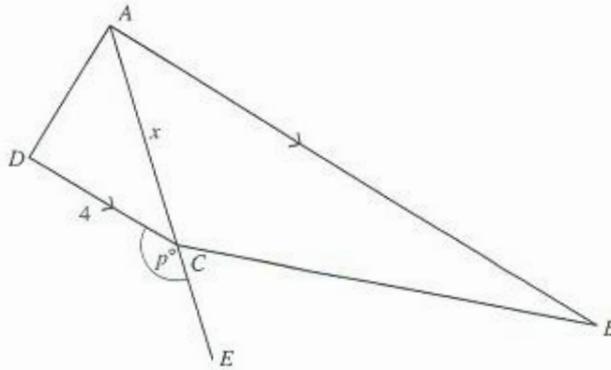## Topic 14

Pythagoras' Theorem and Trigonometry

1.

In the diagram, $ABCD$ is a trapezium with AB parallel to DC.
AD is perpendicular to AB and DC, and ACE is a straight line.
$DC = 4$ cm and $AC = x$ cm.
Angle $DCE = p°$.
(a) Write down an expression, in terms of x, for cos $p°$.   [1]
(b) The area of the trapezium $ABCD$ is 5 times the area of the triangle ADC.
Find AB.   [2]

(N2011/P1/Q11)

2.

The base, L, of a lighthouse is at sea level.
Yacht A is 250 m from L.
Yacht B is 400 m due west of yacht A.
Angle $LAB = 65°$.
(a) Calculate
    (i) LB,   [3]
    (ii) the area of triangle LAB,   [2]
    (iii) angle LBA,   [3]
    (iv) the bearing of B from L.   [1]
(b) The angle of elevation of the top of the lighthouse seen from A is 7°.
Calculate the angle of elevation of the top of the lighthouse from B.   [3]
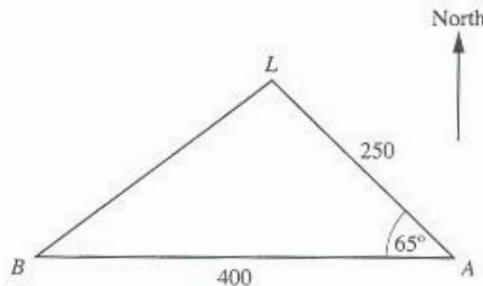
(N2011/P2/Q6)

TOPIC 14 Pythagoras' Theorem and Trigonometry

3.   The diagram is a scale drawing showing the positions of two airfields, A and B.
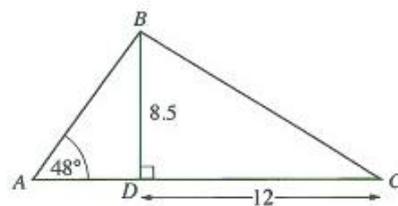
Scale: 1 cm represents 10 km

N
↑
●
A

N
↑
●
B

An aeroplane is 60 km from A on a bearing of 055°.
(a) Mark and label on the diagram the position, P, of the aeroplane.   [1]
(b) Find the actual distance of the aeroplane from B.   [1]
(c) Find the bearing of the aeroplane from B.   [1]
(N2012/P1/Q14)

4.

B
8.5
48°
A   D   ——12——   C

In triangle ABC, BD is perpendicular to AC.
Angle $BAD = 48°$, $BD = 8.5$ cm and $DC = 12$ cm.
Calculate
(a) $B\hat{C}D$,   [2]
(b) AB.   [2]
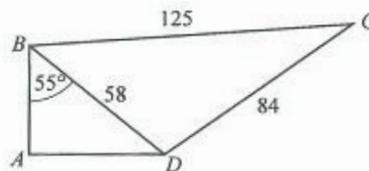(N2012/P1/Q22)

5.
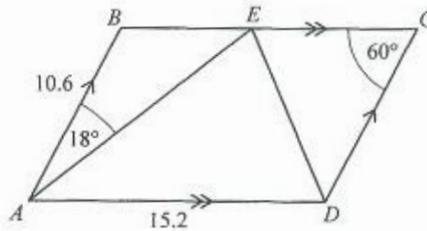
ABCD is a parallelogram with $AB = 10.6$ cm and $AD = 15.2$ cm.
Angle $BAE = 18°$ and angle $ECD = 60°$.
(a) Find
    (i) angle ABC, [1]
    (ii) angle DAE. [1]
(b) Find the area of parallelogram $ABCD$. [2]
(c) Show that $AE = 13.72$ cm, correct to four significant figures. [2]
(d) Calculate DE. [3]

