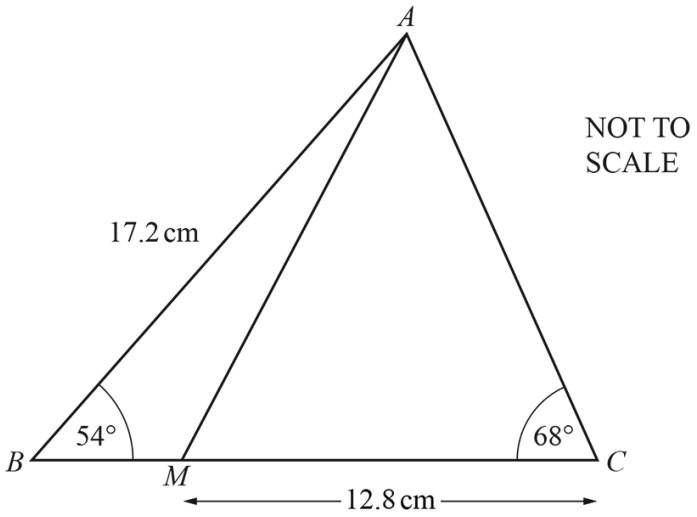
Chapter 6

Trigonometry

01. 0580_m24_qp_42 Q: 6



The diagram shows triangle ABC with $AB = 17.2$ cm.
Angle $ABC = 54°$ and angle $ACB = 68°$.

(a) Calculate AC.

$AC =$ ..... cm [3]

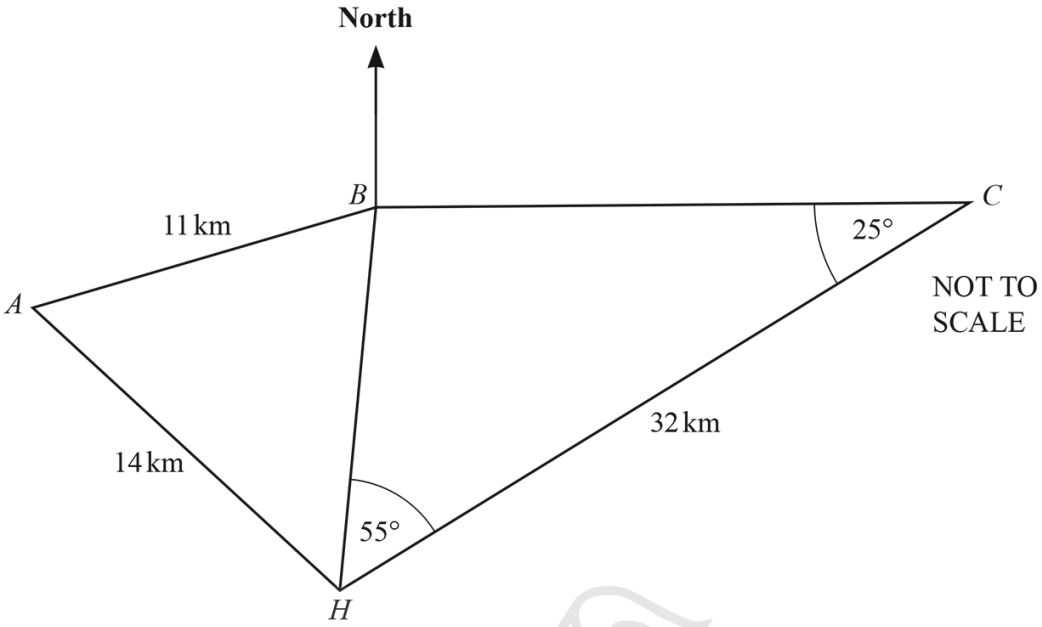
(b) M lies on BC and $MC = 12.8$ cm.

Calculate AM.

$AM =$ ..... cm [3]

(c) Calculate the shortest distance from A to BC.

.....cm [3]



The diagram shows the positions of two lighthouses A and B, a boat C and a harbour H.
C is due east of B.

(a) Find the bearing of the harbour from boat C.

..... [1]

(b) (i) Show that angle $CBH = 100°$.

[1]

(ii) Show that $BH = 13.7$ km, correct to 1 decimal place.

[3]

(c) Calculate the bearing of A from B.

..... [5]

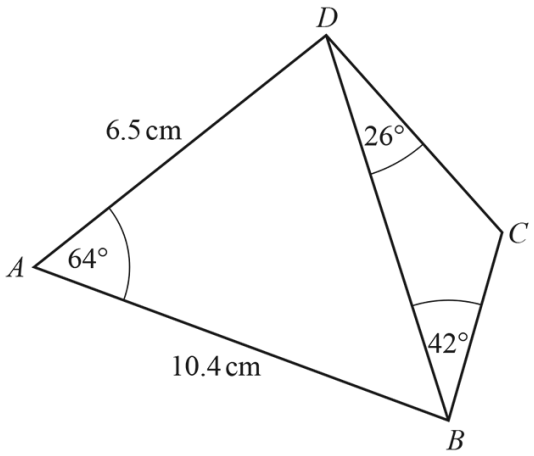
(d) At 1 pm boat C sails 32 km directly to the harbour at a speed of 10 knots.

(i) Calculate the time when boat C arrives at the harbour.
Give this time correct to the nearest minute.
[1 knot = 1.852 km/h]

..... [4]

(ii) Calculate the distance of boat C to the harbour when boat C is at the shortest distance from lighthouse B.

..... km [3]



NOT TO SCALE

$ABCD$ is a quadrilateral with $AB = 10.4$ cm and $AD = 6.5$ cm.
Angle $DAB = 64°$, angle $BDC = 26°$ and angle $DBC = 42°$.

(a) Show that $BD = 9.55$ cm, correct to 2 decimal places.

[3]

(b) **(i)** Show that angle $BCD = 112°$.

[1]

(ii) Calculate CD.

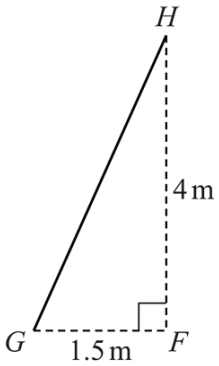
$CD =$ ..... [3]

(c) Find the shortest distance from D to AB.

..... cm [3]

04. 0580_s24_qp_43 Q: 6

(a)



NOT TO SCALE

The diagram shows a ladder, GH, on horizontal ground, leaning against a vertical wall, HF.
$GF = 1.5$ m and $HF = 4$ m.

Calculate the length of the ladder, GH.

..... m [2]

(b)

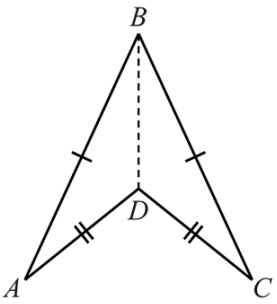
NOT TO SCALE

W is 120 m north of V and 50 m east of V.

Calculate the bearing of V from W.

..... [3]

(c)



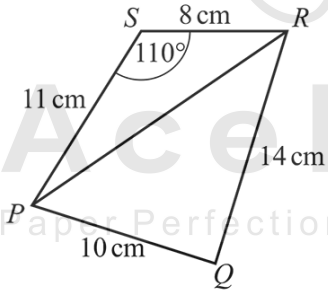
NOT TO SCALE

In the quadrilateral $ABCD$, $AD = DC = 5$ cm and $AB = BC$.
Angle $ABD = 25°$ and angle $BAD = 15°$.

Calculate the perimeter of the quadrilateral $ABCD$.

..... cm [5]

(d)



NOT TO SCALE

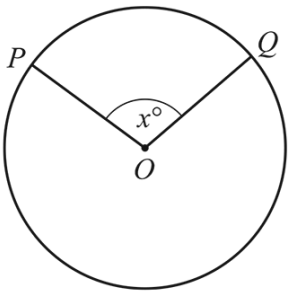
$PQRS$ is a quadrilateral.

Calculate angle PQR.

Angle PQR = ... [5]

05. 0580_s24_qp_43 Q: 11

(a)

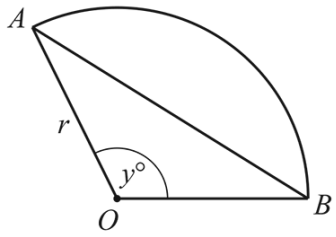


NOT TO SCALE

In the circle, centre O, the length of the minor arc PQ is $\frac{3}{7}$ of the length of the major arc PQ.
Show that $x = 108$.

[3]

(b)



NOT TO SCALE

The diagram shows a sector, OAB, of a circle with centre O and radius r.
The area of triangle OAB is half the area of the sector.
Angle $AOB = y°$ and is obtuse.

(i) Show that $360 \sin y = \pi y$.

[2]

(ii) Complete the table, giving your answers correct to two decimal places.

y	$360 \sin y$	πy
108.4	341.60	340.55
108.5	341.40	340.86
108.6	341.20	
108.7		

[3]

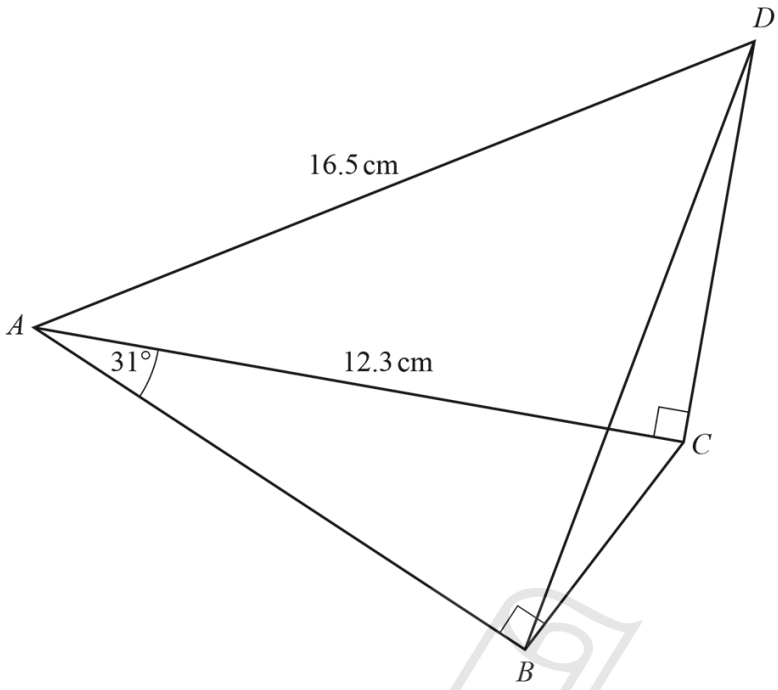
(iii) Complete the statement.

The value of y, correct to one decimal place, that satisfies

the equation $360 \sin y = \pi y$ is ..... .

[1]

06. 0580_m23_qp_42 Q: 10



The diagram shows a quadrilateral $ABCD$.
$AC = 12.3$ cm and $AD = 16.5$ cm.
Angle $BAC = 31°$, angle $ABC = 90°$ and angle $ACD = 90°$.

(a) Show that $AB = 10.54$ cm, correct to 2 decimal places.

[2]

(b) Show that angle $DAC = 41.80°$ correct to 2 decimal places.

[2]

(c) Calculate BD.

$BD =$ .....cm [3]

(d) Calculate angle CBD.

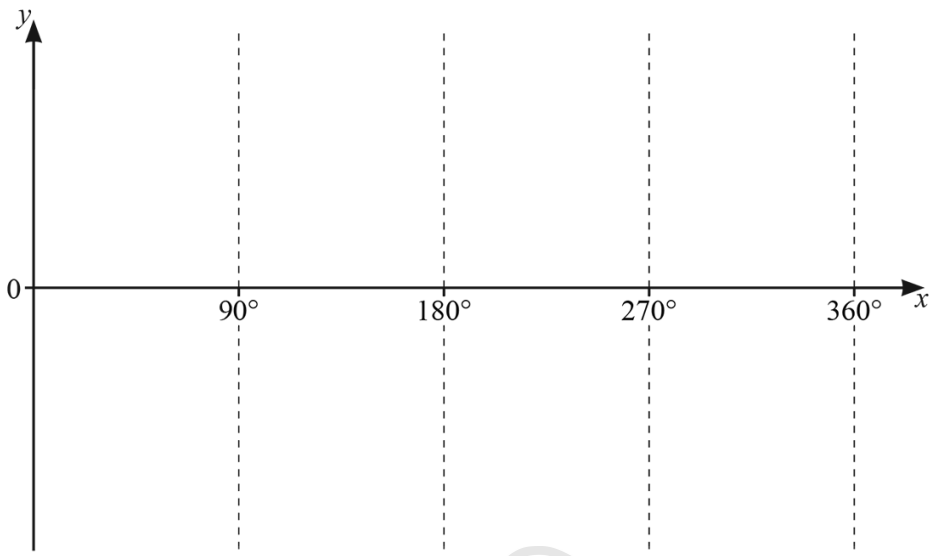
Angle $CBD =$ ..... [4]

(e) Calculate the shortest distance from C to BD.

..... cm [4]

07. 0580_m23_qp_42 Q: 12

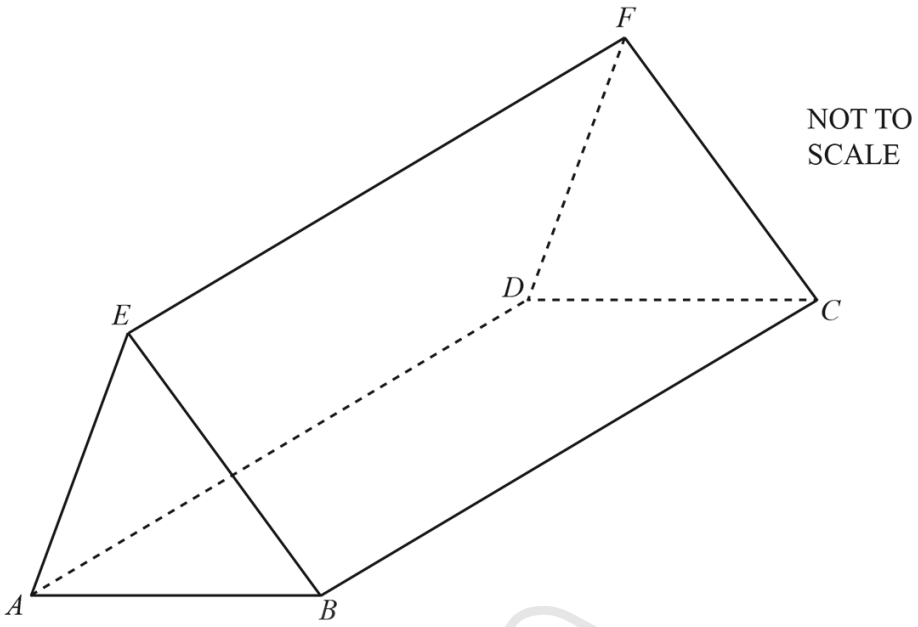
(a) Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) Find x when $\tan x = \frac{1}{\sqrt{3}}$ and $0° \leqslant x \leqslant 360°$.

..... [2]



The diagram shows a solid triangular prism $ABCDEF$ of length 15 cm.
$AB = 6.4$ cm, $EB = 5.7$ cm and the volume of the prism is 145 cm^3.

(a) Show that angle $EBA = 32°$, correct to the nearest degree.

[3]

(b) Find the length of EA.

..... cm [3]

(c) Calculate the shortest distance from E to AB.

..... cm [3]

(d) Calculate the angle BF makes with the base, $ABCD$, of the prism.

..... [4]

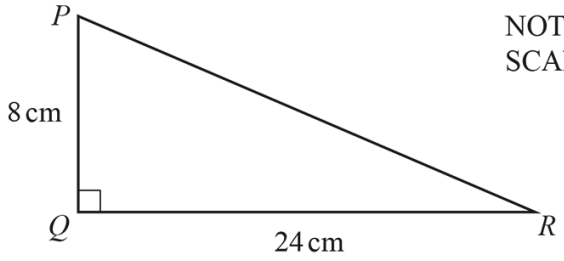
(e) The prism is made of plastic with density $938\,\text{kg/m}^3$.

Calculate the mass of the prism in **grams**.
[Density = mass ÷ volume]

..... g [3]

09. 0580_s23_qp_41 Q: 4

(a)



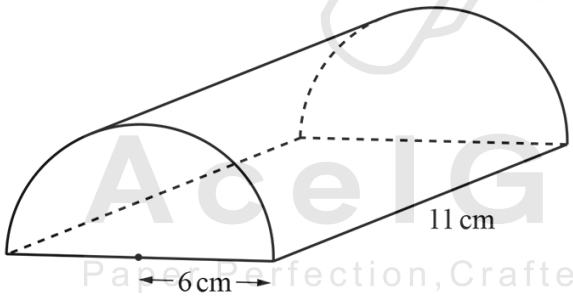
(i) Calculate the area of triangle PQR.

..... cm^2 [2]

(ii) Calculate angle PRQ.

Angle PRQ = ... [2]

(b)

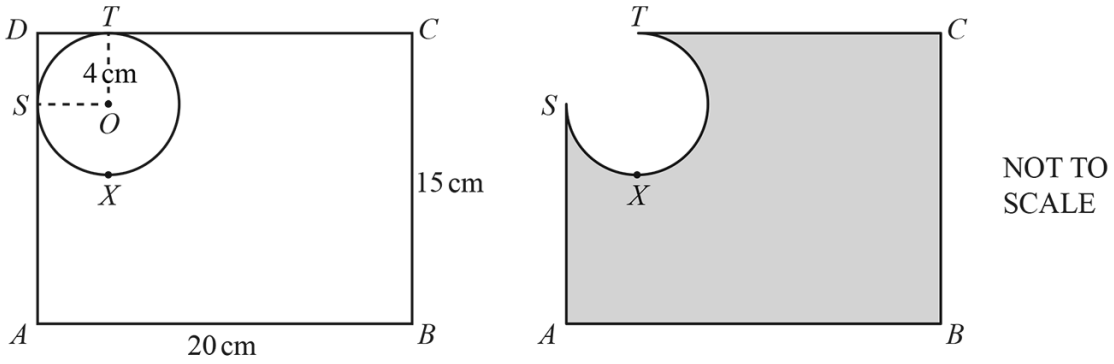


The diagram shows a half-cylinder of radius 6 cm and length 11 cm.

Calculate the volume of the half-cylinder.

..... cm^3 [2]

(c)



(i) $ABCD$ is a rectangle with $AB = 20$ cm and $BC = 15$ cm.
S, X and T are points on a circle centre O, such that DSA and DTC are tangents to the circle.
The radius of the circle is 4 cm and TX is a diameter of the circle.
The shape $DSXT$ is removed from the corner of the rectangle, leaving the shaded shape shown in the second diagram.

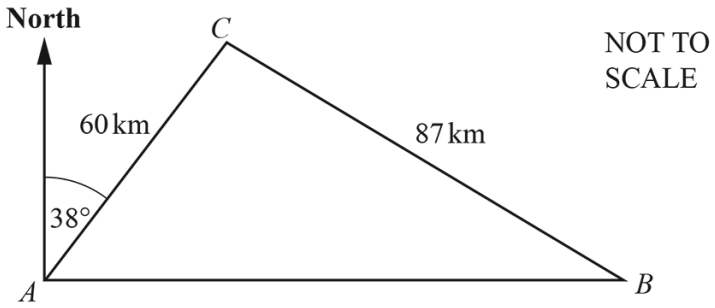
Calculate the area of the shaded shape.

..... cm^2 [5]

(ii) Calculate the perimeter of the shaded shape.

..... cm [3]

10. 0580_s23_qp_42 Q: 7



The diagram shows the straight roads between town A, town B and town C.
$AC = 60$ km, $CB = 87$ km and B is due east of A.
The bearing of C from A is 038°.

(a) Show that angle $ACB = 95.1°$, correct to 1 decimal place.

[5]

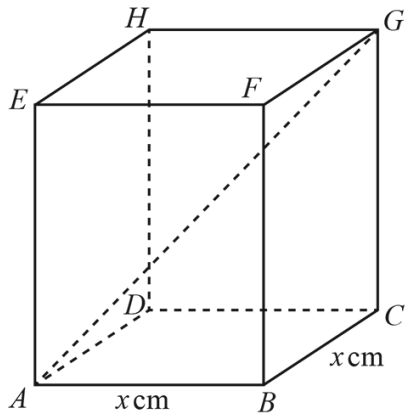
(b) Without stopping, a car travels from town A to town C then to town B, before returning directly to town A.
The total time taken for the journey is 3 hours 20 minutes.

Calculate the average speed of the car for this journey.
Give your answer in kilometres per hour.

..... km/h [6]

11. 0580_s23_qp_42 Q: 10

(a)



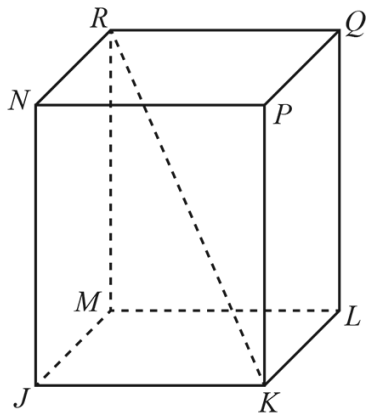
NOT TO SCALE

ABCDEFGH is a cuboid with a square base of side x cm.
$CG = 20$ cm and $AG = 28$ cm.

Calculate the value of x.

$x =$ ..... [4]

(b)



NOT TO SCALE

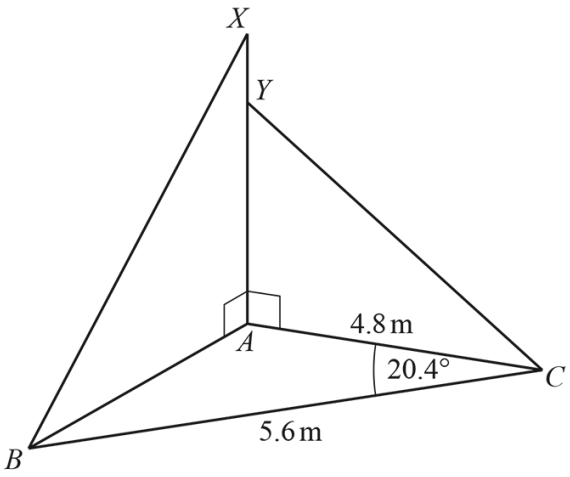
The diagram shows a different cuboid $JKLMNPQR$.
$MR = 30$ cm correct to the nearest centimetre.
$KR = 37$ cm correct to the nearest centimetre.

Calculate the lower bound of the angle between KR and the base $JKLM$ of the cuboid.

..... [4]

12. 0580_s23_qp_43 Q: 5

(a)



NOT TO SCALE

ABC is a scalene triangle on horizontal ground.
AYX is a straight vertical post, held in place by two straight wires XB and YC.
$AC = 4.8$ m, $BC = 5.6$ m and angle $ACB = 20.4°$.

(i) Calculate AB.

$AB =$ ..... m [3]

(ii) Angle $XBA = 64°$.

Calculate AX.

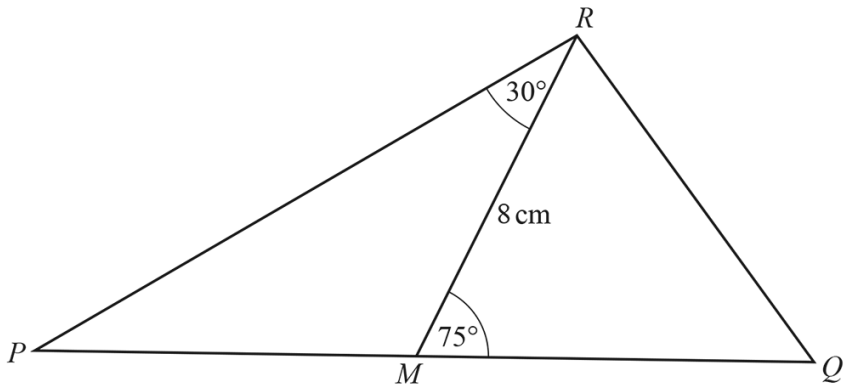
$AX =$ ..... m [2]

(iii) $AY = 2.9$ m.

Calculate the area of triangle YAC.

..... m^2 [2]

(b)



NOT TO SCALE

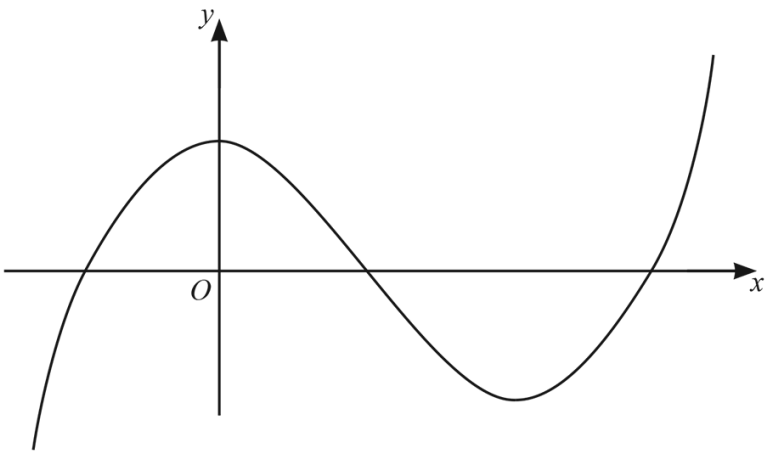
In triangle PQR, M is the midpoint of PQ.
$RM = 8$ cm, angle $PRM = 30°$ and angle $RMQ = 75°$.

Calculate PQ.

