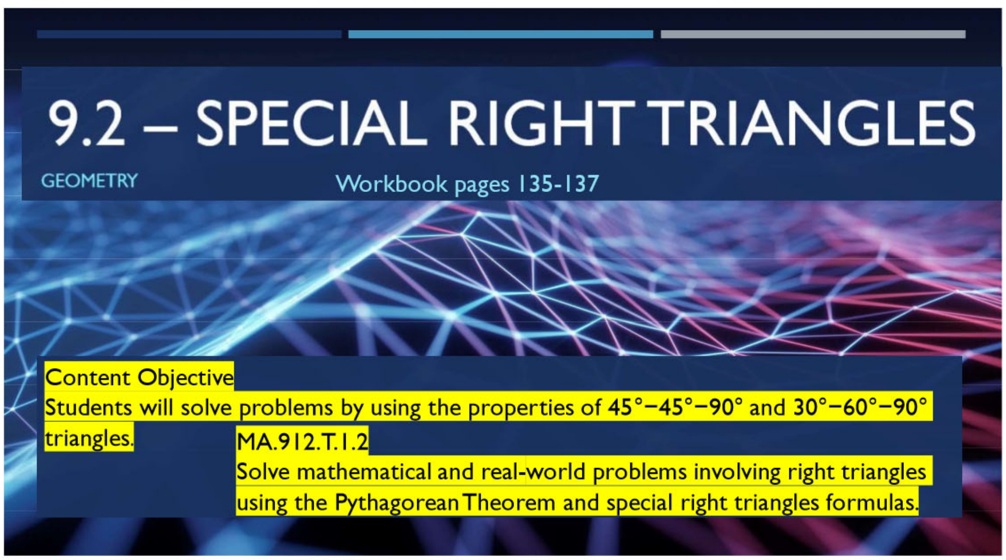
Special Right Triangles

Monday, February 26, 2024 10:07 PM

Click Link Below to Open the Interactive Pear Deck PowerPoint
https://app.peardeck.com/student/twobctvds

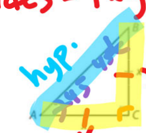
special right



Locker

Explore 1 Investigating an Isosceles Right Triangle

Discover relationships that always apply in an isosceles right triangle. 2 sides = legs



C = 90
S = 180

(A) The figure shows an isosceles right triangle. Identify the base angles, and use the fact that they are complementary to write an equation relating their measures.

90

$\angle A$ and $\angle B$ = 90°

(B) Use the Isosceles Triangle Theorem to write a different equation relating the base angle measures.

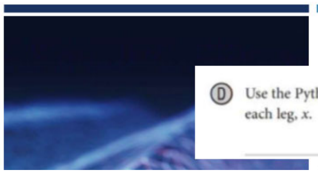
$x + x = 90$ $\quad \frac{2x}{2} = \frac{90}{2}$ $\quad x = 45°$

$$\begin{array}{r} 180 \\ -\ 90 \\ \hline 90 \end{array}$$

(C) What must the measures of the base angles be? Why?

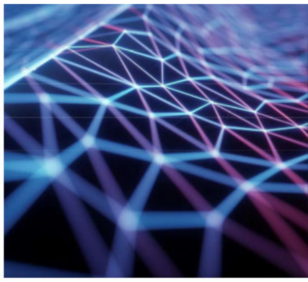
45° same (isosceles)

Locker



Explore 1 Investigating an Isosceles Right Triangle

(D) Use the Pythagorean Theorem to find the length of the hypotenuse in terms of the length of each leg, x.



