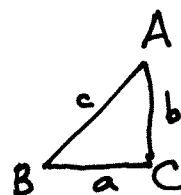
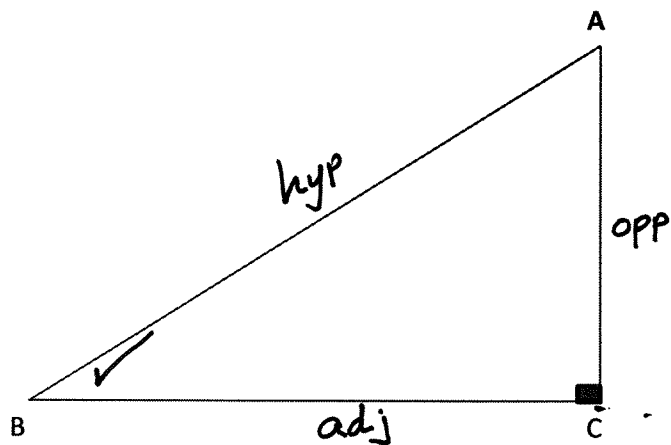


How the sides  
are named:

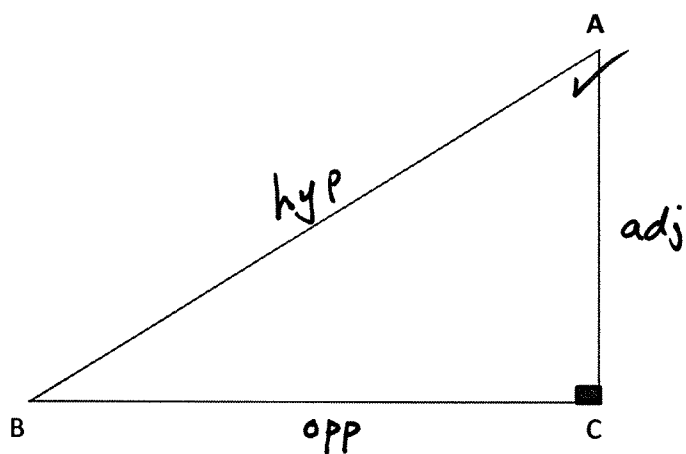


Math 10C Chapter 2 - Trigonometry Notes - An Introduction



From angle B

$\angle B$  is opposite to side  $b$   
 $\angle B$  is adjacent to side  $a$   
hyp is always opposite  
the right angle



From angle A

$\angle A$  is opposite side  $a$   
 $\angle A$  is adjacent to side  $b$

There are 3 sides to a right angled triangle. If you compare:

i) opp side to the adj side you get the tangent ratio.

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

ii) opp side to the hypotenuse you get the sine ratio.

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

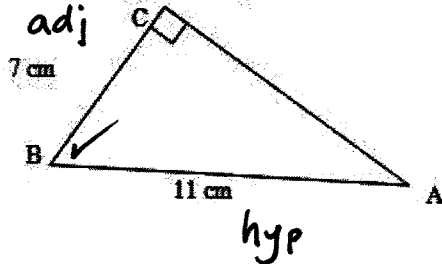
iii) adj side to the hypotenuse you get the cosine ratio

SOHCAHTOA

We can use these trig ratios to find the missing sides and the missing angles of any right angled triangles.

