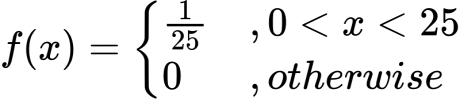
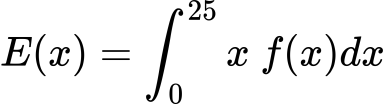
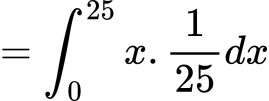
1.

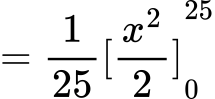
Given probability density function of x,

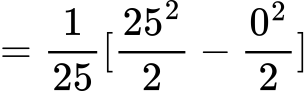


Expected value of x,







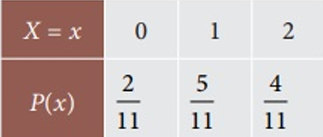


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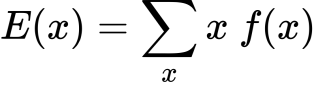
Therefore, in long run the commuter is expected to wait, at the station for the train to arrive from the time he reached the station, for 12.5 minutes.

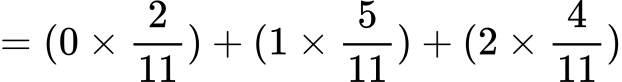
2.

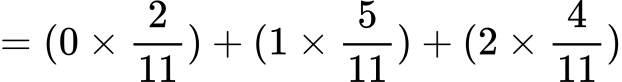
Given random variable, x and it’s probability mass function P(x)=f(x),

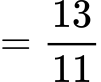


So, the expected value of x,







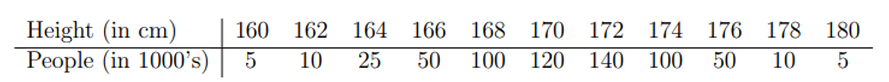


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Therefore, the expected number of women in the interview pool is 1.182

3.

(3.1) Given table,

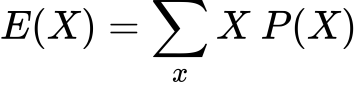


So, total number of people (in 1000’s)

= (5+10+25+50+100+120+140+5+10+50+100) = 615

|  |  |
| --- | --- |
| X | P(X) |
| 160  162  164  166  168  170  172  174  176  178  180 | 0.008  0.016  0.041  0.081  0.163  0.195  0.228  0.163  0.081  0.016  0.008 |
|  | ΣP(X) = 1 |

So, the mathematical expectation,



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wps

wps

.’. E(X) = 170.699

(3.2)

The most likely hight is the one with the highest propability. That is;

MAX(P(X)) = 0.228 with a hight of 172 cm.

So, the most likely height is 172 cm.

(3.3)

Total population = 5 + 10 + 25 + 50 + 100 + 120 + 140 + 100 + 50 + 10 + 5

= 615 Thousands

50% of the population = 615 \* 50%

= 307.5 Thousands

P(X < h) > 0.5

We sum the probabilities starting from the smallest height until we reach a cumulative probability of at least 0.5

|  |  |  |
| --- | --- | --- |
| Height (h) | Frequency (f) | Cumulative frequency (FC) |
| 160  162  164  166  168  170  172  174  176  178  180 | 5  10  25  50  100  120  140  100  50  10  5 | 5  15  40  90  190  310  450  550  600  610  615 |

A rolling sum shows that the population of people with height less than or equal to 170 cm is 310 thousands which is nearly 50% of the population.

(3.4)

We got from (3.1),

E(X) = μ(X) = 170.699

Variance,

σ2  = E(X - μ)2

= E(X2) - μ2

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C:/Users/BAB AL SAFA/AppData/Local/Temp/wps.rbZjmewps

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Standard deviation,

σ(X) =

= 3.56

.’. The variance, σ2 (X) = 12.679

The standard deviation, σ(X) = 3.62

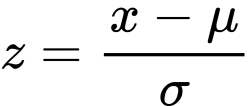
4.

