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1. $y' = (1+x)(1+y^2)$

$\frac{dy}{dx} = (1+x)(1+y^2)$

$\frac{dy}{1+y^2} = (1+x)\,dx$

$\int \frac{dy}{1+y^2} = \int (1+x)\,dx$

$\arctan(y) = x + \frac{x^2}{2} + c$

$y = \tan\left(x + \frac{x^2}{2} + c\right)$

2. $y' \sin 2x = y \cos 2x$

$y' \tan 2x = y$

$\frac{dy}{dx} \tan 2x = y$

$\frac{dy}{dx} = \frac{dx}{\tan 2x}$

$\int \frac{dy}{y} = \int \frac{dx}{\tan 2x}$

$\ln|y| = \ln|\sin(2y)| + c$

$y = (\sin(2x))^{1/2} + c$

3. $y' = \frac{4y}{x(y-3)} \Rightarrow \frac{dy}{dx} = \frac{4y}{x(y-3)} \Rightarrow \frac{dy}{dx} = \frac{4y}{y(-3)} \frac{1}{x} \Rightarrow \frac{y-3}{4y}\,dy = \frac{dx}{x}$

$\int \frac{y-3}{4y}\,dy = \int \frac{dx}{x}$

$\frac{1}{4}\int \frac{y-3}{y}\,dy = \ln|x| + c$

$\frac{1}{4}\int 1 - \frac{3}{y}\,dy = \ln|x| + c$

$\frac{1}{4}\left(\int dy - \int \frac{3}{y}\,dy\right) = \ln|x| + c$

$\frac{1}{4}(y - 3\ln|y|) = \ln|x| + \ln|c|$

$y - 3\ln|y| = 4\ln|x| + \ln|c|$

$y = \ln|x^4| + \ln|y^3| + \ln|c|$

$= \ln|x^4 y^3| c$

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4. $x^3\,dx + (y+1)^2\,dy = 0$

$x^3\,dx = -(y+1)^2\,dy$

$\int x^3\,dx = -\int (y+1)^2\,dy$

$\frac{x^4}{4} = -\left(\frac{y^3}{3} + y^2 + y + c\right)$

$\frac{x^4}{4} + c = -\frac{y^3}{3} - y^2 - y$

$\frac{x^4}{4} + c = y\left(-\frac{y^2}{3} - y - 1\right)$

$\frac{x^4 + c}{4\left(-\frac{y^2}{3} - y - 1\right)} = y$

5. $y' = (1+2y)(1+x^2+2x^3)$

$\frac{dy}{dx} = (1+2y)(1+x^2+2x^3)$

$\frac{dy}{dx} = (1+x^2+2x^3)\,dx$

$\int \frac{dy}{1+2y} = \int (1+x^2+2x^3)\,dx$

$\frac{1}{2}\ln|1+2y| = x + \frac{x^3}{3} + \frac{x^4}{2} + c$

$\ln|1+2y| = 2x + \frac{2}{3}x^3 + x^4 + c$

$y = \frac{e^{2x+\frac{2}{3}x^3+x^4+c}}{2} - 1$

6. $y' = 4\sqrt{1+y}\cos 2x$, $y\left(\frac{\pi}{4}\right) = -1$

$\frac{dy}{dx} = 4\sqrt{1+y}\cos 2x$

$\frac{dy}{dx} = 4\sqrt{1+y}\cdot\cos 2x$

$\frac{dy}{4\sqrt{1+y}} = dx\cos 2x$

$\frac{1}{4}\int \frac{dy}{\sqrt{1+y}} = \int \cos 2x\,dx$

$\frac{1}{2}\sqrt{1+y} = \frac{1}{2}\sin(2x) + c$

$\sqrt{1+y} = \sin(2x) + c$

$1+y = (\sin(2x) + c)^2$

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$y = \sin^2(2x) + 2\sin 2x + c^2 - 1$

$-1 = 1 + 2c + c^2 - 1$

$0 = c^2 + 2c + 1$

$y = \sin^2(2x) - 2\sin 2x = Sk$

7. $e^x y' = 2(x+3)y^3$, $y(0) = 1/4$

$e^x \frac{dy}{dx} = 2(x+3)y^3$

$\frac{dy}{y^3} = \frac{2(x+3)}{e^x}\,dx$

$\int \frac{dy}{y^3} = 2\int \frac{(x+3)}{e^x}\,dx \Rightarrow -\frac{1}{2y^2} = 2\left(-\frac{x}{e^x} - \frac{4}{e^x} + c\right)$

$= -\frac{1}{4y^2} = \frac{-x}{e^x} - \frac{4}{e^x} + c$

$\frac{1}{y^2} = \frac{4x}{e^x} + \frac{16}{e^x} - 4c$

$\sqrt{\frac{1}{\frac{4x}{e^x} + \frac{16}{e^x} - 4c}} = y$

$\sqrt{\frac{1}{\frac{4x+16-4ce^x}{e^x}}} = y$

$\pm\sqrt{\frac{e^x}{4x+16-4ce^x}} = y \Rightarrow Su$

$\sqrt{\frac{1}{16-4c}} = \frac{1}{4}$

$\sqrt{\frac{1}{16-4c}} = \frac{1}{4}$

$16 = 16 - 4c$

$c = 0$

$y = \sqrt{\frac{e^x}{4x+16}} \Rightarrow Sk$

8. $(1+e^x)\frac{dy}{dx} + e^x y = 0$

$(1+e^x)\frac{dy}{dx} = -e^x y$

$\frac{dy}{y} = \frac{-e^x}{1+e^x}\,dx$

$\int \frac{dy}{y} = \int \frac{-e^x}{1+e^x}\,dx$

$\ln|y| = -\int \frac{dv}{v}$

$\ln|y| = -\ln|1+e^x| + \ln|c|$

$\ln y = \ln\left|\frac{c}{1+e^x}\right|$

$y = \frac{c}{1+e^x} \Rightarrow Su$

$1 = \frac{c}{1+1}$, $c = 2$

$y = \frac{2}{1+e^x} \Rightarrow Sk$