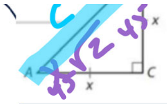
$a^2+b^2=c^2$

$1x^2+1x^2=c^2$

$\sqrt{2x^2}=\sqrt{c^2}$

$\sqrt{2\cdot x\cdot x}=c$

$x\sqrt{2}=c$



b

a

$\sqrt{25}$

$\sqrt{5\cdot 5}$

$=5$

$\sqrt{4\cdot 4}$

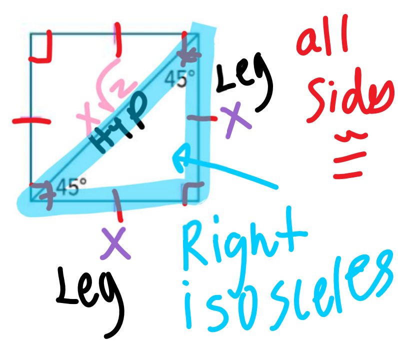
4

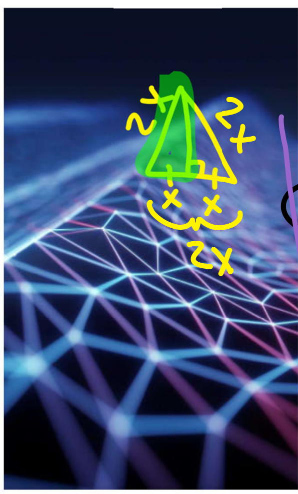
Learn

45° – 45° – 90° Triangles

The diagonal of a square forms two congruent isosceles right triangles. Because the base angles of an isosceles triangle are congruent, the measure of each acute angle is 90°÷2 or 45°. Such a special right triangle is known as a **45° – 45° – 90° triangle.**

***In a 45° – 45° – 90° triangle, the legs ℓ are congruent and the length of the hypotenuse h is $\sqrt{2}$ times the length of a leg.**





Explore 2 Investigating Another Special Right Triangle

Discover relationships that always apply in a right triangle formed as half of an equilateral triangle.

all sides ≅ 90

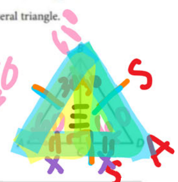
(A) $\triangle ABD$ is an equilateral triangle and $\overline{BC}$ is a perpendicular from B to $\overline{AD}$. Determine all three angle measures in $\triangle ABC$.

$x+x+x=180$

$3x=180$

$\frac{3x}{3}=\frac{180}{3}$

$x=60$



(B) Explain why $\triangle ABC \cong \triangle DBC$.

SSS ASA

SAS

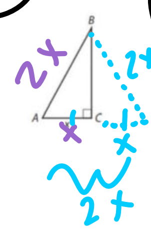
AAS

SAS

BC = BC Reflexive Prop

(C) Let the length of $\overline{AC}$ be x. What is the length of $\overline{AB}$, and why?

2x all sides are 2x



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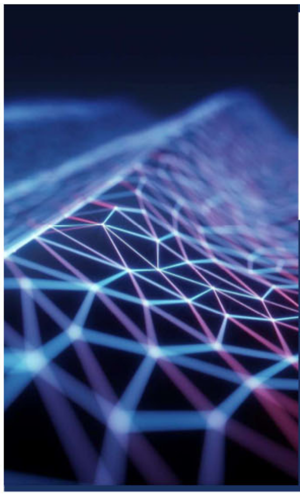


Explore 2 **Investigating Another Special Right Triangle**

(D) Using the Pythagorean Theorem, find the length of $\overline{BC}$.

$a^2+b^2=c^2$

$x^2+b^2=(2x)^2$

$2x\cdot 2x$

$\cancel{x^2}+b^2=4x^2$

$-x^2 \qquad -1x^2$

$\sqrt{b^2}=\sqrt{3x^2}$

$b=\sqrt{3\cdot x\cdot x}=x\sqrt{3}$

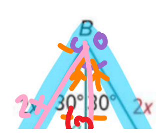
Learn

$30° - 60° - 90°$ Triangles

A $\mathbf{30° - 60° - 90°}$ **triangle** is a special right triangle or right triangle with side lengths that share a special relationship. You can use an equilateral triangle to find this relationship.

When an altitude is drawn from any vertex of an

$\overline{BD}$ is a perp. bis...

