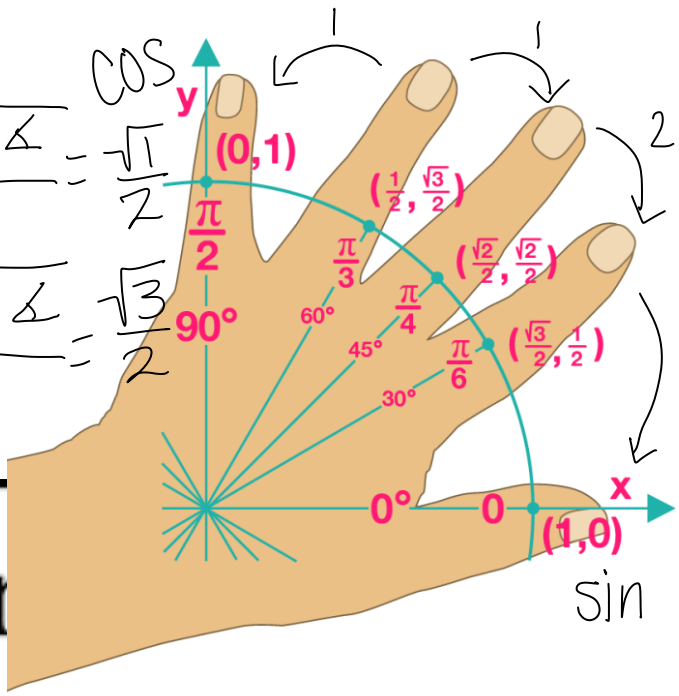
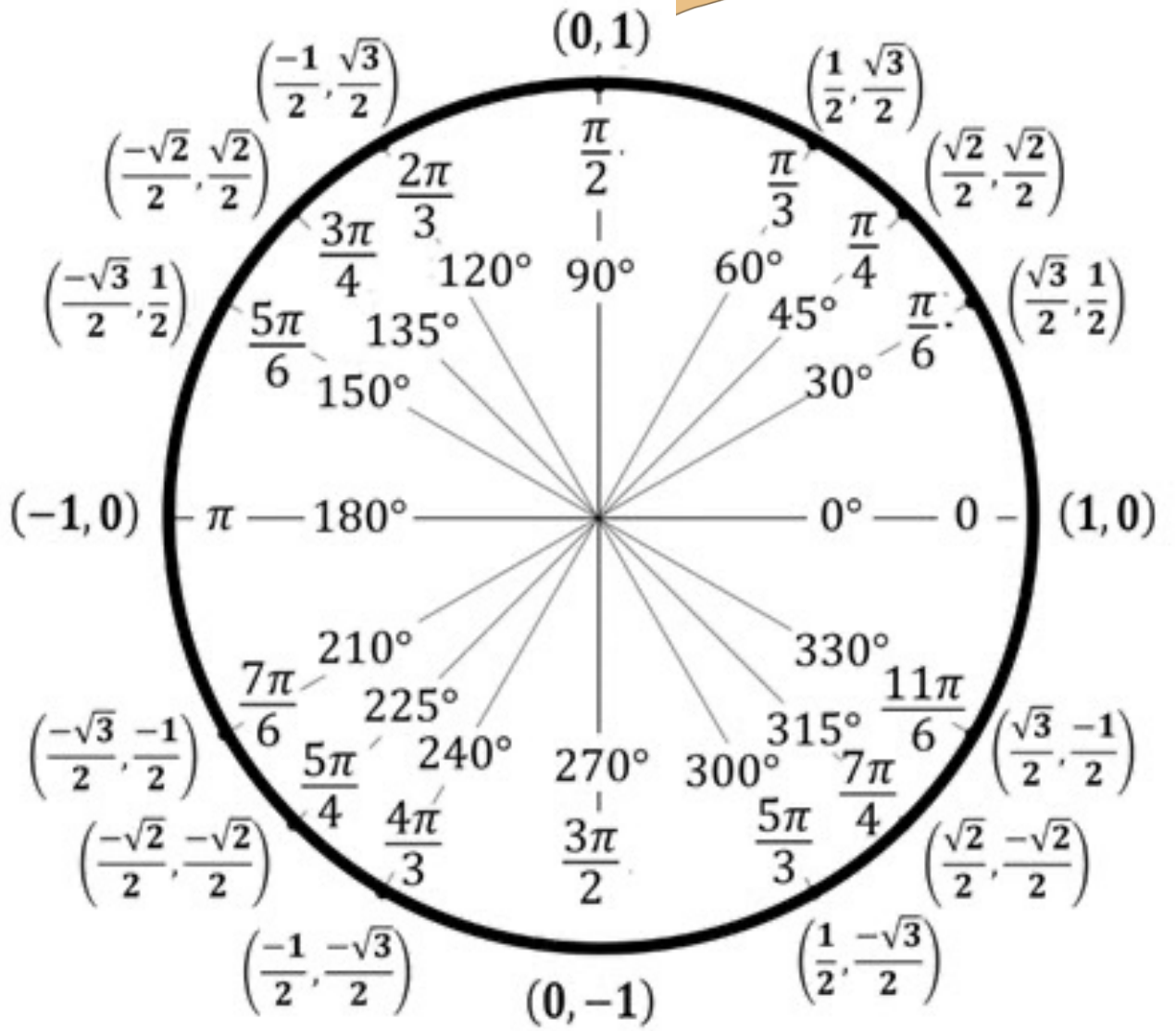
Left hand trick –

