Section 13.1 – Right Triangles

Objectives:
1. To find values of trigonometric functions for acute angles.
2. To solve triangles involving right angles

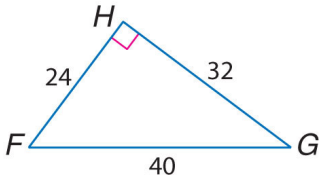
I. Right Triangle Trigonometry

A. Review – _____-_____-_____

1. SOH – sin = ——— Reciprocal – csc = ———
2. CAH – cos = ——— Reciprocal – sec = ———
3. TOA – tan = ——— Reciprocal – cot = ———

B. Examples

1. Find the values of the six trigonometric functions for angle G.



2. Find csc A if $\tan A = \frac{5}{3}$

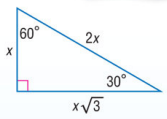
C. Special Right Triangles

Key Concept — **Trigonometric Values for Special Angles** — For Your FOLDABLE

30°-60°-90°

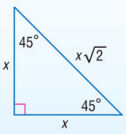
$\sin 30° = \frac{1}{2}$ $\cos 30° = \frac{\sqrt{3}}{2}$ $\tan 30° = \frac{\sqrt{3}}{3}$

$\sin 60° = \frac{\sqrt{3}}{2}$ $\cos 60° = \frac{1}{2}$ $\tan 60° = \sqrt{3}$



45°-45°-90°

$\sin 45° = \frac{\sqrt{2}}{2}$ $\cos 45° = \frac{\sqrt{2}}{2}$ $\tan 45° = 1$



Ratios

30-60-90 Triangles

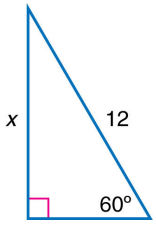
_____:_____:_____

45-45-90 Triangles

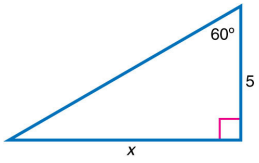
_____:_____:_____

Examples

1. Use you trigonometric values for special angles to find the value of x.

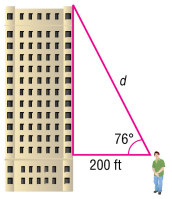


2. Write an equation involving sin, cos, or tan that can be used to find the value of x. Then solve the equation.



D. Using your Calculator

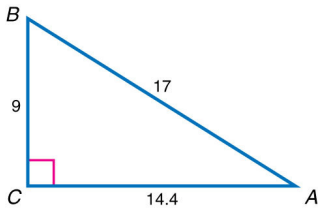
1. To calculate the height of a building, Joel walked 200 feet from the base of the building and used an inclinometer to measure the angle from his eye to the top of the building. If Joel's eye level is at 6 feet, what is the distance from the top of the building to Joel's eye?



2. To calculate the height of a tree in his front yard, Aaron walked 50 feet from the base of the tree and used an inclinometer to measure the angle from his eye to the top of the tree, which was 62°. If Aaron's eye level is at 6 feet, about how tall is the tree?

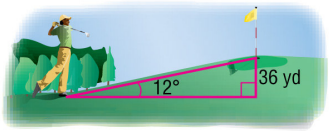
E. Inverse Trig Functions

1. To find the angle given the ratio
2. Symbolism:
   a) $\sin^{-1} r = \theta$ b) $\cos^{-1} r = \theta$ c) $\tan^{-1} r = \theta$
3. Examples:
   a) Find the measure of $\angle A$.

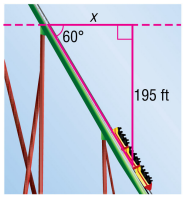


   b) Find the measure of $\angle B$.

   c) A golfer is standing at the tee, looking up to the green on a hill. The tee is 36 yards lower than the green and the angle of elevation from the tee to the hole is 12°. From a camera in a blimp, the apparent distance between the golfer and the hole is the horizontal distance. Find the horizontal distance.



   d) The hill of the roller coaster has an angle of descent, or an angle of depression, of 60°. Its vertical drop is 195 feet. From a blimp, the apparent distance traveled by the roller coaster is the horizontal distance from the top of the hill to the bottom. Find the horizontal distance.



