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GCSE MATHS

Geometry and measures

Edexcel 1MA1 | Subtopic collection Topic 37

Angles, parallel lines and polygons

Higher tier

Past paper question booklet

84	2003-2025	Higher
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

23.

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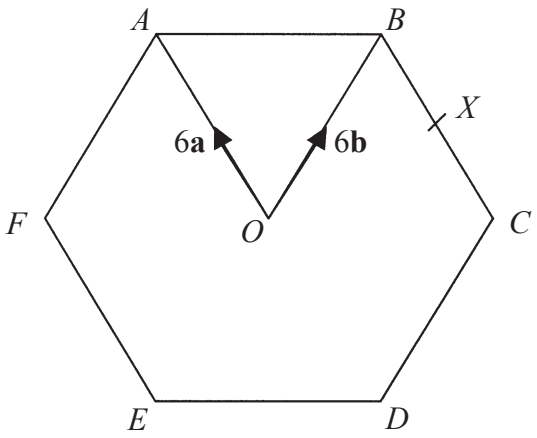


Diagram **NOT** accurately drawn

The diagram shows a regular hexagon $ABCDEF$ with centre O.

$\overrightarrow{OA} = 6\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$

(a) Express in terms of **a** and/or **b**

(i) $\overrightarrow{AB}$,

.....

(ii) $\overrightarrow{EF}$.

.....

(2)

X is the midpoint of BC.

(b) Express $\overrightarrow{EX}$ in terms of **a** and/or **b**

.....

(2)

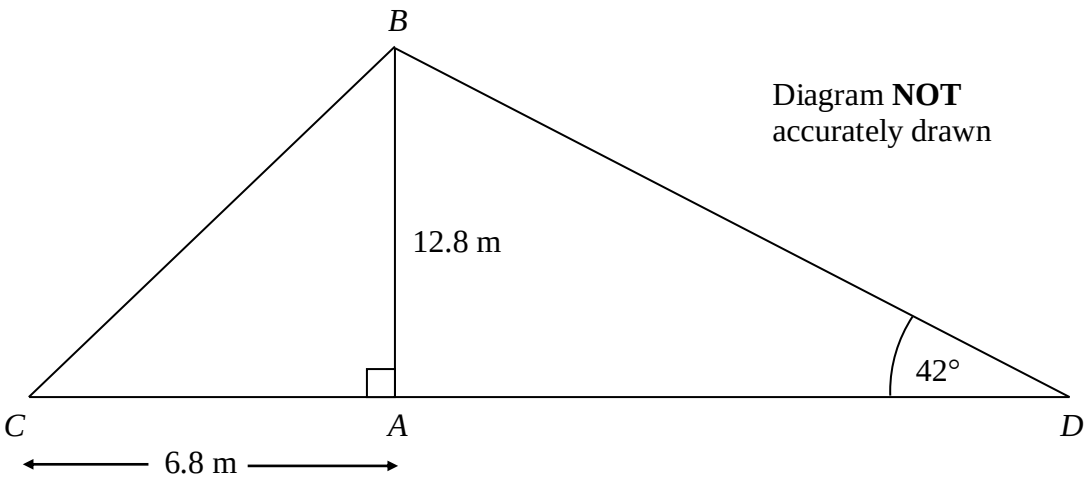
Y is the point on AB extended, such that $AB : BY = 3 : 2$

(c) Prove that E, X and Y lie on the same straight line.

(3)

Page Total

9. The diagram represents a vertical flagpole, *AB*.
The flagpole is supported by two ropes, *BC* and *BD*, fixed to the horizontal ground at *C* and *D*.



AB = 12.8 m.
AC = 6.8 m.
Angle *BDA* = 42°.

(a) Calculate the size of angle *BCA*.
Give your answer correct to 3 significant figures.

.....°
(3)

(b) Calculate the length of the rope *BD*.
Give your answer correct to 3 significant figures.

..... m
(3)

8. Each side of a regular pentagon has a length of 101 mm, correct to the nearest millimetre.

(i) Write down the **least** possible length of each side.

..... mm

(ii) Write down the **greatest** possible length of each side.

..... mm

(2)

19. The diagram shows a pyramid. The apex of the pyramid is V.
Each of the sloping edges is of length 6 cm.

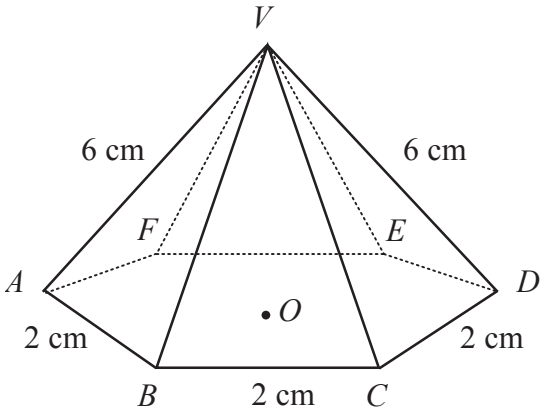


Diagram **NOT** accurately drawn

The base of the pyramid is a regular hexagon with sides of length 2 cm.
O is the centre of the base.

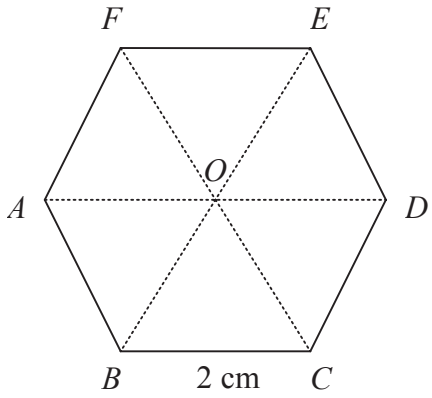


Diagram **NOT** accurately drawn

(a) Calculate the height of V above the base of the pyramid.
Give your answer correct to 3 significant figures.

..... cm
(2)

blank

(b) Calculate the size of angle DVA.
Give your answer correct to 3 significant figures.

..... °
(3)

(c) Calculate the size of angle AVC.
Give your answer correct to 3 significant figures.

..... °
(4)

(Total 9 marks)

Q19

15.

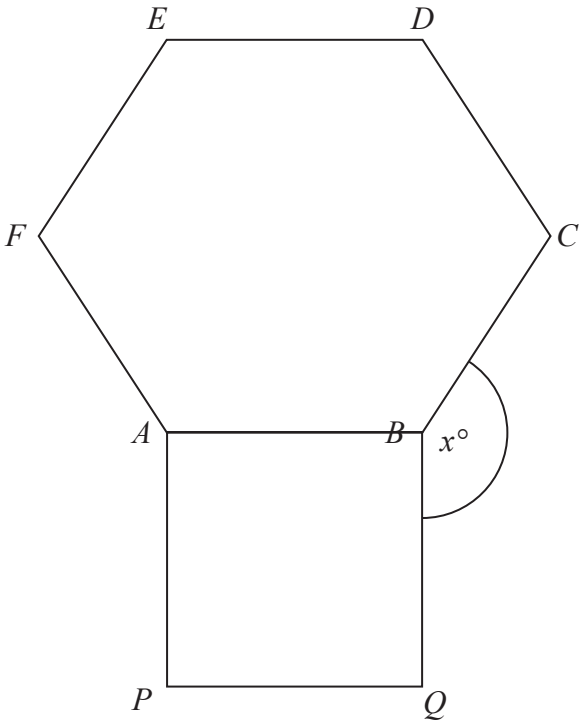


Diagram **NOT** accurately drawn

ABCDEF is a regular hexagon and *ABQP* is a square.
Angle *CBQ* = *x*°.

Work out the value of *x*.

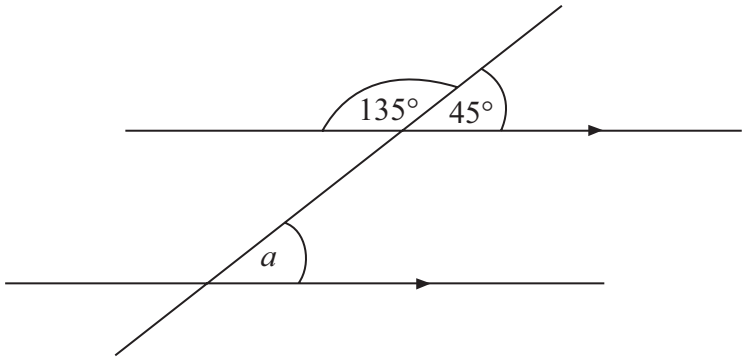
x = ...

Q15

(Total 4 marks)

6.

Diagram **NOT** accurately drawn



(i) Write down the size of the angle marked *a*.

..... °

(ii) Give a reason for your answer.

.....

Q6

(Total 2 marks)

12.

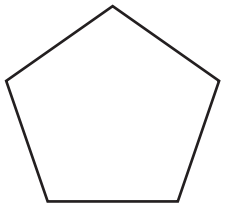


Diagram **NOT** accurately drawn

Work out the size of an exterior angle of a regular pentagon.

..... °

Q12

(Total 2 marks)

5.

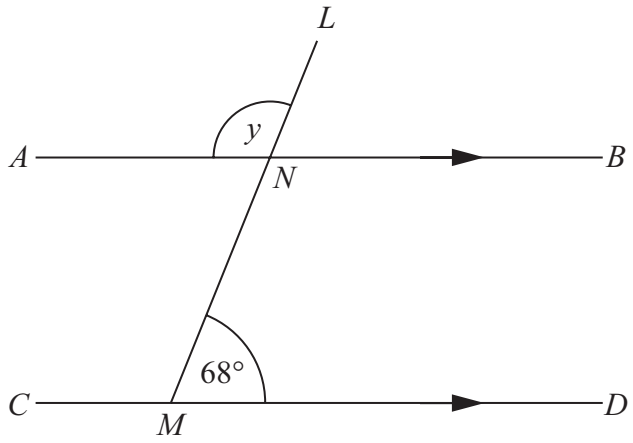


Diagram **NOT** accurately drawn

ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 68°

(i) Work out the size of the angle marked *y*.

.....°

(ii) Give reasons for your answer.

.....

