N5 Trig - Bearings

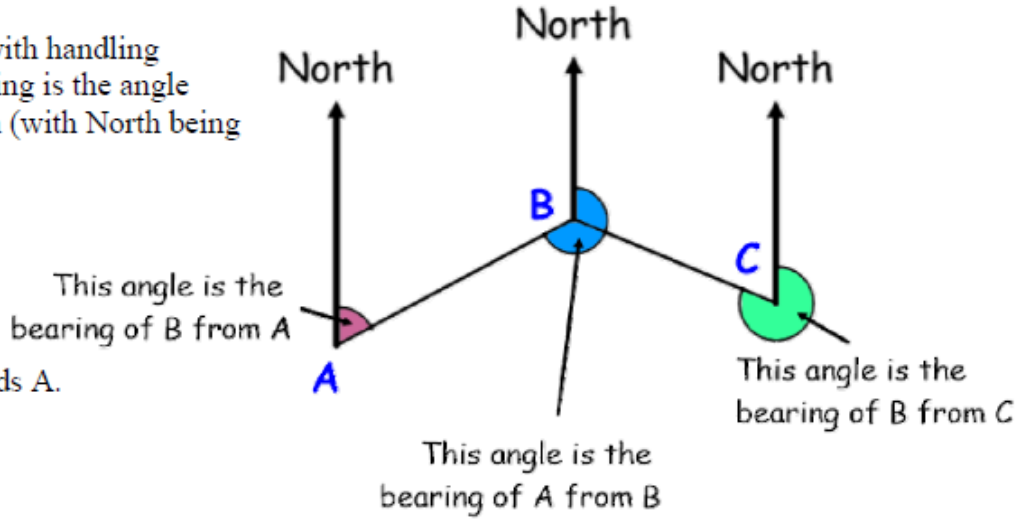
Applications

SPTA Mathematics – Topic Questions with Notes

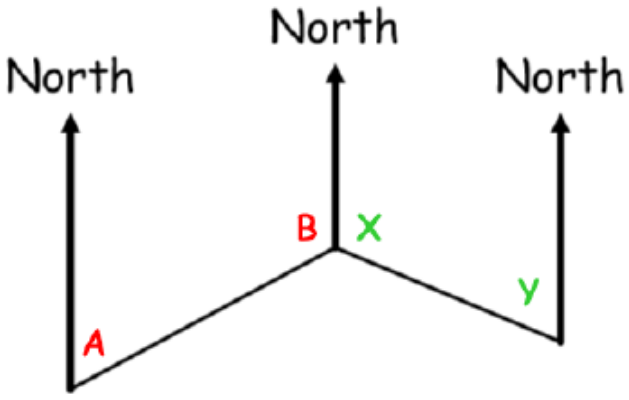
Bearings

You also need to be confident with handling bearings in diagrams. The bearing is the angle measured clockwise from North (with North being 000°)

When describing bearings, it is important to go the correct way. The bearing of A **from** B refers to the angle that is centred at B and pointing towards A.



Fact
In a diagram involving bearings, some angles add to make 180°. In the diagram below, A and B add to make 180°, and so do X and Y.

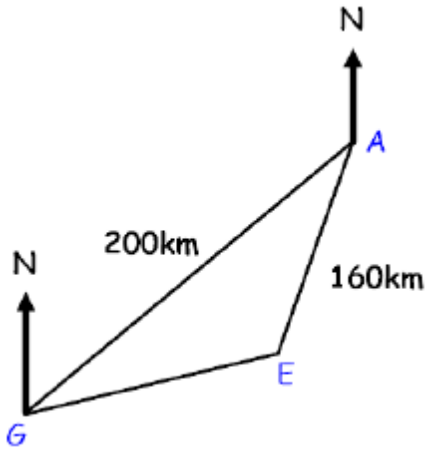


Example (past SQA Standard Grade Credit question)

The diagram shows the position of airports A, E and G.

- **G is 200 kilometres from A**
- **E is 160 kilometres from A**
- **From G the bearing of A is 052°**
- **From A the bearing of E is 216°**

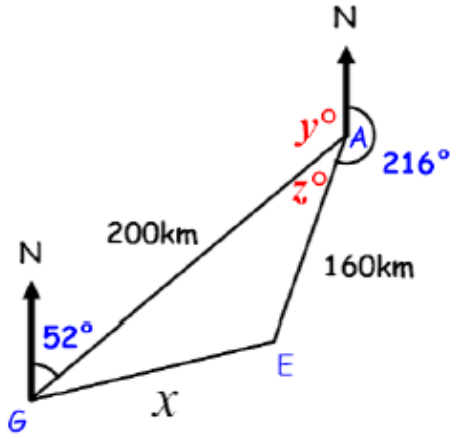
How far apart are airports G and E?



Solution

Step one – put the information from the question into the diagram

We begin by adding the angles to the diagram.
Also since the distance we are being asked to find is GE, we can label that side as x.



