



## Science Objectives

- Students will identify the number of significant figures in a numeric value.
- Students will learn how accuracy of measurement relates to the number of significant figures in a numeric value.
- Students will understand how to determine the number of significant figures in numerical values and how to perform calculations using significant figures.
- Students will practice significant figure calculations using addition, subtraction, multiplication, and division.

## Vocabulary

- Measurement
- Accuracy
- Precision
- Significant Figure
- Calculate
- Decimal Point
- Scientific Notation

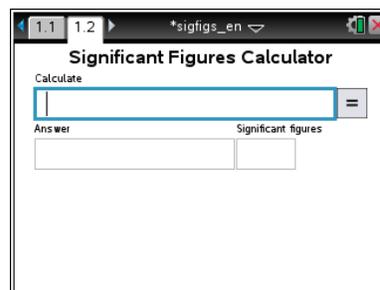
## About the Lesson

In this activity, students will use a significant figures calculator tool to perform calculations using addition, subtraction, multiplication, and division. This tool allows students to identify the significant figures of numeric values. It also allows students the ability to perform mathematical operations using either decimals or scientific notation.

- As a result, students will understand:
  - why scientists use significant figures and how those values correspond to accurate measurements.
  - how to perform calculations and give the solution with the appropriate number of significant figures.

## TI-Nspire™ Navigator™

- Send out the *sigfigs\_en.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.



### TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages

### Lesson Materials:

#### *Student Activity*

- Significant\_Figures\_Student.doc
- Significant\_Figures\_Student.pdf

#### *TI-Nspire document*

- sigfigs\_en.tns



## Discussion Points and Possible Answers

Have students read the background information on their activity sheet. Discuss with students the following rules for performing calculations with appropriate significant figures:

- When multiplying and dividing, round the answer to the least number of significant figures shown in any of the factors.
- When adding or subtracting, round the answer to the least number of decimal places shown in any of the numbers that make up the answer.

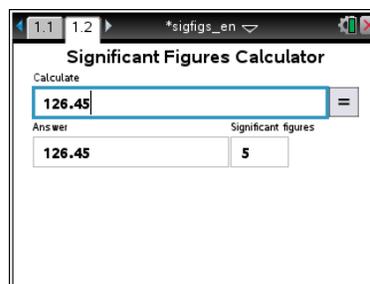
Have students practice using the significant figure tool using the following two examples.

Move to page 1.2.

### Example 1:

In this first example, students will learn how to navigate a significant figure problem using the handheld.

1. Students enter 126.45 into the Calculate box and press **enter**.
2. The Answer box displays the number in terms of the number of Significant figures. **(5)**
3. Now students delete the last two numbers (45) and the decimal point so that the number reads 126 in the Calculate box and press **enter**, (or **tab** to **=** and press **enter**).
4. Because students only enter a number, the Answer box will display the same number they entered. The Significant figures box shows the number of significant figures in the number. **(3)**



### Example 2:

A baby ostrich weighs 58.4 lbs. and gains 12.64 lbs. in two months.

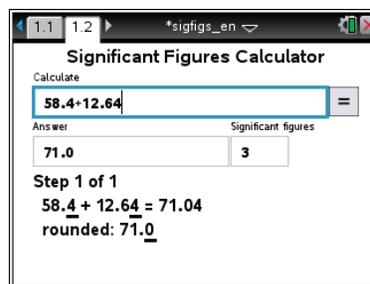
Q1. Type the problem into the Calculate box as shown in the screenshot at the right.

- A. What is this ostrich's new weight (lbs.)?

**Answer:** 71.0

- B. How many significant figures are there in the answer? Why?

**Answer:** 3 significant figures; The numeric answer can only be as accurate as the least accurate measurement. In this example, 58.4 lbs. is the least accurate measurement with 3 significant figures.





**Teacher Tip: Rules of Rounding**

When the number to the right of the last significant figure is less than five, the number remains the same and the rest of the numbers to the right are dropped.

When the number to the right of the last significant figure is greater than five, the last significant figure increases by one and the rest of the numbers to the right are dropped.

**Part 1: Significant Figures of Numbers**

How many significant figures are there in a number?

**NOTE:** When entering scientific notation numbers into the handheld, students must do the following:

- Enter the number with the decimal point with no spaces after the number.
- Press  $\boxed{EE}$  at the bottom left of the keypad. It will appear in the Calculate box as **e**.
- If the exponent is a negative number, press  $\boxed{(-)}$  before entering the numerical exponent.
- Example: If students entered  $\boxed{1} \boxed{.} \boxed{3} \boxed{3} \boxed{EE} \boxed{(-)} \boxed{2}$ , it would appear as **1.38e-2** in the Calculate box.
- Click  $\boxed{=}$  and the answer should read 0.0138 with 3 significant figures.