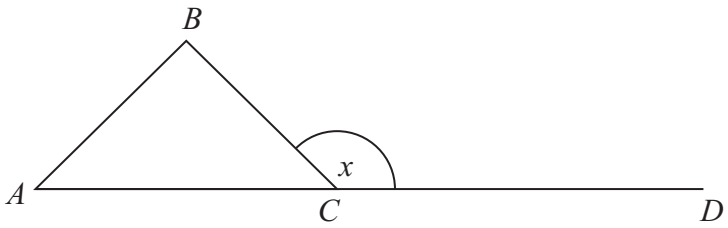
.....

Q5

(Total 3 marks)

9.

Diagram **NOT** accurately drawn



ABC is an equilateral triangle.
ACD is a straight line.

(a) Work out the size of the angle marked *x*.

..... °

(2)

(b) Give a reason for your answer.

.....

.....

(1)

(Total 3 marks)

Q9

4

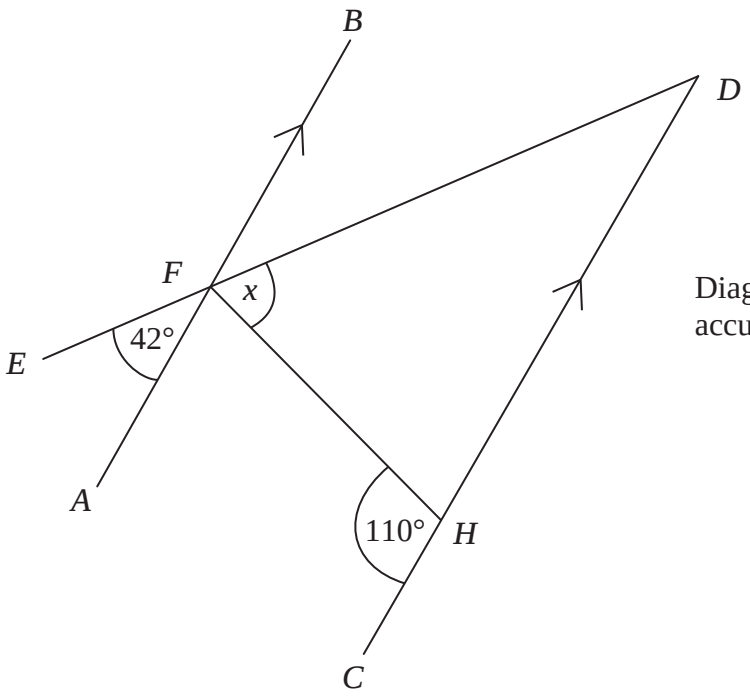


Diagram **NOT** accurately drawn

AFB and *CHD* are parallel lines.
EFD is a straight line.

Work out the size of the angle marked *x*.

x = ... °

(Total for Question 4 is 3 marks)

6 The diagram shows 3 sides of a regular polygon.

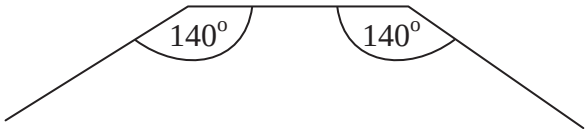


Diagram **NOT** accurately drawn

Each interior angle of the regular polygon is 140°.

Work out the number of sides of the regular polygon.

.....

(Total for Question 6 is 3 marks)

6 The interior angle of a regular polygon is 160°.

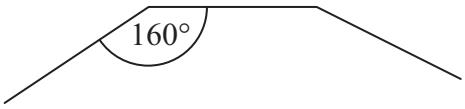


Diagram **NOT** accurately drawn.

(i) Write down the size of an exterior angle of the polygon.

.....°

(ii) Work out the number of sides of the polygon.

.....

(Total for Question 6 is 3 marks)

3.

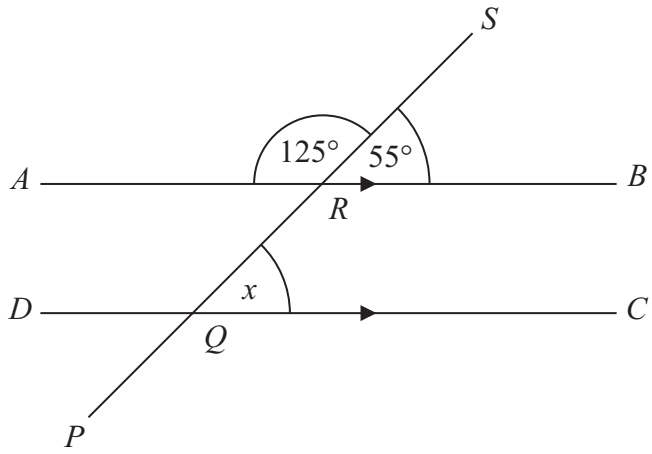


Diagram **NOT** accurately drawn

ARB is parallel to *DQC*.

PQRS is a straight line.

Angle *SRB* = 55°.

(i) Find the size of the angle marked *x*.

..... °

(ii) Give a reason for your answer.

.....

(Total 2 marks)

Q3

6. Each exterior angle of a regular polygon is 30°.

Work out the number of sides of the polygon.

.....

Q6

(Total 2 marks)

17.

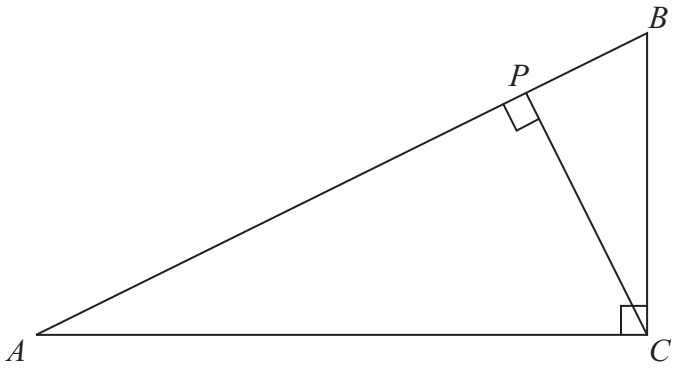


Diagram **NOT** accurately drawn

In the diagram,

ABC is a triangle,
angle *ACB* = 90°,
P lies on the line *AB*,
CP is perpendicular to *AB*.

Prove that the angles of triangle *APC* are the same as the angles of triangle *CPB*.

Q17

(Total 3 marks)

11

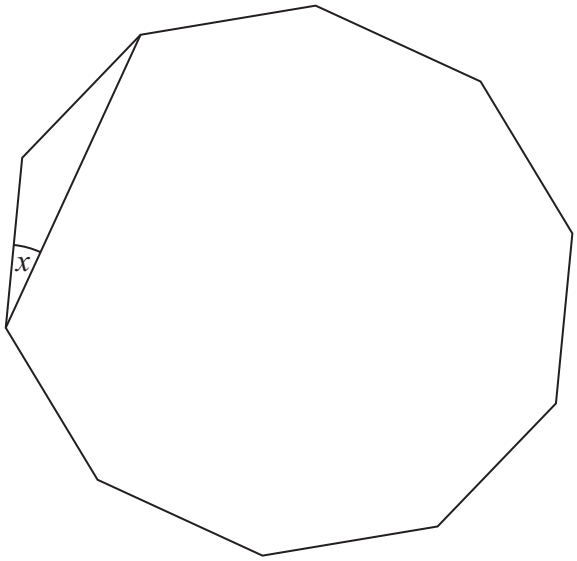


Diagram **NOT** accurately drawn

The diagram shows a regular decagon.

Work out the size of angle x.

.....°

(Total for Question 11 is 4 marks)

3.

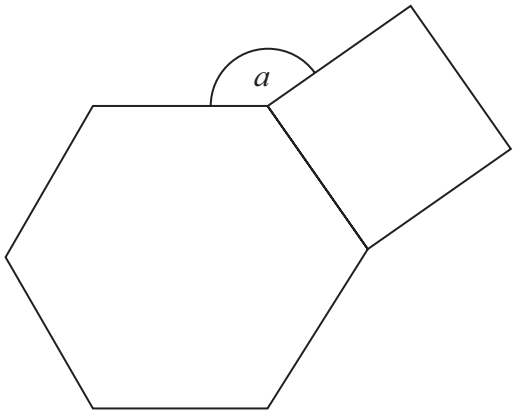


Diagram **NOT** accurately drawn

The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*.

..... °

(Total 4 marks)

Q3

10.

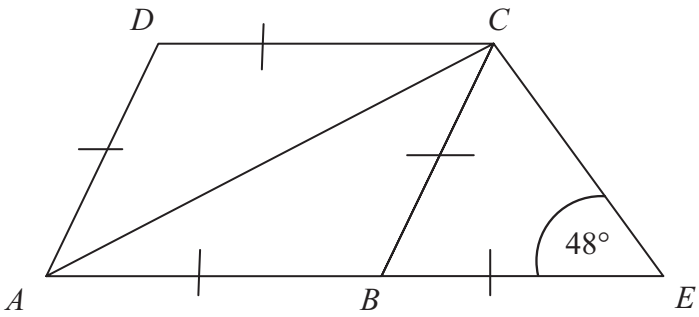


Diagram **NOT** accurately drawn

ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

Work out the size of angle *DCA*.

..... °

(Total 3 marks)

Q10

6.

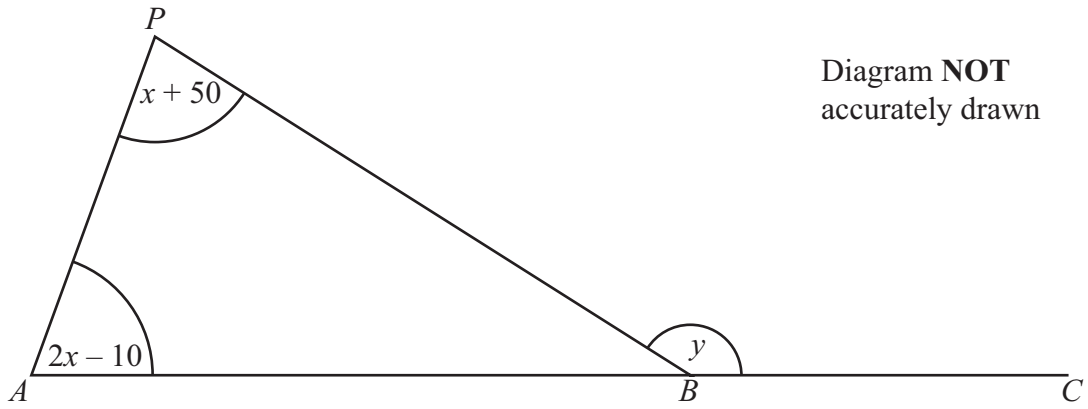


Diagram **NOT** accurately drawn

All angles are measured in degrees.

