

## Looking Ahead

The following example is calculating a statistical measure called the sample variance. To calculate this statistic, the difference between each value and the sample mean is raised to the second power.

### Example Preview

Calculate the value of the sample variance for the following data. Round your answer to one decimal place.

$$-12, -12, 2, 7, 7, 2$$

### Solution

There are  $n = 6$  data values, and the mean of the values is

$$\bar{x} = \frac{-12 + (-12) + 2 + 7 + 7 + 2}{6} = -1$$

In the following table, we have used the mean and data values to calculate the sum of squared deviations.

Data $x_i$	Deviations $(x_i - \bar{x})$	Squared Deviations $(x_i - \bar{x})^2$
-12	$-12 - (-1) = -11$	$(-11)^2 = 121$
-12	$-12 - (-1) = -11$	$(-11)^2 = 121$
2	$2 - (-1) = 3$	$3^2 = 9$
7	$7 - (-1) = 8$	$8^2 = 64$
7	$7 - (-1) = 8$	$8^2 = 64$
2	$2 - (-1) = 3$	$3^2 = 9$
Total		388

We can substitute the values we have found into the formula for the sample variance.

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{n - 1} = \frac{388}{5} = 77.6$$

## 3.R.4 Exercises

### Concept Check

**True/False.** Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

1. If a constant does not have an exponent written, it is assumed that the exponent is 0.

2. If  $a$  is a nonzero real number and  $n$  is an integer, then  $a^{-n} = -a^n$ .
3. Since the product rule is stated for integer exponents, the rule is also valid for 0 and negative exponents.
4. When using the quotient rule, you should subtract the smaller exponent from the larger exponent.

## Practice

Simplify each expression. The final form of the expressions with variables should contain only positive exponents. Assume that all variables represent nonzero numbers.

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5.  $y^3 \cdot y^8$

7.  $x^{-3} \cdot x^0 \cdot x^2$

6.  $\frac{y^7}{y^2}$

8.  $\frac{10^4 \cdot 10^{-3}}{10^{-2}}$

## Applications

Solve.

9. **Computers:** Rylee wants to move all her files to a new hard drive that has  $2^{12}$  GB of storage on it. She wants to designate the same amount of storage for each of  $2^4$  projects. How much storage should be assigned to each project? Write your answer as a power of two.

10. **Bacteria:** Trey is studying patterns in bacteria. For a positive test result in his experiment, bacteria must grow in population at a minimum rate of  $3^2$  in 24 hours. If the initial population of the bacteria is  $3^5$  and his final measurement after 24 hours is  $3^8$ , should he mark the test as positive or negative?

11. **Calculating Variance Given a Data Set:** The following data represent the average number of tweets per day posted on Twitter for 16 high school students. Calculate the sample variance of the data set.

0.8	42.2	20.6	2.8
36.7	18.6	23.3	11.5
3.7	14.9	9.4	1.5
14.9	31.1	23.5	9.5

12. **Calculating Variance Given a Stem-and-Leaf Plot:** The following data represent the ages of 20 American entrepreneurs (in years). Calculate the sample variance of the data set.

**Ages of American Entrepreneurs**

Stem	Leaves
2	2 3
2	5 8 9 9
3	0 1 1 2 2 3 4
3	5 6 9
4	1 3
4	7
5	3
5	

**Key: 2 | 2 = 22 years old**