1. a)

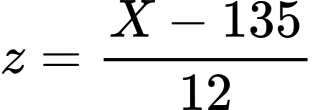
X = Number of miles that Anita’s motorbike will travel on one gallon of petrol

We know that,

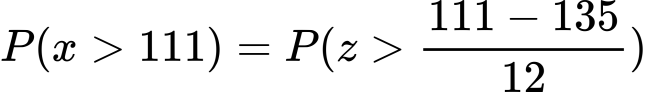
For a normal random variable x, a particular value of x can be converted to its corresponding z value by using the following formula,

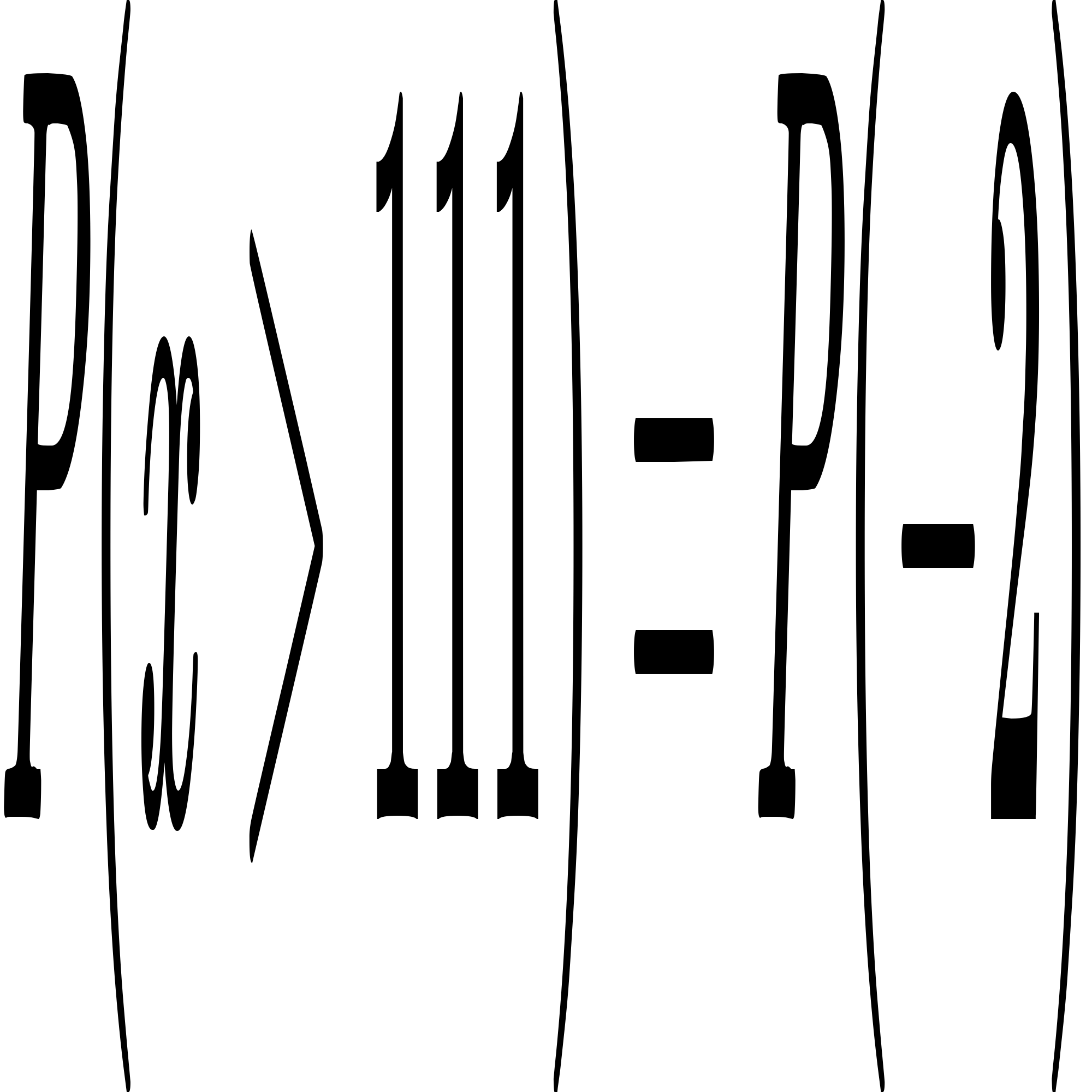


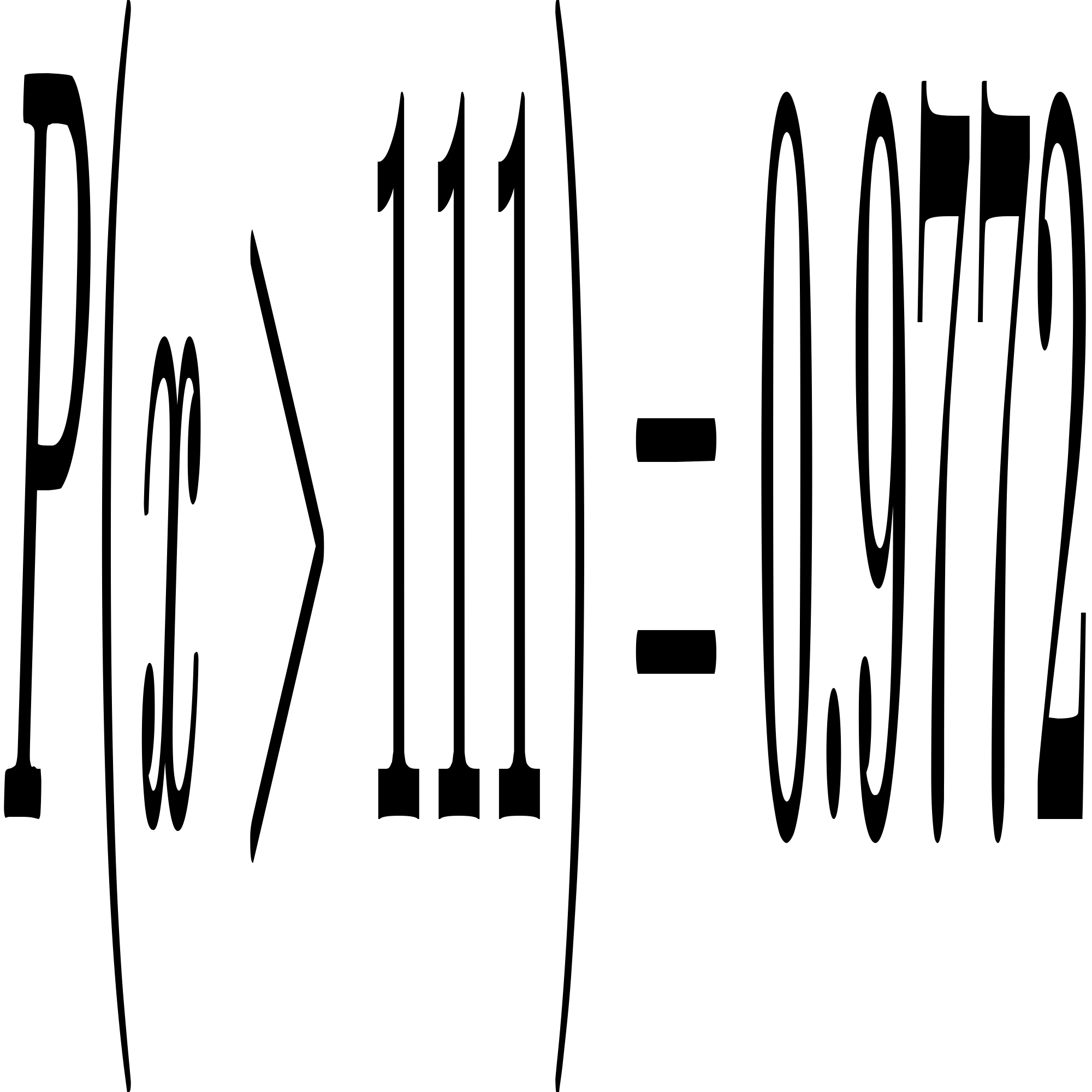
Here,



1. a.i)

