# *Stat 134: Section 17*

*Adam Lucas*

*April 11th, 2023*

## *Conceptual Review*

Recall the convolution formula for $Z = X + Y$ and $W = X/Y$.

## *Problem 1*

Finish what we haven't covered from Section 16.

## *Problem 2*

Let joint distribution of $X, Y$ be a function of $R = \sqrt{X^2 + Y^2}$ (i.e., $f_{X,Y}(x, y) = g(\sqrt{x^2 + y^2})$ for some $g$). Then prove that $W = X/Y$ follows the Cauchy distribution. i.e., prove that

$$f_W(w) = \frac{1}{\pi(w^2 + 1)}.$$

(Hint : You want to use the fact that $\iint_{\mathbb{R}^2} f(x, y)dxdy = \int_0^{2\pi} \int_0^{\infty} rf(r\cos\theta, r\sin\theta)drd\theta$.)

## *Problem 3*

Prove that the density of $Z = X - Y$ for independent exponential ($\lambda$) variables $X$ and $Y$ is Laplace distribution (i.e., $f_Z(z) = \frac{\lambda}{2}\exp\{-\lambda|Z|\}$) by using

a. Moment generating function.

b. Convolution formula.