Step two – use the rules of angles to fill in the other angles in the diagram

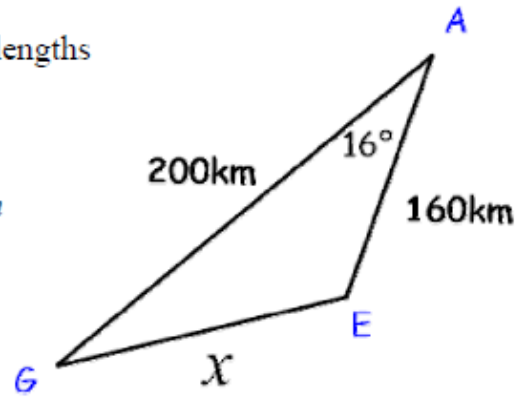
The angle marked y and 52° add to make 180°, so $52 + y = 180$

$$y = 180 - 52$$
$$= 128°$$

The angle marked 216°, along with the angles called y and z add up to make 360°. Therefore $216 + y + z = 360$

$$216 + 128 + z = 360$$
$$z = 360 - 216 - 128$$
$$= 16°$$

Step three – sketch triangle AEG, showing the angles and lengths



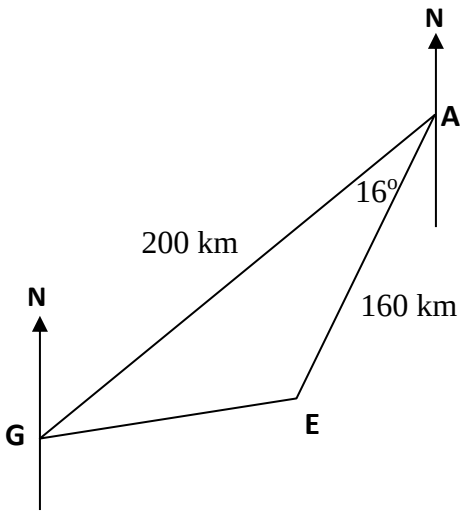
Step four – use the sine rule or cosine rule to solve for x

In this triangle, we have two sides and the angle in between, so we choose the cosine rule:

$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$= 200^2 + 160^2 - 2 \times 200 \times 160 \times \cos 16$$
$$= 4079 \cdot 251...$$
$$a = \sqrt{4079 \cdot 251...}$$
$$= \underline{63 \cdot 9\text{km}} \text{ (1 d.p.)}$$

Exercise 1

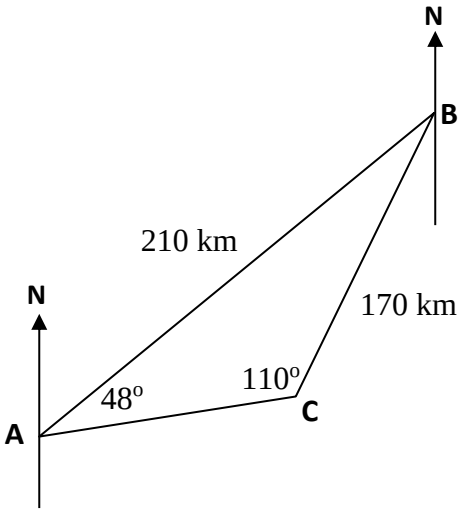
1.



The diagram shows the path of an aircraft from Glasgow to Aberdeen, a distance of 200 km and then from Aberdeen to Edinburgh, a distance of 160 km.

Calculate the distance from Glasgow to Edinburgh.

2.



The diagram shows the path of an aircraft from A to B to C.

(a) Write down the size of ∠ABC.

(b) Calculate the distance AC.

3. **a)** Copy the bearing diagram opposite fill in as many angles as you can.

b) Now answer the following questions …..

