

**CHAPTER
7****Exploring Non-Integer Exponents with a Graphing Calculator**

Some of the ways to evaluate non-integer exponents with a graphing calculator are explored here.

EXAMPLE 1 Evaluate exponents that are multiples of $\frac{1}{2}$ with a graphing calculator

Evaluate the expression with a graphing calculator.

a. $196^{1/2}$

b. $4^{5/2}$

Solution:

- a. Use the $\sqrt{}$ command to evaluate $196^{1/2}$.

Enter these keystrokes: $\boxed{2\text{nd}} \sqrt{} \boxed{196} \boxed{\text{ENTER}}$

Display reads: 14

- b. Another way to evaluate *any* fractional exponent is to use the $\frac{\Box}{\Box}$ command.

Enter these keystrokes: $4 \boxed{\Delta} \boxed{(} \boxed{5} \boxed{\div} \boxed{2} \boxed{)} \boxed{\text{ENTER}}$

Display reads: 32

Notice what happens when parentheses are *not* used to evaluate $4^{5/2}$.

Enter the keystrokes: $4 \boxed{\Delta} \boxed{5} \boxed{\div} \boxed{2} \boxed{\text{ENTER}}$

Display reads: 512

This is not correct. By *not* using parentheses, the calculator evaluates $4^5 \div 2$.

Parentheses are used to tell the calculator to raise 4 to the $\frac{5}{2}$ power. ■

EXAMPLE 2 Evaluate exponents that are multiples of $\frac{1}{3}$ with a graphing calculator

Evaluate the expression with a graphing calculator.

a. $64^{1/3}$

b. $125^{4/3}$

c. $27^{-1/3}$

Solution:

- a. $64^{1/3}$ is the same as $\sqrt[3]{64}$. Use the $\sqrt[3]{}$ (command found in the $\boxed{\text{MATH}}$ menu.

Use these keystrokes: $\boxed{\text{MATH}} \sqrt[3]{} \boxed{(} \boxed{64} \boxed{\text{ENTER}}$

Display reads: 4

- b. $125^{4/3}$ is the same as $(\sqrt[3]{125})^4$.

Use these keystrokes: $\boxed{\text{MATH}} \sqrt[3]{} \boxed{(} \boxed{125} \boxed{)} \boxed{\Delta} \boxed{4} \boxed{\text{ENTER}}$

Display reads: 625

- c. Use these keystrokes: $27 \boxed{\Delta} \boxed{(} \boxed{-1} \boxed{\div} \boxed{3} \boxed{)} \boxed{\text{ENTER}}$

Displays reads: .3333333333 ■

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Exploring Non-Integer Exponents with a Graphing Calculator *continued*

EXAMPLE 3 Evaluate other non-integer exponents with a graphing calculator

Evaluate the expression with a graphing calculator.

a. $81^{1/4}$

b. $32^{3/5}$

Solution:

a. $81^{1/4}$ is the same as $\sqrt[4]{81}$. Use the $\sqrt[x]{}$ command found in the **MATH** menu.

Use these keystrokes: 4 **MATH** $\sqrt[x]{}$ 81 **ENTER**

Display reads: 3

b. $32^{3/5}$ is the same as $(\sqrt[5]{32})^3$.

Use these keystrokes: 5 **MATH** $\sqrt[x]{}$ 32 **▲** 3 **ENTER**

Display reads: 8 ■

When using the $\sqrt[x]{}$ function, notice the root is entered *before* the $\sqrt[x]{}$ function key.

EXAMPLE 4 Evaluate expressions containing multiple fractional exponents with a graphing calculator

Evaluate $8^{-5/3} \cdot \frac{64^{3/2}}{512^{-1/3}}$ with a graphing calculator.

Solution:

Use these keystrokes: 8 **▲** **(** **(-)** 5 **÷** 3 **)** **×** 64 **▲** **(** 3 **÷** 2 **)** **÷** 512

▲ **(** **(-)** 1 **÷** 3 **)** **ENTER**

Display reads: 128 ■

Practice

Evaluate the expression using a graphing calculator.

1. $9^{5/2}$

2. $1024^{2/5}$

3. $(243^{-9/10})^{2/3}$

4. $(27^{4/3})(81^{-1/4})$

5. $\frac{16^{3/4}}{(512^{-1/3})^{4/3}}$

6. $\frac{256^{5/8}}{8^{-5/3}} \cdot 64^{-2/3}$

Find two sets of keystrokes that can be used to evaluate the expression with a graphing calculator. Then evaluate the expression.

7. $25^{5/2}$

8. $343^{-1/3}$

9. $64^{5/6}$

10. $(8^{2/3})(16)^{3/4}$

11. $\frac{36^{1/2}}{(8^{2/3})^{1/2}}$

12. $125^{2/3} \cdot \frac{225^{-1/2}}{9^{3/2}}$