ABC is a straight line.
Angle *APB* = $x + 50$
Angle *PAB* = $2x - 10$
Angle *PBC* = y

(a) Show that $y = 3x + 40$
Give reasons for each stage of your working.

(3)

(b) Given that $y = 145$,

(i) work out the value of x,

$x =$ .....

(ii) work out the size of the largest angle in triangle *ABP*.

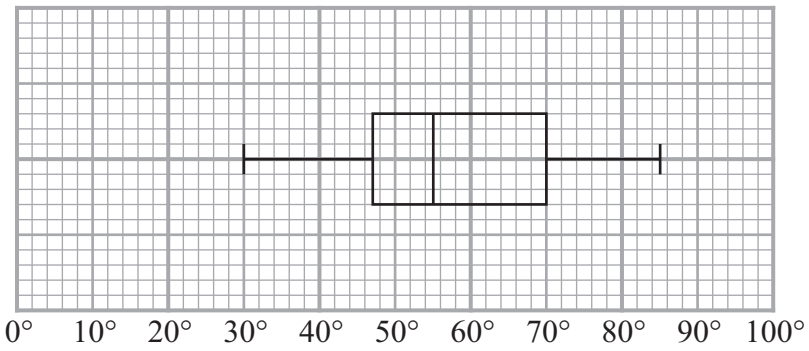
..... °

(4) **Q6**

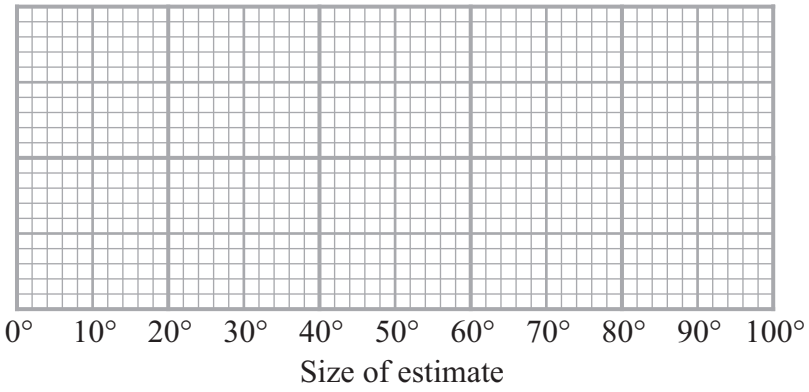
(Total 7 marks)

16. Barry drew an angle of 60°.
He asked some children to estimate the size of the angle he had drawn.
He recorded their estimates.
The box plot gives some information about these estimates.

Children's estimates



Adults' estimates



(a) Write down the median of the children's estimates.

..... °

(1)

(b) Find the interquartile range of the children's estimates.

..... °

(2)

blank

Barry then asked some adults to estimate the size of the angle he had drawn.
The table gives some information about the adults' estimates.

	Angle
Lowest estimate	20°
Lower quartile	45°
Median	62°
Upper quartile	75°
Highest estimate	95°

(c) On the grid opposite, draw a box plot to show this information.

(2)

(d) Use the two box plots, to compare the distribution of the children's estimates with the distribution of the adults' estimates.

.....

.....

.....

.....

(2)

(Total 7 marks)

Q16

***10**

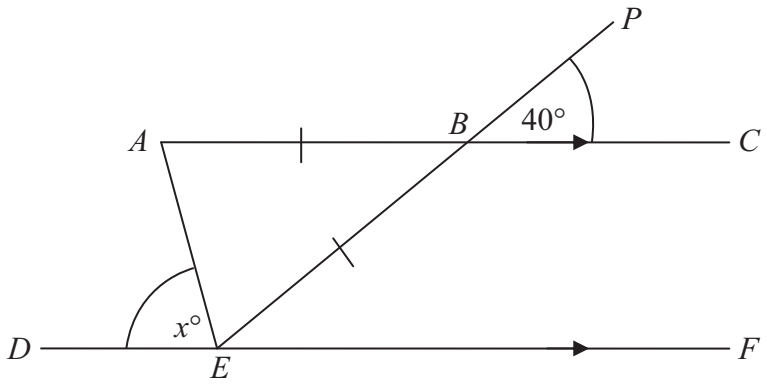


Diagram **NOT** accurately drawn

ABC is parallel to *DEF*.
EBP is a straight line.
AB = *EB*.
Angle *PBC* = 40°.
Angle *AED* = *x*°.

Work out the value of *x*.
Give a reason for each stage of your working.

(Total for Question 10 is 5 marks)

13

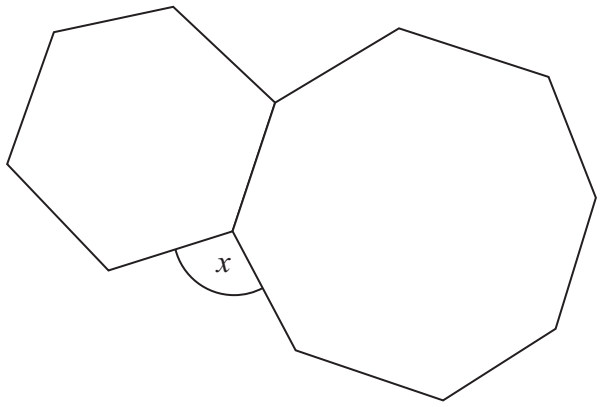


Diagram **NOT** accurately drawn

The diagram shows a regular hexagon and a regular octagon.

Calculate the size of the angle marked x.
You must show all your working.

.....°

(Total for Question 13 is 4 marks)

1

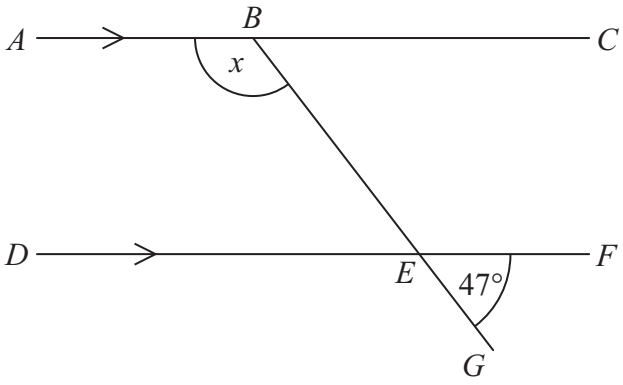


Diagram **NOT** accurately drawn

ABC and *DEF* are parallel lines.
BEG is a straight line.
Angle *GEF* = 47°.

Work out the size of the angle marked *x*.
Give reasons for your answer.

.....°

(Total for Question 1 is 3 marks)

***1**

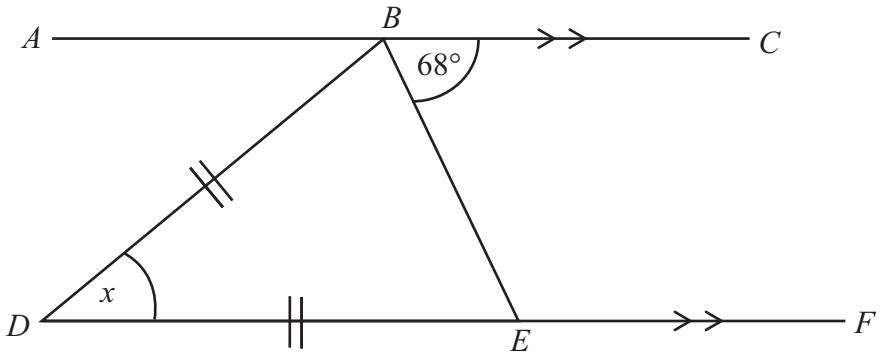


Diagram **NOT** accurately drawn

BDE is an isosceles triangle.
DB = *DE*.
The straight line *ABC* is parallel to the straight line *DEF*.

Work out the size of the angle marked *x*.
You must give reasons for each stage in your working.

(Total for Question 1 is 4 marks)

18 The diagram shows part of a pattern made from tiles.

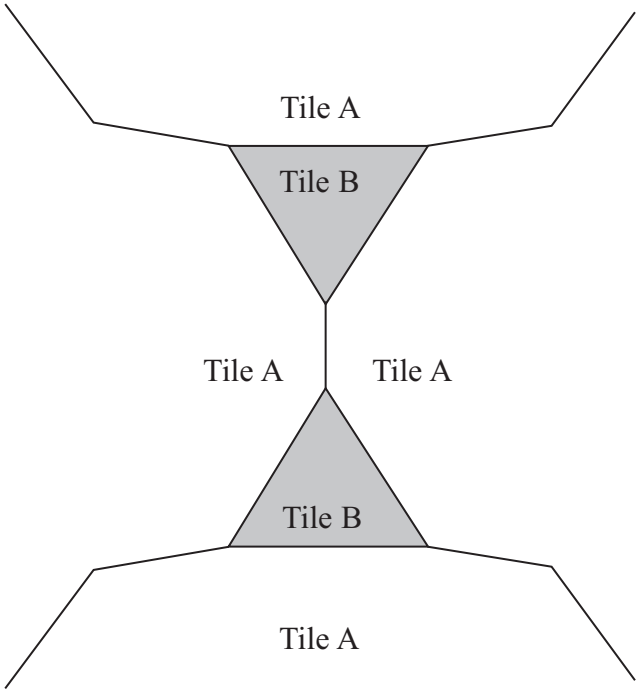


Diagram **NOT** accurately drawn

The pattern is made from two types of tiles, tile A and tile B.

