

Teaching Examples

(3B10A001)

Teaching Example 10.1

Kelvin is walking down a steep road with a road sign indicating '1 : 6'.

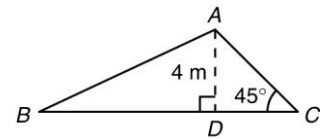
- Find the inclination of the road, correct to the nearest 0.01° .
- If Kelvin walks down a vertical distance of 10 m, what is the horizontal distance he has travelled?

(3B10A002)

Teaching Example 10.2

The figure shows a path AB of gradient $\frac{1}{8}$ and a staircase AC of inclination 45° .

If point A is 4 m above the horizontal ground BDC , find the distance between B and C .

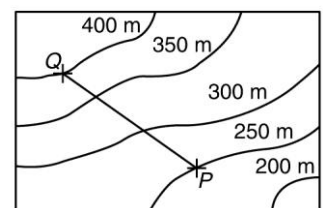


(3B10A003)

Teaching Example 10.3

In the figure, the scale of the contour map is 1 : 20 000. PQ is a straight road, where P is on the contour line 250 m and Q is on the contour line 400 m. PQ is measured to be 1.5 cm on the map.

- Find the gradient of road PQ in the form 1 : n .
- Find the inclination of road PQ , correct to the nearest 0.01° .

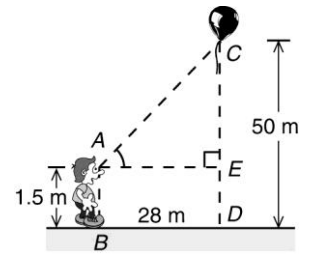


scale 1 : 20 000

(3B10A004)

Teaching Example 10.4

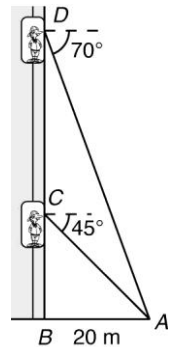
In the figure, Raymond's eye level is 1.5 m above the ground. A balloon C is fixed at 50 m vertically above the ground. If the horizontal distance BD between Raymond and the balloon is 28 m, find the angle of elevation of the balloon C from his eye at A correct to 3 significant figures.



(3B10A005)

Teaching Example 10.5

In the figure, a tourist is travelling upwards from B to D via C in a sightseeing lift. The angle of depression of a point A on the ground from C is 45° , while that of A from D is 70° . If $AB = 20$ m, find the vertical distance between C and D . (Give your answer correct to the nearest 0.1 m.)



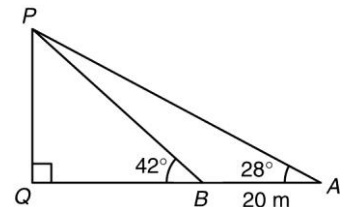
(3B10A006)

Teaching Example 10.6

In the figure, PQ is a vertical flagpole. Nicole measures the angle of elevation of P from A to be 28° . Then she walks 20 m towards Q and arrives at B , where she measures the angle of elevation of P from B to be 42° .

- (a) Find the height of the flagpole PQ .
- (b) Find the horizontal distance QB .

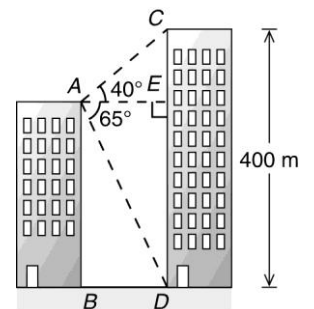
(Give your answers correct to 3 significant figures.)



(3B10A007)

Teaching Example 10.7

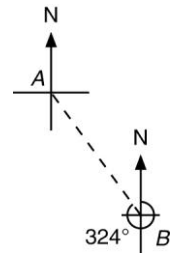
The figure shows two buildings AB and CD . Kelvin measures the angle of elevation of C from A to be 40° , and the angle of depression of D from A to be 65° . If C is 400 m above the horizontal ground, find the horizontal distance between the two buildings, correct to the nearest 0.1 m.



(3B10A008)

Teaching Example 10.8

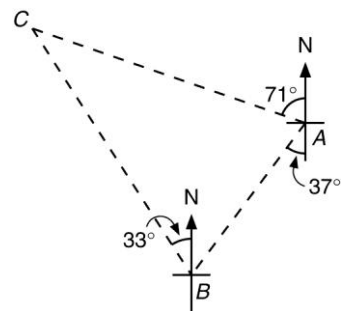
In the figure, the true bearing of A from B is 324° . Find the true bearing of B from A .



(3B10A009)

Teaching Example 10.9

In the figure, the compass bearings of B and C from A are $S37^\circ W$ and $N71^\circ W$ respectively, while the compass bearing of C from B is $N33^\circ W$. Find all interior angles of $\triangle ABC$.

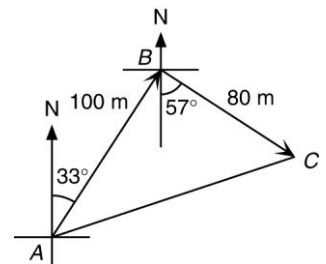


(3B10A010)

Teaching Example 10.10

In the figure, Cherie runs for 100 m from A to B at a bearing of $N33^\circ E$. Then she runs for 80 m to C at a bearing of $S57^\circ E$.

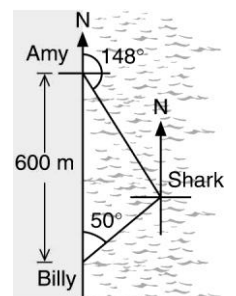
- (a) Find the distance between A and C .
 - (b) Find the compass bearing of C from A .
- (Give your answers correct to 3 significant figures.)



(3B10A011)

Teaching Example 10.11

In the figure, Amy and Billy are 600 m apart on a shore extending from north to south. Amy measures the bearing of a shark to be 148° . At the same moment, Billy measures the bearing of the shark to be 050° . Find the distance from the shark to the shore.
(Give your answer correct to the nearest m.)

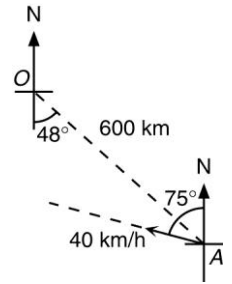


(3B10A012)

Teaching Example 10.12

At noon, a typhoon at point A is 600 km from the observatory O , its compass bearing from observatory O was $S48^\circ E$. If the typhoon keeps moving in the direction of $N75^\circ W$ at a speed of 40 km/h,

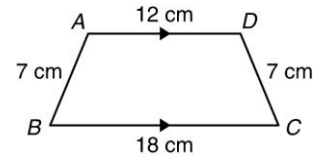
- (a) find the shortest distance between the track of the typhoon and observatory O ,
(Give your answer correct to 1 decimal place.)
- (b) determine whether the typhoon is approaching or leaving the observatory O at 11 p.m. that day.



(3B10A013)

Teaching Example 10.13

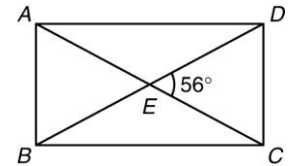
In the figure, $ABCD$ is an isosceles trapezium where $AD \parallel BC$, $AB = CD = 7$ cm, $AD = 12$ cm and $BC = 18$ cm. Find $\angle DAB$ correct to the nearest 0.1° .



(3B10A014)

Teaching Example 10.14

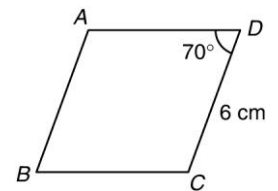
In the figure, $ABCD$ is a rectangle. If $AC = 14$ cm and $\angle CED = 56^\circ$, find the area of rectangle $ABCD$ correct to 3 significant figures.



(3B10A015)

Teaching Example 10.15

In the figure, $ABCD$ is a rhombus with $CD = 6$ cm and $\angle CDA = 70^\circ$. Find the lengths of diagonals AC and BD correct to 3 significant figures.

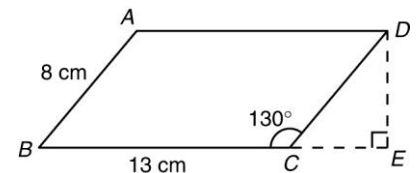


(3B10A016)

Teaching Example 10.16

In the figure, $ABCD$ is a parallelogram, $AB = 8$ cm, $BC = 13$ cm and $\angle BCD = 130^\circ$. E is a point on BC produced such that $DE \perp BE$.

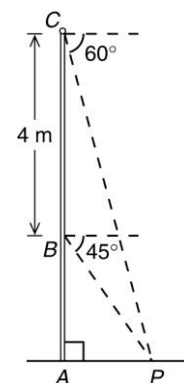
- (a) Find the lengths of CE and DE .
 - (b) Hence, find the length of BD .
- (Give your answers correct to 3 significant figures.)



(3B10A017)

Teaching Example 10.6 (Extra)

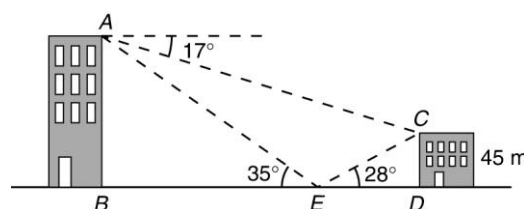
As shown in the figure, AC is a vertical flagpole. The angle of depression of P from B is 45° and that of P from C is 60° . If the distance between C and B is 4 m, find the length of AP in surd form.



(3B10A018)

Teaching Example 10.7 (Extra)

The figure shows two buildings AB and CD . E is a point on horizontal ground between the two buildings, where BED is a straight line. The angles of elevation of A and C from E are 35° and 28° respectively. The angle of depression of C from A is 17° . If the height of building CD is 45 m, find the height of building AB correct to the nearest 0.1 m.



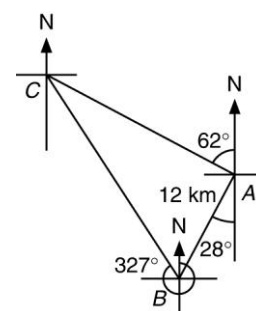
(Hint: Drop a perpendicular from C to AB and meet AB at F . Let $AF = x$ m.)

(3B10A019)

Teaching Example 10.10 (Extra)

In the figure, the compass bearing of B from A is $S28^\circ W$ and that of C from A is $N62^\circ W$. The true bearing of C from B is 327° . If $BA = 12$ km, find

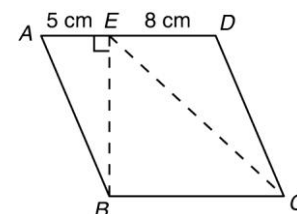
- (a) the compass bearing of B from C ,
- (b) the distance CA correct to 1 decimal place.



(3B10A020)

Teaching Example 10.16 (Extra)

In the figure, $ABCD$ is a rhombus. E is a point on AD such that $BE \perp AD$. If $AE = 5$ cm and $ED = 8$ cm, find $\angle ECD$ correct to the nearest 0.1° .

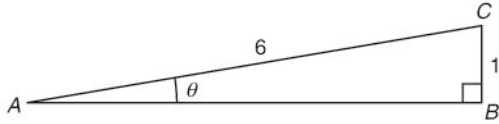


Pre-study Questions

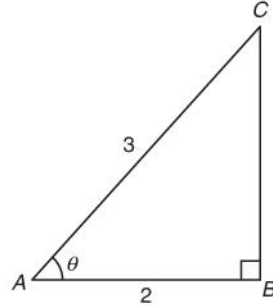
(3B10B001)

In the following figures, find θ correct to 3 significant figures.

(a)



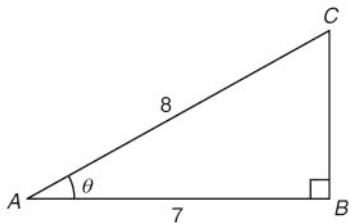
(b)



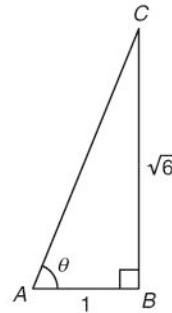
(3B10B002)

In the following figures, find θ correct to 3 significant figures.

(a)



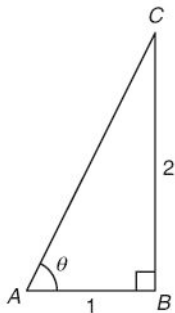
(b)



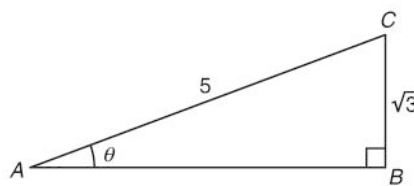
(3B10B003)

In the following figures, find θ correct to the nearest degree.

