

Exponential Distribution

Let T be a nonnegative waiting time with positive rate λ . Convert between rate and mean in matching units. Use a calculator for exponential and logarithm values. Round final probabilities to the 3 decimal places; if that would display 0, use scientific notation. Round requested quantiles as stated.

1. Let T be an exponential waiting time in hours with mean waiting time 0.8 hours, so $\lambda = 1/\text{mean} > 0$. Find the mean and population variance of T .

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

2. Let T be an exponential waiting time in minutes with positive rate $\lambda = 0.5$ per minute. Find $P(2 < T \leq 10)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

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3. Let T be an exponential waiting time in hours with mean waiting time 5 hours, so $\lambda = 1/\text{mean} > 0$. Find $P(T > 8)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

4. Let T be an exponential waiting time in hours with positive rate $\lambda = 0.125$ per hour. Find q such that $P(T \leq q) = 0.2$. Round q to the nearest thousandth.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

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5. Let T be an exponential waiting time in minutes with positive rate $\lambda = 0.25$ per minute. Given that $T > 0.5$, find $P(T > 6.5 \mid T > 0.5)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

6. Let T be an exponential waiting time in minutes with mean waiting time 0.5 minutes, so $\lambda = 1/\text{mean} > 0$. Find $P(T \leq 4)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

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Let T be a nonnegative waiting time with positive rate λ . Convert between rate and mean in matching units. Use a calculator for exponential and logarithm values. Round final probabilities to the 3 decimal places; if that would display 0, use scientific notation. Round requested quantiles as stated.

7. Let T be an exponential waiting time in hours with mean waiting time 2 hours, so $\lambda = 1/\text{mean} > 0$. Find $P(T > 4)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

8. Let T be an exponential waiting time in hours with positive rate $\lambda = 0.2$ per hour. Given that $T > 2$, find $P(T > 7 \mid T > 2)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.
Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Exponential Distribution

Worked Answer Key

Let T be a nonnegative waiting time with positive rate λ . Convert between rate and mean in matching units. Use a calculator for exponential and logarithm values. Round final probabilities to the 3 decimal places; if that would display 0, use scientific notation. Round requested quantiles as stated.

- 1. Let T be an exponential waiting time in hours with mean waiting time 0.8 hours, so $\lambda = 1/\text{mean} > 0$. Find the mean and population variance of T .**

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: mean 0.8 hours, variance 0.64 hours squared

1. $E(T) = 1/\lambda = 1/1.25 = 0.8$ hours.
2. $\text{Var}(T) = 1/\lambda^2 = 0.64$ hours squared.

- 2. Let T be an exponential waiting time in minutes with positive rate $\lambda = 0.5$ per minute. Find $P(2 < T \leq 10)$.**

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: approximately 0.361

1. Use $\lambda = 0.5$ per minute.
2. $P(2 < T \leq 10) = \exp[-\lambda(2)] - \exp[-\lambda(10)] = 0.361$.

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Exponential Distribution

Worked Answer Key

Let T be a nonnegative waiting time with positive rate λ . Convert between rate and mean in matching units. Use a calculator for exponential and logarithm values. Round final probabilities to the 3 decimal places; if that would display 0, use scientific notation. Round requested quantiles as stated.

3. Let T be an exponential waiting time in hours with mean waiting time 5 hours, so $\lambda = 1/\text{mean} > 0$. Find $P(T > 8)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: approximately 0.202

1. Use $\lambda = 0.2$ per hour.
2. $P(T > 8) = \exp[-(0.2)(8)] = 0.202$.

4. Let T be an exponential waiting time in hours with positive rate $\lambda = 0.125$ per hour. Find q such that $P(T \leq q) = 0.2$. Round q to the nearest thousandth.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: approximately 1.785 hours

1. Set $1 - \exp(-\lambda q) = 0.2$ with $\lambda = 0.125$.
2. $q = -\ln(1 - 0.2)/0.125 = 1.785$ hours.

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5. Let T be an exponential waiting time in minutes with positive rate $\lambda = 0.25$ per minute. Given that $T > 0.5$, find $P(T > 6.5 \mid T > 0.5)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: approximately 0.223

1. Memorylessness gives $P(T > s+t \mid T > s) = P(T > t)$. Here $s=0.5$ and $t=6$.
2. $P(T > 6) = \exp[-(0.25)(6)] = 0.223$.

6. Let T be an exponential waiting time in minutes with mean waiting time 0.5 minutes, so $\lambda = 1/\text{mean} > 0$. Find $P(T \leq 4)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: approximately 1.000

1. Use $\lambda = 2$ per minute.
2. $F(4) = 1 - \exp[-(2)(4)] = 1.000$.

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Let T be a nonnegative waiting time with positive rate λ . Convert between rate and mean in matching units. Use a calculator for exponential and logarithm values. Round final probabilities to the 3 decimal places; if that would display 0, use scientific notation. Round requested quantiles as stated.

7. Let T be an exponential waiting time in hours with mean waiting time 2 hours, so $\lambda = 1/\text{mean} = 0.5$. Find $P(T > 4)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: approximately 0.135

1. Use $\lambda = 0.5$ per hour.
2. $P(T > 4) = \exp[-(0.5)(4)] = 0.135$.

8. Let T be an exponential waiting time in hours with positive rate $\lambda = 0.2$ per hour. Given that $T > 2$, find $P(T > 7 \mid T > 2)$.

Assumptions: The waiting time is nonnegative and exponential with one constant positive rate; the process is stationary and memoryless.

Reference: $F(t) = 1 - \exp(-\lambda t)$, $P(T > t) = \exp(-\lambda t)$, and $\text{mean} = 1/\lambda$ for $t \geq 0$. Calculator required for exponential and logarithm values.

Answer: approximately 0.368

1. Memorylessness gives $P(T > s+t \mid T > s) = P(T > t)$. Here $s=2$ and $t=5$.
2. $P(T > 5) = \exp[-(0.2)(5)] = 0.368$.