{3.1 - 2.4}{2.0 - 1.5} = 1.4$, $m_2 = \frac{4.4 - 3.1}{2.5 - 2.0} = 2.6$. So $f'(2) \approx \frac{m_1 + m_2}{2} = 2$.

For $f'(1)$: $m_1 = \frac{2.0 - 1.8}{1.0 - 0.5} = 0.4$, $m_2 = \frac{2.4 - 2.0}{1.5 - 1.0} = 0.8$. So $f'(1) \approx \frac{m_1 + m_2}{2} = 0.6$.

Hence, $g'(1) = f'(2)f'(1) \approx (2)(0.6) = 1.2$.