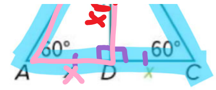


Equilateral all sides

equilateral triangle, two congruent $30° - 60° - 90°$ triangles are formed. In the figure,

$\triangle ABD \cong \triangle CBD$, so $\overline{AD} \cong \overline{CD}$. If $AD = x$, then $CD = x$ and $AC = 2x$. Because $\triangle ABC$ is equilateral, $AB = 2x$ and $BC = 2x$.

bisect also < bisector



2x

≅ angles each ≅ 60°

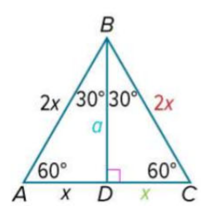
(*continued on the next slide*)

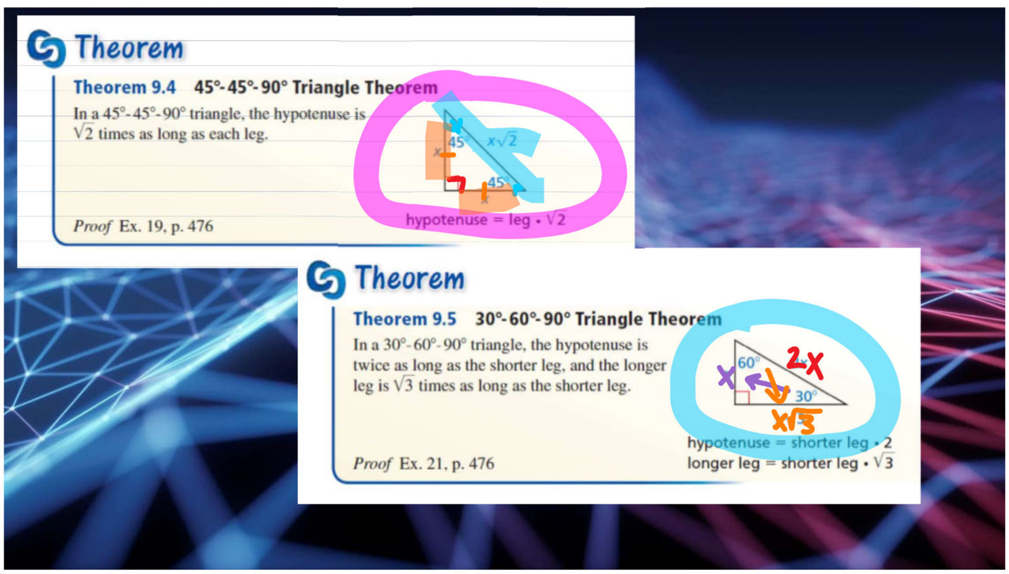
Learn

$30° - 60° - 90°$ Triangles

Use the Pythagorean Theorem to find a, the length of the altitude $\overline{BD}$, which is also the longer leg of $\triangle BDC$.

$a^2 + x^2 = (2x)^2$	Pythagorean Theorem
$a^2 + x^2 = 4x^2$	Simplify.
$a^2 = 3x^2$	Subtract x^2 from each side.
$a = x\sqrt{3}$	Simplify.





Theorem

Theorem 9.4 45°-45°-90° Triangle Theorem

In a 45°-45°-90° triangle, the hypotenuse is $\sqrt{2}$ times as long as each leg.