(a)



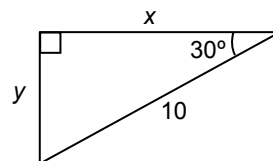
(b)



(3B10B004)

Find the values of x and y in the figure.

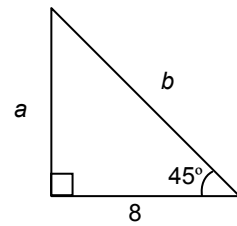
(Leave your answers in surd form if necessary.)



(3B10B005)

Find the values of a and b in the figure.

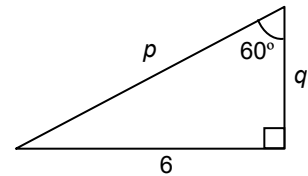
(Leave your answers in surd form if necessary.)



(3B10B006)

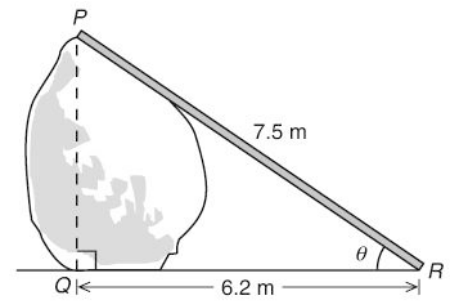
Find the values of p and q in the figure.

(Leave your answers in surd form.)



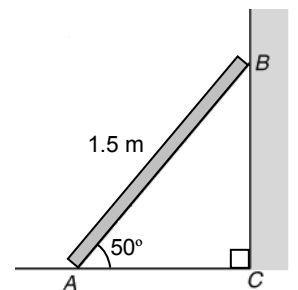
(3B10B007)

The figure shows a wooden board leaning against a stone. Find θ correct to 3 significant figures.



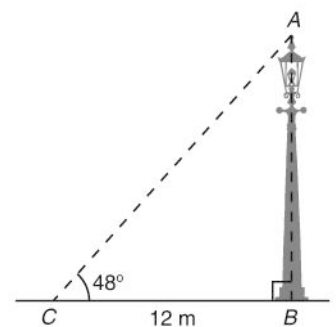
(3B10B008)

In the figure, a rectangular block AB of length 1.5 m leans against a wall at an angle of 50° with the horizontal ground. Find the vertical distance between B and the ground. (Give your answer correct to 3 significant figures.)



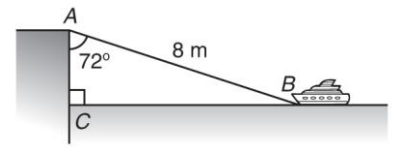
(3B10B009)

Find the height of the lamp post as shown in the figure. (Give your answer correct to 3 significant figures.)



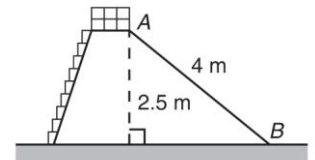
(3B10B010)

In the figure, a rope of length 8 m is attached to a boat at B and the edge of the dock at A . If AB makes an angle of 72° with the vertical AC , find the height of A above the water level. (Give your answer correct to 3 significant figures.)



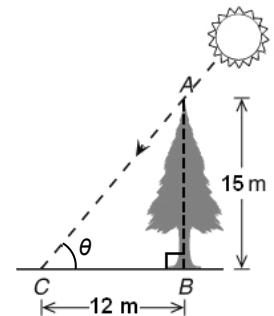
(3B10B011)

The figure shows a slide AB of length 4 m. If A is 2.5 m above the ground, find the angle that AB makes with the horizontal ground. (Give your answer correct to 3 significant figures.)



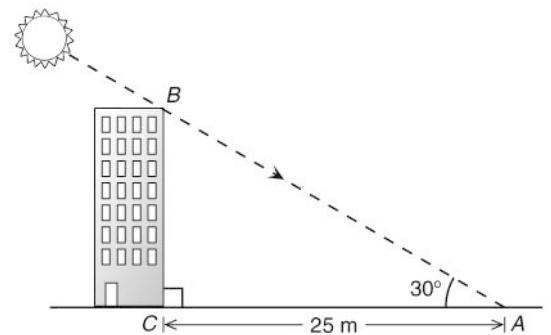
(3B10B012)

The figure shows a tree of height 15 m. When the sun ray makes an angle θ with the horizontal ground, the tree casts a shadow of 12 m long on the ground. Find θ correct to 3 significant figures.



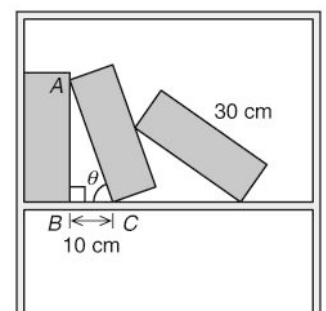
(3B10B013)

In the figure, a building casts a shadow of 25 m long on the ground when the sun ray makes an angle of 30° with the horizontal ground. Find the height of the building. (Give your answer correct to the nearest m.)



(3B10B014)

The figure shows three identical books of length 30 cm leaning against one another on a bookshelf. Find θ correct to the nearest degree.



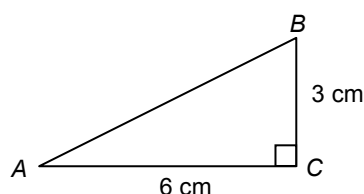
Level 1 Questions

§10.1 Gradients

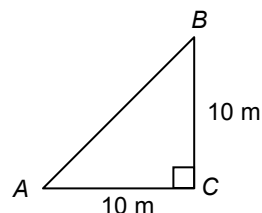
(3B10C001)

Find the gradients of the following inclined planes in the form $1 : n$.

(a)



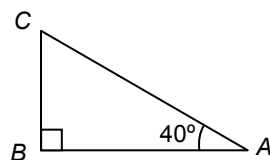
(b)



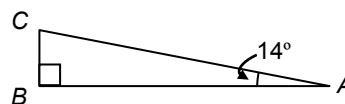
(3B10C002)

Find the gradients of the following inclined planes in decimal. (Give your answers correct to 3 significant figures.)

(a)



(b)



(3B10C003)

On an inclined road with a gradient of $\frac{1}{5}$, when the change in vertical distance is 20 m, what is the corresponding change in horizontal distance?

(3B10C004)

On an inclined road with a gradient of $1 : 3$, when the change in horizontal distance is 45 m, what is the corresponding change in vertical distance?

(3B10C005)

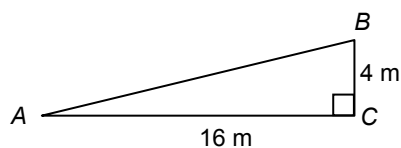
In each of the following, find the inclination of a straight road with the given gradient. (Give your answers correct to 3 significant figures.)

- (a) $1 : 12$ (b) 0.15 (c) $\frac{1}{9}$

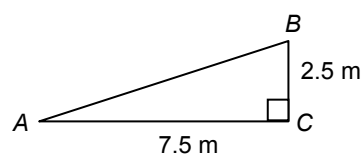
(3B10C006)

Find the inclinations of the following inclined road AB . (Give your answers correct to 3 significant figures.)

(a)



(b)



(3B10C007)

Lily is walking along an inclined path with a road sign indicating '1 : 9'. If she travelled a vertical distance of 100 m, what is the horizontal distance she has travelled?

(3B10C008)

The gradient of a straight road is 1 : 13.

(a) Find the inclination of the road.

(b) If a man walks along the road with a horizontal distance of 2000 m, what is the actual distance he has travelled?

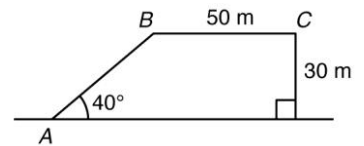
(Give your answers correct to 3 significant figures.)

(3B10C009)

The gradient of a straight road is $\frac{1}{25}$. If a car travels 5 km along the road, what is the vertical distance it has travelled? (Give your answer correct to 3 significant figures.)

(3B10C010)

In the figure, Maggie walks up an inclined road AB with inclination 40° , then she walks along a horizontal road BC for 50 m. The vertical distance she has travelled is 30 m.



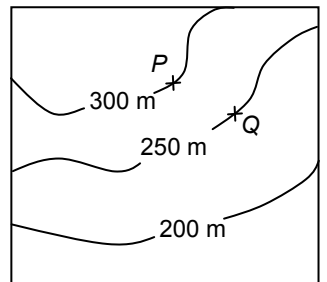
(a) Find the gradient of the road AB .

(b) Find the total horizontal distance Maggie has travelled.

(Give your answers correct to 3 significant figures.)

(3B10C011)

The figure shows a part of a contour map. If the horizontal distance between P and Q is 250 m, find the gradient of road PQ in fraction.

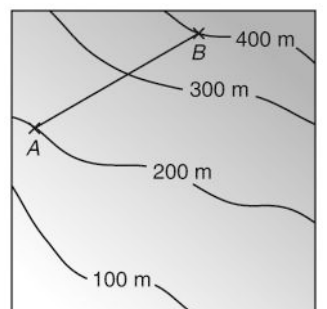


(3B10C012)

The figure shows a part of a contour map. The map is drawn to the scale 1 : 15 000 and the length of AB is measured to be 2.5 cm on the map.

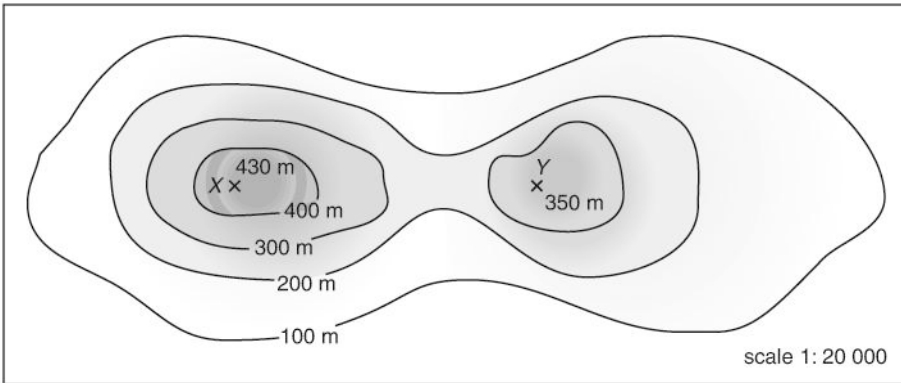
(a) Find the gradient of road AB in the form 1 : n .

(b) Find the distance between A and B .



(3B10C013)

The figure shows the contour map of two mountains. X and Y are the peaks of the mountains. The length of XY is measured to be 4 cm on the map.

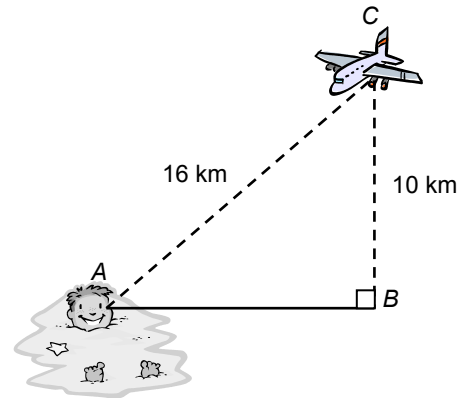


- (a) Find the horizontal distance between X and Y .
 - (b) Find the inclination of the bridge joining X and Y .
- (Give your answers correct to 3 significant figures if necessary.)

§10.2 Angles of Elevation and Depression

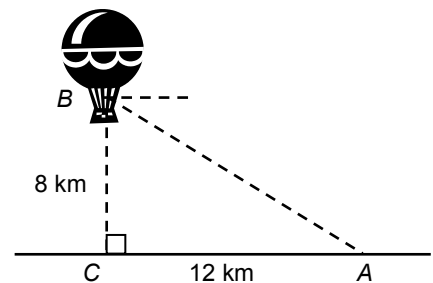
(3B10C014)

The figure shows a boy covered with sand. At a certain moment, an aeroplane which is 10 km above ground level passed by. If the distance between the boy and the aeroplane is 16 km, find the angle of elevation of the aeroplane from the boy, correct to 3 significant figures.



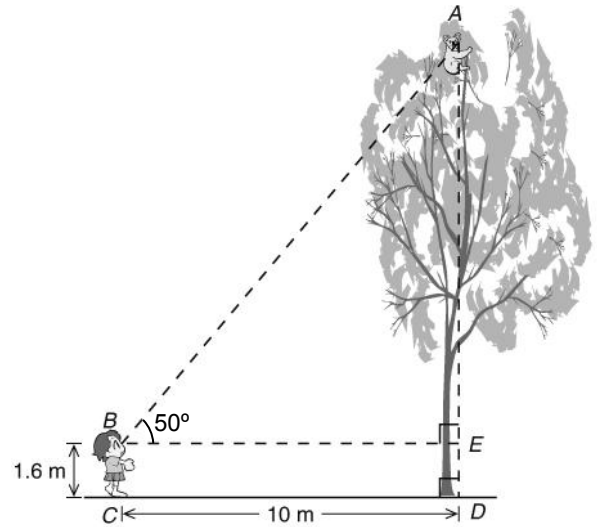
(3B10C015)

In the figure, a hot-air balloon B is 8 km vertically above C on the ground. If the horizontal distance between A and C is 12 km, find the angle of depression of A from B , correct to 3 significant figures.



