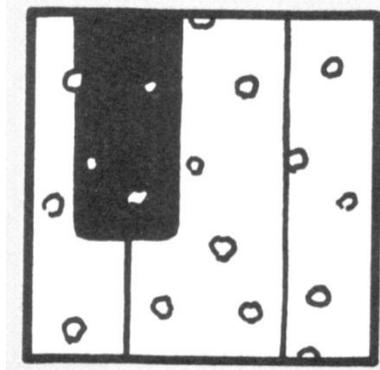


A Turvy for Right Angle Trig Applications

Puzzle and Answer Key by David Pleacher



Caption for the picture:

"C O O K I E C R U M B S O N A P I A N O."

10 17 17 1 6 15 10 9 5 3 11 18 17 16 19 13 6 19 16 17

Caption for the picture turned upside down:

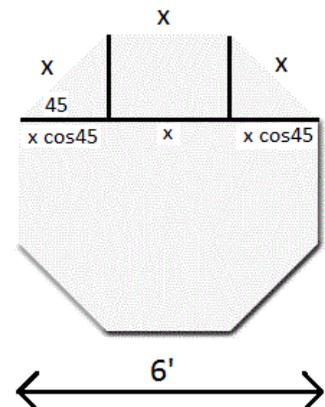
"A B E L I N C O L N W A L K I N G B Y A

19 11 15 2 6 16 10 17 2 16 8 19 2 1 6 16 12 11 4 19

T A L L F E N C E I N A S N O W S T O R M."

14 19 2 2 7 15 16 10 15 6 16 19 18 16 17 8 18 14 17 9 3

- 1 - 2. The students in the class of '78 at John Handley High School decided to make a well for the 1977 Prom ("Midnight at the Oasis"). The shop teacher, Mr. Ritter, said that his students would build it if given the dimensions. The well was to be a regular octagon, six feet across. Determine the lengths of the eight sides (problem #1) and the measure of the angle between the sides (prob. #2).

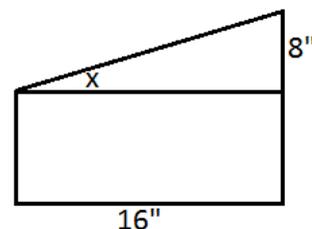


Each angle of a regular octagon is 135° using the formula, $(n - 2) \times 180^\circ$, and divide by 8. Then using the definition of the cosine, you can set up the equation: $x \cos 45^\circ + x + x \cos 45^\circ = 6$. Solving, you obtain $x = 2.48'$.

26.6° 3. A student in my 7th period trig class was building a small greenhouse for a window. In the drawing at the right, determine the measure of angle x.

$$\tan(x) = 8 / 16$$

$$\tan(x) = .5, \text{ so } x = 26.6^\circ$$

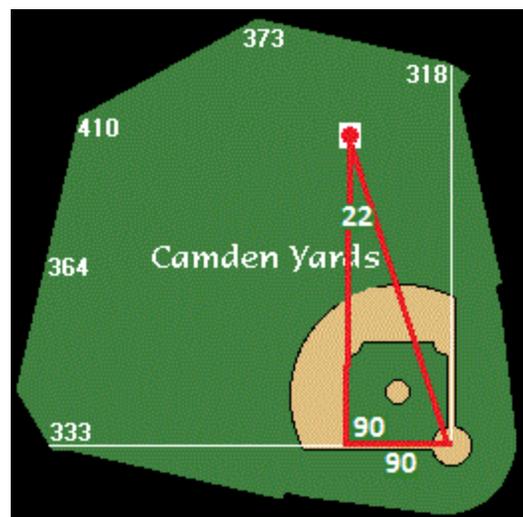


240.25' 4. The Right fielder is standing at the red dot in the diagram of Oriole Park at Camden Yards at the right. He is collinear with second and third base and his lines of sight to third base and to home plate form a 22° angle. How far is he standing from home plate?

Let x = distance from RF to Home. Then $\sin 22 = 90/x$.
= 240.25 feet.

132.75' 5. In Problem #4 above, how far is the right fielder standing from second base?

Use Pythagorean Theorem or $\cos 22 = a/240.25$, where a = distance from RF to 3B.
a = 222.75' but you must subtract 90' to get 132.75'.



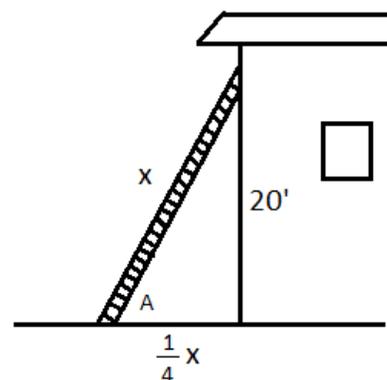
15.12° 6. Using the diagram of Camden Yards at the right, if the left fielder caught a ball right in the corner, 333 yards from home plate, at what angle would he have to throw the ball to first base (i.e., find the angle between the third base line and a line drawn from the left field corner to first base)?

$\tan A = 90/333$, so the angle = 15.12°.

