Theorem [UNDER CONSTRUCTION! The von Mises distribution appears to not have the scaling property.] The von Mises distribution has the scaling property. That is, if $X \sim$ von Mises(κ, μ) then $Y = cX$ also has the von Mises distribution.

Proof [UNDER CONSTRUCTION! The von Mises distribution appears to not have the scaling property.] Let the random variable X have the von Mises(κ, μ) distribution with probability density function

$$f(x) = \frac{e^{\kappa \cos(x-\mu)}}{2\pi \, I_0(\kappa)} \qquad\qquad 0 < x < 2\pi,$$

where

$$I_0(\kappa) = \sum_{i=0}^{\infty} \frac{\kappa^{2i}}{2^{2i}(i!)^2}.$$

Let c be a positive, real constant. The transformation $Y = g(X) = cX$ is a 1–1 transformation from $\mathcal{X} = \{x \mid 0 < x < 2\pi\}$ to $\mathcal{Y} = \{y \mid 0 < y < 2\pi\}$ with inverse $X = g^{-1}(Y) = Y/c$ and Jacobian

$$\frac{dX}{dY} = \frac{1}{c}.$$

Therefore, by the transformation technique, the probability density function of Y is

$$\begin{aligned} f_Y(y) &= f_X(g^{-1}(y)) \left| \frac{dx}{dy} \right| \\ &= \frac{e^{\kappa \cos(y/c-\mu)}}{2\pi \; I_0(\kappa)} \left| \frac{1}{c} \right|, \end{aligned}$$

which is the probability density function of a von Mises() random variable.