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Course > Probability: Continuous Random Variables > Normal Random Variables > Learn By Doing Activity

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Learn By Doing Activity

The purpose of this activity is to show you how to solve word problems involving the normal distribution. Most statistical software packages, much like the normal table, are set up to give answers to problems involving "less than." This means that the software does the "finding z-scores and looking up the table" work for us, but we still need to make sure that we pose the question in terms of "less than," and/or, if needed, adjust the answer that the software gives us.

Recall that we have two types of problems that are of interest: finding probabilities given values, and finding values given probabilities.

Finding Probability (Given Value)

To illustrate this we'll use an example from a previous activity: Finding $P(X > 700)$ where X is the SAT-M score which has a normal distribution with a mean of 507 and standard deviation of 111.

Using a statistical package, we find $P(X < 700) = 0.9589596$ and $P(X > 700) = 1 - P(X < 700) = 0.0410404$.

Similarly, if we wanted to find $P(400 < X < 600)$, we would need to do two separate calculations; one for $P(X < 600)$, and one for $P(X < 400)$, and subtract.

Scenario: Adult Male Height

Adult male height (X) follows (approximately) a normal distribution with a mean of 69 inches and a standard deviation of 2.8 inches. Using a statistical package, we find the following probabilities:

$$P(X < 65) = 0.07656373$$

$$P(X < 75) = 0.98393771$$

Learn By Doing

1/1 point (graded)

What proportion of males are less than 65 inches tall? Round your answer to TWO decimal places.



0.08

Answer

Correct:

The proportion of males that are less than 65 inches tall is equal to 0.07656373 which rounds to 0.08.

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1/1 point (graded)

What proportion of males are more than 75 inches tall? Round your answer to TWO decimal places.



0.02

Answer

Correct:

The proportion of males that are more than 75 inches tall is equal to $1 - 0.98393771$ which equals 0.01606229 and rounds to 0.02.

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Finding Value (Given Probability)

As mentioned before, most statistical packages are set up to find a value x that satisfies $P(X < x) = \text{some given probability}$. To illustrate this, we'll use an example from a previous activity: Finding the value of x that satisfies $P(X > x) = 0.02$ where X is the SAT-M score, which has a normal distribution with a mean of 507 and standard deviation of 111. Before we start, it will be useful to rephrase the problem in terms of " $X < x$ "; we are looking for the value of x that satisfies $P(X < x) = 0.98$.

Using a statistical package we find that the value that we are looking for (the 98th percentile) is 734.966. Our solution in the previous activity using the table gave us the answer 734.55 due to rounding.

Scenario: Adult Male Height

Adult male height (X) follows (approximately) a normal distribution with a mean of 69 inches and a standard deviation of 2.8 inches. Using a statistical package, we find the following the value for x that satisfies $P(X < x)$

$$P(X < x) = 0.005, x = 61.78768$$

$$P(X < x) = 0.9975, x = 76.8597$$

Learn By Doing

1/1 point (graded)

How tall must a male be, in order to be among the tallest 0.25% of males? Round your answer to ONE decimal place.



76.9

Answer

Correct:

There proportion for men *less* than 76.9 is 0.9975, so the proportion of males *greater* than 76.9 is 0.0025.

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