9.6 Solving Right Triangles

Geometry

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Spring 2005

Objectives/Assignment

- Solve a right triangle.
- Use right triangles to solve real-life problems, such as finding the glide angle and altitude of a space shuttle.
- To solve problems like determining the correct dimensions of a wheel-chair ramp.
- Assignment: pp. 570-571 #4-38
- Due today 9.5 and Quiz at the end of class.

Solving a right triangle

- Every right triangle has one right angle, two acute angles, one hypotenuse and two legs. To solve a right triangle, means to determine the measures of all six (6) parts. You can solve a right triangle if the following one of the two situations exist:
  - Two side lengths
  - One side length and one acute angle measure

Note:

- As you learned in Lesson 9.5, you can use the side lengths of a right triangle to find trigonometric ratios for the acute angles of the triangle. As you will see in this lesson, once you know the sine, cosine, or tangent of an acute angle, you can use a calculator to find the measure of the angle.

WRITE THIS DOWN!!!

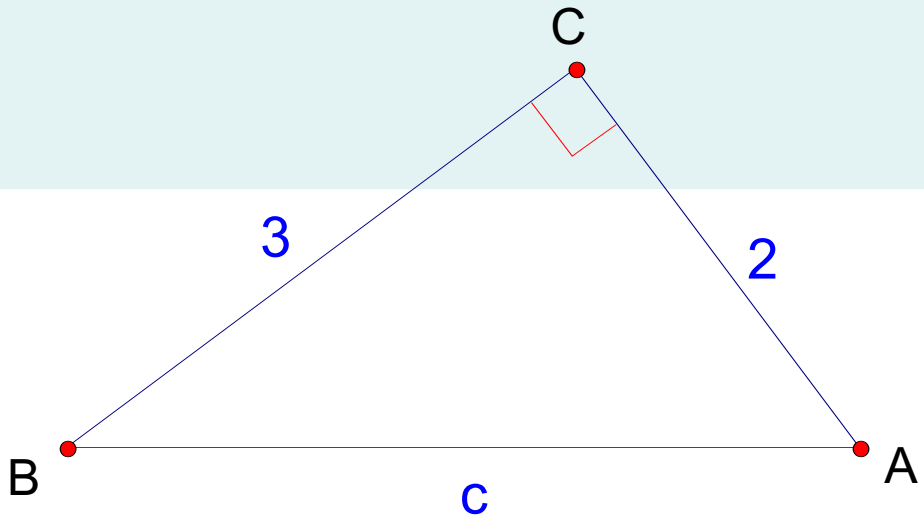
- In general, for an acute angle A:
  - If $\sin A = x$, then $\sin^{-1} x = m\angle A$
  - If $\cos A = y$, then $\cos^{-1} y = m\angle A$
  - If $\tan A = z$, then $\tan^{-1} z = m\angle A$

The expression $\sin^{-1} x$ is read as "the inverse sine of x."

On your calculator, this means you will be punching the 2^{nd} function button usually in yellow prior to doing the calculation. This is to find the degree of the angle.

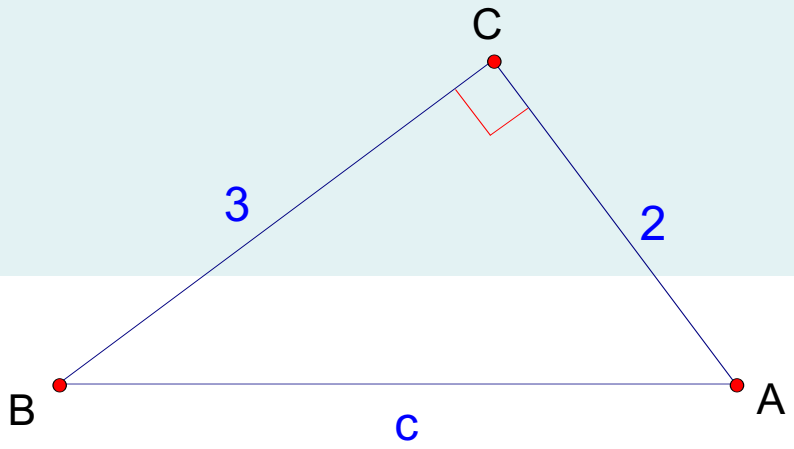
Example 1:

- Solve the right triangle. Round the decimals to the nearest tenth.



