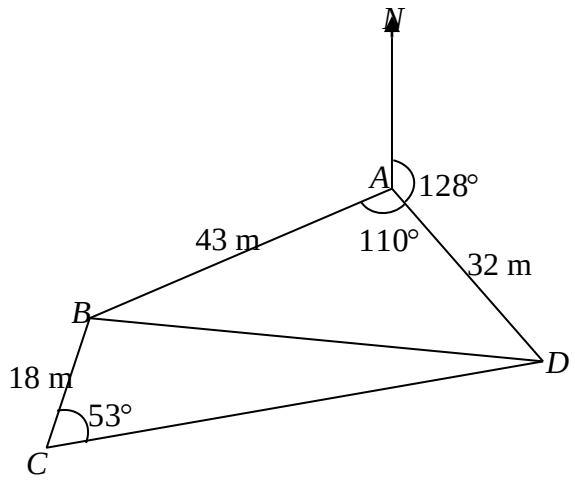
**Application of Trignometry**
**Worksheet I**

Question 1

*A, B, C* and *D* are points on horizontal ground. *D* is 32 m from *A* on a bearing of 128°. $\angle BAC = 110°$, $\angle BCD = 53°$, *BC* = 18 m and *AB* = 43 m.



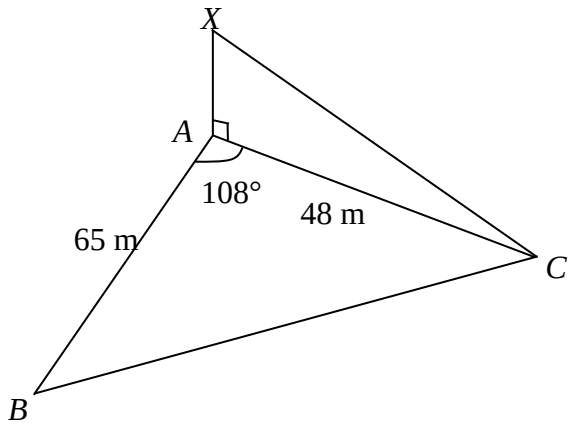

(a) Calculate
(i) the length of *BD*,
(ii) $\angle BDC$,
(iii) the area of triangle *ABD*,
(iv) the bearing of *A* from *B*.

(b) A tower of height 70 m is erected vertically at point *A*. Find the angle of elevation when viewed from the point *B*.

Ans: (a) (i) 61.8 m (3sf) (ii) 13.5° (1dp) (iii) 647 $m^2$ (3sf) (iv) 058° (b) 58.4° (1dp)

Question 2

In the diagram, $ABC$ is a horizontal triangular field in which $AB$ = 65 m, $AC$ = 48 m and $\angle BAC = 108°$.




(a) Calculate
  (i) the length of $BC$,
  (ii) the area of triangle $ABC$,
  (iii) the shortest distance from $A$ to $BC$.

(b) A vertical tower $XA$ stands at $A$. The angle of elevation of the top of the tower from $C$ is 14°. Calculate the height of the tower.

(c) Calculate the greatest angle of elevation of the top of the tower when viewed from any point along $BC$.

(d) $C$ is due east of $B$. Find the bearing of $A$ from $B$.

Ans: (a) (i) 92.0 m (3sf) (ii) 1 480 $m^2$ (3sf) (iii) 32.3 m
(b) 12.0 m (3sf) (c) 20.4° (1dp) (d) 060.2° (1dp)

**Solutions**

1.(a)(i) In $\Delta ABD$,

$$BD = \sqrt{43^2 + 32^2 - 2(43)(32)\cos 110°}$$
$$= 61.759$$
$$= 61.8\,\text{m}\ (3\,\text{sf})$$

(ii) In $\Delta BCD$,

$$\frac{\sin \angle BDC}{18} = \frac{\sin 53°}{61.759}$$
$$\sin \angle BDC = \frac{18\sin 53°}{61.759}$$
$$\angle BDC = 13.460°$$
$$= 13.5°\ (1\,\text{dp})$$

(iii) $\text{Area of } \Delta ABD = \frac{1}{2}(43)(32)\sin 110°$
$$= 646.509$$
$$= 647\ \text{m}^2\ (3\,\text{sf})$$

(iv) $\angle NAB = 360° - 110° - 128°$ ($\angle$s at a pt)
$$= 122°$$

Bearing of $A$ from $B = 180° - 122°$ (int $\angle$s, // lines)
$$= 058°$$

(b) In $\Delta TBA$,

$$\tan \angle TBA = \frac{70}{43}$$
$$\angle TBA = 58.438$$
$$= 58.4°\ (1\,\text{dp})$$

$\therefore$ angle of elevation is 58.4°

2.(a)(i) In $\Delta ABC$,

$$BC = \sqrt{65^2 + 48^2 - 2(65)(48)\cos 108°}$$
$$= 91.963$$
$$= 92.0\,\text{m}\ (3\,\text{sf})$$

(ii) $\text{Area of } \Delta ABC = \frac{1}{2}(65)(48)\sin 108°$
$$= 1483.648$$
$$= 1480\ \text{m}^2\ (3\,\text{sf})$$

(iii) Let the shortest distance be $AD$.

$$\text{Area of } \Delta ABC = 1483.648\,\text{m}^2$$

$$\frac{1}{2} \times 91.963 \times AD = 1483.648$$

$$AD = \frac{1483.648}{\frac{1}{2} \times 91.963}$$

$$= 32.266$$

$$= 32.3\,\text{m}\,(3\,\text{sf})$$

$\therefore$ shortest distance is 32.3 m

(b) In $\Delta XAC$,

$$\tan 14° = \frac{XA}{48}$$

$$XA = 48 \tan 14°$$

$$= 11.968$$

$$= 12.0\,\text{m}\,(3\,\text{sf})$$

$\therefore$ height of the tower is 12.0 m

(c) In $\Delta XAD$,

$$\tan \angle XDA = \frac{11.968}{32.266}$$

$$\angle XDA = 20.35$$

$$= 20.4°\,(1\,\text{dp})$$

$\therefore$ greatest angle of elevation is 20.4°

(d) In $\Delta ABC$,

$$\frac{\sin \angle ABC}{48} = \frac{\sin 108°}{91.963}$$

$$\sin \angle ABC = \frac{48 \sin 108°}{91.963}$$

$$\angle ABC = 29.762°$$

$$\text{Bearing of } A \text{ from } B = 90° - 29.762°$$

$$= 060.2°\,(1\,\text{dp})$$