Homework: p.813 – 1-12 all, 21, 23, 27, 46-48, 51

Section 13.2 --Angles and Angle Measure

Work Together

- Draw three different sized circles (see next page).
- Draw a diameter through the middle of the circle and find its length.
- Find the length of the radius.
- Find the circumference of the circle. Leave answers in terms of π.
- Measure the distance around the circle in terms of the radius. Leave answers in terms of π.
  - How many radii were there on the first circle? _____
  - How many radii were there on the second circle? _____
  - How many radii were there on the third circle? _____
  - How many radii would go around a circle with a diameter of 1500 feet? _____

- Wrap Up
  - If you measured the distance around a circle in terms of its radius, what units of measure would you give it?

  - In relationship to a circle, if I go half way around the edge of a circle how many of your units of measure is it?

  - With what you just learned, how many degrees of rotation are there for $\frac{3\pi}{4}$ of your units of measure?

  - How many of your units of measure are there for a degree of rotation of 150º?

- Other Items
  - Standard Position (Initial Sides, Terminal Side and Vertex)

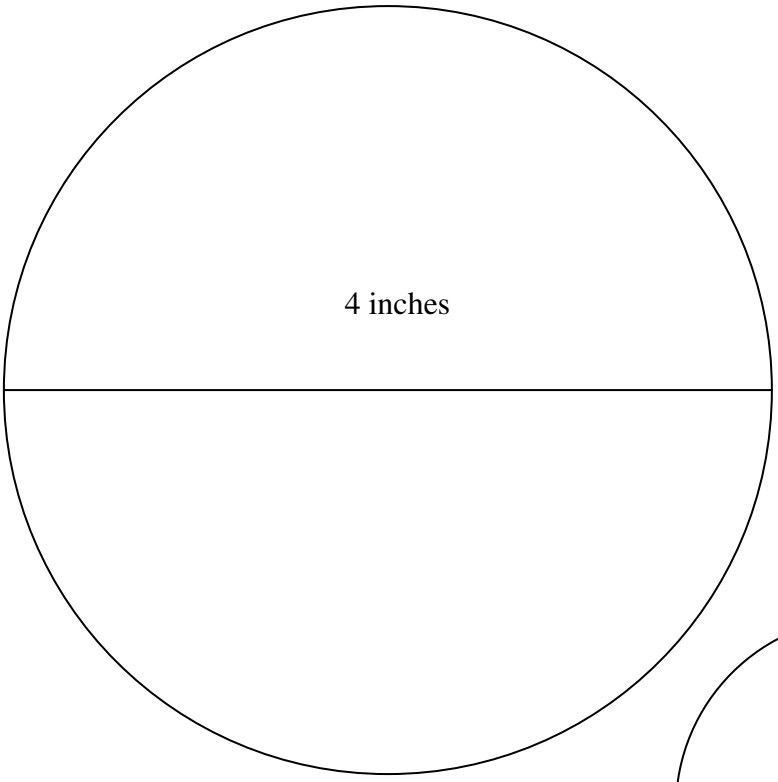
  - Angle rotation

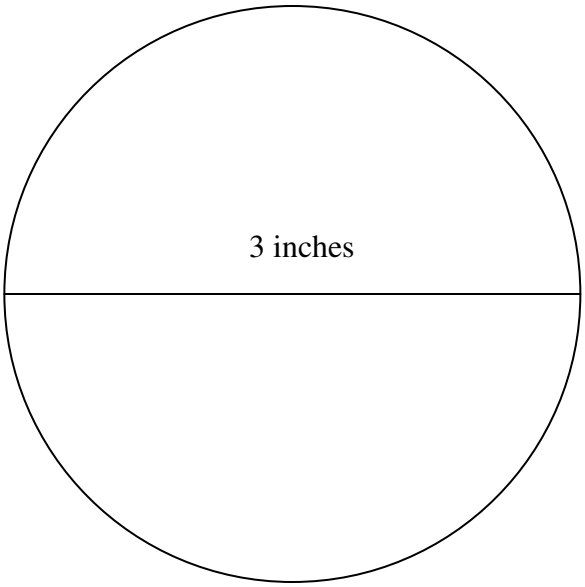
  - Coterminal Angles
    Find one angle with positive measure and one angle with negative measure coterminal with each angle
    1. 210º
    2. $\frac{7\pi}{3}$
  - Reference Angles
    1. Find the reference angles for:
    2. 312°
    3. –195°