$PQ =$ ..... cm [5]

13. 0580_s23_qp_43 Q: 7

(a) The diagram shows the graph of a function.

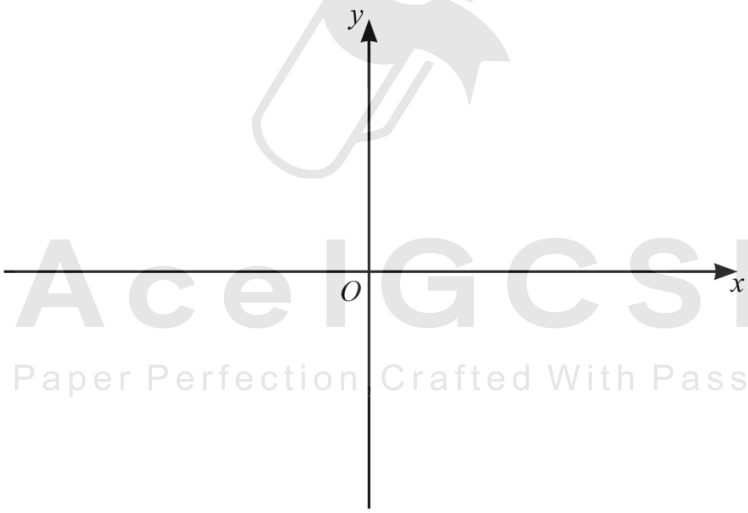


Put a ring around the word which correctly identifies the type of function.

reciprocal quadratic cubic exponential linear

[1]

(b) (i)

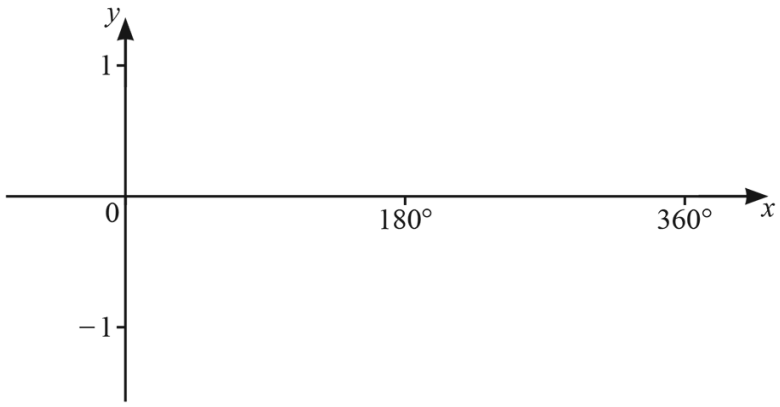


On the diagram, sketch the graph of $y = \frac{1}{2x}$, $x \neq 0$. [2]

(ii) Solve the equation $\frac{1}{2x} = 2x$.

$x =$ ..... and $x =$ ..... [2]

(c) (i)



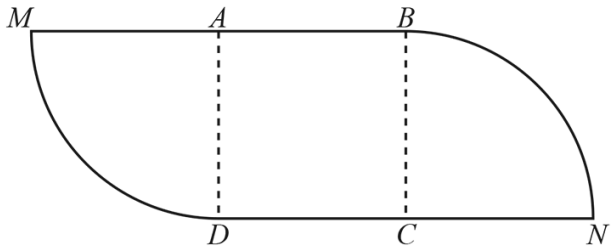
On the diagram, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

(ii) Solve the equation $3\sin x + 1 = 0$ for $0° \leqslant x \leqslant 360°$.

$x =$ ..... and $x =$ ..... [3]

14. 0580_s23_qp_43 Q: 9

(a)



NOT TO SCALE

The diagram shows a shape made from a square *ABCD* and two equal sectors of a circle.
The square has side 11 cm.
MAB and *DCN* are straight lines.

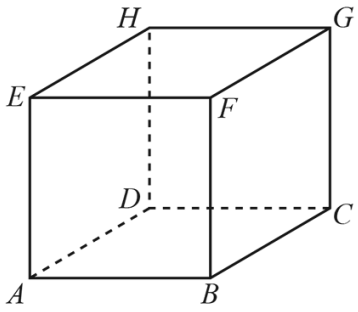
(i) Calculate the area of the shape.

..... cm^2 [3]

(ii) Calculate the perimeter of the shape.

..... cm [3]

(b)



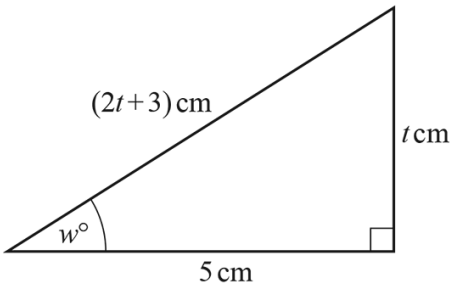
NOT TO SCALE

The diagram shows a cube $ABCDEFGH$ of edge 7 cm.

Calculate the angle between AG and the base of the cube.

..... [4]

15. 0580_w23_qp_42 Q: 6



NOT TO SCALE

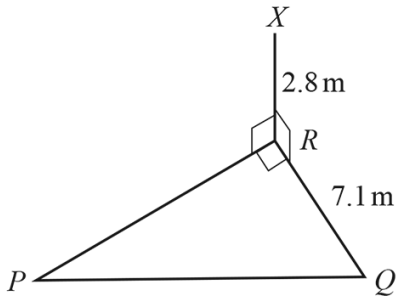
The diagram shows a right-angled triangle.

Find the value of w.

$w =$ ..... [7]

16. 0580_w23_qp_42 Q: 7

(a)



NOT TO SCALE

The diagram shows a right-angled triangle PQR on horizontal ground.
X is vertically above R and the angle of elevation of X from P is 21°.
$XR = 2.8$ m and $RQ = 7.1$ m.

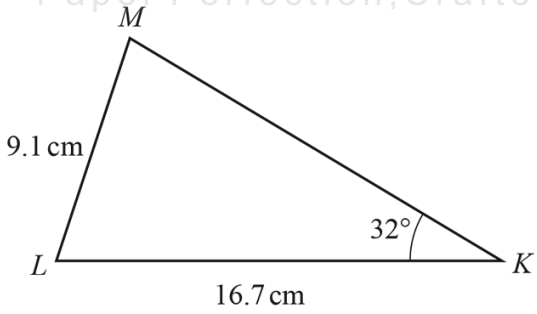
(i) Calculate the angle of elevation of X from Q.

..... [2]

(ii) Calculate PQ.

..... m [3]

(b)

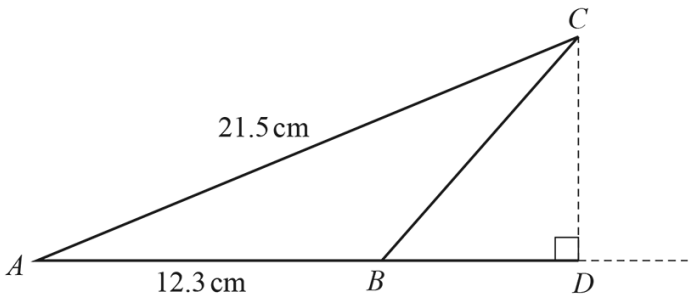


NOT TO SCALE

Calculate the acute angle KML.

Angle KML = ... [3]

(c)



NOT TO SCALE

The area of triangle ABC is $62.89\,\text{cm}^2$.

(i) Show that angle $BAC = 28.4°$, correct to 1 decimal place.

[2]

(ii) Calculate BC.

..... cm [3]

(iii) AB is extended to a point D such that angle $BDC = 90°$.

Calculate BD.

..... cm [3]

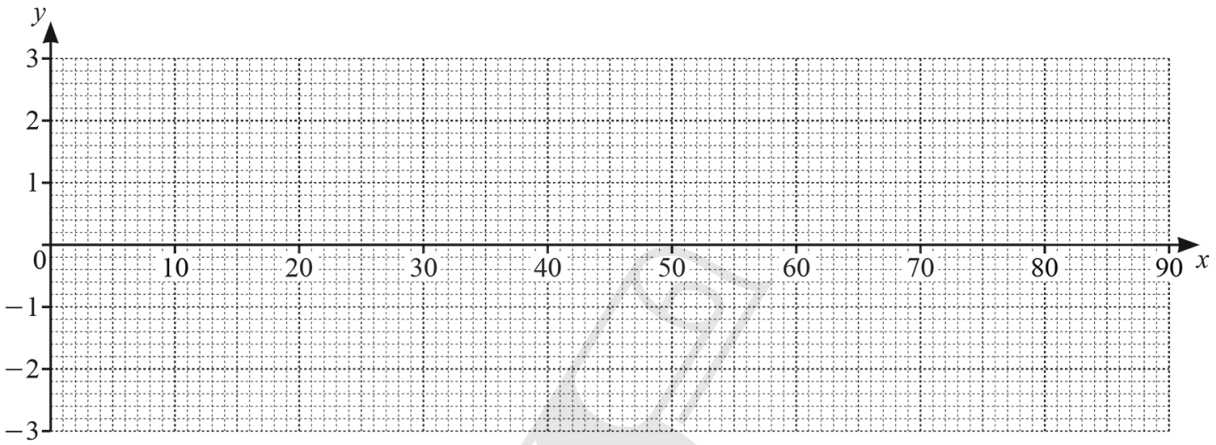
17. 0580_w23_qp_43 Q: 7

7 **(a)** Complete the table of values for $y = 3\cos 2x°$.
Values are given correct to 1 decimal place.

x	0	10	20	30	40	45	50	60	70	80	90
y	3.0	2.8	2.3	1.5	0.5		−0.5		−2.3		−3.0

[3]

(b) Draw the graph of $y = 3\cos 2x°$ for $0 \leqslant x \leqslant 90$.



[4]

(c) Use your graph to solve the equation $3\cos 2x° = -2$ for $0 \leqslant x \leqslant 90$.

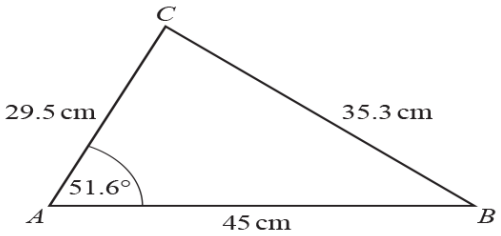
$x =$ ..... [1]

(d) By drawing a suitable straight line, solve the equation $120\cos 2x° = 80 - x$ for $0 \leqslant x \leqslant 90$.

$x =$ ..... [3]

18. 0580_m22_qp_42 Q: 4

(a)



In triangle ABC, $AB = 45$ cm, $AC = 29.5$ cm, $BC = 35.3$ cm and angle $CAB = 51.6°$.

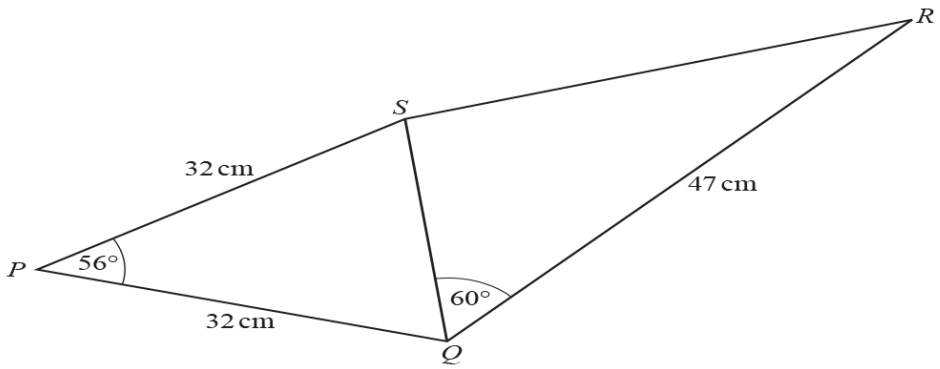
(i) Calculate angle ABC.

Angle ABC = ... [3]

(ii) Calculate the area of triangle ABC.

..... cm^2 [2]

(b)



The diagram shows a quadrilateral $PQRS$ formed from two triangles, PQS and QRS.
Triangle PQS is isosceles, with $PQ = PS = 32$ cm and angle $SPQ = 56°$.
$QR = 47$ cm and angle $SQR = 60°$.

(i) Calculate SR.

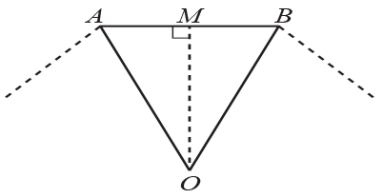
$SR =$ ..... cm [4]

(ii) Calculate the shortest distance from P to SQ.

..... cm [3]

19. 0580_s22_qp_41 Q: 5

(a) $ABCDEFGH$ is a regular octagon with sides of length 6 cm.
The diagram shows part of the octagon.
O is the centre of the octagon and M is the midpoint of AB.



(i) **(a)** Show that angle OAM is 67.5°.

[2]

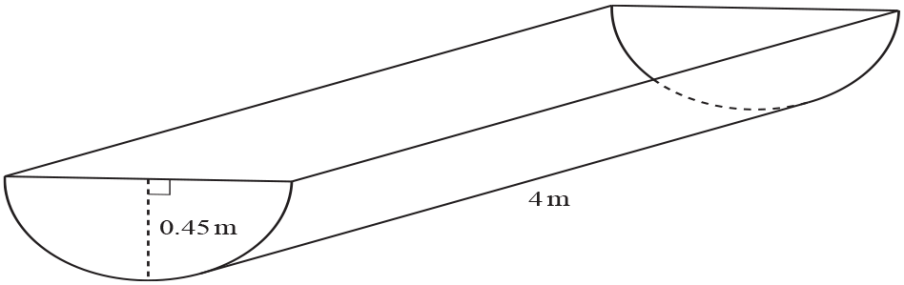
(b) Calculate the area of the octagon.

..... cm^2 [4]

(ii) Find the area of the circle that passes through the vertices of the octagon.

..... cm^2 [3]

(b)

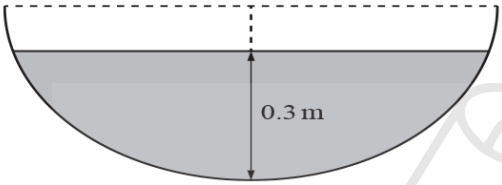


The diagram shows a horizontal container for water with a uniform cross-section.
The cross-section is a semicircle.
The radius of the semicircle is 0.45 m and the length of the container is 4 m.

(i) Calculate the volume of the container.

..... m^3 [2]

(ii)

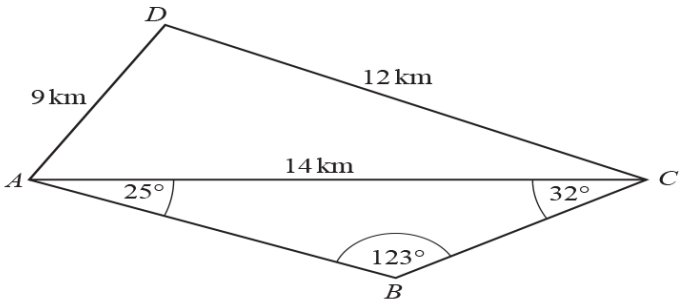


The greatest depth of the water in the container is 0.3 m.
The diagram shows the cross-section.

Calculate the number of litres of water in the container.
Give your answer correct to the nearest integer.

..... litres [6]

20. 0580_s22_qp_41 Q: 7



(a) Calculate angle ACD.

Angle ACD = ... [4]

(b) Show that $BC = 7.05\,\text{km}$, correct to 2 decimal places.

[3]

(c) Calculate the shortest distance from B to AC.

..... km [3]

(d) Calculate the length of the straight line BD.

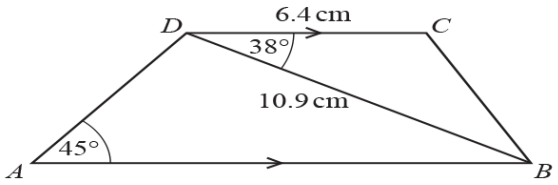
$BD =$ ..... km [4]

(e) C is due east of A.

Find the bearing of D from C.

..... [2]

21. 0580_s22_qp_42 Q: 4



$ABCD$ is a trapezium with DC parallel to AB.
$DC = 6.4$ cm, $DB = 10.9$ cm, angle $CDB = 38°$ and angle $DAB = 45°$.

(a) Find CB.

$CB =$ ..... cm [3]

(b) **(i)** Find angle ADB.

Angle $ADB =$ ..... [1]

(ii) Find AB.

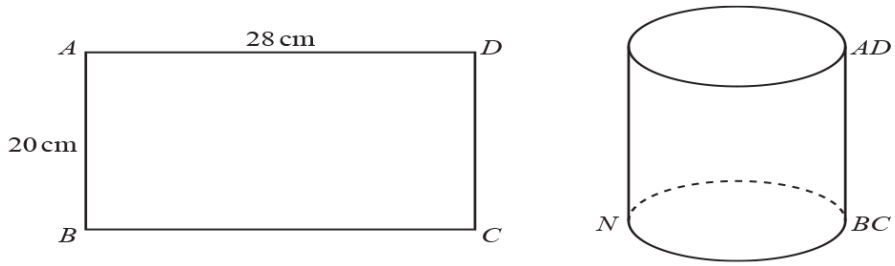
$AB =$ ..... cm [3]

(c) Calculate the area of the trapezium.

..... cm^2 [3]

22. 0580_s22_qp_42 Q: 11

(a)



A rectangular sheet of paper $ABCD$ is made into an open cylinder with the edge AB meeting the edge DC.
$AD = 28$ cm and $AB = 20$ cm.

(i) Show that the radius of the cylinder is 4.46 cm, correct to 3 significant figures.

[2]

(ii) Calculate the volume of the cylinder.

..... cm^3 [2]

(iii) N is a point on the base of the cylinder, such that BN is a diameter.

Calculate the angle between AN and the base of the cylinder.

..... [3]

(b) The volume of a solid cone is $310\,\text{cm}^3$.
The height of the cone is twice the radius of its base.

Calculate the slant height of the cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm [5]

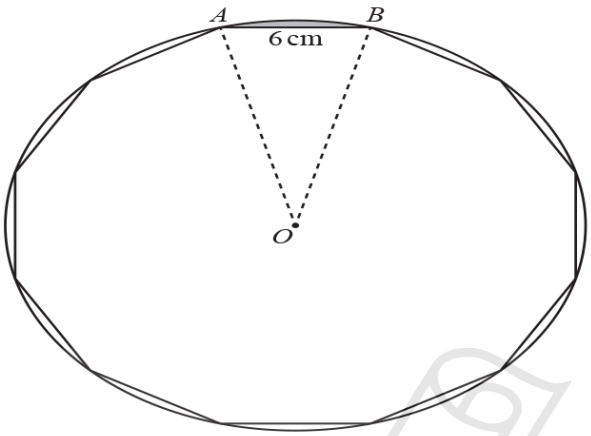
23. 0580_s22_qp_43 Q: 4

A regular 12-sided polygon has side length 6 cm.

(a) Show that one interior angle of the polygon is 150°.

[1]

(b) The polygon is enclosed by a circle, centre O, so that each vertex touches the circumference of the circle.



(i) Show that the radius, AO, of the circle is 11.6 cm, correct to 1 decimal place.

[3]

(ii) Calculate

(a) the circumference of the circle,

..... cm [2]

(b) the perimeter of the shaded **minor** segment formed by the chord AB.

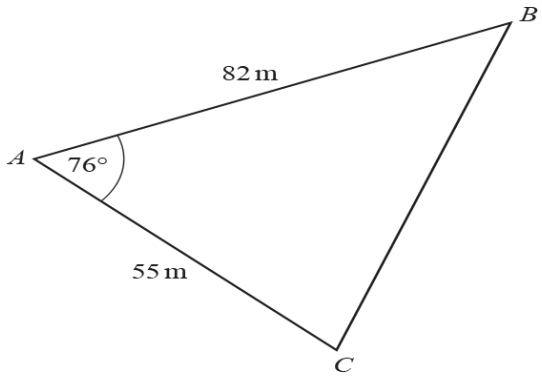
..... cm [2]

(c) The regular 12-sided polygon is the cross-section of a prism of length 2 cm.

Calculate the volume of the prism.

..... cm^3 [3]

24. 0580_s22_qp_43 Q: 7



The diagram shows a field ABC.

(a) Calculate BC.

$BC =$ ..... m [3]

(b) Calculate angle ACB.

Angle $ACB =$ ..... [3]

(c) A gate, G, lies on AB at the shortest distance from C.

Calculate AG.

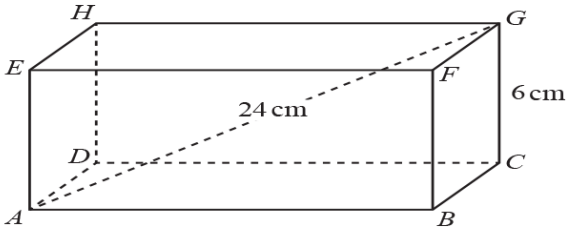
$AG =$ ..... m [3]

(d) A different triangular field PQR has the same area as ABC.
$PQ = 90\,\text{m}$ and $QR = 60\,\text{m}$.

Work out the two possible values of angle PQR.

Angle $PQR =$ ..... or ..... [5]

25. 0580_s22_qp_43 Q: 10



The diagram shows a cuboid $ABCDEFGH$.
$CG = 6$ cm, $AG = 24$ cm and $AB = 2BC$.

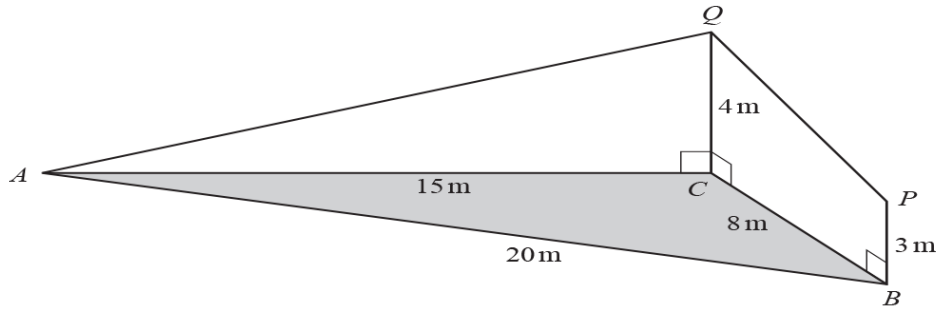
(a) Calculate AB.

$AB =$ ..... cm [4]

(b) Calculate the angle between AG and the base $ABCD$.

..... [3]

26. 0580_w22_qp_41 Q: 8



The diagram shows triangle ABC on horizontal ground.
$AC = 15\,\text{m}$, $BC = 8\,\text{m}$ and $AB = 20\,\text{m}$.

BP and CQ are vertical poles of different heights.
$BP = 3\,\text{m}$ and $CQ = 4\,\text{m}$.
AQ and PQ are straight wires.

(a) Show that angle $ACB = 117.5°$, correct to 1 decimal place.

[4]

(b) Calculate the area of triangle ABC.

..... m^2 [2]

(c) Calculate the length of AQ.

..... m [2]

(d) Calculate the angle of elevation of Q from P.

..... [3]

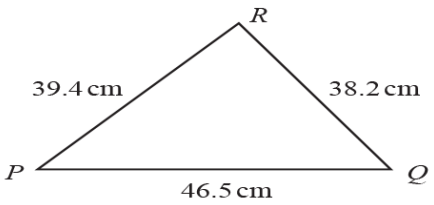
(e) Another straight wire connects A to the midpoint of PQ.

Calculate the angle between this wire and the horizontal ground.

..... [5]

27. 0580_w22_qp_42 Q: 7

(a)



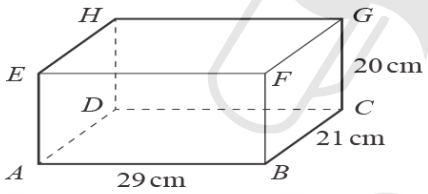
(i) Calculate angle QPR.

Angle QPR = ... [4]

(ii) Find the shortest distance from Q to PR.

..... cm [3]

(b) The diagram shows a cuboid.



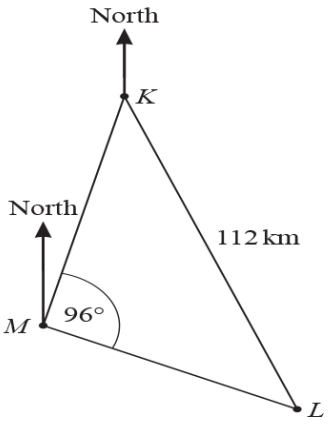
(i) Calculate the length AG.

AG = ... cm [3]

(ii) Calculate the angle between AG and the base $ABCD$.

..... [3]

(c)



The diagram shows the positions of a lighthouse, L, and two ships, K and M.
The bearing of L from K is 155° and $KL = 112\,\text{km}$.
The bearing of K from M is 010° and angle $KML = 96°$.

Find the bearing and distance of ship M from the lighthouse, L.

Bearing .....