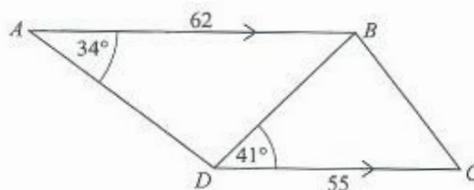(N2012/P2/Q2)

6. ABCD represents a plot of land.

B is due north of A, D is due east of A.
$BC = 125$ m, $CD = 84$ m and $BD = 58$ m.
Angle $ABD = 55°$.
(a) Calculate BDC. [3]
(b) Find the bearing of D from C. [2]

(N2013/P1/Q20)

7.

The diagram shows a company logo, $ABCD$, in the shape of a trapezium with AB parallel to DC. $AB = 62$ mm, $CD = 55$ mm, angle $BAD = 34°$ and angle $BDC = 41°$.
(a) Calculate
    (i) angle ADB, [1]
    (ii) BD, [2]
    (iii) the area of trapezium $ABCD$. [3]
(b) An enlarged copy of the logo is made. In the enlargement $CD = 88$ mm.
    Find the area of the enlarged logo. [2]

(N2013/P2/Q3)
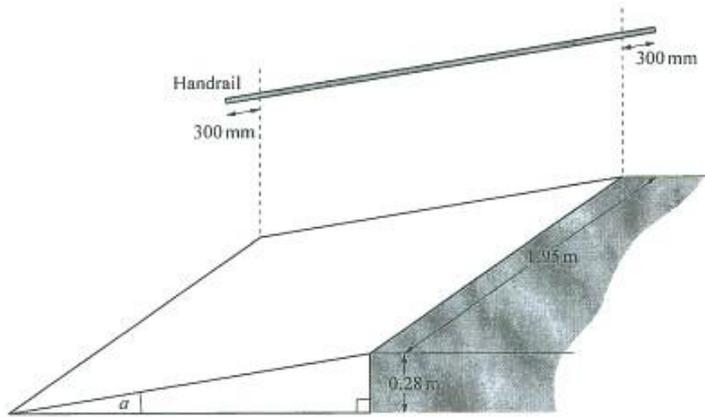
8. The sine of an angle is 0.7420.
    Give two possible values for the angle.   [2]
                                                                  (N2014/P1/Q4)

9.

    There is a vertical step 0.28 m high on horizontal ground at the entrance to a building.
    The width of the step is 1.95 m.
    A ramp in the shape of a prism is to be installed so that wheelchairs can enter the building.
    The gradient of the ramp is such that the ratio vertical distance : horizontal distance is
    $1 : 12$.
    (a) Show that the angle, a, of the ramp is 4.76°, correct to 3 significant figures.   [1]
    (b) A handrail is to be positioned on the wall, parallel to the ramp.
         The handrail must extend 300 mm at both ends of the ramp.
         Calculate the total length, in metres, of the handrail.   [3]
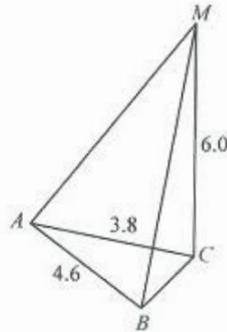   (N2014/P2/Q6a, c)

10.
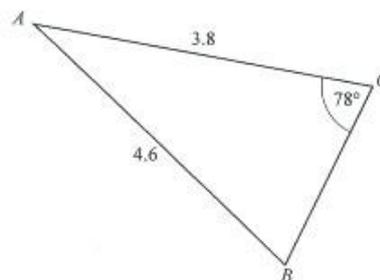
    The diagram shows a triangular flower bed ABC on horizontal ground.
    $AB = 4.6$ m, $AC = 3.8$ m and angle $ACB = 78°$.
    (a) Calculate
         (i)   angle ABC,   [2]
         (ii) the area of the flower bed.   [2]

(b)

The base of a vertical flagpole, CM, is at vertex C of the flower bed.
The flagpole is held by two cables, AM and BM.
$CM = 6.0$ m.

