9. $f(t) = \left(2t^3 - t\right)^{-3} \Rightarrow f'(t) = -3\left(2t^3 - t\right)^{-4}\left(6t^2 - 1\right) = -\dfrac{3\left(6t^2 - 1\right)}{t^4\left(2t^2 - 1\right)^4}$

31. $f(x) = \sin 2x + \tan\sqrt{x} \Rightarrow f'(x) = (\cos 2x)\,2 + \left(\sec^2\sqrt{x}\right)\left(\frac{1}{2}x^{-1/2}\right) = 2\cos 2x + \dfrac{\sec^2\sqrt{x}}{2\sqrt{x}}$

59. $f(t) = \sin^2 t - \sin t^2 \Rightarrow f'(t) = 2\sin t\dfrac{d}{dt}\sin t - \cos t^2\dfrac{d}{dt}\left(t^2\right) = 2\sin t\cos t - 2t\cos t^2 = \sin 2t - 2t\cos t^2$ (since $2\sin t\cos t = \sin 2t$) $\Rightarrow$

$$f''(t) = \cos 2t\frac{d}{dt}(2t) - 2\left[t\frac{d}{dt}\left(\cos t^2\right) + \cos t^2\frac{d}{dt}(t)\right] = 2\cos 2t - 2\left[(t)\left(-\sin t^2\right)\frac{d}{dt}\left(t^2\right) + \cos t^2\right]$$

$$= 2\cos 2t - 2\left(-2t^2\sin t^2 + \cos t^2\right) = 2\left(\cos 2t + 2t^2\sin t^2 - \cos t^2\right)$$

66. $F(x) = g(f(x)) \Rightarrow F'(x) = g'(f(x))\,f'(x)$, so $F'(3) = g'(f(3))\,f'(3) = g'(16)\cdot 6 = \frac{1}{8}\cdot 6 = \frac{3}{4}$.

4. $x^2y + 2xy^2 - x + 3 = 0 \Rightarrow 2xy + x^2y' + 2y^2 + 4xyy' - 1 = 0 \Rightarrow \left(x^2 + 4xy\right)y' = 1 - 2xy - 2y^2 \Rightarrow y' = \dfrac{1 - 2xy - 2y^2}{x(x + 4y)}$

16. $x + y^2 = \cos xy \Rightarrow 1 + 2yy' = (-\sin xy)\left(y + xy'\right) \Rightarrow (2y + x\sin xy)\,y' = -y\sin xy - 1 \Rightarrow y' = -\dfrac{y\sin xy + 1}{2y + x\sin xy}$

24. $y = \sin xy \Rightarrow y' = (\cos xy)\left(y + xy'\right) \Rightarrow y' = \dfrac{y\cos xy}{1 - x\cos xy} \Rightarrow y'\big|_{(\pi/2,1)} = 0$. An equation of the tangent line is $y - 1 = 0\left(x - \frac{\pi}{2}\right)$ or $y = 1$.

29. $xy + x^3 = 4 \Rightarrow y + xy' + 3x^2 = 0 \Rightarrow y' = -\dfrac{3x^2 + y}{x}$. Differentiating both sides of the next-to-last expression yields

$$y' + y' + xy'' + 6x = 0 \Rightarrow y'' = -\frac{6x + 2y'}{x} = -\frac{6x - 2\cdot\dfrac{3x^2 + y}{x}}{x} = -\frac{2\left(3x^2 - 3x^2 - y\right)}{x^2} = \frac{2y}{x^2}.$$