

(b) Use $u = \cos(2t)$, $du = -2\sin(2t) dt$: $\int \frac{\sin(2t)}{\cos(2t)} dt = \int \frac{1}{u} \cdot \frac{-1}{2} du = -\frac{1}{2} \ln|u| + C = -\frac{1}{2} \ln|\cos(2t)| + C$

(c) Use $u = e^w + 1$, $du = e^w dw$: $\int \frac{1}{u} du = \ln|u| + C = \ln|e^w + 1| + C$

(d) Use $u = e^w$, $du = e^w dw$: $\int \frac{1}{u^2+1} du = \arctan(u) + C = \arctan(e^w) + C$

0.(a) Split it into two integrals. Use $u = 2x + 4$, $du = 2dx$ in the first (use u endpoints):

$$\int_6^{10} u^{-2} \frac{1}{2} du + \int_1^3 \frac{1}{x+4} dx = -\frac{1}{2} u^{-1} \Big|_6^{10} + \ln|x+4| \Big|_1^3 = -\frac{1}{20} - (-\frac{1}{12}) + \ln 7 - \ln 5 = \frac{1}{30} + \ln\left(\frac{7}{5}\right)$$

(b) Use $u = \ln x$, $du = \frac{1}{x} dx$: $\int_0^1 u^2 du = \frac{1}{3} u^3 \Big|_0^1 = \frac{1}{3} - 0 = \frac{1}{3}$

7. Use $u = \sin x$, $du = \cos x dx$: $\int_{\sin 0}^{\sin \frac{\pi}{2}} \frac{1}{1+u^2} du = \arctan u \Big|_0^1 = \arctan 1 - \arctan 0 = \frac{\pi}{4}$

24. $\int_0^x 100 \cdot e^{-2t} dt = \frac{100}{-2} \cdot e^{-2t} \Big|_0^x = -500(e^{-2x} - 1) = 500 - 500e^{-2x}$, for $x = 3$ this is about 226 ants.

26. x hours from now: $4 + \int_0^x -e^{-2t} dt = 4 - \left(\frac{1}{2} e^{-2t}\right) \Big|_0^x = 4 - 5(e^{-2x} - 1) = 9 - 5e^{-2x}$ gallons.

$$9 - 5e^{-2x} = 0, \quad e^{-2x} = \frac{9}{5}, \quad x = \frac{\ln \frac{9}{5}}{-2} \approx 2.94, \text{ so it takes almost 3 hours to dry out.}$$