Both tile A and tile B are regular polygons.

Work out the number of sides tile A has.

.....

(Total for Question 18 is 4 marks)

***6**

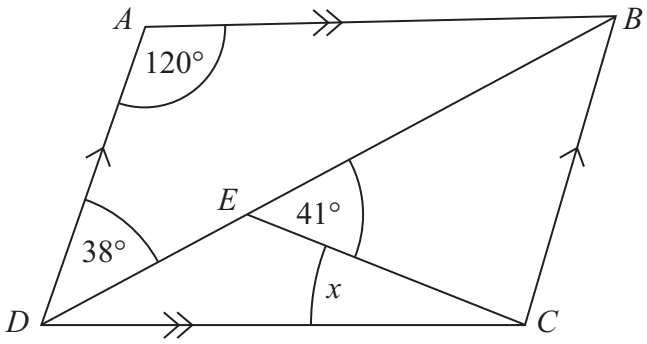


Diagram **NOT** accurately drawn

ABCD is a parallelogram.

Angle *ADB* = 38°.
Angle *BEC* = 41°.
Angle *DAB* = 120°.

Calculate the size of angle *x*.
You must give reasons for your answer.

(Total for Question 6 is 4 marks)

23 The diagram shows a pyramid.

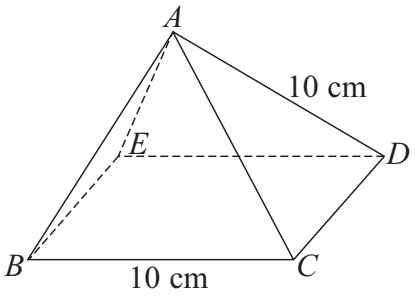


Diagram **NOT** accurately drawn

BCDE is a square with sides of length 10 cm.
The other faces of the pyramid are equilateral triangles with sides of length 10 cm.

(a) Calculate the volume of the pyramid.
Give your answer correct to 3 significant figures.

..... cm^3

(4)

(b) Find the size of angle *DAB*.

.....°

(2)

(Total for Question 23 is 6 marks)

9

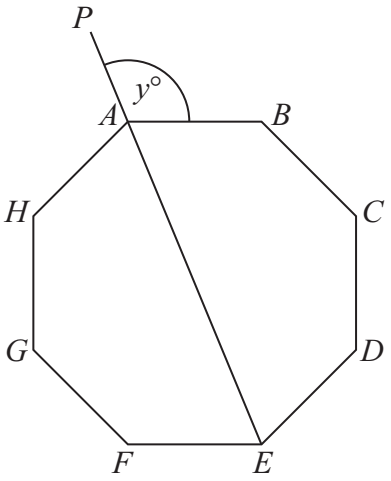


Diagram **NOT** accurately drawn

ABCDEFGH is a regular octagon.
PAE is a straight line.

Angle *PAB* = $y°$

Work out the value of y

$y =$ .....

(Total for Question 9 is 4 marks)

***10**

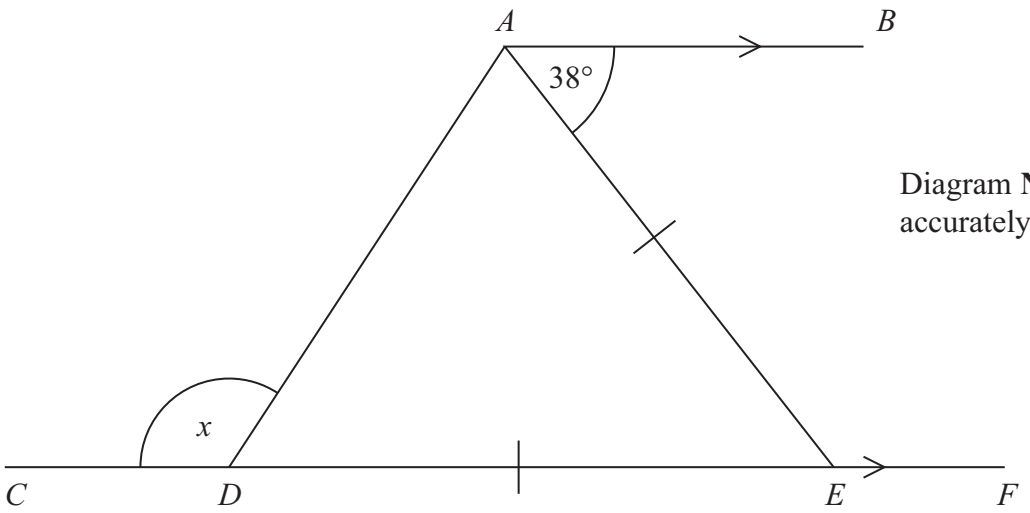


Diagram **NOT** accurately drawn

CDEF is a straight line.
AB is parallel to *CF*.
DE = *AE*.

Work out the size of the angle marked *x*.
You must give reasons for your answer.

(Total for Question 10 is 4 marks)

13

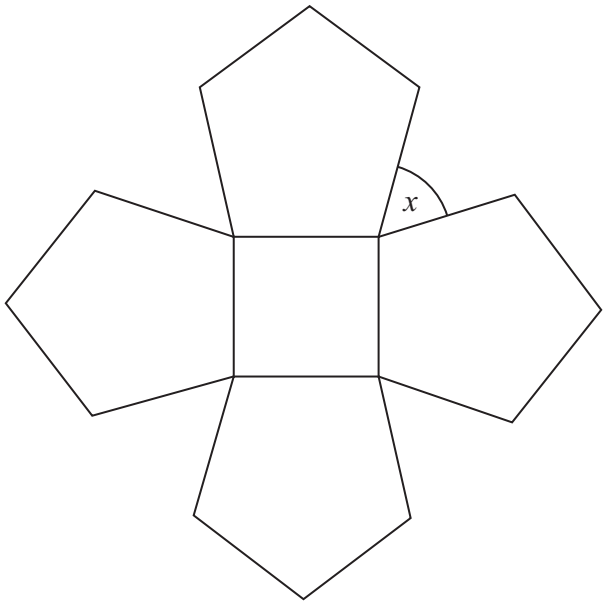


Diagram **NOT** accurately drawn

The diagram shows a square and 4 regular pentagons.

Work out the size of the angle marked x.

.....°

(Total for Question 13 is 3 marks)

8

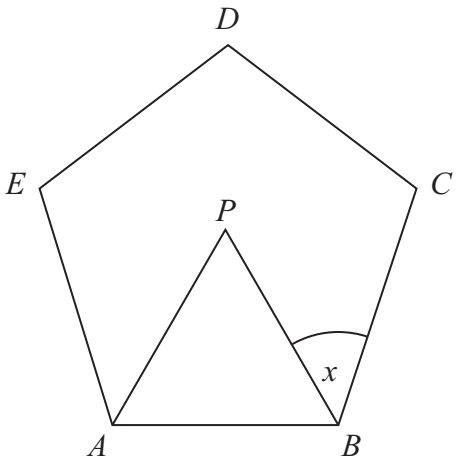


Diagram **NOT** accurately drawn

ABCDE is a regular pentagon.
ABP is an equilateral triangle.

Work out the size of angle x.

.....°

(Total for Question 8 is 4 marks)

9

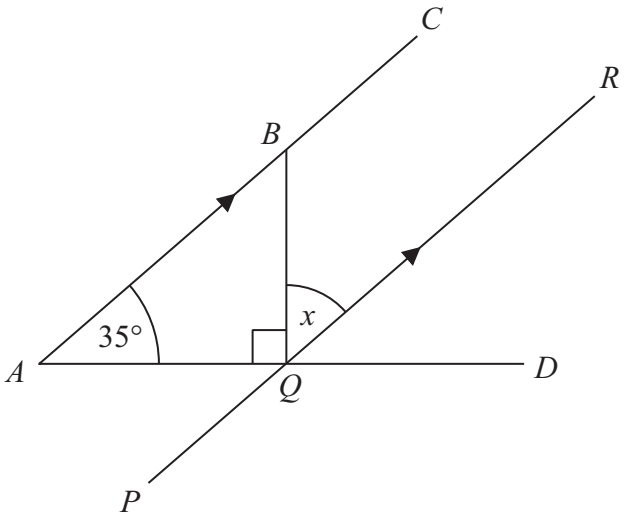


Diagram **NOT** accurately drawn

ABC, *PQR* and *AQD* are straight lines.
ABC is parallel to *PQR*.

Angle *BAQ* = 35°
Angle *BQA* = 90°

Work out the size of the angle marked *x*.
Give reasons for each stage of your working.

x = ... °

(Total for Question 9 is 4 marks)

10

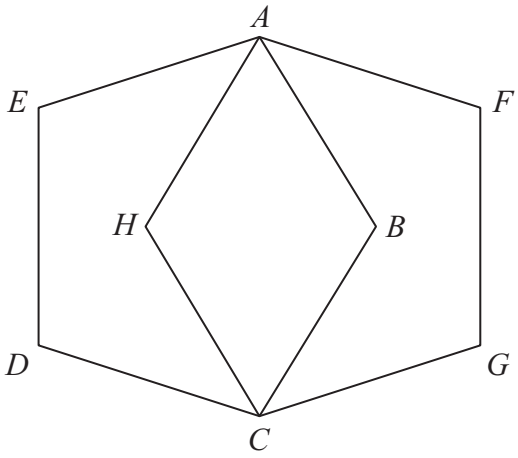


Diagram **NOT** accurately drawn

ABCDE and *AFGCH* are regular pentagons.
The two pentagons are the same size.

Work out the size of angle *EAH*.
You must show how you got your answer.

.....°

(Total for Question 10 is 4 marks)

8 ABC is a triangle.

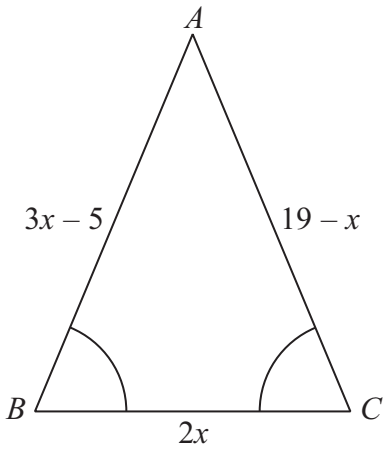


Diagram **NOT** accurately drawn

Angle ABC = angle BCA.

