

POWERS & ROOTS

Middle School • International Curriculum Worksheet Pack

What's inside	Core skills
12 printable pages of structured practice, reasoning, puzzles and real-life applications.	Powers • exponents • square roots • cube roots • laws of indices • powers of 10 • scientific notation

Suggested age: 11–14 years • Grades 6–8 • KS3

International alignment: supports common lower-secondary expectations for exponents, powers of 10, square roots and numerical reasoning, including Common Core 6.EE and 8.EE strands.

Name: _____ Date: _____

Learning Targets

By the end of this pack, I can:

- write repeated multiplication using powers.
- identify bases and exponents and evaluate powers.
- recognise square numbers and find square roots.
- recognise perfect cubes and find cube roots.
- apply basic exponent laws for positive integer exponents.
- use powers of 10 and scientific notation.
- solve real-world problems involving powers and roots.

Powers & Roots Toolkit

Idea	Example	Meaning
Power	3^4	$3 \times 3 \times 3 \times 3 = 81$
Base	5^2	5 is the base.
Exponent	5^2	2 tells how many times the base is a factor.
Square root	$\sqrt{49} = 7$	$7 \times 7 = 49$
Cube root	$\sqrt[3]{27} = 3$	$3 \times 3 \times 3 = 27$
Power of 10	$10^3 = 1,000$	A positive exponent counts factors of 10.

Important

A square root asks: Which number multiplied by itself gives the number inside the root? For example, $\sqrt{64} = 8$ because $8 \times 8 = 64$.

A. Write Repeated Multiplication as a Power

1. Write $2 \times 2 \times 2$ using exponent notation.

2. Write $5 \times 5 \times 5 \times 5$ using exponent notation.

3. Write 7×7 using exponent notation.

4. Write $10 \times 10 \times 10 \times 10 \times 10$ using exponent notation.

5. Write $3 \times 3 \times 3 \times 3$ using exponent notation.

B. Expand Each Power

6. Write 4^3 as repeated multiplication.

7. Write 6^2 as repeated multiplication.

8. Write 2^5 as repeated multiplication.

9. Write 9^2 as repeated multiplication.

10. Write 3^4 as repeated multiplication.

C. Identify the Base and Exponent

For 7^5 , state the base and the exponent.

Calculate each power. Remember: an exponent is not multiplication.

1. Evaluate 2^3 .

2. Evaluate 3^4 .

3. Evaluate 5^2 .

4. Evaluate 4^3 .

5. Evaluate 10^2 .

6. Evaluate 6^2 .

7. Evaluate 2^6 .

8. Evaluate 7^2 .

9. Evaluate 3^5 .

10. Evaluate 10^3 .

Reasoning Check

A student says $4^3 = 12$. Explain the mistake and give the correct answer.

A. Complete the Square Number Facts

n	1	2	3	4	5	6	7	8	9	10
n^2	1	—	—	—	—	—	—	—	—	—

B. Find the Square Roots

1. Find $\sqrt{16}$.

2. Find $\sqrt{25}$.

3. Find $\sqrt{36}$.

4. Find $\sqrt{49}$.

5. Find $\sqrt{64}$.

6. Find $\sqrt{81}$.

7. Find $\sqrt{100}$.

8. Find $\sqrt{121}$.

9. Find $\sqrt{144}$.

Challenge: Between which two whole numbers does $\sqrt{50}$ lie?

A perfect cube can be written as n^3 for a whole number n .

n	1	2	3	4	5	6
n^3	1	—	—	—	—	—

Find each cube root

1. Find $\sqrt[3]{8}$.

2. Find $\sqrt[3]{27}$.

3. Find $\sqrt[3]{64}$.

4. Find $\sqrt[3]{125}$.

5. Find $\sqrt[3]{216}$.

6. Find $\sqrt[3]{343}$.

Think Deeper

How is finding a cube root different from finding a square root?

For positive integer exponents with the same non-zero base:

$$a^m \times a^n = a^{m+n} \cdot a^m \div a^n = a^{m-n} \cdot (a^m)^n = a^{mn}$$

Simplify. Leave answers in exponent form where appropriate.

1. Simplify: $2^3 \times 2^2$.

2. Simplify: $5^4 \times 5^2$.

3. Simplify: $x^3 \times x^5$.

4. Simplify: $7^6 \div 7^2$.

5. Simplify: $a^8 \div a^3$.

6. Simplify: $(3^2)^3$.

7. Simplify: $(x^4)^2$.

8. Simplify: $10^2 \times 10^3$.

Reasoning Check

Explain why $3^2 \times 3^3 = 3^5$ rather than 3^6 .