x value = $\frac{\sqrt{\#\text{ of fingers above } \angle}}{2}$ = $\frac{\sqrt{1}}{2}$ = cos

y value = $\frac{\sqrt{\#\text{ of fingers below } \angle}}{2}$ = $\frac{\sqrt{3}}{2}$ = sin



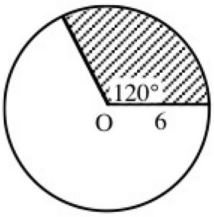
Unit Circle



1. What is the formula for arc length? $S = r\theta$

2. What is the formula for sector area? $A = \frac{1}{2} r^2 \theta$

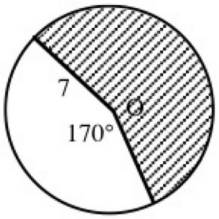
3.



$S = 6 \cdot \frac{120\pi}{180} = 12.6$

$A = \frac{6^2}{2} \cdot \frac{120\pi}{180} = 37.7$

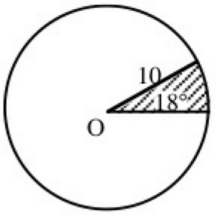
4.



$S = 7 \cdot \frac{(360-170)\pi}{180} = 23.2$

$A = \frac{7^2}{2} \cdot \frac{190\pi}{180} = 81.2$

5.



$S = 10 \cdot \frac{18\pi}{180} = 3.1$

$A = \frac{10^2}{2} \cdot \frac{18\pi}{180} = 15.7$

6. What is the formula for linear speed? $V = \frac{r\theta}{t}$

7. What is the formula for angular speed? $V = \frac{\theta}{t}$

Linear Speed

8. An earth satellite travels in a circular orbit at 20,000 mph. If the radius of the orbit is 4,300 mi, what angular velocity (in radians per hour, to one decimal place) is generated?

$\frac{r\theta}{t} = \frac{20000\ m}{1\ hr}$ $\quad 4300\theta = 20000\ miles/hr$

$\theta = 4.7$ radians/hr

9. The earth revolves about the sun in an orbit that is approximately circular with a radius of 9.3×10^7 mi. The radius of orbit sweeps out an angle with what exact angular velocity (in radians per hour)? How fast (to the nearest hundred miles per hour) is the earth traveling around its orbit. Hint: it takes the earth 365 days to complete its orbit.

Angular $= \frac{\theta}{t} = \frac{2\pi}{365 days} \cdot \frac{1 day}{24 hrs} = \frac{2\pi}{8760} = \boxed{\frac{\pi}{4380}\ radians/hr}$

Linear $= \frac{9.3 \times 10^7 \pi\ miles}{4380\ hour} = \boxed{66705.05\ mph}$

10. The second hand on Mr. Incredible's watch is .25 inches long. How fast is the tip of the second hand moving? Give your answer in inches per second.

Linear speed $\frac{r\theta}{t} = \frac{.25(1)2\pi}{60 sec} = \boxed{.026\ in/sec}$

Draw an angle with the given measure in standard position.

