key

1. $y = x + \sec\left(x^2 + \sqrt{2}\right)$	$\frac{dy}{dx} =$ $1 + \sec(x^2+\sqrt{2})\tan(x^2+\sqrt{2}) \cdot 2x$
2. $y = -\csc\left(x^2 + 7x\right)$	$\frac{dy}{dx} =$ $\csc(x^2+7x)\cot(x^2+7x) \cdot (2x+7)$
3. $y = \cos(\sin x)$	$\frac{dy}{dx} =$ $-\sin(\sin x) \cdot \cos x$
4. $y = \sin\left(x^2 + 3x\right)^2$	$\frac{dy}{dx} =$ $\cos(x^2+3x)^2 \cdot 2(x^2+3x)^1 \cdot (2x+3)$
5. $y = \sin^2\left(x^2 + 3x\right)$ $y = (\sin(x^2+3x))^2$	$\frac{dy}{dx} =$ $2(\sin(x^2+3x))^1 \cdot \cos(x^2+3x) \cdot (2x+3)$
6. $y = \frac{e^x}{x^2}$	$\frac{dy}{dx} =$ $\frac{(x^2)(e^x) - (e^x)(2x)}{(x^2)^2}$
7. $y = 4 - x^2 \sin\left(\frac{2}{x}\right)$	$\frac{dy}{dx} =$ $(-x^2)\left(\cos\left(\frac{2}{x}\right) \cdot -\frac{2}{x^2}\right) + \sin\left(\frac{2}{x}\right)(-2x)$
8. $y = xe^x$	$\frac{dy}{dx} =$ $xe^x + e^x$
9. $y = (\sin x)e^x$	$\frac{dy}{dx} =$ $\sin x\, e^x + e^x \cos x$
10. $y = 2^x\left(x^2 + 1\right)$	$\frac{dy}{dx} =$ $2^x(2x) + (x^2+1)(2^x \cdot \ln 2)$
11. $y = \cos^2\left(3x^2 - 1\right)$ $y = (\cos(3x^2-1))^2$	$\frac{dy}{dx} =$ $2\cos(3x^2-1) \cdot -\sin(3x^2-1) \cdot 6x$

12. $y = 10^{\sin x}$	$\frac{dy}{dx} =$ $10^{\sin x} \cdot \ln 10 \cdot \cos x$
13. $y = e^{\csc x}$	$\frac{dy}{dx} =$ $e^{\csc x} \cdot -\csc x \cot x$
14. $y = \left(\frac{\sin x}{1+\cos x}\right)^2$	$\frac{dy}{dx} =$ $2\left(\frac{\sin x}{1+\cos x}\right)^1 \cdot \frac{(1+\cos x)(\cos x) - (\sin x)(-\sin x)}{(1+\cos x)^2}$
15. $y = \sin e^{3x}$	$\frac{dy}{dx} =$ $\cos e^{3x} \cdot e^{3x} \cdot 3$
16. $y = x^2 e^x$	$\frac{dy}{dx} =$ $x^2 \cdot e^x + e^x \cdot 2x$
17. $y = e^{3x} \cdot 4^{5x}$	$\frac{dy}{dx} =$ $e^{3x} \cdot 4^{5x} \cdot \ln 4 \cdot 5 + 4^{5x} \cdot e^{3x} \cdot 3$
18. $y = x^2 + 4^x$	$\frac{dy}{dx} =$ $2x + 4^x \cdot \ln 4$
19. $y = \sin^2 x^3 + \cos^2 x^3$ $y = 1$	$\frac{dy}{dx} =$ 0
20. $y = \frac{7^x}{x^2+1}$	$\frac{dy}{dx} =$ $\frac{(x^2+1)(7^x \cdot \ln 7) - (7^x)(2x)}{(x^2+1)^2}$
21. $y = \ln e^{x^2}$ $y = x^2$	$\frac{dy}{dx} =$ $2x$
22. $y = \ln(5-x)^6$ $y = 6\ln(5-x)$	$\frac{dy}{dx} =$ $6 \cdot \frac{1}{5-x} \cdot -1$