A. Powers of 10

1. Write 10^1 as an ordinary number.

2. Write 10^2 as an ordinary number.

3. Write 10^3 as an ordinary number.

4. Write 10^4 as an ordinary number.

5. Write 10^5 as an ordinary number.

6. Write 10^6 as an ordinary number.

B. Scientific Notation

7. Write 4,500 in scientific notation.

8. Write 72,000 in scientific notation.

9. Write 3,600,000 in scientific notation.

10. Write 0.0008 in scientific notation.

11. Write 0.0052 in scientific notation.

Challenge

Which is greater: 3.2×10^5 or 2.9×10^6 ? Explain how you know.

Show your working and use estimation when helpful.

1. Evaluate: $2^4 + 3^2$.

2. Evaluate: $5^3 - 4^2$.

3. Find: $\sqrt{81} + \sqrt{49}$.

4. Find: $\sqrt[3]{125} + \sqrt{64}$.

5. Simplify: $2^2 \times 2^3$.

6. Simplify: $5^6 \div 5^2$.

7. Which is greater: $\sqrt{100}$ or 3^3 ?

8. Find the missing number: $\square^2 = 169$.

9. Find the missing number: $\square^3 = 512$.

1. A square garden has an area of 196 m^2 . What is the length of one side.

2. A cube-shaped box has a volume of 125 cm^3 . What is the length of each edge?

3. A computer stores 2^5 files in a small folder. How many files is that?

4. A population doubles each year. Starting with 250 organisms, how many are there after 3 years?

5. A square photograph has an area of 324 cm^2 . What is its side length?

6. Earth-to-Moon distance is approximately $3.84 \times 10^5 \text{ km}$. Write this number in ordinary form.

7. A science experiment uses 10^3 millilitres of water. How many litres is this?

Part A • Find the Mistake

1. A student says $2^4 = 8$. Explain the mistake and correct the answer.

Explanation:

Correct answer:

2. A student says $\sqrt{36} = 18$ because $18 \times 2 = 36$. Explain the mistake.

Explanation:

Correct answer:

3. A student says $3^2 \times 3^3 = 3^6$. Correct the work and explain the exponent rule.

Explanation:

Correct answer:

Part B • Mixed Skills Check

1. Write $6 \times 6 \times 6 \times 6$ as a power.

2. Evaluate 7^2 .

3. Find $\sqrt{225}$.

4. Find $\sqrt[3]{729}$.

5. Simplify $10^2 \times 10^4$.

6. Simplify $x^7 \div x^3$.

7. Write 5,700,000 in scientific notation.

8. A square has area 400 cm^2 . Find its perimeter.

Page 3

A: 2^3 , 5^4 , 7^2 , 10^5 , 3^4 . B: $4 \times 4 \times 4$; 6×6 ; $2 \times 2 \times 2 \times 2 \times 2$; 9×9 ; $3 \times 3 \times 3 \times 3$. C: base 7, exponent 5.

Page 4

1. 8 • 2. 81 • 3. 25 • 4. 64 • 5. 100 • 6. 36 • 7. 64 • 8. 49 • 9. 243 • 10. 1,000. The error is treating the exponent as a multiplier.

Page 5

Square numbers: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100. Roots: 4, 5, 6, 7, 8, 9, 10, 11, 12. $\sqrt{50}$ lies between 7 and 8.

Page 6

Cubes: 1, 8, 27, 64, 125, 216. Cube roots: 2, 3, 4, 5, 6, 7.

Page 7

1. 2^5 • 2. 5^6 • 3. x^8 • 4. 7^4 • 5. a^5 • 6. 3^6 • 7. x^8 • 8. 10^5 . Exponents are added when multiplying powers with the same base.

Page 8

$10^1=10$; $10^2=100$; $10^3=1,000$; $10^4=10,000$; $10^5=100,000$; $10^6=1,000,000$. Scientific notation: 4.5×10^3 ; 7.2×10^4 ; 3.6×10^6 ; 8×10^{-4} ; 5.2×10^{-3} . 2.9×10^6 is greater.

Page 9

1. 25 • 2. 109 • 3. 16 • 4. 17 • 5. 32 • 6. 625 • 7. $3^3=27$ is greater • 8. 13 • 9. 8.

Page 10

1. 14 m • 2. 5 cm • 3. 32 files • 4. 2,000 organisms • 5. 18 cm • 6. 384,000 km • 7. 1 litre.

Page 11

Mistakes: 1. $2^4=16$. 2. $\sqrt{36}=6$ because $6 \times 6=36$. 3. $3^2 \times 3^3=3^5$. Mixed: 6^4 ; 49; 15; 9; 10^6 ; x^4 ; 5.7×10^6 ; side 20 cm, perimeter 80 cm.

Teacher note

Encourage students to distinguish powers from multiplication, explain root notation in words, show working, estimate where useful, and check answers using inverse operations.