**TI-Nspire™ Navigator™ Opportunities**

Use *Class Capture* to make sure that all students understand how to correctly type in calculation problems on their handhelds and when entering scientific notation numbers into the handheld.

Q2. For each number in the table, determine the number of significant figures. Type the number into the Calculate Box and click  $\boxed{=}$ . Record the number of significant figures in the table below.

Number	# of Significant Figures	Number	# of Significant Figures
387.04	<b>5</b>	2.530	<b>4</b>
0.00193	<b>3</b>	0.00713	<b>3</b>
12.00075	<b>7</b>	10,634.005	<b>8</b>
$2.15 \times 10^3$	<b>3</b>	$6.02 \times 10^{23}$	<b>3</b>
405.0089	<b>7</b>	0.022	<b>2</b>
0.0130507	<b>6</b>	$9.1 \times 10^{-3}$	<b>2</b>
6506	<b>4</b>	400,000	<b>1</b>

In this tool, students must enter a decimal point at the end of a number. The handheld does not automatically assume that there is a decimal point at the end of a number unless you enter the decimal point.



Q3. Enter the following numbers into the Calculate box and click .

- A. How many significant figures are there in the number 1,200?

**Answer:** 2; only the 1 and 2 are significant figures

- B. How many significant figures are there in the number 1,200.? (Enter a period after 1,200.)

**Answer:** 4, all of the digits are significant figures

Q4. Determine the location of the last significant digit of each number by underlining the digit.

- A. 6,070.                      B. 0.00213                      C. 90,312.  
D. 8,900.                      E. 0.1020                      F. 0.00410

**Answers:** A. 6,070.    B. 0.00213    C. 90,312.    D. 8,900.    E. 0.1020    F. 0.00410

Students are to check their answers by entering the numbers into the significant figures calculator.

**Part 2: Significant Figures of Problems**

Students can use this significant figures tool to determine the number of significant figures for a mathematical problem. After the problem is entered and  is clicked, the numeric answer and number of significant figures will be displayed. The steps to determine the answer of the problems are displayed under the Answer box. If there are more than two operations in the problem, left and right arrow buttons ( and ) will appear on the right side of the page. Students can click these buttons to see all the steps.

Q5. Calculate the problems in the table using your handheld. Record the numeric answer and the number of significant figures in the answer.

<b>Problem</b>	<b>Answer</b>	<b># Significant Figures</b>
1.35 × 2.467	<b>3.33</b>	<b>3</b>
1045 ÷ 35.23	<b>29.66</b>	<b>4</b>
0.15 + 2.86 + 32.046	<b>35.06</b>	<b>4</b>
0.0087 + 1.345 + 100.1	<b>101.5</b>	<b>4</b>
1.278 × 0.6548 × 0.012	<b>0.010</b>	<b>2</b>
893.13 – 674.005	<b>219.13</b>	<b>5</b>
505 ÷ 6.5	<b>78</b>	<b>2</b>
55.46 – 27.3	<b>28.2</b>	<b>3</b>
3003.45 ÷ 13.2 × 55.003	<b>12,500</b>	<b>3</b>
19.45 × 7.29 ÷ 2.114	<b>67.2</b>	<b>3</b>



### Student Inquiry

Using their knowledge of significant figures, students will answer the following questions:

Q6. Reduce the number 4897.84 to 4 significant figures:

**Answer: 4898**

Q7. Explain in a sentence how you determined the four significant figures for the number in question 6.

**Answer:** The answer was derived from the rules of rounding. The two numbers after the decimal point (.84) are rounded to .8. To further reduce the number, the 7 in the ones place is rounded up to make the overall number 4898.

Q8. Give an example of a situation or experiment in which a chemist studying exothermic (heat is released) reactions might use this significant figures calculator tool.

**Answer:** Answers will vary, but should include:

- Exothermic reactions are reactions where heat is released, so the experiment should include a measurement of heat.
- Significant figures in temperature measurements equate to the accuracy of the tool used for measuring the temperature (a thermometer).

### TI-Nspire™ Navigator™ Opportunities

Have students work out individual significant figure problems and review the steps together as a class. Use Class Capture to monitor students' progress through the lesson. Use Quick Poll to send formative assessment questions during the lesson.

### Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire™ Navigator™. Save grades to Portfolio. Discuss activity questions using Slide Show.

### Assessment

- Formative assessment will consist of questions on the student activity sheet to be used alongside the unit conversion tool.
- Summative assessment will consist of questions/problems on the chapter test.