7 – 8. A man wants to reach a point on his house 20 feet above the ground. According to safety experts, a ladder should be set up by placing the bottom of the ladder $\frac{1}{4}$ of length of the ladder away from the building. Determine the length of the ladder (problem #7) and the measure of the angle that the ladder makes with the ground (problem #8).

$$\cos(A) = \frac{1}{4}, \text{ so Angle } A = 75.5^\circ$$

$$\sin(75.5) = 20/x, \text{ so } x = 20.66'$$

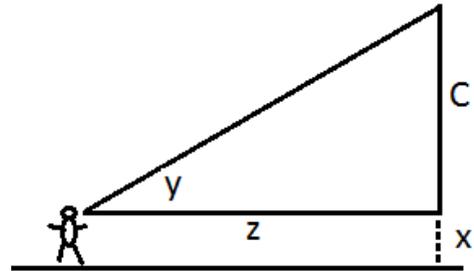


7.6° 9. At what angle should a paper airplane be flown so as to just clear the geometry teacher's head if the teacher is 6 feet tall and standing 15 feet away? Assume that you are throwing the plane from a height of 4 feet (while seated at your desk).

$$\tan(x) = 2/15, \text{ so } x = 7.6^\circ.$$

below 10. Launching Estes Solid Fuel Rockets.

The Estes Company sells a device to help you determine how high your rocket goes. It gives you the angle from the horizontal to the top of the rocket's flight. Explain how you can figure its height H if you know the distance from the launching pad (z feet), the angle to the rocket (y degrees), and your height (x feet).



Total Height $H = x + z \tan y$

1,453' 11. Determine the height of the Willis Tower in Chicago (formerly known as the Sears Tower) if the angle of elevation of its top from a point on the ground 1,177 feet from its base is 51 degrees.

$$\tan(51^\circ) = x/1177, \text{ so } x = 1,453 \text{ feet}$$

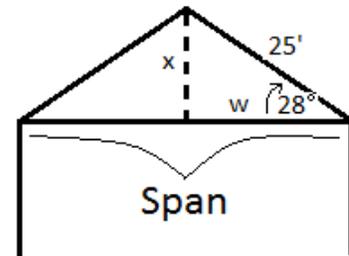
453 mi 12. Philadelphia is 420 miles due East of Columbus, Ohio. Detroit is due North of Columbus and is N 68° W from Philadelphia. How far is Detroit from Philadelphia?

$$\cos(22) = 420 / x, \text{ so } x = 453 \text{ miles.}$$

16.7° 13. A tennis court has a three foot high net. Standing 10 feet back from it, a ball is returned low to the ground. What is the minimum angle at which it may be returned in order to clear the net?

$$\tan(A) = 3 / 10, \text{ so } A = 16.7^\circ.$$

.27 14. In architecture, the pitch of a roof is defined to be the ratio of the height to its span. Determine the pitch of the roof at the right.



$$\cos(28) = w / 25. \quad \text{So, } w = 22.07.$$

$$\sin(28) = x / 25. \quad \text{So, } x = 11.74. \quad \text{Pitch} = 11.74/44.14$$

- 763.9' 15. The Washington Monument is 555 feet high. If you look out one of the top windows at an angle of depression of 36° , determine the distance that you can see from the monument.

$$\tan(54) = x / 555, \text{ so } x = 763.9'.$$

- 49.2° 16. If a woman 5'6" tall casts a shadow 4'9" long, determine the angle of elevation of the sun.

$$\tan(A) = 66 / 57, \text{ so the angle of elevation is } 49.2^\circ.$$

- 57.2 yd 17. A railroad track crosses a highway at an angle of 78° . A locomotive is 40 yards away from the intersection when a car is 50 yards away from the intersection. What is the distance between the train and car?

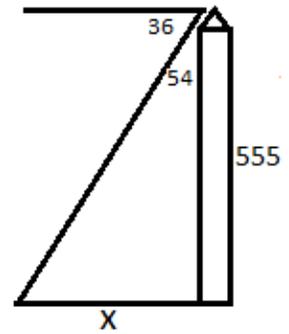
$$\text{Use Law of cosines: } x^2 = 40^2 + 50^2 - 2(40)(50)\cos(78^\circ).$$

- 287.6' 18. A ranger in a fire tower 250 feet above the ground spots a fire at an angle of depression of 41° . How far away is the fire?

$$\tan(49) = x / 250, \text{ so } x = 287.6'.$$

- 15.56' 19. If you stood 10 feet away from a wall and threw a ball at a 40 degree angle to the wall, how far would the ball travel until it hit the wall?

$$\sin(40) = 10 / x, \text{ so } x = 15.56'.$$



Answers: (units have been omitted)

a. 15.56

j. 17

s. 287.6

b. 1,453

k. 2.48

t. .27

c. $H = x + z \tan y$

l. 135

u. 132.75

d. $H = x + z \sin y$

m. 26.6

v. 2,001

e. 763.9

n. 49.2

w. 75.5

f. 20.7

o. 57.2

x. 74

g. 453

p. 16.7

y. 240.25

h. $H = x + z \cos y$

q. 45

z. None of the above

i. 15.12

r. 7.6