Distance ..... km [5]

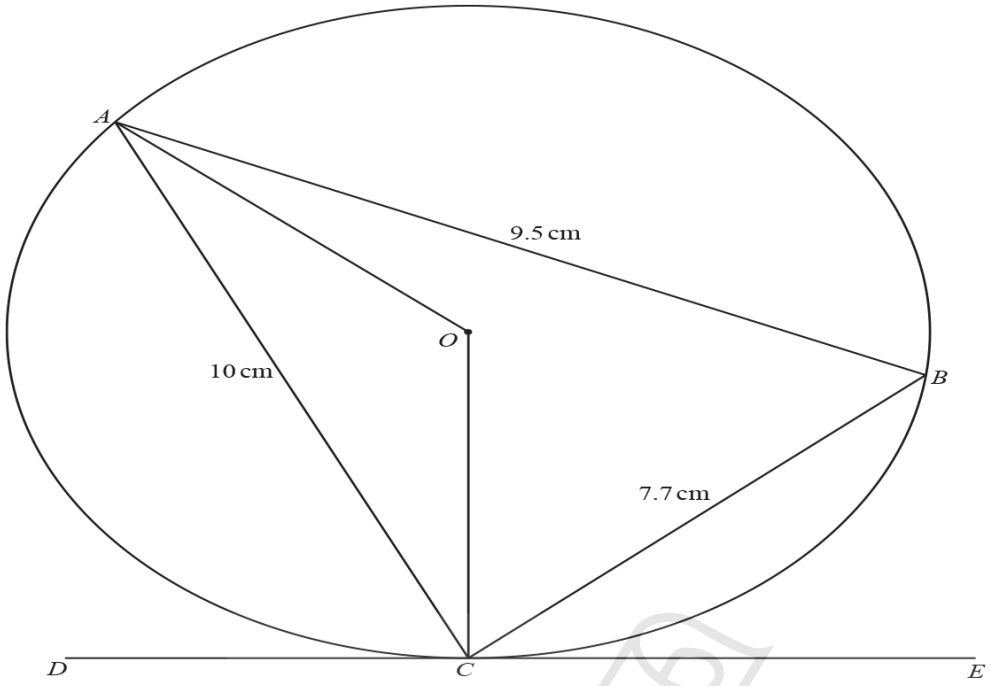
28. 0580_w22_qp_42 Q: 9

(a) On the diagram, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

(b) Solve the equation $5\sin x + 4 = 0$ for $0° \leqslant x \leqslant 360°$.

$x =$ ..... or $x =$ ..... [3]

29. 0580_w22_qp_43 Q: 8



A, B and C are points on the circle, centre O.
DE is a tangent to the circle at C.
$AC = 10\,\text{cm}$, $AB = 9.5\,\text{cm}$ and $BC = 7.7\,\text{cm}$.

(a) Show that angle $ABC = 70.2°$, correct to 1 decimal place. [4]

(b) Find

(i) angle AOC

Angle AOC = ... [1]

(ii) angle ACO

Angle ACO = ... [1]

(iii) angle ACD.

Angle ACD = ... [1]

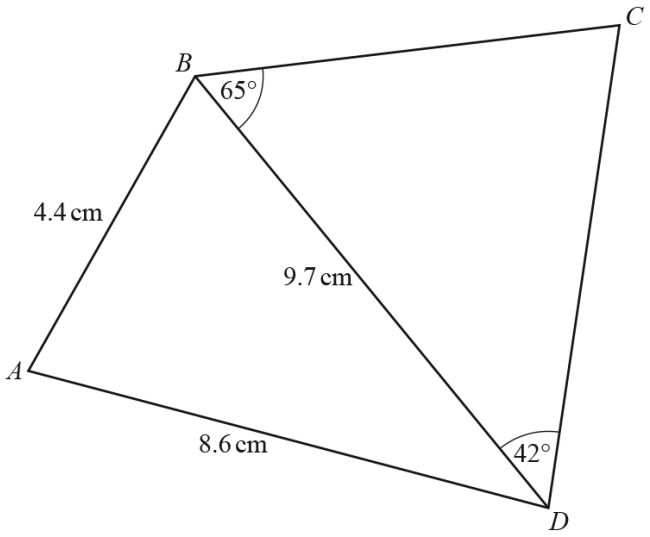
(c) Calculate the radius, OC, of the circle.

OC = ... cm [3]

(d) Calculate the area of triangle ABC as a percentage of the area of the circle.

..... % [4]

30. 0580_m21_qp_42 Q: 5



NOT TO SCALE

(a) Calculate angle *ADB*.

Angle *ADB* = ... [3]

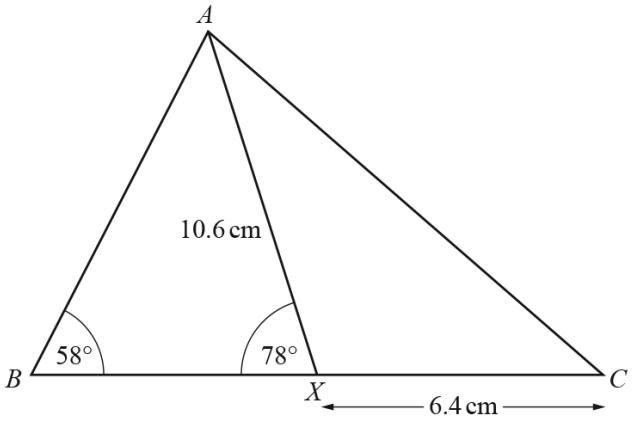
(b) Calculate *DC*.

DC = ... cm [4]

(c) Calculate the shortest distance from *C* to *BD*.

..... cm [3]

31. 0580_s21_qp_41 Q: 5



NOT TO SCALE

The diagram shows triangle ABC.
X is a point on BC.
$AX = 10.6$ cm, $XC = 6.4$ cm, angle $ABC = 58°$ and angle $AXB = 78°$.

(a) Calculate AC.

$AC =$ ..... cm [4]

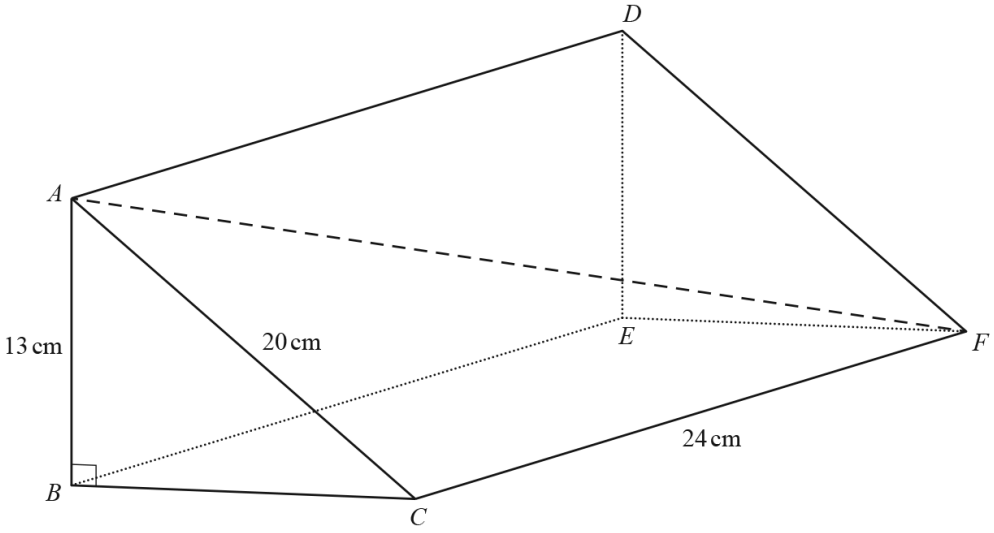
(b) Calculate BX.

$BX =$ ..... cm [4]

(c) Calculate the area of triangle ABC.

..... cm^2 [3]

32. 0580_s21_qp_41 Q: 9



NOT TO SCALE

The diagram shows a prism, *ABCDEF*.
AB = 13 cm, *AC* = 20 cm, *CF* = 24 cm and angle *ABC* = 90°.

(a) Calculate the total surface area of the prism.

..... cm^2 [6]

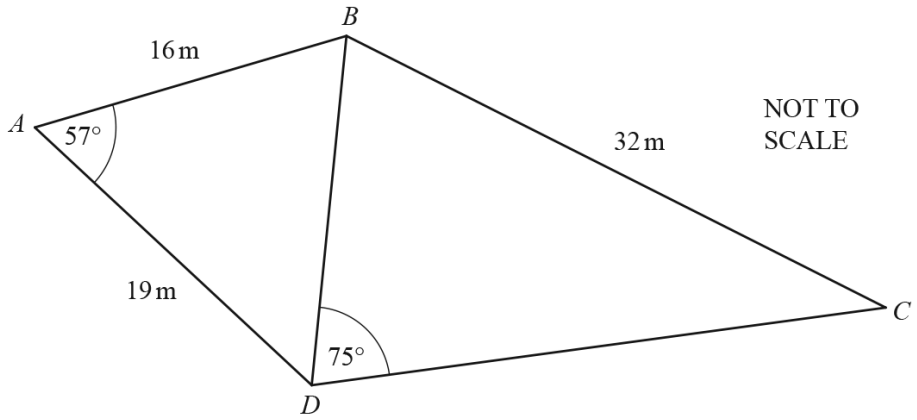
(b) Calculate the volume of the prism.

..... cm^3 [1]

(c) Calculate the angle that *AF* makes with the base *BCFE*.

..... [4]

33. 0580_s21_qp_42 Q: 6



The diagram shows a quadrilateral *ABCD* made from two triangles, *ABD* and *BCD*.

(a) Show that $BD = 16.9$ m, correct to 1 decimal place.

[3]

(b) Calculate angle *CBD*.

Angle *CBD* = ... [4]

(c) Find the area of the quadrilateral *ABCD*.

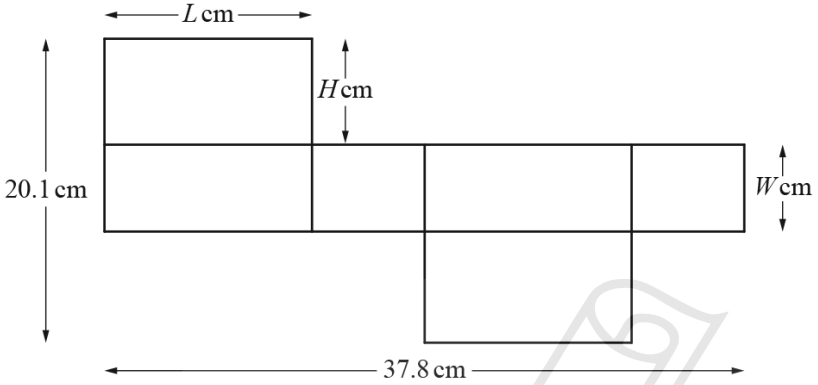
..... m^2 [3]

(d) Find the shortest distance from B to AD.

..... m [3]

34. 0580_s21_qp_42 Q: 8

(a) A cuboid has length L cm, width W cm and height H cm.



NOT TO SCALE

The diagram shows the net of this cuboid.
The ratio $W : L = 1 : 2$.

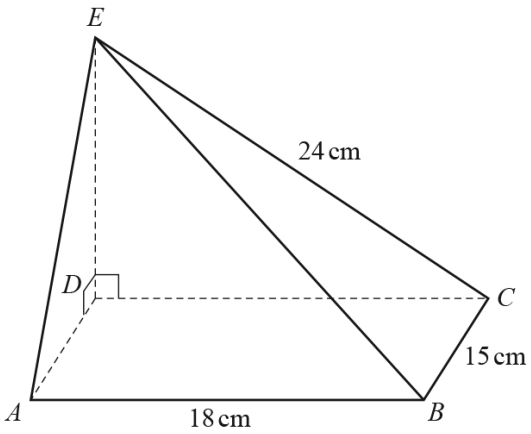
Find the value of L, the value of W and the value of H.

$L =$ .....

$W =$ .....

$H =$ ..... [5]

(b)



NOT TO SCALE

The diagram shows a solid pyramid with a rectangular base $ABCD$.
E is vertically above D.
Angle EDC = angle EDA = 90°.
AB = 18 cm, BC = 15 cm and EC = 24 cm.

(i) The pyramid is made of wood and has a mass of 800 g.

Calculate the density of the wood.
Give the units of your answer.

[The volume, V, of a pyramid is $V = \frac{1}{3} \times$ area of base $\times$ height.]
[Density = mass ÷ volume]

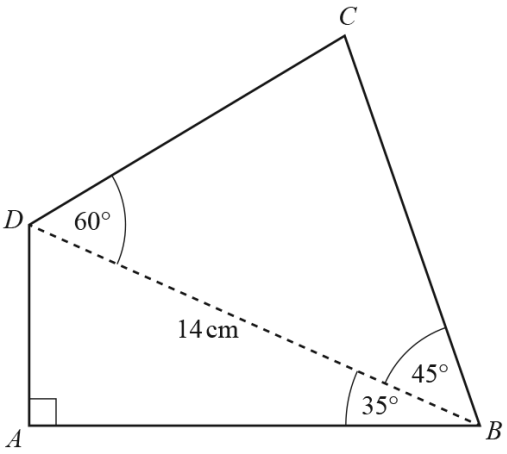
.... [5]

(ii) Calculate the angle between BE and the base of the pyramid.

..... [4]

35. 0580_s21_qp_43 Q: 9

(a)

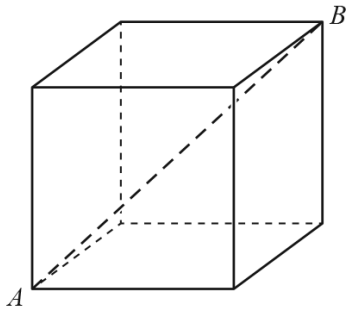


NOT TO SCALE

Calculate the perimeter of the quadrilateral *ABCD*.

..... cm [7]

(b)



NOT TO SCALE

The diagram shows a cube.
The length of the diagonal AB is 8.5 cm.

(i) Calculate the length of an edge of the cube.

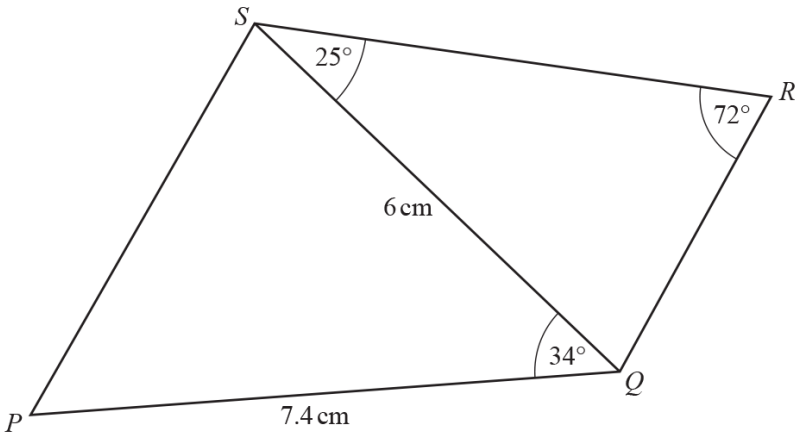
..... cm [3]

(ii) Calculate the angle between AB and the base of the cube.

..... [3]

36. 0580_m20_qp_42 Q: 8

(a)



NOT TO SCALE

The diagram shows a quadrilateral *PQRS* formed from two triangles, *PQS* and *QRS*.

Calculate

(i) *QR*,

QR = ... cm [3]

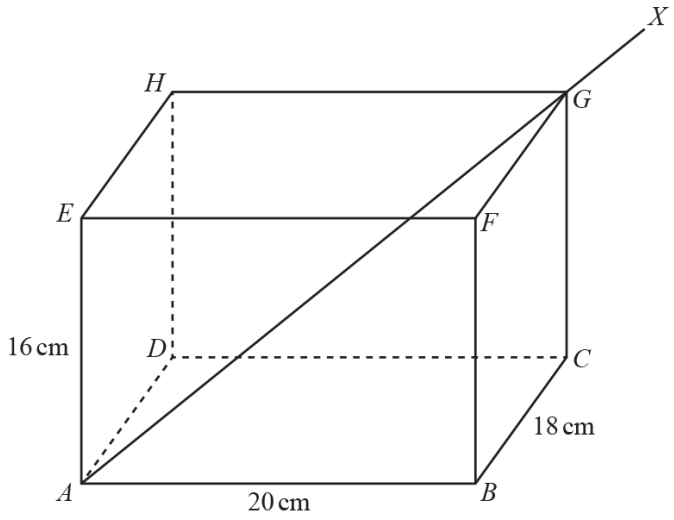
(ii) *PS*,

PS = ... cm [3]

(iii) the area of quadrilateral *PQRS*.

..... cm^2 [4]

(b)



NOT TO SCALE

The diagram shows an open box $ABCDEFGH$ in the shape of a cuboid.
$AB = 20$ cm, $BC = 18$ cm and $AE = 16$ cm.
A thin rod AGX rests partly in the box as shown.
The rod is 40 cm long.

(i) Calculate GX, the length of the rod which is outside the box.

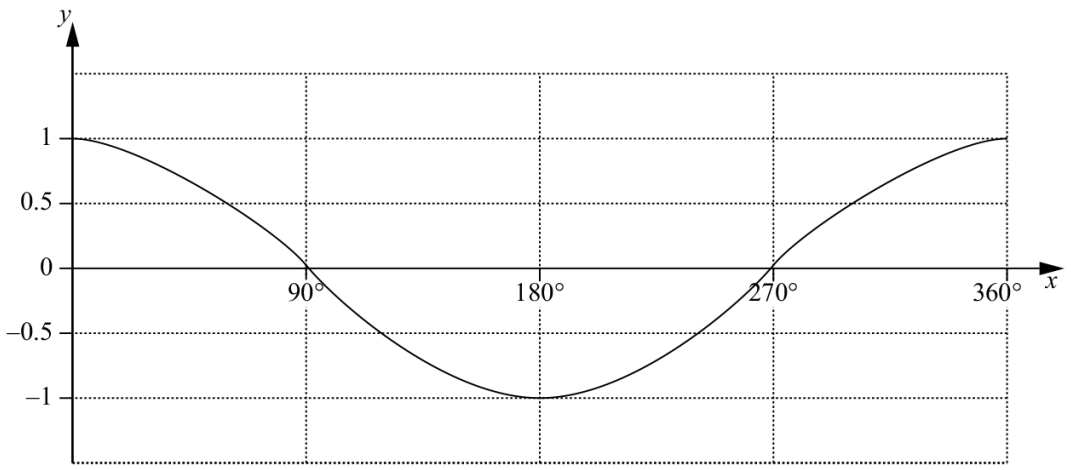
$GX =$ ..... cm [4]

(ii) Calculate the angle the rod makes with the base of the box.

..... [3]

37. 0580_p20_qp_40 Q: 8

The grid shows the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$.

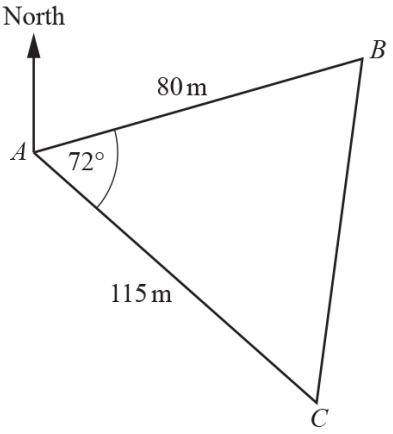


(a) Solve the equation $3\cos x = 1$ for $0° \leqslant x \leqslant 360°$.
Give your answers correct to 1 decimal place.

..... and ..... [4]

(b) On the same grid, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$. [2]

38. 0580_s20_qp_41 Q: 7



NOT TO SCALE

The diagram shows the positions of three points A, B and C in a field.

(a) Show that BC is 118.1 m, correct to 1 decimal place.

[3]

(b) Calculate angle ABC.

Angle ABC = ... [3]

(c) The bearing of C from A is 147°.

Find the bearing of

(i) A from B,

..... [3]

(ii) B from C.

..... [2]

(d) Mitchell takes 35 seconds to run from A to C.

Calculate his average running speed in kilometres per hour.

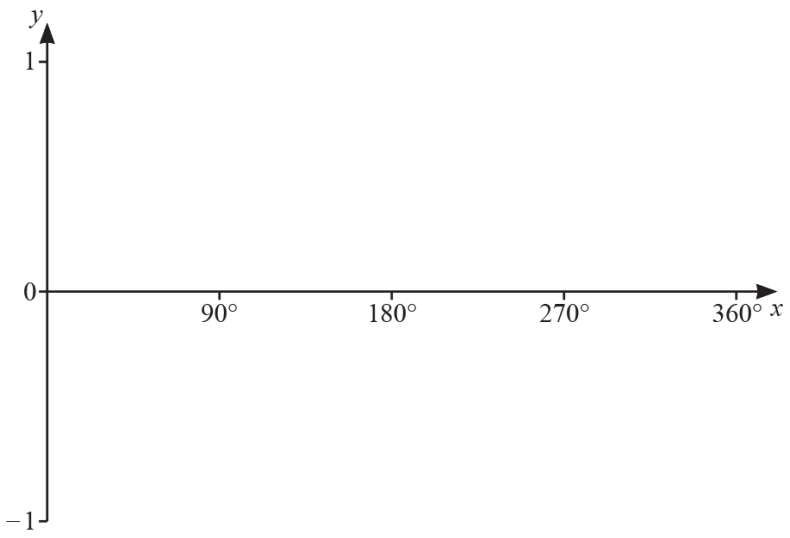
..... km/h [3]

(e) Calculate the shortest distance from point B to AC.

..... m [3]

39. 0580_s20_qp_41 Q: 8

(a) (i) On the axes, sketch the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.



[2]

(ii) Describe fully the symmetry of the graph of $y = \sin x$ for $0° \leqslant x \leqslant 360°$.

.....

..... [2]

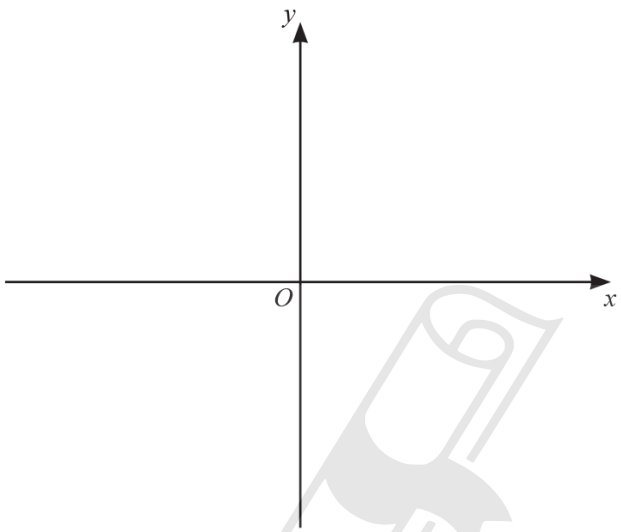
(b) Solve $4\sin x - 1 = 2$ for $0° \leqslant x \leqslant 360°$.

$x =$ ..... and $x =$ ..... [3]

(c) **(i)** Write $x^2+10x+14$ in the form $(x+a)^2+b$.

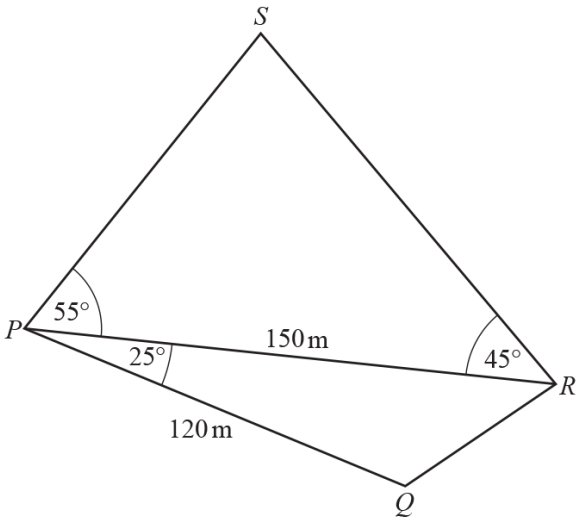
..... [2]

(ii) On the axes, sketch the graph of $y=x^2+10x+14$, indicating the coordinates of the turning point.



[3]

40. 0580_s20_qp_42 Q: 4



NOT TO SCALE

The diagram shows two triangles.

(a) Calculate QR.

$QR =$ ..... m [3]

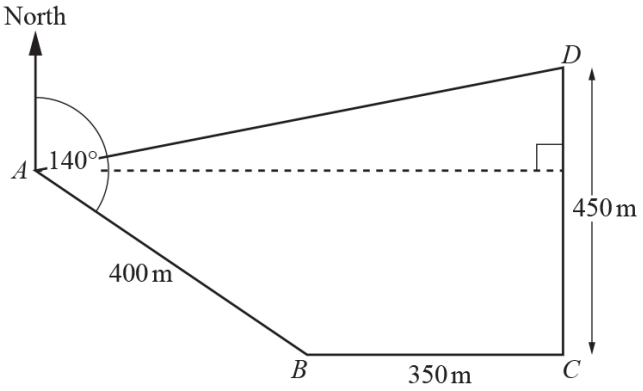
(b) Calculate RS.

$RS =$ ..... m [4]

(c) Calculate the total area of the two triangles.

..... m^2 [3]

41. 0580_s20_qp_42 Q: 5



NOT TO SCALE

The diagram shows a field $ABCD$.
The bearing of B from A is 140°.
C is due east of B and D is due north of C.
$AB = 400$ m, $BC = 350$ m and $CD = 450$ m.

(a) Find the bearing of D from B.

..... [2]

(b) Calculate the distance from D to A.