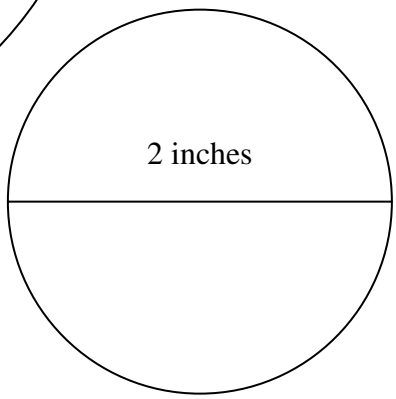
  - Arc length
    1. The steering wheel on a monster truck has a radius of 11 inches. How far does a point on the steering wheel travel if the wheel makes four fifths of a rotation?

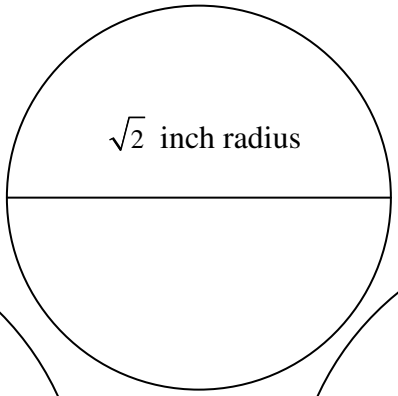
    2. The steering wheel on a yacht has a radius of 16 inches. How far does a point on the steering wheel travel if the wheel makes a 70 degree rotation?

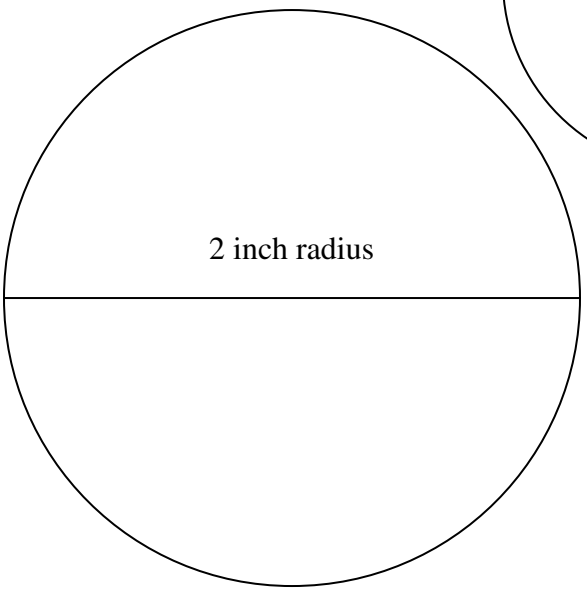
Homework – p. 820 – 1-10 all, 11-29 odds, 32-34, 60

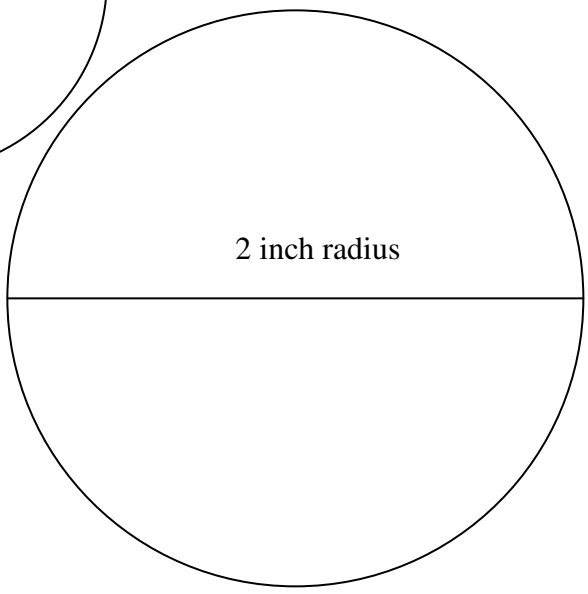

4 inches


3 inches


2 inches


$\sqrt{2}$ inch radius


2 inch radius


2 inch radius

Work Together

- Use a protractor. Draw an angle of 30° in the 2 inch radius circle. Place the angle in standard position. Label the point where the terminal ray intersects the circle P(x ,y).
  - Find the values of x and y. Use your special right triangles for assistance.
    What is sin 30°, cos 30°, and tan 30°?