HINT: Start by using the Pythagorean Theorem. You have side a and side b. You don't have the hypotenuse which is side c—directly across from the right angle.

Example 1:



$(\text{hypotenuse})^2 = (\text{leg})^2 + (\text{leg})^2$ Pythagorean Theorem

$c^2 = 3^2 + 2^2$ Substitute values

$c^2 = 9 + 4$ Simplify

$c^2 = 13$ Simplify

$c = \sqrt{13}$ Find the positive square root

$c \approx 3.6$ Use a calculator to approximate

Example 1 continued

- Then use a calculator to find the measure of $\angle B$:

2^{nd} function

Tangent button

2

Divided by symbol

3≈ 33.7°

Finally

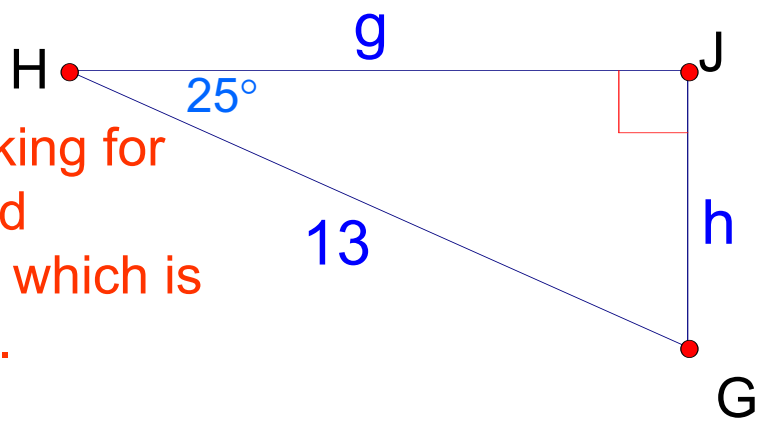
- Because $\angle A$ and $\angle B$ are complements, you can write

$m\angle A = 90° - m\angle B \approx 90° - 33.7° = 56.3°$

The side lengths of the triangle are 2, 3 and $\sqrt{13}$, or about 3.6. The triangle has one right angle and two acute angles whose measure are about 33.7° and 56.3°.

Ex. 2: Solving a Right Triangle (h)

- Solve the right triangle. Round decimals to the nearest tenth.



You are looking for opposite and hypotenuse which is the sin ratio.

$$\sin H = \frac{\text{opp.}}{\text{hyp.}}$$

Set up the correct ratio

$$13 \sin 25° = \frac{h}{13}$$

Substitute values/multiply by reciprocal

$$13(0.4226) \approx h$$

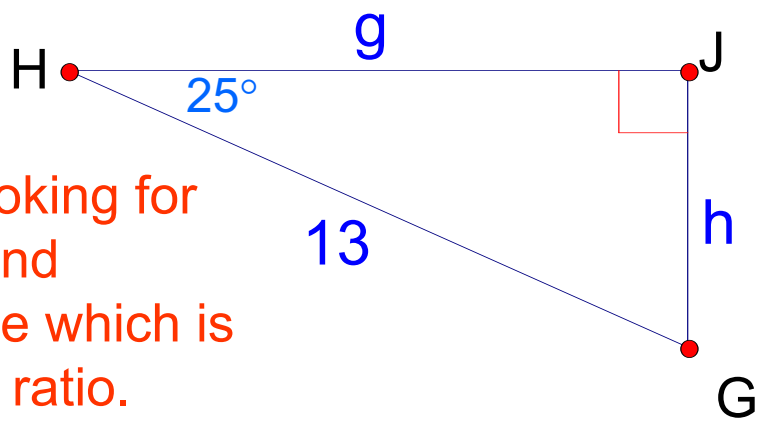
Substitute value from table or calculator

$$5.5 \approx h$$

Use your calculator to approximate.