What is the bearing of … **(i)** B from A

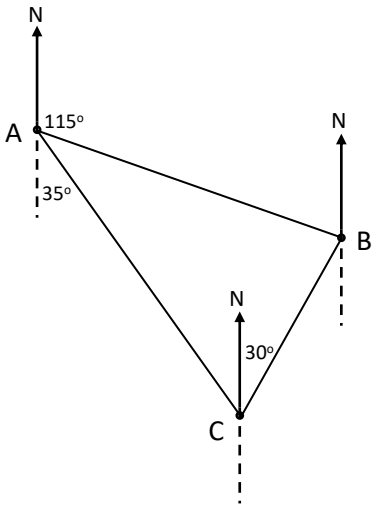
(ii) A from B

(iii) C from B

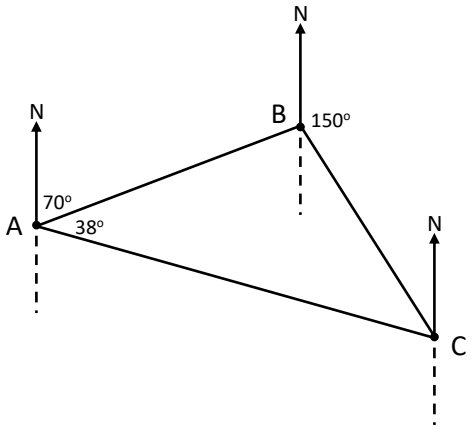
(iv) A from C

(v) C from A

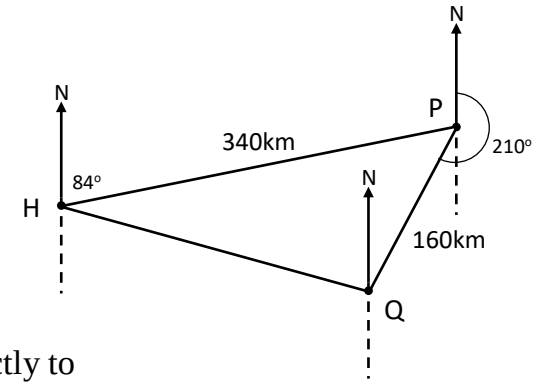
(vi) B from C



4. Repeat question 1. for this bearing diagram.



5. A ship sails from harbour H on a bearing of 084° for 340km until it reaches point P. It then sails on a bearing of 210° for 160km until it reaches point Q.



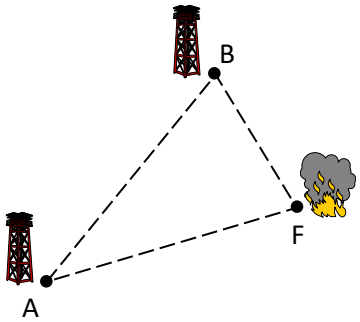
(a) Calculate the distance between point Q and the harbour.

(b) On what bearing must the ship sail to return directly to the harbour from Q?

6. A and B represent two forest look-out towers.

A is 5km and on a bearing of 220° from B.

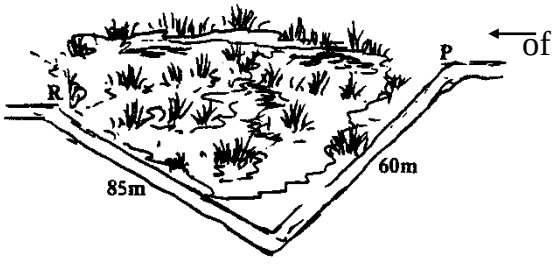
A forest fire is sighted at F, on a bearing of 070° from A and 150° from B.



A fire-fighting helicopter leaves A for F. What distance does this helicopter have to travel to reach the fire?

7. A surveyor is walking due west when he comes to a marsh. To avoid the marsh he turns at P and walks for 60 metres on a bearing of 215° and then for 85 290°.

He then calculates the distance PR, the direct distance across the marsh. What answer should he get?



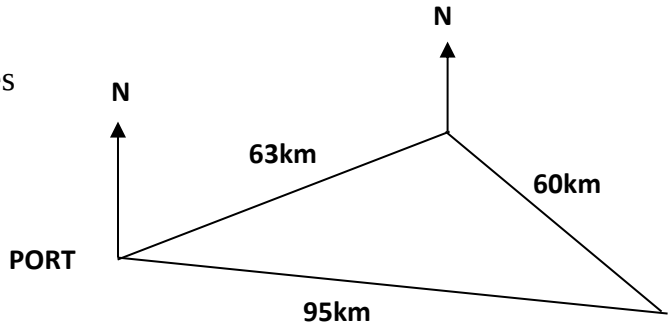
8. Two ships leave Liverpool at the same time. One of them travels north-west at an average speed of 10·5 km/h while the other travels at an average speed of 14 km/h on a bearing of 280°.

How far apart are these ships after 2 hours?

9. A ship leaves a port on a bearing of 073° and sails 63km. The ship then changes course and sails a further 60km on a bearing of 110° where it anchors.

When it anchors it is 95km from the port.

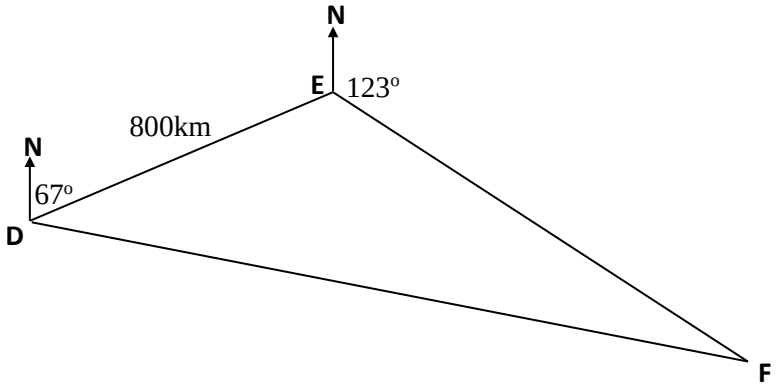
Calculate the bearing of the ship from the port at this point.



10. A ship's captain is plotting a course for the next voyage.

He knows that he has to sail from Port D to port E on a bearing of 067° for a distance of 800km and from there to Port F on a bearing of 123°.