  - Repeat the steps above using an angle of 45° and radius of $\sqrt{2}$ inches. What are the coordinates of the new point P?
    What is sin 45°, cos 45°, and tan 45°?

  - Repeat the steps above using an angle of 210° and a radius of 2 inches. What are the coordinates of the new point P? What is sin 210°, cos 210°, and tan 210°? Can you find the exact values?

    Hint: Think reference triangle!

- Wrap Up
  - How can you write sin θ , cos θ, and tan θ using x, y, and r (radius)

Sin θ =
Cos θ =
Tan θ =

  - Update the following chart with exact values for the reference angles using information we discussed today and yesterday.

Radian	Degree	Sin	Cos	Tan
0	0°			
π/6	30°			
π/4	45°			
π/3	60°			
π/2	90°			

  - Fill in the following chart to indicate the sign of trig functions in each quadrant.

	I	II	III	IV
sin & csc				
cos & sec				
tan & cot				

S	A
T	C

Think and Discuss

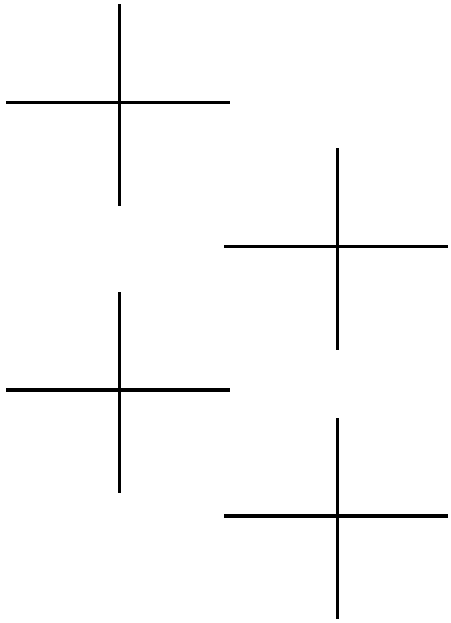
- Draw the angle in standard position, draw the reference angle, and find the exact value of the trig function.

$\sin\frac{7\pi}{4}$

$\tan 240°$

$\sec\frac{-13\pi}{6}$

$\csc 270°$



- Find the values of the sine and cosine functions of an angle in standard position with measure θ if the point with coordinates (3,4) lies on its terminal side.

- Find $\sin\theta$ when $\cos\theta = \frac{5}{13}$ and the terminal side of θ is in the first quadrant.

- If $\sec\theta = 2$ and θ lies in quadrant IV, find $\tan\theta$.

HW – p. 829 – 1-11 all, 13-23 odds, 24-32 all, 37-46 all

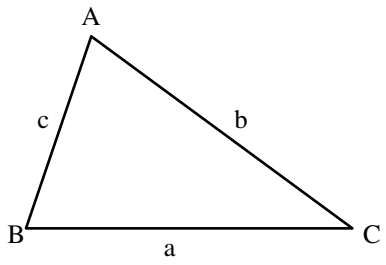
Note: when asking for <u>exact values</u> this means <u>do not</u> use your calculator.

Section 13.4 – Law of Sine

Objectives:
1. To solve non right Δ's (ASA, AAS) using the Law of Sines
2. To solve the ambiguous non right Δ (SSA) using Law of Sines

I. Area of a Triangle

A. Formula

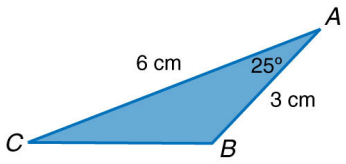


1.

2.

3.

B. Example Find the area of the given triangle.

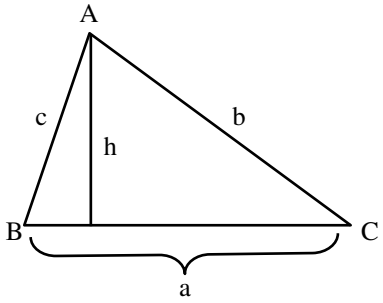


II. Law of Sines

A.

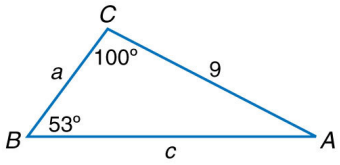
B.