11. 75°

12. 160°

13. −90°

14. −120°

15. 295°

16. 510°

17. **GYMNASTICS** A gymnast on the uneven bars swings to make a 240° angle of rotation.

18. **FOOD** The lid on a jar of pasta sauce is turned 420° before it comes off.

Find an angle with a positive measure and an angle with a negative measure that are coterminal with each angle.

19. 50° 410°; −310°

20. 95° 455°; −265°

21. 205° 565°; −155°

22. 350° 710°; −10°

23. −80° 280°; −440°

24. −195° 165°, −555°

Rewrite each degree measure in radians and each radian measure in degrees.

25. 330° $\frac{11\pi}{6}$

26. $\frac{5\pi}{6}$ 150°

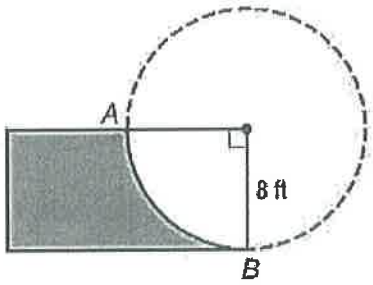
27. $-\frac{\pi}{3}$ −60°

28. −50° $-\frac{5\pi}{18}$

29. 190° $\frac{19\pi}{18}$

30. $-\frac{7\pi}{3}$ −420°

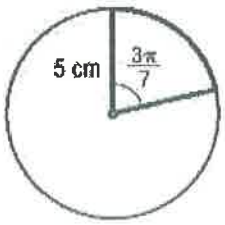
31. **SKATEBOARDING** The skateboard ramp at the right is called a *quarter pipe*. The curved surface is determined by the radius of a circle. Find the length of the curved part of the ramp. 12.6 ft



32. **RIVERBOATS** The paddlewheel of a riverboat has a diameter of 24 feet. Find the arc length of the circle made when the paddlewheel rotates 300°. 62.8 ft

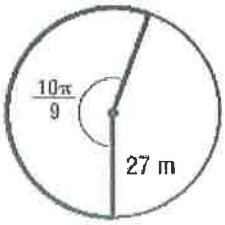
Find the length of each arc. Round to the nearest tenth.

33.



6.7 cm

34.



94.2m

35. **CLOCKS** How long does it take for the minute hand on a clock to pass through 2.5π radians? 1hr 15min

Law of Sines
Law of Cosines

Round angles to the nearest tenth and round sides to the nearest hundredth

1. Use the Law of Sines to solve the triangle.

$C = 20°$
$B = 10°$
$c = 33$

SAA $180° - 20° - 10° = 150° = A$

$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

$a = 48.24$ $b = 16.76$ $\frac{\sin(150)}{a} = \frac{\sin(10)}{b} = \frac{\sin(20)}{33}$

2. Use the Law of Sines to solve the triangle.

$B = 150°$
$a = 10$
$b = 3$

SSA $A + C = 30°$

$\frac{\sin(150)}{3} = \frac{\sin(<30°)}{10}$ Triangle DNE

3. Use the Law of Cosines to solve the triangle.

$B = 110°$
$a = 4$
$c = 4$

SSA $b^2 = a^2 + c^2 - 2ac\cos(B)$

$b^2 = 16 + 16 - 2 \cdot 16 \cdot \cos(110)$

$b = 6.55$

$A = C$ $180 - 110 = 70$

$\frac{70}{2} = 35° = A = C$

4. Use the Law of Cosines to solve the triangle.

$a = 2.5$
$b = 5.0$
$c = 4.5$

SSS $2.5^2 = (5)^2 + (4.5)^2 - 2(5)(4.5)\cos A$

$5^2 = (2.5)^2 + (4.5)^2 - 2(2.5)(4.5)\cos B$

$4.5^2 = (2.5)^2 + (5)^2 - 2(2.5)(5)\cos C$

$A = 29.9°$
$B = 86.2°$
$C = 63.9°$

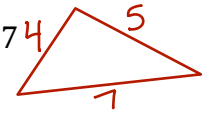
For questions 5 – 8, find the area of the triangle. $A = \frac{s_1 s_2 \sin(A_3)}{2}$

