

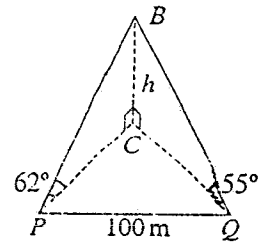
## Exercise 2H

1. A balloon  $B$  is due north of an observer  $P$  and its angle of elevation is  $62^\circ$ . From another observer  $Q$  100 metres from  $P$ , the balloon is due west and its angle of elevation is  $55^\circ$ . Let the height of the balloon be  $h$  metres and let  $C$  be the point on the level ground vertically below  $B$ .

- (a) Show that  $PC = h \cot 62^\circ$ , and write down a similar expression for  $QC$ .  
 (b) Explain why  $\angle PCQ = 90^\circ$ .  
 (c) Use Pythagoras' theorem in  $\triangle CPQ$  to show that

$$h^2 = \frac{100^2}{\cot^2 62^\circ + \cot^2 55^\circ}.$$

- (d) Hence find  $h$ , correct to the nearest metre.



2. From a point  $P$  due south of a vertical tower, the angle of elevation of the top of the tower is  $20^\circ$ . From a point  $Q$  situated 40 metres from  $P$  and due east of the tower, the angle of elevation is  $35^\circ$ . Let  $h$  metres be the height of the tower.

- (a) Draw a diagram to represent the situation.

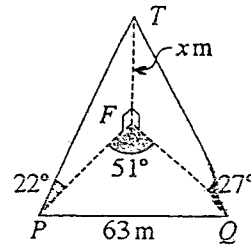
- (b) Show that  $h = \frac{40}{\sqrt{\tan^2 70^\circ + \tan^2 55^\circ}}$ , and evaluate  $h$ , correct to the nearest metre.

3. In the diagram,  $TF$  represents a vertical tower of height  $x$  metres standing on level ground. From  $P$  and  $Q$  at ground level, the angles of elevation of  $T$  are  $22^\circ$  and  $27^\circ$  respectively.  $PQ = 63$  metres and  $\angle PFQ = 51^\circ$ .

- (a) Show that  $PF = x \cot 22^\circ$  and write down a similar expression for  $QF$ .

- (b) Use the cosine rule to show that  $x^2 = \frac{63^2}{\cot^2 22^\circ + \cot^2 27^\circ - 2 \cot 22^\circ \cot 27^\circ \cos 51^\circ}$ .

- (c) Use a calculator to show that  $x \doteq 32$ .

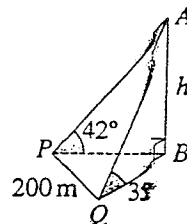


4. The points  $P$ ,  $Q$  and  $B$  lie in a horizontal plane. From  $P$ , which is due west of  $B$ , the angle of elevation of the top of a tower  $AB$  of height  $h$  metres is  $42^\circ$ . From  $Q$ , which is on a bearing of  $196^\circ$  from the tower, the angle of elevation of the top of the tower is  $35^\circ$ . The distance  $PQ$  is 200 metres.

- (a) Explain why  $\angle PBQ = 74^\circ$ .

- (b) Show that  $h^2 = \frac{200^2}{\cot^2 42^\circ + \cot^2 35^\circ - 2 \cot 35^\circ \cot 42^\circ \cos 74^\circ}$ .

- (c) Hence find the height of the tower, correct to the nearest metre.



### DEVELOPMENT

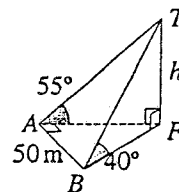
5. The diagram shows a tower of height  $h$  metres standing on level ground. The angles of elevation of the top  $T$  of the tower from two points  $A$  and  $B$  on the ground nearby are  $55^\circ$  and  $40^\circ$  respectively. The distance  $AB$  is 50 metres and the interval  $AB$  is perpendicular to the interval  $AF$ , where  $F$  is the foot of the tower.

- (a) Find  $AT$  and  $BT$  in terms of  $h$ .

- (b) What is the size of  $\angle BAT$ ?

- (c) Use Pythagoras' theorem in  $\triangle BAT$  to show that  $h = \frac{50 \sin 55^\circ \sin 40^\circ}{\sqrt{\sin^2 55^\circ - \sin^2 40^\circ}}$ .

- (d) Hence find the height of the tower, correct to the nearest metre.



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1(a)  $h \cot 55^\circ$

(b) It is the angle between south and east.

(d) 114 metres

2(b) 13 metres

3(a)  $x \cot 27^\circ$

4(c) 129 metres

5(a)  $AT = h \operatorname{cosec} 55^\circ$ ,  $BT = h \operatorname{cosec} 40^\circ$

(d) 52 metres

(b)  $90^\circ$