Example 1:
Suppose that the height of a female in a geographical region is normally distributed with μ = 64 inches and σ = 4 inches.

- What is the probability of finding a woman who will be less than 58 inches tall ?

```
norm.cdf(58, 64, 4)
0.06680720126885807
```

Example 2 :
Suppose the weight of a typical male in a geographical region follows a normal distribution with μ = 180lb and σ = 30lb.
What fraction of males weigh more than 200 pounds?

```
norm.sf(200, 180, 30)
0.2524925375469229
```

37. In determining bike mileage ratings, it was found that the mpg (X) for a certain model is normally distributed, with a mean of 34 mpg and a standard deviation of 1.9 mpg. Find the following:

a. $P(X < 33)$

b. $P(31 < X < 38)$

c. $P(X > 36)$

d. $P(X > 33)$

e. The mileage rating that the upper 6% of bikes achieve.

```
norm.cdf(33, 34, 1.9)
0.2993344071288827

norm.cdf(38, 34, 1.9) - norm.cdf(31, 34, 1.9)
0.9251917315155274

norm.sf(36, 34, 1.9)
0.1462549390919427

norm.sf(33, 34, 1.9)
0.7006655928711173
```

38. The distribution of SAT scores in math for an incoming class of business students has a mean of 610 and standard deviation of 20. Assume that the scores are normally distributed.

a. Find the probability that an individual's SAT score is less than 600.

b. Find the probability that an individual's SAT score is between 590 and 620.

c. Find the probability that an individual's SAT score is greater than 650.

d. What scores will the top 5% of students have?

e. Find the standardized values for students scoring 540, 600, 650, and 700 on the test. Explain what these mean.

```
norm.cdf(600, 610, 20)
0.3085375387259869

norm.cdf(620, 610, 20) - norm.cdf(590, 610, 20)
0.532807207342556

norm.sf(650, 610, 20)
0.022750131948179195

norm.ppf(0.95,610, 20 )
642.8970725390294
```

```
In [26]: import numpy as np

In [27]: values = np.array([540, 600, 650, 700])

In [28]: print("Standardized Values:", (values-610)/20)
Standardized Values: [-3.5 -0.5  2.   4.5]
```

4. As per a survey on use of pesticides among 1000 farmers in grape farming for around 10 acres of grape farmland, it was found that the grape farmers spray 38 liters of pesticides in a week on an average with the corresponding standard deviation of 5 liters. Assume that the pesticide spray per week follows a normal distribution. Write code to answer the following questions:

(a) What proportion of the farmers is spraying more than 50 liters of pesticide in a week?

(b) What proportion of farmers is spraying less than 10 liters?

(c) What proportion of farmers is spraying between 30 liters and 60 liters?

```
norm.sf(50, 38, 5)
0.008197535924596131

norm.cdf(10, 38, 5)
1.0717590258310887e-08

norm.cdf(60, 38, 5) - norm.cdf(30, 38, 5)
0.9451952957565343
```

A fast-food restaurant sells As and Bs. On a typical weekday the demand for As is normally distributed with mean 313 and standard deviation 57; the demand for Bs is normally distributed with mean 93 and standard deviation 22.

A) How many As must the restaurant stock to be 98% sure of not running out of stock on a given day ?

B) How many Bs must the restaurant stock to be 90% sure of not running out on a given day ?

C) If the restaurant stocks 450 As and 150 Bs for a given day, what is the probability that it will run out of As or Bs (or both) that day ? Assume that the demand for As and Bs are probabilistically independent.

$$P(X_a > 450 \cup X_b > 150) = P(X_a > 450) + P(X_b > 150) - P(X_a > 450 \cap X_b > 150)$$
$$= P(X_a > 450) + P(X_b > 150) - P(X_a > 450) * P(X_b > 150)$$