Examples

1. In the triangle shown, determine  $\angle B$  to the nearest degree.

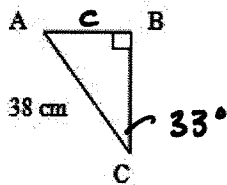


$$\cos \angle B = \frac{\text{adj}}{\text{hyp}}$$

$$\cos \angle B = \frac{7}{11} = 0.6364$$

$$\cos^{-1}(0.6364) = 50^\circ$$

2. In triangle ABC, calculate AB to the nearest centimetre given that  $\angle C = 33^\circ$ .

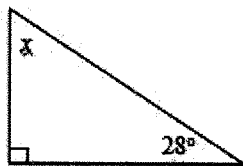


$$\sin 33 = \frac{c}{38}$$

$$c = 38 \sin 33$$

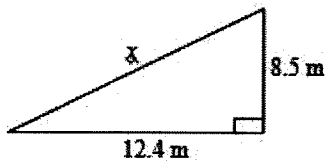
$$c = 20.7 \text{ cm}$$

3. Determine the measure of angle  $x$  in the triangle below.



$$180^\circ - 90^\circ - 28^\circ = 62^\circ$$

4. Determine the length of side  $x$  in the triangle below.



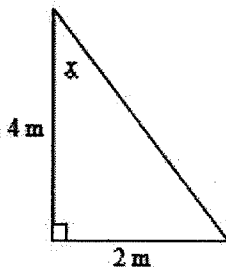
$$a^2 + b^2 = c^2$$

$$12.4^2 + 8.5^2 = x^2$$

$$226.01 = x^2$$

$$15.0 \text{ m} = x$$

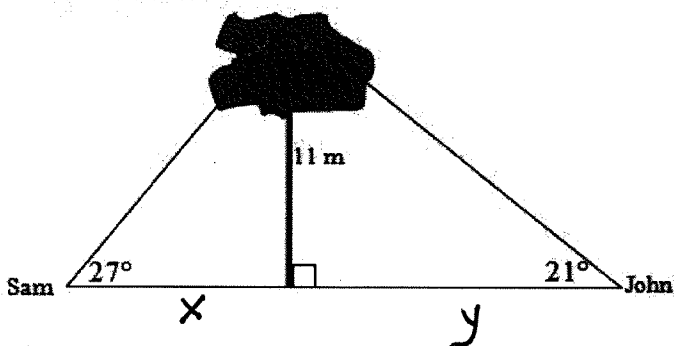
5. Determine the measure of angle  $x$  in the triangle below.



$$\tan \angle x = \frac{\text{opp}}{\text{adj}} = \frac{2}{4} = 0.5$$

$$\tan^{-1}(0.5) = 27^\circ$$

6. Sam and John are playing in the grass on opposite sides of a tree. The tree is 11 m tall. The angle of elevation from Sam to the top of the tree is  $27^\circ$ . The angle of elevation from John to the top of the tree is  $21^\circ$ . How far apart are the boys playing?



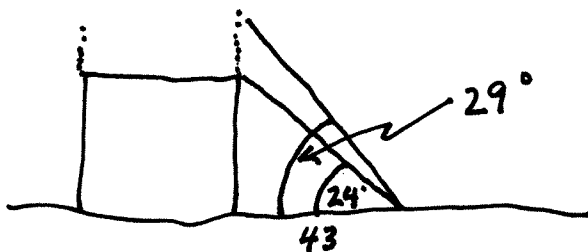
the boys  
are 50.24m  
apart.

$$\tan 27 = \frac{11}{x} \qquad \tan 21 = \frac{11}{y}$$

$$x = \frac{11}{\tan 27} \qquad y = \frac{11}{\tan 21}$$

$$x = 21.588 \qquad y = 28.656$$

7. On the top of a building, there is a garden with a fence around its perimeter. From a point 43 m from the base of the building, the angle of elevation to the top of the building is  $24^\circ$ . From the same point, the angle of elevation to the top of the fence is  $29^\circ$ . Determine the height of the fence. Be sure to draw a diagram.



