HW Mark:	10	9	8	7	6	RE-Submit

Trigonometry

This booklet belongs to:____________________Period____

LESSON #	DATE	QUESTIONS FROM NOTES	Questions that I find difficult
		Pg.	
		Pg.	
		Pg.	
		Pg.	
		Pg.	
		Pg.	
		Pg.	
		Pg.	
		Pg.	
		Pg.	
		REVIEW	
		TEST	

Your teacher has important instructions for you to write down below.

Trigonometry

STRAND Measurement		DAILY TOPIC	EXAMPLE
4. Develop and apply the primary trigonometric ratios (sine, cosine, tangent) to solve problems that involve right triangles.	4.1	Explain the relationships between similar right triangles and the definitions of the primary trigonometric ratios.	
	4.2	Identify the hypotenuse of a right triangle and the opposite and adjacent sides for a given acute angle in the triangle.	
	4.3	Solve right triangles, with or without technology.	
	4.4	Solve a problem that involves one or more right triangles by applying the primary trigonometric ratios or the Pythagorean theorem.	
	4.5	Solve a problem that involves indirect and direct measurement, using the trigonometric ratios, the Pythagorean theorem and measurement instruments such as a clinometer or metre stick.	

[C] Communication **[PS]** Problem Solving, **[CN]** Connections **[R]** Reasoning, **[ME]** Mental Mathematics **[T]** Technology, and Estimation, **[V]** Visualizatio

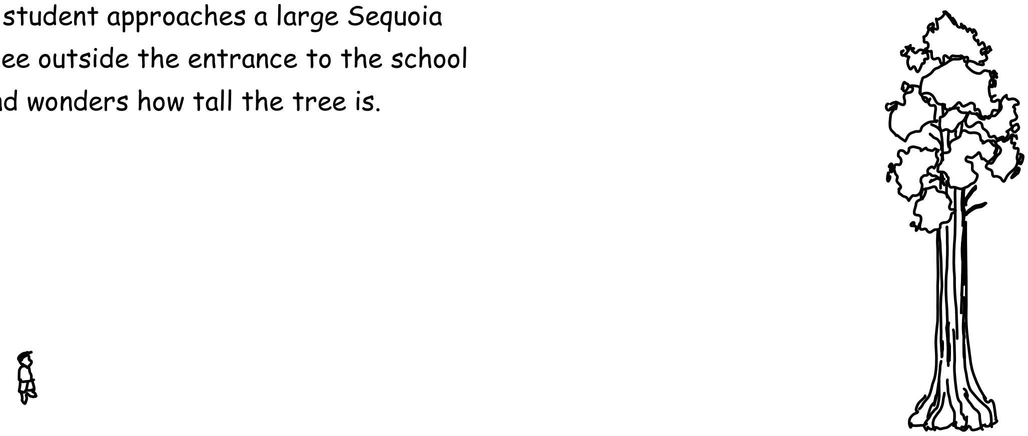
Key Terms

Term	Definition	Example
Triangle		
Similar Triangles		
Theta		
Acute angle		
Obtuse angle		
Right Triangle		
Oblique Triangle		
Legs		
Hypotenuse		
Trigonometry		
Opposite side		
Adjacent side		
Sine ratio		
Cosine ratio		
Tangent ratio		
Theta (θ)		

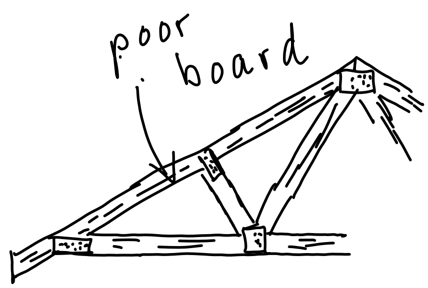
Why Trigonometry?

There is an application of trigonometry that could solve each problem below.

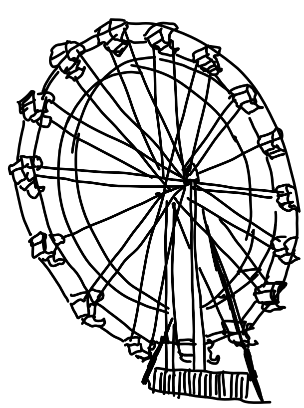
A student approaches a large Sequoia tree outside the entrance to the school and wonders how tall the tree is.



A homeowner wants to cut a new board to replace a decaying roof truss. He can measure the horizontal distance and the angle of inclination but needs to know how long to cut the board.



An engineer is constructing a Ferris wheel for a downtown park. There are 16 passenger carts.

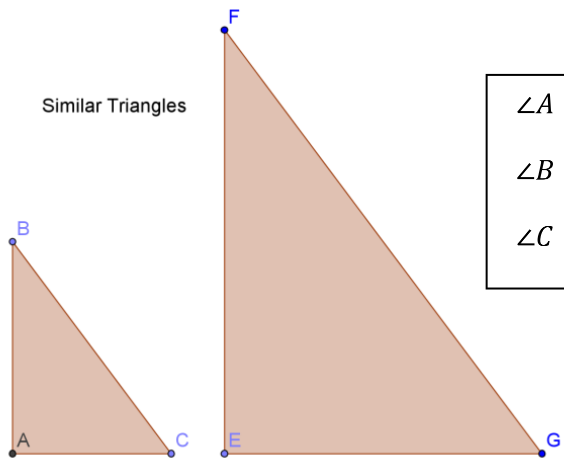


Similar Triangles:

To understand what trigonometry is, we need to understand the properties of similar triangles.

Two triangles are similar if…

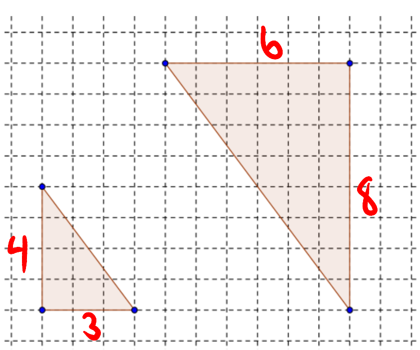
- They have the **same angles**.
- **Ratios of corresponding** sides are equal.



$\angle A \approx \angle E$	$AB \approx EF$	$\dfrac{AB}{EF}=\dfrac{AC}{EG}=\dfrac{BC}{FG}$
$\angle B \approx \angle F$	$AC \approx EG$	
$\angle C \approx \angle G$	$BC \approx FG$	

Determine if each of the following pairs of triangles are similar. Explain why or why not.

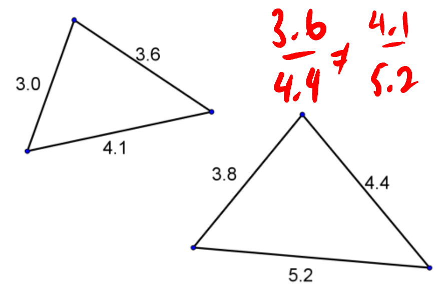
1.



$\frac{6}{3} = \frac{8}{4}$

yes

2.

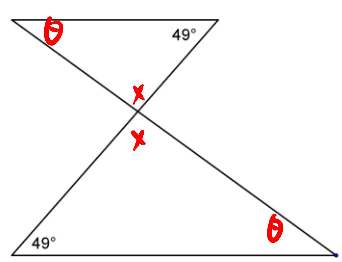


$\frac{3.6}{4.4} \neq \frac{4.1}{5.2} \neq \frac{3.0}{3.8}$

not equal ratios

∴ No

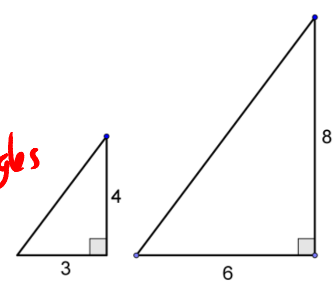
3.



yes.

3 = angles

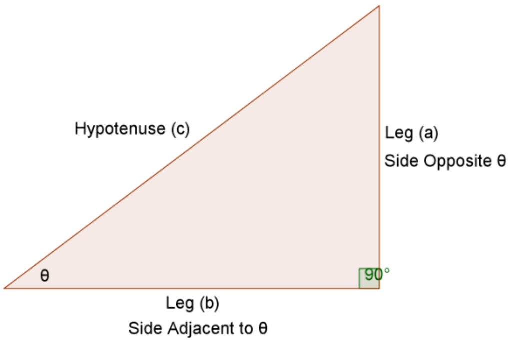
4.



$\frac{4}{8} = \frac{3}{6}$

yes

The Right Triangle



A right triangle is a triangle with one right angle (90°).

The side opposite the right angle is called the hypotenuse.

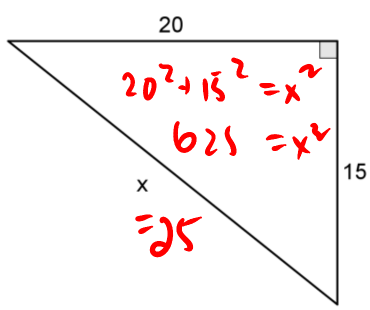
The other two sides are called "legs".

The sides of the right triangle form a Pythagorean Triple. That is, they satisfy the Pythagorean Theorem: $a^2 + b^2 = c^2$.

Some Prime Triples:
(3,4,5), (5,12,13), (7,24,25), (8,15,17), (9,40,41), (11,60,61,), ...

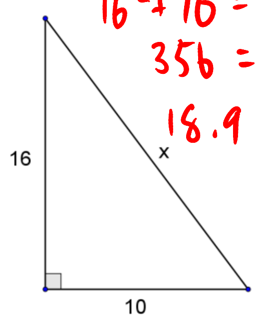
Find the indicated side length (nearest tenth) in the following right triangles.

5.



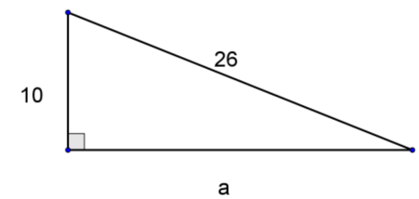
$20^2 + 15^2 = x^2$
$625 = x^2$
$= 25$

6.



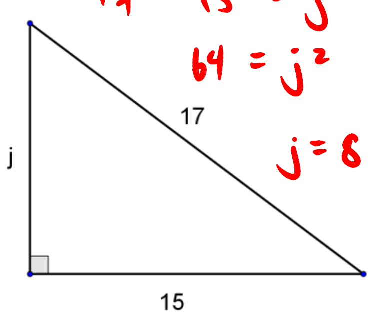
$16^2 + 10^2 = x^2$
$356 = x^2$
$18.9 = x$

7.



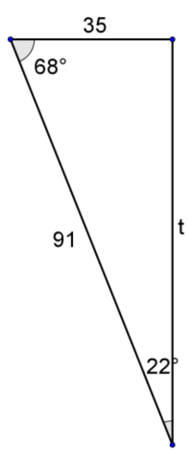
$10^2 + a^2 = 26^2$
$a^2 = 676 - 100$
$a^2 = 576$ $\therefore a = 24$

8.



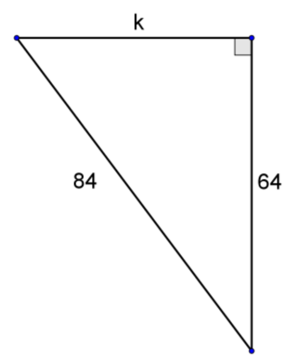
$17^2 - 15^2 = j^2$
$64 = j^2$
$j = 8$

9.



$91^2 - 35^2 = t^2$
$t = 84$

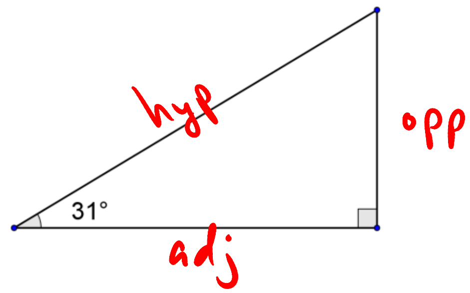
10.



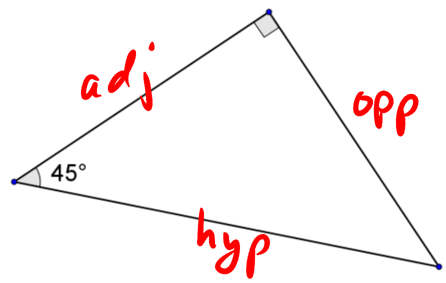
$84^2 - 64^2 = k^2$
$2960 = k^2$
$544 = k$

One acute angle is indicated on each of the following triangles. If possible, label each triangle with: opposite, adjacent, and hypotenuse in respect to that angle. Remember, only **right** triangles can be labeled this way.

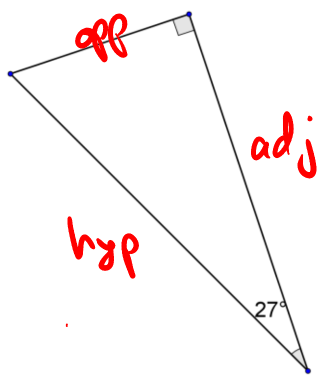
11.



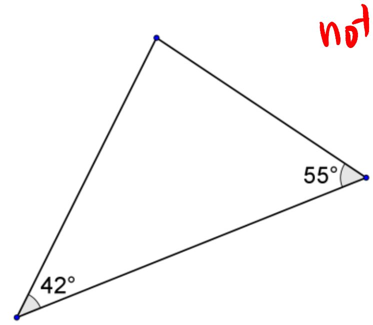
12.



13.

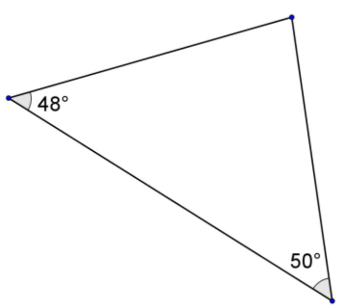


14.



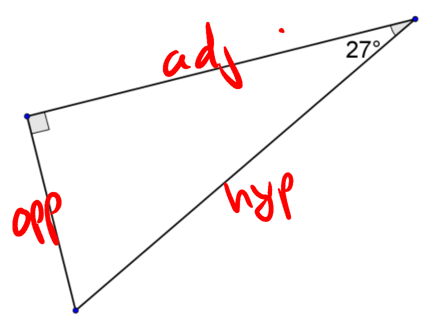
not a right Δ

15.

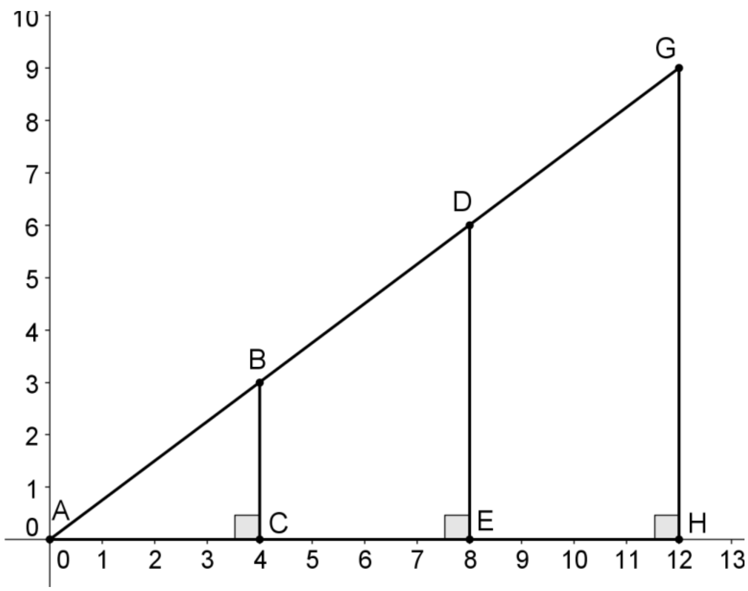


not a right Δ

16.



Observe the three "embedded" similar triangles below. Find the missing information on the right.



17. What are the names of the three triangles?

$\Delta ABC \approx \Delta \underline{ADE} \approx AGH$

Δ_______

DAE GAH

18. $\angle BAC = \angle$____ $= \angle$____

$\angle ABC = \angle \underline{ADE} = \angle \underline{AGH}$

$\angle BCA = \angle \underline{DEA} = \angle \underline{GHA}$

19. $\frac{BC}{AC} = \frac{3}{4} = 0.7500$

$\frac{DE}{AE} = \frac{6}{8} = 0.7500$

$\frac{GH}{AH} = \frac{9}{12} = 0.7500$

20. Based on the work you've done, how do you know all three triangles are similar?

ratios of corresponding sides are congruent (same)

21. Earlier, we saw that similar triangles have the following similar ratios: (using the two smaller triangles embedded above)

$$\frac{BC}{DE} = \frac{AC}{AE} = \frac{AB}{AD} = \frac{1}{2}$$

In the questions above we see that we could write different equivalent ratios:

$$\frac{BC}{AC} = \frac{DE}{AE} = \frac{GH}{AG} = \frac{3}{4} or\ 0.7500$$

Write two more sets of equivalent ratios that would be true for the similar right triangles above.

$$\frac{BC}{AB} = \frac{DE}{AD} = \frac{GH}{AG} = \frac{3}{5} or\ 0.6000$$

$$\frac{AC}{AB} = \frac{AE}{AD} = \frac{AH}{AG} = \frac{4}{5} or\ 0.8000$$

Trigonometry of Right Triangles

Since similar right triangles have equivalent ratios for corresponding angles, we can use those ratios to find unknown angles and/or side lengths.

These ratios have been calculated and stored in our calculator for many angles to help us solve problems.

We will use the three **primary trigonometric ratios:**

Tangent ratio **Sine ratio** **Cosine ratio**

The Tangent Ratio

For an acute angle in a right triangle, the ratio of $\frac{opposite\ \angle\theta}{adjacent\ \angle\theta}$ is called the TANGENT RATIO.

We have seen previously that in <u>similar</u> right triangles, the ratios of the legs of a triangle remain constant despite reducing or enlarging the triangle.

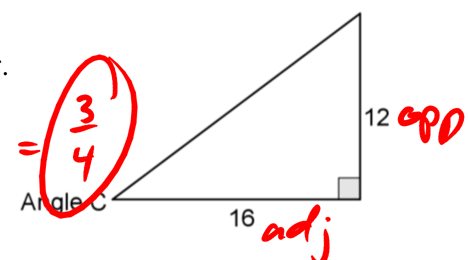
These ratios have been calculated and stored in our calculator for many angles to help us solve problems.

---

22. Challenge Question

Find the tangent ratio for angle C in the triangle to the right.

$\tan C = \frac{opp}{adj} = \frac{12}{16} = \frac{3}{4}$



---

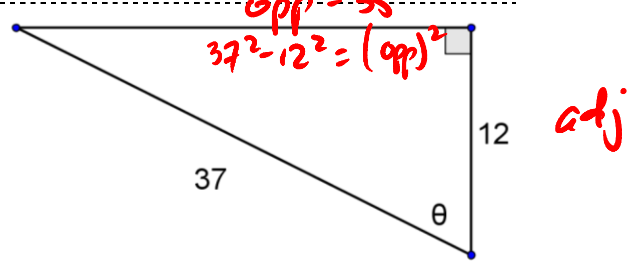
23. Challenge Question

What is $tan\theta$ for the triangle to the right?

opp = 35

$37^2 - 12^2 = (opp)^2$

$\tan\theta = \frac{opp}{adj}$ $\tan\theta = \frac{35}{12}$



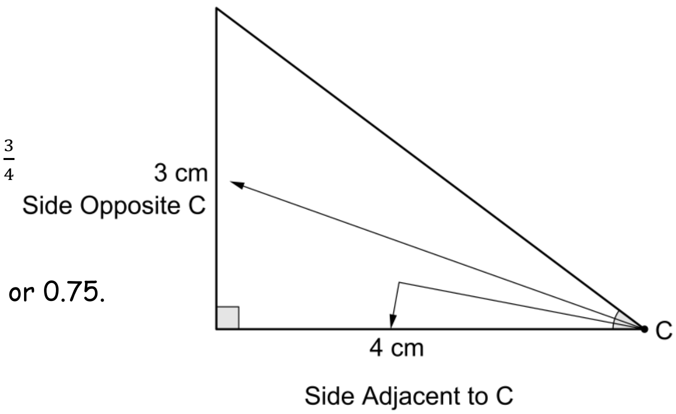
The Tangent Ratio

Remember, the tangent ratio is a ratio involving the "legs" of the right triangle.

$$TanC = \frac{opposite\ \angle\theta}{adjacent\ \angle\theta}$$

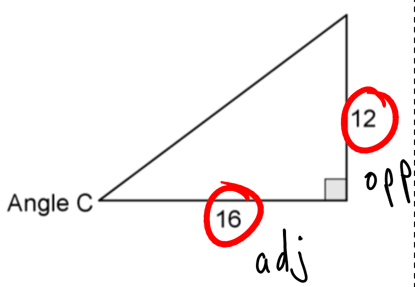
From the diagram we see that Tan C = $\frac{3}{4}$

The ratio of one leg to the other is 3:4 or 0.75.



Find the tangent ratio for the indicated angles below.
Answer as a fraction AND as a decimal to 4 places.

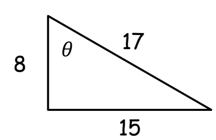
24. Find the tangent ratio for angle C in the triangle below.



$tan\theta = \frac{12}{16} = \frac{3}{4}$

= 0.7500

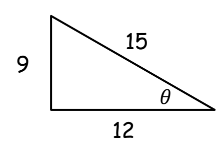
25. Find the tangent ratio for angle θ in the triangle below.



$tan\theta =$ $\frac{15}{8}$

= 1.8750

26. Find the tangent ratio for angle θ in the triangle below.

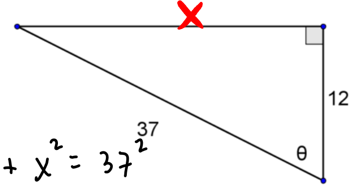


$tan\theta =$ $\frac{9}{12}$

= 0.7500

Find the tangent ratio for the indicated angles below.
Answer as a fraction AND as a decimal to 4 places.

27. What is $tan\theta$ for the triangle below?



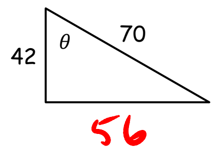
$12^2 + x^2 = 37^2$

$x^2 = 37^2 - 12^2$ $X = 35$

$tan\theta = \frac{x}{12} = \frac{35}{12}$

$\cong 2.9167$

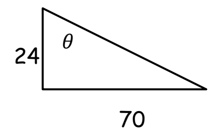
28. What is $tan\theta$ for the triangle below?



$tan\theta = \frac{56}{42}$

= 1.3333

29. What is $tan\theta$ for the triangle below?



$tan\theta = \frac{70}{24}$

= 9167

Skill Reminder: Solve the following equations. Answer to the nearest hundredth if necessary.

30. $\frac{12}{x} = \frac{4}{1}$

$x = \frac{12}{4}$
$= 3$

31. $\frac{x}{4} = \frac{6}{1}$

$x = 24$

32. $\frac{x}{4} = \frac{0.55}{1}$

$x = 2.2$

33. $\frac{x}{5} = \frac{10}{2}$

$x = \frac{50}{2} = 25$

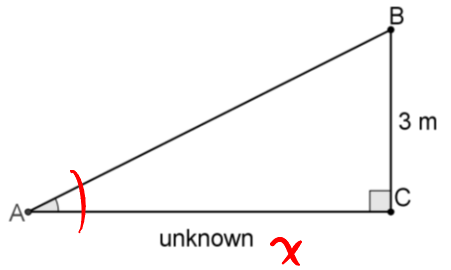
34. $\frac{2}{x} = \frac{1.3}{1}$

$x = \frac{2}{1.3}$
$= 1.54$

35. $\frac{x}{2.5} = \frac{6}{1}$ $x = 15$

36. Challenge Question

Given that the ratio of $\frac{opposite}{adjacent}$ for $\angle A$ in $\triangle ABC$ is 0.5000, find the length of the missing leg.



$\tan A = \frac{opp}{adj}$

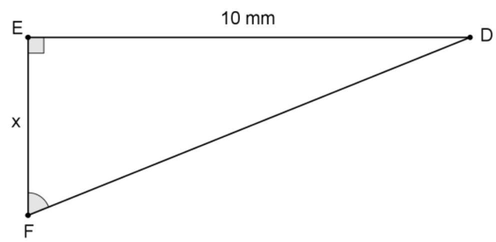
$\frac{0.5000}{1} = \frac{3}{x}$

$x = \frac{3(1)}{0.5000}$

$x = 6\text{ m}$

37. Challenge Question

Given that the tangent ratio of Angle F is 0.4000, find the length of the missing leg.



$\tan F = \frac{opp}{adj}$

$\frac{0.4000}{1} = \frac{10}{x}$

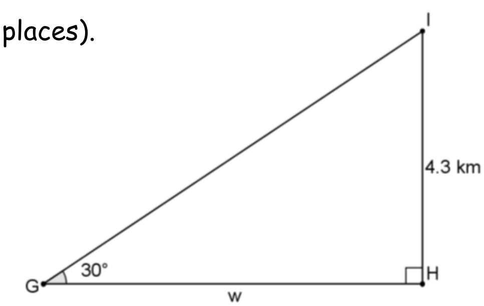
$x = \frac{10}{0.4000}$

$x = 25\text{ mm}$

38. Challenge Question

Use your calculator to find $\tan 30°$ (round to 4 decimal places).

Use $\tan 30°$ to find the length of the missing leg.



$\tan 30° = 0.5774$

$\tan 30° = \frac{opp}{adj}$

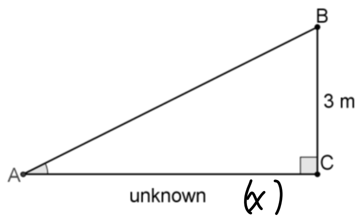
$\frac{0.5774}{1} = \frac{4.3}{w}$

$w = \frac{4.3}{0.5774}$

$w = 7.4\text{ km}$

Finding Missing Sides Lengths Using the Tangent Ratio

39. Given that the ratio of $\frac{opposite}{adjacent}$ for $\angle A$ in $\triangle ABC$ is 0.5000, find the length of the missing leg.



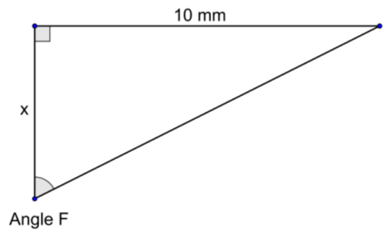
(x)

$0.5000 = \frac{opp}{adj}$

$\frac{0.5}{1} = \frac{3}{x}$

$x = 6$

40. Given that the tangent ratio of Angle F is 0.4000, find the length of the missing leg.



$\frac{0.4000}{1} = \frac{10}{x}$

$x = 25$

41. Use your calculator to find $\tan 30°$ (round to 4 decimal places). Use $\tan 30°$ to find the length of the missing leg.

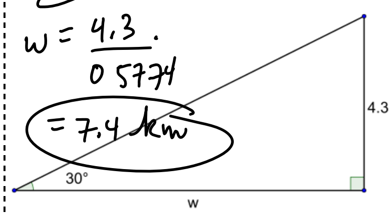
tan 30 = 0.5774

$0.5774 = \frac{opp}{adj}$

$\frac{0.5744}{1} = \frac{4.3}{w}$

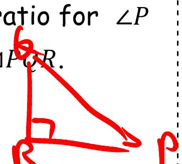
$w = \frac{4.3}{0.5774}$

= 7.4 km



42. Draw a diagram illustrating the tangent ratio for $\angle P$ in right $\triangle PQR$.

$\tan P = \frac{QR}{PR}$



43. The tangent ratio is a ratio of what two sides in a right triangle?

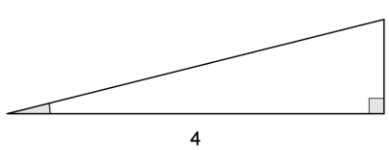
the two "legs" (opposite + adjacent)

44. Can you use the tangent ratio to find the hypotenuse of a right triangle?

NO, we use opp / adj only.

Use the tangent ratio to find the missing side lengths to the nearest tenth.

45. The tangent ratio for the triangle below is 0.2500. Calculate x.

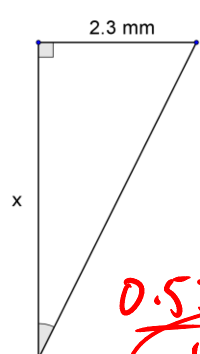


$$0.2500 = \frac{x}{4}$$

$$\frac{0.2500}{1} = \frac{x}{4}$$

$$4(0.2500) = 1(x)$$
$$x = 1$$

46. The tangent ratio for the triangle below is 0.5325. Calculate x.

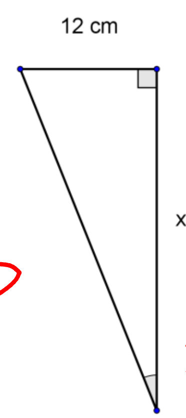


$\frac{0.5325}{1} = \frac{2.3}{x}$

$x = \frac{2.3}{0.5325}$

$x = 4.3$ mm

47. The tangent ratio for the triangle below is 2.7321. Calculate x.



$\frac{2.7321}{1} = \frac{12}{x}$

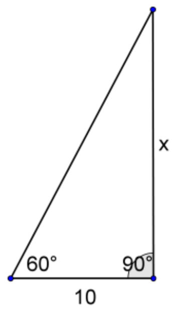
$x = \frac{12}{2.7321}$

$x = 4.4$ cm

(not scale diagram)

Use your calculator to find the following ratios to 4 decimal places, then solve for x.

48. $\tan 60° =$ 1.7321



$1.7321 = \frac{x}{10}$

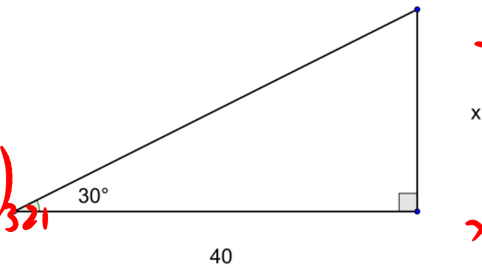
$x = 10(1.7321)$

or

$x = 10(\tan 60)$

17.3

49. $\tan 30° =$ 0.5774



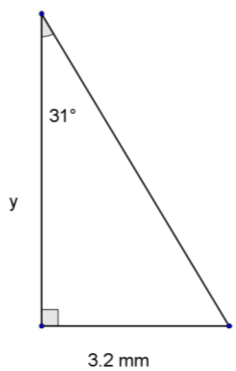
$\tan 30 = \frac{x}{40}$

$x = 40 \tan 30$

$x = 23.1$

Find the length of the indicated side to the nearest tenth.

50.

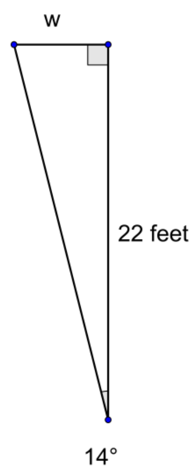


$\tan 31 = \frac{3.2}{y}$

$y = \frac{3.2}{\tan 31}$

$y = 5.3$ mm

51.

