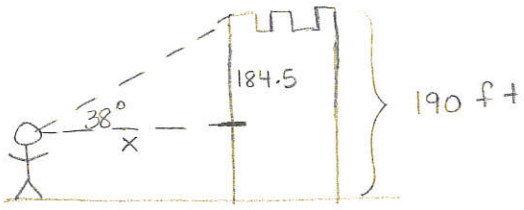
Honors Math II
Unit 9 day 4

Name Key
Period _____ Date _____

1. Leah wants to see a castle in an amusement park. She sights the top of the castle at an angle of elevation of 38°. She knows that the castle is 190 feet tall. If Leah is 5.5 feet tall, how far is she from the castle to the nearest foot?

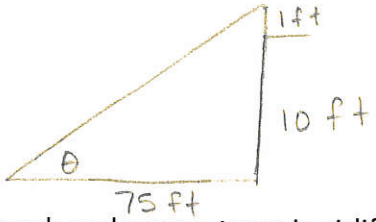


$\tan 38° = \frac{184.5}{x}$

$x = \frac{184.5}{\tan 38°} = 236.1 \text{ ft}$

2. The cross bar of a goalpost is 10 feet high. If a field goal attempt is made 25 yards from the base of the goalpost that clears the goal by 1 foot, what is the smallest angle of elevation at which the ball could have been kicked to the nearest degree?

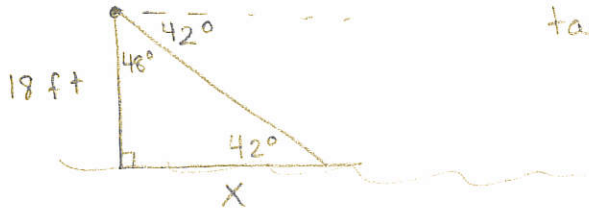
25 yards = 75 ft



$\tan\theta = \frac{11}{75}$

$\tan^{-1}\left(\frac{11}{75}\right) = \theta$ $\quad \theta = 8.3°$

3. A search and rescue team is airlifting people from the scene of a boating accident when they observe another person I need of help. If the angle of depression to this other person is 42° and the helicopter is 18 feet above the water, what is the horizontal distance from the rescuers to this person to the nearest foot?

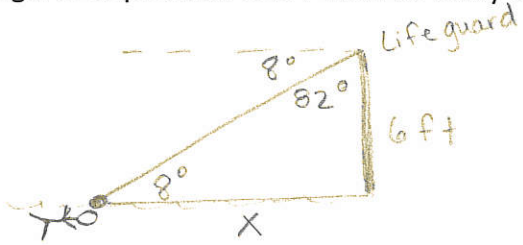


$\tan 48° = \frac{x}{18}$

$x = 18 \tan 48°$

$x = 19.99 \text{ ft}$

4. A lifeguard is watching a beach from a line of sight 6 feet above the ground. She sees a swimmer at an angle of depression of 8°. How far away from the tower is the swimmer?



$\tan 82° = \frac{x}{6}$

$6 \tan 82° = x$

$x = 42.7 \text{ ft}$

5. A hockey player takes a shot 20 feet away from a 5-foot goal. If the puck travels at a 15° angle of elevation toward the center of the goal, will the player score?

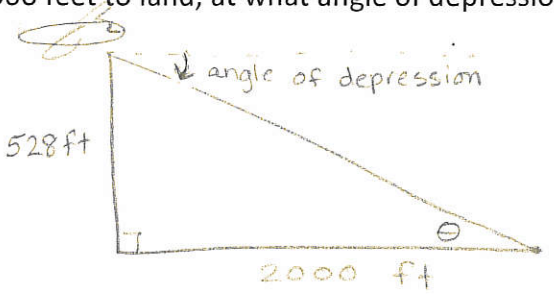
$\tan 15° = \frac{x}{20}$

$20 \tan 15° = x$

$5.36 = x$

No higher than 5 ft.

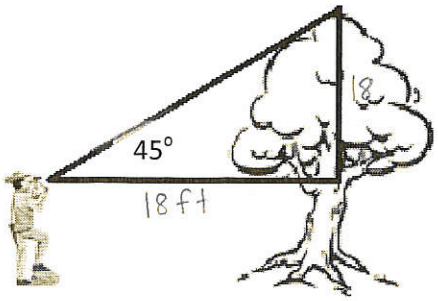
6. Due to a storm, a pilot flying at an altitude of 528 feet has to land. If he has a horizontal distance of 2000 feet to land, at what angle of depression should he land?