(i) Show that $AM = 7.10$ m, correct to 2 decimal places. [1]
(ii) Given that $BM = 6.95$ m, find the angle of elevation of M from B. [2]
(iii) Find the angle AMB, the angle between the two cables. [3]

(N2014/P2/Q9)

11. The diagram shows the positions of three towns P, Q and R.
PQ is 46.5 km, PR is 23.6 km and QR is 56.0 km.
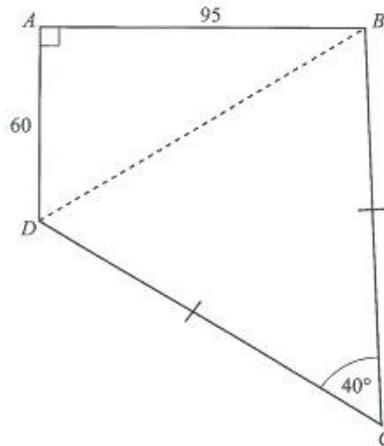The bearing of Q from P is 041°.
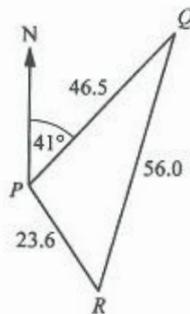
Calculate the bearing of R from P. [4]

(N2015/P1/Q18)

TOPIC 14 Pythagoras' Theorem and Trigonometry

12.

The diagram shows a field $ABCD$ on horizontal ground, crossed by a path BD.
$AB = 95$ m, $AD = 60$ m and $BC = CD$.
$B\hat{A}D = 90°$ and $B\hat{C}D = 40°$.
(a) Show that $A\hat{D}C = 127.7°$, correct to one decimal place. [2]
(b) Find CD. [4]
(c) The land is valued at $40 000 per hectare.
    Given that 1 hectare = 10 000 square metres, calculate the value of the field. [4]
(d) A bird is hovering vertically above B.
    The angle of elevation of the bird from A is $18°$.
    Find the angle of elevation of the bird from D. [3]

(N2015/P2/Q9)

13. The area of triangle ABC is 58.6 cm^2.
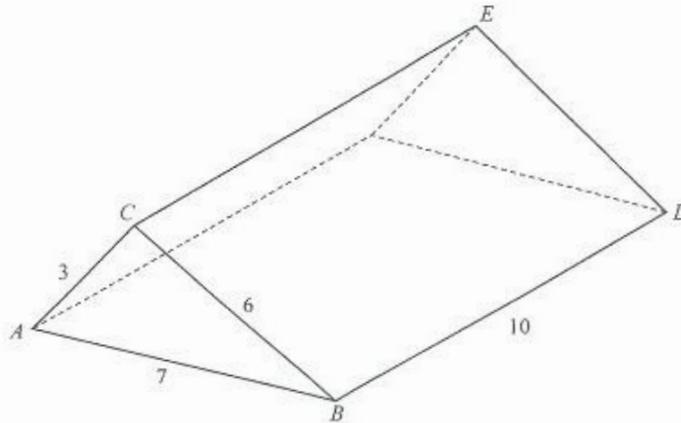 $AB = 18.7$ cm and $BC = 12.8$ cm.
    Find the two possible sizes of angle ABC. [2]

(N2016/P1/Q6)

14.

The diagram shows a solid triangular prism with three rectangular faces.
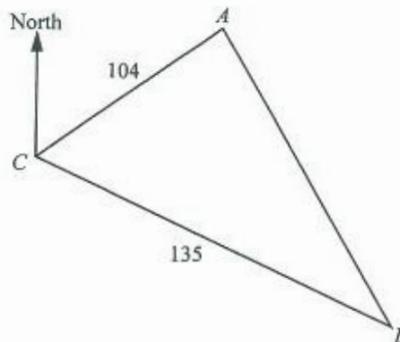$AB = 7$ cm, $AC = 3$ cm, $BC = 6$ cm and $BD = 10$ cm.
(a) Show that angle $BAC = 58.4°$, correct to 1 decimal place.   [3]
(b) Calculate the surface area of the prism.   [3]
(c) Calculate the vertical distance of C above AB.   [2]
(d) Calculate the angle of elevation E from A.   [4]

(N2016/P2/Q8)

15.

