9. $F(x) = \sqrt[4]{1+2x+x^3} = \left(1+2x+x^3\right)^{1/4} \Rightarrow$

$$F'(x) = \tfrac{1}{4}\left(1+2x+x^3\right)^{-3/4} \cdot \frac{d}{dx}\left(1+2x+x^3\right) = \frac{1}{4(1+2x+x^3)^{3/4}} \cdot \left(2+3x^2\right)$$

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

10. $f(x) = (1+x^4)^{2/3} \Rightarrow f'(x) = \frac{2}{3}\left(1+x^4\right)^{-1/3}\left(4x^3\right) = \dfrac{8x^3}{3\sqrt[3]{1+x^4}}$

11. $g(t) = \dfrac{1}{(t^4+1)^3} = \left(t^4+1\right)^{-3} \Rightarrow g'(t) = -3\left(t^4+1\right)^{-4}\left(4t^3\right) = -12t^3\left(t^4+1\right)^{-4} = \dfrac{-12t^3}{\left(t^4+1\right)^4}$

12. $f(t) = \sqrt[3]{1+\tan t} = \left(1+\tan t\right)^{1/3} \Rightarrow f'(t) = \frac{1}{3}(1+\tan t)^{-2/3}\sec^2 t = \dfrac{\sec^2 t}{3\sqrt[3]{(1+\tan t)^2}}$

13. $y = \cos\left(a^3+x^3\right) \Rightarrow y' = -\sin\left(a^3+x^3\right)\cdot 3x^2$ [a^3 is just a constant] $= -3x^2\sin\left(a^3+x^3\right)$

14. $y = a^3 + \cos^3 x \Rightarrow y' = 3(\cos x)^2(-\sin x)$ [a^3 is just a constant] $= -3\sin x\cos^2 x$

15. $y = \cot(x/2) \Rightarrow y' = -\csc^2(x/2)\cdot\frac{1}{2} = -\frac{1}{2}\csc^2(x/2)$

16. $y = 4\sec 5x \Rightarrow y' = 4\sec 5x\tan 5x(5) = 20\sec 5x\tan 5x$

17. $g(x) = (1+4x)^5(3+x-x^2)^8 \Rightarrow$

$$\begin{aligned} g'(x) &= (1+4x)^5\cdot 8(3+x-x^2)^7(1-2x) + (3+x-x^2)^8\cdot 5(1+4x)^4\cdot 4 \\ &= 4(1+4x)^4(3+x-x^2)^7\left[2(1+4x)(1-2x)+5(3+x-x^2)\right] \\ &= 4(1+4x)^4(3+x-x^2)^7\left[(2+4x-16x^2)+(15+5x-5x^2)\right] \\ &= 4(1+4x)^4(3+x-x^2)^7\left(17+9x-21x^2\right) \end{aligned}$$

18. $h(t) = (t^4-1)^3(t^3+1)^4 \Rightarrow$

$$\begin{aligned} h'(t) &= (t^4-1)^3\cdot 4(t^3+1)^3(3t^2) + \left(t^3+1\right)^4\cdot 3(t^4-1)^2(4t^3) \\ &= 12t^2(t^4-1)^2(t^3+1)^3\left[(t^4-1)+t(t^3+1)\right] = 12t^2(t^4-1)^2(t^3+1)^3\left(2t^4+t-1\right) \end{aligned}$$

19. $y = (2x-5)^4\left(8x^2-5\right)^{-3} \Rightarrow$

$$\begin{aligned} y' &= 4(2x-5)^3(2)\left(8x^2-5\right)^{-3} + (2x-5)^4(-3)\left(8x^2-5\right)^{-4}(16x) \\ &= 8(2x-5)^3\left(8x^2-5\right)^{-3} - 48x(2x-5)^4\left(8x^2-5\right)^{-4} \end{aligned}$$

[This simplifies to $8(2x-5)^3\left(8x^2-5\right)^{-4}\left(-4x^2+30x-5\right)$.]

20. $y = \left(x^2+1\right)\left(x^2+2\right)^{1/3} \Rightarrow$

$$y' = 2x\left(x^2+2\right)^{1/3} + \left(x^2+1\right)\left(\tfrac{1}{3}\right)\left(x^2+2\right)^{-2/3}(2x) = 2x\left(x^2+2\right)^{1/3}\left[1+\frac{x^2+1}{3(x^2+2)}\right]$$

21. $y = x^3\cos nx \Rightarrow y' = x^3(-\sin nx)(n) + \cos nx\left(3x^2\right) = x^2(3\cos nx - nx\sin nx)$

22. $y = x\sin\sqrt{x} \Rightarrow y' = x\cos\sqrt{x}\cdot\frac{1}{2}x^{-1/2} + \sin\sqrt{x}\cdot 1 = \frac{1}{2}\sqrt{x}\cos\sqrt{x} + \sin\sqrt{x}$

23. $y = \sin(x\cos x) \Rightarrow y' = \cos(x\cos x)\cdot[x(-\sin x)+\cos x\cdot 1] = (\cos x - x\sin x)\cos(x\cos x)$

29. $y = \tan(\cos x) \quad \Rightarrow \quad y' = \sec^2(\cos x) \cdot (-\sin x) = -\sin x \sec^2(\cos x)$

