

1. For this problem you may use any of the results in the previous homework (whether you proved it or not).

(a) Prove if  $n \in \mathbb{N}$  and  $a > 0$  then prove  $\ln(a^n) = n \ln(a)$ .

(b) Prove that if  $a > 0$  then  $\ln\left(\frac{1}{a}\right) = -\ln(a)$ .

(c) Prove  $\ln((0, \infty)) = \mathbb{R}$  and thus the domain of  $\exp(x)$  is  $\mathbb{R}$ .

(d) Suppose  $m \in \mathbb{N}$  and  $a > 0$ , prove  $\ln(\sqrt[m]{a}) = \frac{\ln(a)}{m}$ .

(e) Let  $n \in \mathbb{N}$  and define  $e = \exp(1)$  prove  $\exp(n) = e^n$ .

(f) Show  $e \geq 2$ .

(g) Prove the derivative of  $\exp(x)$  is  $\exp(x)$ .

2. (a) Find  $\int_1^3 x^2 \exp(x)$ .

(b) Find  $\int_1^3 \ln(x)$ .