2014/07/11 Summer Math 1432 "Turn it in Lab" 1

- $\int \frac{\csc^2(t)}{2+\cot(t)}\,dt$

  let $u = 2+\cot(t)$, $du = -\csc^2(t)\,dt$

  $\Rightarrow \int \frac{\csc^2(t)}{2+\cot(t)}\,dt \overset{\downarrow}{=} \int \frac{-du}{u} = -\ln|u| + C$

  $= \boxed{-\ln|2+\cot(t)| + C}$

- $\int \frac{\cos\theta}{\sin\theta}\,d\theta$ (or $\int \cot\theta\,d\theta$) (compare with $\int \tan\theta\,d\theta$)

  let $u = \sin\theta$. $du = \cos\theta\,d\theta$

  $\Rightarrow \int \frac{\cos\theta}{\sin\theta}\,d\theta \overset{\downarrow}{=} \int \frac{du}{u} = \ln|u| + C = \boxed{\ln|\sin\theta| + C}$.

- $\int \sec(t)\,dt$ (Hint: times $\frac{\sec(t)+\tan(t)}{\sec(t)+\tan(t)}$)

  $= \int \sec(t) \cdot \frac{\sec(t)+\tan(t)}{\sec(t)+\tan(t)}\,dt = \int \frac{\sec^2(t) + \sec(t)\tan(t)}{\sec(t)+\tan(t)}\,dt$

  (let $u = \sec(t)+\tan(t)$, $du = [\sec(t)\tan(t) + \sec^2(t)]\,dt$)

  $\downarrow$

  $= \int \frac{du}{u} = \ln|u| + C = \boxed{\ln|\sec(t)+\tan(t)| + C}$.

- $\frac{d}{dx} e^{-x^2}$ (Hint: Chain Rule)

$$= e^{-x^2} \cdot (-2x) = \boxed{-2x e^{-x^2}}$$

- Given $y = x^2 e^{2x} - e^x \ln x$ (Hint: Product Rule & Chain Rule)

$$\Rightarrow y' = \frac{dy}{dx} = 2x e^{2x} + x^2 \cdot 2e^{2x} - e^x \ln x - \frac{e^x}{x}$$

$$= \boxed{2x e^{2x} + 2x^2 e^{2x} - e^x \ln x - \frac{e^x}{x}}$$

- Given $y = \ln \sqrt{e^x + 4x} = \ln (e^x + 4x)^{\frac{1}{2}} = \frac{1}{2} \ln (e^x + 4x)$

$$\Rightarrow y' = \frac{dy}{dx} = \frac{d}{dx} \left[\frac{1}{2} \ln (e^x + 4x) \right] = \frac{1}{2 \cdot (e^x + 4x)} \cdot (e^x + 4)$$

$$= \boxed{\frac{e^x + 4}{2 \cdot (e^x + 4x)}}$$