5. $B = 80°, a = 4, c = 8$

$A = \frac{a \cdot c \cos(B)}{2}$

$A = \frac{4 \cdot 8 \cdot \cos(80)}{2} = 15.8$

6. $a = 4, b = 5, c = 7$



$A = \frac{a \cdot b \sin(C)}{2}$

$7^2 = 4^2 + 5^2 - 2 \cdot 4 \cdot 5 \cdot \cos(C)$

$-0.2 = \cos(C)$

$C = 101.5°$

$A = \frac{4 \cdot 5 \sin(101.5)}{2}$

$A = 9.8$

7. $A = 110°, b = 22, c = 21$

$A = \frac{22 \cdot 21 \cdot \sin(110°)}{2}$

$A = 217.1$

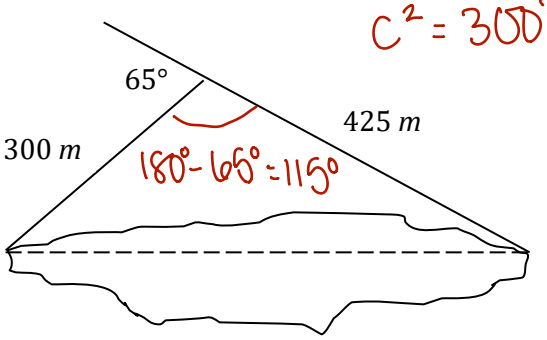
8. $a = 12.3, b = 15.8, c = 3.7$

$3.7^2 = 12.3^2 + 15.8^2 - 2(12.3)(15.8)\cos(C)$

$0.99 = \cos C$ $4.9 = C$

$A = \frac{12.3 \cdot 15.8 \cdot \sin(4.9)}{2} = 8.3$

9. To approximate the length of a marsh, a surveyor walks 425 meters from point A to point B. Then the surveyor turns 65° and walks 300 meters to point C. Approximate the length AC of the marsh.



$c^2 = 300^2 + 425^2 - 2 \cdot 300 \cdot 425 \cdot \cos(115°)$

$C = 615\ m$

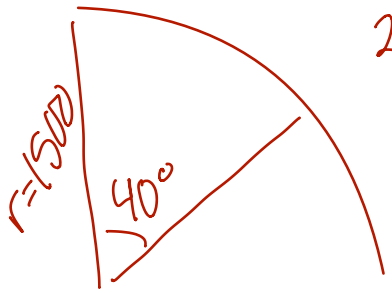
10. The circular arc of a railroad curve has a diameter of length 3000 feet and a central angle of 40°. Draw a picture. Find the length of the circular arc. $s = r\theta$

$S = r\theta$ $\quad \theta = 40° \times \frac{\pi}{180°} = \frac{2\pi}{9}$ $\quad S = 1500 \cdot \frac{2\pi}{9}$

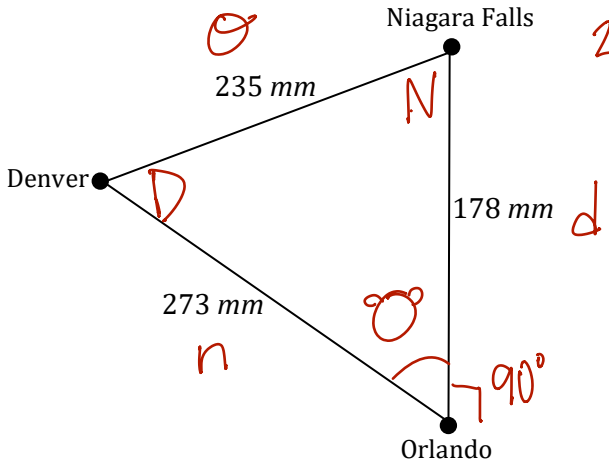
$2r = d$

$r = 1500$

$S = 1047\ ft$



11. On a map, Orlando is 178 millimeters due south of Niagara Falls, Denver is 273 millimeters from Orlando and 235 millimeters from Niagara Falls. Find the bearing of Denver from Orlando.



$235^2 = 273^2 + 178^2 - 2(273)(178)\cos(\theta)$

$.52 = \cos(\theta)$ $\quad \theta = 58.4$

$58.4°$ NW

W ← ↑ N