$\tan\theta = \frac{528}{2000}$ $\quad \theta = 14.8°$

$\tan^{-1}\left(\frac{528}{2000}\right) = \theta$

7. John needs to determine the height of a tree. Holding a drafter's 45° triangle so that one leg is horizontal, he sights the top of the tree along the hypotenuse, as shown at the right. If he is 6 yards from the tree and his eyes are 5 feet from the ground, find the height of the tree.



6 yds = 18 ft

45°-45°- special triangle

tree is 18 ft + 5 ft = 23 ft

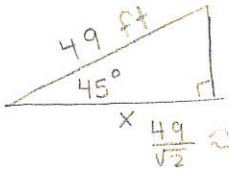
or

$\tan 45° = \frac{x}{18}$

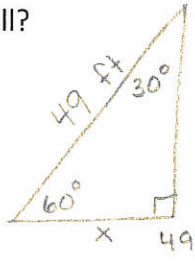
$18\tan 45° = x$

$x = 18$

8. You and a friend each kick a football with in initial speed of 49 feet per second. Your kick is projected at an angle of 45° and your friend's kick is projected at an angle of 60°. About how much farther will your football travel than your friend's football?



$\frac{49}{\sqrt{2}} \approx 34.6$ ft



$49/2 = 24.5$ ft

34.6 ft - 24.5 ft

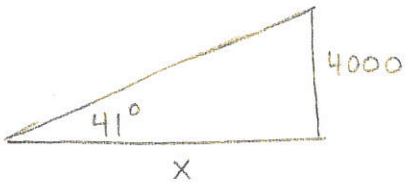
10.1 ft farther

9. A monster truck drives off a ramp in order to jump onto a row of cars. The ramp has a height of 8 feet and a horizontal length of 20 feet. What is the angle θ of the ramp?

$\tan\theta = \frac{8}{20}$ $\quad \theta = 21.8°$

$\tan^{-1}\left(\frac{8}{20}\right) = \theta$

10. An air traffic controller at an airport sights a plane at an angle of elevation of 41°. The pilot reports that the plane's altitude is 4000 feet. What is the horizontal distance between the plane and the airport?



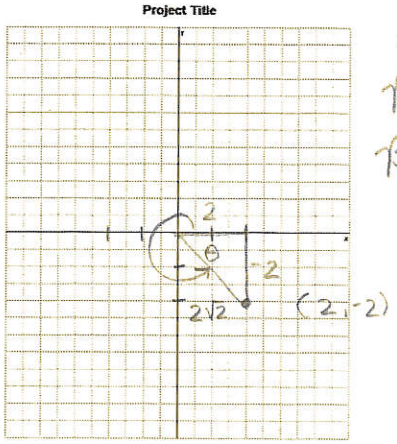
$\tan 41° = \frac{4000}{x}$

$x = \frac{4000}{\tan 41°}$ $\quad x = 4601.5$ ft

Use the given point on the terminal side of an angle β in standard position to evaluate the six trigonometric functions of θ. And then state the angle rotated β to reach the terminal side and the reference angle θ.

1. (2, -2)

Count by 2



$\theta = 45°$

$\beta = 360° - 45°$

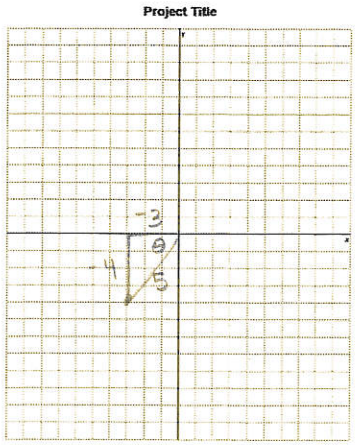
$\beta = 315°$

$\sin\theta = \frac{-2}{2\sqrt{2}} = \frac{-1}{\sqrt{2}} = \frac{-\sqrt{2}}{2}$ $\quad \csc\theta = -\sqrt{2}$

$\cos\theta = \frac{2}{2\sqrt{2}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$ $\quad \sec\theta = \sqrt{2}$

$\tan\theta = \frac{-2}{2} = -1$ $\quad \cot\theta = -1$

12. (-3, -4)



$\tan\theta = \frac{4}{3}$

$\tan^{-1}(\frac{4}{3}) = \theta$

$\theta = 53.1°$

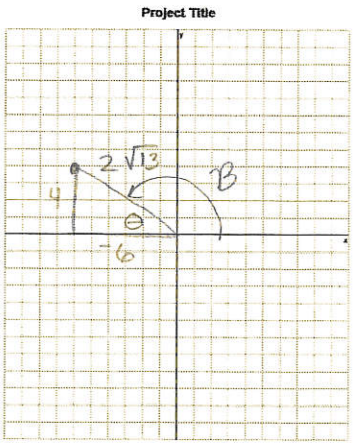
$\beta = 233.1°$

$\sin\theta = -\frac{4}{5}$ $\quad \csc\theta = -\frac{5}{4}$

$\cos\theta = -\frac{3}{5}$ $\quad \sec\theta = -\frac{5}{3}$

$\tan\theta = \frac{4}{3}$ $\quad \cot\theta = \frac{3}{4}$

13. (-6, 4)