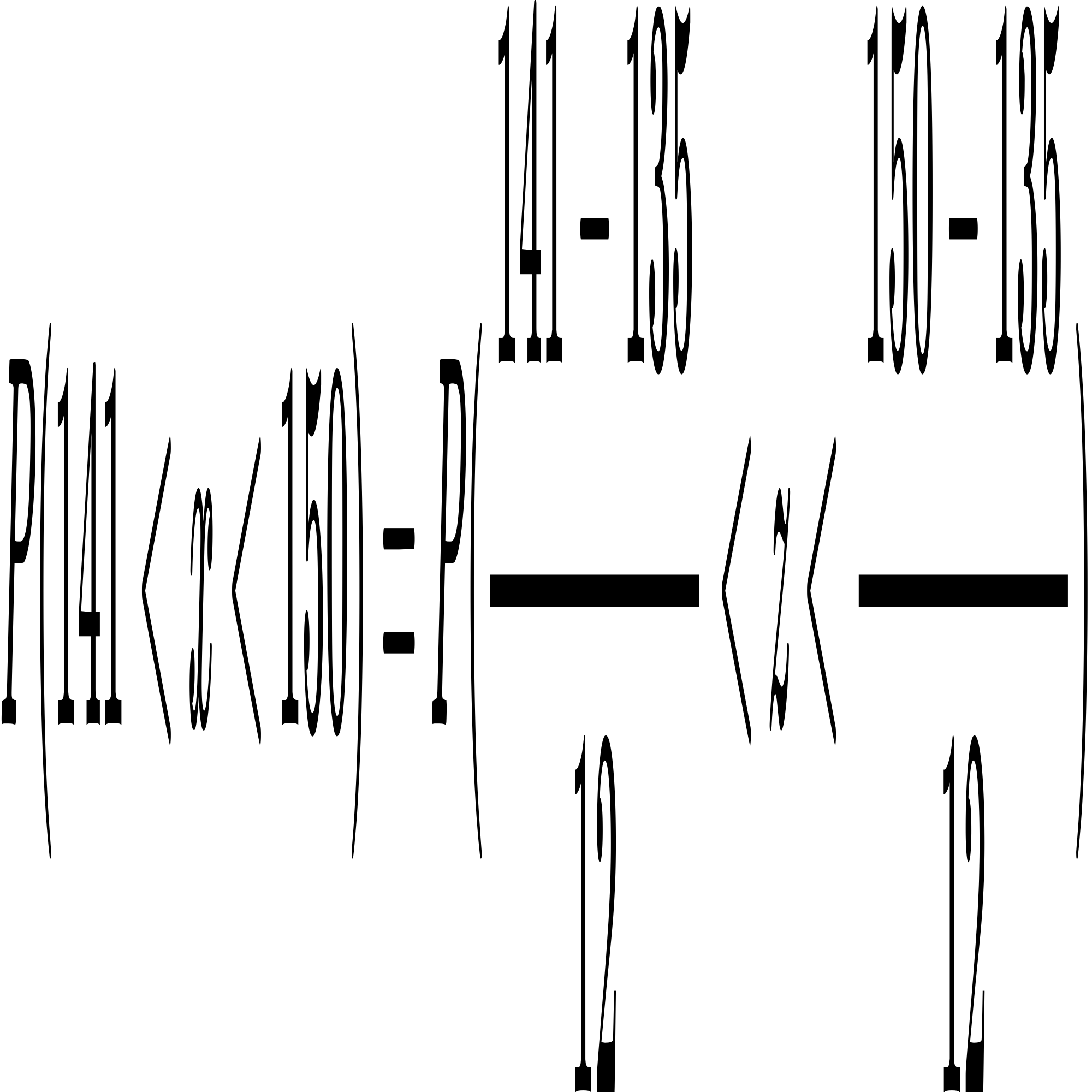






Probability that, without refueling, Anita can travel more than 111 miles = 0.9772

1. a.ii)



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C:/Users/BAB AL SAFA/AppData/Local/Temp/wps.KlUjMewps

C:/Users/BAB AL SAFA/AppData/Local/Temp/wps.FGfdixwps

Probability that, without refueling, Anita can travel between 141 and 150 miles

= 0.2029

5.