..... m [6]

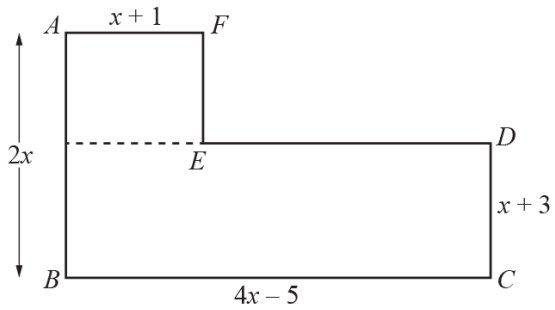
(c) Jono runs around the field from A to B, B to C, C to D and D to A.
He runs at a speed of 3 m/s.

Calculate the total time Jono takes to run around the field.
Give your answer in minutes and seconds, correct to the nearest second.

..... min ..... s [4]

42. 0580_s20_qp_43 Q: 5

All the lengths in this question are in centimetres.



NOT TO SCALE

The diagram shows a shape *ABCDEF* made from two rectangles.
The total area of the shape is 342 cm^2.

(a) Show that $x^2 + x - 72 = 0$.

[5]

(b) Solve by factorisation.

$x^2 + x - 72 = 0$

$x =$ ..... or $x =$ ..... [3]

(c) Work out the perimeter of the shape *ABCDEF*.

..... cm [2]

(d) Calculate angle *DBC*.

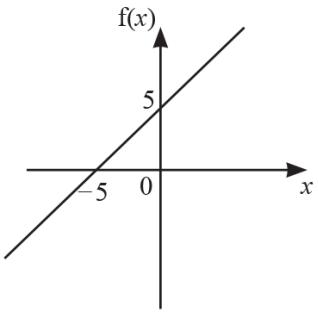
Angle *DBC* = ... [2]

43. 0580_s20_qp_43 Q: 10

(a) The diagrams show the graphs of two functions.

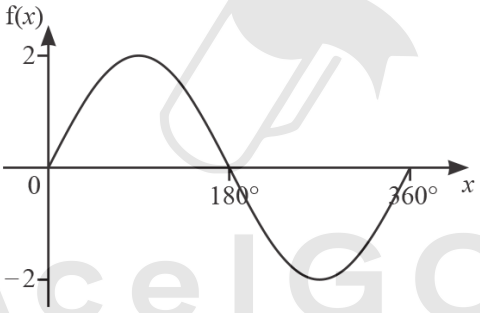
Write down each function.

(i)



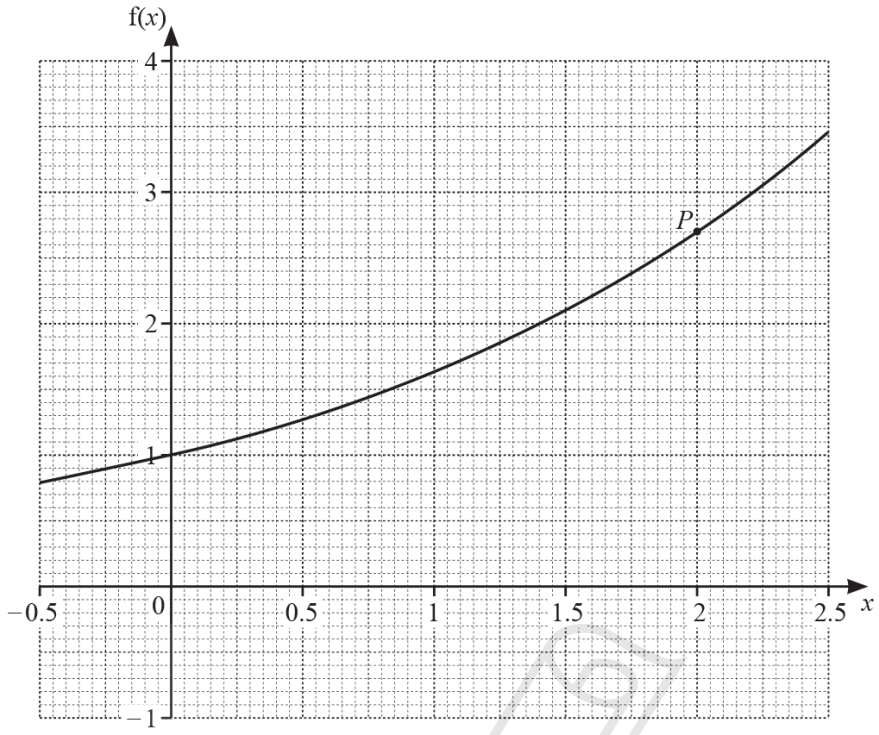
f(x) = ... [2]

(ii)



f(x) = ... [2]

(b)



The diagram shows the graph of another function.

By drawing a suitable tangent, find an estimate for the gradient of the function at the point P.

..... [3]

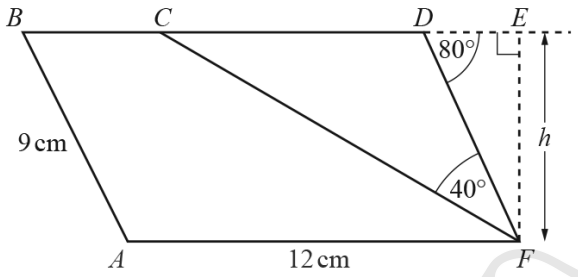
44. 0580_w20_qp_41 Q: 4

(a) A rectangle measures 8.5 cm by 10.7 cm, both correct to 1 decimal place.

Calculate the upper bound of the perimeter of the rectangle.

..... cm [3]

(b)



NOT TO SCALE

ABDF is a parallelogram and *BCDE* is a straight line.
AF = 12 cm, *AB* = 9 cm, angle *CFD* = 40° and angle *FDE* = 80°.

(i) Calculate the height, *h*, of the parallelogram.

h = ... cm [2]

(ii) Explain why triangle *CDF* is isosceles.

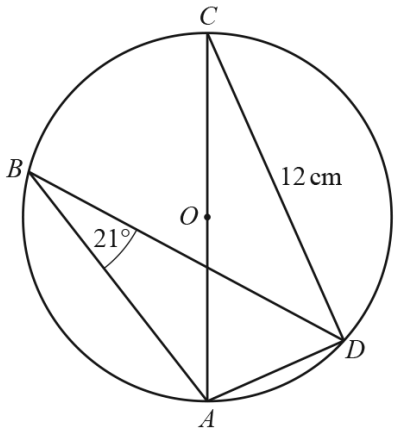
.....

..... [2]

(iii) Calculate the area of the **trapezium** *ABCF*.

..... cm^2 [3]

(c)



NOT TO SCALE

A, B, C and D are points on the circle, centre O.
Angle $ABD = 21°$ and $CD = 12$ cm.

Calculate the area of the circle.

..... cm^2 [5]

(d)

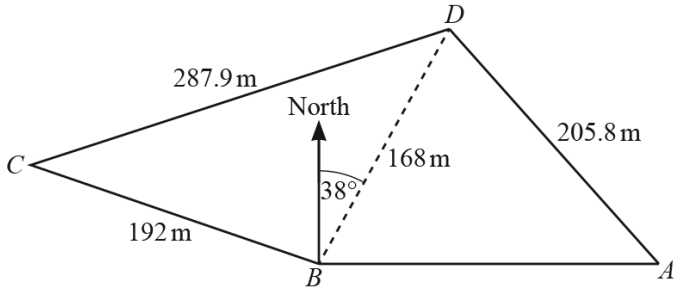
NOT TO SCALE

The diagram shows a square with side length 8 cm and a sector of a circle with radius 9.5 cm and sector angle $x°$.
The perimeter of the square is equal to the perimeter of the sector.

Calculate the value of x.

$x =$ ..... [3]

45. 0580_w20_qp_41 Q: 6



NOT TO SCALE

The diagram shows a field, *ABCD*, on horizontal ground.
BC = 192 m, *CD* = 287.9 m, *BD* = 168 m and *AD* = 205.8 m.

(a) (i) Calculate angle *CBD* and show that it rounds to 106.0°, correct to 1 decimal place.

[4]

(ii) The bearing of *D* from *B* is 038°.

Find the bearing of *C* from *B*.

..... [1]

(iii) *A* is **due east** of *B*.

Calculate the bearing of *D* from *A*.

..... [5]

(b) (i) Calculate the area of triangle *BCD*.

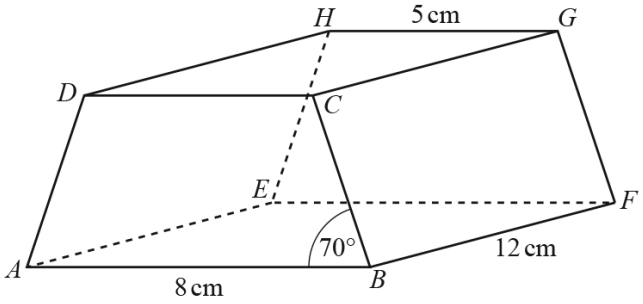
..... m^2 [2]

(ii) Tomas buys the triangular part of the field, *BCD*.
The cost is \$35 750 per hectare.

Calculate the amount he pays.
Give your answer correct to the nearest \$100.
[1 hectare = 10 000 m^2]

\$ ..... [2]

46. 0580_w20_qp_42 Q: 9



NOT TO SCALE

The diagram shows a prism with a rectangular base, $ABFE$.
The cross-section, $ABCD$, is a trapezium with $AD = BC$.
$AB = 8$ cm, $GH = 5$ cm, $BF = 12$ cm and angle $ABC = 70°$.

(a) Calculate the total surface area of the prism.

..... cm^2 [6]

(b) The perpendicular from G onto EF meets EF at X.

(i) Show that $EX = 6.5$ cm.

[1]

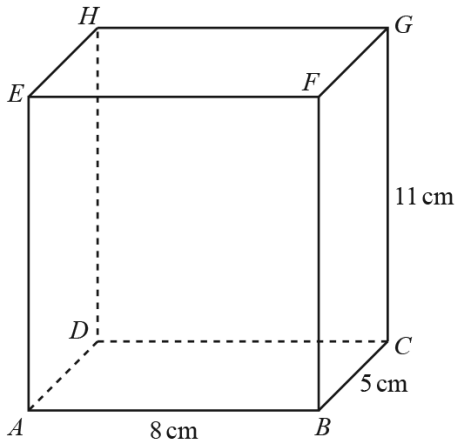
(ii) Calculate AX.

$AX =$ ..... cm [2]

(iii) Calculate the angle between the diagonal AG and the base $ABFE$.

..... [2]

47. 0580_w20_qp_43 Q: 6



NOT TO SCALE

ABCDEFGH is a cuboid.
$AB = 8$ cm, $BC = 5$ cm and $CG = 11$ cm.

(a) Work out the volume of the cuboid.

..... cm^3 [2]

(b) Ivana has a pencil of length 13 cm.

Does this pencil fit completely inside the cuboid?
Show how you decide.

[4]

(c) **(i)** Calculate angle *CAB*.

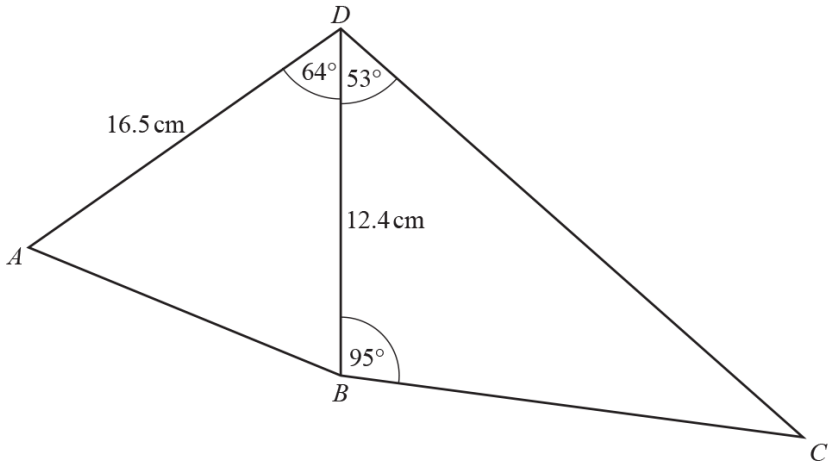
Angle *CAB* = ... [2]

(ii) Calculate angle *GAC*.

Angle *GAC* = ... [2]

48. 0580_s19_qp_42 Q: 8

(a)



NOT TO SCALE

The diagram shows two triangles *ABD* and *BCD*.
AD = 16.5 cm and *BD* = 12.4 cm.
Angle *ADB* = 64°, angle *BDC* = 53° and angle *DBC* = 95°.

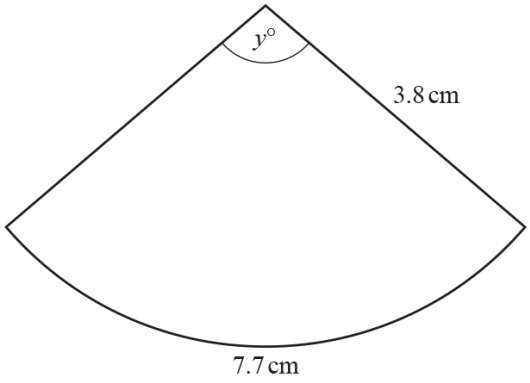
(i) Find *AB*.

AB = ... cm [4]

(ii) Find *BC*.

BC = ... cm [4]

(b)



NOT TO SCALE

The diagram shows a sector of a circle of radius 3.8 cm.
The arc length is 7.7 cm.

(i) Calculate the value of y.

$y =$ ..... [2]

(ii) Calculate the area of the sector.

..... cm^2 [2]

49. 0580_w19_qp_41 Q: 4

(a) **(i)** Calculate the **external curved** surface area of a cylinder with radius 8 m and height 19 m.

..... m^2 [2]

(ii) This surface is painted at a cost of \$0.85 per square metre.

Calculate the cost of painting this surface.

\$ ..... [2]

(b) A solid metal sphere with radius 6 cm is melted down and all of the metal is used to make a solid cone with radius 8 cm and height h cm.

(i) Show that $h = 13.5$.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

[2]

(ii) Calculate the slant height of the cone.

..... cm [2]

(iii) Calculate the curved surface area of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi r l$.]

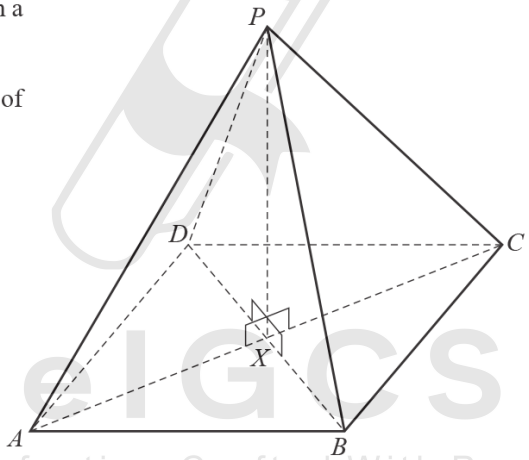
..... cm^2 [1]

(c) Two cones are mathematically similar.
The total surface area of the smaller cone is $80\,cm^2$.
The total surface area of the larger cone is $180\,cm^2$.
The volume of the smaller cone is $168\,cm^3$.

Calculate the volume of the larger cone.

..... cm^3 [3]

(d) The diagram shows a pyramid with a square base $ABCD$.
$DB = 8\,cm$.
P is vertically above the centre, X, of the base and $PX = 5\,cm$.

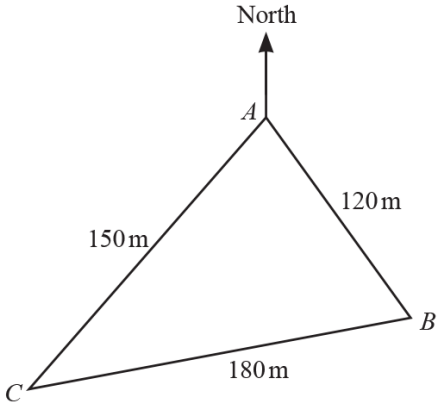


NOT TO SCALE

Calculate the angle between PB and the base $ABCD$.

..... [3]

50. 0580_w19_qp_41 Q: 5



NOT TO SCALE

The diagram shows a triangular field, ABC, on horizontal ground.

(a) Olav runs from A to B at a constant speed of 4 m/s and then from B to C at a constant speed of 3 m/s.
He then runs at a constant speed from C to A.
His average speed for the whole journey is 3.6 m/s.

Calculate his speed when he runs from C to A.

..... m/s [3]

(b) Use the cosine rule to find angle BAC.

Angle BAC = ... [4]

(c) The bearing of C from A is 210°.

(i) Find the bearing of B from A.

..... [1]

(ii) Find the bearing of A from B.

..... [2]

(d) D is the point on AC that is nearest to B.

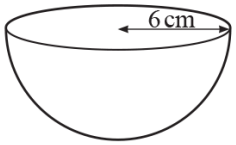
Calculate the distance from D to A.

..... m [2]

51. 0580_w19_qp_42 Q: 4

(a)

NOT TO SCALE



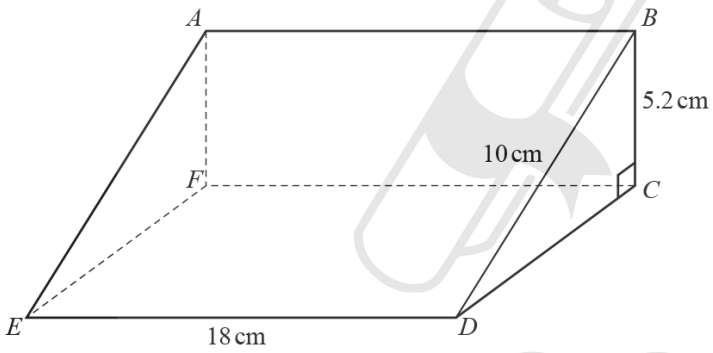
The diagram shows a hemisphere with radius 6 cm.

Calculate the volume.
Give the units of your answer.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

.... [3]

(b)



NOT TO SCALE

The diagram shows a prism $ABCDEF$.
The cross-section is a right-angled triangle BCD.
$BD = 10$ cm, $BC = 5.2$ cm and $ED = 18$ cm.

(i) (a) Work out the volume of the prism.

..... cm^3 [6]

(b) Calculate angle *BEC*.

Angle *BEC* = ... [4]

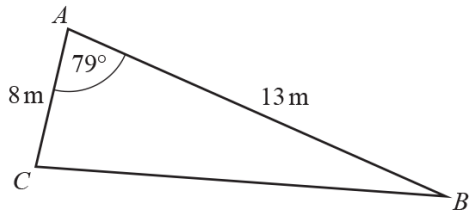
(ii) The point *G* lies on the line *ED* and *GD* = 7 cm.

Work out angle *BGE*.

Angle *BGE* = ... [3]

52. 0580_w19_qp_42 Q: 6

(a)



NOT TO SCALE

The diagram shows triangle ABC.

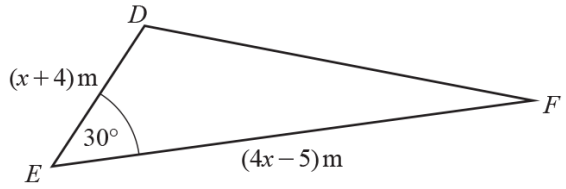
(i) Use the cosine rule to calculate BC.

$BC =$ ..... m [4]

(ii) Use the sine rule to calculate angle ACB.

Angle $ACB =$ ..... [3]

(b)



NOT TO SCALE

The area of triangle DEF is $70\,m^2$.

(i) Show that $4x^2 + 11x - 300 = 0$.

[4]

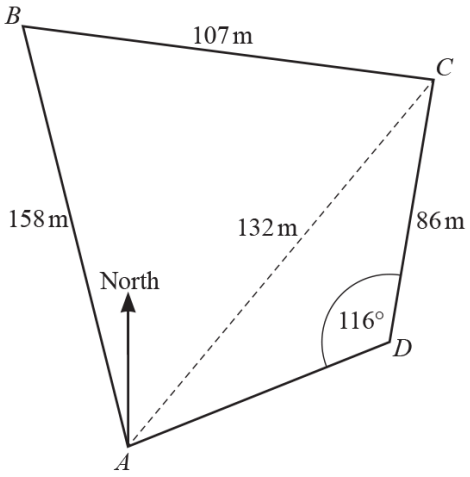
(ii) Use the quadratic formula to solve $4x^2 + 11x - 300 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [4]

(iii) Find the length of DE.

$DE =$ ..... m [1]

53. 0580_w19_qp_43 Q: 4



NOT TO SCALE

The diagram shows a field, *ABCD*, on horizontal ground.

(a) There is a vertical post at *C*.
From *B*, the angle of elevation of the top of the post is 19°.

Find the height of the post.

..... m [2]

(b) Use the cosine rule to find angle *BAC*.

Angle *BAC* = ... [4]

(c) Use the sine rule to find angle *CAD*.

Angle *CAD* = ... [3]

(d) Calculate the area of the field.

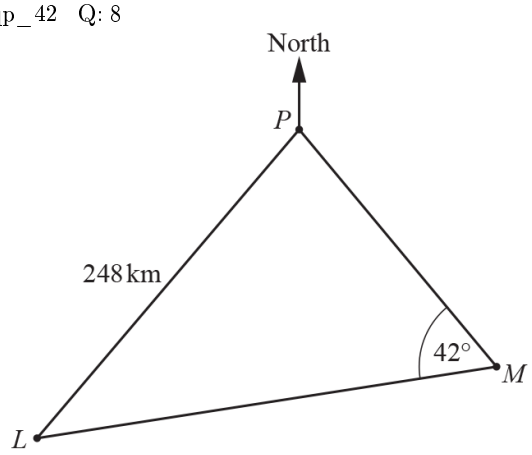
..... m^2 [3]

(e) The bearing of *D* from *A* is 070°.

Find the bearing of *A* from *C*.

..... [2]

54. 0580_m18_qp_42 Q: 8



NOT TO SCALE

The diagram shows two ports, L and P, and a buoy, M.
The bearing of L from P is 201° and $LP = 248$ km.
The bearing of M from P is 127°.
Angle $PML = 42°$.

(a) Use the sine rule to calculate LM.

$LM =$ ..... km [4]

(b) A ship sails directly from L to P.

(i) Calculate the shortest distance from M to LP.

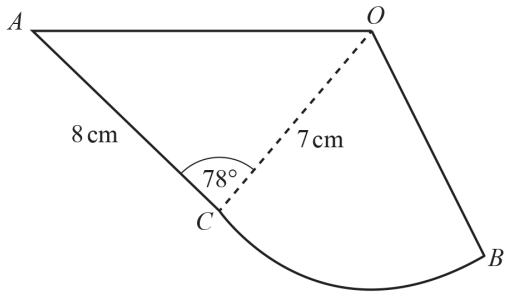
..... km [3]

(ii) The ship leaves L at 2045 and travels at a speed of 40 km/h.

Calculate the time the next day that the ship arrives at P.

..... [3]

55. 0580_s18_qp_42 Q: 5



NOT TO SCALE

The diagram shows a design made from a triangle AOC joined to a sector OCB.
$AC = 8$ cm, $OB = OC = 7$ cm and angle $ACO = 78°$.

(a) Use the cosine rule to show that $OA = 9.47$ cm, correct to 2 decimal places.

[4]

(b) Calculate angle OAC.

Angle OAC = ... [3]

(c) The perimeter of the design is 29.5 cm.

Show that angle $COB = 41.2°$, correct to 1 decimal place.

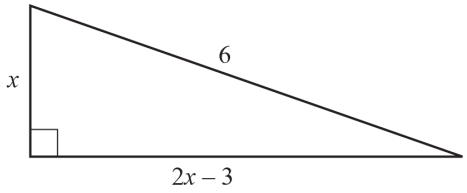
[5]

(d) Calculate the total area of the design.

..... cm^2 [4]

56. 0580_s18_qp_42 Q: 7

In this question, all measurements are in metres.



NOT TO SCALE

The diagram shows a right-angled triangle.

(a) Show that $5x^2 - 12x - 27 = 0$.

[3]

(b) Solve $5x^2 - 12x - 27 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [4]

(c) Calculate the perimeter of the triangle.

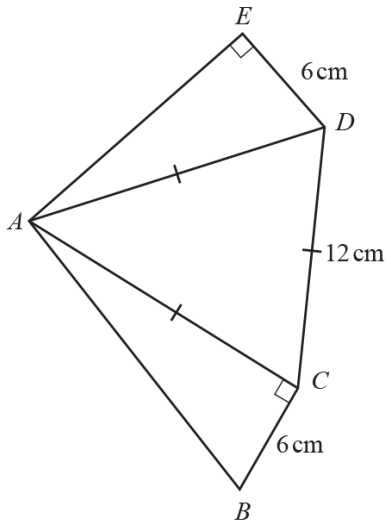
..... m [2]

(d) Calculate the smallest angle of the triangle.

..... [2]

57. 0580_s18_qp_43 Q: 6

(a)



NOT TO SCALE

In the pentagon $ABCDE$, angle ACB = angle AED = 90°.
Triangle ACD is equilateral with side length 12 cm.
$DE = BC = 6$ cm.

(i) Calculate angle BAE.

Angle BAE = ... [4]

(ii) Calculate AB.

AB = ... cm [2]

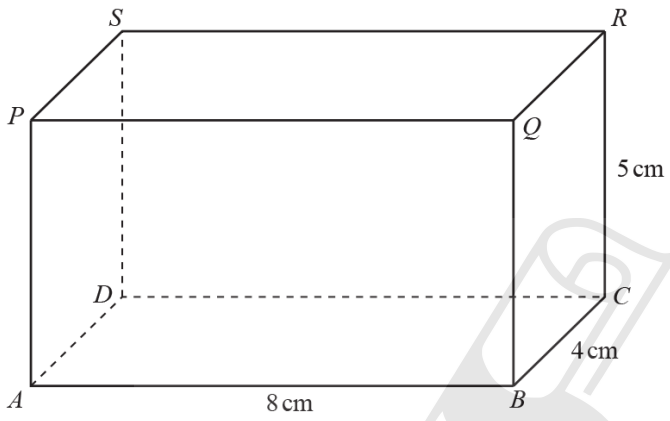
(iii) Calculate AE.

AE = ... cm [3]

(iv) Calculate the area of the pentagon.

..... cm^2 [4]

(b)



NOT TO SCALE

The diagram shows a cuboid.
$AB = 8$ cm, $BC = 4$ cm and $CR = 5$ cm.

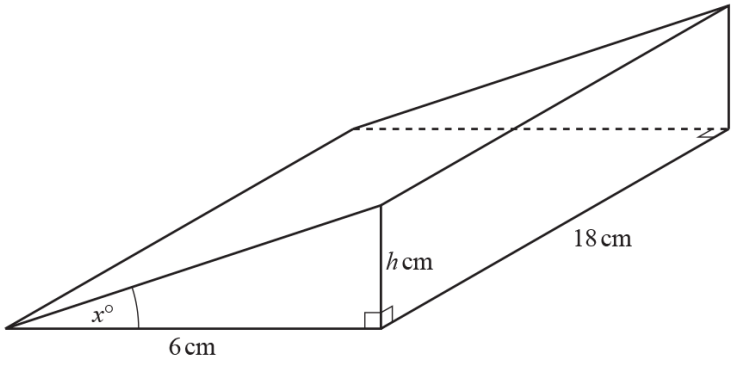
(i) Write down the number of planes of symmetry of this cuboid.

..... [1]

(ii) Calculate the angle between the diagonal AR and the plane $BCRQ$.

..... [4]

58. 0580_w18_qp_41 Q: 5



NOT TO SCALE

The diagram shows a prism with length 18 cm and volume 253.8 cm^3.
The cross-section of the prism is a right-angled triangle with base 6 cm and height h cm.

(a) **(i)** Show that the value of h is 4.7 .

[3]

(ii) Calculate the value of x.

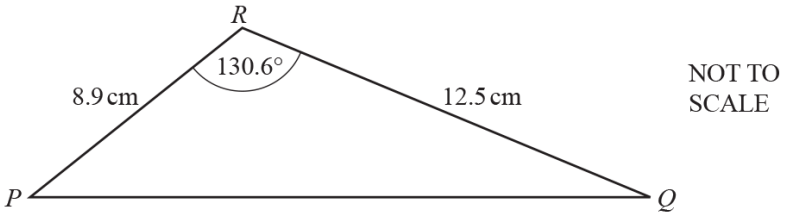
$x =$ ..... [2]

(b) Calculate the total surface area of the prism.

..... cm^2 [6]

59. 0580_w18_qp_41 Q: 7

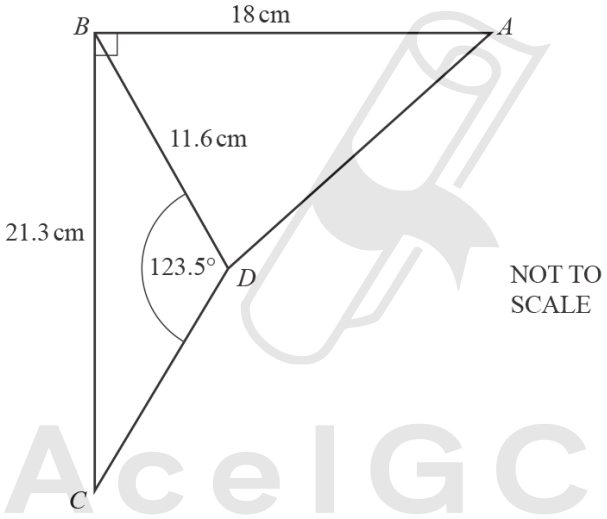
(a)



Calculate the area of triangle PQR.

..... cm^2 [2]

(b)



In the diagram, $AB = 18$ cm, $BC = 21.3$ cm and $BD = 11.6$ cm.
Angle $BDC = 123.5°$ and angle ABC is a right angle.

(i) Calculate angle BCD.

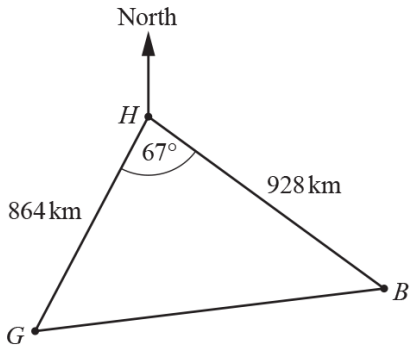
Angle BCD = ... [3]

(ii) Calculate AD.

AD = ... cm [5]

60. 0580_w18_qp_42 Q: 8

The diagram shows the positions of three cities, Geneva (G), Budapest (B) and Hamburg (H).



NOT TO SCALE

(a) A plane flies from Geneva to Hamburg.
The flight takes 2 hours 20 minutes.

Calculate the average speed in kilometres per hour.

..... km/h [2]

(b) Use the cosine rule to calculate the distance from Geneva to Budapest.

..... km [4]

(c) The bearing of Budapest from Hamburg is 133°.

(i) Find the bearing of Hamburg from Budapest.

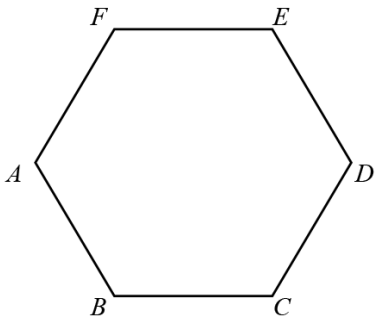
..... [2]

(ii) Calculate the bearing of Budapest from Geneva.

..... [4]

61. 0580_m17_qp_42 Q: 10

(a) The diagram shows a regular hexagon $ABCDEF$ of side 10 cm.



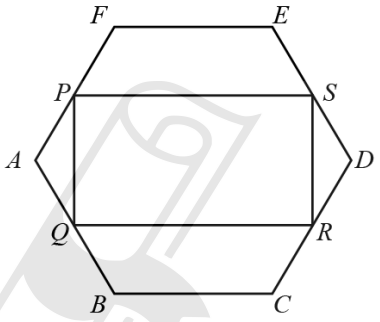
NOT TO SCALE

(i) Show that angle $BAF = 120°$.

[2]

(ii) The vertices of a rectangle $PQRS$ touch the sides FA, AB, CD and DE.

PS is parallel to FE and $AP = x$ cm.



NOT TO SCALE

Use trigonometry to find the length of PQ in terms of x.

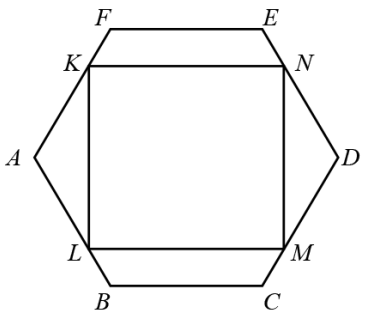
$PQ =$ ..... cm [3]

(iii) $PF = (10 - x)$ cm.

Show that $PS = (20 - x)$ cm.

[3]

(b)



NOT TO SCALE

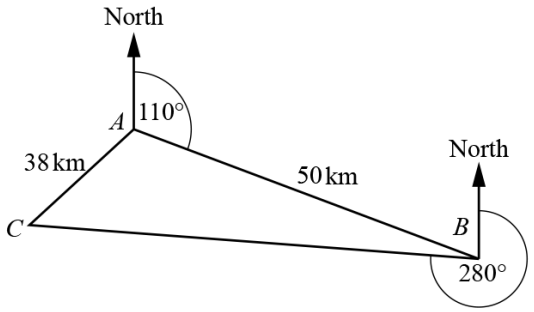
The diagram shows the vertices of a square *KLMN* touching the sides of the same hexagon *ABCDEF*, with *KN* parallel to *FE*.

Use your results from **part (a)(ii)** and **part (a)(iii)** to find the length of a side of the square.

..... cm [4]

62. 0580_s17_qp_41 Q: 8

(a)



NOT TO SCALE

A, B and C are three towns.
The bearing of B from A is 110°.
The bearing of C from B is 280°.
$AC = 38$ km and $AB = 50$ km.

(i) Find the bearing of A from B.

..... [2]

(ii) Calculate angle BAC.

Angle BAC = ... [5]

(iii) A road is built from A to join the straight road BC.

Calculate the shortest possible length of this new road.

..... km [3]

(b) Town A has a rectangular park.
The length of the park is x m.
The width of the park is 25 m shorter than the length.
The area of the park is 2200 m^2.

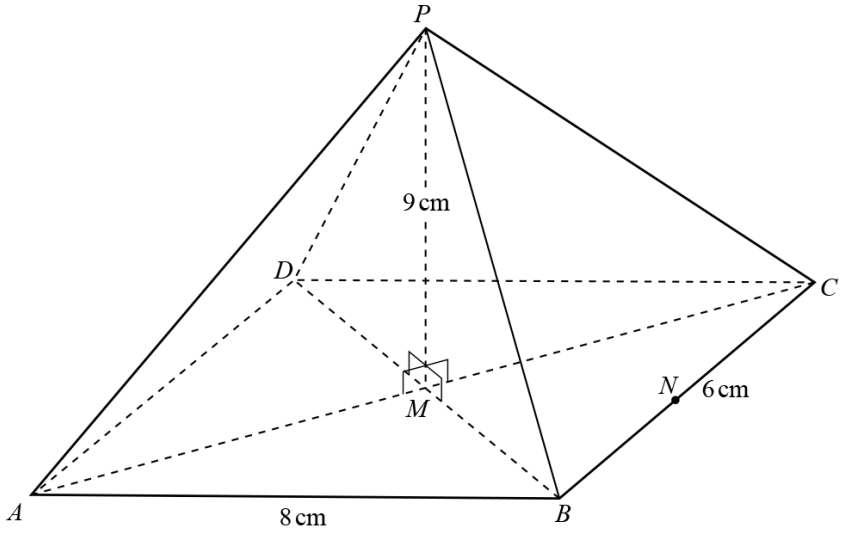
(i) Show that $x^2 - 25x - 2200 = 0$.

[1]

(ii) Solve $x^2 - 25x - 2200 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [4]

63. 0580_s17_qp_42 Q: 8



The diagram shows a pyramid on a rectangular base $ABCD$.
AC and BD intersect at M and P is vertically above M.
$AB = 8$ cm, $BC = 6$ cm and $PM = 9$ cm.

(a) N is the midpoint of BC.

Calculate angle PNM.

Angle PNM = ... [2]

(b) Show that $BM = 5$ cm.

[1]

(c) Calculate the angle between the edge PB and the base $ABCD$.

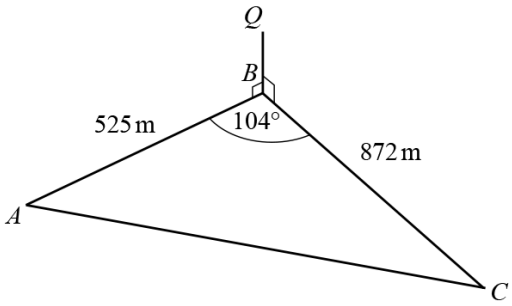
..... [2]

(d) A point X is on PC so that $PX = 7.5$ cm.

Calculate BX.

$BX =$ ..... cm [6]

64. 0580_s17_qp_43 Q: 9



NOT TO SCALE

ABC is a triangular field on horizontal ground.
There is a vertical pole BQ at B.
$AB = 525$ m, $BC = 872$ m and angle $ABC = 104°$.

(a) Use the cosine rule to calculate the distance AC.

$AC =$ ..... m [4]

(b) The angle of elevation of Q from C is 1.0°.

Showing all your working, calculate the angle of elevation of Q from A.

..... [4]

(c) **(i)** Calculate the area of the field.

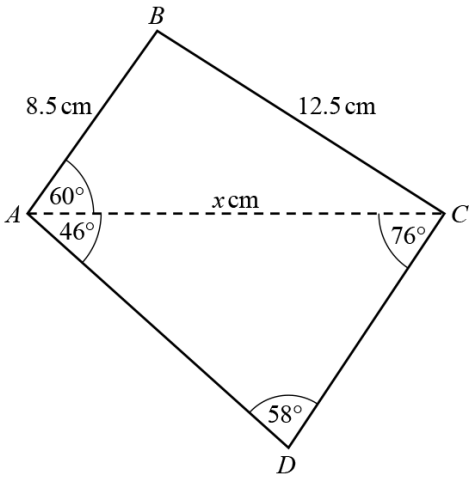
..... m^2 [2]

(ii) The field is drawn on a map with the scale 1 : 20 000.

Calculate the area of the field on the map in cm^2.

..... cm^2 [2]

65. 0580_w17_qp_41 Q: 10



NOT TO SCALE

The diagram shows a quadrilateral $ABCD$.

(a) The length of AC is x cm.

Use the cosine rule in triangle ABC to show that $2x^2 - 17x - 168 = 0$.

[4]

(b) Solve the equation $2x^2 - 17x - 168 = 0$.
Show all your working and give your answers correct to 2 decimal places.

x = ... or x = ... [4]

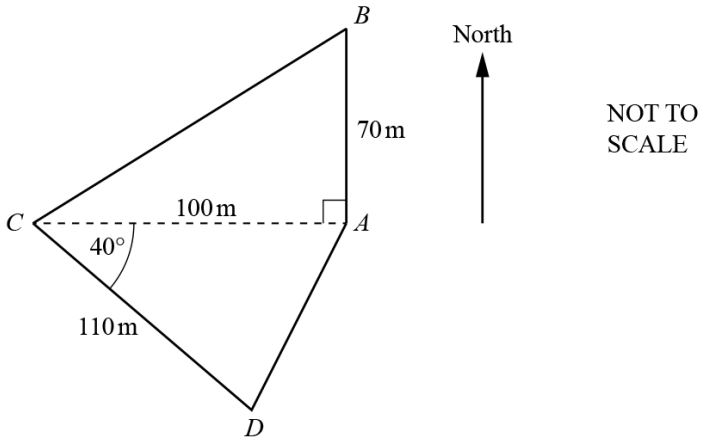
(c) Use the sine rule to calculate the length of CD.

CD = ... cm [3]

(d) Calculate the area of the quadrilateral $ABCD$.

..... cm^2 [3]

66. 0580_w17_qp_42 Q: 3



The diagram shows a field *ABCD*.

(a) Calculate the area of the field *ABCD*.

.....m^2 [3]

(b) Calculate the perimeter of the field *ABCD*.

..... m [5]

(c) Calculate the shortest distance from A to CD.

..... m [2]

(d) B is due north of A.

Find the bearing of C from B.

..... [3]

67. 0580_w17_qp_43 Q: 1

(a) The angles of a triangle are in the ratio 2 : 3 : 5.

(i) Show that the triangle is right-angled.

[1]

(ii) The length of the hypotenuse of the triangle is 12 cm.

Use trigonometry to calculate the length of the shortest side of this triangle.

..... cm [3]

(b) The sides of a different right-angled triangle are in the ratio 3 : 4 : 5.

(i) The length of the shortest side is 7.8 cm.

Calculate the length of the longest side.

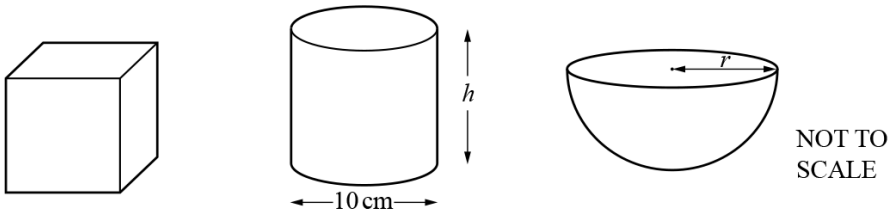
..... cm [2]

(ii) Calculate the smallest angle in this triangle.

..... [3]

68. 0580_w17_qp_43 Q: 6

(a)



The diagrams show a cube, a cylinder and a hemisphere.
The volume of each of these solids is $2000\,\text{cm}^3$.

(i) Work out the height, h, of the cylinder.

$h =$ ..... cm [2]

(ii) Work out the radius, r, of the hemisphere.

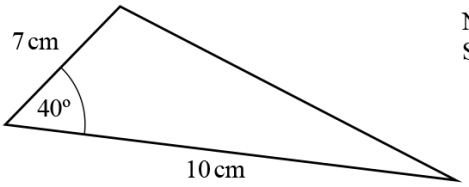
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

$r =$ ..... cm [3]

(iii) Work out the surface area of the cube.

..... cm^2 [3]

(b)



NOT TO SCALE

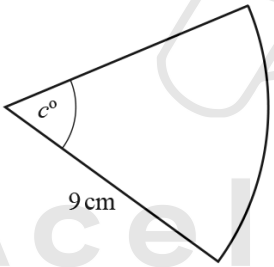
(i) Calculate the area of the triangle.

.....cm^2 [2]

(ii) Calculate the perimeter of the triangle and show that it is 23.5 cm, correct to 1 decimal place. Show all your working.

[5]

(c)



NOT TO SCALE

The perimeter of this sector of a circle is 28.2 cm.

Calculate the value of c.

c = ... [3]

01. 0580_m24_ms_42 Q: 6

Question	Answer	Marks	Partial Marks
(a)	15[.0] or 15.00 to 15.01	3	**M2** for $\frac{17.2}{\sin 68} \times \sin 54$ oe or **M1** for $\frac{\sin 54}{AC} = \frac{\sin 68}{17.2}$ oe
(b)	15.7 or 15.65 to 15.66	3	**M2** for $\sqrt{their15^2 + 12.8^2 - 2 \times their15 \times 12.8 \times \cos 68}$ OR **M1** for $their15^2 + 12.8^2 - 2 \times their15 \times 12.8 \times \cos 68$ **A1** for 244.9 to 245.2

Question	Answer	Marks	Partial Marks
(c)	13.9 or 13.90 to 13.92	3	**M2** for $\frac{x}{17.2} = \sin 54$ oe or $\frac{x}{their15} = \sin 68$ oe or **M1** for distance required is the perpendicular from A to BC soi

02. 0580_s24_ms_41 Q: 6

Question	Answer	Marks	Partial Marks
(a)	245	1	
(b)(i)	180 – (55 + 25) [=100]	M1	
(b)(ii)	$\frac{32 \times \sin 25}{\sin 100}$ oe	M2	**M1** for $\frac{\sin 25}{BH} = \frac{\sin 100}{32}$ oe
	13.73…	A1	

Question	Answer	Marks	Partial Marks
(c)	258 or 257.9 to 258.0…	**5**	**B4** for 67.9 to 68.0… OR **M2** for [cos =] $\left(\frac{11^2+13.7^2-14^2}{2\times13.7\times11}\right)$ **A1** for 0.3738 to 0.376 or **M1** for $14^2 = 11^2 + 13.7^2 - 2\times 11 \times 13.7 \times \cos B$ **M1dep** on at least M1 for 190 + *their* angle B
(d)(i)	2 44 pm or 14 44 cao	**4**	**B3** for 1 hour 44 or 1 hour 43.6 to 1 hour 43.8 or 104 or 103.6 to 103.8 or **B2** for 1.727 to 1.73 or **M2** for $\frac{32}{10\times1.852}\times60$ or **M1** for 32 ÷ (10 × 1.852)
(d)(ii)	7.857 to 7.88	**3**	**M2** for $\frac{x}{13.7} = \cos 55$ oe or **M1** for dist to H occurs when perpendicular from B meets CH soi

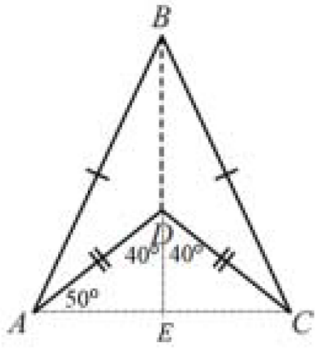
03. 0580_s24_ms_42 Q: 6

Question	Answer	Marks	Partial Marks
(a)	$\sqrt{10.4^2+6.5^2-2\times10.4\times6.5\times\cos64}$	**M2**	**M1** for $10.4^2 + 6.5^2 - 2\times 10.4 \times 6.5 \times \cos64$ **A1** for 91.1 to 91.2
	9.546 to 9.547	**A1**	

Question	Answer	Marks	Partial Marks
(b)(i)	$180-(26+42)$	**B1**	
(b)(ii)	6.89 or 6.888 to 6.892...	**3**	**M2** for $\frac{9.55}{\sin 112}\times \sin 42$ oe or **M1** for $\frac{\sin 112}{9.55}=\frac{\sin 42}{CD}$ oe
(c)	5.84[2…]	**3**	**M2** for $\frac{x}{6.5}=\sin 64$ oe or **M1** for identifying shortest distance from D is perpendicular to AB

04. 0580_s24_ms_43 Q: 6

Question	Answer	Marks	Partial Marks
(a)	4.27 or 4.272...	**2**	**M1** for $4^2 + 1.5^2$ oe

Question	Answer	Marks	Partial Marks
(b)	203 or 202.6…	3	**B2** for [angle at W =] 22.6... or for [angle at V =] 67.4 or 67.38… or **M1** for tan = $\frac{5}{12}$ or $\frac{12}{5}$ oe
(c)	25.2 or 25.20 to 25.21[0]  	5	**B4** for [BC or AB =] 7.6[0] or 7.604 to 7.605 OR **M3** for a complete explicit method leading to AB or BC, e.g. $\frac{5\sin 140}{\sin 25}$ OR **M2** for a complete implicit method leading to AB or BC, e.g. $\frac{\sin 25}{5} = \frac{\sin 140}{BC \text{ or } AB}$ oe and **M1** (dep on AB from trig) for 2 × *their* AB + 10 OR **B1** for any relevant angle E.g. $\angle BDA$ or $\angle BDC$ = 140, $\angle DAE$ or $\angle DCE$ = 50 or $\angle ADE$ or $\angle CDE$ = 40 or $\angle ADC$ = 80
(d)	79.5 or 79.6 or 79.54 to 79.55...	5	**B2** for [PR^2 =] 245 or 245.1 to 245.2 or [PR =] 15.65 to 15.66 or 15.7 or **M1** for [PR^2 =] $11^2 + 8^2 - 2 \times 11 \times 8 \times \cos 110$ **M2** for [cosPQR =] $\frac{10^2 + 14^2 - (\textit{their } PR)^2}{2 \times 10 \times 14}$ oe or **M1** for (*their* PR)^2 = $10^2 + 14^2 - 2 \times 10 \times 14\cos PQR$ oe

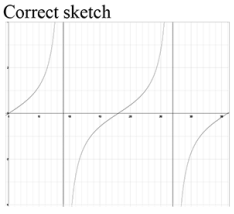
Question	Answer	Marks	Partial Marks
(a)	$\frac{3}{10} \times 360$ oe	**M2**	**M1** for $\frac{3}{3+7} = \frac{x}{360}$ or for $\frac{x}{360}$ $[\times 2\pi r] = \frac{3}{7} \times \frac{360-x}{360}$ $[\times 2\pi r]$ oe or better or 1 $[\times 2\pi r] = \frac{10}{7} \times \frac{360-x}{360}$ $[\times 2\pi r]$ oe or better or $\frac{360}{7+3} \times k$ ($k = 1$ or 7)
	108	**A1**	
(b)(i)	$\frac{1}{2}r^2 \sin y = \frac{1}{2} \times \frac{y}{360} \times \pi r^2$ or $\frac{y}{360} \times \pi r^2 = [2 \times \frac{1}{2}]\, r^2 \sin y$ and one further step leading to $360\sin y = \pi y$ with no errors	**2**	**M1** for $\frac{y}{360} \times \pi r^2$ or for $\frac{1}{2}r^2 \sin y$
(b)(ii)	341.18 or 341.22 341.00 341.49 or 341.54	**3**	**B1** for each
(b)(iii)	108.6 cao	**1**	

06. 0580_m23_ms_42 Q: 10

Question	Answer	Marks	Partial Marks
(a)	$\cos 31 = \frac{AB}{12.3}$ oe	M1	
	10.543...	A1	
(b)	$\cos = \frac{12.3}{16.5}$ oe	M1	
	41.801 to 41.802	A1	
(c)	16.7 or 16.8 or 16.74 to 16.75…	3	**M2** for $\sqrt{10.54^2+16.5^2-2\times10.54\times16.5\times\cos(31+41.8)}$ or for $\sqrt{6.33^2+11^2-2\times6.33\times11\times\cos(180-31)}$ OR **M1** for $10.54^2+16.5^2-2\times10.54\times16.5\times\cos(31+41.8)$ or for $6.33^2+11^2-2\times6.33\times11\times\cos(90+90-31)$ oe **A1** for 280 or 281 or 280.4 to 280.6

Question	Answer	Marks	Partial Marks
(d)	18.9 to 20.7… nfww	4	**M1** for $\sin 31 = \frac{BC}{12.3}$ oe or better and $\sin 41.8[0] = \frac{CD}{16.5}$ oe **M2dep on M1** for $\cos[DBC] = \frac{their(c)^2+6.34^2-10.998^2}{2\times their(c)\times 6.34}$ or **M1dep on M1** for $10.998^2 = their$ **(c)**$^2 + 6.34^2 - 2 \times$ *their* **(c)** $\times 6.34 \times \cos DBC$
(e)	2.05 to 2.24… nfww	4	**M1** for $\sin 31 = \frac{BC}{12.3}$ oe or better or $\sin 41.8[0] = \frac{CD}{16.5}$ oe **M2dep on M1** for $\frac{\text{dist}}{their BC} = \sin(their\ \text{angle}\ CBD)$ or $\frac{\text{dist}}{their CD} = \sin(their\ \text{angle}\ CDB)$ or **M1** for recognition of shortest distance

07. 0580_m23_ms_42 Q: 12

Question	Answer	Marks	Partial Marks
(a)	Correct sketch 	2	Condone curve touching asymptotes but not crossing **B1** for one section correct or for 3 sections in correct part of graph but with incorrect curvature and no other sections in incorrect part of graph
(b)	30 **and** 210 final answer	2	**B1** for each If 0 scored **SC1** for two answers (one acute and one reflex) with a difference of 180

Question	Answer	Marks	Partial Marks
(a)	$[\sin =]\dfrac{145}{\frac{1}{2}\times 6.4\times 5.7\times 15}$	**M2**	**M1** for $145 = \frac{1}{2}\times 6.4\times 5.7\times \sin x\times 15$ oe or for $\dfrac{1}{2}\times 6.4\times h\times 15 = 145$ and $\sin x = \dfrac{h}{5.7}$
	32.0[0]	**A1**	If M0, **SC1** for $145 = 0.5\times 6.4\times 5.7\times sin32\times 15$ oe
(b)	3.4[0] or 3.402 to 3.403 nfww	**3**	**M2** for $\sqrt{6.4^2+5.7^2-2\times 6.4\times 5.7\times\cos(32)}$ OR **M1** for $6.4^2+5.7^2-2\times 6.4\times 5.7\times\cos(32)$ **A1** for 11.6 or 11.57 to 11.58
(c)	3.02 or 3.020 to 3.021	**3**	**M2** for $\sin(32)=\dfrac{x}{\sqrt{80^2+50^2-2\times 80\times 50\times\cos 75}}$ or **M1** for recognition that the line from E is perpendicular to AB e.g. right angle seen or $\dfrac{1}{2}\times 6.4\times h$

Question	Answer	Marks	Partial Marks
(d)	10.8 or 10.9 or 10.84 to 10.85...	**4**	**M3** for $[\sin =]\dfrac{their\ (c)}{\sqrt{15^2+5.7^2}}$ or $[\tan =]\dfrac{their\ (c)}{\sqrt{(5.7\times cos32)^2+15^2}}$ or **M2** for $15^2+5.7^2$ or $(5.7\times\cos 32)^2+15^2$ oe or **M1** for recognition of correct angle
(e)	136 or 136.0...	**3**	**M2** for $938\times 145\times\dfrac{1000}{1000000}$ oe or **M1** for figs 136 or 13601

09. 0580_s23_ms_41 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	96	**2**	**M1** for $\frac{1}{2}\times 24\times 8$
(a)(ii)	18.4 or 18.43...	**2**	**M1** for $\tan[x]=\frac{8}{24}$ oe

Question	Answer	Marks	Partial Marks
(b)	622 or 622.0 to 622.1....	**2**	**M1** for $[\frac{1}{2}\times]\ \pi\times 6^2\times 11$ or $\frac{1}{2}\times\pi\times 6^2[\times 11]$
(c)(i)	246 or 246.2 to 246.3...	**5**	**M4** for $15\times 20-4\times 4-\frac{270}{360}\times\pi\times 4^2$ oe OR **M2** for $\frac{270}{360}\times\pi\times 4^2$ oe or **M1** for $k\times\pi\times 4^2$, where $k\leq 1$ **M1** for 15×20 or 4×4 oe
(c)(ii)	80.8 or 80.9 or 80.84 to 80.85...	**3**	**M1** for $15+20+11+16$ oe **M1** for $\frac{3}{4}\times 2\times\pi\times 4$ oe

10. 0580_s23_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Angle $CAB = 52$	**B1**	
	$180 - 52 - \sin^{-1}\left(\frac{60\sin their 52}{87}\right)$	**M3**	**M2** for $[\sin[...]=]\ \frac{60\sin their 52}{87}$ oe or **M1** for $\frac{60}{\sin B} = \frac{87}{\sin their 52}$ oe
	95.08…	**A1**	
(b)	77.1 or 77.08 to 77.11	**6**	**B4** for dist travelled = 256.9 to 257[.0…] or **B3** for [AB =] 109.9 to 110[.0…] or **M3** for $60 + 87 + \sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or **M2** for $\sqrt{60^2 + 87^2 - 2\times60\times87\times\cos 95.1}$ oe or $AB^2 = 12093.\ldots$ to $12097.\ldots$ or $\frac{87\sin 95.1}{\sin their 52}$ oe or **M1** for $AB^2 = 60^2 + 87^2 - 2\times60\times87\times\cos 95.1$ oe or $\frac{\sin 95.1}{AB} = \frac{\sin their 52}{87}$ oe **M1** for *their* total distance $\div 3\frac{20}{60}$ oe

11. 0580_s23_ms_42 Q: 10

Question	Answer	Marks	Partial Marks
(a)	13.9 or 13.85 to 13.86	4	**M3** for $2x^2 = 28^2 - 20^2$ or better or $x = \left(\sqrt{28^2 - 20^2}\right)\sin 45$ oe or **M2** for $x^2 + x^2 + 20^2 = 28^2$ oe or $\sin 45 = \frac{x}{\sqrt{28^2 - 20^2})}$ or **M1** for any correct Pythag in 2D or *their AC* × sin 45 oe dep on trig/Pythagoras attempt for *AC*
(b)	51.9 or 51.87 to 51.88	4	**M3** for $\sin = \frac{29 \text{ to } 30}{37 + 0.5}$ or $\frac{30 - 0.5}{37 \text{ to } 38}$ oe or **M2** for correct trig statement for correct angle with values in range 29 to 31 and 36 to 38 or **M1** for 30 + 0.5 or 30 – 0.5 or 37 + 0.5 or 37 – 0.5 seen or for identifying correct angle *RKM*

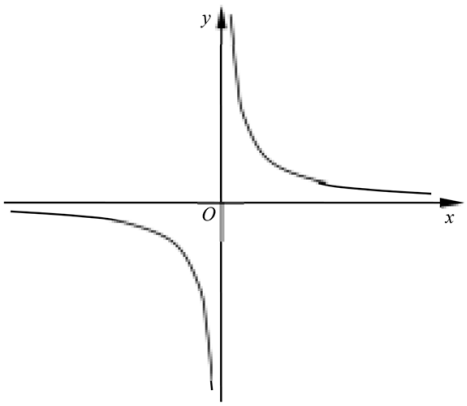
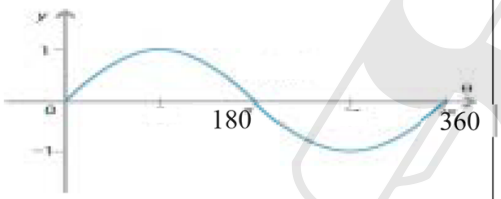
12. 0580_s23_ms_43 Q: 5

Question	Answer	Marks	Partial Marks
(a)(i)	2[.00] or 2.002 to 2.003 nfww	3	**M2** for $\sqrt{4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4}$ OR **M1** for $4.8^2 + 5.6^2 - 2 \times 4.8 \times 5.6 \times \cos 20.4$ **A1** for 4.01[17…] or 4.012
(a)(ii)	4.1[0] or 4.11 or 4.100 to 4.107 cao	2	**M1** for $\tan 64 = \frac{AX}{\textit{their}\ \textbf{(a)(i)}}$ or for $\frac{AX}{\sin 64} = \frac{\textit{their}\ \textbf{(a)(i)}}{\sin(90 - 64)}$ oe
(a)(iii)	6.96	2	**M1** for $\frac{1}{2} \times 4.8 \times 2.9$ oe

Question	Answer	Marks	Partial Marks
(b)	11.3 or 11.31..	**5**	**M4** for $2\times\frac{8}{\sin(45)}\times\sin 30$ or **B4** for PM = 5.65[685...] or 5.66 or better OR **B1** for *angle RPM* = 45° **M2** for $\frac{8}{\sin(their\ 45)}\times\sin 30$ or **M1** for implicit form

13. 0580_s23_ms_43 Q: 7

Question	Answer	Marks	Partial Marks
(a)	Cubic	**1**	

Question	Answer	Marks	Partial Marks
(b)(i)	Correct sketch 	2	**B1** for one branch correct or an attempt at the correct shape Maximum 1 mark if sketch crosses x-axis or y-axis
(b)(ii)	$\pm\frac{1}{2}$ **nfww**	2	**M1** for $4x^2 = 1$ oe or **B1** for $\frac{1}{2}$ or $-\frac{1}{2}$ nfww
(c)(i)	Correct sketch through (0, 0) (180, 0) and (360, 0) with max and min at 1 and –1 resp. 	2	**B1** for correct sine curve shape, starting at the origin, with minimum of 1 cycle.
(c)(ii)	199.5 or 199.47... and 340.5...	3	**B2** for one correct or **M1** for $\sin x = -\frac{1}{3}$ oe If 0 scored, **SC1** for two reflex angles with a sum of 540 or 2 non-reflex angles with a sum of 180

14. 0580_s23_ms_43 Q: 9

Question	Answer	Marks	Partial Marks
(a)(i)	311 or 311.0 to 311.1	3	**M2** for $11 \times 11 + 2 \times \frac{1}{4} \times \pi \times 11^2$ oe or **M1** for [2 ×] $\frac{1}{4} \times \pi \times 11^2$ or 11×11 oe
(a)(ii)	78.6 or 78.55 to 78.56...	3	**M2** for $4 \times 11 + 2 \times \frac{1}{4} \times 2 \times \pi \times 11$ oe or **M1** for [2 ×] $\frac{1}{4} \times 2 \times \pi \times 11$ or 4×11 oe
(b)	35.2 or 35.3 or 35.239… to 35.28	4	**M3** for [tan =] $\frac{7}{\sqrt{7^2+7^2}}$ or [sin =] $\frac{7}{\sqrt{7^2+7^2+7^2}}$ or [cos =] $\frac{\sqrt{7^2+7^2}}{\sqrt{7^2+7^2+7^2}}$ OR **M2** for $AG = \sqrt{7^2+7^2+7^2}$ or for $\sqrt{7^2+\left(\frac{7}{\sin 45}\right)^2}$ oe or for $AC = \sqrt{7^2+7^2}$ or $\frac{7}{\sin 45}$ oe OR **M1** for $7^2 + 7^2$ or for implicit trigonometry or identifying correct angle

15. 0580_w23_ms_42 Q: 6

Question	Answer	Marks	Partial Marks
	11.9 or 11.91 to 11.92	7	**B5** for $t = 1.055$ or 1.0550... **M1** for $\tan w = \frac{their\ t}{5}$ oe OR **M1** for $(2t+3)^2 = t^2 + 5^2$ oe seen isw **M2** for $3t^2 + 12t - 16[=0]$ oe seen isw or **B1** for $4t^2 + 6t + 6t + 9$ **M1FT** for $\frac{-12 \pm \sqrt{12^2 - 4(3)(-16)}}{2(3)}$ oe **M1** for $\tan w = \frac{their\ t}{5}$ oe

16. 0580_w23_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)(i)	21.5 or 21.52...	2	**M1** for $\tan(\ldots) = \frac{2.8}{7.1}$ oe
(a)(ii)	10.2 or 10.17 to 10.18	3	**M2** for $\left(\frac{2.8}{\tan 21}\right)^2 + 7.1^2$ oe or **M1** for $\frac{2.8}{PR} = \tan 21$ oe

Question	Answer	Marks	Partial Marks
(b)	76.5 or 76.52 to 76.53	3	**M2** for $[\sin =]\frac{16.7\sin 32}{9.1}$ oe or **M1** for $\frac{9.1}{\sin 32}=\frac{16.7}{\sin M}$ oe
(c)(i)	$\frac{1}{2}\times 12.3\times 21.5\sin(...)=62.89$ or better	M1	
	28.40 to 28.41…	A1	
(c)(ii)	12.2 or 12.17 to 12.18	3	**M2** for $\sqrt{12.3^2+21.5^2-2\times 12.3\times 21.5\times\cos 28.4}$ OR **M1** for $12.3^2+21.5^2-2\times 12.3\times 21.5\times\cos 28.4$ **A1** for 148 or 148.2 to 148.3
(c)(iii)	6.6[0] to 6.62	3	**M2** for $21.5\cos 28.4-12.3$ or **M1** for $21.5\cos 28.4$

17. 0580_w23_ms_43 Q: 7

Question	Answer	Marks	Partial Marks
(a)	0, –1.5 oe, –2.8	3	**B1** for each
(b)	Correct graph	4	**B3 FT** for 10 or 11 correct points FT *their* table or **B2 FT** for 8 or 9 correct points FT *their* table or **B1 FT** for 6 or 7 correct points FT *their* table
(c)	65 to 67	1	**FT** intersection of *their* graph with $y=-2$
(d)	$y=2-\frac{x}{40}$ oe ruled	M2	**M1** for $[y=]\,2-\frac{x}{40}$ oe soi or for $3\cos 2x=2-\frac{x}{40}$ oe soi
	32 to 36	B1	

18. 0580_m22_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)(i)	40.9 or 40.91...	3	**M2** for [sin ABC=] $\frac{29.5\sin 51.6}{35.3}$ oe or for [cos ABC =] $\frac{35.3^2+45^2-29.5^2}{2\times35.3\times45}$ or **M1** for $\frac{29.5}{\sin ABC}=\frac{35.3}{\sin 51.6}$ oe or for correct implicit cosine rule
(a)(ii)	520 or 520.0 to 520.2...	2	**FT** *their* (a)(i) if used provided working shown **M1** for $0.5\times29.5\times45\times\sin 51.6$ oe or for $0.5\times35.3\times45\times\sin$ (*their*(a)(i)) or for 0.5 × 35.3 × 29.5sin (180–51.6–*their*(a)(i))
(b)(i)	41.2 or 41.21 to 41.23	4	**M1** for $SQ = 2\times32\times\sin\left(\frac{1}{2}\times56\right)$ oe or $\sqrt{32^2+32^2-2\times32\times32\times\cos 56}$ oe or $\frac{32\sin 56}{\sin((180-56)\div2)}$ oe **M2** for $SR^2 = 47^2+(\text{their } SQ^2)-2\times47\times\text{their } SQ\times\cos 60$ or **M1** for implicit form
(b)(ii)	28.3 or 28.25 to 28.29...	3	**M2** for 32 × sin62 oe or **M1** for recognition that line from P is perpendicular to SQ

19. 0580_s22_ms_41 Q: 5

Question	Answer	Marks	Partial Marks
(a)(i)(a)	$\frac{(8-2)\times 180}{8\times 2}$ oe	M2	M1 for $\frac{(8-2)\times 180}{8}$ or $\frac{360}{8}$ or $\frac{(2\times 8-4)\times 90}{8}$
(a)(i)(b)	174 or 173.8....	4	M3 for $\frac{1}{2}\times 6\times OM$ oe or $\frac{1}{2}\times (OA)^2\times \sin 45$ oe or $\frac{1}{2}\times 6\times OA\times sin67.5$ oe where OA and OM are as in the M2 or M2 for $OM = 3\times \tan 67.5$ oe or for $OA = \left(\frac{3}{cos67.5}\right)$ or $\frac{6\times sin67.5}{sin45}$ oe or M1 for $\frac{OM}{3} = \tan 67.5$ oe or for $\frac{3}{OA} = cos67.5$ oe or for $\frac{sin45}{6} = \frac{sin67.5}{OA}$ oe
(a)(ii)	193 or 193.0 to 193.1	3	M2 for $\pi\times\left(\frac{3}{cos67.5}\right)^2$ oe or M1 for $\frac{3}{r} = cos67.5$ or $\frac{sin45}{6} = \frac{sin67.5}{r}$

Question	Answer	Marks	Partial Marks
(b)(i)	1.27 or 1.272 to 1.273	**2**	**M1** for $\left[\frac{1}{2}\times\right]\pi\times0.45^2\times4$ or $\frac{1}{2}\times\pi\times0.45^2[\times4]$
(b)(ii)	742 or 743	**6**	**M5** for a method leading to the volume of water e.g. $4\times\{2\times\frac{invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ $-\frac{1}{2}\times0.45^2\times\sin\left(2invcos\left(\frac{0.15}{0.45}\right)\right)\}$ oe **OR** **M2** $[2\times]\frac{invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ oe or $[2\times]\frac{90-invcos\left(\frac{0.15}{0.45}\right)}{360}\times\pi\times0.45^2$ oe or **M1** for use of $\frac{\theta}{360}\times\pi\times0.45^2$ oe **M2** for $\frac{1}{2}\times0.45^2\times\sin\left(2invcos\left(\frac{0.15}{0.45}\right)\right)$ oe or $\frac{1}{2}\times0.15\times0.45\times\sin\left(invcos\left(\frac{0.15}{0.45}\right)\right)[\times2]$ oe

Question	Answer	Marks	Partial Marks
(b)(ii)			**or M1 for use of** $\frac{1}{2}\times0.45^2\times\sin\theta$ **oe** **or** $[2\times]\frac{1}{2}\times0.15\times0.45\times\sin\beta$ **oe** **If 0 scored,** **SC1 for** *inv***cos** $\left(\frac{0.15}{0.45}\right)$ **or** *inv***sin** $\left(\frac{0.15}{0.45}\right)$ **or** $\sqrt{0.45^2-0.15^2}$ **soi**

20. 0580_s22_ms_41 Q: 7

Question	Answer	Marks	Partial Marks
(a)	39.6 or 39.57....	4	**M2** for [cos =] $\frac{14^2+12^2-9^2}{2\times14\times12}$ or **M1** for $9^2 = 14^2 + 12^2 - 2 \times 14 \times 12 \times \cos ACD$ **A1** for 0.7708... or 0.771 or $\frac{37}{48}$ oe
(b)	$\frac{14\sin 25}{\sin 123}$	M2	**M1** for $\frac{\sin 123}{14} = \frac{\sin 25}{BC}$ oe
	7.054…	A1	
(c)	3.74 or 3.735 to 3.739	3	**M2** for $7.05 \times \sin 32$ or **M1** for recognition that the line from B is perpendicular to AC
(d)	11.8 or 11.83 to 11.85	4	**M1** for $32 + their(a)$ soi **M2** for $12^2 + 7.05^2 - 2\times12\times7.05\times\cos(their(a)+32)$ or **M1** for $\cos(their(a)+32) = \frac{12^2+7.05^2-BD^2}{2\times12\times7.05}$
(e)	309.6 or 309.57...	2	**FT** $270 + their(a)$ **M1** for $270 + their(a)$ oe

21. 0580_s22_ms_42 Q: 4

Question	Answer	Marks	Partial Marks
(a)	7.06 or 7.058… or 7.059	**3**	**M2** for $\sqrt{6.4^2+10.9^2-2\times6.4\times10.9\times\cos 38}$ oe OR **M1** for $6.4^2 + 10.9^2 - 2 \times 6.4 \times 10.9 \times \cos 38$ oe **A1**= 49.8...
(b)(i)	97	**1**	
(b)(ii)	15.3[0…]	**3**	**M2** for $[AB =] \frac{10.9\times\sin \textit{their } 97}{\sin 45}$ or **M1** for $\frac{\sin \textit{their } 97}{AB}=\frac{\sin 45}{10.9}$ oe
(c)	72.8 to 72.81…	**3**	**M2** for $\frac{1}{2}(6.4)\times10.9\times\sin 38+\frac{1}{2}\textit{their } 15.3\times10.9\times\sin 38$ oe or **M1** for $\frac{1}{2}\times6.4\times10.9\times\sin 38$ oe or $\frac{1}{2}\times\textit{their}15.3\times10.9\times\sin 38$ oe or **M1** for height $=10.9 \times \sin 38$ oe

22. 0580_s22_ms_42 Q: 11

Question	Answer	Marks	Partial Marks
(a)(i)	4.455 to 4.456… [= 4.46]	**2**	**M1** for $[r =] \frac{28}{2\pi}$ oe
(a)(ii)	1250 or 1247 to 1249.9…	**2**	**M1** for $20 \times \pi \times 4.46^2$ oe
(a)(iii)	66[.0] or 65.95 to 66.02	**3**	**M2** for [tan] = $\frac{20}{2 \times 4.46}$ oe or **B1** for identifying angle *ANB* on cylinder **not on rectangle**
(b)	11.8 or 11.82 to 11.83	**5**	**M2** for $[r =] \sqrt[3]{\frac{310 \times 3}{2\pi}}$ oe or $[h =] \sqrt[3]{\frac{310 \times 3 \times 4}{\pi}}$ oe or **M1** for $310 = \frac{1}{3}\pi \times r^2 \times 2r$ or $310 = \frac{1}{3}\pi\left(\frac{h}{2}\right)^2 h$ **M2** for $\sqrt{(their\ r)^2 + (2 \times their\ r)^2}$ oe or **M1** for $[l^2 =](their\ r)^2 + (2 \times their\ r)^2$ oe

23. 0580_s22_ms_43 Q: 4

Question	Answer	Marks	Partial Marks
(a)	$\frac{(12-2) \times 180}{12}$ [= 150] oe or $180 - \frac{360}{12}$ [= 150]	**1**	Accept $\frac{(2 \times 12 - 4) \times 90}{12}$ [= 150]
(b)(i)	$\frac{3}{\cos 75}$ oe or $\frac{6 \sin 75}{\sin 30}$	**M2**	**M1** for $\frac{3}{AO} = \cos 75$ oe or $\frac{r}{\sin 75} = \frac{6}{\sin 30}$
	11.59…	**A1**	
(b)(ii)(a)	72.8 or 72.9 or 72.82 to 72.89…	**2**	**M1** for $2 \times \pi \times 11.6$
(b)(ii)(b)	12.1 or 12.06 to 12.08	**2**	**M1** for [6 +] *their* **(b)(ii)(a)** ÷ 12 oe
(c)	806 or 807 or 805.9 to 807.4	**3**	**B2** for 402.9… to 403.7 OR **M2** for $\frac{1}{2} \times 6 \times 11.6 \times \sin 75 \times 12 \times 2$ oe or **M1** for $\frac{1}{2} \times 6 \times 11.6 \times \sin 75$ [$\times k$] oe

24. 0580_s22_ms_43 Q: 7

Question	Answer	Marks	Partial Marks
(a)	87.[0] or 86.98 to 86.99	3	**M2** for $\sqrt{82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76}$ oe OR **M1** for $82^2 + 55^2 - 2 \times 82 \times 55 \times \cos 76$ oe **A1** for 7570 or 7566 to 7567
(b)	66.1 or 66.2 or 66.13 to 66.17	3	**M2** for $\frac{82 \times \sin 76}{their\ \textbf{(a)}}$ oe or **M1** for $\frac{82}{\sin C} = \frac{their\ \textbf{(a)}}{\sin 76}$ oe
(c)	13.3 or 13.30 to 13.31	3	**M2** for $AG = 55 \cos 76$ oe or **M1** for recognition that CG is perpendicular to AB

Question	Answer	Marks	Partial Marks
(d)	54.1 or 54.13... **and** 125.9 or 125.86 to 125.87	5	**B4** for 54.1 or 54.13... or 125.9 or 125.86 to 125.87 **M3** for [sin Q =] $\frac{0.5 \times 82 \times 55 \times \sin 76}{0.5 \times 90 \times 60}$ oe or **M2** for $0.5 \times 82 \times 55 \times \sin 76 = 0.5 \times 60 \times 90 \times \sin Q$ oe or **M1** for $0.5 \times 82 \times 55 \times \sin 76$ oe or for $0.5 \times 60 \times 90 \sin Q$ = *their* area of ABC If **B4** not scored then **SC1** for two angles seen that sum to 180 (from use of sine ratio) but not 0 and 180.