The length of side AB is $(3x - 5)$ cm.
The length of side AC is $(19 - x)$ cm.
The length of side BC is $2x$ cm.

Work out the perimeter of the triangle.
Give your answer as a number of centimetres.

..... cm

(Total for Question 8 is 5 marks)

9 The diagram shows a pattern using four identical rhombuses.

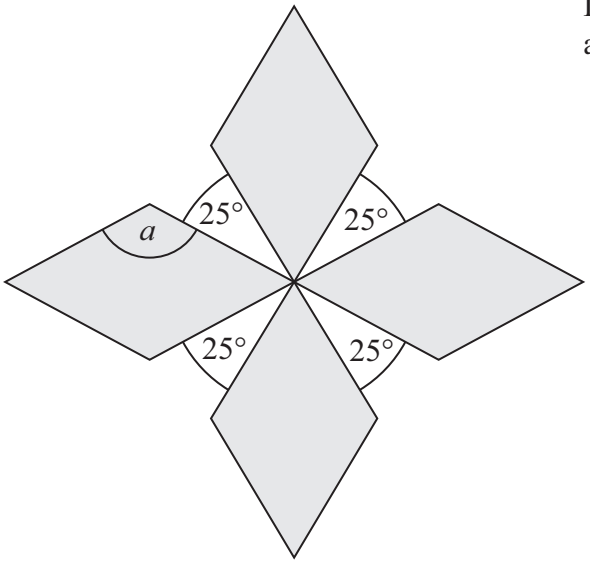


Diagram **NOT** accurately drawn

Work out the size of the angle marked a.
You must show your working.

.....°

(Total for Question 9 is 4 marks)

4

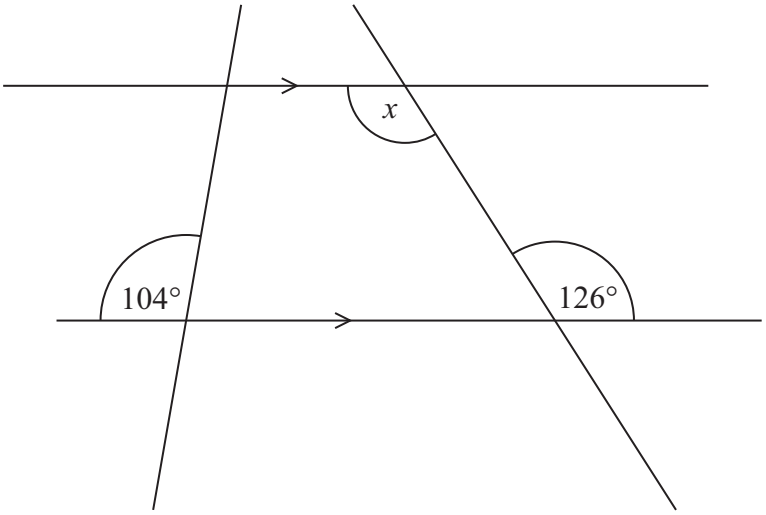


Diagram **NOT** accurately drawn

(i) Find the size of the angle marked x.

.....°

(ii) Give a reason for your answer.

.....

(Total for Question 4 is 2 marks)

10

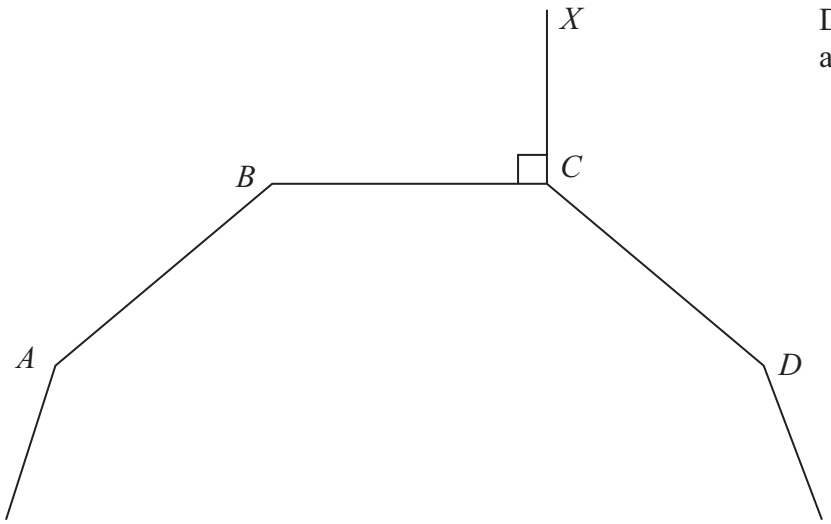


Diagram **NOT** accurately drawn

A, B, C and D are four vertices of a regular 10-sided polygon.
Angle $BCX = 90°$.

Work out the size of angle DCX.

.....°

(Total for Question 10 is 3 marks)

11

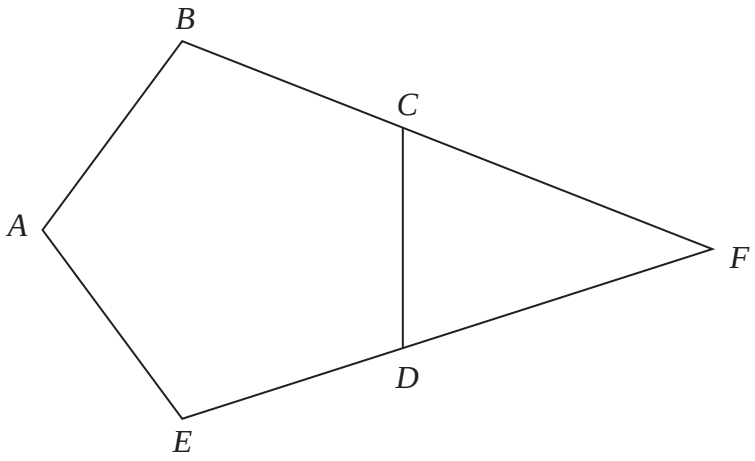


Diagram **NOT** accurately drawn

ABCDE is a regular pentagon.
BCF and *EDF* are straight lines.

Work out the size of angle *CFD*.
You must show how you got your answer.

.....°

(Total for Question 11 is 3 marks)

***7**

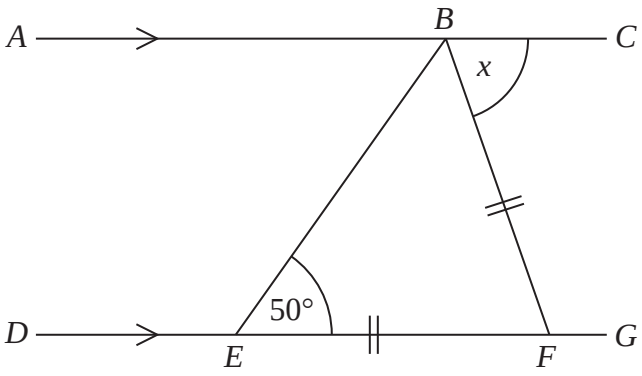


Diagram **NOT** accurately drawn

ABC is a straight line.
DEFG is a straight line.
AC is parallel to *DG*.
EF = *BF*.
Angle *BEF* = 50°.

Work out the size of the angle marked *x*.
Give reasons for your answer.

.....°

(Total for Question 7 is 4 marks)

***8**

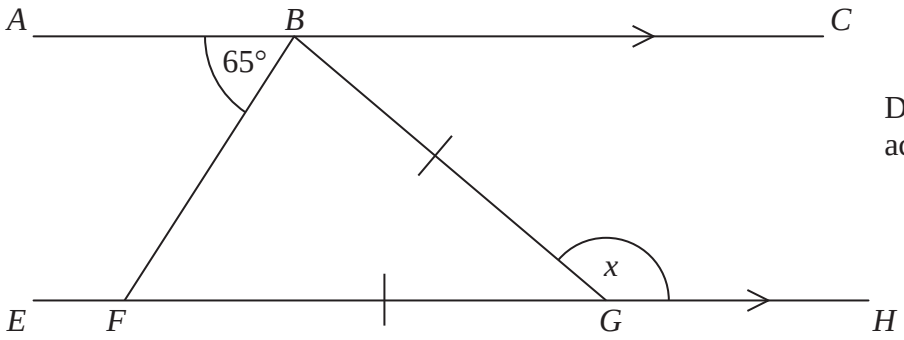


Diagram **NOT** accurately drawn

ABC is parallel to *EFGH*.

GB = *GF*
Angle *ABF* = 65°

Work out the size of the angle marked *x*.
Give reasons for your answer.

(Total for Question 8 is 4 marks)

17

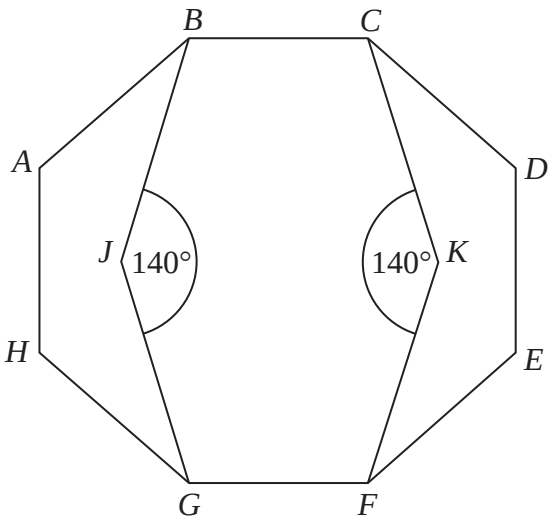


Diagram **NOT** accurately drawn

ABCDEFGH is a regular octagon.
BCKFGJ is a hexagon.

JK is a line of symmetry of the hexagon.
Angle *BJG* = angle *CKF* = 140°

Work out the size of angle *KFE*.
You must show all your working.