Ex. 2: Solving a Right Triangle (g)

- Solve the right triangle. Round decimals to the nearest tenth.



You are looking for adjacent and hypotenuse which is the cosine ratio.

$\cos G = \frac{\text{adj.}}{\text{hyp.}}$ Set up the correct ratio

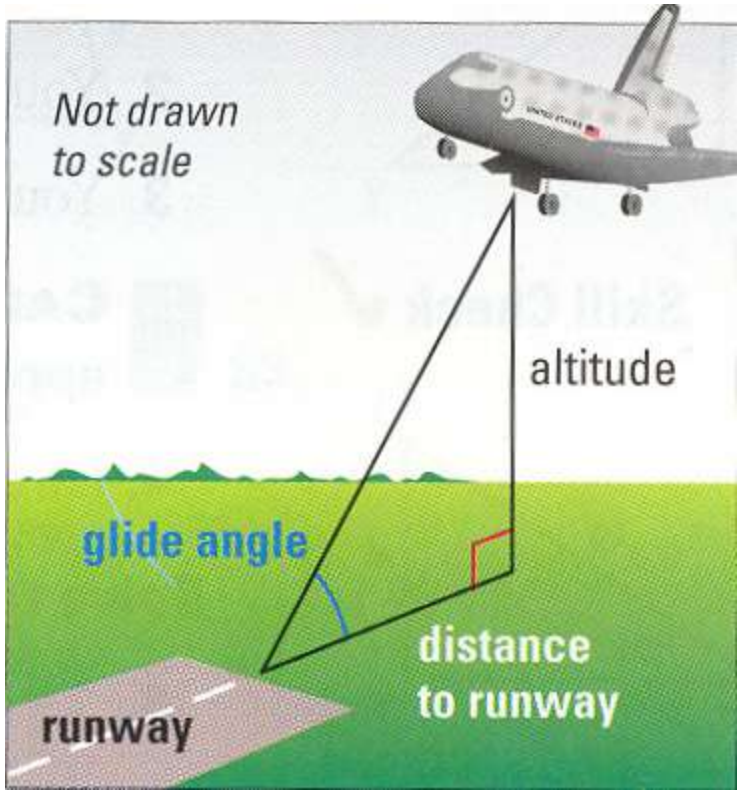
$13 \cos 25° = \frac{g}{13}$ Substitute values/multiply by reciprocal

$13(0.9063) \approx g$ Substitute value from table or calculator

$11.8 \approx h$ Use your calculator to approximate.