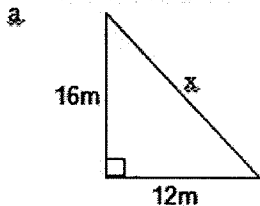
to top of fence      to bottom of fence

$$\tan 29 = \frac{x}{43} \qquad \tan 24 = \frac{x}{43}$$

$$x = 23.84 \qquad x = 19.14$$

Height of fence is 4.7m

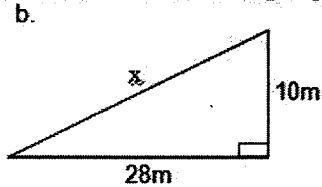
8. Find the missing side to the nearest tenth or the missing angle to the nearest degree.



$$a^2 + b^2 = c^2$$

$$12^2 + 16^2 = x^2$$

$$\underline{20 = x}$$

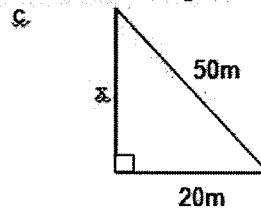


$$a^2 + b^2 = c^2$$

$$10^2 + 28^2 = x^2$$

$$884 = x^2$$

$$\underline{29.7m = x}$$



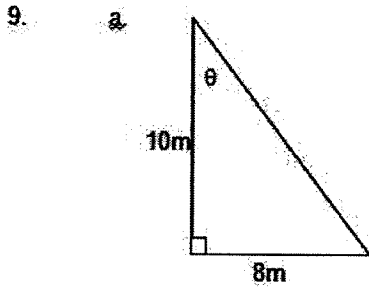
$$a^2 + b^2 = c^2$$

$$20^2 + x^2 = 50^2$$

$$x^2 = 50^2 - 20^2$$

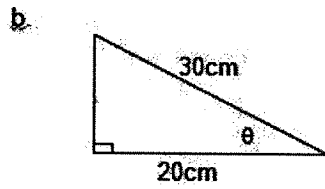
$$x^2 = 2100$$

$$\underline{x = 45.8m}$$



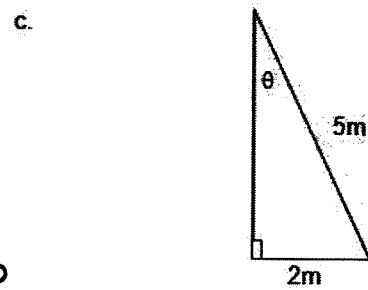
$$\tan \theta = \frac{8}{10}$$

$$\tan^{-1}\left(\frac{8}{10}\right) = 39^\circ$$



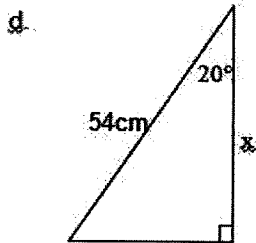
$$\cos \theta = \frac{20}{30}$$

$$\theta = 48^\circ$$



$$\sin \theta = \frac{2}{5}$$

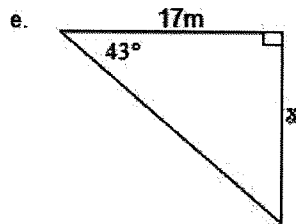
$$\theta = 24^\circ$$



$$\cos 20^\circ = \frac{x}{54}$$

$$x = 54 \cos 20$$

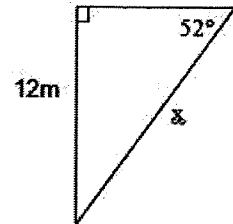
$$x = 50.7 \text{ cm}$$



$$\tan 43^\circ = \frac{x}{17}$$

$$x = 17 \tan 43$$

$$x = 15.9 \text{ m}$$

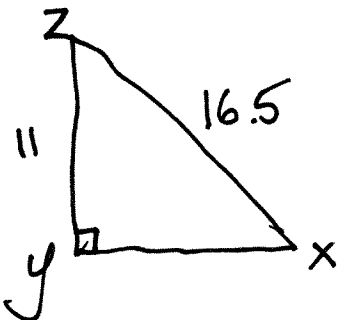


$$\cos 52^\circ = \frac{12}{x}$$

$$x = \frac{12}{\cos 52}$$

$$x = 19.5 \text{ m}$$

10. In the right triangle XYZ,  $Y = 90^\circ$ ,  $y = 16.5 \text{ cm}$  and  $x = 11.0 \text{ cm}$ . Calculate the measure of the two acute angles and the missing side.