30. $y = \dfrac{\sin^2 x}{\cos x} \quad \Rightarrow$

$$y' = \frac{\cos x\,(2\sin x\cos x) - \sin^2 x\,(-\sin x)}{\cos^2 x} = \frac{\sin x\,(2\cos^2 x + \sin^2 x)}{\cos^2 x} = \frac{\sin x\,(1+\cos^2 x)}{\cos^2 x}$$

$$= \sin x\,(1 + \sec^2 x)$$

Another method: $y = \tan x \sin x \quad \Rightarrow \quad y' = \sec^2 x \sin x + \tan x \cos x = \sec^2 x \sin x + \sin x$

31. $y = \sin\sqrt{1+x^2} \quad \Rightarrow \quad y' = \cos\sqrt{1+x^2} \cdot \frac{1}{2}(1+x^2)^{-1/2} \cdot 2x = \left(x \cos\sqrt{1+x^2}\,\right)/\sqrt{1+x^2}$

32. $y = \tan^2(3\theta) = (\tan 3\theta)^2 \quad \Rightarrow \quad y' = 2(\tan 3\theta) \cdot \dfrac{d}{d\theta}(\tan 3\theta) = 2\tan 3\theta \cdot \sec^2 3\theta \cdot 3 = 6\tan 3\theta \sec^2 3\theta$

33. $y = (1+\cos^2 x)^6 \quad \Rightarrow \quad y' = 6(1+\cos^2 x)^5 \cdot 2\cos x\,(-\sin x) = -12\,\cos x\,\sin x\,(1+\cos^2 x)^5$

34. $y = x \sin\dfrac{1}{x} \quad \Rightarrow \quad y' = \sin\dfrac{1}{x} + x\cos\dfrac{1}{x}\left(-\dfrac{1}{x^2}\right) = \sin\dfrac{1}{x} - \dfrac{1}{x}\cos\dfrac{1}{x}$

35. $y = \sec^2 x + \tan^2 x = (\sec x)^2 + (\tan x)^2 \quad \Rightarrow$

$y' = 2(\sec x)(\sec x \tan x) + 2(\tan x)(\sec^2 x) = 2\sec^2 x \tan x + 2\sec^2 x \tan x = 4\sec^2 x \tan x$

36. $y = \cot(x^2) + \cot^2 x = \cot(x^2) + (\cot x)^2 \quad \Rightarrow$

$y' = -\csc^2(x^2) \cdot 2x + 2(\cot x)^1(-\csc^2 x) = -2x\csc^2(x^2) - 2\cot x \csc^2 x$

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

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

38. $y = \sin(\sin(\sin x)) \quad \Rightarrow \quad y' = \cos(\sin(\sin x))\,\dfrac{d}{dx}(\sin(\sin x)) = \cos(\sin(\sin x))\,\cos(\sin x)\,\cos x$

39. $y = \sqrt{x + \sqrt{x}} \quad \Rightarrow \quad y' = \frac{1}{2}(x+\sqrt{x}\,)^{-1/2}\left(1 + \frac{1}{2}x^{-1/2}\right) = \dfrac{1}{2\sqrt{x+\sqrt{x}}}\left(1 + \dfrac{1}{2\sqrt{x}}\right)$

40. $y = \sqrt{x + \sqrt{x + \sqrt{x}}} \quad \Rightarrow \quad y' = \frac{1}{2}\left(x + \sqrt{x+\sqrt{x}}\right)^{-1/2}\left[1 + \frac{1}{2}(x+\sqrt{x}\,)^{-1/2}\left(1 + \frac{1}{2}x^{-1/2}\right)\right]$

41. $y = \sin\left(\tan\sqrt{\sin x}\right) \quad \Rightarrow$

$$y' = \cos\left(\tan\sqrt{\sin x}\right)\cdot\frac{d}{dx}\left(\tan\sqrt{\sin x}\right) = \cos\left(\tan\sqrt{\sin x}\right)\sec^2\sqrt{\sin x}\cdot\frac{d}{dx}(\sin x)^{1/2}$$

$$= \cos\left(\tan\sqrt{\sin x}\right)\sec^2\sqrt{\sin x}\cdot\tfrac{1}{2}(\sin x)^{-1/2}\cdot\cos x$$

$$= \cos\left(\tan\sqrt{\sin x}\right)\left(\sec^2\sqrt{\sin x}\right)\left(\frac{1}{2\sqrt{\sin x}}\right)(\cos x)$$

42. $y = \sqrt{\cos(\sin^2 x)} \quad \Rightarrow \quad y' = \frac{1}{2}(\cos(\sin^2 x))^{-1/2}\,[-\sin(\sin^2 x)]\,(2\sin x\cos x) = -\dfrac{\sin(\sin^2 x)\sin x\cos x}{\sqrt{\cos(\sin^2 x)}}$

43. $y = (1+2x)^{10} \quad \Rightarrow \quad y' = 10(1+2x)^9 \cdot 2 = 20(1+2x)^9$. At $(0,1)$, $y' = 20(1+0)^9 = 20$, and an equation of the tangent line is $y - 1 = 20(x-0)$, or $y = 20x + 1$.

44. $y = \sin x + \sin^2 x \quad \Rightarrow \quad y' = \cos x + 2\sin x\cos x$. At $(0,0)$, $y' = 1$, and an equation of the tangent line is $y - 0 = 1(x-0)$, or $y = x$.

45. $y = \sin(\sin x) \quad \Rightarrow \quad y' = \cos(\sin x)\cdot\cos x$. 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 $y = -x + \pi$.