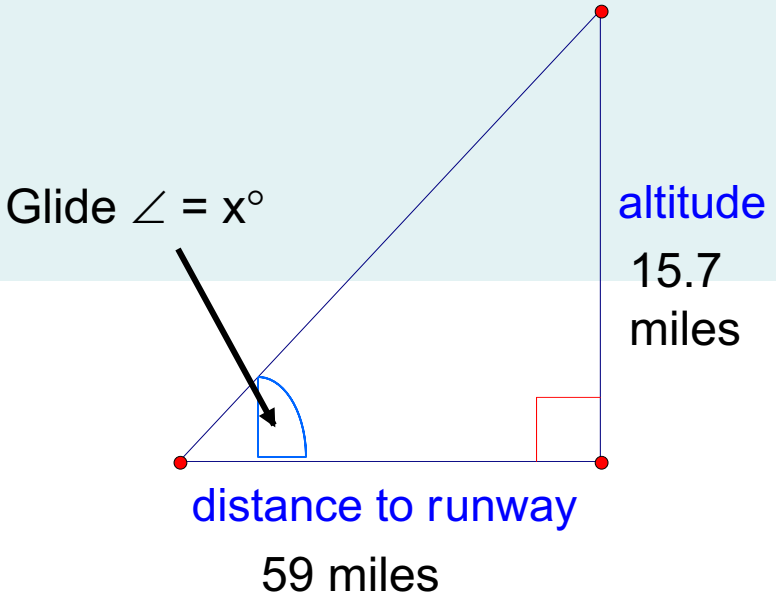
Using Right Triangles in Real Life

- Space Shuttle: During its approach to Earth, the space shuttle's glide angle changes.
- A. When the shuttle's altitude is about 15.7 miles, its horizontal distance to the runway is about 59 miles. What is its glide angle? Round your answer to the nearest tenth.



Solution:

- You know opposite and adjacent sides. If you take the opposite and divide it by the adjacent sides, then take the inverse tangent of the ratio, this will yield you the slide angle.



$$\tan x^\circ = \frac{\text{opp.}}{\text{adj.}}$$ Use correct ratio

$$\tan x^\circ = \frac{15.7}{59}$$ Substitute values

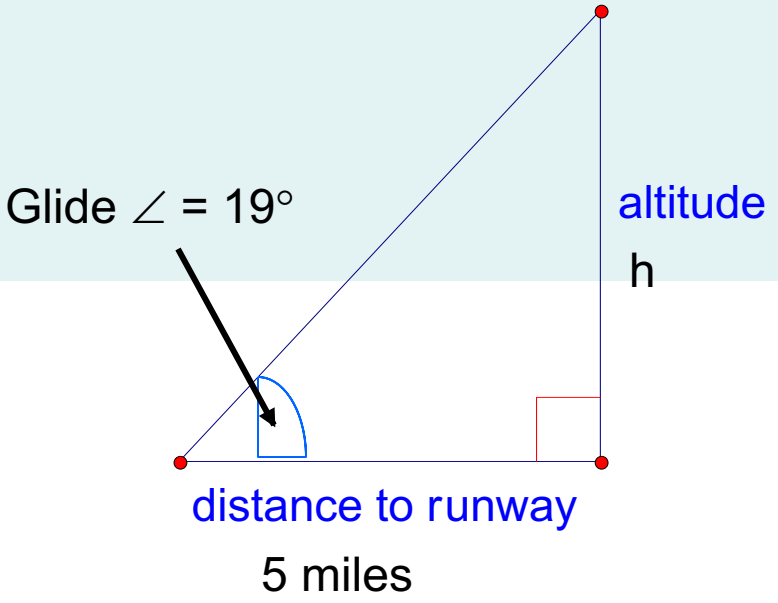
Key in calculator 2nd function,

$\tan 15.7/59 \approx 14.9$

When the space shuttle's altitude is about 15.7 miles, the glide angle is about 14.9°.

B. Solution

- When the space shuttle is 5 miles from the runway, its glide angle is about 19°. Find the shuttle's altitude at this point in its descent. Round your answer to the nearest tenth.



$\tan 19° = \frac{\text{opp.}}{\text{adj.}}$ Use correct ratio

$\tan 19° = \frac{h}{5}$ Substitute values

$5 \tan 19° = \frac{h}{5} \cdot 5$ Isolate h by multiplying by 5.

$1.7 \approx h$ Approximate using calculator

The shuttle's altitude is about 1.7 miles.

Next week: 2nd, 4th and 6th Period

- 9.7: Vectors – Wednesday
- Ch. 9 Review – Friday
- Ch. 9 Test/Binder Check – Monday before you go on Spring Break – Make sure you take this if you are not planning at being in school before this date.
- Chapter 10 Post/Thms. And Ch. 10 Definitions – Due Wednesday
- 10.1 Friday before you leave.

Next week: 5th period only

- 9.7: Vectors -- Friday
- HW: Chapter 9 Review – Bring to class completed on Monday.
- Ch. 9 Test/Binder Check – Monday before you go on Spring Break – Make sure you take this if you are not planning at being in school before this date.
- Baskin & Robbins -- Wednesday