Q1. The time required for servicing transmissions is normally distributed with = 45 minutes and std = 8 minutes. The service manager plans to have work begin on the transmission of a customer's car 10 minutes after the car is dropped off and the customer is told that the car will be ready within 1 hour from drop-off. What is the probability that the service manager cannot meet his commitment?

In [17]:

```
from scipy import stats
import numpy as np
```

In [6]:

```
#P(x>50)
1-stats.norm.cdf(x=50,loc=45,scale=8)
```

Out[6]:

```
0.26598552904870054
```

Probability of serviceman will not meet his demand will be 0.26

Q2. The current age (in years) of 400 clerical employees at an insurance claims processing center is normally distributed with mean = 38 and Standard deviation =6. For each statement below, please specify True/False. If false, briefly explain why.

- More employees at the processing center are older than 44 than between 38 and 44.
- A training program for employees under the age of 30 at the center would be expected to attract about 36 employees.

In [8]:

```
# probability of employees at the processing center are older than 44 (p>44)
1-stats.norm.cdf(x=44,loc=38,scale=6)
```

Out[8]:

```
0.15865525393145707
```

In [10]:

```
##probability of employees at the processing center between 38<x<44
(stats.norm.cdf(x=44,loc=38,scale=6))-(stats.norm.cdf(x=38,loc=38,scale=6))
```

Out[10]:

```
0.3413447460685429
```

Statement 1 is False. More employees at the processing centre are between 38 and 44.

In [12]:

```
# employees under the age 30
stats.norm.cdf(x=30,loc=38,scale=6).round(4)
```

Out[12]:

```
0.0912
```

In [14]:

```
# number of employees with probability 0.912 of them being under age 30
0.0912*400
```

Out[14]:

```
36.480000000000004
```

The statement of training program for employees under the age of 30 at the center would be expected to attract about 36 employees is TRUE

Q3. If X1~ N(μ, σ2) and X2 ~ N(μ, σ2) are iidnormal random variables, then what is the difference between 2 X1 and X1 + X2? Discuss both their distributions and parameters.

In [15]:

```
### 2X1~ N(2u , 4A^2) and
### X1+X2 ~  N(u + u, A^2 + A^2 ) ~ N(2u, 2A^2)
### 2X1-(X1+X2) = N( 4u,6A^2)
```

Q4. Let X ~ N(100, 20^2). Find two values, a andb, symmetric about the mean, such that the probability of the random variable taking a value between them is 0.99.

In [39]:

```
## Mean=100, std=20
interval_value = stats.norm.interval(0.99,100,20)
print('values a and b symmetric about the mean is ',interval_value)
```

```
values a and b symmetric about the mean is  (48.48341392902199, 151.51658607
0978)
```

Q5. Consider a company that has two different divisions. The annual profits from the two divisions are independent and have distributions Profit1 ~ N(5, 3^2) and Profit2 ~ N(7, 4^2) respectively. Both the profits are in Million. Answer the following questions about the total profit of the company in Rupees. Assume that $1 = Rs. 45

A. Specify a Rupee range (centered on the mean) such that it contains 95% probability for the annual profit of the company. B. Specify the 5th percentile of profit (in Rupees) for the company C. Which of the two divisions has a larger probability of making a loss in a given year?

In [16]:

```
# Mean profits from two different divisions of a company = Mean1 + Mean2
Mean = 5+7
print('Mean Profit is Rs', Mean*45)
```

```
Mean Profit is Rs 540 Million
```

In [18]:

```
# Variance of profits from two different divisions of a company = SD^2 = SD1^2 + SD2^2
SD = np.sqrt((9)+(16))
print('Standard Deviation is Rs', SD*45)
```

```
Standard Deviation is Rs 225.0 Million
```

In [24]:

```
# A. Rupee range such that it contains 95% probability for the annual profit of the company
range=stats.norm.interval(alpha=0.95,loc=540,scale=225)
print('Range is Rs.',range)
```

```
range is Rs. (99.00810347848784, 980.9918965215122)
```

In [32]:

```
# B. 5th percentile of profit (in Rupees) for the company
# To compute 5th Percentile, we use the formula X=μ + Zσ
z_value=stats.norm.ppf(0.05).round(4)
print('Z value is: ',z_value)
x=540+((-1.6449)*225)
print('5th percentile of profit (in Rupees) :',np.round(x*45))
```

```
Z value is:  -1.6449
5th percentile of profit (in Rupees) : 7645.0
```

In [36]:

```
#C.
a=stats.norm.cdf(0,5,3)
print('Probability of division A: ',a)
```

```
Probability of division A:  0.0477903522728147
```

In [37]:

```
b=stats.norm.cdf(0,7,4)
print('Probability of division B: ',b)
```

```
Probability of division B:  0.040059156863817086
```

Inference: Divisions A has a larger probability of making a loss in a given year.

In [ ]: