TRIGONOMETRY PROBLEMS

1. What is a $40°$ angle in radians?

2. What is a 2.85 radian angle in degrees?

3. What is a 1.39π radian angle in degrees?

4. What is a $113°$ angle in radians?

5. What is a 1.27 radian angle in degrees?

6. What is a 1.35π radian angle in degrees?

7. What are the sine, cosine, and tangent of $66°$?

8. What are the sine, cosine, and tangent of 0.89 radians?

9. What are the sine, cosine, and tangent of $178°$?

10. What are the sine, cosine, and tangent of 3.41 radians?

11. In a right triangle, the side adjacent to a $53°$ angle has length 52 meters. What is the length of the opposite side and the hypotenuse of the triangle?

12. In a right triangle, the side adjacent to a $31°$ angle has length 81 meters. What is the length of the opposite side and the hypotenuse of the triangle?

13. What would be the percentage error in the small angle approximation for sine at 0.94 radians?

14. What would be the percentage error in the small angle approximation for sine at 0.32 radians?

15. Tabulate the sine, cosine, tangent, and cotangent of angles from 0 to $360°$ in $30°$ intervals. Are the signs of the functions what you would expect from the sign conventions?

16. Express the following angles as decimal fractions of a degree. (a) 25', (b) 45", (c) 20°15', (d) 78°37'22".

17. At noon the sun is directly overhead. At 2:00 PM the shadow of a tree is 40 ft long. How long will the shadow be at 5:00 PM if sunset is at 6:00 PM?

ANSWERS to SELECTED PROBLEMS

1. 0.7 radians

2. 163°

3. 250°

4. 1.97 radians

5. 73°

6. 243°

7. sin66°=0.914, cos66°=0.407, tan66°=2.246

8. sin(0.89 rad)=0.777, cos(0.89 rad)=0.629, tan(0.89 rad)=1.235

9. sin178°=0.035, cos178°=-0.999, tan178°=-0.035

10. sin(3.41 rad)=-0.265, cos(3.41 rad)=-0.964, tan(3.41 rad)=0.275

11. The opposite side is 52tan(53°)=69.01 meters.
The hypoteneuse is $\sqrt{(52^2+69.01^2)}$=86.41 meters.

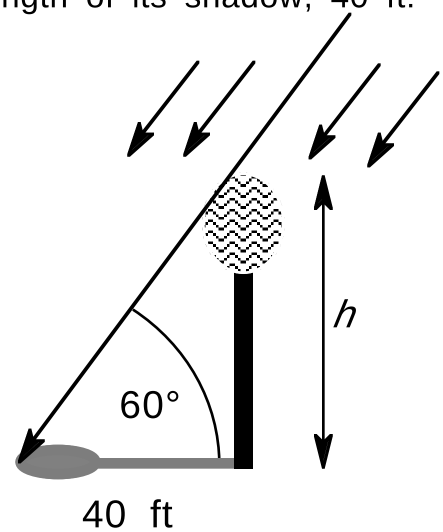
12. The opposite side is 81tan(31°)= 48.67 meters.
The hypoteneuse is $\sqrt{(81^2+48.67^2)}$= 94.5 meters.

13. sin(0.94 rad)=0.808. Error=100%x[(0.94-0.808)/0.808]=16.34%

14. sin(0.32 rad)=0.315. Error=100%x[(0.32-0.315)/0.315]=1.59%

16. (a) 0.417, (b) 0.0125, (c) 20.25, (d) 78.6227...

17. At noon the sun's rays go straight down and at 6:00 PM they go horizontally, hence the angle of incidence of the sun's rays changes 90° in 6 hours or 15° per hour. At 2:00 PM the rays make an angle of 60° with the ground, so the following diagram relates h, the height of the tree to the length of its shadow, 40 ft:



From the diagram, it's clear that the height is given by h=(40 ft)tan60°=69.28 ft. At 5:00 PM the angle of the incoming rays with the ground will be 15°, so the length s of the shadow will be given by h/s=tan15° or s=(69.28 ft)/tan15°=258.6 ft.