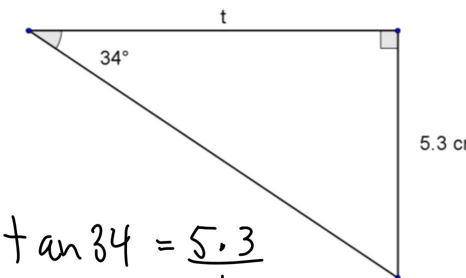


$\tan 14 = \frac{w}{22}$

$w = 22 \tan 14$

5.5 feet

52.

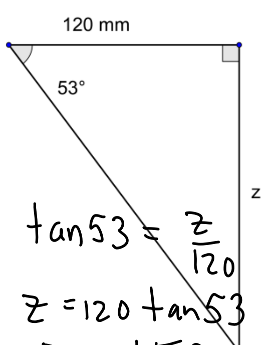


$\tan 34 = \frac{5.3}{t}$

$t = \frac{5.3}{\tan 34}$

$t = 7.9$ cm

53.



$\tan 53 = \frac{z}{120}$

$z = 120 \tan 53$

$z = 159.2$ mm

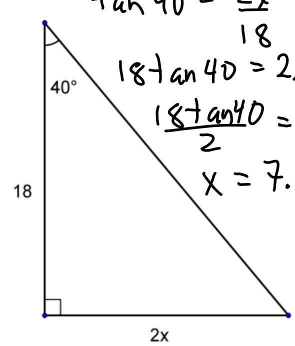
54.

$\tan 40 = \frac{2x}{18}$

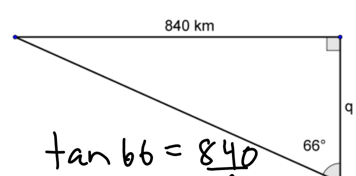
$18 \tan 40 = 2x$

$\frac{18 \tan 40}{2} = x$

$x = 7.6$



55.



$\tan 66 = \frac{840}{q}$

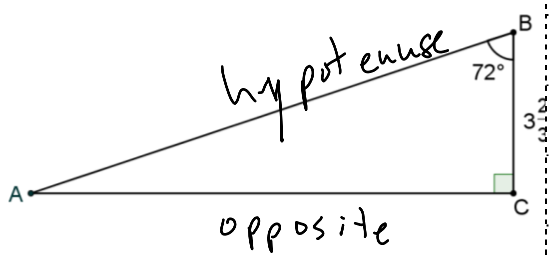
$q = \frac{840}{\tan 66}$

$q = 374.0$

Solving Triangles:

To "solve a triangle" means to find the length of all unknown sides and measure of unknown angles.

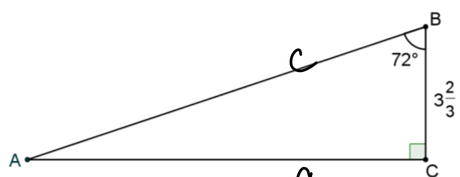
56. Explain the steps you would take to solve the following triangle.



Use 72° and "adjacent" side to find "opposite" side. Then $a^2+b^2=c^2$ to find hypotenuse.

Solve the following triangles. Answer to tenths.

57.



$\tan 72 = \frac{a}{\frac{11}{3}}$

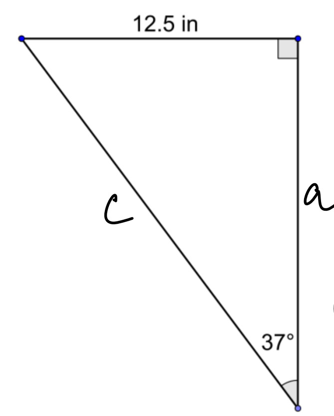
$\frac{11}{3}\tan 72 = a$

$a = 11.3$

$(11.3)^2 + (3.7)^2 = c^2$

$c = 11.9$

58.



$\frac{\tan 37}{1} = \frac{12.5}{a}$

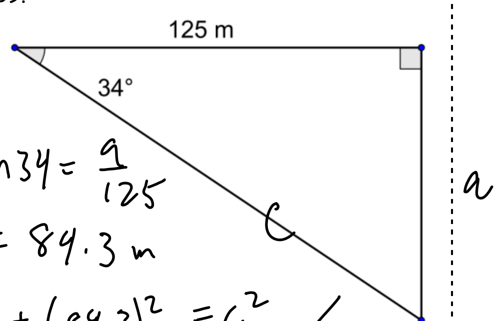
$\frac{12.5}{\tan 37} = a$

$a = 16.6$ in

$(16.6)^2 + (12.5)^2 = c^2$

$c = 20.8$ in

59.



$\tan 34 = \frac{a}{125}$

$a = 84.3$ m

$125^2 + (84.3)^2 = c^2$

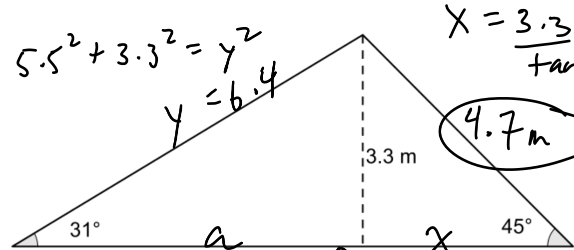
150.8 m $= c$

$(150.8)^2 - 125^2 = a^2$

$a = 84.3$

60.

The dotted line is an altitude.



$\tan 45 = \frac{3.3}{x}$

$x = \frac{3.3}{\tan 45}$

4.7m

$5.5^2 + 3.3^2 = y^2$

$y = 6.4$

$\tan 31 = \frac{3.3}{a}$

$a = \frac{3.3}{\tan 31}$

$a = 5.5$

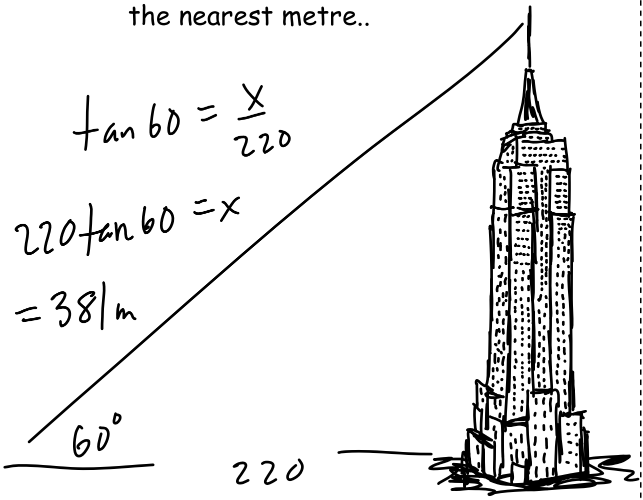
$a = 5.5$

$x = 3.3$ m

$5.5 + 3.3 = 8.8$

Solve each of the following word problems. Include a diagram in your solution.

61. From a point 220 m from the Empire State Building, a tourist measures the angle of inclination to the top to be 60°. Calculate the height of the building to the nearest metre..

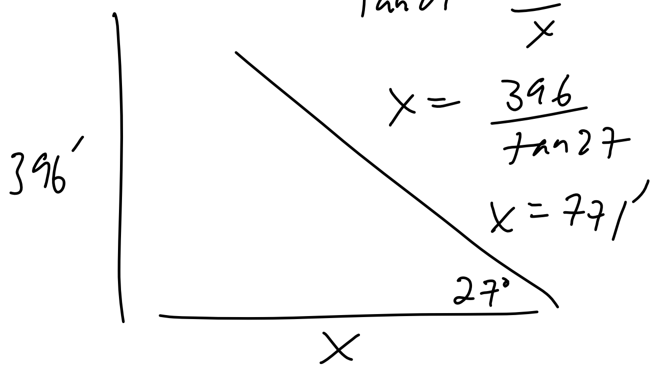


$\tan 60 = \frac{x}{220}$

$220 \tan 60 = x$

$= 381\text{m}$

62. A radio tower is 396 feet tall. How far from the base of the tower is a technician if the angle of inclination to the top of the tower is 27°? Answer to the nearest foot.

