

**Geometric Distribution:**

$X$  = the number of **independent** trials until the first “success”.

Then

$$P(X = x) = (1 - p)^{x-1} \cdot p, \quad x = 1, 2, 3, \dots$$

$$E(X) = \frac{1}{p}, \quad \text{Var}(X) = \frac{1-p}{p^2}.$$

**R:** `pgeom(q, prob)`                      `dgeom(x, prob)`

**Example 1:** ☺

A major oil company has decided to drill independent test wells in the Alaskan wilderness. The probability of any well producing oil is 0.30. Find the probability that the fifth well is the first to produce oil.

**Example 2:**

A slot machine at a casino randomly rewards 15% of the attempts. Assume that all attempts are independent.

a) What is the probability that your first reward occurs on your fourth trial?

b) What is the probability that your first reward occurs on your seventh trial?

c) What is the probability that you get three rewards in ten trials?

d) What is the probability that your third reward occurs on your tenth trial?

### Negative Binomial Distribution:

$X$  = the number of **independent** trials until the  $k^{\text{th}}$  “success”.

Then

$$P(X = x) = \binom{x-1}{k-1} \cdot p^k \cdot (1-p)^{x-k}, \quad x = k, k+1, k+2, \dots$$

$$E(X) = \frac{k}{p} \quad \text{Var}(X) = \frac{k \cdot (1-p)}{p^2}$$

**R:**            `pnbinom(q, size, prob)`                      `dnbinom(x, size, prob)`

### Example 4: (cont.)

e)        What is the probability that your fourth reward occurs on your fifteenth trial?

f)        What is the probability that you get four rewards in fifteen trials?