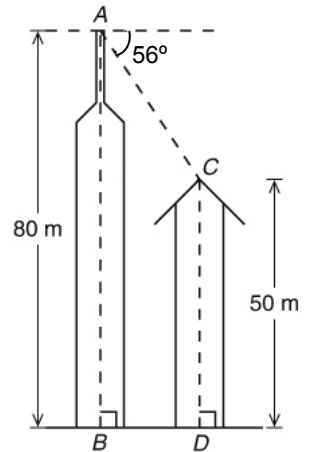
(3B10C016)

In the figure, Gigi is looking at a koala on the top of a tree. The angle of elevation of the koala from her eye level is 50° . If Gigi is 10 m away from the tree and her eye level is 1.6 m above the ground, find the height of the tree, correct to 3 significant figures.



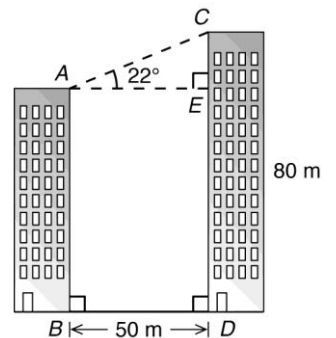
(3B10C017)

The figure shows two buildings AB and CD . The heights of buildings AB and CD are 80 m and 50 m respectively. If the angle of depression of C from A is 56° , find the horizontal distance between the two buildings, correct to 3 significant figures.



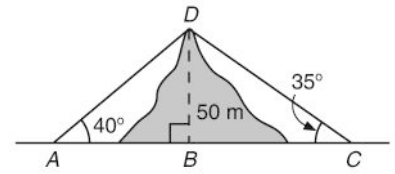
(3B10C018)

In the figure, AB and CD are two buildings which are 50 m apart. The angle of elevation of C from A is 22° . The height of building CD is 80 m. Find the height of building AB , correct to 3 significant figures.



(3B10C019)

In the figure, A , B and C are three points on the horizontal ground. The angles of elevation of the top of a hill D from A and C are 40° and 35° respectively. If the height of the hill is 50 m, find the distance between A and C , correct to 3 significant figures.

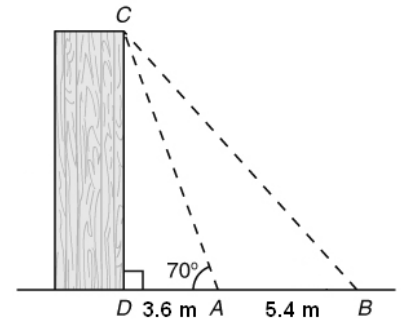


(3B10C020)

The figure shows a pillar. A and B are two points on the horizontal ground. It is given that the angle of elevation of the top C of the pillar from A is 70° , $AD = 3.6$ m and $AB = 5.4$ m. Find

- (a) the height of the pillar,
- (b) the angle of elevation of C from B .

(Give your answers correct to 3 significant figures.)

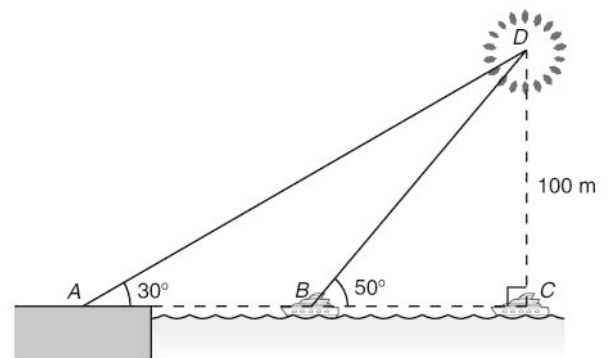


(3B10C021)

In a firework display above the Victoria Harbour, the angle of elevation from point A in Tsim Sha Tsui is 30° and the angle of elevation from point B on a boat is 50° . The firework is 100 m vertically above point C on another boat, and points A , B and C lie on a straight line. Find

- (a) the distance between A and C ,
- (b) the distance between A and B .

(Give your answers correct to 3 significant figures.)

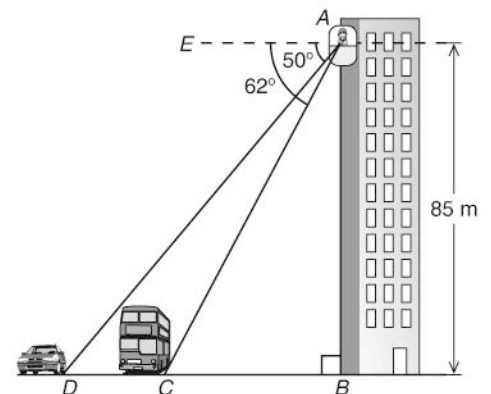


(3B10C022)

In the figure, a woman is inside an elevator of a building which is 85 m above the ground. The angles of depression of bus C and car D from the woman are 62° and 50° respectively. Find

- (a) the distance between the bus and the building,
- (b) the distance between the bus and the car.

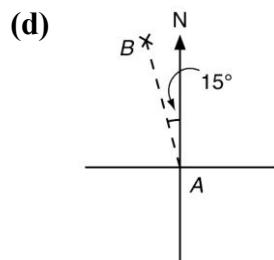
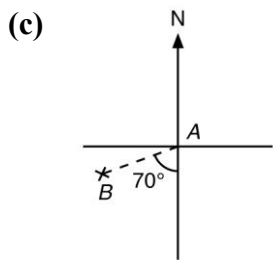
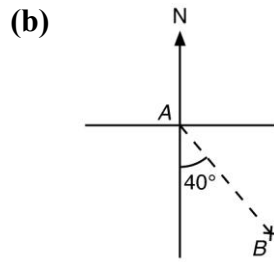
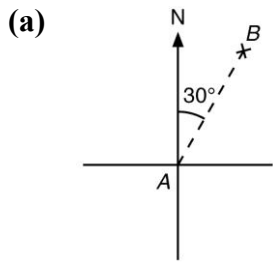
(Give your answers correct to 3 significant figures.)



§10.3 Bearings

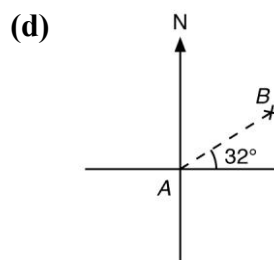
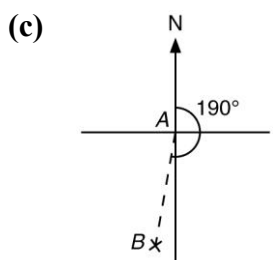
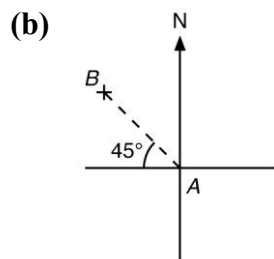
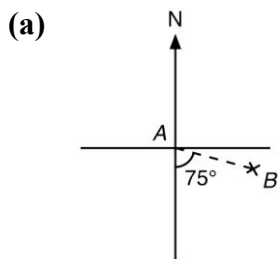
(3B10C023)

Find the true bearing of B from A in each of the following.



(3B10C024)

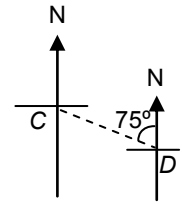
Find the compass bearing of B from A in each of the following.



(3B10C025)

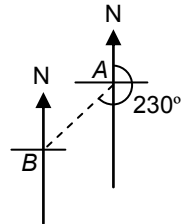
Refer to the figure. Find

- (a) the compass bearing of D from C ,
- (b) the true bearing of C from D .



(3B10C026)

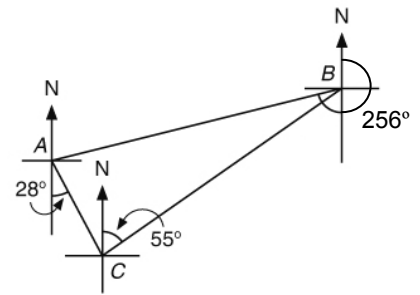
If the true bearing of B from A is 230° , find the true bearing of A from B .



(3B10C027)

In the figure, A , B and C are three mountains. Find the compass bearings of

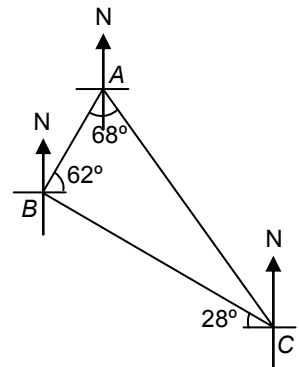
- (a) B from C ,
- (b) A from C ,
- (c) A from B .



(3B10C028)

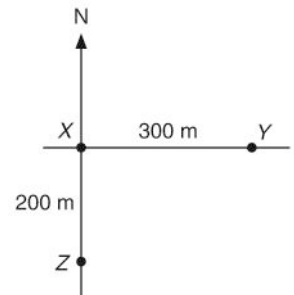
The figure shows three islands A , B and C . Find the true bearings of

- (a) C from B ,
- (b) B from A ,
- (c) A from C .



(3B10C029)

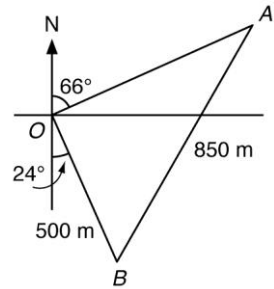
If Y is 300 m due east of X and Z is 200 m due south of X , find the true bearing of Z from Y . (Give your answer correct to 3 significant figures.)



(3B10C030)

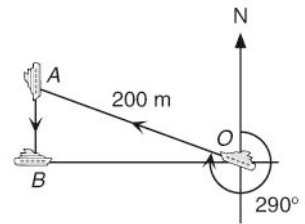
In the figure, Peter walks away from O in the direction $N66^\circ E$ to point A , while Rosa walks 500 m away from O in the direction $S24^\circ E$ to point B .

If A and B are 850 m apart, find the distance Peter has walked, correct to 3 significant figures.



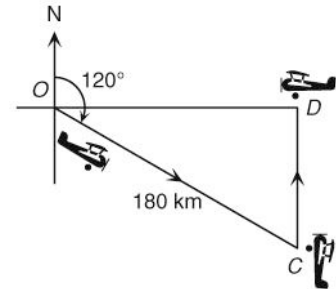
(3B10C031)

In the figure, a boat at O travels in the direction 290° for 200 m to point A and then travels due south to point B , which is due west of O . Find the distance between B and O , correct to 3 significant figures.



(3B10C032)

In the figure, an aeroplane at O travels in the direction 120° for 180 km to C and then travels due north to D , which is due east of O . How far does the aeroplane travel from C to D ?

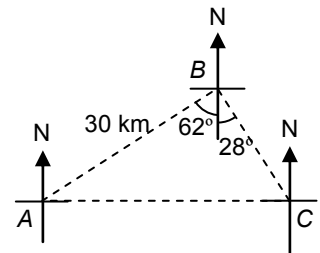


(3B10C033)

In the figure, C is due east of A . The compass bearings of A and C from B are $S62^\circ W$ and $S28^\circ E$ respectively. If the distance between A and B is 30 km, find

- (a) the distance between A and C ,
- (b) the distance between B and C .

(Give your answers correct to 3 significant figures.)



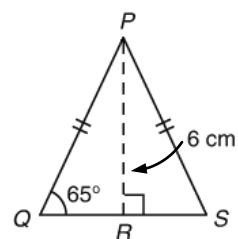
§10.4 Applications of Trigonometry to Rectilinear Figures

(3B10C034)

In the figure, $\triangle PQS$ is an isosceles triangle. Find

- (a) the length of QS ,
- (b) the area of $\triangle PQS$.

(Give your answers correct to 3 significant figures.)



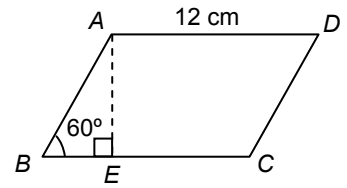
(3B10C035)

In the figure, $ABCD$ is a parallelogram of area 96 cm^2 . Find the lengths of

(a) AE ,

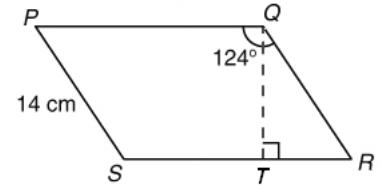
(b) AB .

(Give your answers correct to 3 significant figures if necessary.)



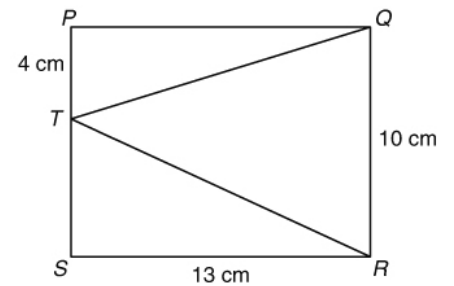
(3B10C036)

In the figure, $PQRS$ is a parallelogram. Find the length of QT , correct to 3 significant figures.



(3B10C037)

In the figure, $PQRS$ is a rectangle. Find $\angle QTR$, correct to 3 significant figures.



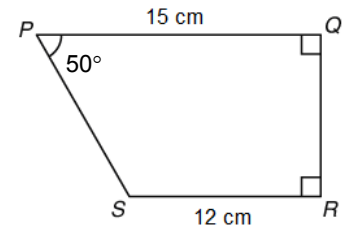
(3B10C038)

In the figure, $PQRS$ is a right-angled trapezium. Find

(a) the length of QR ,

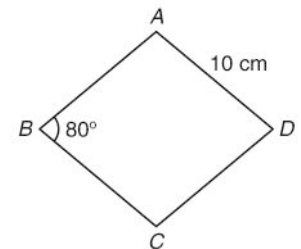
(b) the perimeter of trapezium $PQRS$.

(Give your answers correct to 3 significant figures.)



(3B10C039)

In the figure, $ABCD$ is a rhombus. Find the length of AC , correct to 3 significant figures.

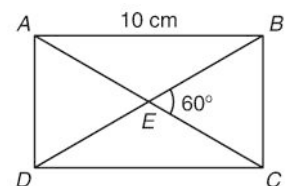


(3B10C040)

The figure shows a rectangle $ABCD$.

(a) Find $\angle ABD$.

(b) Find the length of AD . (Leave your answer in surd form.)



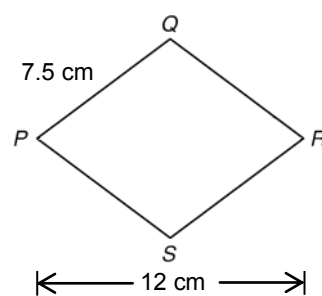
(3B10C041)

The figure shows a rhombus $PQRS$. Find

(a) the length of QS ,

(b) $\angle QPS$.

(Give your answers correct to 3 significant figures if necessary.)



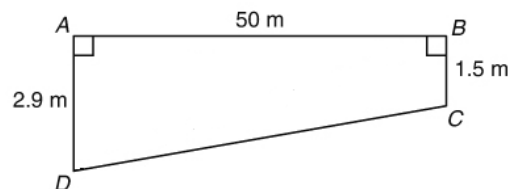
Level 2 Questions

§10.1 Gradients

(3B10D001)

The figure shows the vertical section of a swimming pool.

- (a) Find the gradient of the bottom of the pool in decimal.
- (b) A swimmer at B would like to dive to D through a straight path. At what angle should he dive below the water surface?



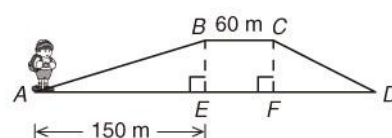
(Give your answers correct to 3 significant figures if necessary.)

(3B10D002)

In the figure, Thomas walks up a straight road AB , then he walks along a horizontal road BC , and finally walks down a straight road to D . It is given that the gradients of AB and CD are 0.3 and 0.5 respectively. Find

- (a) the maximum height that Thomas can reach,
- (b) the total distance that he travelled from A to D .

(Give your answers correct to 3 significant figures if necessary.)



(3B10D003)

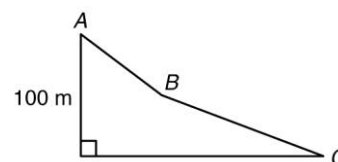
In the figure, Kelvin slides down the slope ABC with a skateboard. It is given that the gradients of slopes AB and BC

are $\frac{3}{4}$ and $\frac{3}{8}$ respectively and the vertical distance he has

travelled is 100 m.

- (a) Find the inclinations of slopes AB and BC .
- (b) If Kelvin travels half way down when he arrives B , what is the horizontal distance he has travelled from A to C ?

(Give your answers correct to 3 significant figures.)



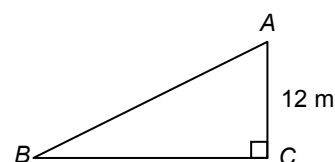
(3B10D004)

In the figure, Henry slides down a slide AB with a gradient of $\frac{1}{2}$ and falls

12 m vertically after 2.5 s.

- (a) Find the inclination of the slide.
- (b) Find the actual distance Henry has travelled.
- (c) Hence, find the average speed of Henry.

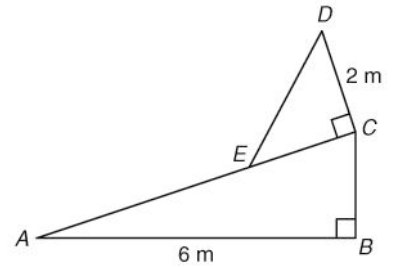
(Give your answers correct to 3 significant figures.)



(3B10D005)

In the figure, ABC and CDE are two triangular blocks. The gradient of AC is 1 : 3.

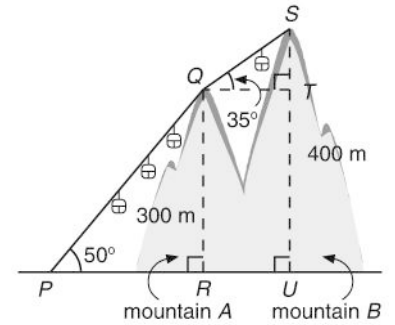
- (a) Find the inclination of AC .
 - (b) If a wooden board is put on AD , find the inclination of the board.
- (Give your answers correct to 3 significant figures.)



(3B10D006)

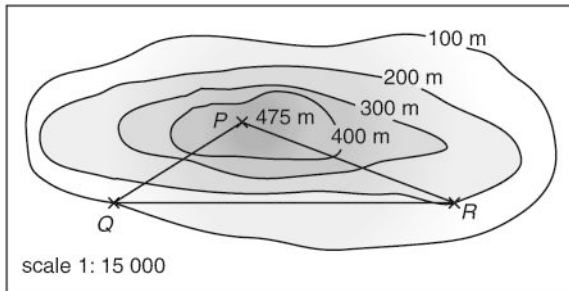
The figure shows a cable car system which takes tourists from the foot P to the peaks Q and S of mountains A and B respectively. The inclinations of PQ and QS are 50° and 35° respectively. The heights of mountains A and B are 300 m and 400 m respectively. The cable cars travel at an average speed of 3 m/s.

- (a) Find the difference in gradient between the cables PQ and QS in decimal.
 - (b) Find the total time taken for the cable car travels from P to S .
- (Give your answers correct to 3 significant figures.)



(3B10D007)

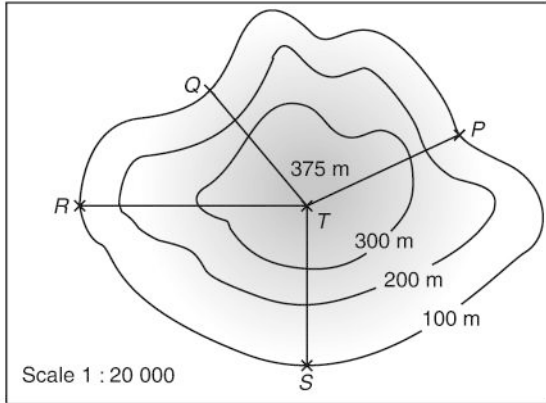
The figure shows the contour map of a hill. The lengths of roads PQ , PR and RQ are measured to be 2 cm, 3 cm and 4.5 cm respectively on the map.



- (a) Find the gradients of the following roads in decimal.
 - (i) PQ (ii) PR (iii) RQ
 - (b) Which road is the steepest?
- (Give your answers correct to 3 significant figures if necessary.)

(3B10D008)

The figure shows the contour map of a hill with a scale 1 : 20 000. T is the top of the hill and there are four straight roads reaching point T from points P , Q , R and S . The lengths of roads PT , QT , RT and ST are measured to be 2.2 cm, 2 cm, 3 cm and 2.1 cm respectively on the map.



- (a) Without calculating the gradients of the roads, determine which road is
- the least steep,
 - the steepest.

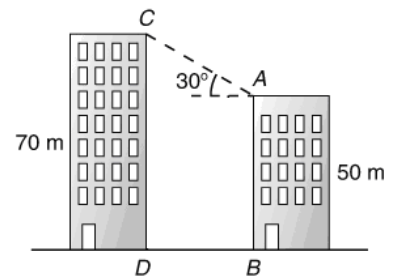
Explain your answers briefly.

- (b) Find the gradient of the road that is the least steep. (Give your answer in the form 1 : n .)
- (c) Find the inclination of the road that is the steepest.
(Give your answers correct to 3 significant figures if necessary.)

§10.2 Angles of Elevation and Depression

(3B10D009)

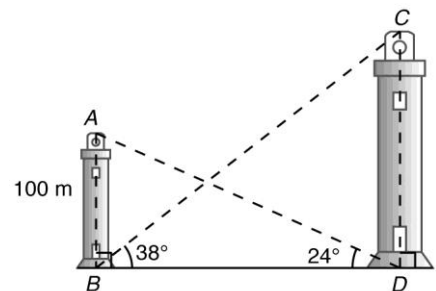
The figure shows two buildings AB and CD of heights 50 m and 70 m respectively. The angle of elevation of C from A is 30° . Find the angle of depression of D from A , correct to 3 significant figures.



(3B10D010)

The figure shows two towers AB and CD . The height of tower AB is 100 m. It is given that the angles of elevation of A from D , and of C from B are 24° and 38° respectively.

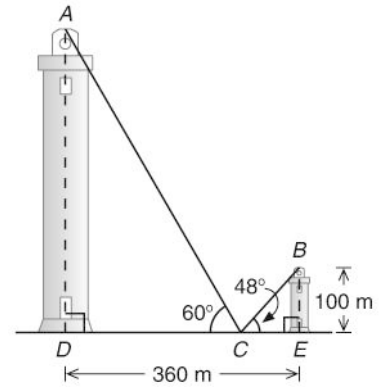
- (a) Find the height of tower CD .
- (b) Find the distance between A and C .
(Give your answers correct to 3 significant figures.)



(3B10D011)

In the figure, AD and BE are two towers. The angles of elevation of A and B from C are 60° and 48° respectively. If the horizontal distance between the two towers is 360 m and the height of tower BE is 100 m, find

- (a) the height of tower AD ,
 - (b) the angle of depression of B from A .
- (Give your answers correct to 3 significant figures.)

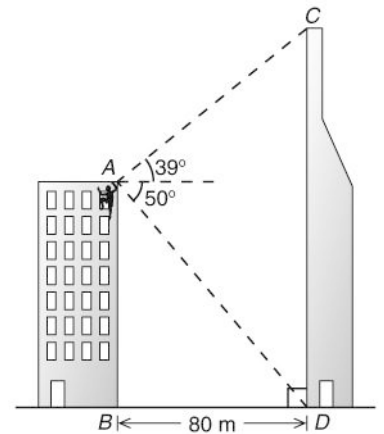


(3B10D012)

In the figure, Spiderman is at the top of building AB . He finds that the angle of elevation of C is 39° and the angle of depression of D is 50° . He wants to reach C by shooting his spider web to the top of the tower CD . The distance between the building and the tower is 80 m.

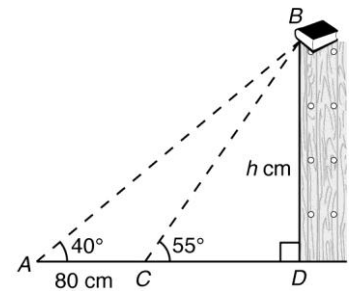
- (a) Find the height of the building AB .
- (b) Find the height of the tower CD .
- (c) Can Spiderman reach the top of the tower from A by shooting his spider web to point C if the maximum length of his spider web is 120 m?

(Give your answers correct to 3 significant figures if necessary.)



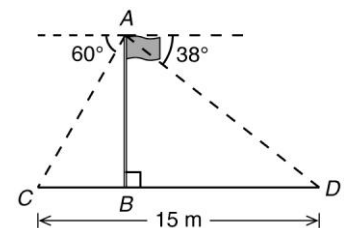
(3B10D013)

In the figure, A , C and D are points on the horizontal ground. A book B is put on a bookshelf of h cm high above D . The angles of elevation of B from A and C are 40° and 55° respectively. If the distance between A and C is 80 cm, find the value of h , correct to 3 significant figures.



