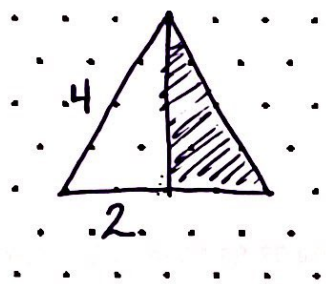
Day 4 - Discovering 30-60-90 Triangle Relationships – Notes

Activity: Discovering the 30-60-90 Triangle Relationship

1. Create three different equilateral triangles on the graphs below.
2. Draw an altitude for each triangle (height of triangle)
3. Use the Pythagorean Theorem to find the height of the triangle.
4. Simplify the answer so that it remains in radical form.

Triangle 1



Short Side Length: 2

Long Side Length: $2\sqrt{3}$

Hypotenuse Length: 4

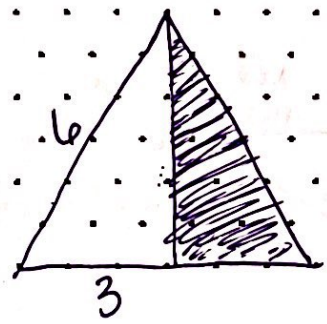
$2^2 + b^2 = 4^2$

$4 + b^2 = 16$

$\sqrt{b^2} = \sqrt{12}$

$b = \sqrt{12} = 2\sqrt{3}$

Triangle 2



Short Side Length: 3

Long Side Length: $3\sqrt{3}$

Hypotenuse Length: 6

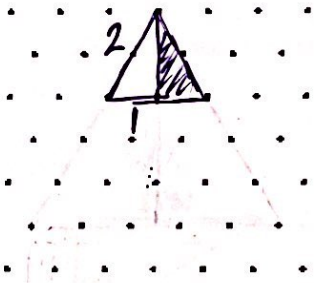
$3^2 + b^2 = 6^2$

$9 + b^2 = 36$

$\sqrt{b^2} = \sqrt{27}$

$b = \sqrt{27}$ or $3\sqrt{3}$

Triangle 3



Short Side Length: 1

Long Side Length: $1\sqrt{3}$

Hypotenuse Length: 2

$1^2 + b^2 = 2^2$

$1 + b^2 = 4$

$b^2 = \sqrt{3}$

What did you notice about the side lengths in each triangle?

- Short side is half of hypotenuse
- long side is the short side $\cdot \sqrt{3}$ $(\times\sqrt{3})$

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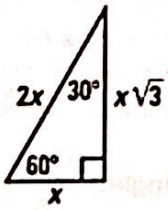
30-60-90 Triangle Relationship

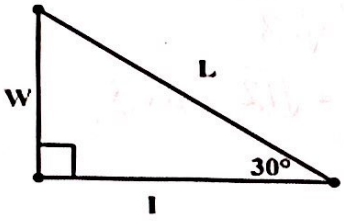
30°-60°-90° Triangle Theorem

Words In a 30°-60°-90° triangle, the hypotenuse is twice as long as the shorter leg, and the longer leg is the length of the shorter leg times $\sqrt{3}$.



Symbols Hypotenuse = 2 • shorter leg
Longer leg = shorter leg • $\sqrt{3}$

Practice: Identify the short leg, long leg, and hypotenuse.



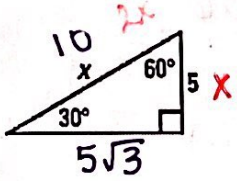
Short leg= W

Long leg= I

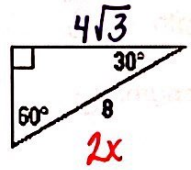
Hypotenuse= L

Practice: Find all missing side lengths.

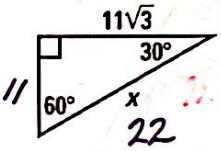
A.



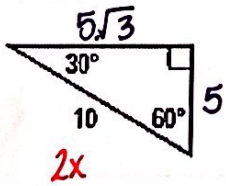
B.



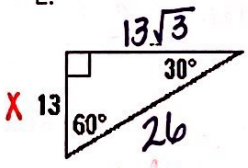
C.



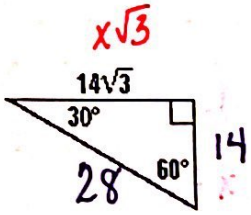
D.



E.



F.



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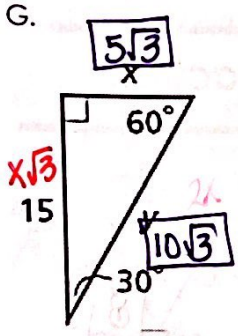
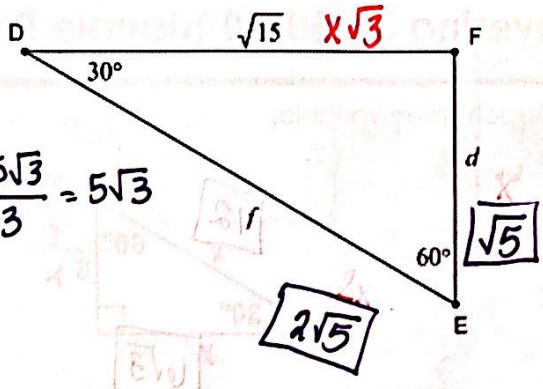
G.



$\frac{x\sqrt{3}}{\sqrt{3}} = \frac{15}{\sqrt{3}}$

$x = \frac{15}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{15\sqrt{3}}{3} = 5\sqrt{3}$

H.

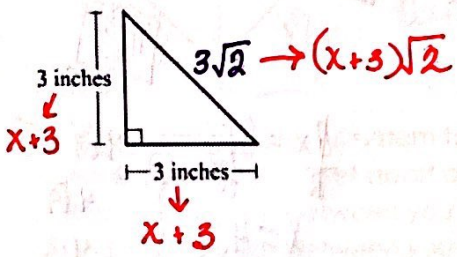


$\frac{\sqrt{15}}{\sqrt{3}} = \frac{x\sqrt{3}}{\sqrt{3}}$

$x = \frac{\sqrt{15}}{\sqrt{3}} = \sqrt{5}$

Application of 30-60-90 Triangles

Kelly makes two different-sized ceramic tiles in the shape of right isosceles triangles. This diagram shows the leg lengths of the small tile. Kelly makes a larger tile by increasing the length of each leg of the small tile by x inches. Which expression represents the length, in inches, of the hypotenuse of the large tile?



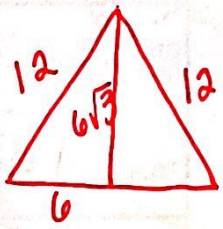
A. 18 + x

B. $(x + 3)^2$

C. $(x + 3)\sqrt{2}$

D. $3\sqrt{2} + x$

The perimeter of an equilateral triangle is 36 in. Find the length of the altitude.



P = 36 so $36 \div 3 = 12$

altitude = $6\sqrt{3}$

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