Points A, B and C are at sea level.
A is 104 m from C on a bearing of 064°.
B is 135 m from C on a bearing of 122°.
(a) Calculate AB.   [3]
(b) Calculate the bearing of A from B.   [3]
(c) A boat, T, travels in a straight line from C to B.
     Calculate the shortest distance of T from A during this journey.   [2]
(d) C is a point at the base of a vertical cliff.
     D is the point on the top of the cliff vertically above C.
     The angle of depression of B from D is 27°.
     Calculate the height of the cliff.   [2]

(N2017/P2/Q5)

16.
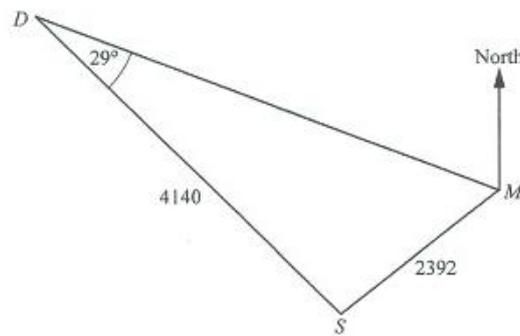
The diagram shows the positions of three cities, Singapore (S), New Delhi (D) and Manila (M).
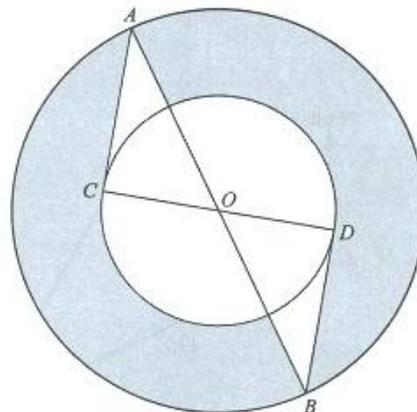SM = 2392 km, SD = 4140 km and angle SDM = 29°.
(a) Calculate acute angle DMS. [2]
(b) The bearing of New Delhi from Manila is 290°.
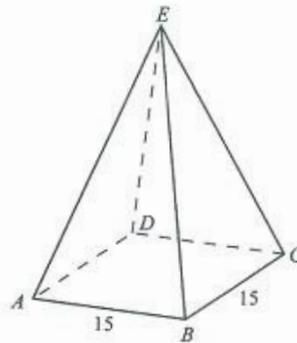   Find the bearing of New Delhi from Singapore. [2]

(N2018/P1/Q24)

17.

AB is a diameter of the large circle, centre O.
CD is a diameter of the small circle, centre O.
AC and BD are tangents to the small circle.
The radius of the large circle is 7 cm and OÂC = 30°.
Calculate the area of triangle OAC. [3]
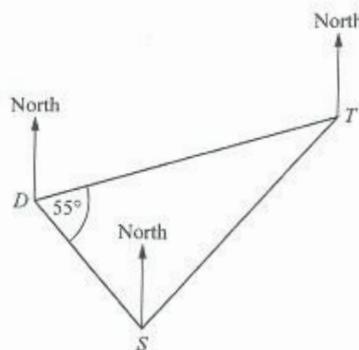
(N2018/P2/Q7b(i))

18.

The diagram shows a pyramid $ABCDE$.
The base of the pyramid is a square of side 15 cm.
E is vertically above the centre of the square base.
The vertical height of the pyramid is 20 cm.
(a) Show that $AE = 22.6$ cm, correct to three significant figures.   [3]
(b) Calculate angle BAE.   [3]

(N2018/P2/Q8a, b)

19.

The diagram shows the positions of three cities , Singapore (S), Delhi (D) and Tokyo (T).
Angle $SDT = 55°$.
The bearing of Delhi from Singapore is 317° and the bearing of Tokyo from Singapore is 044°.
(a) Find the bearing of Singapore from Delhi.   [1]
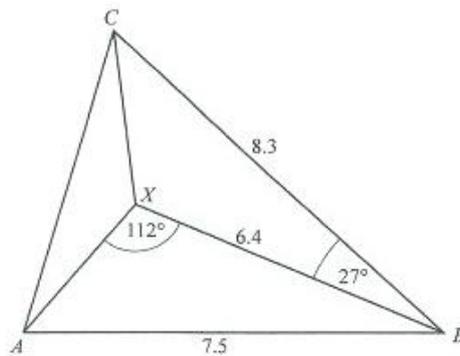(b) Find the bearing of Delhi from Tokyo.   [2]

(N2019/P1/Q14)

TOPIC 14 Pythagoras' Theorem and Trigonometry

20.

X is a point inside triangle ABC.
$AB = 7.5$ cm, $BC = 8.3$ cm and $BX = 6.4$ cm.
Angle $AXB = 112°$ and angle $XBC = 27°$.
(a) Calculate CX.   [3]
(b) Calculate angle XAB.   [2]
(c) Calculate the area of triangle ABC.   [3]
                                      (N2019/P2/Q2)