Geometry: *Hutschenreuter* Name KEY

Section 7.7: Solve Right Triangles

Essential Question:
In a right triangle, how can you find all the sides and angles?

VOCABULARY:

Inverse Tangent
Used to find an angle
If $\tan A = \#$
then $m\angle A = \tan^{-1}(\#)$

Inverse Sine
Used to find an angle
If $\sin A = \#$
then $m\angle A = \sin^{-1}(\#)$

Inverse Cosine
Used to find an angle
If $\cos A = \#$
then $m\angle A = \cos^{-1}(\#)$

Key Concept: Inverse Trigonometric Functions

The inverse trig functions are applied to trig functions to find unknown angle measures.

Example:

$$\cos A = \frac{15}{25}$$

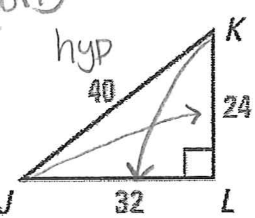
$$\cos^{-1}(\cos A) = \cos^{-1}\left(\frac{15}{25}\right)$$

$$m\angle A = \cos^{-1}(0.6)$$

$$m\angle A \approx 53°$$

EXAMPLES:

A1. Find the measures of $\angle J$ and $\angle K$ to the nearest degree.



$\cos J = \frac{adj}{hyp} = \frac{32}{40}$

$m\angle J = \cos^{-1}\left(\frac{32}{40}\right)$

$m\angle J = 37°$

$\sin K = \frac{opp}{hyp} = \frac{32}{40}$

$m\angle K = \sin^{-1}\left(\frac{32}{40}\right)$

$m\angle K = 53°$

Other options: $\sin J = \frac{24}{40}$, $\tan J = \frac{24}{32}$, $\cos K = \frac{24}{40}$, $\tan K = \frac{32}{24}$

A2. Use your trig table to find the measure of the angles.

a. $\sin A = 0.645$

$\sin A = .6428$

$m\angle A = 40°$

$\sin^{-1}(.645) \approx 40.17°$

b. $\tan B = 2.9$

$\tan B = 2.9042$

$m\angle B = 71°$

$\tan^{-1}(2.9) \approx 70.97°$

c. $\cos C = 0.9239$

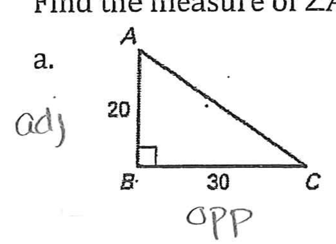
$\cos C = .9272$

$m\angle C = 22°$

$\cos^{-1}(.9239) \approx 22.5°$

A3. Find the measure of $\angle A$.

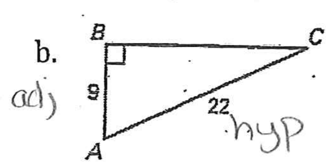
a.



$\tan A = \frac{30}{20}$

$m\angle A = \tan^{-1}\left(\frac{30}{20}\right) = 56.31°$

b.

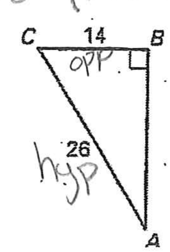


$\cos A = \frac{9}{22}$

$\cos^{-1}\left(\frac{9}{22}\right) = 65.85$

$m\angle A = 65.85°$

c.



$\sin A = \frac{14}{26}$

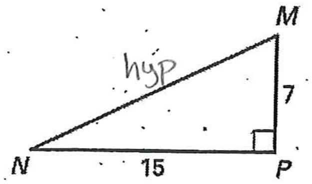
$\sin^{-1}\left(\frac{14}{26}\right) = 32.58$

$m\angle A = 32.58°$

→ find ALL angles & sides

A4. Solve the right triangle.

a.



$m\angle N = ?$

$m\angle M = ?$

$MN = ?$

$\tan N = \frac{opp}{adj} = \frac{7}{15}$

$\tan^{-1}\left(\frac{7}{15}\right) = 25.02$

$m\angle N = 25.02°$

$\tan M = \frac{opp}{adj} = \frac{15}{7}$

$\tan^{-1}\left(\frac{15}{7}\right) = 64.98$

$m\angle M = 64.98°$

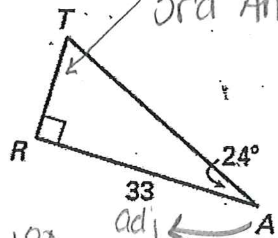
$a^2 + b^2 = c^2$

$7^2 + 15^2 = (MN)^2$

$274 = (MN)^2 \rightarrow \sqrt{MN^2} = \sqrt{274}$

$MN \approx 16.55$ un

b.



3rd Angle Theorem

$m\angle T = ?$

$RT = ?$

$AT = ?$

$180 - 90 - 24 = 66$

$m\angle T = 66°$

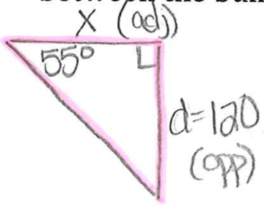
$\cos A = \frac{adj}{hyp} \rightarrow \frac{\cos 24°}{1} = \frac{33}{AT}$

$AT = \frac{1(33)}{\cos 24°} = 36.12$ un $= AT$

$\tan A = \frac{opp}{adj} \rightarrow \frac{\tan 24°}{1} = \frac{RT}{33}$

$RT = \frac{33(\tan 24°)}{1} = 14.69$ un $= RT$

A5. If the angle of depression from the taller building to the shorter building is 55°, find the distance between the buildings.



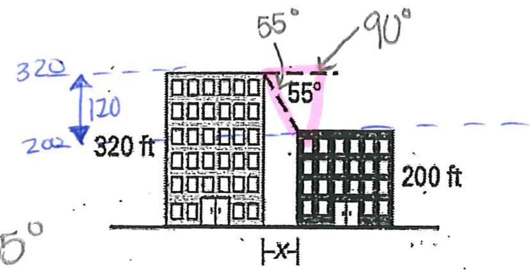
$d = 320 - 200 = 120$

$\tan A = \frac{opp}{adj}$

$\frac{\tan 55°}{1} = \frac{120}{X}$

$X = \frac{1(120)}{\tan 55°}$

$X = 84.02$ feet



Section 7.7 Summary:

In a right △, given one acute angle you can find the 3rd angle using the 3rd Angle Theorem (subtract 2 given angles from 180). You then can find missing lengths using the sin, cos, tan ratios if given only one side length. If you are given 2 side lengths you can find the 3rd side by using the Pythagorean Theorem $a^2 + b^2 = c^2$.