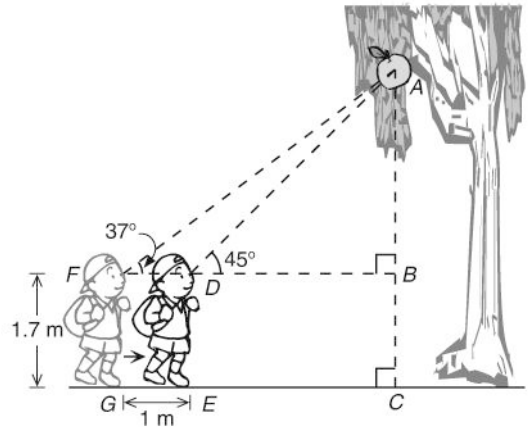
(3B10D014)

In the figure, AB is a vertical flagstaff. B , C and D are three points on the horizontal ground. The angles of depression of C and D from A are 60° and 38° respectively. Given that CD is 15 m apart, find the height of the flagstaff, correct to 3 significant figures.



(3B10D015)

The figure shows a boy looking at an apple on an apple tree with an angle of elevation 37° . He then walks 1 m towards the apple tree and finds that the angle of elevation becomes 45° . If his eye level is 1.7 m above the ground, find the height of the apple above the ground, correct to 3 significant figures.



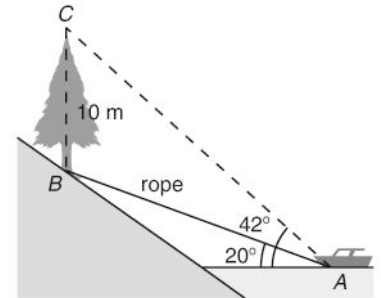
(3B10D016)

In the figure, a tree BC is planted on a slope next to a lake. A boat A in the lake is tied to the bottom of the tree by a rope. The height of the tree is 10 m. The angles of elevation of the top and bottom of the tree from the boat are 42° and 20° respectively.

(a) Find the horizontal distance between the boat and the tree.

(b) Find the length of the rope.

(Give your answers correct to 3 significant figures.)

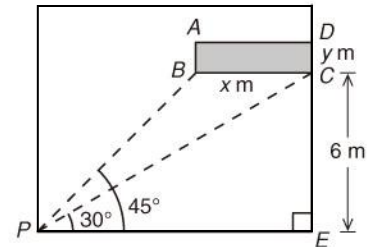


(3B10D017)

In the figure, a rectangular banner $ABCD$ of dimensions x m \times y m is hung on a wall. Suppose $CE = 6$ m and the angles of elevation of B and C from a point P on the ground are 45° and 30° respectively.

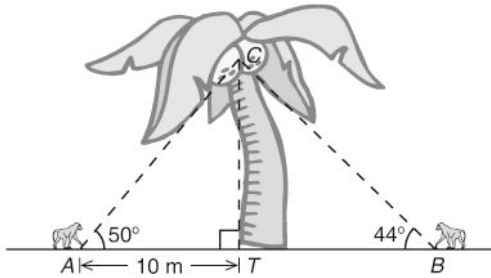
(a) Find x . (Leave your answer in surd form.)

(b) If the angle of elevation of A from P is 50° , find the height of the banner, correct to 3 significant figures.



(3B10D018)

Two monkeys A and B see a coconut on the top of a coconut tree. The angles of elevation of the coconut from monkeys A and B are 50° and 44° respectively. Monkey A is 10 m from the tree.

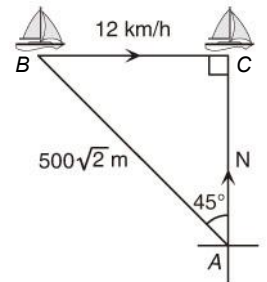


- (a) Find the distance between monkey B and the tree, correct to 3 significant figures.
- (b) It is given that the running speeds of monkeys A and B are 1.5 m/s and 2 m/s respectively, while their tree climbing speeds are 0.6 m/s and 0.55 m/s respectively. If both monkeys try to get the coconut at the same time, which monkey will get the coconut?

§10.3 Bearings

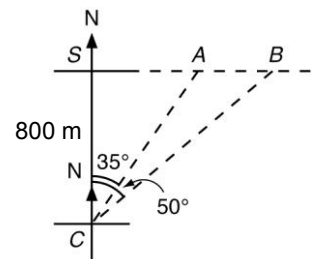
(3B10D019)

In the figure, a ship sails in the direction $N45^\circ W$ from pier A for $500\sqrt{2}$ m to B , and then sails to the east at 12 km/h. In how many minutes later will the ship due north of pier A ?



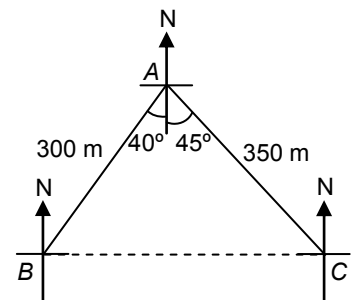
(3B10D020)

In the figure, buildings A and B are due east of a school S . A student leaves school S and walks 800 m due south to C . He finds that the true bearings of A and B from C are 035° and 050° respectively. Find the distance between A and B , correct to 3 significant figures.



(3B10D021)

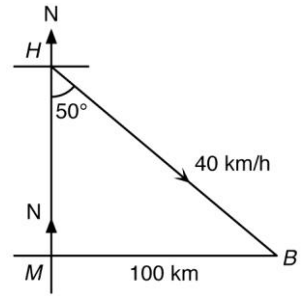
In the figure, Yammy walks away from A in the direction $S40^\circ W$ for 300 m to point B , while Fiona walks away from A in the direction $S45^\circ E$ for 350 m to point C , which is due east of B . What is the distance between B and C ? (Give your answer correct to 3 significant figures.)



(3B10D022)

At 1:00 p.m., a helicopter H is due north of a mountain M . H flies at a speed of 40 km/h in the direction $S50^\circ E$ to island B , which is 100 km due east of M . Suppose the helicopter flies at the same horizontal level.

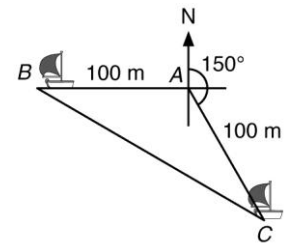
- Find the shortest distance between the helicopter and the mountain, correct to 3 significant figures.
- At what time will the helicopter be nearest to the mountain?
(Give your answer correct to the nearest minute.)



(3B10D023)

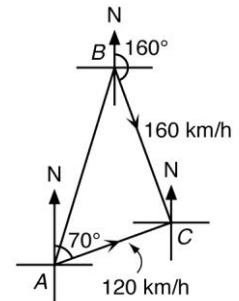
In the figure, two ships B and C leave island A at the same time. Ship B sails westwards 100 m, while ship C sails 100 m in the direction 150° .

- Find the compass bearing of C from B .
- What is the distance between ships B and C ?
(Give your answers correct to 3 significant figures.)



(3B10D024)

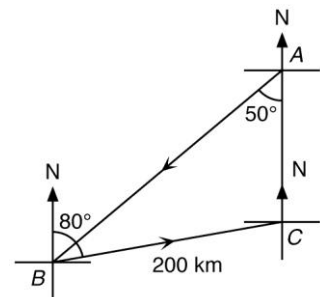
In the figure, the true bearings of city C from cities A and B are 070° and 160° respectively. A train travels at a speed of 120 km/h from city A to city C , while another train travels at a speed of 160 km/h from city B to city C . After 2 hours, the two trains arrive city C . Find the distance between the two cities A and B .



(3B10D025)

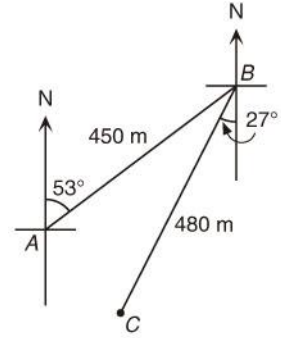
In the figure, a ship sails in the direction $S50^\circ W$ from island A to island B , and then sails in the direction $N80^\circ E$ for 200 km to island C , which is due south of A .

- What is the distance between A and C ?
- What is the distance between A and B ?
(Give your answers correct to 3 significant figures.)



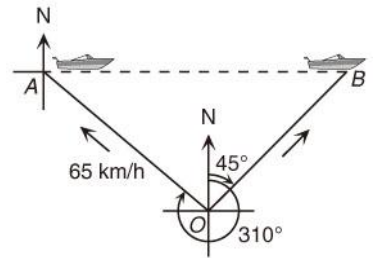
(3B10D026)

In the figure, Raymond walks 450 m from A to B in the direction $N53^\circ E$, and then he walks 480 m from B to C in the direction $S27^\circ W$. Find the direction he should walk to get back to A . (Give your answer correct to 3 significant figures.)



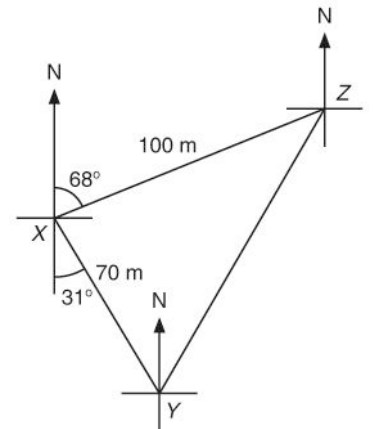
(3B10D027)

Two boats A and B leave port O at the same time. Boat A travels at 65 km/h in the direction 310° while boat B travels at a constant speed in the direction 045° . Find the speed of boat B such that it is always due east of boat A . (Give your answer correct to 3 significant figures.)



(3B10D028)

The figure shows three ships X , Y and Z . Find the distance between ships Y and Z , correct to the nearest m.

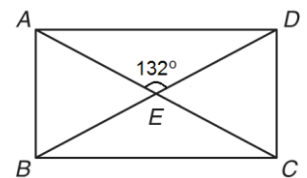


§10.4 Applications of Trigonometry to Rectilinear Figures

(3B10D029)

The figure shows a rectangle $ABCD$ with $AC = 16$ cm and $\angle AED = 132^\circ$.

- (a) Find the length of AD .
 - (b) Find the area of the rectangle $ABCD$.
- (Give your answers correct to 3 significant figures.)



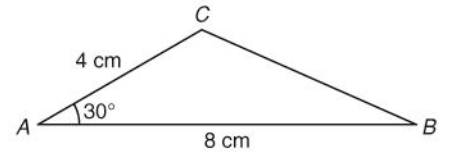
(3B10D030)

Refer to the figure.

(a) Find the length of BC .

(b) Find $\angle ABC$.

(Give your answers correct to 3 significant figures.)



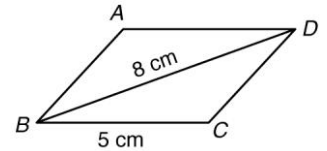
(3B10D031)

The figure shows a parallelogram $ABCD$ with area 15 cm^2 . Find

(a) $\angle DBC$,

(b) $\angle ABD$.

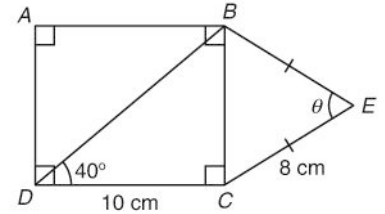
(Give your answers correct to 3 significant figures.)



(3B10D032)

In the figure, $ABCD$ is a rectangle and $\triangle BCE$ is an isosceles triangle.

Find θ , correct to 3 significant figures.



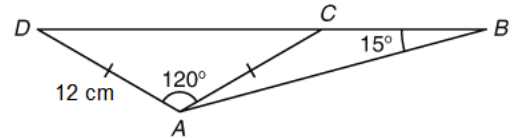
(3B10D033)

Refer to the figure. Find the lengths of

(a) AB ,

(b) BC .

(Give your answers correct to 3 significant figures if necessary.)

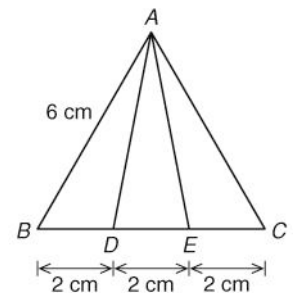


(3B10D034)

In the figure, ABC is an equilateral triangle of side 6 cm. D and E are points on BC such that $BD = DE = EC = 2$ cm. A student claims that $\angle BAD$, $\angle DAE$

and $\angle EAC$ are all equal to $\frac{60^\circ}{3} = 20^\circ$. Is the student's claim correct?

