Answers

U-sub

1. $\frac{1}{2}\arctan(x^2)+C$
2. $-6\ln(\sqrt[6]{x}+1)+2\sqrt{x}-3\sqrt[3]{x}+6\sqrt[6]{x}+C$
3. $2\sqrt{x}-2\arctan(\sqrt{x})+C$

Integration by Parts

1. $\frac{x^2\ln x}{2}-\frac{x^2}{4}+C$
2. $\frac{3e^{2x}\sin(3x)}{13}+\frac{2e^{2x}\cos(3x)}{13}+C$
3. $\frac{x^2\sin(x^2)}{2}+\frac{\cos(x^2)}{2}+C$
4. $\frac{-\ln(x)}{x}-\frac{1}{x}+C$
5. $x\arctan x-\frac{\ln(x^2+1)}{2}+C$
6. $x\arctan(1/x)+\frac{\ln(x^2+1)}{2}+C$

Trig Identities

1. $\frac{\cos^5 x}{5}-\frac{\cos^3 x}{3}+C$
2. $\frac{\sec^2 x}{2}-\ln|\sec x|+C$
3. $\frac{\tan^3 x}{3}-\tan x+x+C$
4. $\frac{\tan^4 x}{4}-\frac{\sec^2 x}{2}+\ln|\sec x|+C$
5. $\frac{\csc^9 x}{9}-\frac{\csc^{11} x}{11}+C$
6. $\sec x-\ln|\csc x+\cot x|+C$

Trig Sub

1. $\frac{-\sqrt{9-x^2}}{x}-\arcsin(\frac{x}{3})+C$
2. $\frac{-\sqrt{x^2+4}}{4x}+C$
3. $\frac{9\arcsin(\frac{x}{3})}{2}+\frac{x\sqrt{9-x^2}}{2}+C$
4. $\frac{\arcsin(2x)}{4}+\frac{x\sqrt{1-4x^2}}{2}+C$
5. $\frac{-2\,\mathrm{arcsec}(\frac{3x}{2})}{3}+\frac{\sqrt{9x^2-4}}{3}+C$
6. $\frac{x\sqrt{25x^2+4}}{2}+\frac{2\ln\left|\frac{5x}{2}+\frac{\sqrt{25x^2}}{2}\right|}{5}+C$
7. $\sqrt{25x^2+1}-\ln\left|\frac{\sqrt{25x^2+1}}{5x}+\frac{1}{5x}\right|+C$
8. $\frac{1}{2}\left(\sqrt{e^{2x}+1}-\ln\left|\frac{\sqrt{e^{2x}+1}}{e^x}+\frac{1}{e^x}\right|\right)+C$
9. $\frac{-\sqrt{1-e^{4x}}}{2e^{2x}}+C$

Partial Fractions

1. $4\ln|x-3|-\ln|x+2|+C$
2. $-\ln|x|+\frac{5}{6}\ln|3x-2|+\frac{1}{2}\ln|x+2|+C$
3. $\frac{5}{9}\ln|x-1|-\frac{4}{3(x-1)}-\frac{5}{9}\ln|x+2|+C$
4. $\frac{1}{2}\ln|x+1|+\frac{1}{4}\ln|x^2+1|-\frac{1}{2}\arctan x+C$
5. $2\ln|x|-\frac{1}{2}\ln|x^2+3|-\frac{\arctan(\frac{x}{\sqrt{3}})}{\sqrt{3}}+C$
6. $\frac{1}{12}\ln|x+2|-\frac{1}{24}\ln\left|\frac{1}{3}(x-1)^2+1\right|+\frac{\sqrt{3}}{12}\arctan\left(\frac{1}{\sqrt{3}}(x-1)\right)+C$

Challenge

1. $\frac{1}{2}(\ln|\sec x+\tan x|+\sec x\tan x)+C$
2. $x\arctan(\sqrt{x})-\sqrt{x}+\arctan(\sqrt{x})+C$
3. StackExchange
4. StackExchange
5. See #4
6. $-2\sqrt{1-\sin x}+C$

Problems: `https://ethanphan.me/sp25-integrals.pdf`
Solutions: `https://ethanphan.me/sp25-integrals-ans.pdf`
Please email `ethanphan@gatech.edu` regarding questions or errors.