$$a^2 + b^2 = c^2$$

$$11^2 + z^2 = 16.5^2$$

$$z^2 = 16.5^2 - 11^2$$

$$z^2 = 151.25$$

$$z = 12.3 \text{ cm}$$

$$\sin \angle X = \frac{11}{16.5}$$

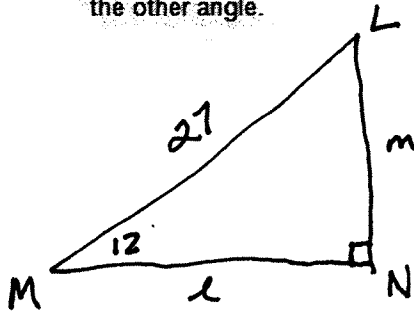
$$\sin^{-1}\left(\frac{11}{16.5}\right) = 42^\circ$$

$$\angle X = 42^\circ$$

$$\angle Z = 48^\circ$$

$$\begin{array}{r} 90 \\ -42 \\ \hline 48 \end{array}$$

11. In the right triangle LMN,  $N = 90^\circ$ ,  $M = 12^\circ$ , and  $n = 27.0\text{m}$ . Calculate the lengths of the other two sides and the other angle.



$$\cos 12 = \frac{m}{27}$$

$$m = 27 \cos 12$$

$$m = 26.4\text{m}$$

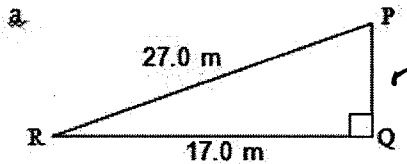
$$\sin 12 = \frac{l}{27}$$

$$l = 27 \sin 12$$

$$l = 5.6\text{m}$$

$$\angle L = 90 - 12 = 78^\circ$$

12. Calculate the measures of all unknown angles and sides in each triangle below.



$$a^2 + b^2 = c^2$$

$$17^2 + r^2 = 27^2$$

$$r^2 = 440$$

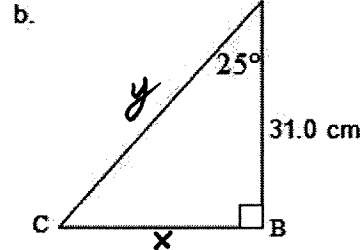
$$r = 21.0\text{m}$$

$$\cos \angle R = \frac{17}{27}$$

$$\cos^{-1}\left(\frac{17}{27}\right) = 51^\circ$$

$$\angle P = 180 - 90 - 51 = 39^\circ$$

$$\angle R = 51^\circ$$



$$\angle C = 180 - 90 - 25 = 65^\circ$$

$$\tan 25 = \frac{x}{31}$$

$$\text{side } a = 14.5\text{cm}$$

$$\cos 25 = \frac{31}{y}$$

$$\text{side } b = \frac{31}{\cos 25} = 34.2\text{cm}$$

Answer Key: 1.  $50^\circ$  2.  $21\text{cm}$  3.  $62^\circ$  4.  $15.03\text{m}$  5.  $27^\circ$  6.  $50.25\text{m}$  7.  $4.7\text{m}$  8a.  $20.0\text{m}$  b.  $29.7\text{m}$  c.  $45.8\text{m}$   
 9a.  $39^\circ$  b.  $48^\circ$  c.  $24^\circ$  d.  $50.7\text{cm}$  e.  $15.9\text{m}$  f.  $15.2\text{mm}$  10.  $X=42^\circ$ ,  $Z=48^\circ$ ,  $z=12.3\text{cm}$   
 11.  $l=26.4\text{m}$ ,  $m=5.6\text{m}$ ,  $L=78^\circ$  12a)  $P=39^\circ$ ,  $R=51^\circ$ ,  $r=21.0\text{cm}$  b)  $a=14.5\text{cm}$ ,  $b=34.2\text{cm}$ ,  $C=65^\circ$