25. 0580_s22_ms_43 Q: 10

Question	Answer	Marks	Partial Marks
(a)	20.8 or 20.76 to 20.79	4	**B3** for [BC =] 10.4 or 10.38 to 10.39... or $6\sqrt{3}$ oe or **M2** for $(2x)^2 + x^2 + 6^2 = 24^2$ oe or **M1** for $24^2 - 6^2$ oe or $x^2 + 6^2$ oe or $(2x)^2 + 6^2$ oe, or $x^2 + (2x)^2$ oe or **SC2** for final answer of $12\sqrt{5}$ or 26.8 or 26.83... OR **M3** for $x^2 + \left(\frac{x}{2}\right)^2 + 6^2 = 24^2$ oe or **M2** for $x^2 + \left(\frac{x}{2}\right)^2$ or **M1** for $x^2 + 6^2$ oe or $\left(\frac{x}{2}\right)^2 + 6^2$ oe or $24^2 - 6^2$ oe

Question	Answer	Marks	Partial Marks
(b)	14.5 or 14.47 to 14.48	3	**M2** for $\sin[\ldots] = \frac{6}{24}$ oe or **M1** for recognising the correct angle *GAC*

26. 0580_w22_ms_41 Q: 8

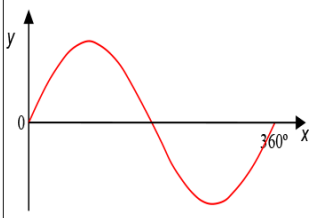
Question	Answer	Marks	Partial Marks
(a)	$[\cos =]\frac{15^2+8^2-20^2}{2.15.8}$	M2	**M1** for $20^2 = 15^2 + 8^2 - 2.15.8\cos(\quad)$
	117.54 to 117.55	A2	**A1** for $-\frac{37}{80}$ or $-\frac{111}{240}$ or –[0].4625

Question	Answer	Marks	Partial Marks
(b)	53.2 or 53.19 to 53.23	2	**M1** for $0.5 \times 8 \times 15 \times \sin(117.5)$ oe
(c)	15.5 or 15.52 to 15.53	2	**M1** for $15^2 + 4^2$ oe
(d)	7.1 or 7.13 or 7.125 to 7.126	3	**M2** for $\tan[P] = \frac{4-3}{8}$ oe or for 7.1 or 7.13 or 7.125 to 7.126 seen or **M1** for vertical line = 4 – 3 soi After 0 scored **SC1** for correct angle identified
(e)	11.5 nfww or 11.48 to 11.49...	5	**B1** for height of 3.5 soi **M2** for $15^2 + 4^2 - 2.15.4\cos(117.5)$ or **M1** for $\cos 117.5 = \frac{15^2+4^2-(\ldots)^2}{2.15.4}$ **M1** for $\tan = \frac{3.5}{\textit{their}\ 17.216\ldots}$ oe After M0 scored **SC1** for correct angle identified

27. 0580_w22_ms_42 Q: 7

Question	Answer	Marks	Partial Marks
(a)(i)	52.[0] or 52.01…	4	**M2** for $[\cos P =]\ \dfrac{39.4^2+46.5^2-38.2^2}{2\times39.4\times46.5}$ oe or **M1** for $38.2^2 = 39.4^2+46.5^2-2\times39.4\times46.5\times\cos P$ oe **A1** for 0.616 or 0.6155…
(a)(ii)	36.6 or 36.64 to 36.65	3	**M2** for $\dfrac{d}{46.5} = \sin(their\ 52.01)$ oe or **M1** for recognition that the line from Q is perpendicular to PR
(b)(i)	41[.0] or 41.01… nfww	3	**M2** for $29^2 + 21^2 + 20^2$ oe or better or **M1** for $29^2 + 21^2$ oe or $29^2 + 20^2$ oe or $21^2 + 20^2$ oe or better
(b)(ii)	29.2 or 29.18 to 29.2	3	**M2** for $\sin[GAC] = \dfrac{20}{their\ AG}$ oe or **M1** for angle GAC identified
(c)	bearing 286	B2	**B1** for angle $MLK = 49$ or for angle $MKL = 35$ correctly identified or angle from North to $ML = 106$
	distance 64.6 or 64.59…	B3	**M2** for $\dfrac{112\times\sin(their 35)}{\sin(96)}$ oe or **M1** for the implicit form

28. 0580_w22_ms_42 Q: 9

Question	Answer	Marks	Partial Marks
(a)	Correct sketch to go through (0, 0), and (360, 0) 	2	**M1** for correct sine curve shape through the origin or for almost correct sketch fitting all tramlines but with an omission at either end or incorrect curvature in one place only
(b)	233.1 or 233.13… and 306.9 or 306.86 to 306.87	3	**B2** for one correct angle or **M1** for $\sin x = -0.8$ oe If 0 scored **SC1** for 2 reflex angles that add to 540 or two non-reflex angles that add to 180

29. 0580_w22_ms_43 Q: 8

Question	Answer	Marks	Partial Marks
(a)	$[\cos B =] \frac{9.5^2+7.7^2-10^2}{2\times9.5\times7.7}$ oe	M2	M1 for $10^2 = 9.5^2 + 7.7^2 - 2\times9.5\times7.7\cos B$ oe or better
	70.206 to 70.207 or 70.21 to 70.22	A2	A1 for $\frac{2477}{7315}$ oe or 0.339 or 0.3386….
(b)(i)	140.4	1	
(b)(ii)	19.8	1	FT (180 – *their* (b)(i)) ÷ 2
(b)(iii)	70.2	1	FT 90 – *their* (b)(ii)
(c)	5.31 or 5.314 to 5.315	3	M2 for $\frac{5}{\cos \textit{their}\,(b)(ii)}$ oe or M1 for $\frac{5}{r} = \cos(\textit{their}\,(b)(ii))$ oe
(d)	38.8 or 38.9 or 38.78 to 38.85	4	M3 for $\frac{0.5\times9.5\times7.7\times\sin 70.2}{\pi\times(\textit{their}\,(c))^2}$ [×100] OR M1 for $0.5\times9.5\times7.7\times\sin70.2$ M1 for $\pi\times(\textit{their}\,(c))^2$

30. 0580_m21_ms_42 Q: 5

	Answer	Mark	Partial Marks
(a)	27[.0] or 26.97… nfww	3	M2 for $[\cos =] \frac{8.6^2+9.7^2-4.4^2}{2\times8.6\times9.7}$ or M1 for implicit form
(b)	9.19 or 9.192 to 9.193	4	B1 for [angle BCD =] 73 seen M2 for $\frac{9.7\times\sin 65}{\sin(180-65-42)}$ oe or M1 for $\frac{\sin(180-65-42)}{9.7} = \frac{\sin 65}{DC}$ oe

	Answer	Mark	Partial Marks
(c)	6.15 or 6.149 to 6.151…	**3**	**M2** for $\frac{d}{their\,9.19} = \sin 42$ oe or **M1** for right angle between line from C to BD and BD soi

31. 0580_s21_ms_41 Q: 5

	Answer	Mark	Partial Marks
(a)	13.5 or 13.47…	**4**	**B1** for angle 102 seen **M2** for $\sqrt{10.6^2 + 6.4^2 - 2\times 10.6\times 6.4\times\cos(180-78)}$ OR **M1** for $10.6^2 + 6.4^2 - 2\times 10.6\times 6.4\times\cos(180-78)$ **A1** for 181.5…
(b)	8.68 or 8.682 to 8.683 nfww	**4**	**B1** for angle = 44 **M2** for $\sin(180-58-78)\times\frac{10.6}{\sin 58}$ oe or **M1** for $\frac{\sin(180-58-78)}{x} = \frac{\sin 58}{10.6}$ oe

	Answer	Mark	Partial Marks
(c)	78.2 or 78.17 to 78.19…	**3**	**M2** for $\frac{1}{2}\times 10.6\times(6.4 + their\ 8.68)\times\sin(78)$ oe OR **M1** for $\frac{1}{2}\times 10.6\times 6.4\times\sin(180-78)$ oe **M1** for $\frac{1}{2}\times 10.6\times their\ 8.68\times\sin 78$ oe

32. 0580_s21_ms_41 Q: 9

(a)	1350 or 1354….	**6**	**M2** for $20^2 - 13^2$ or **M1** for $BC^2 + 13^2 = 20^2$ **A1** for $\sqrt{231}$ or 15.2 or 15.19 to 15.20 **M1** for 20×24 and 13×24 and *their* 15.2×24 **M1** for [½ ×] *their* 15.2×13
(b)	2370 or 2369 to 2371… cao	**1**	
(c)	24.6 or 24.58 to 24.59	**4**	**M3** for $\sin[...] = \frac{13}{\sqrt{20^2 + 24^2}}$ oe or **M2** for $\sqrt{20^2 + 24^2}$ or $\sqrt{24^2 + 20^2 - 13^2}$ or **M1** for $AF^2 = 20^2 + 24^2$ or $24^2 + 20^2 - 13^2$ or **M1** for correct angle identified

33. 0580_s21_ms_42 Q: 6

	Answer	Mark	Partial Marks
(a)	$\sqrt{16^2 + 19^2 - 2 \times 16 \times 19 \cos 57}$ oe	**M2**	or **M1** for $16^2 + 19^2 - 2 \times 16 \times 19 \cos 57$ **A1** for 285.8 to 285.9
	16.90 to 16.91	**A1**	

	Answer	Mark	Partial Marks
(b)	74.3 or 74.30 to 74.33	**4**	**M2** for [sin ... =] $\frac{16.9 \times \sin 75}{32}$ oe or **M1** for $\frac{16.9}{\sin C} = \frac{32}{\sin 75}$ oe **B1** for [angle *BCD* =] 30.7 or 30.67 to 30.69… or **M1dep** for 105 – *their* angle *BCD*
(c)	388 or 387.7 to 387.9… nfww	**3**	**M1** for $\frac{1}{2} \times 16 \times 19 \times \sin 57$ oe **M1** for $\frac{1}{2} \times 16.9 \times 32 \times \sin$ *their* **(b)** oe
(d)	13.4 or 13.41 to 13.42 nfww	**3**	**M2** for $\frac{x}{16} = \sin 57$ oe or **M1** for distance required is perpendicular to *AD* soi

34. 0580_s21_ms_42 Q: 8

	Answer	Mark	Partial Marks
(a)	[L =] 11.8 [W =] 5.9 [H =] 7.1	**5**	**M1** for $L = 2W$ oe soi **M1** for $W + 2H = 20.1$ oe **M1** for $2L + 2H = 37.8$ oe **B1** for at least one correct answer
(b)(i)	0.559 to 0.56[0…]	**B4**	**M2** for $\frac{1}{3}\times 18\times 15\times\sqrt{24^2-18^2}$ isw conversion or **M1** for $h^2 + 18^2 = 24^2$ oe or better **M1** for figs 800 ÷ figs *their* volume isw
	g/cm^3 or g cm^{-3} final answer	**B1**	

	Answer	Mark	Partial Marks
(b)(ii)	34.1 or 34.11 to 34.12	**4**	**M3** for tan [ ] = $\frac{\sqrt{24^2-18^2}}{\sqrt{18^2+15^2}}$ oe or **M2** for $\sqrt{18^2 + 15^2}$ isw or $\sqrt{24^2 + 15^2}$ isw or **M1** for $18^2 + 15^2$ isw or $24^2 + 15^2$ isw or **M1** for indicating required angle is *EBD*

35. 0580_s21_ms_43 Q: 9

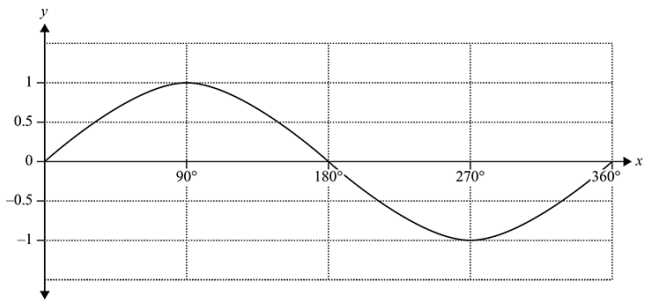
	Answer	Mark	Partial Marks
(a)	42.3 or 42.28 to 42.30...	**7**	**M1** for $\frac{AB}{14} = \cos 35$ oe **M1** for $\frac{AD}{14} = \sin 35$ oe **B1** for [C =] 75 **M3** for [BC =] $\frac{14\sin 60}{\sin \textit{their}\,75}$ oe **and** [DC] $\frac{14\sin 45}{\sin \textit{their}\,75}$ oe or **M2** for $\frac{14\sin 60}{\sin \textit{their}\,75}$ **or** $\frac{14\sin 45}{\sin \textit{their}\,75}$ oe or **M1** for $\frac{\sin \textit{their}\,75}{14} = \frac{\sin 60}{BC}$ oe or $\frac{\sin \textit{their}\,75}{14} = \frac{\sin 45}{CD}$ oe

	Answer	Mark	Partial Marks
(b)(i)	4.91 or 4.907...	**3**	**B2** for $[l^2 =]$ 24.1 or 24.08... or M2 for $\sqrt{3}\, l = 8.5$ or $[l =] \sqrt{\frac{8.5^2}{3}}$ oe or **M1** for $l^2 + l^2 + l^2 = 8.5^2$ oe
(b)(ii)	35.3 or 35.26 to 35.3 nfww	**3**	**M2dep** for sin (angle) = $\frac{\textit{their}\ \textbf{(b)(i)}}{8.5}$ oe or **M1** for clear recognition of correct angle

36. 0580_m20_ms_42 Q: 8

	Answer	Mark	Partial Marks
(a)(i)	2.67 or 2.666…	**3**	**M2** for $\frac{6 \times \sin 25}{\sin 72}$ or **M1** for implicit version
(a)(ii)	4.14 or 4.140…	**3**	**M1** for $6^2 + 7.4^2 - 2 \times 6 \times 7.4 \times \cos 34$ **A1** for 17.1 to 17.2
(a)(iii)	20.4 or 20.35 to 20.36…	**4**	**B1** for angle $SQR = 83$ **M1** for $\frac{1}{2} \times 6 \times$ *their* **(a)(i)** $\times \sin$ *their* (180–72–25) oe **M1** for $\frac{1}{2} \times 6 \times 7.4 \times \sin 34$ oe
(b)(i)	8.7[0] or 8.695…	**4**	**B3** for $\sqrt{980}$ oe or 31.3 or 31.30… or **M3** for $40 - \sqrt{20^2 + 18^2 + 16^2}$ oe or **M2** for $20^2 + 18^2 + 16^2$ oe or **M1** for any correct attempt at 2-dimensional Pythagoras' e.g. $18^2 + 16^2$
(b)(ii)	30.7 or 30.73 to 30.74…	**3**	**M2** for $[\sin =] \frac{16}{\sqrt{20^2 + 18^2 + 16^2}}$ oe or **B1** for identifying angle *GAC*

37. 0580_p20_ms_40 Q: 8

	Answer	Mark	Partial Marks
(a)	70.5 and 289.5	4	**B3** for one correct value or 2 correct values not rounded to 1 decimal place or **M2** for $\cos^{-1}\left(\frac{1}{3}\right)$ or **M1** for $\cos x = \frac{1}{3}$ If 0 scored **SC1** for two solutions which sum to 360°
(b)		2	**B1** for correct shape but inaccurate amplitude or period

38. 0580_s20_ms_41 Q: 7

	Answer	Mark	Partial Marks
(a)	$[BC^2 =]\ 80^2 + 115^2 - 2 \times 80 \times 115 \cos 72$ oe	**M1**	
	118.06…	**A2**	**A1** for 13939…

	Answer	Mark	Partial Marks
(b)	67.8 or 67.9 or 67.83 to 67.88	3	**M2** for $[\sin B =]\ \frac{115 \times \sin 72}{118.1}$ oe or **M1** for $\frac{115}{\sin B} = \frac{118.1}{\sin 72}$ oe
(c)(i)	255	3	**B1** for bearing of B from A is 75 soi **M1** for 180 + 75 oe
(c)(ii)	[00]7.2	2	**M1** for *their* **(c)(i)** – *their* **(b)** –180
(d)	11.8 or 11.82 to 11.83	3	**M1** for 115 ÷ 35 oe **M1** for *their* speed in m/s × 60 × 60 ÷ 1000
(e)	76.1 or 76.08 to 76.09	3	**M2** for $\frac{\text{distance}}{80} = \sin 72$ oe or **M1** for distance required is perpendicular to AC soi

39. 0580_s20_ms_41 Q: 8

	Answer	Mark	Partial Marks
(a)(i)	Correct sketch	**2**	**B1** for correct shape but inaccurate
(a)(ii)	Rotational [symmetry] order 2 [centre] (180, 0)	**2**	**B1** for rotational [symmetry]
(b)	48.6 or 48.59 to 48.60 and 131.4 or 131.40 to 131.41	**3**	**B2** for 48.6 or 48.59 to 48.60 or 131.4 or 131.40 to 131.41 or **M1** for $\sin x = 0.75$ or better If 0 scored, **SC1** for two answers adding to 180
(c)(i)	$(x + 5)^2 - 11$	**2**	**M1** for $(x + 5)^2 + k$ or $(x + \textit{their}\ 5)^2 + 14 - (\textit{their}\ 5)^2$ or $a = 5$
(c)(ii)	Sketch of U-shaped parabola with a minimum indicated at (–5, –11) with no part of graph in 4th quadrant	**3**	**FT** *their* $(x + 5)^2 - 11$ provided in that form **B1** for U shape curve **B1FT** for turning point at $(-5, k)$ or $(k, -11)$

40. 0580_s20_ms_42 Q: 4

	Answer	Mark	Partial Marks
(a)	65.4 or 65.36 to 65.37	**3**	**M1** for $150^2 + 120^2 - 2 \times 150 \times 120 \cos 25$ **A1** for 4270 or 4272 to 4273
(b)	125 or 124.7 to 124.8	**4**	**B1** for [angle S =] 80 **M2** for $\frac{150\sin 55}{\sin \textit{their}\,80}$ or **M1** for $\frac{\sin \textit{their}\,80}{150} = \frac{\sin 55}{RS}$ oe
(c)	10 400 or 10 410 to 10 440 nfww	**3**	**M1** for $\frac{1}{2} \times 120 \times 150 \sin 25$ oe **M1** for $\frac{1}{2} \times 150 \times \textit{their}$ **(b)** $\sin 45$ oe

41. 0580_s20_ms_42 Q: 5

	Answer	Mark	Partial Marks
(a)	[0]38 or [0]37.9 or [0]37.87...	**2**	**M1** for $\tan = \frac{350}{450}$ oe If 0 scored, **SC1** for answer [0]52 or [0]52.1 or [0]52.12 to [0]52.13
(b)	624 or 623.8 to 623.9	**6**	**M2** for $450 - 400 \sin 50$ or **M1** for $\sin 50 = \frac{...}{400}$ **M2** for $350 + 400 \cos 50$ or **M1** for $\cos 50 = \frac{...}{400}$ **M1** for (*their* $(450 - 400 \sin 50))^2 + (\textit{their}\ (350 + 400 \cos 50))^2$
(c)	10 min 8 s	**4**	**B3** for 10.1 or 10.13… or **M2** for (400 + 350 + 450 + *their DA*) ÷ 3 [÷ 60] oe or **M1** for any distance ÷ 3 **M1** for rounding *their* minutes into minutes and seconds to nearest second if clearly seen

42. 0580_s20_ms_43 Q: 5

	Answer	Mark	Partial Marks
(a)	$(4x-5)(x+3)+(x+1)(x-3)=342$ or $2x(4x-5)-(3x-6)(x-3)=342$	M2	**M1** for $(4x-5)(x+3)$ or $(x+1)(x-3)$ or for $2x(4x-5)$ or $(3x-6)(x-3)$
	$4x^2+12x-5x-15$ oe and $x^2+x-3x-3$ oe seen OR $8x^2-10x$ and $3x^2-15x+18$ seen	M2	**M1** for each
	$5x^2+5x-18=342$ leading to $x^2+x-72=0$	A1	no errors or omission
(b)	$(x+9)(x-8)$	M2	**B1** for $(x+a)(x+b)$ where $ab=-72$ or $a+b=1$ and a, b are integers
	8, –9	B1	
(c)	86	2	**FT** for $12\times$*their* $x-10$ (x positive) **B1** for any one of 27, 11, 16 seen or for $2x+2x+4x-5+4x-5$ oe or better soi
(d)	22.2 or 22.16 to 22.17	2	**M1** for tan = $\frac{11}{27}$ or $\frac{\textit{their}\ x+3}{4\times\textit{their}\ x-5}$

43. 0580_s20_ms_43 Q: 10

	Answer	Mark	Partial Marks
(a)(i)	$x+5$	2	**B1** for linear equation with positive gradient or intercept 5
(a)(ii)	2 sin x oe	2	**B1** for recognition of sin or cos($x-90$)
(b)	tangent ruled at P	B1	
	1.3 to 1.4	B2	**dep** on tangent drawn **M1** for rise/run

44. 0580_w20_ms_41 Q: 4

	Answer	Mark	Partial Marks
(a)	38.6	**3**	**M2** for [2 ×] (8.5 + 0.05 + 10.7 + 0.05) or **M1** for 8.5 + 0.05 or 10.7 + 0.05
(b)(i)	8.86 or 8.863…	**2**	**M1** for $\frac{h}{9}$ = sin 80 or better oe
(b)(ii)	∠CDF = 100 leading to ∠*DCF* = 40 Or ∠EDF = 80 leading to ∠*DCF* = 40	**M1**	Implied by 180-(100 + 40) = 40 or 80 – 40
	'two equal angles'	**A1**	With no incorrect work seen
(b)(iii)	66.5 or 66.45 to 66.47…	**3**	**M2** for 0.5(3 + 12) × *their* **(b)(i)** or 12 × *their* **(b)(i)** – 0.5 × 9 × 9 × sin 100 oe or **B1** for *DC* = 9 or *BC* = 3

	Answer	Mark	Partial Marks
(c)	130 nfww or 129.6 to 129.8	**5**	**B1** for $\angle ACD = 21^\circ$ or $\angle CAD = 69^\circ$ **Method 1** **M2** for $\cos 21 = \frac{12}{AC}$ oe or **M1** for $\angle ADC = 90$ soi **M1** for $\pi(\text{their } AC/2)^2$ OR **Method 2** **M2** for $\frac{12}{\sin 138} = \frac{r}{\sin 21}$ oe or **M1** for $\angle COD = 138$ soi **M1** for $\pi(\text{their } r)^2$ OR **Method 3** **M2** for $\cos 21 = \frac{6}{OC}$ oe or **M1** for $\angle CXO = 90$ soi where X is the point where the perpendicular from O meets the chord CD **M1** for $\pi(\text{their } OC)^2$
(d)	78.4 or 78.37 to 78.41	**3**	**M2** for $\frac{x}{360} \times 2 \times \pi \times 9.5 + 2 \times 9.5 = 4 \times 8$ oe or **M1** for $\frac{x}{360} \times 2 \times \pi \times 9.5$ After **M0, SC1** for $9.5x + 19 = 32$ oe

45. 0580_w20_ms_41 Q: 6

	Answer	Mark	Partial Marks
(a)(i)	106.01 to 106.02	**4**	**M2** for $[\cos[\angle CBD] =] \frac{192^2 + 168^2 - 287.9^2}{2 \times 192 \times 168}$ oe or **M1** for the implicit form **A1** for –0.276 to – 0.275
(a)(ii)	292.0 or 291.98 to 291.99	**1**	
(a)(iii)	310.0 or 310.03 to 310.04	**5**	**M2** for $[\sin A =] \frac{168 \times \sin(90 - 38)}{205.8}$ or **M1** for $\frac{\sin A}{168} = \frac{\sin(90 - 38)}{205.8}$ **A1** for [*A* =] 40.0 or 40.03 to 40.04 **M1 dep** for 270 + *their* angle *DAB* oe
(b)(i)	15 500 or 15 501 to 15 503. …	**2**	**M1** for $0.5 \times 192 \times 168 \times \sin(106)$ oe
(b)(ii)	55 400	**2**	**FT** $3.575 \times$ *their* **(b)(i)** oe rounded to nearest 100 **M1** for figs 35 75 × figs *their* **(b)(i)** or figs 554 or figs 5541 to figs 5543

46. 0580_w20_ms_42 Q: 9

	Answer	Mark	Partial Marks
(a)	315 or 314.5 to 315.0	6	**M1** for $\tan 70 = \frac{\text{height}}{\frac{1}{2}(8-5)}$ oe or better seen **M1dep** for $\frac{1}{2}(8+5)\times$ *their* height or better seen **dep** on trig attempt for height **M2** for $12 \times \frac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen or **M1** for $\frac{\frac{1}{2}(8-5)}{\cos 70}$ oe or better seen **M1** for 8×12 oe isw and 5×12 oe isw
(b)(i)	$8 - ½ (8 - 5)$ or $5 + ½ (8 - 5)$	M1	
(b)(ii)	13.6 or 13.64 to 13.65	2	**M1** for $12^2 + (6.5)^2$ oe
(b)(iii)	16.8 or 16.9 or 16.79 to 16.91… nfww	2	**M1** for identifying angle *GAX* from a diagram or from working or better

47. 0580_w20_ms_43 Q: 6

	Answer	Mark	Partial Marks
(a)	440	2	**M1** for $8 \times 5 \times 11$
(b)	$\sqrt{8^2+5^2+11^2}$ oe or $8^2 + 5^2 + 11^2$ and 13^2 ALTERNATIVE $\sqrt{8^2+11^2}$ or $8^2 + 11^2$ and 13^2	M3	**M2** for $8^2 + 5^2 + 11^2$ or $8^2 + 11^2$ oe or **M1** for $8^2 + 5^2$ or $5^2 + 11^2$ oe
	Yes and 14.5 or 14.4 or 14.49… or Yes and 13.6[0…]	A1	Accept equivalent conclusion
(c)(i)	32.0[…]	2	**M1** for $\tan[..] = \frac{5}{8}$ oe
(c)(ii)	49.4 or 49.38 to 49.39	2	**M1** for $\sin[..] = \frac{11}{\text{their } AG}$ oe

48. 0580_s19_ms_42 Q: 8

	Answer	Mark	Partial Marks
(a)(i)	15.7 or 15.70...	4	**M2** for $16.5^2 + 12.4^2 - 2\times16.5\times12.4\times\cos 64$ or **M1** for implicit form **A1** for 246 to 247

	Answer	Mark	Partial Marks
(a)(ii)	18.7 or 18.68 to 18.69	4	**B1** for 32 or angle $DBM = 37$ or angle $CBM = 58$ **M2** for $\frac{12.4\times\sin 53}{\sin 32}$ oe or **M1** for implicit form oe
(b)(i)	116.1 or 116.08 to 116.09...	2	**M1** for $\frac{y}{360}\times 2\times\pi\times 3.8 = 7.7$ oe
(b)(ii)	14.6 or 14.61 to 14.63…	2	**M1** for $\frac{\textit{their}\textbf{(b)(i)}}{360}\times\pi\times 3.8^2$ oe