His course is shown in the diagram below.

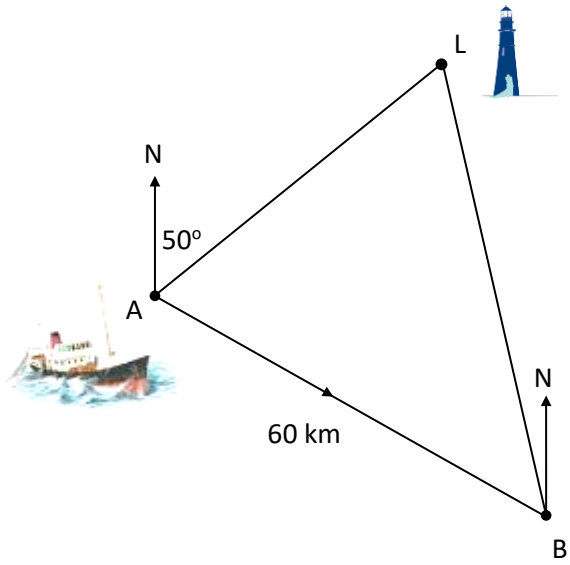


(a) Make a copy of the diagram and calculate the size of angle DEF.

(b) New instructions come through which inform the captain that he has to sail directly from Port D to Port F, a distance of 1750km.

Calculate the bearing on which the ship should sail in order to carry out these instructions. Give the bearing to the nearest degree.

11. A ship is at position A. Lighthouse L is on a bearing of 050° from the ship.



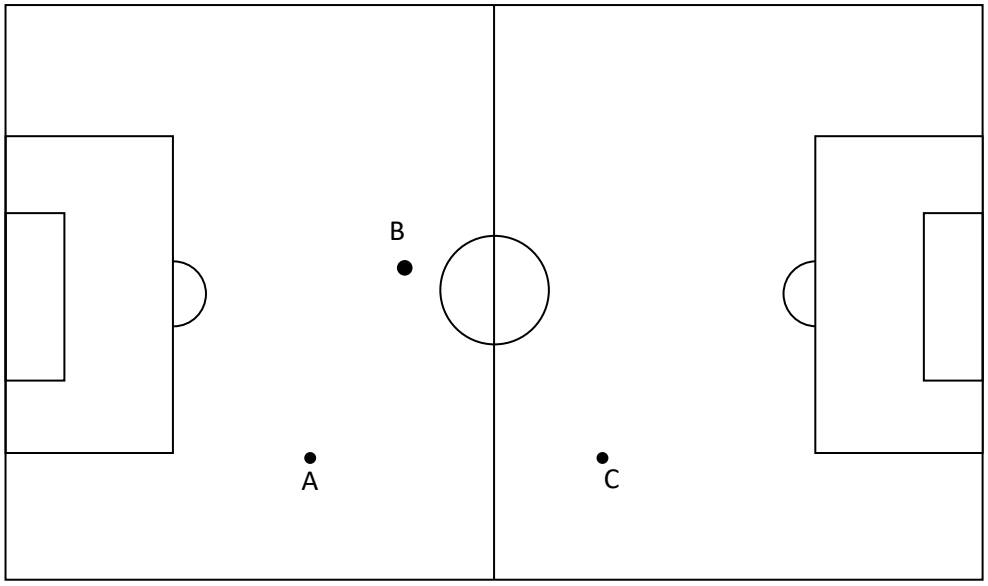
The ship then travels 60 kilometres on a bearing of 130° to position B.

From position B the captain now observes the lighthouse on a bearing of 340°.

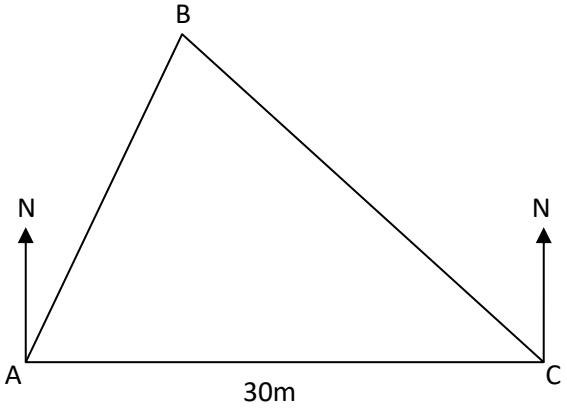
Calculate the distance between the ship and the lighthouse when the ship is at position B.

12. Two students, Ally and Cameron are playing football and at one point they are in the positions shown in the diagram. Ally (A) is 30m due west of Cameron (C).

They are both facing North.



The ball (B) is on a bearing of 026° from A and on a bearing of 312° from C.



(a) Make a copy of the above diagram and mark the sizes of the 3 angles in the triangle.