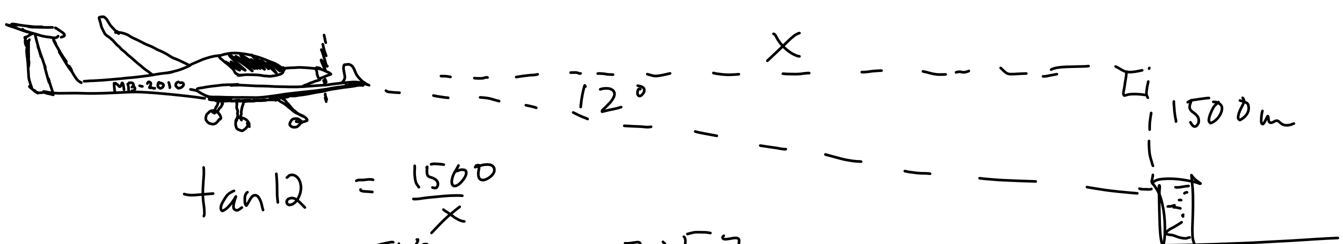


$\tan 27 = \frac{396}{x}$

$x = \frac{396}{\tan 27}$

$x = 771'$

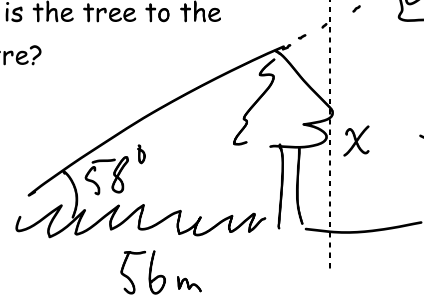
63. An airplane approaches a control tower. The angle of depression from the pilot to the tower is 12°. If the plane is flying at an altitude of 1500 m, how far is the plane from being directly above the tower (to the nearest kilometer)?



$\tan 12 = \frac{1500}{x}$

$x = \frac{1500}{\tan 12} = 7057\text{m}$

64. At 11:00 in the morning, the angle of elevation to the sun 58°. A tree in the school yard casts a shadow of 56 m. How tall is the tree to the nearest metre?

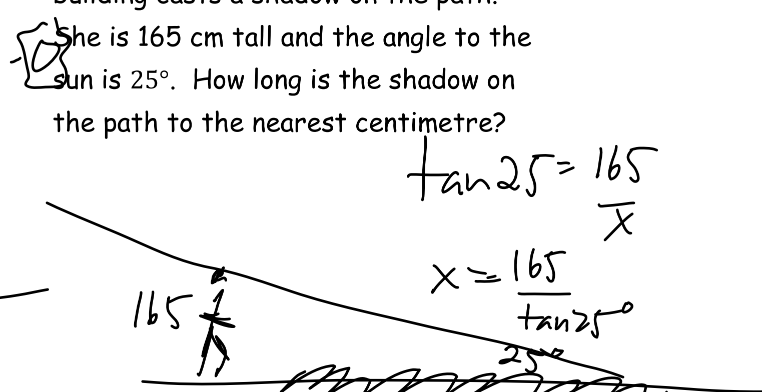


$\tan 58 = \frac{x}{56}$

$56 \tan 58 = x$

$x = 89.6 \rightarrow 90\text{m}$

65. A student crossing to the west building casts a shadow on the path. She is 165 cm tall and the angle to the sun is 25°. How long is the shadow on the path to the nearest centimetre?



$\tan 25 = \frac{165}{x}$

$x = \frac{165}{\tan 25°}$

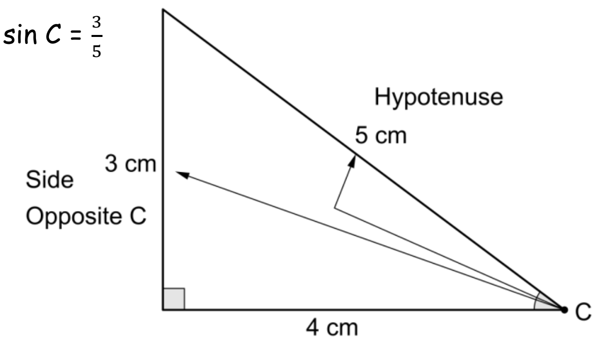
$x = 354\text{m}$

The Sine Ratio

The sine ratio is a ratio involving the hypotenuse and one leg of the right triangle.

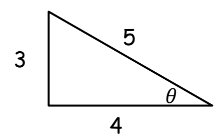
From the diagram to the right we see that sin $C = \frac{3}{5}$

The ratio of the opposite leg to the hypotenuse is 3:5 or 0.60.



Find the sine ratio for the indicated angles below.
Answer as a fraction AND as a decimal to 4 places.

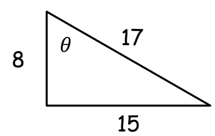
66. Find the sine ratio for angle θ in the triangle below.



$sin\theta = \frac{3}{5} =$

= 0.6000

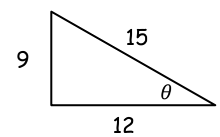
67. Find the sine ratio for angle C in the triangle below.



$sin\theta = \frac{15}{17}$

= 0.8824

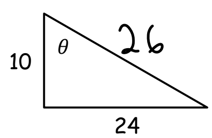
68. Find the sine ratio for angle C in the triangle below.



$sin\theta = \frac{9}{15}$

= 0.6000

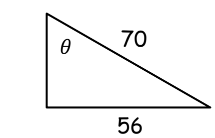
69. What is $sin\theta$ for the triangle below?



$sin\theta = \frac{24}{26}$

= 0.9231

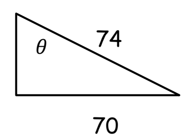
70. What is $sin\theta$ for the triangle below?



$sin\theta = \frac{56}{70}$

= 0.8000

71. What is $sin\theta$ for the triangle below?

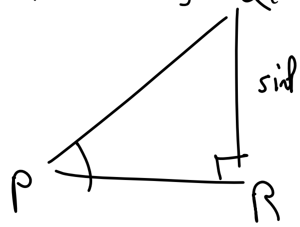


$sin\theta = \frac{70}{74} = \frac{35}{37}$

= 0.9459

Finding Missing Sides Lengths Using the Sine Ratio

72. Draw a diagram illustrating the sine ratio for $\angle P$ in right $\triangle PQR$.



$\sin P = \frac{QR}{PQ}$

73. The sine ratio is a ratio of what two sides in a right triangle?

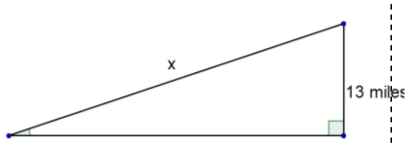
$\frac{\text{opposite}}{\text{hypotenuse}}$

74. Can you use the sine ratio to find the hypotenuse of a right triangle?

yes, the ratio contains hypotenuse

Use the sine ratio to find the missing side lengths to the nearest tenth.

75. The sine ratio for the triangle below is 0.3788. Find the length of side x.



$\frac{0.3788}{1} = \frac{13}{x}$

$\frac{13}{0.3788} = x$

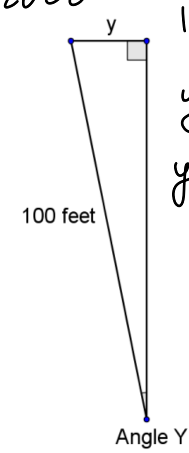
$34.3 = x$

76. The sine ratio for the triangle below is 0.2000. Find the length of side y.

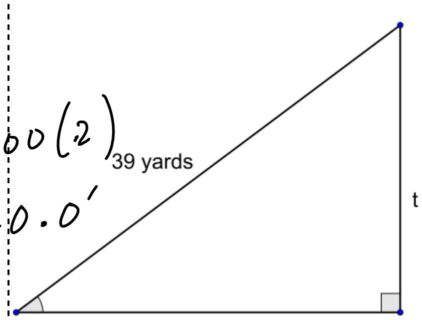
$0.2000 = \frac{y}{100}$

$y = 100(.2)$

$y = 20.0'$



77. The sine ratio for the triangle below is 0.6018. Find the length of side t.



$0.6018 = \frac{t}{39}$

$t = 39(0.6018)$

$t = 23.5$ y

78. The sine ratio of a right triangle is 0.8000. If the hypotenuse is 20 cm long, what are the lengths of the other two sides?