49. 0580_w19_ms_41 Q: 4

	Answer	Mark	Partial Marks
(a)(i)	955 or 955.0 to 955.2	2	**M1** for $2\times\pi\times 8\times 19$ oe
(a)(ii)	812 or 811.7 to 811.9...	2	**FT** *their* (i) × 0.85 **M1** for *their* (i) × 0.85 or *their* (i) × 85
(b)(i)	$\frac{4}{3}\times\pi\times 6^3$ $\frac{1}{3}\times\pi\times 8^2$ or cancelling clearly seen to reach 13.5	M2	**M1** for $\frac{4}{3}\times\pi\times 6^3 = \frac{1}{3}\times\pi\times 8^2\times h$
(b)(ii)	15.7 or 15.69...	2	**M1** for $8^2 + 13.5^2$ or better
(b)(iii)	394 or 395 or 394.3 to 394.6...	1	**FT** π × 8 × *their* (b)(ii)

	Answer	Mark	Partial Marks
(c)	567	**3**	**M2** for $\frac{168}{V} = \left(\frac{80}{180}\right)^{\frac{3}{2}}$ oe or better or **M1** for $\left(\frac{180}{80}\right)^{\frac{1}{2}}$ or $\left(\frac{80}{180}\right)^{\frac{1}{2}}$ oe seen or better
(d)	51.3 or 51.34...	**3**	**M2** for $\tan = \frac{5}{4}$ oe or **M1** for recognition of angle *PBX*

50. 0580_w19_ms_41 Q: 5

	Answer	Mark	Partial Marks
(a)	4.29 or 4.285 to 4.286	**3**	**M2** for $\frac{150}{\frac{450}{3.6} - \frac{120}{4} - \frac{180}{3}}$ or **M1** for [time =] $120 \div 4$ or $180 \div 3$ or $450 \div 3.6$ or $3.6 = \frac{150+180+120}{\text{total time}}$
(b)	82.8 or 82.81 to 82.82 using cosine rule	**4**	**M2** for $\frac{150^2 + 120^2 - 180^2}{2 \times 150 \times 120}$ or **M1** for $180^2 = 120^2 + 150^2 - 2 \times 120 \times 150 \cos(...)$ **A1** for $\frac{4500}{36000}$ oe
(c)(i)	127.2 or 127.1 to 127.2 or 127	**1**	**FT** 210 – *their* (b)
(c)(ii)	307.2 or 307.1 to 307.2 or 307	**2**	**FT** 180 + *their*(c)(i) **M1** for 180 + *their* (c)(i)
(d)	15 or 14.99 to 15.04	**2**	**M1** for $\cos(\textit{their}\ (b)) = \frac{\text{dist}}{120}$ oe

51. 0580_w19_ms_42 Q: 4

	Answer	Mark	Partial Marks
(a)	452 or 452.2 to 452.4…	**2**	**M1** for $\left[\frac{1}{2}\times\right]\frac{4}{3}\times\pi\times 6^3$
	cm^3	**1**	
(b)(i)(a)	400 or 399.6 to 399.9	**6**	**B3** for [CD =] $\sqrt{72.96}$ or [angle CBD =] 58.7 or 58.66 to 58.67 or **M2** for $\sqrt{10^2-5.2^2}$ oe or [CBD =] $\cos^{-1}\left(\frac{5.2}{10}\right)$ oe or **M1** for $(CD)^2 + 5.2^2 = 10^2$ oe or $\cos[CBD] = \frac{5.2}{10}$ oe or $\sin[CDB] = \frac{5.2}{10}$ oe **M1dep** for $\frac{5.2\times \textit{their } CD}{2}$ oe or $\frac{1}{2}\times 5.2\times 10\times\sin(\textit{their } CBD)$ oe **M1** for *their* area × 18 oe
(b)(i)(b)	14.6 or 14.62 to 14.63…	**4**	**M3** for $\sin BEC = \frac{5.2}{\sqrt{10^2+18^2}}$ oe or **M2** for [BE=] $\sqrt{10^2+18^2}$ oe seen or [EC =] $\sqrt{18^2+10^2-5.2^2}$ oe seen or **M1** for [BE^2 =] $10^2 + 18^2$ oe seen or [EC^2=] $18^2 + 10^2 - 5.2^2$ seen
(b)(ii)	125 or 124.9 to 125.0…	**3**	**B2** for 55[.0…] seen or **M2** for $180 - \tan^{-1}\left(\frac{10}{7}\right)$ oe or $\cos EGB = \frac{11^2+(10^2+7^2)-(10^2+18)^2}{2\times 11\times\sqrt{10^2+7^2}}$ oe or **M1** for $\tan[\ \ ] = \left(\frac{10}{7}\right)$ oe or for $(10^2+18^2) = 11^2 + (10^2+7^2) - 2\times 11\times$ $\sqrt{10^2+7^2}\ \cos EGB$ oe

52. 0580_w19_ms_42 Q: 6

	Answer	Mark	Partial Marks
(a)(i)	13.9[0…] from cosine rule	**4**	**M2** for $8^2 + 13^2 - 2 \times 8 \times 13\cos 79$ or **M1** for $\cos 79 = \frac{13^2 + 8^2 - BC^2}{2 \times 8 \times 13}$ **A1** for 193 ....
(a)(ii)	66.6 or 66.60… to 66.65 from sine rule	**3**	**M2** for [$\sin ACB =$] $\frac{13 \times \sin 79}{their(a)(i)}$ or **M1** for $\frac{\sin ACB}{13} = \frac{\sin 79}{their(a)(i)}$ oe
(b)(i)	$\frac{1}{2}(x+4)(4x-5)\sin 30 = 70$	**M1**	
	$4x^2 + 16x - 5x - 20 = 280$	**M2**	**Dep on M1** **B1** for $4x^2 + 16x - 5x - 20$ or better
	Leading to $4x^2 + 11x - 300 = 0$	**A1**	with no errors or omissions seen

	Answer	Mark	Partial Marks
(b)(ii)	$\frac{-11 \pm \sqrt{11^2 - 4 \times 4 \times -300}}{2 \times 4}$	**B2**	**B1** for $\sqrt{11^2 - 4(4)(-300)}$ or better or for $\frac{-11 + \sqrt{q}}{2 \times 4}$ or $\frac{-11 - \sqrt{q}}{2 \times 4}$
	–10.14 and 7.39	**B2**	**B1** for each or **SC1** for final answers –10.1 or –10.144 to –10.143 **and** 7.4 or 7.393 to 7.394 or –10.14 **and** 7.39 seen in working or for –7.39 **and** 10.14 as final answer
(b)(iii)	11.4 or 11.39…	**1**	**FT** *their* positive root + 4

53. 0580_w19_ms_43 Q: 4

	Answer	Mark	Partial Marks
(a)	36.8 or 36.84…	2	**M1** for $\frac{h}{107} = \tan 19$ or $\frac{h}{\sin 19} = \frac{107}{\sin 71}$ oe or better
(b)	42.1 or 42.12… from cosine rule	4	**M2** for $[\cos BAC =]\frac{158^2 + 132^2 - 107^2}{2 \times 158 \times 132}$ or **M1** for implicit version **A1** for $[\cos BAC =]\frac{30939}{41712}$ or 0.7417…
(c)	35.8 or 35.84… from sine rule	3	**M2** for $\frac{86 \times \sin 116}{132}[= 0.58557...]$ or **M1** for $\frac{\sin CAD}{86} = \frac{\sin 116}{132}$ oe
(d)	9670 or 9669 to 9676	3	**M2** for $\frac{1}{2} \times 158 \times 132 \times \sin(their\ (b))$ oe and $\frac{1}{2} \times 86 \times 132 \times \sin(64 - their\ (c))$ oe or **M1** for either area
(e)	214.2 or 214.1… or 214	2	**M1** for [180 +]70–*their* (c) oe

54. 0580_m18_ms_42 Q: 8

	Answer	Mark	Partial Marks
(a)	356 or 356.2 to 356.3	4	**B1** for [Angle *LPM*] = 74 soi **M2** for $\frac{248 \times \sin their\ 74}{\sin 42}$ oe or **M1** for implicit statement
(b)(i)	320 or 319.9 to 320.2...	3	**B1** for angle *PLM* = 64 soi or for angle between *LM* and perpendicular from *M* = 26 soi or [*PM* =] 333.[1…] **M1** for *their* 356 × sin *their* 64 oe or *their* 356 × cos *their* 26 oe
(b)(ii)	0257 or 257 am	3	**B2** for 6 hours 12 mins or 372 mins seen or **M1** for 248 ÷ 40 oe If 0 scored, **SC1** for *their* time in hours converted to hours and minutes

55. 0580_s18_ms_42 Q: 5

	Answer	Mark	Partial Marks
(a)	$8^2 + 7^2 - 2 \times 7 \times 8 \times \cos 78$ oe	**M2**	**M1** for correct implicit version
	9.471.. to 9.472	**A2**	**A1** for 89.7…
(b)	46.3 or 46.29 to 46.30…	**3**	**M2** for $[\sin OAC =]\frac{7\sin 78}{9.47}$ or **M1** for $\frac{\sin OAC}{7} = \frac{\sin 78}{9.47}$

	Answer	Mark	Partial Marks
(c)	$29.5 - (7 + 8 + 9.47)$	**M1**	
	$\frac{360 \times (29.5 - (7 + 8 + 9.47))}{2 \times \pi \times 7}$	**M3**	**M2** for $\frac{x}{360} \times 2 \times \pi \times 7 =$ *their* arc length oe or **M1** for $\frac{x}{360} \times 2 \times \pi \times 7$ oe
	41.15 to 41.171..	**B1**	
(d)	45[.0] or 44.98 to 45.01 nfww	**4**	**M3** for ½ × 8 × 7 × sin 78 oe + $\frac{41.2}{360} \times \pi \times 7^2$ oe OR **M1** for ½ × 8 × 7 × sin 78 oe or ½ × 8 × 9.47 × sin *their* **(b)** oe **M1** for $\frac{41.2}{360} \times \pi \times 7^2$ oe

56. 0580_s18_ms_42 Q: 7

	Answer	Mark	Partial Marks
(a)	$x^2 + (2x - 3)^2 = 6^2$ oe or $x^2 + 4x^2 - 6x - 6x + 9 = 36$	**M1**	
	$4x^2 - 6x - 6x + 9$ or better	**B1**	
	$5x^2 - 12x - 27 = 0$	**A1**	Dep on **M1B1** with no errors or omissions
(b)	$\frac{-(-12) \pm \sqrt{(-12)^2 - 4(5)(-27)}}{2 \times 5}$ or better or $\frac{12}{10} \pm \sqrt{\left(\frac{12}{10}\right)^2 + \frac{27}{5}}$	**B2**	**B1** for $\sqrt{(-12)^2 - 4(5)(-27)}$ or for $\left(x - \frac{12}{10}\right)^2$ oe or $\frac{-(-12) + \sqrt{q}}{2 \times 5}$ oe or $\frac{-(-12) - \sqrt{q}}{2 \times 5}$ oe or both
	– 1.42, 3.82 final answers	**B2**	**B1** for each If **B0**, **SC1** for answers – 1.4 or –1.415… to – 1.415 **and** 3.8 or 3.815 to 3.815… or answers –1.41 and 3.81 or – 1.42 **and** 3.82 seen in working or for –3.82 and 1.42 as final ans
(c)	14.4 or 14.5 or 14.44 to 14.46	**2**	**2FT** for 3 × *their* positive root + 3 evaluated to 3sf or better **M1** for 3 × *their* positive root + 3 oe
(d)	39.5 or 39.46 to 39.54…	**2**	**M1** for trig statement seen to find either angle sin = $\frac{\textit{their}\, x}{6}$ oe or sin = $\frac{\textit{their}\,(2x - 3)}{6}$ oe

57. 0580_s18_ms_43 Q: 6

	Answer	Mark	Partial Marks
(a)(i)	116.6 or 116.56 to 116.57	4	**M1** for $\sin[EAD]=\frac{6}{12}$ oe **M1** for $\tan[BAC]=\frac{6}{12}$ oe **B1** for [angle DAC] = 60
(a)(ii)	13.4 or 13.41 to 13.42	2	**M1** for 12^2+6^2
(a)(iii)	10.4 or 10.39…	3	**M2** for $\sqrt{12^2-6^2}$ or **M1** for $AE^2+6^2=12^2$
(a)(iv)	130 or 129.5… to 129.6	4	**M1** for $0.5\times6\times theirAE$ oe **M1** for $0.5\times12\times12\times\sin60$ oe **M1** for $0.5\times6\times12$ oe
(b)(i)	3	1	
(b)(ii)	51.3 or 51.30 to 51.34…	4	**M3** for $\tan=\frac{8}{\sqrt{4^2+5^2}}$ or $\sin=\frac{8}{\sqrt{4^2+5^2+8^2}}$ oe or **M2** for $\sqrt{4^2+5^2}$ or $\sqrt{4^2+5^2+8^2}$ or **M1** for angle ARB clearly indicated

58. 0580_w18_ms_41 Q: 5

	Answer	Mark	Partial Marks
(a)(i)	$[h=]\ 253.8\div18\div\left(\frac{6}{2}\right)$ or $[h=]\ \frac{253.8\times2}{6\times18}$ or $[h=]\ \frac{253.8}{18\times\frac{6}{2}}$	3	For **M3** no errors at any stage **M2** for $253.8=\frac{1}{2}\times6\times h\times18$ oe (no previous errors) or **M1** for triangle area $=\frac{1}{2}\times6\times h$ soi
(a)(ii)	38.1 or 38.06 to 38.08	2	**M1** for $\tan=\frac{4.7}{6}$ oe
(b)	358 or 357.9 to 358	6	**M1** for $6^2+4.7^2$ **M1** for $\sqrt{6^2+4.7^2}\times18$ [$\times2$] **M1** for 6×18 [$\times2$] **M1** for 4.7×18 **M1** for $2\times\frac{1}{2}\times6\times4.7$ oe

59. 0580_w18_ms_41 Q: 7

	Answer	Mark	Partial Marks
(a)	42.2 or 42.23....	**2**	**M1** for $\frac{1}{2}\times 8.9\times 12.5\times \sin 130.6$ oe
(b)(i)	27[.0] or 27.00 to 27.01	**3**	**M2** for $\frac{11.6\times \sin 123.5}{21.3}$ or **M1** for $\frac{11.6}{\sin BCD}=\frac{21.3}{\sin 123.5}$ oe
(b)(ii)	15.9 or 15.90 to 15.91	**5**	**M1** for angle *ABD* = *their* angle *BCD* + 33.5 **and** **M2** for $11.6^2+18^2-2\times 11.6\times 18\times\cos(their ABD)$ or **M1** for implicit version **A1** for 252.9 to 253

60. 0580_w18_ms_42 Q: 8

	Answer	Mark	Partial Marks
(a)	370 or 370.2 to 370.3	**2**	**M1** for 864 ÷ *their* time
(b)	991 or 990.5 …	**4**	**M2** for $864^2 + 928^2 - 2 \times 864 \times 928\cos 67$ or **M1** for correct implicit version **A1** for 981100 to 981110
(c)(i)	313	**2**	**M1** for 180 + 133 or 360 – 47
(c)(ii)	[0]79.5 to [0]79.6 …	**4**	**M2** for $\frac{928\times \sin 67}{their\ 991}$ or $\frac{864\times \sin 67}{their\ 991}$ oe or **M1** for implicit form of either **A1** for [angle *HGB* =] 59.5 to 59.6 … or [angle *HBG* =] 53.4 or 53.37 to 53.42 **M1 dep** for *their* angle *HGB* + 20 leading to answer or for 133 – *their* angle *HBG* leading to answer

61. 0580_m17_ms_42 Q: 10

	ANSWER	MARK	PARTIAL MARKS
(a) (i)	$(6 - 2) \times 180$ or $(2 \times 6 - 4) \times 90$ or $(360 \div 6)$	M1	
	$(6 - 2) \times 180 \div 6$ or $(2 \times 6 - 4) \times 90 \div 6$ or $180 - (360 \div 6)$	M1dep	dep on previous M1
(ii)	$1.73x$ or $x\sqrt{3}$ oe	3	**M2** for $2x\sin 60$ or $2x\cos 30$ oe or for $\sqrt{x^2 + x^2 - 2 \times x \times x \times \cos 120}$ or **M1** for $x\sin 60$ or $x\cos 30$ oe or for $x^2 + x^2 - 2 \times x \times x \times \cos 120$

	ANSWER	MARK	PARTIAL MARKS
(iii)	$(10 - x)\sin 30$ seen oe	M1	
	$10 + 2\big((10 - x)\sin 30\big)$ oe	M1dep	dep on previous **M1**
	$10 + 10 - x$ or $10 + 2 \times \frac{1}{2} \times (10 - x)$	A1	with no errors or omissions seen
(b)	12.7 or 12.67 to 12.68.... nfww	4	**B3** for 7.32 to 7.33 or **M2** for $x = 20 \div (1 + 1.73)$ oe or **M1** for $20 - x =$ *their* **(a)(ii)** oe

62. 0580_s17_ms_41 Q: 8

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	290	2	**M1** for $180 + 110$ oe
(a)(ii)	156.8 or 156.7[9..]	5	**B1FT** for $CBA = 10°$ (*their* **(a)** $- 280$) and **B3** for [angle ACB =]13.2° or **M2** for [$\sin C$] = $\frac{50\sin(\textit{their}10)}{38}$ or **M1** for $\frac{50}{\sin C} = \frac{38}{\sin(\textit{their}10)}$ oe

	ANSWER	MARK	PARTIAL MARKS
(a)(iii)	8.68 or 8.677 to 8.684	**3**	**M2** for [x =]50sin(*their*10) oe or **M1** for $\sin(\textit{their}10) = \frac{x}{50}$ oe or **M1** for a correct right-angled triangle drawn with 50 as hypotenuse
(b)(i)	$x\,(x - 25) = 2200$	**1**	and no errors seen
(b)(ii)	$\frac{-(-25) \pm \sqrt{(-25)^2 - 4(1)(-2200)}}{2(1)}$ or better	**B2**	**B1** for $\sqrt{(-25)^2 - 4(1)(-2200)}$ or better **or** for $\left(x - \frac{25}{2}\right)^2$ oe or **B1** for $\frac{-(-25) + \sqrt{q}}{2(1)}$ or $\frac{-(-25) - \sqrt{q}}{2(1)}$ or both or for $\frac{25}{2} + \text{or} - \sqrt{\left(\frac{25}{2}\right)^2 + 2200}$
	–36.04 and 61.04 final answer	**B1,B1**	If **B0B0, SC1** for values in ranges –36.042 to –36.041 **and** 61.041 to 61.042 seen or for answers –36[.0] or –36.042 to –36.041 **and** 61[.0] or 61.041 to 61.042 or –36.04 **and** 61.04 seen in working or for –61.04 **and** 36.04 as final ans

63. 0580_s17_ms_42 Q: 8

	ANSWER	MARK	PARTIAL MARKS
(a)	66[.0] or 66.03 to 66.04	**2**	**M1** for tan = $\frac{9}{4}$ oe
(b)	$\sqrt{3^2+4^2}$ or $\frac{1}{2}\sqrt{6^2+8^2}$	**M1**	Any alternative method must be full and complete and result in exactly 5
(c)	60.9 or 60.94 to 60.95	**2**	**M1** for tan = $\frac{9}{5}$ oe
(d)	5.83 or 5.84 or 5.827 to 5.840	**6**	**M1** for [PB or PC =] $\sqrt{9^2+5^2}$ or [XC =] $\sqrt{9^2+5^2}$ − 7.5 **M1** for angle $BPX = 2 \times \text{invsin}\frac{3}{\textit{their } PB}$ oe **B1** for [PB or PC =] $\sqrt{106}$ = 10.29 to 10.30 or XC = 2.79 to 2.8[0] or angle BPX = 33.9 or 33.86 to 33.90… **M2** for $\sqrt{(\textit{their } PB)^2 + 7.5^2 - 2 \times \textit{their } PB \times 7.5 \times \cos(\textit{their } BPX)}$ oe or **M1** for correct implicit equation

64. 0580_s17_ms_43 Q: 9

	ANSWER	MARK	PARTIAL MARKS
(a)	1120 or 1121.	**4**	**M2** for $[AC^2 =]$ $525^2 + 872^2 - 2\times525\times872\times\cos 104$ or **M1** for implicit version **A1** for 1 257 000 to 1 258 000
(b)	[*QB* or *x* =] 872 × tan 1 seen	**M2**	**M1** for $\tan 1 = \frac{QB}{872}$
	tan = *their QB* ÷ 525	**M1**	
	1.7 or 1.660 to 1.661 nfww	**A1**	dep on **M3**
(c)(i)	222 000 or 222 100. .... or 222 101	**2**	**M1** for $\frac{1}{2}\times525\times872\times\sin104$
(c)(ii)	5.55 or 5.550 to 5.553 nfww	**2FT**	**FT** *their* **(c)(i)** × $100^2 \div 20\,000^2$ **M1** for *their* **(c)(i)** × $100^2 \div 20000^2$ or restart

65. 0580_w17_ms_41 Q: 10

	ANSWER	MARK	PARTIAL MARKS
(a)	$12.5^2 = x^2 + 8.5^2 - 2 \times x \times 8.5\cos 60$ oe isw	**M2**	**M1** for $\cos 60 = \frac{x^2 + 8.5^2 - 12.5^2}{2 \times x \times 8.5}$
	$156.25 = x^2 + 72.25 - 8.5x$	**A1**	or better
	$2x^2 - 17x - 168 = 0$	**A1**	with no errors or omissions
(b)	$\frac{[--]17 \pm \sqrt{([-]17)^2 - 4(2)(-168)}}{2 \times 2}$	**2**	**B1** for $\sqrt{([-]17)^2 - 4(2)(-168)}$ or better seen and if in form $\frac{p + or - \sqrt{q}}{r}$ **B1** for $p = [- -]\ 17$ **and** $r = 2 \times 2$
	14.35, –5.85 final answers	**1, 1**	**SC1** for 14.352 to 14.353 and –5.853 to –5.852 seen or 14.3 or 14.4 and –5.8 or –5.9 as final answers or –14.35 and 5.85 as final answers or 14.35 and –5.85 seen in working
(c)	12.2 or 12.17… nfww	**3**	**M2** for $\frac{their\ 14.35 \times \sin 46}{\sin 58}$ or **M1** for $\frac{\sin 46}{CD} = \frac{\sin 58}{their 14.35}$
(d)	138 or 137.5 to 137.8 nfww	**3**	**M1** for $0.5 \times their\ 14.35 \times 8.5\sin 60$ **M1** for $0.5 \times their\ 14.35 \times their 12.2 \times \sin 76$

66. 0580_w17_ms_42 Q: 3

	ANSWER	MARK	PARTIAL MARKS
(a)	7040 or 7035. …	3	**M1** for $\frac{1}{2}\times 100\times 70$ oe **M1** for $\frac{1}{2}\times 100\times 110\times \sin 40$ oe
(b)	374 or 375 or 374.4 to 374.5….	5	**M2** for $110^2+100^2-2\times 110\times 100\times \cos 40$ oe or **M1** for implicit form **A1** for 5250 or 5247. … (or 72.4 or 72.43 to 72.44) **M1** for 70^2+100^2
(c)	64.3 or 64.27 to 64.28 nfww	2	**M1** for $\sin 40 = \frac{\text{distance}}{100}$ oe
(d)	235	3	**B2** for [angle ACB =] 34.99 to 35 or [angle ABC =] 55[.0…] or **M1** for $\tan[\,ACB\,] = \frac{70}{100}$ or $\tan[\,ABC] = \frac{100}{70}$ or equivalent trig ratio

67. 0580_w17_ms_43 Q: 1

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	180 ÷ (2 + 3 + 5) × 5 [= 90]	1	with no errors seen
(a)(ii)	7.05 or 7.053….	3	**M2** for $\frac{x}{12} = \sin 36$ oe or better or **B1** for 36 or 54 seen
(b)(i)	13	2	**M1** for 7.8 ÷ 3 soi
(b)(ii)	36.9 or 36.86 to 36.87	3	**B1** for smallest angle identified **M1** for $\sin[\,] = \frac{3}{5}$ oe or $\sin[\,] = \frac{7.8}{\textit{their}\ \textbf{(b)(i)}}$ oe If zero scored, **SC1** for calculation of 53.1

68. 0580_w17_ms_43 Q: 6

	ANSWER	MARK	PARTIAL MARKS
(a)(i)	25.5 or 25.46…	**2**	**M1** for $\pi \times 5^2 \times h = 2000$ oe
(a)(ii)	9.85 or 9.847…	**3**	**M2** for $[r^3=]\ 2000 \div \left(\frac{2}{3}\pi\right)$ oe or **M1** for $\frac{2}{3}\pi r^3 = 2000$ oe
(a)(iii)	952 or 952.4….	**3**	**M2** for $[6 \times]\ \sqrt[3]{2000}^2$ or **M1** for $\sqrt[3]{2000}$ or 6 times *their* area of one face
(b)(i)	22.5 or 22.49…	**2**	**M1** for $\frac{1}{2} \times 7 \times 10 \times \sin 40$
(b)(ii)	$\sqrt{(10^2 + 7^2 - 2 \times 10 \times 7 \cos 40)} + 7 + 10$	**M3**	**M2** for $10^2 + 7^2 - 2 \times 10 \times 7 \cos 40$ or **M1** for correct implicit cosine rule
	23.46…	**A2**	**A1** for 6.46… or 41.7 to 41.8
(c)	64.9 or 64.92 to 64.94	**3**	**M2** for $28.2 - 2 \times 9 = \frac{c}{360} \times 2 \times \pi \times 9$ oe or **M1** for $\frac{c}{360} \times 2 \times \pi \times 9$ soi