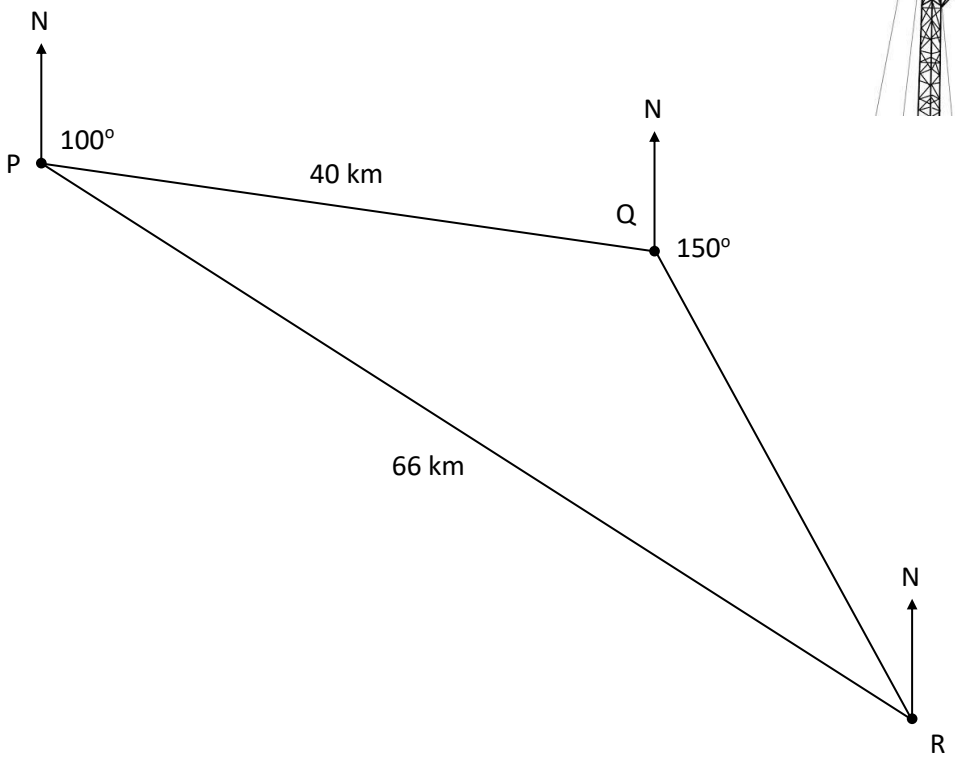
(b) Calculate how far Cameron is away from the ball.

13. The diagram below, which is not drawn to scale, represents the positions of three mobile phone masts.

Mast Q is on a bearing of 100° from mast P and is 40km away.

The bearing of mast R from mast Q is 150°.

Masts P and R are 66km apart.



(a) Use the information in the diagram to establish the size of angle PQR.

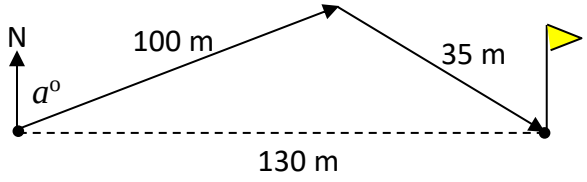
(b) Hence find the bearing of mast P **from** mast R.

14. A par 3 hole on a golf course the tee is a distance of 130 metres due west from the pin.

On his first shot, Bruce hits the ball 100 metres but not at the correct angle.

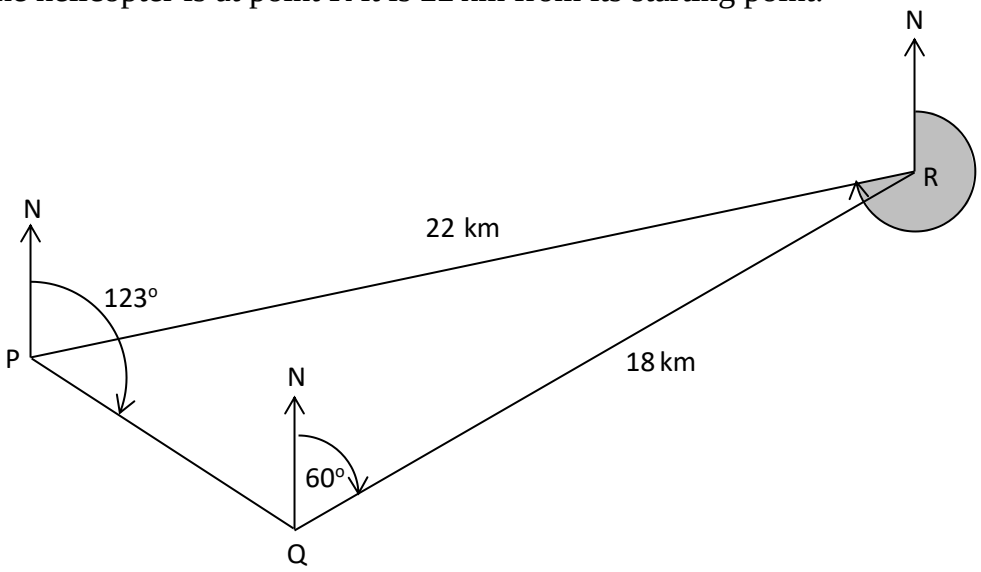
On his second shot he hits the ball 35 metres and gets it in the hole.

