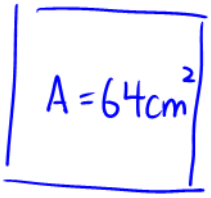
4.1 Warmup

Name_____

1. The area of a square is $64cm^2$. Draw a picture that represents this information. What equation could you use to determine the side length of the square? What would the side length be?



$$s = \sqrt{64cm^2}$$
$$= 8\,cm$$

2. The volume of a cube is $64\ cm^3$. Draw a picture that represents this information. What equation could be used to determine the edge length of the cube? What would the edge length be?

$$s = \sqrt[3]{64cm^3}$$
$$= 4\,cm$$

FCP 10 Date:_____

4.1 Square Roots and Cube Roots

Study the table below of perfect squares and perfect cubes. What patterns do you observe?

Perfect Squares	Prime Factorization	Square Root		Perfect Cubes	Prime Factorization	Cube Root
1		$\sqrt{1}=1$		1		$\sqrt[3]{1}=1$
4	2x2	$\sqrt{4}=2$		8	2x2x2	$\sqrt[3]{8}=2$
9	3x3	$\sqrt{9}=3$		27	3x3x3	$\sqrt[3]{27}=3$
16	2x2x2x2	$\sqrt{16}=4$		64	2x2x2x2x2x2	$\sqrt[3]{64}=4$
25	5x5	$\sqrt{25}=5$		125	5x5x5	$\sqrt[3]{125}=5$
36	2x2x3x3	$\sqrt{36}=6$		216	2x2x2x3x3x3	$\sqrt[3]{216}=6$
⋮				⋮		
100	2x2x5x5	$\sqrt{100}=10$		1000	2x2x2x5x5x5	$\sqrt[3]{1000}=10$
⋮				⋮		
144	2x2x2x2x3x3	$\sqrt{144}=12$		1728	2x2x2x2x2x2x3x3x3	$\sqrt[3]{1728}=12$

Thus $\sqrt{49}=$ 7 because 49 = 7x7

And $\sqrt[3]{729}=$ 9 because 729 = 9x9x9

A perfect square is the product of 2 equal factors

A perfect cube is the product of 3 equal factors

How can prime factorization be used to determine if a number is a perfect square?

if the factors can be put in pairs.

How can prime factorization be used to determine if a number is a perfect cube?

if factors can be put in groups of 3.

eg $\sqrt{3\times3\times3\times3\times\pi\times\pi\times a\cdot a} = 9\pi a$

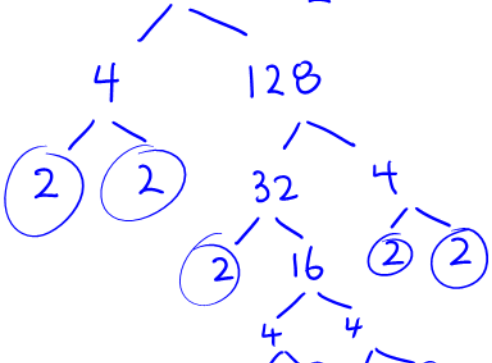
Notice that some numbers are both perfect squares and perfect cubes (1 and 8)

1. Which of the following numbers is a perfect square? A perfect cube? Neither?
Justify your answer using i) prime factorization ii) your calculator

a) 512 b) 300 c) 729

Prime Factorization

a) 512 $= 2^9$



b) 300 $= 2 \times 2 \times 3 \times 5 \times 5$

$2^2 \cdot 3^1 \cdot 5^2$

c) 729 $= 3^6$

Calculator

$\sqrt{512} =$ 22.6 .....

$\sqrt{300} =$ 17.32 .....

$\sqrt{729} = 3^3 = 27$

$\sqrt[3]{512} = 2^3 = 8$

$\sqrt[3]{300} =$ 6.69 ....

$\sqrt[3]{729} = 3^2 = 9$

2. Determine the answers to the following: (Use a calculator only when appropriate)

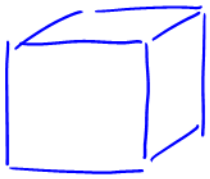
a) $(-4)^2 = -4 \times -4$ $= 16$	b) $(-4)^3 = -4 \times -4 \times -4$ $= -64$	c) $-3^2 = -3 \times 3$ $= -9$

* note : $(-3)^2 \neq -3^2$

$\frac{3^3}{5} = \frac{3^3}{5^1} = \frac{27}{5}$ $\left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4}$

d) -5^3 $-(5^3)$ -125	e) $\left(\frac{3}{5}\right)^3$ $\frac{3}{5} \times \frac{3}{5} \times \frac{3}{5} = \frac{3^3}{5^3}$ $= \frac{27}{125}$	f) $\frac{27}{\sqrt{81}} = \frac{27}{9} = 3$
g) $\sqrt{25x^2}$ $= \sqrt{5^2 x^2}$ $= 5x$	h) $\sqrt{(16)(25)}$ $= \sqrt{2^4 \cdot 5^2}$ $= 4 \cdot 5$ $= 20$	i) $\sqrt{\frac{36}{25}}$ $\sqrt{\frac{6^2}{5^2}} = \frac{6}{5}$ $= 1.2$
j) $\sqrt[3]{\frac{27}{8}} = \sqrt[3]{\frac{3^3}{2^3}} = \frac{3}{2}$ eg $\sqrt[3]{\frac{x^6}{y^3}} = \frac{x^2}{y^1}$	k) $\sqrt[3]{(27)(125)} = \sqrt[3]{3^3 \cdot 5^3}$ $= 15$	l) $\sqrt[3]{125x^3} = 5x$
m) $\frac{6}{\sqrt[3]{8}}$ $\frac{6}{2} = 3$	n) $\sqrt[3]{27d^3} = 3d$	o) $\sqrt[3]{27\,000}$ $\sqrt[3]{27 \cdot 1000}$ $= 3 \cdot 10$ $= 30$

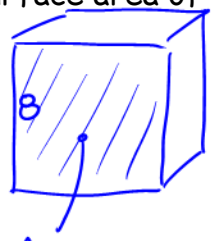
3. The volume of a cube is 512 in^3. What is the surface area of the cube?



$V = 512\text{ in}^3$

$\sqrt[3]{512\text{ in}^3} = s$

$s = 8\text{ in}$



6 sides

$A = 8\text{in} \times 8\text{in}$

$SA = 6 \times 8\text{in} \times 8\text{in}$

$= 384\text{ in}^2$

4. The surface area of a sugar cube is 13.5 cm^2. What is the volume of the cube?

$\frac{13.5\text{cm}^2}{6} = \frac{6 \cdot s^2}{6}$

$\sqrt{2.25\text{cm}^2} = \sqrt{s^2}$

$1.5\text{ cm} = s$

$V = s^3$

$= (1.5\text{cm})^3$

$= 3.375\text{ cm}^3$

p 158 # 1, 3, 4, 6–11, 14, 16, 18–20