$\tan\theta = \frac{4}{6}$

$\tan^{-1}(\frac{4}{6}) = \theta$

$\theta = 33.7°$

$\beta = 180° - 33.7°$

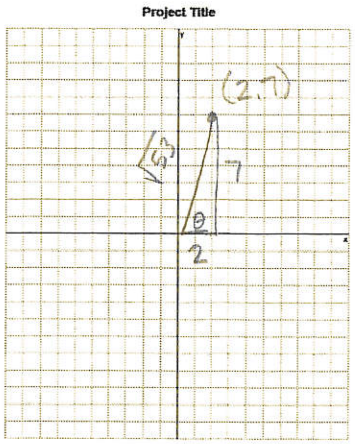
$\beta = 146.3°$

$\sin\theta = \frac{4}{2\sqrt{13}} = \frac{2}{\sqrt{13}} = \frac{2\sqrt{13}}{13}$ $\quad \csc\theta = \frac{\sqrt{13}}{2}$

$\cos\theta = \frac{-6}{2\sqrt{13}} = \frac{-3}{\sqrt{13}} = \frac{-3\sqrt{13}}{13}$ $\quad \sec\theta = -\frac{\sqrt{13}}{3}$

$\tan\theta = \frac{-4}{6} = -\frac{2}{3}$ $\quad \cot\theta = -\frac{3}{2}$

14. (2, 7)



$\tan\theta = \frac{7}{2}$

$\tan^{-1}(\frac{7}{2}) = \theta$

$\theta = 74.1°$

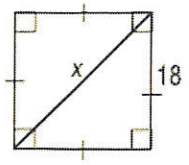
$\beta = 74.1°$

$\sin\theta = \frac{7}{\sqrt{53}} = \frac{7\sqrt{53}}{53}$ $\quad \csc\theta = \frac{\sqrt{53}}{7}$

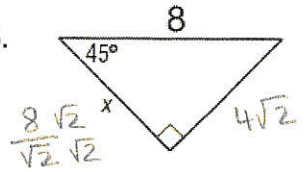
$\cos\theta = \frac{2}{\sqrt{53}} = \frac{2\sqrt{53}}{53}$ $\quad \sec\theta = \frac{\sqrt{53}}{2}$

$\tan\theta = \frac{7}{2}$ $\quad \cot\theta = \frac{2}{7}$

Find the value of x and y in each triangle.

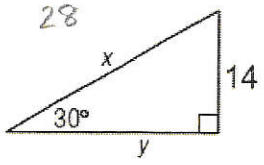
15. 

$X = 18\sqrt{2}$

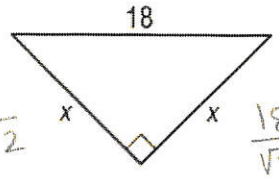
16. 

$\frac{8\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$4\sqrt{2}$

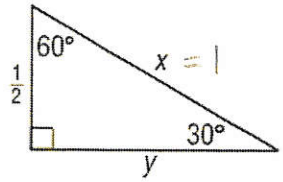
17. 

$14\sqrt{3}$

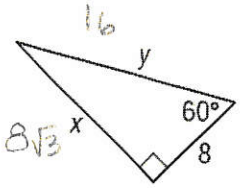
18. 

$9\sqrt{2}$

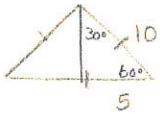
$\frac{18\sqrt{2}}{\sqrt{2}\sqrt{2}} = 9\sqrt{2}$

19. 

$\frac{\sqrt{3}}{2}$

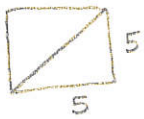
20. 

21. An equilateral triangle has a side length of 10 inches. Find the length of the triangles altitude.



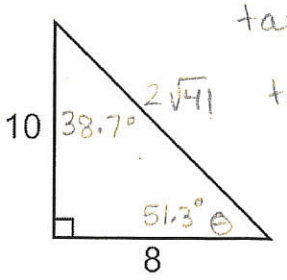
altitude $5\sqrt{3}$

22. The perimeter of a square is 20 cm. Find the length of a diagonal.



diagonal $5\sqrt{2}$

Solve the following triangles.

23. 

