Free Mathematics Tutorials

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Normal Distribution Problems with Answers

Problems and applications on normal distributions are presented. The answers to these problems a at the bottom of the page. Also an online normal distribution probability calculator may be useful to check your answers.

1. X is a normally normally distributed variable with mean μ = 30 and standard deviation σ = 4. F

   a) P(x < 40)

b) P(x > 21)

c) P(30 < x < 35)

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2. A radar unit is used to measure speeds of cars on a motorway. The speeds are normally distributed with a mean of 90 km/hr and a standard deviation of 10 km/hr. What is the probabil that a car picked at random is travelling at more than 100 km/hr?

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3. For a certain type of computers, the length of ti bewteen charges of the battery is normally distributed with a mean of 50 hours and a standard deviation of 15 hours. John owns one these computers and wants to know the probability that the length of time will be betwee 50 and 70 hours.

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4. Entry to a certain University is determined by a national test. The scores on this test are norma distributed with a mean of 500 and a standard deviation of 100. Tom wants to be admitted to tl university and he knows that he must score bet than at least 70% of the students who took the test. Tom takes the test and scores 585. Will he

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5. d by a company are approximated by a normal d a standard deviation of 0.02 cm. If a component is

this component is between 4.98 and 5.02 cm?

this component is between 4.96 and 5.04 cm?

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6. The length of life of an instrument produced by a machine has a normal ditribution with a mea 12 months and standard deviation of 2 months. Find the probability that an instrument produce by this machine will last

   a) less than 7 months.

   b) between 7 and 12 months.

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7. The time taken to assemble a car in a certain plant is a random variable having a normal distribution of 20 hours and a standard deviation of 2 hours. What is the probability that a car be assembled at this plant in a period of time

a) less than 19.5 hours?

b) between 20 and 22 hours?

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8. A large group of students took a test in Physics and the final grades have a mean of 70 and a standard deviation of 10. If we can approximate the distribution of these grades by a normal distribution, what percent of the students

   a) scored higher than 80?

   b) should pass the test (grades≥60)?

   c) should fail the test (grades<60)?

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9. The annual salaries of employees in a large company are approximateley normally distributed with a mean of $50,000 and a standard deviation of $20,000.

   a) What percent of people earn less than $40,000?

   b) What percent of people earn between $45,000 and $65,000?

   c) What percent of people earn more than $70,000?

Answers to the Above Problems

Answers to the Above Questions

1. Note: What is meant here by area is the area under the standard normal curve.

   a) For x = 40, the z-value z = (40 - 30) / 4 = 2.5

   Hence P(x < 40) = P(z < 2.5) = [area to the left of 2.5] = 0.9938

   b) For x = 21, z = (21 - 30) / 4 = -2.25

   Hence P(x > 21) = P(z > -2.25) = [total area] - [area to the left of -2.25]

   = 1 - 0.0122 = 0.9878

   c) For x = 30 , z = (30 - 30) / 4 = 0 and for x = 35, z = (35 - 30) / 4 = 1.25

   Hence P(30 < x < 35) = P(0 < z < 1.25) = [area to the left of z = 1.25] - [area to the left of 0]

   = 0.8944 - 0.5 = 0.3944

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2. Let x be the random variable that represents the speed of cars. x has μ = 90 and σ = 10. We have to find the probability that x is higher than 100 or P(x > 100)

   For x = 100 , z = (100 - 90) / 10 = 1

   P(x > 90) = P(z >, 1) = [total area] - [area to the left of z = 1]

   = 1 - 0.8413 = 0.1587

   The probability that a car selected at a random has a speed greater than 100 km/hr is equal to 0.1587

3.

   Let x be the random variable that represents th length of time. It has a mean of 50 and a standa deviation of 15. We have to find the probability that x is between 50 and 70 or P(50< x < 70)

   For x = 50 , z = (50 - 50) / 15 = 0

   For x = 70 , z = (70 - 50) / 15 = 1.33 (rounded t decimal places)

   P(50< x < 70) = P(0< z < 1.33) = [area to the l of z = 1.33] - [area to the left of z = 0]

   = 0.9082 - 0.5 = 0.4082

   The probability that John's computer has a leng o 0.4082.

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4. ts the scores. x is normally ditsributed with a mean otal area under the normal curve represents the tot e multiply the values of the areas under the curve by

   elow 585 is given by

   P = [area to the left of z = 0.85] = 0.8023 = 80.23%

   Tom scored better than 80.23% of the students who took the test and he will be admitted to thi University.

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5. a) P(4.98 < x < 5.02) = P(-1 < z < 1)

= 0.6826

b) P(4.96 < x < 5.04) = P(-2 < z < 2)

= 0.9544

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6. a) P(x < 7) = P(z < -2.5)

   = 0.0062

   b) P(7 < x < 12) = P(-2.5 < z < 0)

   = 0.4938

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7. a) P(x < 19.5) = P(z < -0.25)

   = 0.4013

   b) P(20 < x < 22) = P(0 < z < 1)

   = 0.3413

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8. a) For x = 80, z = 1

   Area to the right (higher than) z = 1 is equal to 0.1586 = 15.87% scored more that 80.

   b) For x = 60, z = -1

   Area to the right of z = -1 is equal to 0.8413 = 84.13% should pass the test.

   c)100% - 84.13% = 15.87% should fail the test.

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9. a) For x = 40000, z = -0.5

   Area to the left (less than) of z = -0.5 is equal to 0.3085 = 30.85% earn less than $40,000.

   b) For x = 45000 , z = -0.25 and for x = 65000, z = 0.75

   Area between z = -0.25 and z = 0.75 is equal to 0.3720 = 37.20 earn between $45,000 and $65,000.

   c)For x = 70000, z = 1

   Area to the right (higher) of z = 1 is equal to 0.1586 = 15.86% earn more than $70,000.

More references on elementary statistics and probabilities.

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