

## Percentiles

ID: 9538

 Time required  
 25 minutes

## Activity Overview

Students use the area to the left of a value in a normal distribution to find its percentile. Then, they reverse the process and find the value for a given percentile. In doing so, students become proficient with the **normalcdf** and **invNorm** commands.

## Topic: The Normal Distribution

- Determine the  $x^{\text{th}}$  percentile for a normally distributed variable given its mean and standard deviation.

## Teacher Preparation and Notes

- This activity is designed to be used for students studying Statistics and Probability.
- This activity is designed to have students explore **individually and in pairs**. Instruct students to work through each problem (there will be three in all) and then stop. When everyone is ready, discuss findings and answer any questions before having students move onto the next problem.
- Students should already be familiar with the normal distribution and its characteristics, specifically the 68-95-99.7 rule (the empirical rule).
- Percentiles divide data into 100 equal parts.
- For the sake of simplicity, round all percentiles to the nearest whole percent.
- Prior to beginning Problem 1, define and discuss **percentile**. Stress that the percentile gives the proportion of values to the **left** of that value.
- **To download the student worksheet, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter "9538" in the quick search box.**

## Associated Materials

- [StatWeek09\\_Percentiles\\_worksheet\\_TI84.doc](#)

## Suggested Related Activities

To download any activity listed, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter the number in the quick search box.

- [Percentiles & Z-scores \(TI-84 Plus family\)](#) — 11204
- [Average Orange \(TI-84 Plus family\)](#) — 10279
- [Areas In Intervals \(TI-84 Plus family\)](#) — 9503

**Problem 1 – Finding the Percentile Given the Score**

Explain to students that a percentile gives the proportion of values to the left of a given value. Stress that the percentile gives the proportion of the scores to the *left* of a given score.

Knowing what students know about the 68–95–99.7 rule, they should be able to determine the percentile in which the score is the mean or is the value of the standard deviation below or above the mean, without any use of calculator commands.

Students will graph the normal curve for which they were given the mean and standard deviation of test scores.

If it helps, students can draw a vertical line on the graph by pressing `[2nd] [DRAW]` and choosing **Vertical**. Then, use the arrow keys to place the line as needed.

Students will check the percentiles using the **normalcdf** command.

*Hint:* After finding the first percentile, students can save time by pressing `[2nd] [ENTRY]` to bring up the last command entered. Then use arrow keys to change the score only.

When students record their answers, they should round to the nearest whole percent: 74%, 98%, 51%, and 12%.

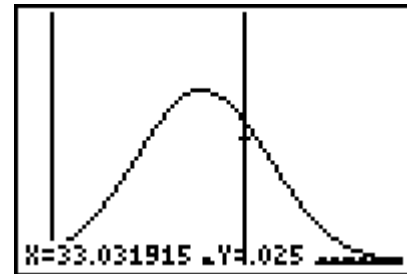
Have students work independently to answer Questions 3 and 4. Students should assume the distributions are normal.

**Problem 2 – Finding the Score Given the Percentile**

To reverse the process and find a score given its percentile, students must use the **invNorm** command from the DISTR menu. This command takes the format:

Percentile is entered as a decimal because it refers to the area to the left of the given score.

50	50
$50 + (68/2)$	84
$50 - (68/2)$	16



```
normalcdf(-1E99,
33.25.7,11.5)
.7372149602
```

```
invNorm(0.6,120,
12)
123.0401652
```

Before having students find this value, have them guess what it will be and explain how they determined it.

Let students work independently to complete the rest of the table on the worksheet.

Again, encourage them to guess each value before they find it.

$$30^{\text{th}} \text{ percentile: } \text{invNorm}(0.3, 120, 12) = 113.707$$

$$70^{\text{th}} \text{ percentile: } \text{invNorm}(0.7, 120, 12) = 126.293$$

$$90^{\text{th}} \text{ percentile: } \text{invNorm}(0.9, 120, 12) = 135.379$$

### Problem 3 – Practice

Problem 3 consists of three practice problems. Let students work through these questions on their own, and then review the answers.

$$6. \text{ normcdf}(-1E99, 465, 380, 42) = 0.978505$$

$$\text{normcdf}(-1E99, 88, 65, 10) = 0.989276$$

Juan is in the higher percentile.

$$7. \text{ invNorm}(0.86, 200, 35) = 237.811$$

$$8. \text{ invNorm}(0.95, 325, 35) = 382.57$$

### Solutions – student worksheet

$$1. 50\%, 84\%, 16\%$$

2. Answers will vary for students' guesses.

$$74\%, 98\%, 51\%, 12\%$$

3. 98th

4. 12th

5. Answers will vary for students' guesses.

$$123, 114, 126, 135$$

6. Juan; Juan is in the 99th percentile and Helen is in the 98th percentile.

7. 238

8. 383