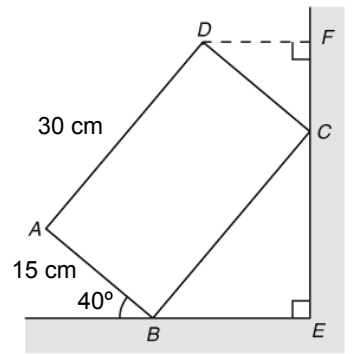
Explain briefly.



(3B10D035)

The figure shows a rectangular block $ABCD$ leaning against a vertical wall. AB makes an angle of 40° with the horizontal ground.

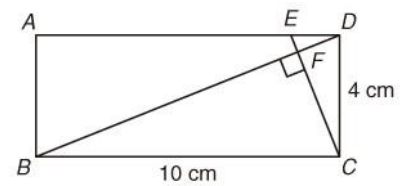
- (a) Find the length of CE .
 - (b) Find the height of D from the ground.
- (Give your answers correct to 3 significant figures.)



(3B10D036)

The figure shows a rectangle $ABCD$ of dimensions $10\text{ cm} \times 4\text{ cm}$. E is a point on AD such that $EC \perp DB$. EC and DB intersect at F .

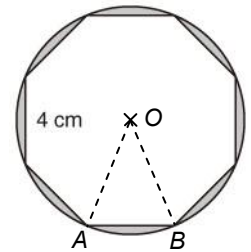
- (a) Find the area of $\triangle BCF$.
 - (b) Hence, find the area of quadrilateral $ABFE$.
- (Give your answers correct to 3 significant figures.)



(3B10D037)

The figure shows a regular octagon of side 4 cm inscribed in a circle with centre O . Find

- (a) the radius of the circle,
 - (b) the area of the shaded region.
- (Give your answers correct to 3 significant figures.)



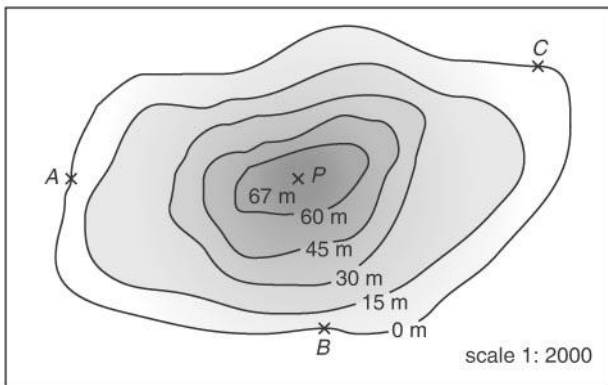
Level 3 Questions

(3B10E001)

The figure shows a contour map of a hill. A developer is planning to build a cable car system to reach the top of the hill P with the following two constraints:

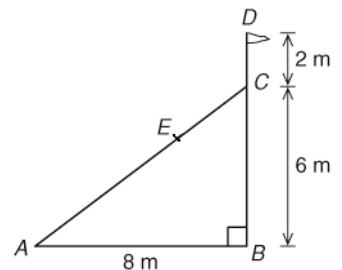
- (1) The cable cannot be longer than 90 m.
- (2) The inclination of the cable cannot be greater than 50° .

Three routes are proposed, namely PA , PB and PC . The lengths of PA , PB and PC are measured to be 3 cm, 2 cm and 3.5 cm respectively on the map. Decide which route(s) is/are feasible.



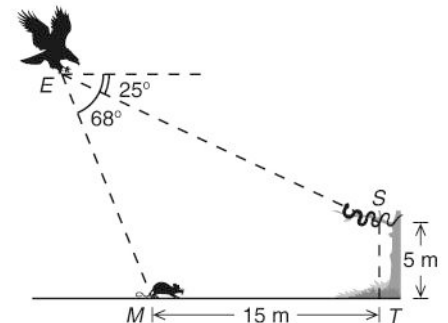
(3B10E002)

In the figure, AC is an inclined road and B is vertically below C . A flagstaff DC of height 2 m is posted vertically at C . E is a point on AC such that $AE : EC = 2 : 1$. Find the angle of elevation of the top of the flagstaff D from E , correct to 3 significant figures.



(3B10E003)

An eagle finds a mouse on the ground and a snake on the top of a tree. The angles of depression of the mouse and the snake from the eagle are 68° and 25° respectively. The height of the tree is 5 m and the mouse is 15 m from the tree. If the eagle is likely to catch a prey which is closer to it, which prey would the eagle catch?



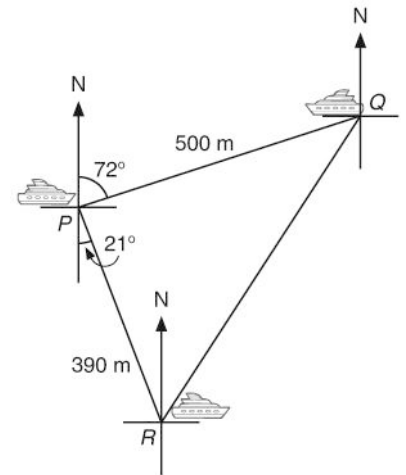
(3B10E004)

The figure shows three boats, P , Q and R .

(a) Find the distance between boats Q and R .

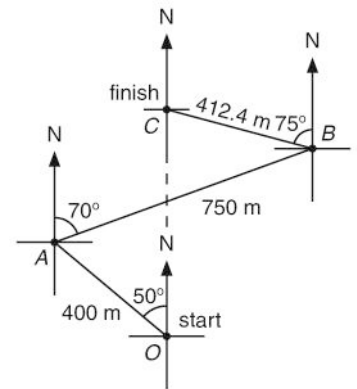
(b) What is the compass bearing of Q from R ?

(Give your answers correct to 3 significant figures.)



(3B10E005)

The figure shows the route of a windsurfer travelling from O to C through A and B . The starting point O is due south of the finishing point C . Find the distance between the starting point and the finishing point, correct to 3 significant figures.



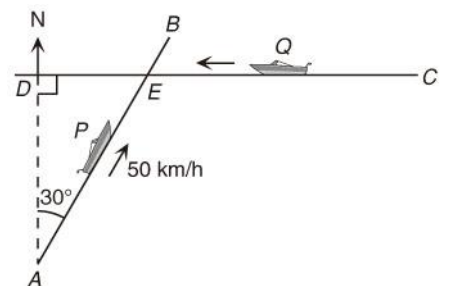
(3B10E006)

In the figure, ship P sails in the direction $N30^\circ E$ at 50 km/h from A along route AB . At the same time, ship Q sails due west from C along route CD at a constant speed. Suppose D is due north of A , $AD = 10 \text{ km}$ and $CD = 20 \text{ km}$.

(a) If the two ships meet at E , find the speed of ship Q .

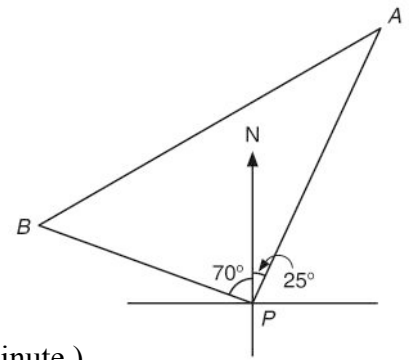
(b) If the two ships continue to sail without changing their speeds, find the true bearing of ship P from ship Q when ship Q arrives at D .

(Give your answers correct to 3 significant figures.)



(3B10E007)

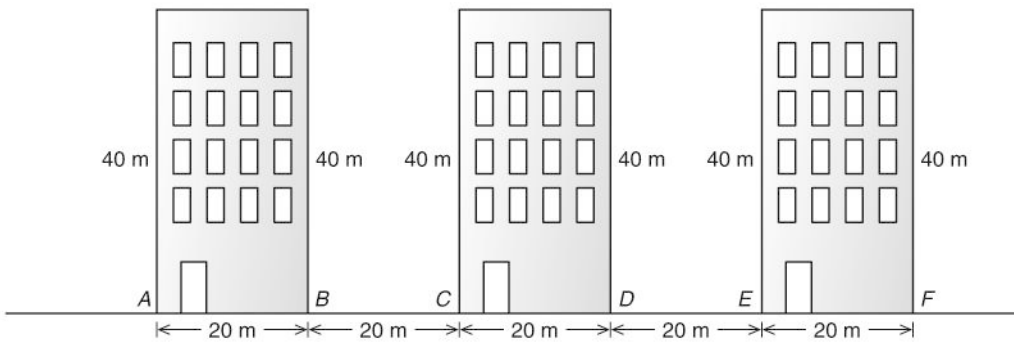
At 2:00 p.m., John and Mary left point P and ran to point A and point B respectively. John ran in the direction $N25^\circ E$ at an average speed of 3 m/s. Mary ran in the direction $N70^\circ W$ at an average speed of 2.5 m/s. At 4:30 p.m., they ran towards each other to meet again without changing their speeds.



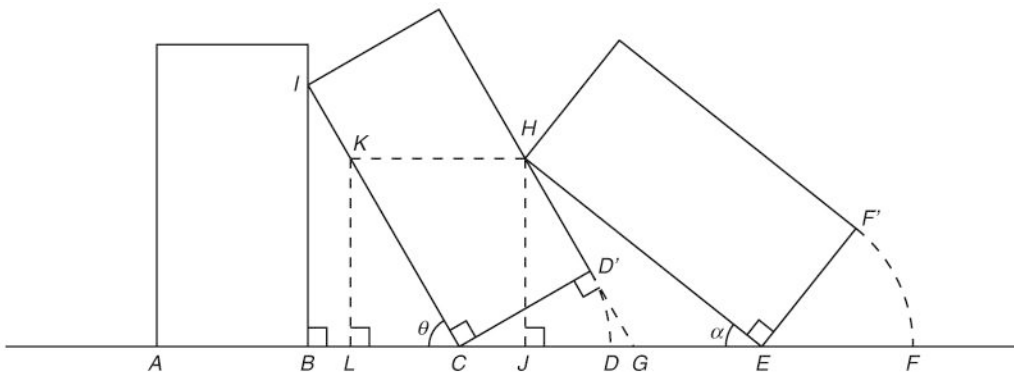
- (a) Which directions should they take in compass bearing?
(Give your answers correct to 3 significant figures.)
- (b) When will they meet? (Give your answer correct to the nearest minute.)

(3B10E008)

In a housing estate, there are three identical blocks of flats 20 m apart as shown in the figure.



Each block is 40 m high and 20 m wide. An earthquake occurs and the blocks fall on each other as shown in the figure below.



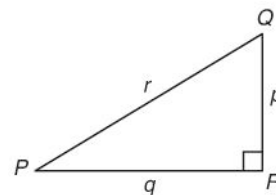
- (a) Find θ .
- (b) (i) Find HJ and JE in terms of α .
(ii) Hence, find BL in terms of α .
- (c) Find KH .
- (d) Using the results in (b) and (c), show that $\frac{1 - \sin \alpha}{1 - \cos \alpha} = \sqrt{3}$.
- (Leave your answers in surd form if necessary.)

Multiple Choice Questions

(3B10F001)

Find the gradient of the inclined plane PQ in the figure.

- A. $\frac{q}{p}$
- B. $\frac{p}{q}$
- C. r^2
- D. $\sqrt{p^2 + q^2}$



(3B10F002)

The gradient of an inclined road is 1 : 10. Find the inclination of the road. (Give your answer correct to 3 significant figures if necessary.)

- A. 5.71°
- B. 7.62°
- C. 10°
- D. 0.1°

(3B10F003)

The inclination of a straight road is 26° . Express the gradient of the road in the form 1 : n . (Give n correct to the nearest integer.)

- A. 1 : 2
- B. 1 : 4
- C. 1 : 10
- D. 1 : 20

(3B10F004)

Vivian is walking down an inclined road which has a road sign indicating '1 : 8'. If Vivian has travelled a vertical distance of 50 m, what is the horizontal distance she has travelled? (Give your answer correct to 3 significant figures if necessary.)

- A. 356 m
- B. 400 m
- C. 403 m
- D. 414 m

(3B10F005)

The gradient of a straight road is given to be $\frac{1}{12}$. If an athlete runs 100 m along the road, find the

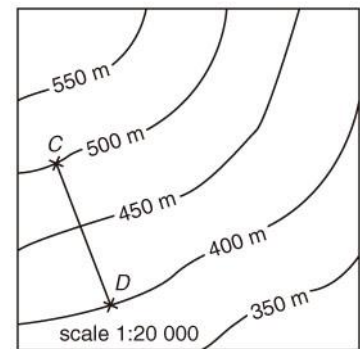
vertical distance he travels, correct to 3 significant figures.

- A. 8.30 m
- B. 8.33 m
- C. 9.97 m
- D. 12.0 m

(3B10F006)

In the figure, the contour map is drawn to the scale 1 : 20 000. A straight road CD is measured to be 2 cm on the map. Find the gradient of road CD in fraction.

