Continuous Distributions

- pdf $f_X(x)$: `dnorm(x)` for "density"
- cdf $F_X(x) = \int_{-\infty}^{x} f_X(y)dy$: `pnorm(x)` for "probability"
- qf $Q_X(u) = F_X^{-1}(u)$: `qnorm(u)` for "quantile"

For standard normal,

```
> c(dnorm(-1.4),dnorm(1.4))
[1] 0.1497275 0.1497275
> pnorm(1.4)
[1] 0.9192433
> qnorm(.95)
[1] 1.644854
> qnorm(.975)
[1] 1.959964
```

Distribution parameters may be specified:

```
> pnorm(15.5, mean=10, sd=3)
[1] 0.9666235
```

Probabilities (and quantiles) may be for the upper tail:

```
> pnorm(15.5, mean=10, sd=3, lower.tail=FALSE)
[1] 0.03337651
```

Vectors are allowed:

```
> qnorm(c(.05,.25,.5,.75,.95), mean=10, sd=3)
[1]  5.065439  7.976531 10.000000 12.023469 14.934561
>
```

Discrete Distributions

- pmf $f_X(x) = \Pr\{X = x\}$: `dpois(x, lambda)` for "density" (!?)
- cdf $F_X(x) = \sum_{y \leq x} \Pr\{X = y\}$: `ppois(x, lambda)` for "probability"
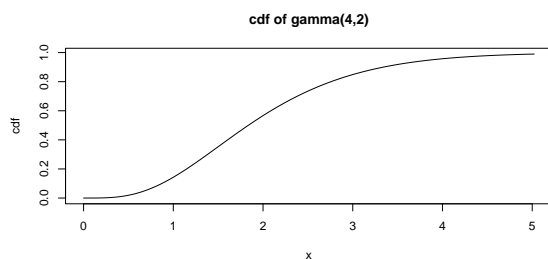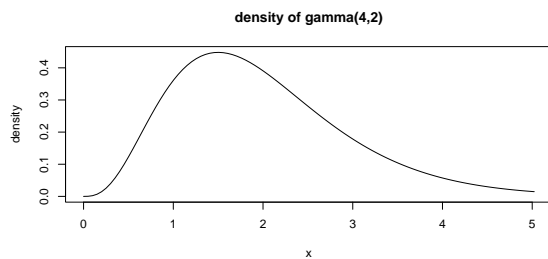- qf $Q_X(u) = \inf\{x : F_X(x) \geq u\}$: `qpois(u,lambda)` for "quantile"

Some examples:

```
> dpois(0,lambda=1)
[1] 0.3678794
> exp(-1)
[1] 0.3678794
> ppois(18,lambda=20)
[1] 0.3814219
> ppois(18,lambda=20,lower.tail=F)
[1] 0.618578
> qpois(c(0,.05,.25,.5,.95,1), lambda=3)
[1]   0   1   2   3   6 Inf
>
```
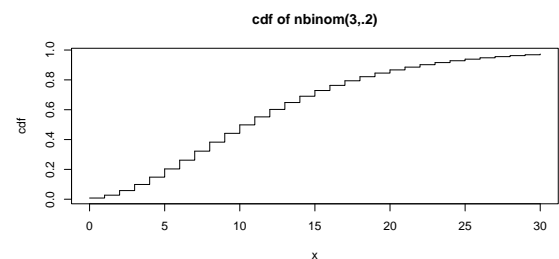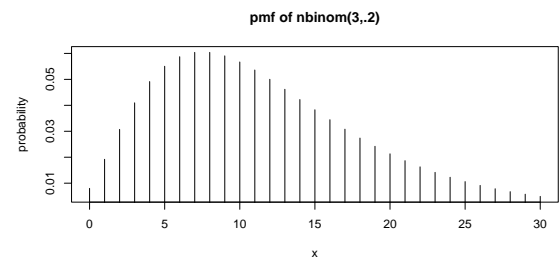
Plotting Continuous Dists

```
> curve(dgamma(x, shape=4, rate=2), 0, qgamma(.99, shape=4, rate=2),
        main="density of gamma(4,2)", ylab="density")
> curve(pgamma(x, shape=4, rate=2), 0, qgamma(.99, shape=4, rate=2),
        main="cdf of gamma(4,2)", ylab="cdf")
>
```


density of gamma(4,2)

cdf of gamma(4,2)

Plotting Discrete Dists

```
> x <- 0:30
> plot(x, dnbinom(x, size=3, prob=.2), type="h",
        main="pmf of nbinom(3,.2)", ylab="probability")
> plot(x, pnbinom(x, size=3, prob=.2), type="s",
        main="cdf of nbinom(3,.2)", ylab="cdf")
>
```


pmf of nbinom(3,.2)

cdf of nbinom(3,.2)