Warm up

① State if the following are Natural, whole, integer, rational, irrational or real numbers. (Some might have more than one answer or None!)

a) $4.87325\ldots$ keeps going

Irrational
Real

b) $-0.\overline{423}$ repeats

Rational - $\frac{423}{999}$
Real

c) $\sqrt{-50}$

Not Real

$\emptyset$ (No answer)

d) $-\sqrt{9} = -3$

Integers
Rational $= \frac{-3}{1}$
Real

② Find a number that is a whole number, but not a natural number

0, 1, 2, 3, 4, ...

1, 2, 3, 4, ...

1(l) $5.4732891\ldots$

T

$$
\begin{array}{r}
5.4732891\ldots \\
+\ 3.2 \\
\hline
8.6732891\ldots
\end{array}
$$

Ir

1(m) $\sqrt{3} \times \sqrt{3} = (\cancel{\sqrt{3}})^{\cancel{2}}$

F

$= 3$ ← Rational

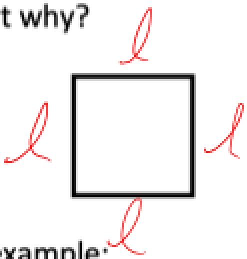
$\sqrt{4} = 2$

When we went over the grade 8 exam, I told you that:

$(\sqrt{x})^2 = x$	$\sqrt{x^2} = x$

In other words, Squaring and Square rooting are opposites!
(Like adding/subtracting or multiplying/dividing)

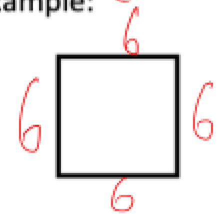
... But why?



Area = A = length × width $= l \times l = l^2$

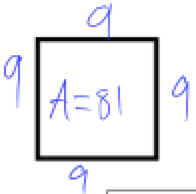
Perimeter = P = $l + l + l + l = 4l$

For example:



Area = A = $l^2 = 6^2 = 36$

What if we start with the area?



what number squared gives 81?

Area = A = $81 = l^2$

$l = \sqrt{81} = 9$

because $9^2 = 81$

In Summary:

#1. $A = l^2$	**AND**	#2. $l = \sqrt{A}$

#1. → #2.	#2. → #1.
$l = \sqrt{A} \Rightarrow l = \sqrt{l^2}$	$A = l^2 \Rightarrow A = (\sqrt{A})^2$

This shows that, Squaring and Square rooting are opposites!

Perfect Squares – Any whole **number squared!**

$0^2 = 0$	$\sqrt{0} = 0$
$1^2 = 1$	$\sqrt{1} = 1$
$2^2 = 4$	$\sqrt{4} = 2$
$3^2 = 9$	$\sqrt{9} = 3$
$4^2 = 16$	$\sqrt{16} = 4$
$5^2 = 25$	$\sqrt{25} = 5$
$6^2 = 36$	$\sqrt{36} = 6$
$7^2 = 49$	$\sqrt{49} = 7$
$8^2 = 64$	$\sqrt{64} = 8$
$9^2 = 81$	$\sqrt{81} = 9$
$10^2 = 100$	$\sqrt{100} = 10$

Let's try some problems with roots…

$$\sqrt{\frac{49}{121}} = \frac{\sqrt{49}}{\sqrt{121}} = \frac{7}{11}$$

$$\sqrt{\frac{7\times 7}{11\times 11}} = \sqrt{\frac{7}{11}\times\frac{7}{11}} = \sqrt{\left(\frac{7}{11}\right)^2} = \frac{7}{11}$$

$$\sqrt{16+9} \neq \cancel{\sqrt{16}+\sqrt{9}}$$

$$\sqrt{25} = \boxed{5}$$

$$\sqrt{16}+\sqrt{9} \neq \cancel{\sqrt{16+9}}$$

$$4+3 = 7$$

$$\sqrt{-100} = \emptyset$$

$$(\_)^2 = -100$$

$$(-10)^2 = +100$$

$$-\sqrt{100} = -\left(\sqrt{100}\right) = -(10) = -10$$

$$\sqrt{0.81} = 0.9$$

use calculator for decimals

check: $(0.9)^2 = 0.81$ ✓ !

What happens if we take the square root of a number that isn't a perfect square?

$$\sqrt{12} = 3.4641016\ldots$$

$$3 < \sqrt{12} < 4$$

$$\sqrt{9} < \sqrt{12} < \sqrt{16}$$

$$\sqrt{78} = 8.8317608\ldots$$

$$8 < \sqrt{78} < 9$$

$$\sqrt{64} < \sqrt{78} < \sqrt{81}$$

since 78 is close to 81, $\sqrt{78}$ is close to 9

$$-\sqrt{97} = -9.8488578\ldots$$

$$-9 > -\sqrt{97} > -10$$

$$-\sqrt{81} > -\sqrt{97} > -\sqrt{100}$$

since 97 is close to 100, $-\sqrt{97}$ is close to -10