n = 45

wps = 63.4

s = 3

H0 : μ > 65

H1 : μ < 65

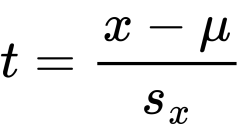
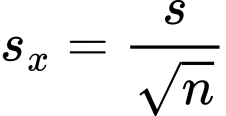
t - distribution with df = n - 1

= 45 - 1

= 44

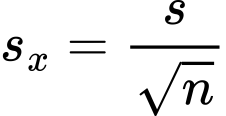
**Test Statistic**

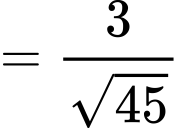
We know that, the value of the test statistic t for the sample mean wps is computed as

 where 

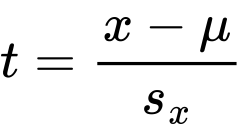
The population standard deviation σ is not known and the sample size is large (n > 30)

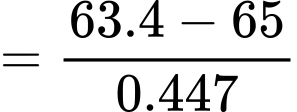
Consequently, we will use the t distribution to find the p - value for the test.





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df = n - 1

= 45 -1

= 44

p - value < 0.001

The < sign in the alternative hypothesis indicates that the test is left-tailed.

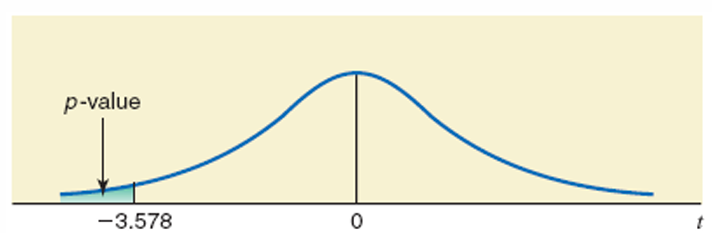


Fig. 1: The required p-value

6.

For Discrete Distribution:

When discrete distribution are used, the problem will have a finite number of scenarios.

The probability of these three scenarios are 1/3 each. Them the problem can be formulated as follows:

**Scenario 1:**

Max

Z1 = 3x1 + 9x2

Subject to

0.5x1 + 1.2x2 < 15000

2.5x1 + x2 < 10000

x1 , x2 < 0

**Scenario 2:**

Max

Z1 = 3x1 + 9x2

Subject to

0.6x1 + 1.3x2 < 17000

2.5x1 + x2 < 10000

x1 , x2 < 0

**Scenario 3:**

Max

Z1 = 3x1 + 9x2

Subject to

0.7x1 + 1.4x2 < 20000

2.5x1 + x2 < 10000

x1 , x2 < 0

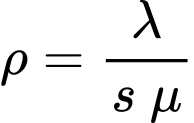
7.

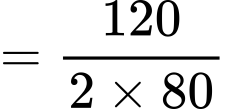
The tool crib constitutes a queuing system, with the clerks as its servers and the mechanics as its customers. After gathering some data on inter-arrival times and service times, the OR team has concluded that the queuing system best is the M/M/s model. The estimates of the mean arrival rate λ and the mean service rate (per server) μ are

λ = 120 customers per hour

μ = 80 customers per hour

So, the utilization factor for the two clerks is:





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The total cost to the company of each tool crib clerk is about ＄20 per hour,

So, Cs = ＄20

While a mechanic is busy, the value to the company of his or her output averages about ＄48 per hour

So, Cw = ＄48

Therefore, the OR team now needs to find the number of servers (tool crib clerks) s that will

Minimize E(TC) = ＄20 s + ＄48 L

It turns out s = 3 yields the minimum total cost.

8.

If there are r correct answers, there are 10 - r wrong answers and the score is

3r - (10 - r) = 3r - 10 + r

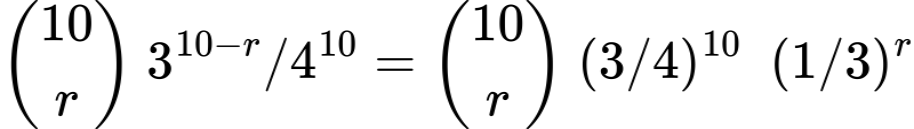
= 4r - 10

The probability of a correct answer = 1/4

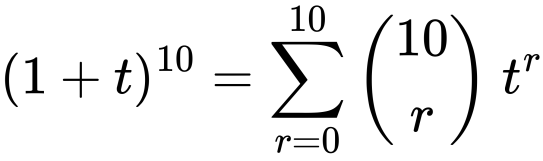
The probability of a wrong answer = 1 - (1/4)

