

STAT/MA 41600  
In-Class Problem Set #43: December 8, 2014  
Solutions by Mark Daniel Ward

1. We compute  $M_X(t) = \mathbb{E}(e^{tX}) = \int_0^\infty (e^{tx})(3e^{-3x}) dx = 3/(3-t)$ .
- 2a. We compute  $M'_X(t) = \frac{d}{dt}(\frac{3}{3-t}) = 3/(3-t)^2$ .
- 2b. We have  $M'_X(0) = 3/(3-0)^2 = 1/3$ .
3. We have  $\mathbb{E}(e^{tX}) = \int_0^\infty (e^{tx})(25xe^{-5x}) dx = 25/(t-5)^2 = 25/(25-10t+t^2)$ .
4. We compute  $M'_X(t) = 50/(125-75t+15t^2-t^3) = 50/(5-t)^3$ , so  $\mathbb{E}(X) = M'_X(0) = 50/125 = 2/5$ .
5. We compute  $M_X(t) = \mathbb{E}(e^{tX}) = \sum_{x=1}^\infty (e^{tx})(4/5)^{x-1}(1/5) = e^t/(5-4e^t)$ .
- 6a. We have  $M'_X(t) = 5e^t/(5-4e^t)^2$ .
- 6b. We compute  $\mathbb{E}(X) = M'_X(0) = (5)(1)/(5-(4)(1))^2 = 5$ .