

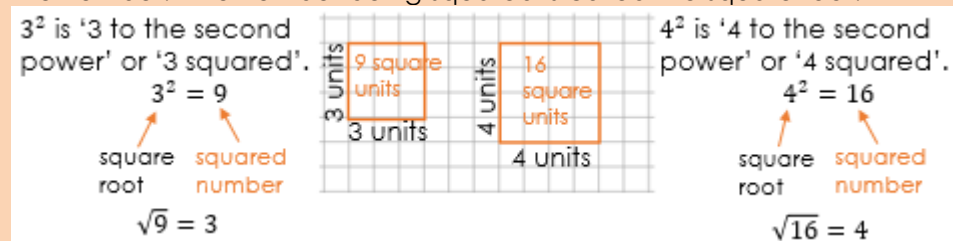
## Packet 11: Exponents and Roots

Dear Parents/Guardians,

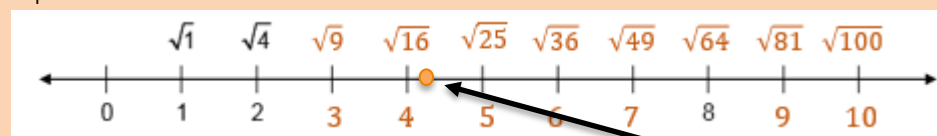
Packet 11 introduces exponents and roots. In Lesson 1, students explore the inverse relationship between numbers that are squares and square roots. In Lessons 2 and 3, students use patterns to develop exponential rules. They use these rules to simplify expressions involving exponential numbers.

### Squares and Square Roots

When a number is taken to the second power, we refer to it as 'squaring the number.' The number being squared is called the square root.



Students will observe that most numbers do not have a whole number square root.



To approximate a square root...

Step 1: locate it between two consecutive integers. Example:  $\sqrt{18}$  would be in between 4 and 5. This means  $\sqrt{18} = 4$  and a bit more.

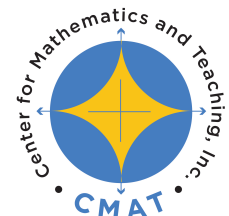
Step 2: To find a fractional approximation, subtract the difference from the two square roots the number lies between.  $\sqrt{18}$  lies between  $\sqrt{16}$  and  $\sqrt{25}$ . Estimate of fractional part of  $\sqrt{18} \rightarrow \frac{18-16}{25-16} = \frac{2}{9}$ .

$$\sqrt{18} \approx 4\frac{2}{9} \approx 4.22$$

### Exponent Rules

Students explore exponential relationships to make conjectures and determine rules for exponentials.

Rule	Expanded Form (Example)	Exponential Form (Example)
Product Rule $(x^a)(x^b) = x^{a+b}$	$(4^3)(4^2)$ $= (4 \cdot 4 \cdot 4) \cdot (4 \cdot 4)$ $= 4^5$	$(4^3)(4^2)$ $= 4^{3+2} = 4^5$
Power Rule $(x^a)^b = x^{a \cdot b}$	$(4^3)^2$ $= (4 \cdot 4 \cdot 4) \cdot (4 \cdot 4 \cdot 4)$ (2 sets) $= 4^6$	$(4^3)^2$ $= 4^{3 \cdot 2} = 4^6$
Quotient Rule $\frac{x^a}{x^b} = x^{a-b}$	$\frac{4^5}{4^2}$ $= \frac{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}{4 \cdot 4}$ Simplify. $= 4^3$	$\frac{4^5}{4^2}$ $= 4^{5-2} = 4^3$



**MathLinks 8**

**By the end of the packet, your student should know...**

How to locate square roots on a number line [Lesson 11.1](#)

How to approximate square roots as fractions and decimals [Lesson 11.1](#)

How to simplify expressions involving exponents [Lessons 11.2 and 11.3](#)

How to use different notations to represent large and small numbers, such as scientific notation and exponential notation (See video tutorials) [Lesson 11.3](#)

### Additional Resources

Resource Guide (RG)  
Part 2, pages 29-34

For video tutorials on exponent rules:

<http://www.mathtv.com/>

Click: Algebra → Exponents

For video tutorials on scientific notation:

<http://www.mathtv.com/>

Click: Algebra → Scientific notation