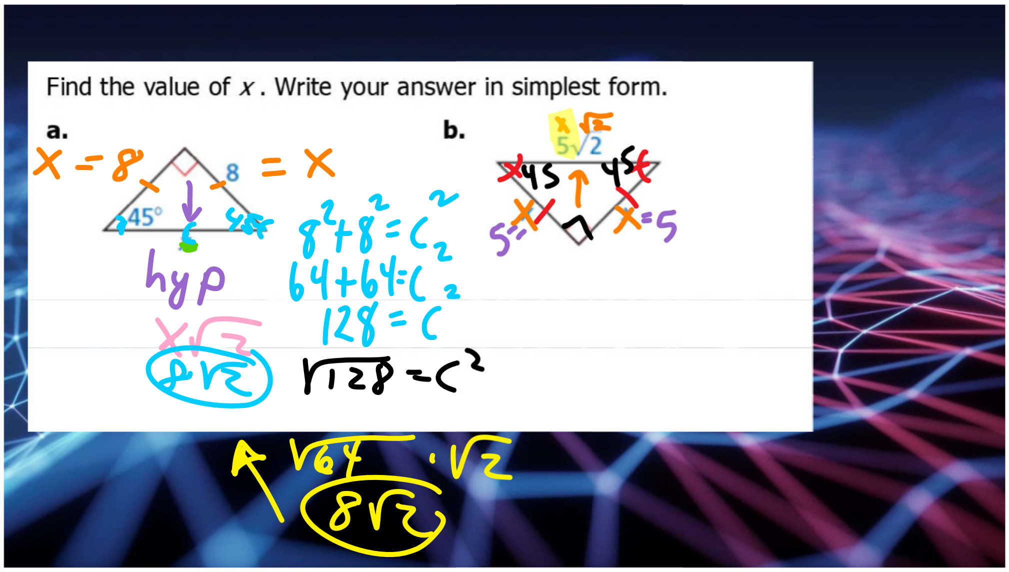
Proof Ex. 19, p. 476

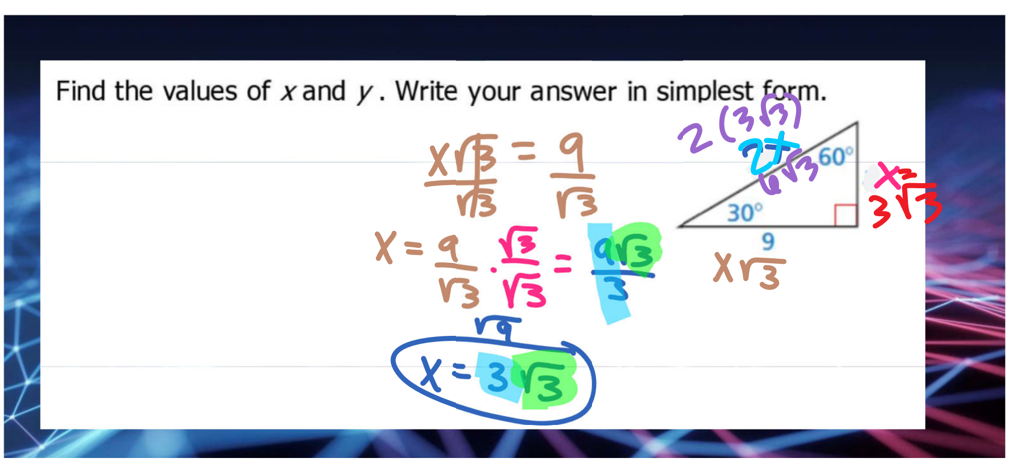
Theorem

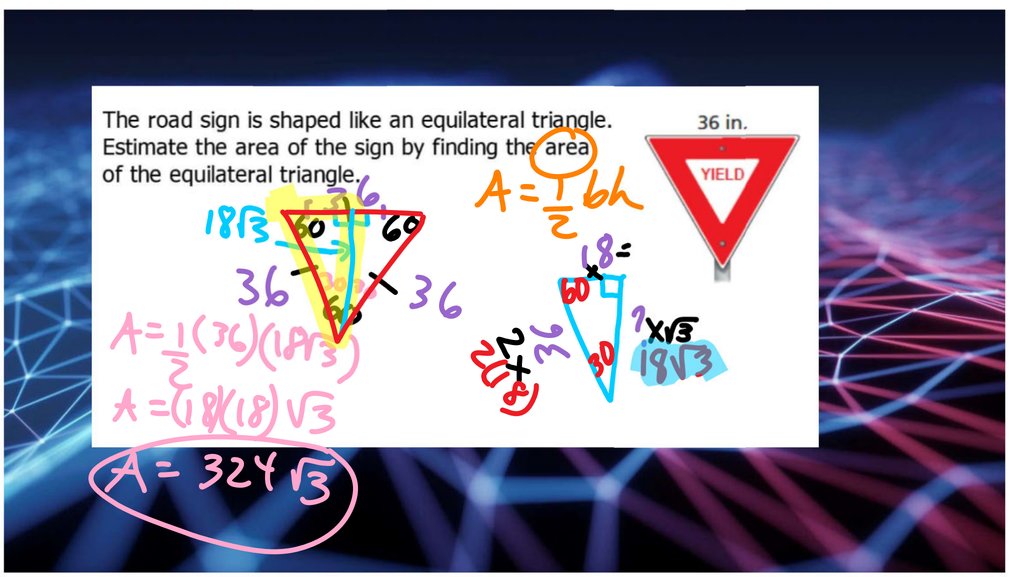
Theorem 9.5 30°-60°-90° Triangle Theorem