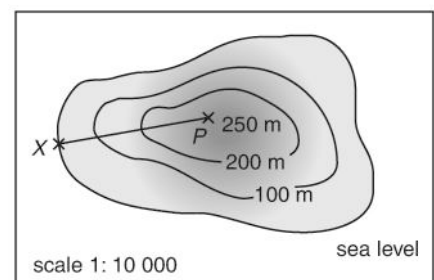
- A. $\frac{1}{3}$
- B. $\frac{1}{4}$
- C. $\frac{1}{5}$
- D. $\frac{1}{6}$



(3B10F007)

The figure shows the contour map of an island. The length of PX is measured to be 2 cm on the map. Find the inclination of road PX , correct to 3 significant figures.

- A. 36.9°
- B. 38.7°
- C. 51.3°
- D. 53.1°

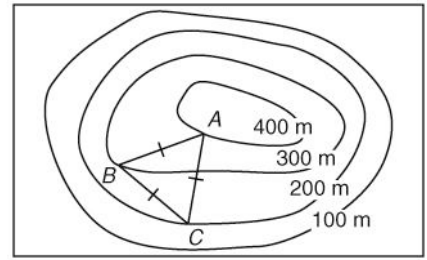


(3B10F008)

Referring to the contour map, which of the following is/are true?

- I. Gradient of AB = gradient of BC
- II. Gradient of AB = gradient of AC
- III. Gradient of BC = gradient of AC

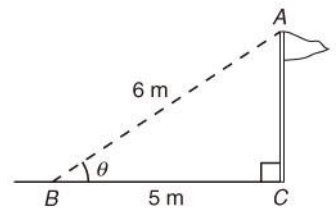
- A. I only
- B. II only
- C. I and II only
- D. I, II and III



(3B10F009)

The figure shows a vertical flag AC . B is a point on the horizontal ground. Find the angle of elevation θ of A from B . (Give your answer correct to 3 significant figures.)

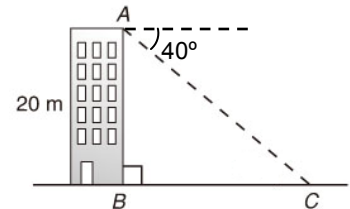
- A. 33.6°
- B. 39.8°
- C. 50.2°
- D. 56.4°



(3B10F010)

In the figure, the angle of depression of a point C on the ground from the top A of building AB is 40° . If the height of building AB is 20 m, find the horizontal distance between the point C and the building, correct to the nearest m.

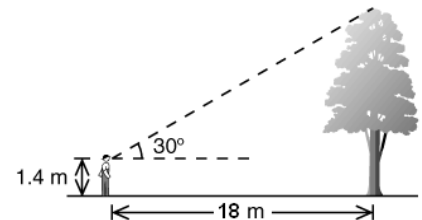
- A. 17 m
- B. 24 m
- C. 26 m
- D. 31 m



(3B10F011)

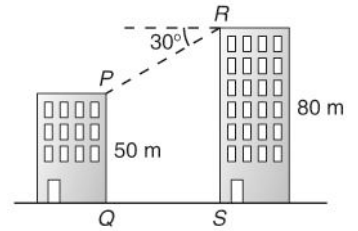
In the figure, Johnny is 18 m away from a tree, looking at the top of the tree. His eye level is 1.4 m above the horizontal ground. The angle of elevation of the top of the tree from his eye level is 30° . Find the height of the tree, correct to 3 significant figures.

- A. 8.99 m
- B. 10.4 m
- C. 11.8 m
- D. 31.2 m



(3B10F012)

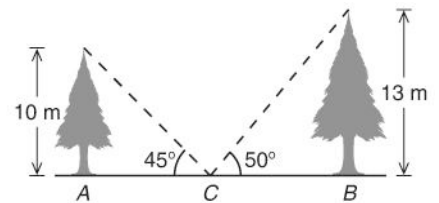
The figure shows two buildings PQ and RS of heights 50 m and 80 m respectively. The angle of depression of P from R is 30° . Find the distance between the two buildings.



- A. 30 m
- B. 60 m
- C. $\frac{30\sqrt{3}}{3}$ m
- D. $30\sqrt{3}$ m

(3B10F013)

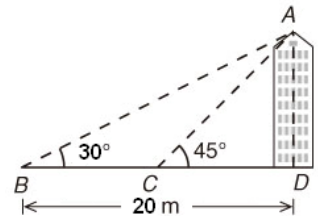
Tree A is due south of point C , whereas tree B is due north of point C . If the heights of tree A and tree B are 10 m and 13 m respectively, find the distance between the two trees, correct to the nearest m.



- A. 19 m
- B. 21 m
- C. 24 m
- D. 32 m

(3B10F014)

In the figure, AD is a tower. B and C are points on the horizontal ground. The angles of elevation of the top A from B and C are 30° and 45° respectively. What is the distance between C and D ?



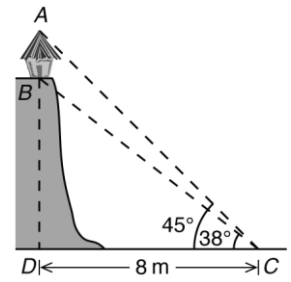
- A. $\frac{10}{\sqrt{2}}$ m
- B. $\frac{10}{\sqrt{3}}$ m
- C. $\frac{20}{\sqrt{2}}$ m
- D. $\frac{20}{\sqrt{3}}$ m

(3B10F015)

In the figure, a house AB is standing on the top of a hill. C is a point on the horizontal ground. The angles of elevation of A and B from C are 45° and 38° respectively. Given that the horizontal distance between C and the house is

8 m, find the height of the house, correct to 3 significant figures.

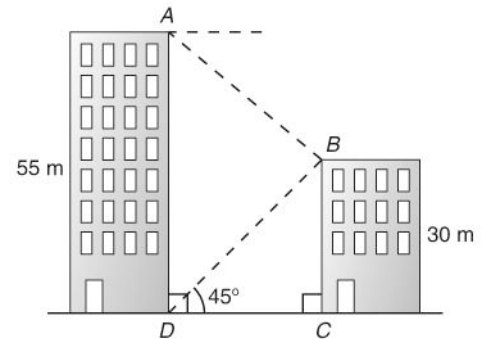
- A. 1.47 m
- B. 1.65 m
- C. 1.75 m
- D. 2.19 m



(3B10F016)

The figure shows two buildings AD and BC with heights 55 m and 30 m respectively. The angle of elevation of B from D is 45° . Find the angle of depression of B from A , correct to 3 significant figures.

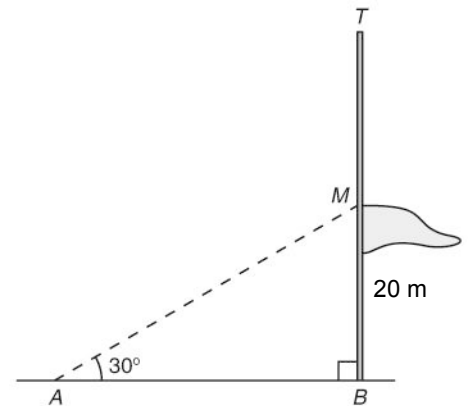
- A. 30.0°
- B. 39.8°
- C. 45.0°
- D. 50.2°



(3B10F017)

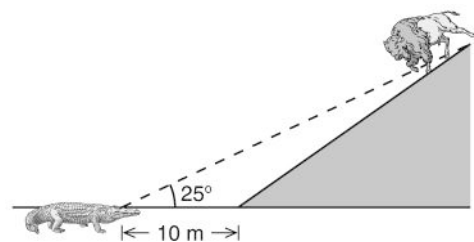
In the figure, a flag is originally at point M which is 20 m vertically above B . A is a point on the horizontal ground. The angle of elevation of the flag from A is 30° . If the flag rises 20 m more to the top T of the flagpole, find the new angle of elevation of the flag from A , correct to 3 significant figures.

- A. 73.9°
- B. 60.0°
- C. 49.1°
- D. 40.9°



(3B10F018)

As shown in the figure, a crocodile in a river stares at a buffalo standing on a slope. The angle of elevation of the buffalo from the crocodile is 25° . The gradient of the slope is 0.7 and the crocodile is 10 m from the shore. Find the vertical distance between the buffalo and the water level. (Give your answer correct to 3 significant figures.)



- A. 14.0 m
- B. 15.2 m
- C. 16.8 m
- D. 18.1 m

(3B10F019)

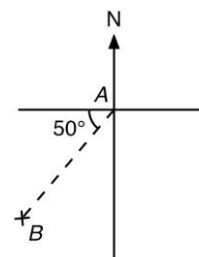
Express the compass bearing $N30^\circ W$ as true bearing.

- A. 030°
- B. 060°
- C. 210°
- D. 330°

(3B10F020)

In the figure, the compass bearing of B from A is

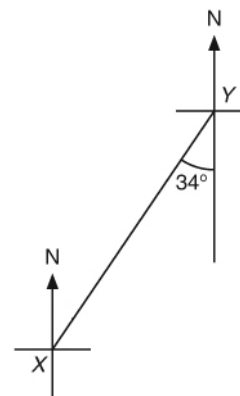
- A. $N40^\circ W$.
- B. $N50^\circ W$.
- C. $S40^\circ W$.
- D. $S50^\circ W$.



(3B10F021)

Refer to the figure. Find the compass bearing of Y from X .

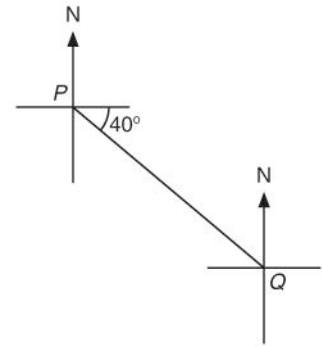
- A. $S56^\circ E$
- B. $N56^\circ E$
- C. $S34^\circ W$
- D. $N34^\circ E$



(3B10F022)

Refer to the figure. Find the true bearing of P from Q .

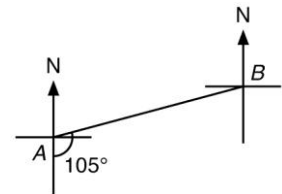
- A. 040°
- B. 130°
- C. 310°
- D. 320°



(3B10F023)

Refer to the figure. Find the compass bearing of A from B .

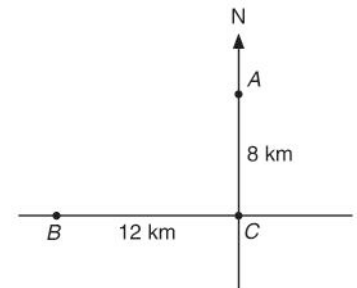
- A. $S15^\circ E$
- B. $S75^\circ W$
- C. $N15^\circ E$
- D. $N75^\circ W$



(3B10F024)

It is given that A is 8 km due north of C and B is 12 km due west of C , find the compass bearing of B from A , correct to 3 significant figures.

- A. $S33.7^\circ W$
- B. $N33.7^\circ W$
- C. $N56.3^\circ E$
- D. $S56.3^\circ W$

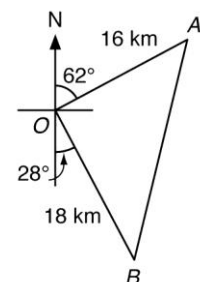


(3B10F025)

In the figure, the compass bearings of stations A and B from O are $N62^\circ E$ and $S28^\circ E$ respectively. If A and B are 16 km and 18 km from port O respectively, find the distance between the two stations.

(Give your answer correct to 3 significant figures.)

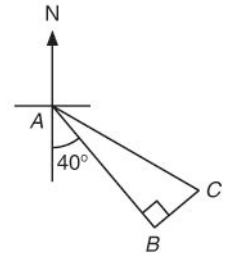
- A. 21.8 km
- B. 22.5 km
- C. 24.0 km
- D. 24.1 km



(3B10F026)

The figure shows three boats A , B and C . Find the compass bearing of B from C .

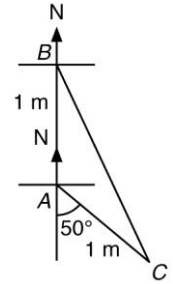
- A. $S50^\circ W$
- B. $S40^\circ E$
- C. $N50^\circ E$
- D. $S40^\circ W$



(3B10F027)

In the figure, Patrick observes two sculptures B and C from A . He observes that B is 1 m due north of A , C is 1 m from A and the compass bearing of C from A is $S50^\circ E$. Find the true bearing of C from B .