$\sin A = \frac{opp}{hyp}$

$0.8000 = \frac{opp}{20}$

$20(0.8) = opp$

$16 = opp$

$20^2 - 16^2 = (adj)^2$

$12 = adj$

79. The sine ratio of a right triangle is 0.4500. If the hypotenuse is 8 m long, what are the lengths of the other two sides?

$0.4500 = \frac{x}{8}$

$x = 8(.45)$

$x = 3.6$

$8^2 - 3.6^2 = y^2$

$y = 7.1$

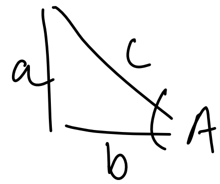
80. The sine ratio for a right triangle is 2.1042. Find the opposite side if the hypotenuse is 4 mm.

not possible

81. The sine ratio for a right triangle is 7.1004. Find the hypotenuse if the opposite side is 17 cm.

not possible

82. Explain why the previous questions have no solutions.
What do you notice about the value of ratio where this happens?
Interpret that kind of ratio in the sense of a right triangle.



$\sin A = \frac{a}{c} \Rightarrow$ cannot have sine ratio > 1 otherwise a > c, But c is longest side!

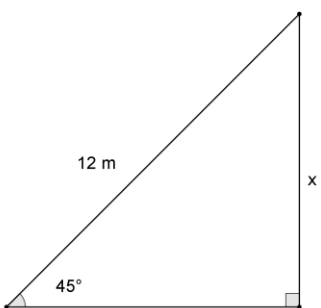
Use your calculator to find the following ratios to 4 decimal places.

83. $\sin 45° =$ 0.7071

84. $\sin 60° =$ 0.8660

85. $\sin 42° =$ 0.6691

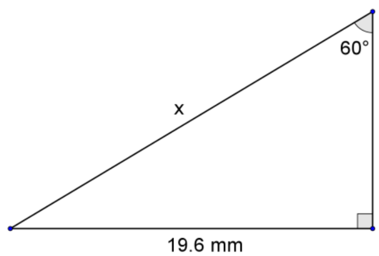
86. Find the length of side x.



$\sin 45 = \frac{x}{12}$

$x = 12 \sin 45$ $x = 8.5$

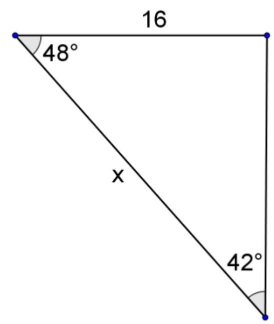
87. Find the length of side x.



$\sin 60 = \frac{19.6}{x}$

$\frac{19.6}{\sin 60} = x$ $x = 22.6$ mm

88. Find the length of side x.



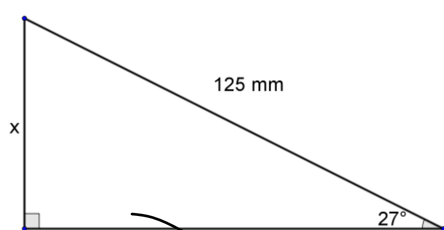
$\sin 42 = \frac{16}{x}$

$x = \frac{16}{\sin 42}$

$x = 23.9$

Find the length of the indicated side to the nearest tenth.

89.

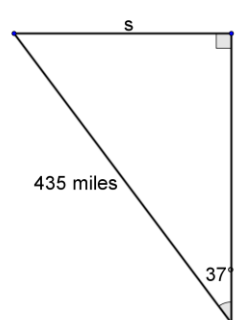


$\sin 27 = \frac{x}{125}$

$125 \sin 27 = x$

$x = 56.7$ mm

90.



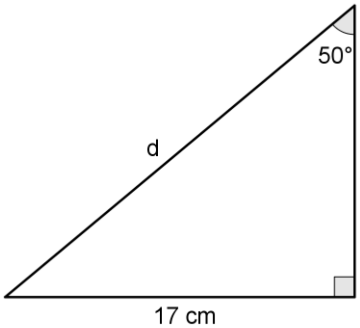
$\sin 37 = \frac{s}{435}$

$435 \sin 37 = s$

261.8 miles $= s$

Find the length of the indicated side to the nearest tenth.

91.

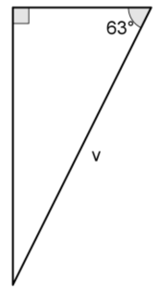


$\sin 50 = \frac{17}{d}$

$d = \frac{17}{\sin 50}$

$d = 22.2$ cm

92.

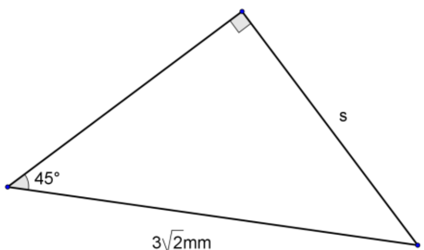


$\sin 63 = \frac{12.1}{v}$

$v = \frac{12.1}{\sin 63}$

$v = 13.6$ m

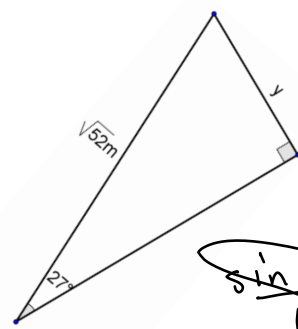
93.



$\frac{\sin 45}{1} = \frac{s}{3\sqrt{2}}$

$s = 3.0$ mm

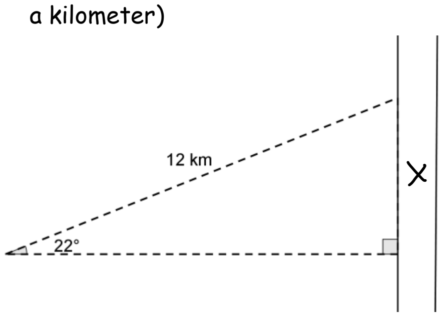
94.



$\frac{\sin 27}{1} = \frac{y}{\sqrt{52}}$

$y = 3.3$ m

95. A hiker loses track of her direction and wanders 22 degrees off course. If she continues to walk for 12 km to the river destination, how far away from her actual destination will she be? (nearest tenth of a kilometer)

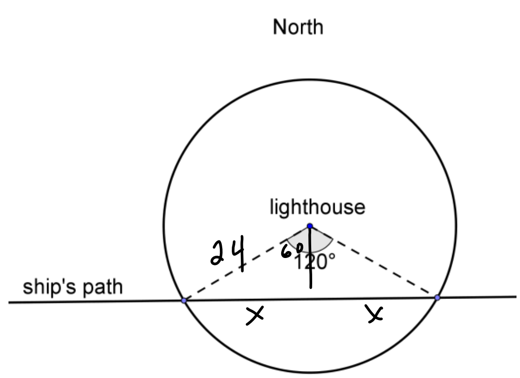


$\sin 22 = \frac{x}{12}$

$x = 12 \sin 22$

$= 4.5$ km

96. A lighthouse attendant has a range of visibility of 24 km. A ship on the horizon passes by the lighthouse. The attendant sees the ship for a total of 120 degrees. For how many kilometers was the ship within the attendant's range of sight? (nearest tenth)



$\sin 60 = \frac{x}{24}$

$x = 24 \sin 60$

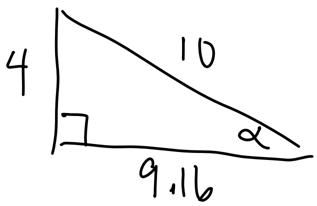
$x = 20.7$

$2x = 41.6$ km

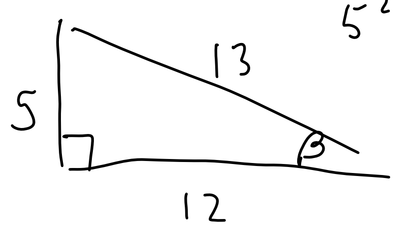
Draw a scale diagram that would **represent** each of the following.