On what bearing, a^o, did he hit his first stroke?



15. A helicopter sets out from its base P and flies on a bearing of 123° to point Q where it changes course to 060° and flies 18 km to point R.

When the helicopter is at point R it is 22 km from its starting point.



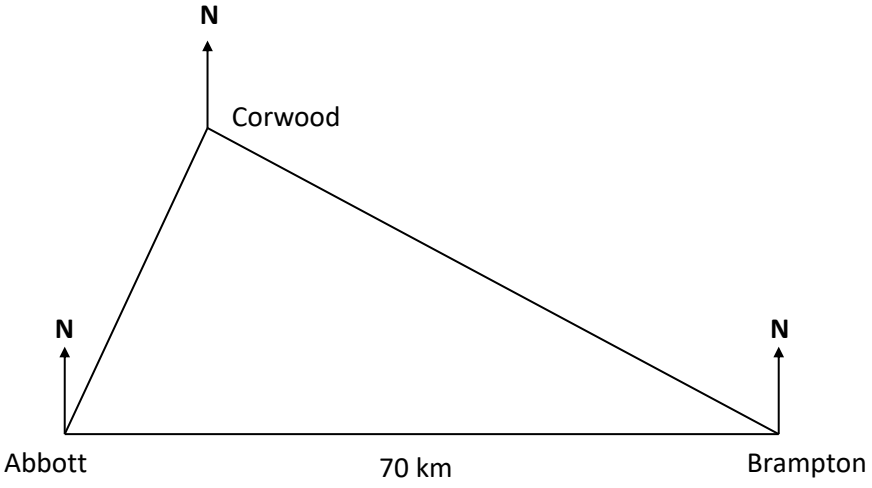
(a) Find the size of angle PQR.

(b) Calculate the bearing on which the helicopter must fly to return directly to its base i.e. the shaded angle in the diagram.

Give answers to the nearest whole number throughout your calculations.

16. Brampton is 70 kilometres due east of Abbott.

The bearing of Corwood from Abbott is 015° and from Brampton is 290°.



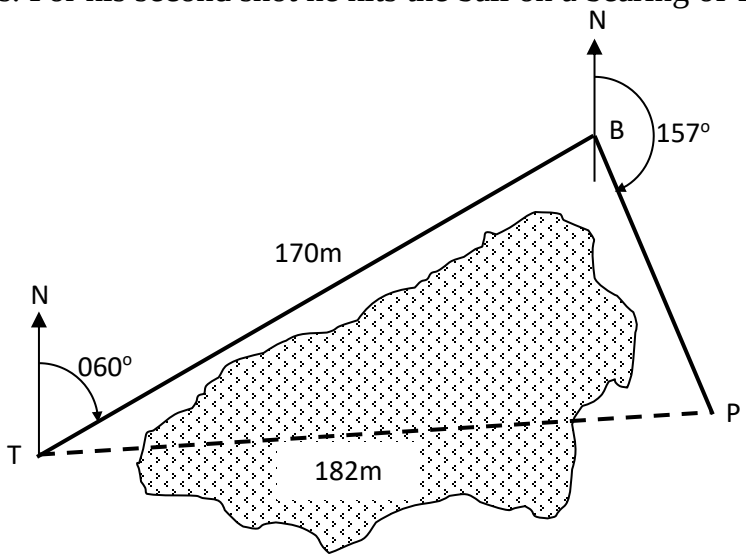
(a) Make a neat copy of the diagram and fill in all three angles inside the triangle.

(b) Calculate the distance between Corwood and Brampton, to the nearest kilometre.

17. The diagram shows part of a golf course where players have to get the ball from the tee (T) to the pin(P).

They can either play one stroke across the lake or play 1 stroke from T to B then another from B to P which avoids the lake.

Harry decides to take the 2 stroke option and hits his first shot on a bearing of 060° or a distance of 170metres. For his second shot he hits the ball on a bearing of 157° from B to P.

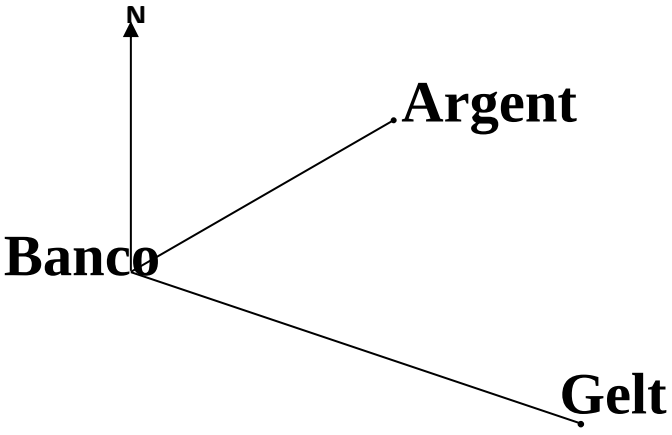


(a) Calculate the size of angle TBP.

