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Geometric Mean

Let's Review:

Algebraic Mean: The average. Add numbers up and divide by the number of numbers.

Example: Lucy scored a 75, 92, 83, 85 & 89 on her chapter tests. What is her test average?

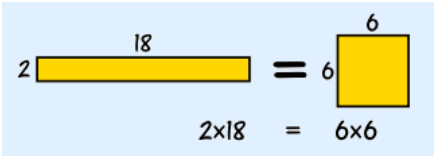
New Information:

Geometric mean: a special type of average. Multiply numbers together and take a square root (for two numbers), cube root (for three numbers)...

Example: Find the geometric mean of 2 and 18.

Why do we need this?

The geometric mean is useful when we want to compare things with very different properties. As you can see a rectangle with dimensions of 2 and 18 has the same area as a square with a side length of 6.



Example: you want to buy a new camera.

- One camera has a zoom of 200 and gets an 8 in reviews,
- The other has a zoom of 250 and gets a 6 in reviews.

Comparing using the usual arithmetic mean gives (200+8)/2 = **104** vs (250+6) = **128**. The zoom is such a big number that the user rating gets lost.

But the geometric means of the two cameras are:

- $\sqrt{(200 \times 8)} = \mathbf{40}$
- $\sqrt{(250 \times 6)} = \mathbf{38.7...}$

So, even though the zoom is 50 bigger, the lower user rating of 6 is still important.

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Find the geometric mean of each pair of numbers. If necessary, give the answer in simplest radical form.

2a. 2 and 8 **2b.** 10 and 30 **2c.** 8 and 9

How can we use this?

Geometric means can also be written as proportions.

Can you find a number that fits below?

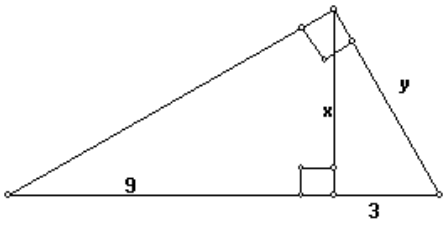
1 : ☐ : 4 2 : ☐ : 18 4 : ☐ : 36

SECOND DEFINITION: A proportion where the numerator of one ratio is the denominator of the other.

$$\frac{a}{x} = \frac{x}{b}$$

Goal:

Find missing side lengths given a triangle like the one on the right. In a right triangle, an altitude drawn from the vertex of the right angle to the hypotenuse forms two right triangles.



Prove:

These three triangles are similar with index cards.

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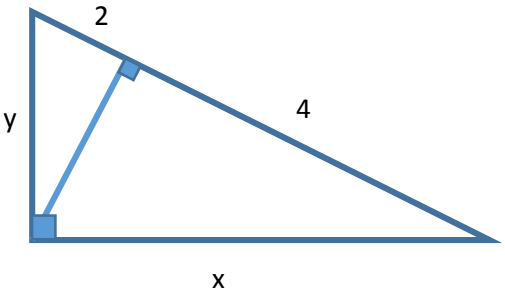
Problem:

Since we have proved these triangles similar, we know the sides must be proportional (definition of similarity).

Find x & y.

1.



2.