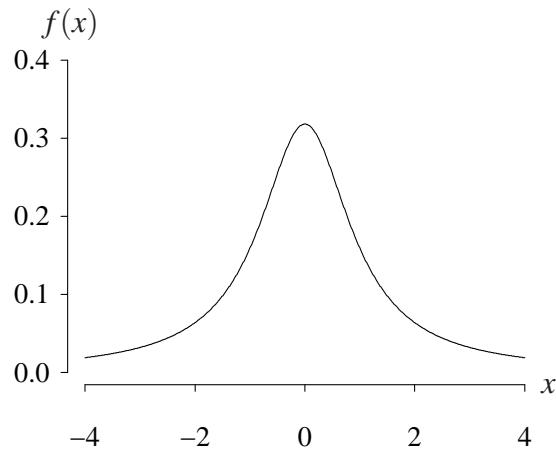**Standard Cauchy distribution** (from http://www.math.wm.edu/~leemis/chart/UDR/UDR.html)
The shorthand $X \sim \text{Cauchy}(1,0)$ is used to indicate that the random variable X has the standard
Cauchy distribution. A standard Cauchy random variable X has probability density function

$$f(x) = \frac{1}{\pi \left(1 + x^2\right)} \qquad -\infty < x < \infty.$$

The probability density function is illustrated below.

The cumulative distribution function on the support of X is

$$F(x) = P(X \le x) = \frac{\pi + 2 \arctan(x)}{2\pi} \qquad -\infty < x < \infty.$$

The survivor function on the support of X is

$$S(x) = P(X \ge x) = \frac{\pi - 2 \arctan(x)}{2\pi} \qquad -\infty < x < \infty.$$

The hazard function on the support of X is

$$h(x) = \frac{f(x)}{S(x)} = \frac{2}{\left(1 + x^2\right)\left(\pi - 2 \arctan(x)\right)} \qquad -\infty < x < \infty.$$

The cumulative hazard function on the support of X is

$$H(x) = -\ln S(x) = \ln(2) + \ln(\pi) - \ln(\pi - 2 \arctan(x)) \qquad -\infty < x < \infty.$$

The inverse distribution function of X is

$$F^{-1}(u) = -\cot(u \cdot \pi) \qquad 0 < u < 1.$$

The median of X is 0.

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The moments of *X* are undefined. It follows that the population mean, variance, skewness, and kurtosis of *X* are also undefined.

APPL verification: The APPL statements

```
X := StandardCauchyRV( );
CDF(X);
SF(X);
HF(X);
CHF(X);
IDF(X);
```

verify the cumulative distribution function, survivor function, hazard function, and cumulative hazard function.