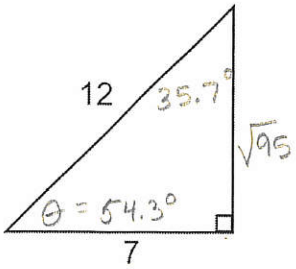
$\tan\theta = \frac{10}{8}$

$\tan^{-1}(10/8) = \theta$

$\theta = 51.3°$

$10^2 + 8^2 = h^2$

$h = \sqrt{164}$

24. 

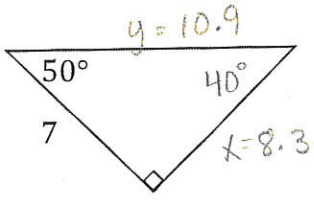
$\cos\theta = \frac{7}{12}$

$\cos^{-1}\left(\frac{7}{12}\right) = \theta$

$\theta = 54.3°$

$12^2 = 7^2 + x^2$

$X = \sqrt{95}$

25. 

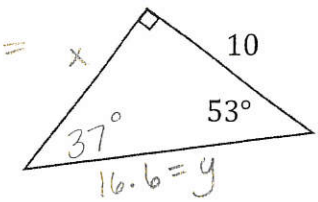
$\tan 50° = \frac{X}{7}$

$X = 8.3$

$\cos 50° = \frac{7}{y}$

$y = \frac{7}{\cos 50°}$

$y = 10.9$

26. 

$\cos 53° = \frac{10}{y}$

$y = \frac{10}{\cos 53°}$

$y = 16.6$

$\tan 53° = \frac{x}{10}$

$x = \tan 53°(10)$

Convert the following angles from degrees to radians or radians to degrees.

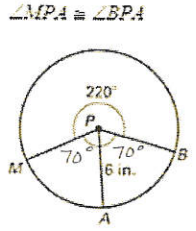
27. $140^\circ \left(\frac{\pi}{180^\circ}\right) = \frac{7\pi}{9}$

28. $4.65 \left(\frac{180^\circ}{\pi}\right) \approx 266.4^\circ$

29. $\frac{4\pi}{5} \left(\frac{180^\circ}{\pi}\right) = 144^\circ$

30. $-270^\circ \left(\frac{\pi}{180^\circ}\right) = -\frac{3\pi}{2}$

31. Find the length of $\overset{\frown}{AB}$

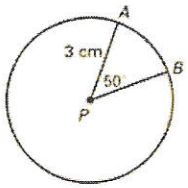


$70^\circ \left(\frac{\pi}{180^\circ}\right) = \frac{7\pi}{18}$

$S = 6\left(\frac{7\pi}{18}\right)$

$S = \frac{42\pi}{18} = \frac{7\pi}{3} \approx 7.33 \text{ in}$

32. Find the length of $\overset{\frown}{AB}$.

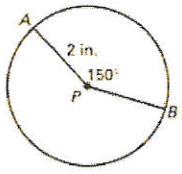


$50^\circ \left(\frac{\pi}{180^\circ}\right) = \frac{5\pi}{18}$

$S = 3\left(\frac{5\pi}{18}\right)$

$S = \frac{5\pi}{6} \approx 2.62 \text{ cm}$

33. Find the length of $\overset{\frown}{AB}$

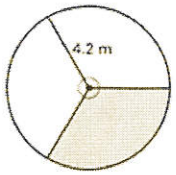


$150^\circ \left(\frac{\pi}{180^\circ}\right) = \frac{5\pi}{6}$

$S = 2\left(\frac{5\pi}{6}\right)$

$S = \frac{5\pi}{3} \approx 5.24 \text{ in.}$

34. Find the area of the shaded region.

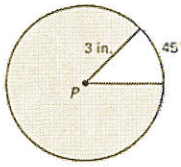


$120^\circ \left(\frac{\pi}{180^\circ}\right)$

$A = \frac{1}{2}(4.2)^2\left(\frac{2\pi}{3}\right)$

$A = 18.47 \text{m}^2$

35. Find the area of the shaded region.



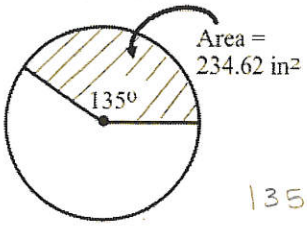
$315^\circ \left(\frac{\pi}{180^\circ}\right)$

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

$A = \frac{1}{2}(3)^2\left(\frac{7\pi}{4}\right)$

$A = 24.74 \text{in}^2$

36. Find the radius.



$135^\circ \left(\frac{\pi}{180^\circ}\right)$

$\frac{3\pi}{4}$

$A = \frac{1}{2} r^2 \theta$

$234.62 = \frac{1}{2}(r^2)\left(\frac{3\pi}{4}\right)$

$r^2 = 199.15$

$r = 14.11 \text{ in.}$