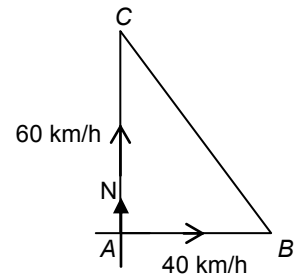
- A. 145°
- B. 150°
- C. 155°
- D. 160°



(3B10F028)

At 1:00 p.m., a bus travels due east from A with a speed of 40 km/h and a car travels due north from A with a speed of 60 km/h. At 3:00 p.m., the bus arrives B and the car arrives C . Find the true bearing of B from C , correct to the nearest degree.

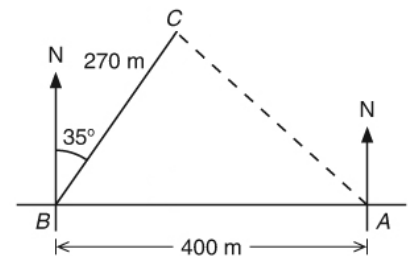
- A. 034°
- B. 098°
- C. 124°
- D. 146°



(3B10F029)

In the figure, a man walks 400 m due west from A to B , and then walks in the direction $N35^\circ E$ for 270 m to C . What is the compass bearing of the man's starting position from the man's present position? (Give your answer correct to the nearest degree.)

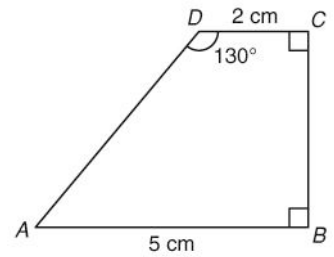
- A. $S48^\circ W$
- B. $N36^\circ W$
- C. $S42^\circ E$
- D. $S48^\circ E$



(3B10F030)

In the figure, $ABCD$ is a trapezium. Find the length of BC , correct to 3 significant figures.

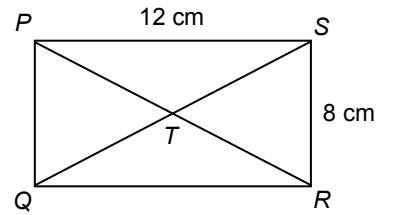
- A. 1.93 cm
- B. 2.30 cm
- C. 3.58 cm
- D. 4.02 cm



(3B10F031)

In the figure, $PQRS$ is a rectangle. Find $\angle PTS$, correct to 3 significant figures.

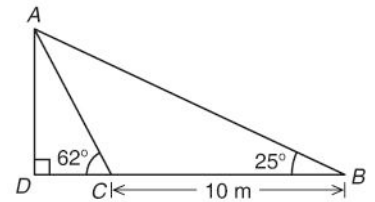
- A. 96.4°
- B. 107°
- C. 113°
- D. 146°



(3B10F032)

In the figure, find the length of AD , correct to the nearest 0.1 m.

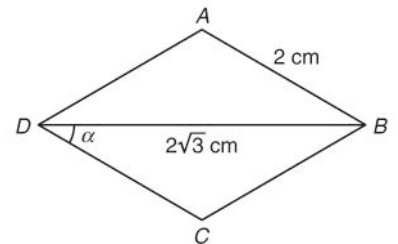
- A. 6.2 m
- B. 7.5 m
- C. 7.9 m
- D. 8.6 m



(3B10F033)

The figure shows a rhombus $ABCD$. Find α .

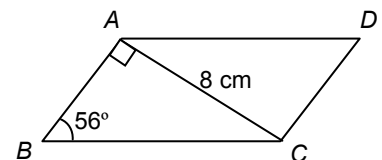
- A. 15°
- B. 30°
- C. 45°
- D. 60°



(3B10F034)

In the figure, $ABCD$ is a parallelogram. Find the perimeter of the parallelogram, correct to 3 significant figures.

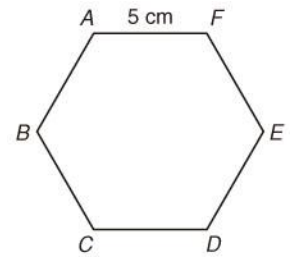
- A. 15.0 cm
- B. 30.1 cm
- C. 37.0 cm
- D. 39.4 cm



(3B10F035)

The figure shows a regular hexagon $ABCDEF$ of side 5 cm. Find the area of hexagon $ABCDEF$, correct to 3 significant figures.

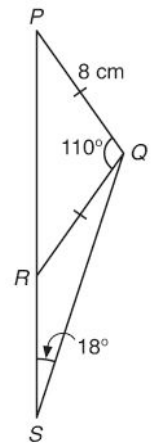
- A. 50.0 cm^2
- B. 65.0 cm^2
- C. 75.2 cm^2
- D. 130 cm^2



(3B10F036)

In the figure, $\triangle PQR$ is an isosceles triangle and PRS is a straight line. Find the length of QS , correct to 3 significant figures.

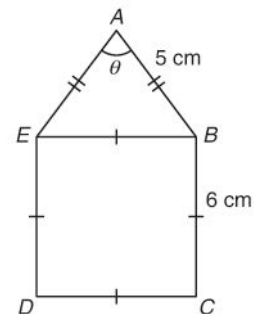
- A. 12.4 cm
- B. 14.9 cm
- C. 15.1 cm
- D. 21.2 cm



(3B10F037)

In the figure, $\triangle ABE$ is an isosceles triangle and $BCDE$ is a square. Find θ correct to 3 significant figures.

- A. 36.9°
- B. 40.8°
- C. 53.1°
- D. 73.7°



3B Chapter 10 Quiz

Applications of Trigonometry

Name: _____ Class: _____ () Result: _____

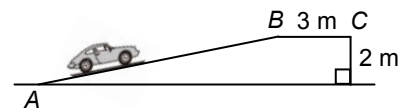
(In this quiz, unless specified, give your answers correct to 3 significant figures if necessary.)

Section A (10 marks)

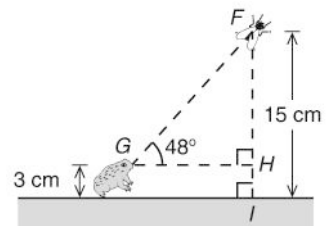
(Working steps are NOT required in this section.)

1. Find the inclination of a straight road of gradient 0.25.

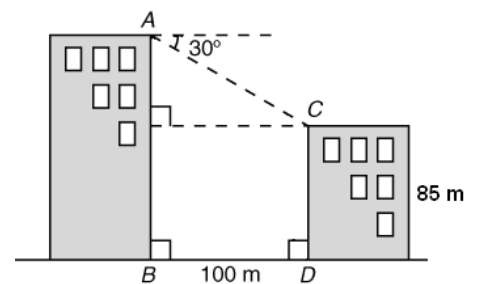
2. The figure shows a road ABC . The gradient of the inclined road AB is 1 : 10. If a car travelled from A to C , find the horizontal distance travelled.



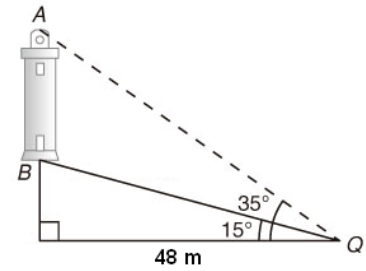
3. In the figure, a frog is looking at a fly which is 15 cm above the ground. If the angle of elevation and the eye level of the frog are 48° and 3 cm respectively, find the horizontal distance between the frog and the fly.



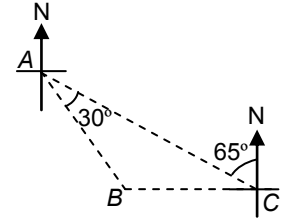
4. The figure shows two buildings AB and CD which are 100 m apart. The angle of depression from A to C is 30° . If the height of building CD is 85 m, find the height of building AB .



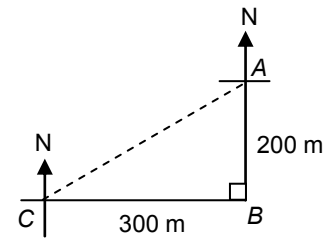
5. In the figure, a tower AB is built on a slope. Q is a point on the horizontal ground at the foot of the slope and the horizontal distance between Q and the tower is 48 m. The angles of elevation of A and B from Q are 35° and 15° respectively. Find the height of the tower.



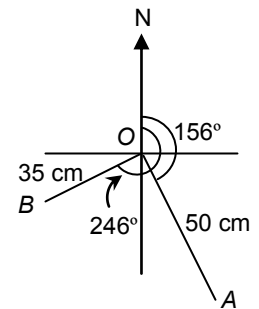
6. Refer to the figure. Find the compass bearing of B from A .



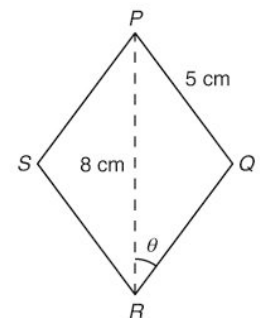
7. In the figure, Susan walks 200 m due south from A to B , and then walks 300 m due west to C . If she wants to return to A by the shortest route, which direction should she take?
(Give your answer correct to the nearest degree.)



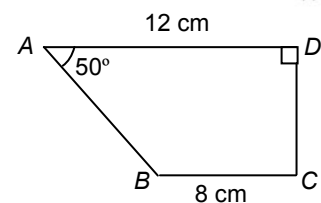
8. In the figure, an ant walks 50 cm away from O in the direction 156° to point A , while another ant walks 35 cm away from O in the direction 246° to point B . Find the distance between A and B .



9. In the figure, $PQRS$ is a rhombus. Find θ .



10. Find the height of trapezium $ABCD$ on the right.

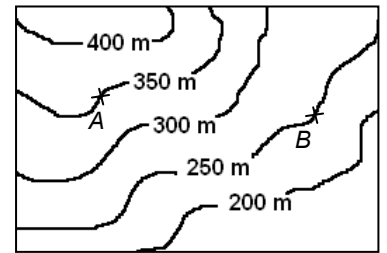


Section B (20 marks)

(Write your mathematical expressions, answers and statements/conclusions in the spaces provided.)

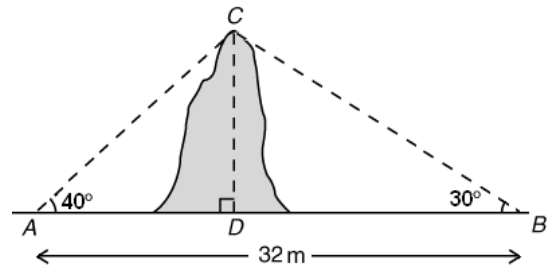
11. In the figure, the scale of the contour map is 1 : 35 000. AB is a straight road. AB is measured to be 2 cm on the map.

- (a) Find the gradient of road AB in fraction.
- (b) Find the inclination of road AB .



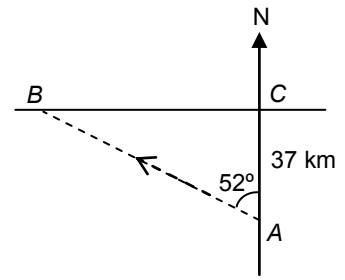
(4 marks)

12. The figure shows a rock CD . A and B are two points on the horizontal ground and $AB = 32$ m. The angles of elevation of C from A and B are 40° and 30° respectively. Find the height of the rock.



(3 marks)

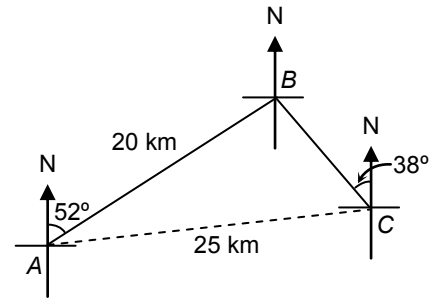
13. At noon, a ship A is 37 km due south of pier C . The ship sails at 20 km/h in the direction $N52^\circ W$ to pier B , which is due west of C . When will ship A reach pier B ?



(3 marks)

14. The figure shows three islands A , B and C . The compass bearings of B from A and C are $N52^\circ E$ and $N38^\circ W$ respectively. The distance between A and B is 20 km and the distance between A and C is 25 km.

- (a) Find the distance between B and C .
- (b) Find the true bearing of C from A .

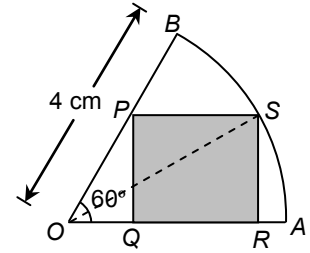


(4 marks)

15. In the figure, OAB is a sector of radius 4 cm and $\angle BOA = 60^\circ$.

$PQRS$ is a rectangle. If $\widehat{AS} = \widehat{SB}$, find

- (a) $\angle SOA$,
- (b) the lengths of OR and RS ,
- (c) the length of QR .



(6 marks)

~ End of Quiz ~