.....°

(Total for Question 17 is 4 marks)

21 The diagram shows a regular hexagon *OABCDE*.

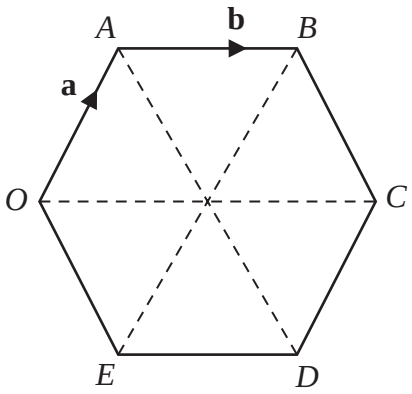


Diagram **NOT** accurately drawn

$\overrightarrow{OA} = \mathbf{a}$

$\overrightarrow{AB} = \mathbf{b}$

M is the midpoint of *OE*.
N is the midpoint of *AB*.

(a) Find $\overrightarrow{MN}$ in terms of **a** and/or **b**.

$\overrightarrow{MN}$ = ...

(3)

(b) Describe fully what your answer to part (a) shows about the lines *OA* and *MN*.

.....

.....

(2)

(Total for Question 21 is 5 marks)

***12**

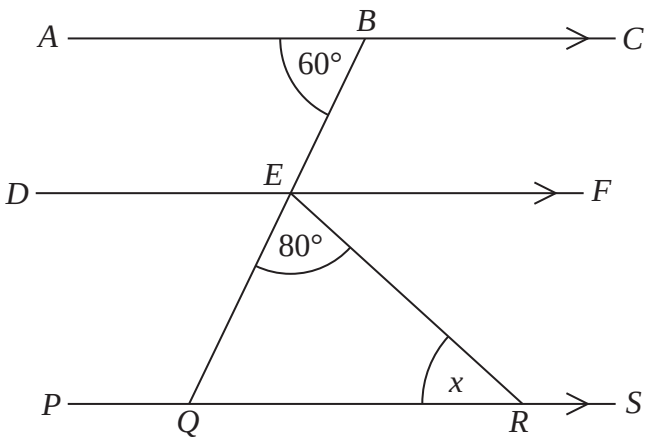


Diagram **NOT** accurately drawn

ABC, *DEF* and *PQRS* are parallel lines.
BEQ is a straight line.

Angle *ABE* = 60°
Angle *QER* = 80°

Work out the size of the angle marked *x*.
Give reasons for each stage of your working.

(Total for Question 12 is 4 marks)

17

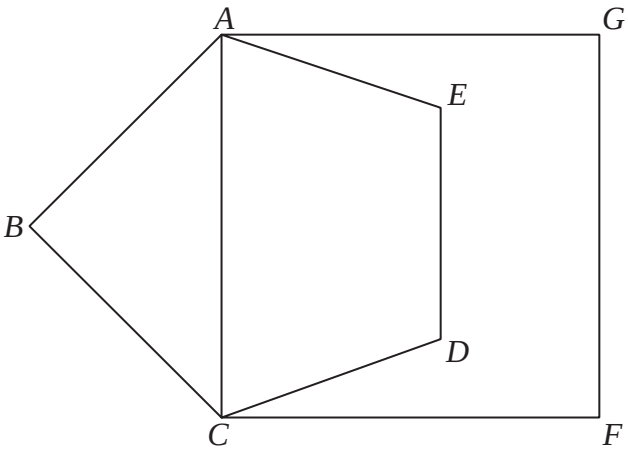


Diagram **NOT** accurately drawn

ABCDE is a regular pentagon.
ACFG is a square.

Work out the size of angle *DCF*.
You must show all your working.

.....°

(Total for Question 17 is 4 marks)

***10**

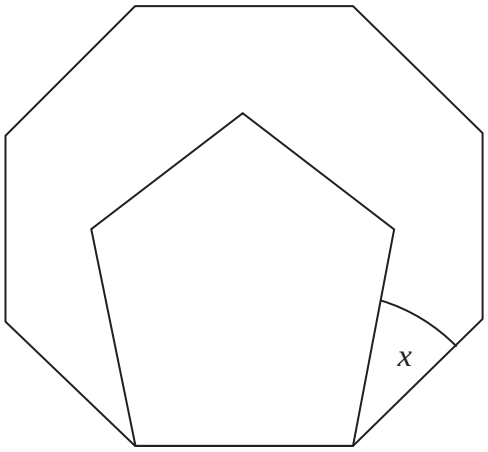


Diagram **NOT** accurately drawn

The diagram shows two regular polygons.

Find the size of the angle marked x.
Give reasons for your answer.

(Total for Question 10 is 4 marks)

17 The diagram shows a regular pentagon *ABCDE*.

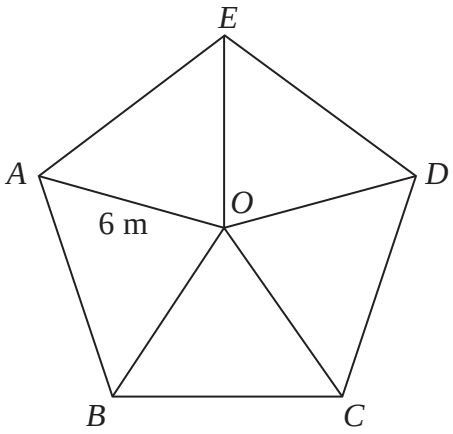


Diagram **NOT** accurately drawn

The pentagon is divided into 5 isosceles triangles.
$OA = OB = OC = OD = OE = 6$ m

Work out the area of the pentagon.
Give your answer correct to 1 decimal place.

..... m^2

(Total for Question 17 is 4 marks)

***6**

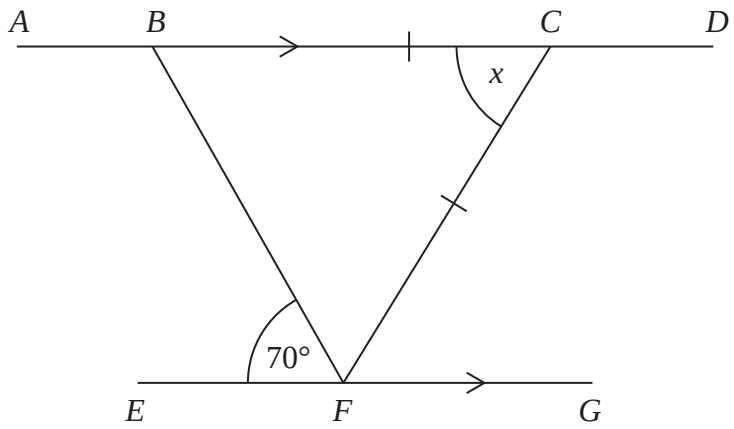


Diagram **NOT** accurately drawn

ABCD and *EFG* are parallel lines.
BC = *CF*
Angle *BFE* = 70°

Work out the size of the angle marked *x*.
Give reasons for each stage of your working.

(Total for Question 6 is 4 marks)

14

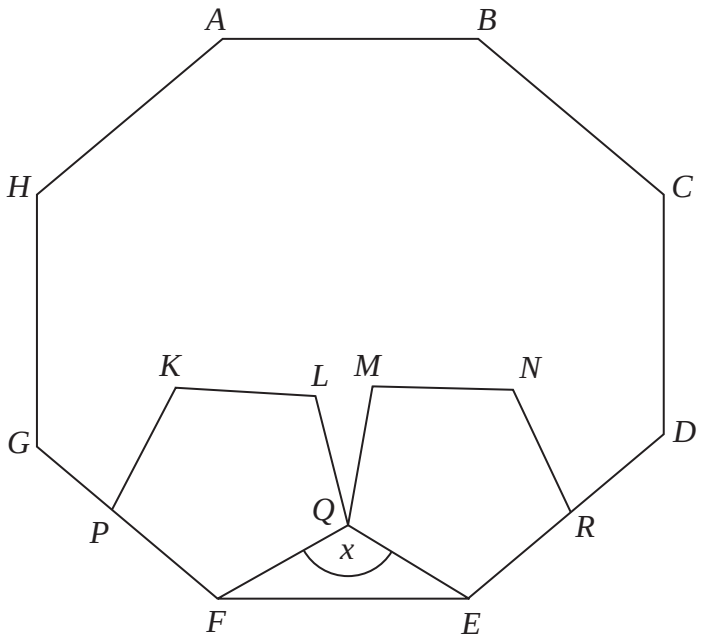


Diagram **NOT** accurately drawn

ABCDEFGH is a regular octagon.
KLQFP and *MNREQ* are two identical regular pentagons.

Work out the size of the angle marked *x*.
You must show all your working.

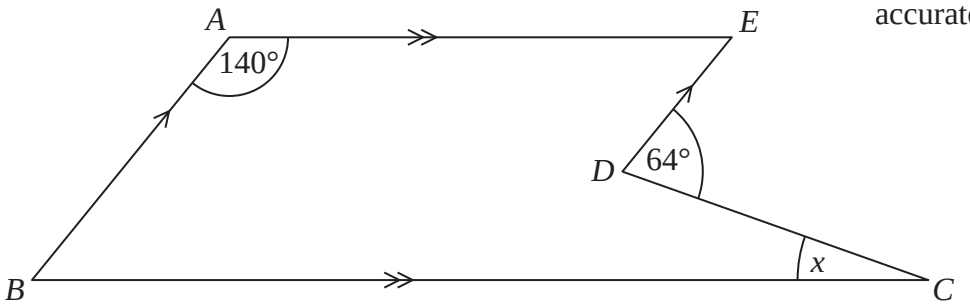
°

.....

(Total for Question 14 is 4 marks)

***9** The diagram shows a pentagon *ABCDE*.

Diagram **NOT** accurately drawn



AE is parallel to *BC*.
BA is parallel to *DE*.

Angle *EDC* = 64°
Angle *BAE* = 140°

Work out the size of the angle marked *x*.
You must give reasons for your answer.