The distance TP is 182 metres. David decided to attempt to hit his ball across the lake.

(b) Calculate the bearing on which he would have to hit the ball to achieve this.

18.



Two ships, the Argent and the Gelt leave port Banco at the same time.

The Argent follows a course of 045° for 20 km and the Gelt travels on a course of 108° for 30 km.

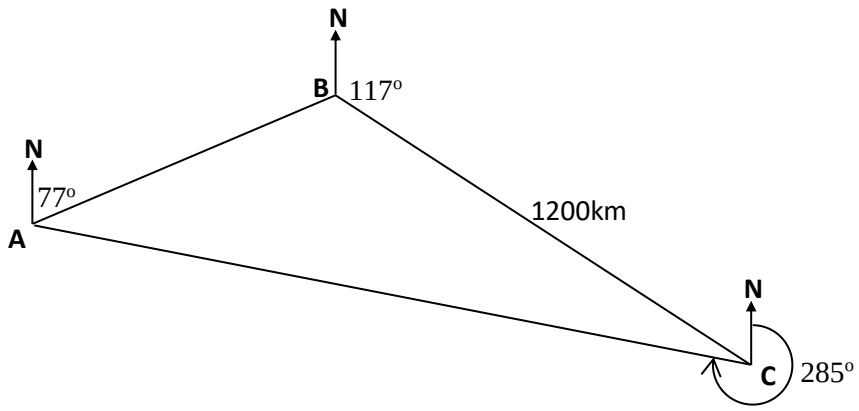
Calculate the distance between the two ships.

19. A ship's mate is planning the course for a voyage.

The course is shown in the diagram below.

He knows that he has to sail from Port A to Port B on a bearing of 077° and from there to Port C on a bearing of 117° for 1200 km.

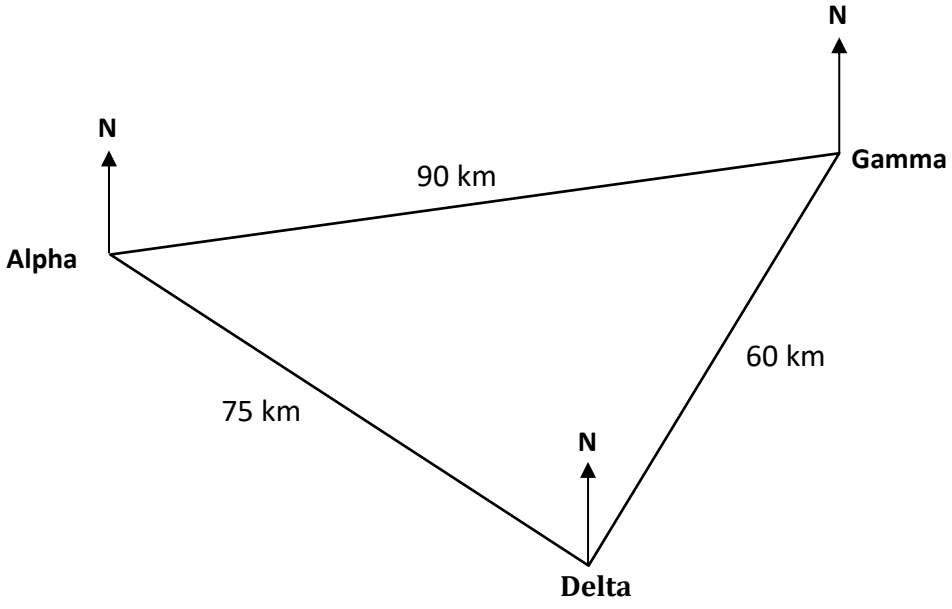
In order to return to port A the ship has to sail on a bearing of 285°.



Calculate how far the ship will have to sail to return to its starting point. i.e. the distance AC in the diagram.

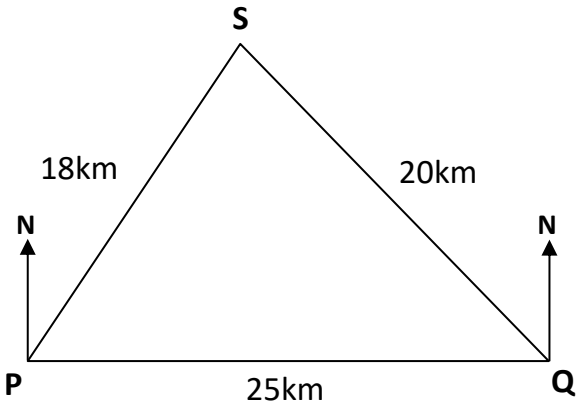
20. Three oil platforms, Alpha, Gamma and Delta are situated in the North Sea as shown in the diagram below.

The distances between the oil platforms are shown in the diagram.



If the bearing of Delta from Alpha is 125°, what is the bearing of Gamma from Alpha?