97. Draw a triangle that has a the following:
$sin\alpha = \frac{2}{5}$, hypotenuse is 10 cm long.

$\frac{2}{5} \rightarrow \frac{4}{10}$

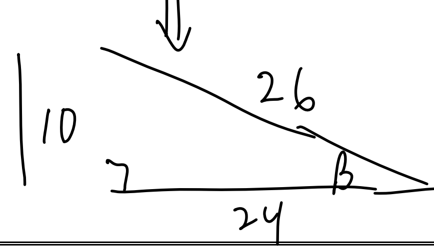


98. Draw a triangle that has a the following:
$tan\beta = \frac{12}{5}$, hypotenuse is 26 cm long.



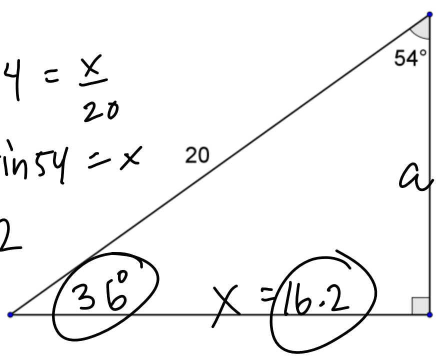
$5^2 + 12^2 = c^2$
$13 = c$

$\Downarrow$



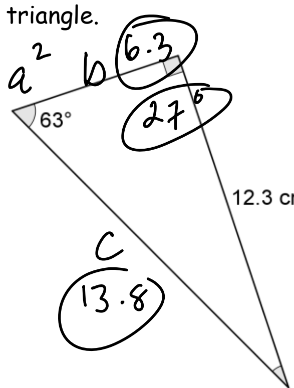
99. Solve the triangle.

$\sin 54 = \frac{x}{20}$
$20 \sin 54 = x$
16.2



100. Solve the triangle.

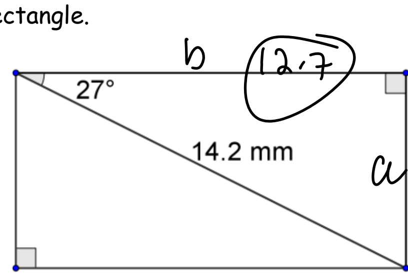
$20^2 - 16.2^2 = a^2$
$a = 11.7$



$\sin 63 = \frac{12.3}{c}$
$c = \frac{12.3}{\sin 63}$
$c = 13.8$

$13.8^2 - 12.3^2 = b^2$
$6.3 = b$

101. Find the perimeter of the following rectangle.

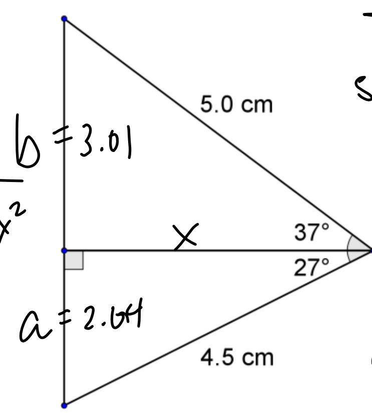


$\sin 27 = \frac{a}{14.2}$
$14.2 \sin 27 = a$
$6.4 = a$

$14.2^2 - 6.4^2 = b^2$
$12.7 = b$

$P = 2a + 2b$
$= 2(6.4) + 2(12.7) = 38.2\text{ mm}$

102. Find the total area.



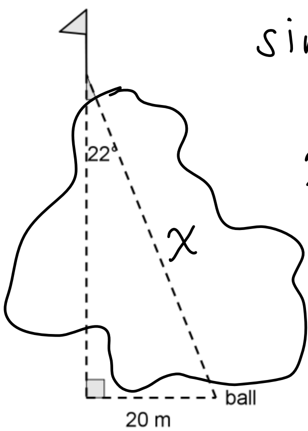
$5^2 - (3.01)^2 = x^2$
$x = 3.99$

$\sin 37 = \frac{b}{5}$
$b = 5 \sin 37$
$b = 3.01$

$\sin 27 = \frac{a}{4.5}$
$a = 4.5 \sin 27$
$a = 2.04$

$\text{Area} = \frac{(a+b)x}{2} \rightarrow A = \frac{(5.05)(3.99)}{2}$
$= 10\text{ cm}^2$

103. While golfing with his father-in-law, Mr. J hits a shot short of a pond. He walks 20 m to his left to a point directly across the pond from the hole. The angle between the two lines of sight is 22°. Find the distance from his ball to the hole to the nearest tenth of a metre.

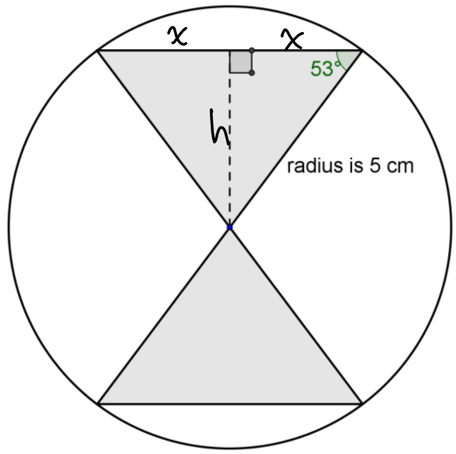


$\sin 22 = \frac{20}{x}$

$x = \frac{20}{\sin 22}$

$x = 53.4$ m

104. Find the area of the circle that is not covered by the shaded triangles. Answer to the nearest tenth.



Unshaded Area

$78.5 - 12 - 12$

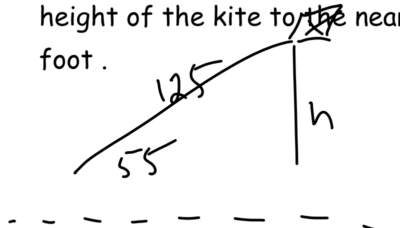
$= 54.5 \text{ cm}^2$

Find h $\sin 53 = \frac{h}{5}$ $h = 5\sin 53 = 4.0$

Find x : $5^2 - 4^2 = x^2$ $x = 3$

$\text{Area}_\Delta = \frac{6(4)}{2} = 12$ | $\text{Area}_c = \pi(5)^2 = 78.5$

105. Anya lets out 125 feet of kite string at Clover Point. The wind pulls the kite string tight at an angle of 55° to the ground. Approximate the height of the kite to the nearest foot .



$\sin 55 = \frac{h}{125}$

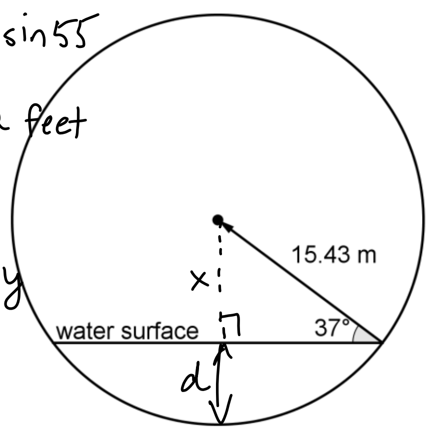
$h = 125\sin 55$

$h = 102$ feet

What assumptions did you make?

string is completely straight.

106. The diameter of a circular tunnel in Shanghai is 15.43 m. During a flood, a worker in the water at the side of the tunnel measured an angle to the centre to be 37°. Find the depth of the water at its deepest point. (The water surface forms a chord across the tunnel.)



$d = 15.43 - x$

$\sin 37 = \frac{x}{15.43}$

$x = 15.43\sin 37$

$x = 9.29$

$d = 6.14$ m

