5. $\int (x^2 + x^{-2})\, dx = \frac{x^3}{3} + \frac{x^{-1}}{-1} + C = \frac{1}{3}x^3 - \frac{1}{x} + C$

6. $\int \left(\sqrt{x^3} + \sqrt[3]{x^2}\right) dx = \int (x^{3/2} + x^{2/3})\, dx = \frac{x^{5/2}}{5/2} + \frac{x^{5/3}}{5/3} + C = \frac{2}{5}x^{5/2} + \frac{3}{5}x^{5/3} + C$

12. $\int \left(x^2 + 1 + \frac{1}{x^2+1}\right) dx = \frac{x^3}{3} + x + \tan^{-1} x + C$

17. $\int (1 + \tan^2 \alpha)\, d\alpha = \int \sec^2 \alpha\, d\alpha = \tan \alpha + C$

18. $\int \frac{\sin 2x}{\sin x}\, dx = \int \frac{2 \sin x \cos x}{\sin x}\, dx = \int 2 \cos x\, dx = 2 \sin x + C$

42. $\int_1^2 \frac{(x-1)^3}{x^2}\, dx = \int_1^2 \frac{x^3 - 3x^2 + 3x - 1}{x^2}\, dx = \int_1^2 \left(x - 3 + \frac{3}{x} - \frac{1}{x^2}\right) dx = \left[\frac{1}{2}x^2 - 3x + 3 \ln |x| + \frac{1}{x}\right]_1^2$

$= \left(2 - 6 + 3 \ln 2 + \frac{1}{2}\right) - \left(\frac{1}{2} - 3 + 0 + 1\right) = 3 \ln 2 - 2$

49. $A = \int_0^2 \left(2y - y^2\right) dy = \left[y^2 - \frac{1}{3}y^3\right]_0^2 = \left(4 - \frac{8}{3}\right) - 0 = \frac{4}{3}$

2. Let $u = 2 + x^4$. Then $du = 4x^3\, dx$ and $x^3\, dx = \frac{1}{4}\, du$,

so $\int x^3 (2 + x^4)^5\, dx = \int u^5 \left(\frac{1}{4}\, du\right) = \frac{1}{4}\frac{u^6}{6} + C = \frac{1}{24}(2 + x^4)^6 + C.$

4. Let $u = 1 - 6t$. Then $du = -6\, dt$ and $dt = -\frac{1}{6}\, du$, so

$$\int \frac{dt}{(1-6t)^4} = \int \frac{-\frac{1}{6}\, du}{u^4} = -\frac{1}{6} \int u^{-4}\, du = -\frac{1}{6}\frac{u^{-3}}{-3} + C = \frac{1}{18u^3} + C = \frac{1}{18(1-6t)^3} + C.$$

5. Let $u = \cos \theta$. Then $du = -\sin \theta\, d\theta$ and $\sin \theta\, d\theta = -du$, so

$$\int \cos^3 \theta\, \sin \theta\, d\theta = \int u^3 (-du) = -\frac{u^4}{4} + C = -\frac{1}{4} \cos^4 \theta + C.$$

6. Let $u = 1/x$. Then $du = -1/x^2\, dx$ and $1/x^2\, dx = -du$, so

$$\int \frac{\sec^2(1/x)}{x^2}\, dx = \int \sec^2 u\, (-du) = -\tan u + C = -\tan(1/x) + C.$$

8. Let $u = x^3$. Then $du = 3x^2\, dx$ and $x^2\, dx = \frac{1}{3}\, du$, so $\int x^2 e^{x^3}\, dx = \int e^u \left(\frac{1}{3}\, du\right) = \frac{1}{3}e^u + C = \frac{1}{3}e^{x^3} + C.$

10. Let $u = 3t + 2$. Then $du = 3\, dt$ and $dt = \frac{1}{3}\, du$, so

$$\int (3t+2)^{2.4}\, dt = \int u^{2.4} \left(\frac{1}{3}\, du\right) = \frac{1}{3}\frac{u^{3.4}}{3.4} + C = \frac{1}{10.2}(3t+2)^{3.4} + C.$$

18. Let $u = \sqrt{x}$. Then $du = \dfrac{1}{2\sqrt{x}}\,dx$ and $2\,du = \dfrac{1}{\sqrt{x}}\,dx$, so

$$\int \frac{\sin\sqrt{x}}{\sqrt{x}}\,dx = \int \sin u\,(2\,du) = -2\cos u + C = -2\cos\sqrt{x} + C.$$

28. Let $u = \cos t$. Then $du = -\sin t\,dt$ and $\sin t\,dt = -du$, so $\int e^{\cos t}\sin t\,dt = \int e^u\,(-du) = -e^u + C = -e^{\cos t} + C$.

32. Let $u = \ln x$. Then $du = (1/x)\,dx$, so $\displaystyle\int \frac{\sin(\ln x)}{x}\,dx = \int \sin u\,du = -\cos u + C = -\cos(\ln x) + C$.

44. Let $u = x^2$. Then $du = 2x\,dx$, so $\displaystyle\int \frac{x}{1+x^4}\,dx = \int \frac{\frac{1}{2}\,du}{1+u^2} = \frac{1}{2}\tan^{-1}u + C = \frac{1}{2}\tan^{-1}(x^2) + C$.

86. Let $u = x^2$. Then $du = 2x\,dx$, so $\int_0^3 x f(x^2)\,dx = \int_0^9 f(u)\left(\frac{1}{2}\,du\right) = \frac{1}{2}\int_0^9 f(u)\,du = \frac{1}{2}(4) = 2$.