(Total for Question 9 is 4 marks)

***9**

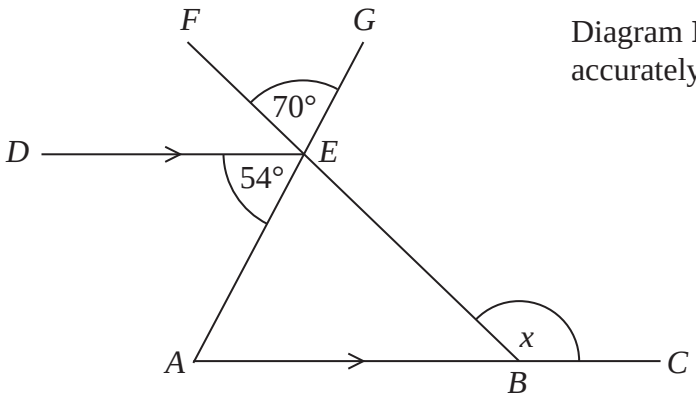


Diagram **NOT** accurately drawn

ABC and *DE* are parallel lines.
AEG and *BEF* are straight lines.

Angle *AED* = 54°
Angle *FEG* = 70°

Work out the size of the angle marked *x*.
Give a reason for each stage of your working.

(Total for Question 9 is 4 marks)

12

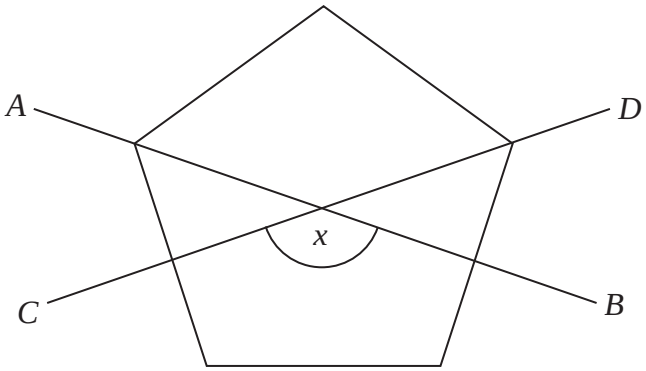


Diagram **NOT** accurately drawn

The diagram shows a regular pentagon.
AB and *CD* are two of the lines of symmetry of the pentagon.

Work out the size of the angle marked *x*.
You must show all your working.

.....°

(Total for Question 12 is 4 marks)

8

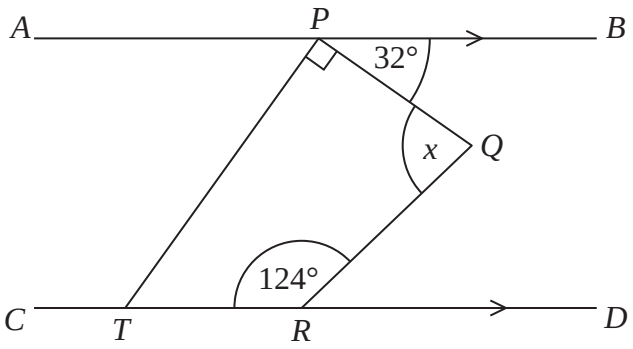


Diagram **NOT** accurately drawn

APB is parallel to *CTRD*.
PQRT is a quadrilateral.

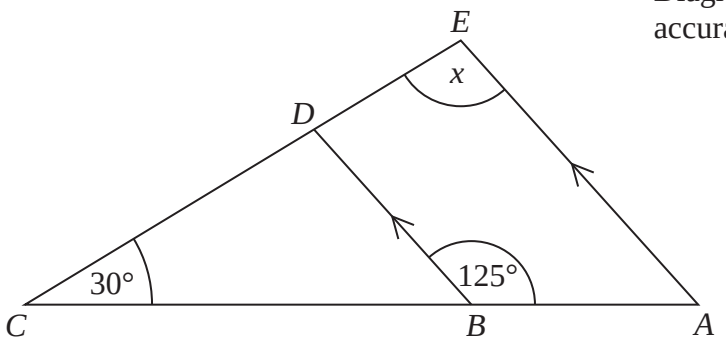
Work out the size of the angle marked *x*.
You must show your working.

.....°

(Total for Question 8 is 4 marks)

***9**

Diagram **NOT** accurately drawn



ABC and *EDC* are straight lines.
AE and *BD* are parallel.
Angle *ABD* = 125°
Angle *BCD* = 30°

Work out the size of the angle marked *x*.
Give reasons for your answer.

(Total for Question 9 is 4 marks)

14 *ABCDE* and *PQRST* are regular pentagons.

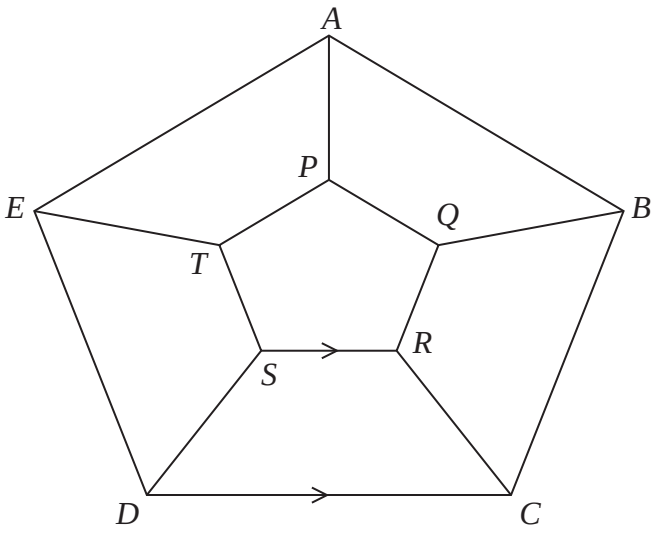


Diagram **NOT** accurately drawn

SR is parallel to *DC*
AP = *BQ* = *CR* = *DS* = *ET*

Work out the size of angle *SRC*.
You must show all your working.

.....°

(Total for Question 14 is 3 marks)

***5**

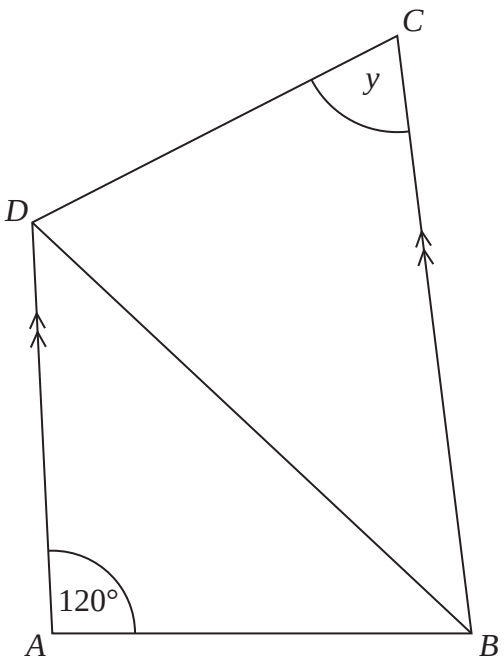


Diagram **NOT** accurately drawn

BCD and *ABD* are isosceles triangles.
AB = *AD*
BC = *BD*

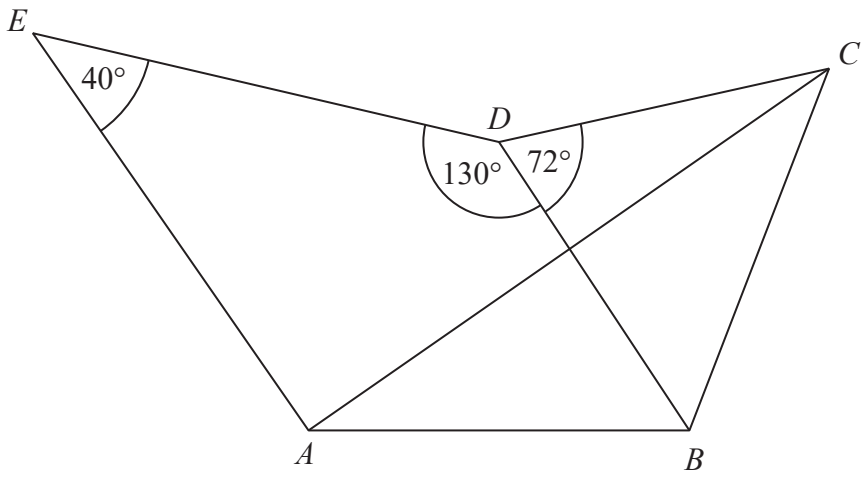
AD is parallel to *BC*.

Work out the size of angle *y*.
You must give reasons for your answer.

(Total for Question 5 is 4 marks)

5 Here is a pentagon $ABCDE$.

Diagram **NOT** accurately drawn



$AB = BC = BD$
$ABDE$ is a kite.

Angle $AED = 40°$
Angle $EDB = 130°$
Angle $BDC = 72°$

Work out the size of angle ACB.

.....°

(Total for Question 5 is 3 marks)

***5**

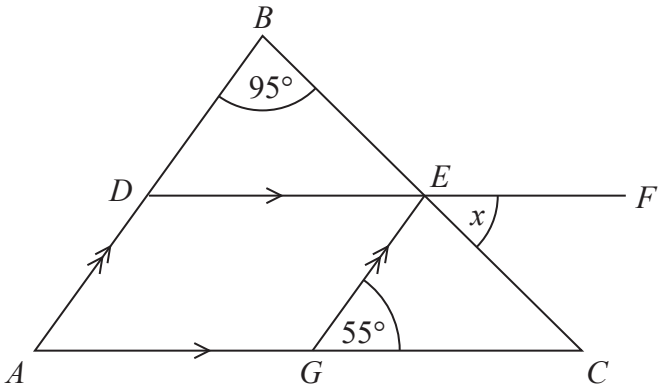


Diagram **NOT** accurately drawn

AGC and *DEF* are parallel lines.
ADB and *GE* are parallel lines.
*BE*C is a straight line.

Angle *DBE* = 95°
Angle *CGE* = 55°

Work out the size of the angle marked *x*.
Give reasons for each stage of your working.

(Total for Question 5 is 4 marks)

15 *ABCDEFGHI* is a regular 9-sided polygon.