= 3/4

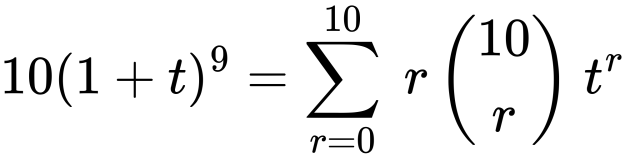
Here, by the binomial distribution, the probability of r correct answer is:



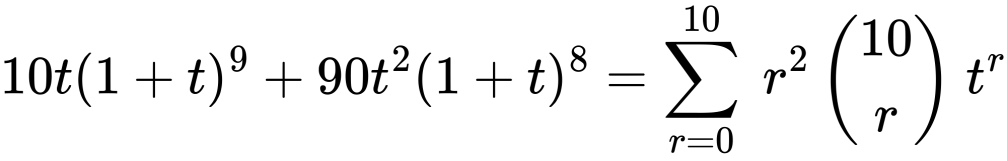
By the Binomial theorem,



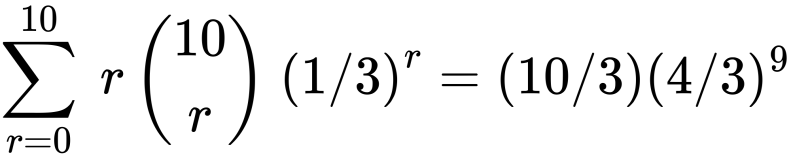
Differentiating both sides with respect to t and then multiplying by t, we have,



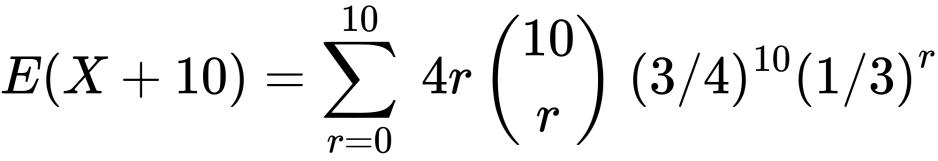
Doing the same operation once more, we have,



The second formula gives us, on putting t =1/3



Or Equivalently,



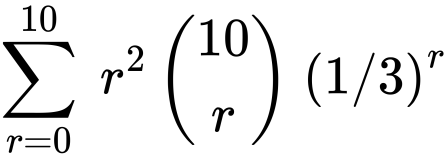
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In other words, as we might expect we get,

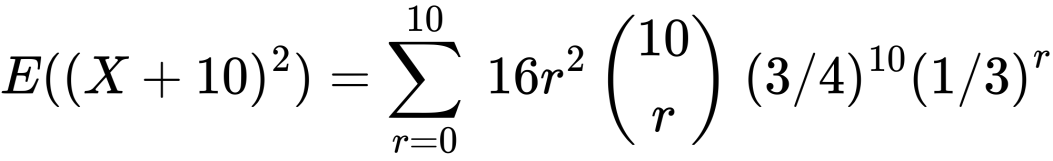
E(X) = 0

Similarly, we can use the third formula with t = 1/3 to get,



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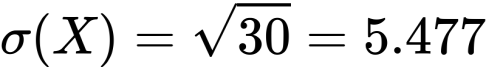
Or Equivalently,



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wps

This gives the variance , wps

Hence, the standard deviation, 

The table of probabilities,

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| r | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 410\*P | 59049 | 196830 | 295245 | 26244 | 153090 | 61236 | 17010 | 3240 | 405 | 30 | 1 |

We note that to get at least 50% of the population we can take r < 2

Since the score is then (4r - 10) < -2

It means that more than 50% of the time we will get a negative score.

(8.1) E(X) = 0

(8.2) Most probable score : 0

(8.3) Smallest s such that P(x < s) > (1/2) : ‘negative score’

(8.4) Variance, C:/Users/BAB AL SAFA/AppData/Local/Temp/wps.lRcyiiwps