

Trigonometry 5

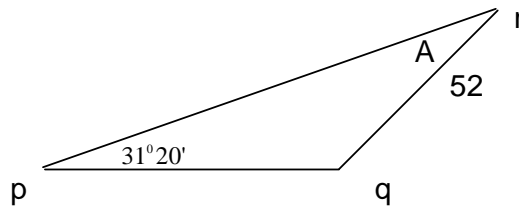
This class non right angled triangles.

Non right angled triangles

Example 1 Two lighthouses, p and q, are 73 km apart. q is directly East of p. Another lighthouse, r, is situated 52 km from q. The bearing of r from p is E $31^{\circ}20'$ N.

- (i) Find $|\angle prq|$.
- (ii) Calculate $|pr|$, correct to the nearest kilometre.

This is an example of a direction question. Most of the time they will draw the diagram that goes with the question.



Is the triangle right angled ? No so must move on.

Have we an angle and it's opposite length so then we can use the sin rule ?
Yes.

We have the length $|qr|$ and it's opposite angle and we have the length $|pq|$ so we can find it's opposite angle which is marked in the diagram as the angle A.

$$\frac{a}{\sin A} = \frac{b}{\sin B} \quad \text{this is the rule in the maths tables}$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} \quad \text{turn both sides up side down so that the angle is on top}$$

$$\frac{\sin A}{73} = \frac{\sin 31^{\circ}20'}{52} \quad \text{put the figures in}$$

$$52 \sin A = 73 \sin 31^{\circ}20' \quad \text{cross multiply}$$

$$52 \sin A = 73(0.52) \quad \text{find } \sin 31^{\circ}20' \text{ the using the calculator}$$

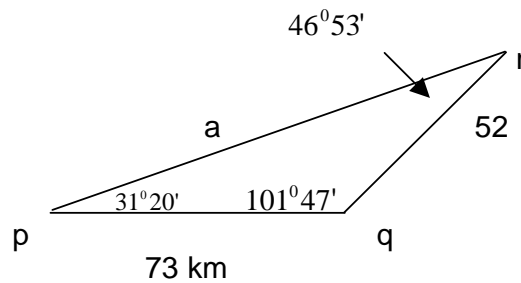
$$52 \sin A = 37.96 \quad \text{divide across by 52}$$

$$\sin A = \frac{37.96}{52} \quad \text{divide bottom into top}$$

$$\sin A = 0.73 \quad \text{use the calculator to find the angle}$$

$$A = 46.88^{\circ}$$

$$A = 46^{\circ}53'$$



Add $31^{\circ}20' + 46^{\circ}53' = 78^{\circ}13'$ now we can find the third angle.
 $180^{\circ} - 78^{\circ}13' = 101^{\circ}47'$

Use the sin rule again to find $|pr|$ which we will call a .

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{a}{\sin 101^{\circ}47'} = \frac{52}{\sin 31^{\circ}20'}$$

$$\frac{a}{0.9789} = \frac{52}{0.5348}$$

$$0.5348a = 52(0.9789)$$

$$0.5348a = 50.9$$

$$a = \frac{50.9}{0.5348} = 95.1 = 95\text{km to the nearest km}$$

Example 2 t, x, u and y are points on level ground, x, u and y in a straight line.

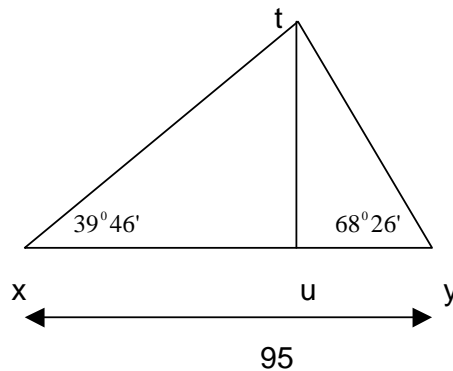
From x the direction of t is East $39^{\circ}46'$ North.

From y the direction of t is West $68^{\circ}26'$ North.

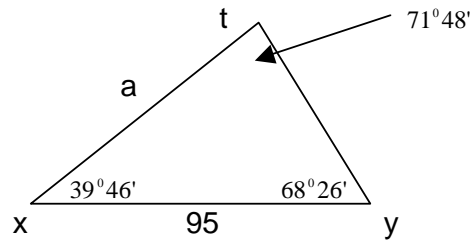
u is directly South of t.

$|xy| = 95\text{m}$.

- (i) Find $|tx|$, correct to the nearest meter.
- (ii) Find $|tu|$, correct to the nearest meter.



Again there are 3 possible triangles for us to draw out but the question is which one has got a length in it.



Add $39^{\circ}46' + 68^{\circ}26' = 108^{\circ}12'$ now we can find the third angle.

$$180^{\circ} - 108^{\circ}12' = 71^{\circ}48'$$

The best way to do this on a calculator of to put in $180 \text{ DMS } 00 - 108 \text{ DMS } 12$

Is the triangle right angled ? No so must move on.

Have we an angle and it's opposite length so then we can use the sin rule ?
Yes.

Mark in missing side $|tx|$ as a .

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

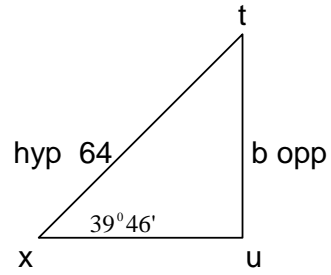
$$\frac{a}{\sin 39^{\circ}46'} = \frac{95}{\sin 71^{\circ}48'}$$

$$\frac{a}{0.6396} = \frac{95}{0.9499}$$

$$0.9499a = 95(0.6396)$$

$$0.9499a = 60.762$$

$$a = \frac{60.762}{0.9499} = 63.96 = 64$$



$$\sin 39^{\circ}46' = \frac{b}{64}$$

$$0.6396 = \frac{b}{64}$$

$$64(0.6396) = b$$

$$b = 40.9$$

$$b = 41$$