Ex 1

For $y \geq 0$, $\mathbb{P}(\ln X > y) = \mathbb{P}(X > e^y) = \int_{e^y}^{\infty} \frac{4}{x^5}\,dx = -x^{-4}\Big|_{e^y}^{\infty} = e^{-4y}$

Then $f_Y(y) = \begin{cases} 0, & y < 0 \quad \text{(because } X \geq 1 \text{ and hence } Y = \ln X \geq 0\text{)} \\ -\frac{d}{dy}\mathbb{P}(Y > y) = 4e^{-4y}, & y \geq 0 \end{cases}$

Ex 2 $X \sim \text{Bin}(n=200, p=0.5)$

$\mathbb{P}(X \leq 104) \overset{\text{continuity correction}}{=} \mathbb{P}(X \leq 104.5) =$

$= \mathbb{P}\left(\frac{X - 200\cdot 0.5}{\sqrt{200\cdot 0.5\cdot 0.5}} \leq \frac{104.5 - 200\cdot 0.5}{\sqrt{200\cdot 0.5\cdot 0.5}}\right) \approx \Phi\left(\frac{4.5}{\sqrt{50}}\right)$

$\approx N(0,1)$

$\frac{4.5}{\sqrt{50}}$

rule of thumb satisfied: $np(1-p) = 200\cdot 0.5\cdot 0.5 = 50 > 10$

Ex 3 $f_Y(y) = \int_{-\infty}^{\infty} f_{X,Y}(x,y)\,dx$

$= \begin{cases} 0, & \text{if } y < 0 \\ \int_y^{\infty} e^{-y}\,dx = ye^{-y}, & \text{if } y \geq 0 \end{cases}$