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

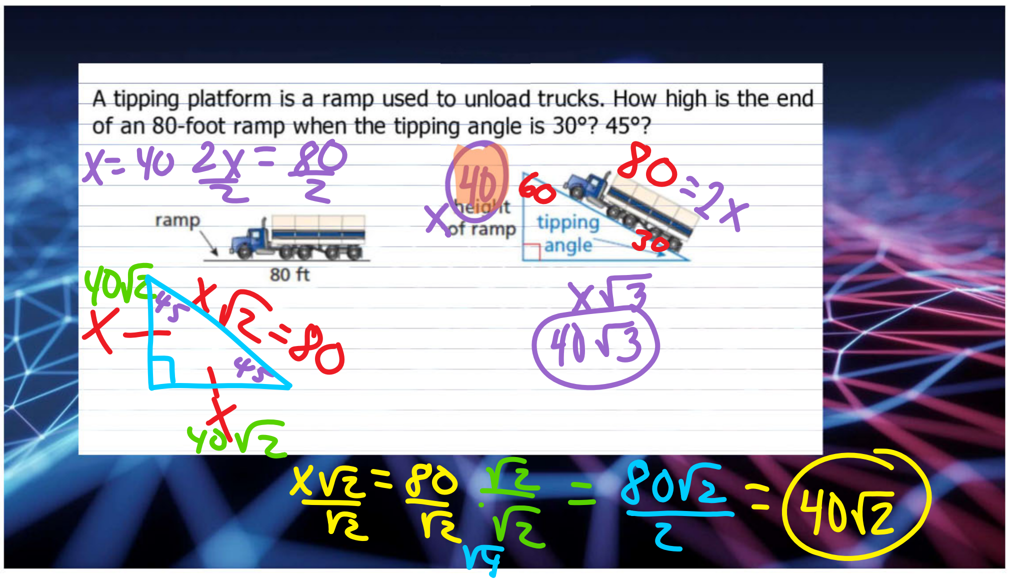
Proof Ex. 21, p. 476


Find the value of x. Write your answer in simplest form.
a.
x = 8
8
= x
45°
45°
$8^2+8^2=c^2$
$64+64=c^2$
$128=c$
hyp
$x\sqrt{2}$
$8\sqrt{2}$
$\sqrt{128}=c^2$
$\sqrt{64}\cdot\sqrt{2}$
$8\sqrt{2}$
b.
$x\sqrt{2}$
$5\sqrt{2}$
45
45
x
x = 5
5 =


Find the values of x and y. Write your answer in simplest form.
$\frac{x\sqrt{3}}{\sqrt{3}}=\frac{9}{\sqrt{3}}$
$x=\frac{9}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}}=\frac{9\sqrt{3}}{3}$
$\sqrt{9}$
$x=3\sqrt{3}$
$2(3\sqrt{3})$
2x
$6\sqrt{3}$
60°
30°
9
$x\sqrt{3}$
$x=3\sqrt{3}$



The road sign is shaped like an equilateral triangle. Estimate the area of the sign by finding the area of the equilateral triangle.
36 in.
YIELD
$A = \frac{1}{2}bh$
$18\sqrt{3}$
36
36
60
60
60
30
$18 = x$
$x\sqrt{3}$
$18\sqrt{3}$
$A = \frac{1}{2}(36)(18\sqrt{3})$
$A = (18)(18)\sqrt{3}$
$A = 324\sqrt{3}$


A tipping platform is a ramp used to unload trucks. How high is the end of an 80-foot ramp when the tipping angle is 30°? 45°?
x = 40
2x = 80
ramp
80 ft
height of ramp
tipping angle
40
60
30
80 = 2x
x√3
40√3
40√2
45
45
x√2 = 80
x
x
x√2 = 80
√2 √2
= 80√2 / 2 = 40√2
√4