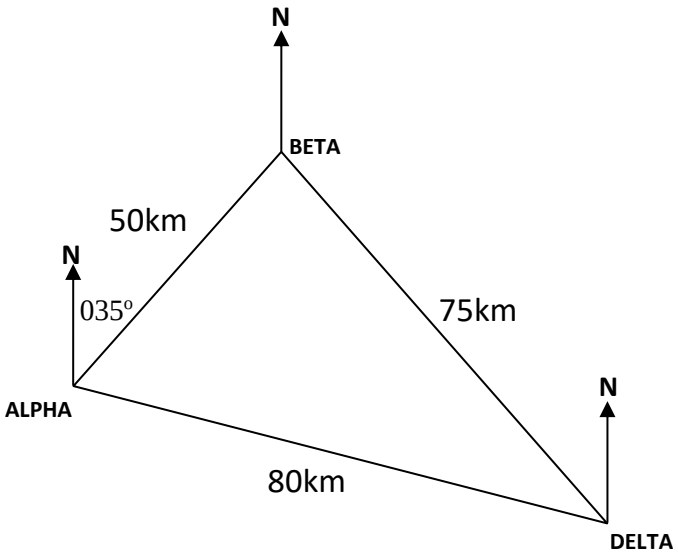
21. Two coastguard stations, P and Q, are 25 km apart. Q is due East of P. A ship, S, is at a distance of 18 km from P and 20 km from Q.



(a) Calculate the size of angle SPQ.

(b) Hence calculate the bearing of the ship S from station P.

22. The diagram below shows the positions of three radar stations Alpha, Beta and Delta. The bearing of Beta from Alpha is 035°.



Calculate the bearing of Delta from Alpha.

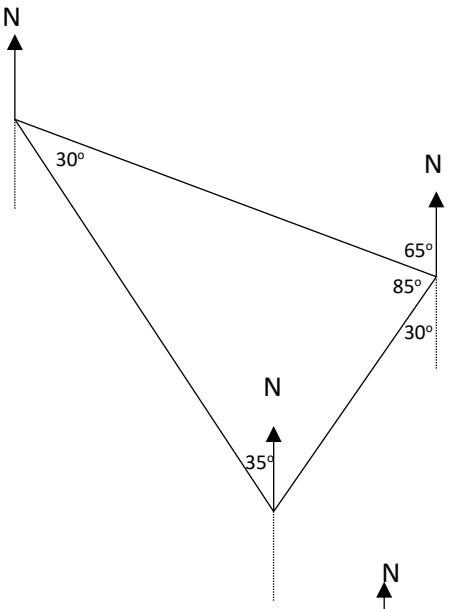
Answers

Exercise 1

1. 63·9km

2. **a)** 22^o **(b)** 82·5km

3. **(a)**



(b) **(i)** 115^o

(ii) 295^o

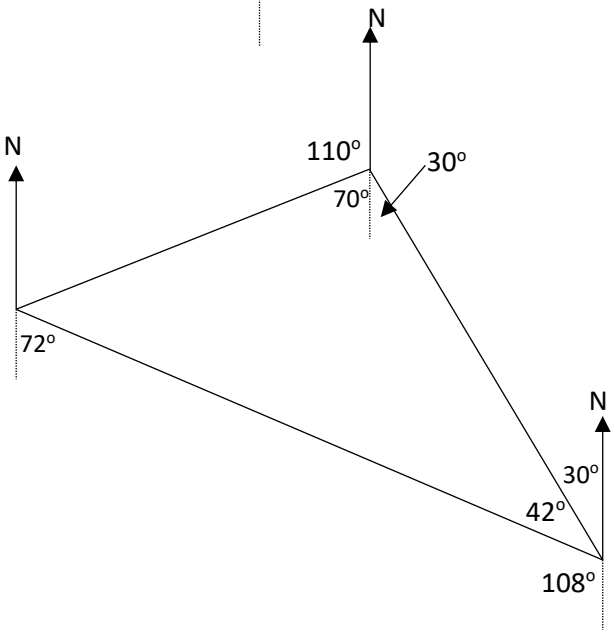
(iii) 210^o

(iv) 325^o

(v) 145^o

(vi) 030^o

4. **(a)**



(i) 070^o

(ii) 250^o

(iii) 150^o

(iv) 288^o

(v) 108^o

(vi) 330

5. **(a)** 278km **(b)** 292^o

6. 4·77km

7. 116·0m

8. 16·2km

9. 249^o

10. **(a)** 124^o **(b)** 101^o

11. 62·9km

12. **(a)** A: 64^o B: 74^o C: 42^o **(b)** 28m

13. **(a)** 130^o **(b)** 302^o

14. 081^o

15. **(a)** 117^o **(b)** 256^o

16. **(a)** Abbott: 75^o Brampton: 20^o Corwood: 85^o **(b)** 68km

17. **(a)** 83^o **(b)** 089^o

18. 27·5km

19. 1 643km

20. 084^o

21. **(a)** 52^o **(b)** 038^o

22. 101^o