Proof:

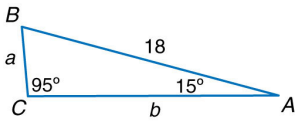


C. Examples

1. Solve: ΔABC



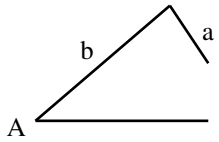
2. Solve: ΔABC



III. The Ambiguous Triangle (SSA)

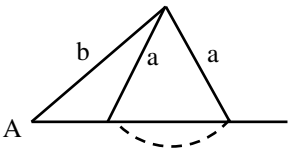
A. Case 1: $m\angle A < 90°$

1. Situation a: If $a = b\sin A$, then
2. Situation b: If $a < b\sin A$, then
3. Situation c: If $a > b\sin A$, and $a \geq b$, then
4. Situation d: If $a > b\sin A$, and $a < b$ then



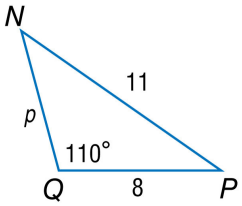
B. Case 2: $m\angle A \geq 90°$

1. Situation a: If $a \leq b$, then
2. Situation b: If $a > b$, then



C. Examples:

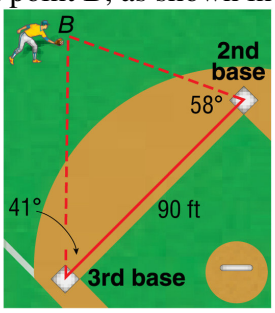
1. Determine whether ΔNPQ has no solution, one solution, or two solutions. Then solve the triangle. Round side lengths to the nearest tenth and angle measures to the nearest degree



2. Determine whether ΔDEF has no solution, one solution, or two solutions. Then solve the triangle. Round side lengths to the nearest tenth and angle measures to the nearest degree. In ΔDEF, $E = 52°$, $e = 5$, and $f = 9$.

3. Determine whether ΔXYZ has no solution, one solution, or two solutions. Then solve the triangle. Round side lengths to the nearest tenth and angle measures to the nearest degree. In ΔXYZ, $X = 28°$, $z = 15$, and $x = 9$.

4. A baseball is hit between second and third bases and is caught at point B, as shown in the figure. How far away from second base was the ball caught?



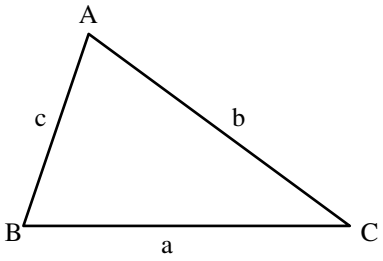
Homework: p.836 – Day 1: 1-7 all, 19, 20, 27, 28. 39, 42, 49-52 all
Day 2: 8-12 all, 29-36 all (just tell me number of solutions), 53-58 all

Section 13.5 – Law of Cosines

Objectives:

1. To solve nonright Δ's (SAS and SSS) using the Law of Cosines

A. Review – Law of Cosines

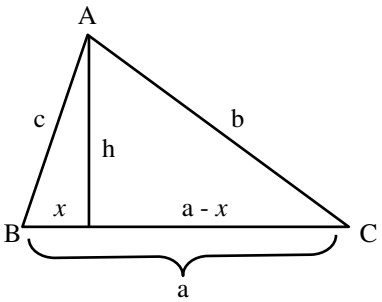


1.

2.

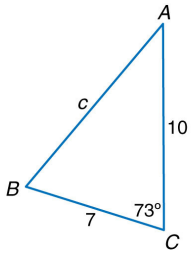
3.

Proof:

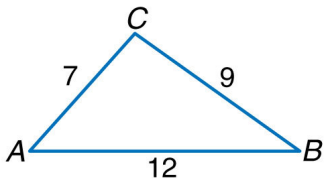


B. Examples

1. Solve ΔABC:



2. Solve ΔABC:



3. Two pilots in a stationary airplane look 38° to the left of their runway and see a bus 75 feet away. They look 28° to the right of their runway and see a truck 110 feet away. How far apart are the bus and the truck?

Concept Summary — **Solving Oblique Triangles** — For Your FOLDABLE

Given	Begin by Using
two angles and any sides	Law of Sines
two sides and an angle opposite one of them	Law of Sines
two sides and their included angle	Law of Cosines
three sides	Law of Cosines

Homework: p.843 – 1-8 all, 21-23 all, 38-41 all, 44-47 all, 50-52 all