Name________________________ Class______________ Date__________

1-4

COMMON CORE

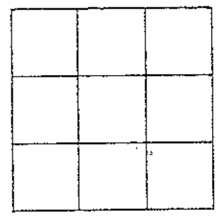
CC.8.EE.2

Square Roots and Cube Roots

Essential question: *How do you evaluate square roots and cube roots?*

1 EXPLORE Finding the Square Root of Perfect Squares

There are 9 square tiles used to make a square mosaic. There are 3 tiles along each side of the mosaic.



Another square mosaic is made using 64 square tiles. How many tiles are on each side of this mosaic?

A Use what you know about the mosaic made with 9 tiles to find the relationship between number of tiles on each side and the total number of square tiles.

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B Use this relationship to find the number of tiles along the side of a square mosaic made of 64 square tiles.

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C In this context, the total number of tiles is the number of tiles along each side of the mosaic squared. When the total number of tiles is 9, the number of tiles along a side is 3. Because $3^2 = 9$, we call 3 a *square root* of 9. This is written as $3 = \sqrt{9}$.

Use this notation to write the square root of 64: $\sqrt{64} =$

TRY THIS!

Evaluate each square root.

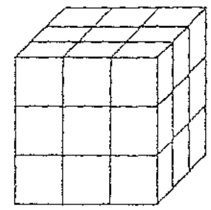
1a. $\sqrt{169}$ ________ **1b.** $\sqrt{\frac{1}{16}}$ ________ **1c.** $\sqrt{81}$ ________ **1d.** $\sqrt{\frac{1}{400}}$ ________

The square root of a positive number p is x if $x^2 = p$. There are two square roots for every positive number. For example, the square roots of 36 are 6 and -6 because $6^2 = 36$ and $(-6)^2 = 36$. The square roots of $\frac{1}{25}$ are $\frac{1}{5}$ and $-\frac{1}{5}$. You can write the square roots of $\frac{1}{25}$ as $\pm\frac{1}{5}$. The symbol $\sqrt{\ }$ indicates the positive, or principal square root.

A number that is a perfect square has square roots that are integers. The number 81 is a perfect square because its square roots are 9 and -9.

2 EXPLORE Finding the Cube Root

A cube shaped toy is made of 27 small cubes.
There are 3 cubes along each edge of the toy.



Another cube shaped toy is made using 8 small cubes.
How many small cubes are on each edge of this toy?

A Use what you know about the toy made with 27 small cubes to find the relationship between number of cubes on each edge and the total number of cubes.

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B Use this relationship to find the number of small cubes along each edge of a toy made of 8 small cubes.

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C In this situation, the total number of small cubes is the number of small cubes along each edge of the toy cubed. When the total number of small cubes is 27, the number of small cubes along each edge is 3. Because $3^3 = 27$, we call 3 a *cube root* of 27. This is written as $\sqrt[3]{27} = 3$.

Use this notation to write the cube root of 8: $\sqrt[3]{8} =$

REFLECT

2a. The product of 3 equal positive factors is positive / negative.

2b. The product of 3 equal negative factors is positive / negative.

2c. Use your answers to **2a** and **2b** to explain whey there is only one cube root of a positive number.

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TRY THIS!

Evaluate each cube root.

2d. $\sqrt[3]{125}$ ______ **2e.** $\sqrt[3]{\frac{1}{8}}$ ______ **2f.** $\sqrt[3]{1000}$ ______ **2g.** $\sqrt[3]{\frac{1}{343}}$ ______

PRACTICE

Find the square roots of each number.

1. 144 ____________
2. 256 ____________
3. $\frac{1}{81}$ ____________
4. $\frac{49}{900}$ ____________
5. 400 ____________
6. $\frac{1}{100}$ ____________

Find the cube root of each number.

7. 216 ____________
8. 8000 ____________
9. $\frac{27}{125}$ ____________
10. $\frac{1}{27}$ ____________
11. $\frac{27}{64}$ ____________
12. 512 ____________

Simplify each expression.

13. $\sqrt{16} + \sqrt{25}$ ____________
14. $\sqrt[3]{125} + 10$ ____________
15. $\sqrt{25} + 10$ ____________
16. $8 - \sqrt{64}$ ____________
17. $\sqrt[3]{\frac{16}{2}} + 1$ ____________
18. $\sqrt{\frac{16}{4}} + \sqrt{4}$ ____________

19. The foyer of Ann's house is a square with an area of 36 square feet. What is the length of each side of the foyer?

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20. A chessboard has 32 black squares and 32 white squares arranged in a square. How many squares are along each side of the chessboard?

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21. A cubic aquarium holds 27 cubic feet of water. What is the length of each edge of the cube?

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22. **Reasoning** How can you check your answer when you find the square root(s) of a number?

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23. **Reasoning** Can you arrange 12 small squares to make a larger square? Can you arrange 20 small cubes to make a larger cube? Explain how this relates to perfect squares and perfect cubes.

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