23. $y = 5^x \cos x$	$\frac{dy}{dx} = 5^x \cdot -\sin x + \cos x \cdot 5^x \ln 5$
24. $y = \sqrt{\sin x^3}$ $y = (\sin x^3)^{1/2}$	$\frac{dy}{dx} = \frac{1}{2}(\sin x^3)^{-1/2} \cdot \cos x^3 \cdot 3x^2$
25. $y = x^2 e^x - x e^x$	$\frac{dy}{dx} = \left(x^2 \cdot e^x + e^x \cdot 2x\right) - \left(x \cdot e^x + e^x \cdot 1\right)$
26. $y = 3^{\ln x}$	$\frac{dy}{dx} = 3^{\ln x} \cdot \ln 3 \cdot \frac{1}{x}$
27. $y = \frac{x^2}{\ln x}$	$\frac{dy}{dx} = \frac{(\ln x)(2x) - (x^2)(1/x)}{(\ln x)^2}$
28. $y = \ln(\ln x)$	$\frac{dy}{dx} = \frac{1}{\ln x} \cdot \frac{1}{x}$
29. $y = (\sin x)(\ln x)$	$\frac{dy}{dx} = (\sin x)(1/x) + (\ln x)(\cos x)$
30. $y = \frac{\ln x}{x^2}$	$\frac{dy}{dx} = \frac{(x^2)(1/x) - (\ln x)(2x)}{(x^2)^2}$
31. $y = \ln\left(\frac{5}{5-x}\right)$ $y = \ln 5 - \ln(5-x)$	$\frac{dy}{dx} = -\frac{1}{5-x} \cdot -1$
32. $y = \ln\sqrt{x^2+4}$	$\frac{dy}{dx} = \frac{1}{\sqrt{x^2+4}} \cdot \frac{1}{2}(x^2+4)^{-1/2} \cdot 2x$
33. $y = \ln(\arctan x)$	$\frac{dy}{dx} = \frac{1}{\arctan x} \cdot \frac{1}{1+x^2}$

34. $y = \ln(2 - \cos x)$	$\frac{dy}{dx} = \frac{1}{2-\cos x} \cdot \sin x$
35. $f(x) = \frac{x^2+2x+1}{x^2-2x+1}$ $= \frac{(x+1)(x+1)}{(x-1)(x-1)}$	$\frac{dy}{dx} = \frac{(x^2-2x+1)(2x+2) - (x^2+2x+1)(2x-2)}{(x^2-2x+1)^2}$
36. $f(x) = (3x^2-1)(2x+3)^{-1}$	$\frac{dy}{dx} = (3x^2-1) \cdot -1(2x+3)^{-2} \cdot 2 + (2x+3)^{-1} \cdot 6x$
37. $y = (2x-5)^3(5x-7)^5$	$\frac{dy}{dx} = 3(2x-5)^3 \cdot 5(5x-7)^4 + (5x-7)^5 \cdot 3(2x-5)^2 \cdot 2$
38. $y = \frac{x^2-2\sqrt{x}}{x}$	$\frac{dy}{dx} = \frac{(x)(2x - x^{-1/2}) - (x^2 - 2\sqrt{x})(1)}{x^2}$
39. $f(x) = \sin^2 x + \cos^2 x$ $= 1$	$\frac{dy}{dx} = 0$
40. $y = \arcsin(\cos x)$	$\frac{dy}{dx} = \frac{1}{\sqrt{1-(\cos x)^2}} \cdot -\sin x$
41. $y = \arcsin(4x)$	$\frac{dy}{dx} = \frac{1}{\sqrt{1-(4x)^2}} \cdot 4$
42. $y = \arctan\sqrt{x}$	$\frac{dy}{dx} = \frac{1}{1+(\sqrt{x})^2} \cdot \frac{1}{2}x^{-1/2}$

$\sin^2 + \cos^2 = 1$

$\cos^2 - 1 = -\sin^2$