



### CALCULATOR CORNER

**Rational Exponents** We can use a graphing calculator to approximate rational roots of real numbers. To approximate  $7^{2/3}$ , we press  $\boxed{7} \boxed{\wedge} \boxed{(}$   $\boxed{2} \boxed{+} \boxed{3} \boxed{)}$   $\boxed{=}$ . Note that the parentheses around the exponent are necessary. If they are not used, the calculator will read the expression as  $7^2 \div 3$ . To approximate  $14^{-1.9}$ , we press  $\boxed{1} \boxed{4} \boxed{\wedge} \boxed{(-)}$   $\boxed{1} \boxed{.}$   $\boxed{9} \boxed{=}$ . Parentheses are not required when a rational exponent is expressed in a single decimal number. The display indicates that  $7^{2/3} \approx 3.659$  and  $14^{-1.9} \approx 0.007$ .

$7^{(2/3)}$	3.65930571
$14^{-1.9}$	.006642885

**Exercises:** Approximate each of the following.

- |                |                 |
|----------------|-----------------|
| 1. $5^{3/4}$   | 4. $73^{0.56}$  |
| 2. $8^{4/7}$   | 5. $34^{-2.78}$ |
| 3. $29^{-3/8}$ | 6. $32^{0.2}$   |

Use the laws of exponents to simplify.

20.  $7^{1/3} \cdot 7^{3/5}$

21.  $\frac{5^{7/6}}{5^{5/6}}$

22.  $(9^{3/5})^{2/3}$

23.  $(p^{-2/3}q^{1/4})^{1/2}$

## C Laws of Exponents

The same laws hold for rational-number exponents as for integer exponents. We list them for review.

For any real number  $a$  and any rational exponents  $m$  and  $n$ :

- |   |   |
|---|---|
| 1. $a^m \cdot a^n = a^{m+n}$                      | In multiplying, we can add exponents if the bases are the same.                                   |
| 2. $\frac{a^m}{a^n} = a^{m-n}$                    | In dividing, we can subtract exponents if the bases are the same.                                 |
| 3. $(a^m)^n = a^{m \cdot n}$                      | To raise a power to a power, we can multiply the exponents.                                       |
| 4. $(ab)^m = a^m b^m$                             | To raise a product to a power, we can raise each factor to the power.                             |
| 5. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$ | To raise a quotient to a power, we can raise both the numerator and the denominator to the power. |

**EXAMPLES** Use the laws of exponents to simplify.

16.  $3^{1/5} \cdot 3^{3/5} = 3^{1/5+3/5} = 3^{4/5}$

Adding exponents

17.  $\frac{7^{1/4}}{7^{1/2}} = 7^{1/4-1/2} = 7^{1/4-2/4} = 7^{-1/4} = \frac{1}{7^{1/4}}$

Subtracting exponents

18.  $(7.2^{2/3})^{3/4} = 7.2^{2/3 \cdot 3/4} = 7.2^{6/12} = 7.2^{1/2}$

Multiplying exponents

19.  $(a^{-1/3}b^{2/5})^{1/2} = a^{-1/3 \cdot 1/2} \cdot b^{2/5 \cdot 1/2}$

Raising a product to a power and multiplying exponents

$$= a^{-1/6}b^{1/5} = \frac{b^{1/5}}{a^{1/6}}$$

Answers on page A-43

Do Exercises 20–23.