Tutorial 13 : Problems in 2 dimensions
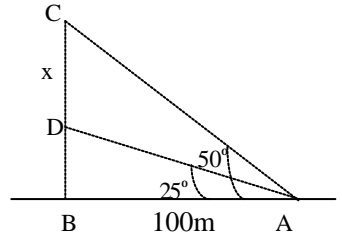
1 . A parachutist is descending vertically from C to B as shown in the figure. If AB= 100 m, how far (x m) does the parachutist fall as the angle of elevation from A changes from $50°$ to $25°$?


2. Aeroplane B is 12 km and N65°E from aeroplane A. Aeroplane C is 8 km and N25°W from aeroplane B. What is the compass bearing of C from A?

3. P and Q are two points 200 m apart on a beach running east to west (P being west of Q). Find the distance of a buoy B from the beach if the true bearing of the buoy from P is $050°$ and that from Q is $020°$.
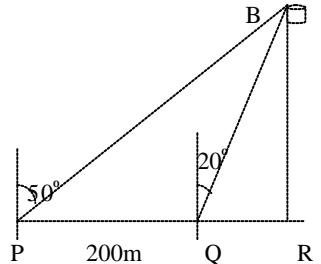

4. The angles of depression of two cars from a building are $26°$ and $42°$ respectively. If the distance between the cars is 50 m. find the height of the building.
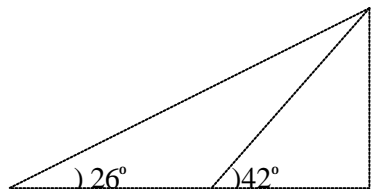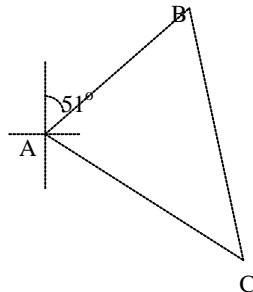
5. A and C are two bus stops on a straight road and 10 km apart. If the bearing of a boy
    B from A and C are S44° E and N62° E respectively, find
    a) the distance of the closest bus stop;
    b) the shortest distance of the boy to the road in order to get a taxi.
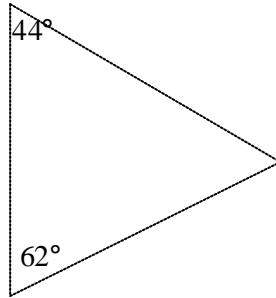
6. A man walks 400m on a bearing of 124° and then 700m on a bearing of 25°. Find
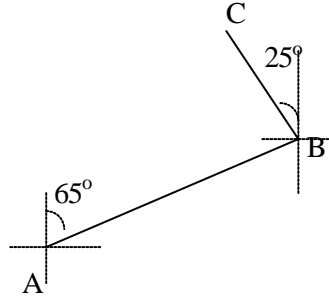   the distance and the bearing of the final position from his starting point.
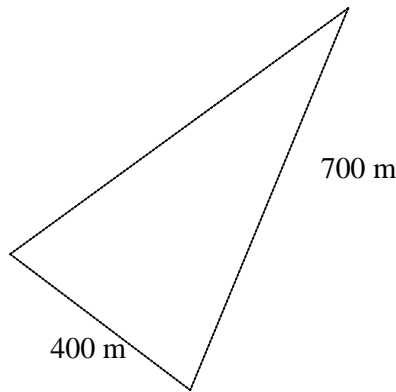
7.   In Fig. 3, A, B, C are 3 cities such that AB = 80 km, BC = 120 km, AC = 100 km
    and the bearing of B from A is N51°E. Find the bearings of C from A and B.

Solutions

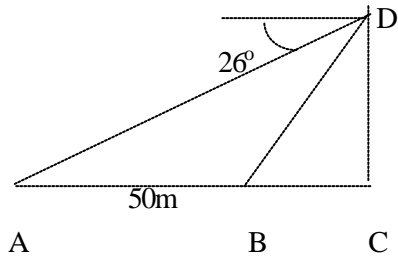1. $\tan 50^o = BC/100$, $BC = 100\tan 50^o = 119.2$ m
    $\tan 25^o = BD/100$, $BD = 100\tan 25^o = 46.63$ m
    $x = 119.2 - 46.63 = 72.57$ m

2. $\angle ABC = 90^o$,
    $AC^2 = 8^2 + 12^2$, $AC = 14.42$ km
    $\text{Sin } \angle CAB = 8/14.42 = 0.5548$
    $\angle CAB = 33.7^o$
    Bearing of C from A is N31.3°E

3. $\tan 40^o = BR/PR$, $PR = BR/\tan 40^o$
    $\tan 70^o = BR/QR$, $QR = BR/\tan 70^o$
    $PR - QR = BR/\tan 40^o - BR/\tan 70^o$
    $200 = BR/\tan 40^o - BR/\tan 70^o$
    $200 = BR(\cot 40^o - \cot 70^o)$
    $BR = 241.6$ m

4. $AC = DC/\tan 26^o$
    $BC = DC/\tan 42^o$
    $AC - BC = DC/\tan 26^o - DC/\tan 42^o$
    $50 = DC/\tan 26^o - DC/\tan 42^o$
    $DC = 53.21$ m

5.   a) $\angle ABC = 180° - 44\ 62°$

            $= 74°$

   By sine rule, $AB/\sin62° = BC/\sin44° = 80km/\sin74°$

   So, $BC = (80\sin44°)/\sin74°$

          $= 57.81$ km

    b) $\sin 62° = BD/BC$

     $BD = 57.81 \sin62° = 51.04$ km
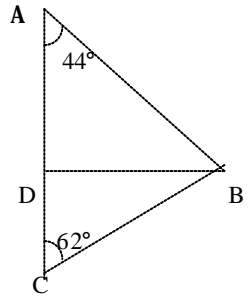
6. $\angle a = 180° - 124° = 56°$

   $\angle OAB = \angle a + 25° = 81°$

   By cosine rule,

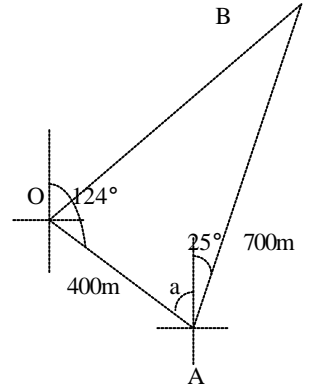 $OB^2 = 400^2 + 700^2 - 2\times400\times700\cos81°$

   $OB = 749.9$ m

   By sine rule, $700/\sin\angle BOA = 749.9/\sin81°$

                 $\sin\angle BOA = (700\sin81°)/749.9$

                 $\angle BOA = 67.2°$

   So, the bearing of B from O is $(124° - 67.2°) = 56.8°$

7. $AC^2 = AB^2 + BC^2 - 2\times AB\times BC \cos \angle ABC$

   $100^2 = 80^2 + 120^2 - 2\times80\times120 \cos \angle ABC$

   $\angle ABC = 55.77°$

   $120/\sin \angle BAC = 100/\sin \angle ABC$

   $\sin \angle BAC = (120 \sin 55.77°)/100 = 0.992$

   $\angle BAC = 82.81°$

   $\angle ACB = 180° - 55.77° - 82.81° = 41.42°$

   so, bearing of C from A $= 50° + 82.81° = 132.81°$

    bearing of C from B $= 174.23°$