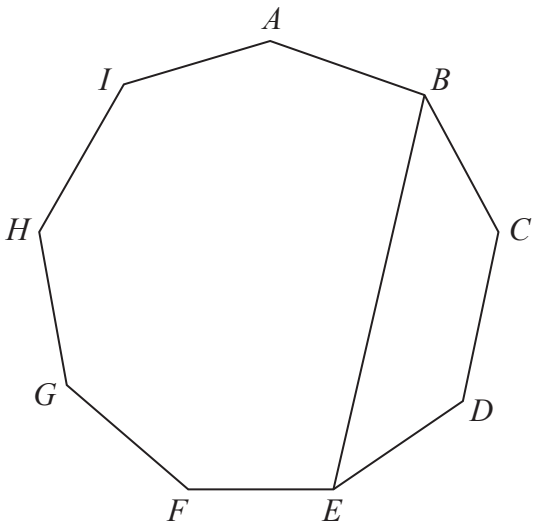


Diagram **NOT** accurately drawn

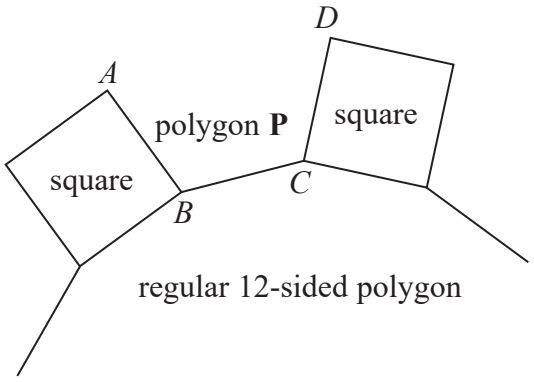
The vertices *B* and *E* are joined with a straight line.

Work out the size of angle *BEF*.
You must show how you get your answer.

.....°

(Total for Question 15 is 4 marks)

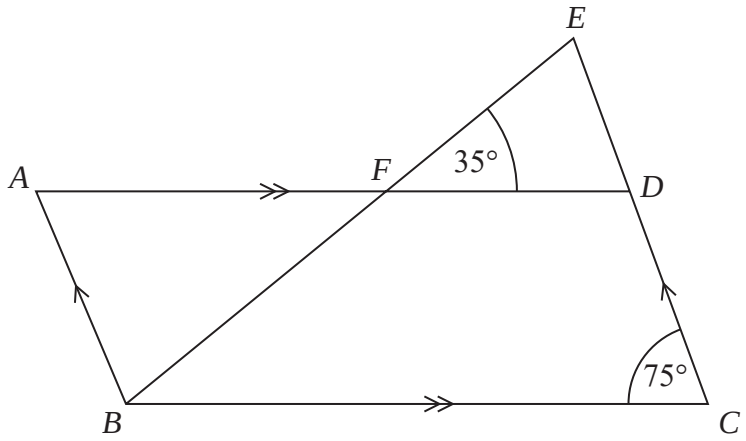
5 In the diagram, AB, BC and CD are three sides of a regular polygon **P**.



Show that polygon **P** is a hexagon.
You must show your working.

(Total for Question 5 is 4 marks)

3



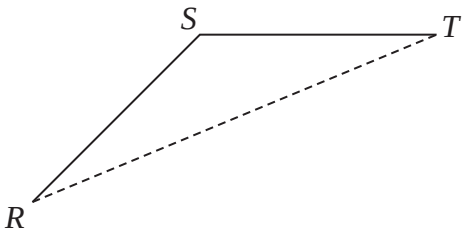
ABCD is a parallelogram.
EDC is a straight line.
F is the point on *AD* so that *BFE* is a straight line.

Angle *EFD* = 35°
Angle *DCB* = 75°

Show that angle *ABF* = 70°
Give a reason for each stage of your working.

(Total for Question 3 is 4 marks)

12



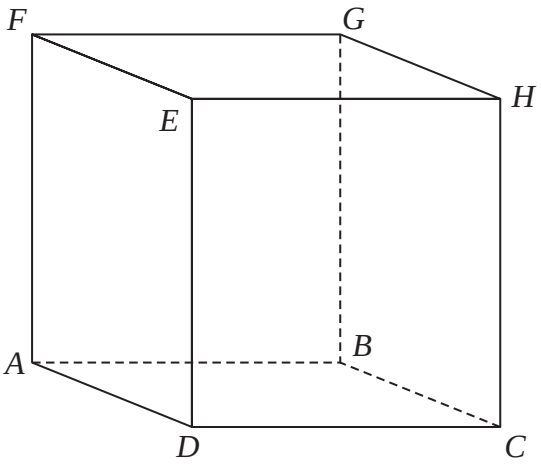
RS and *ST* are 2 sides of a regular 12-sided polygon.
RT is a diagonal of the polygon.

Work out the size of angle *STR*.
You must show your working.

.....°

(Total for Question 12 is 3 marks)

18 *ABCDEFGH* is a cuboid.



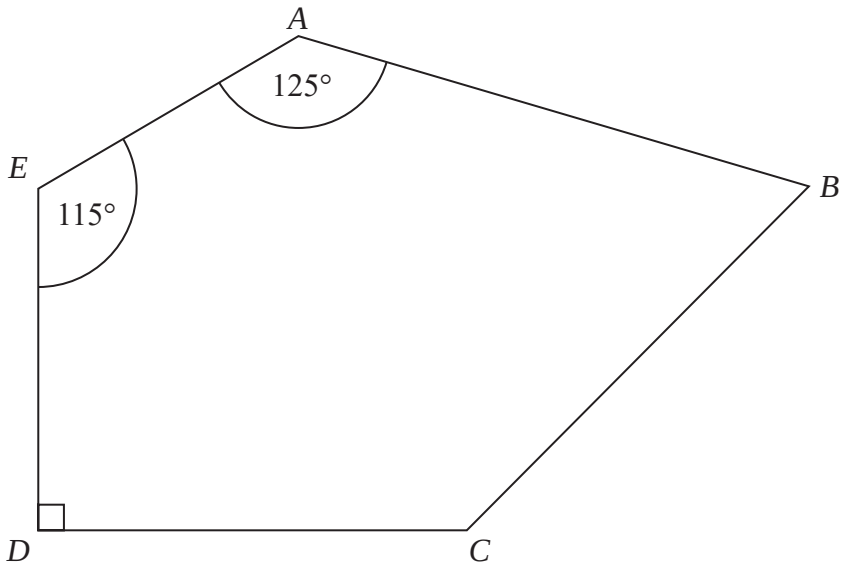
$AB = 7.3$ cm
$CH = 8.1$ cm
Angle $BCA = 48°$

Find the size of the angle between AH and the plane $ABCD$.
Give your answer correct to 1 decimal place.

.....°

(Total for Question 18 is 4 marks)

8 *ABCDE* is a pentagon.



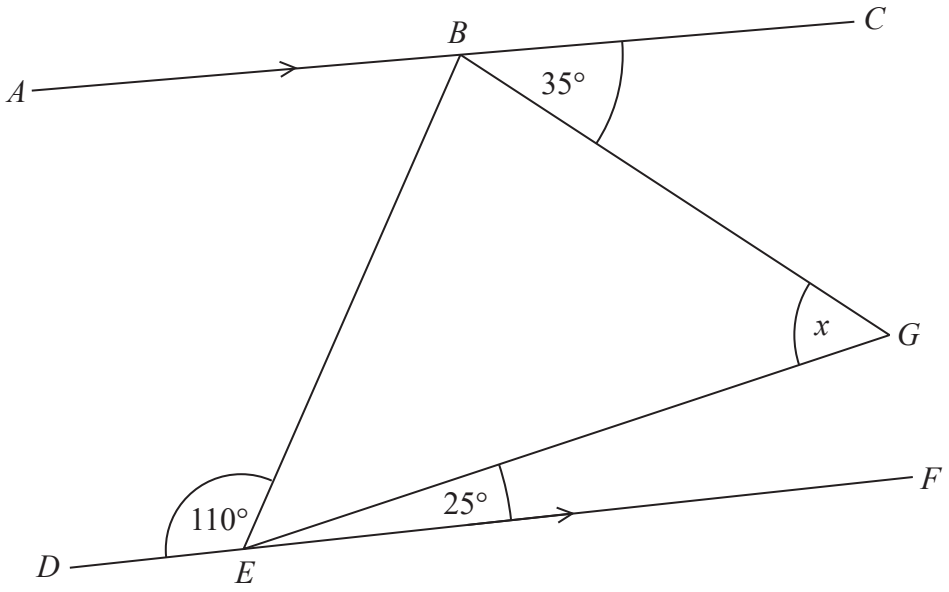
Angle *BCD* = 2 × angle *ABC*

Work out the size of angle *BCD*.
You must show all your working.

.....°

(Total for Question 8 is 5 marks)

3 *BEG* is a triangle.



ABC and *DEF* are parallel lines.

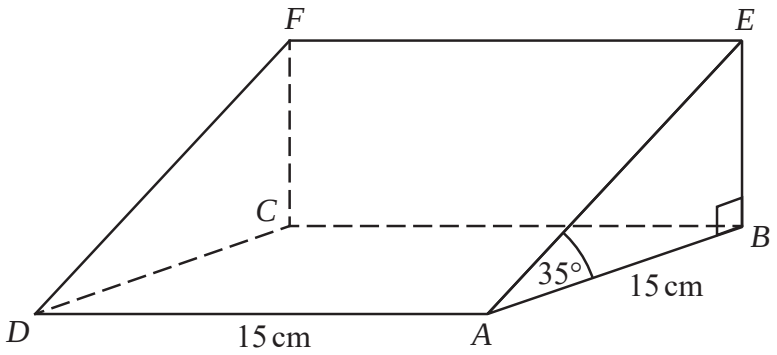
Work out the size of angle *x*.
Give a reason for each stage of your working.

.....°

.....

(Total for Question 3 is 4 marks)

19 The diagram shows a triangular prism.



The base, *ABCD*, of the prism is a square of side length 15 cm.
Angle *ABE* and angle *CBE* are right angles.
Angle *EAB* = 35°

M is the point on *DA* such that

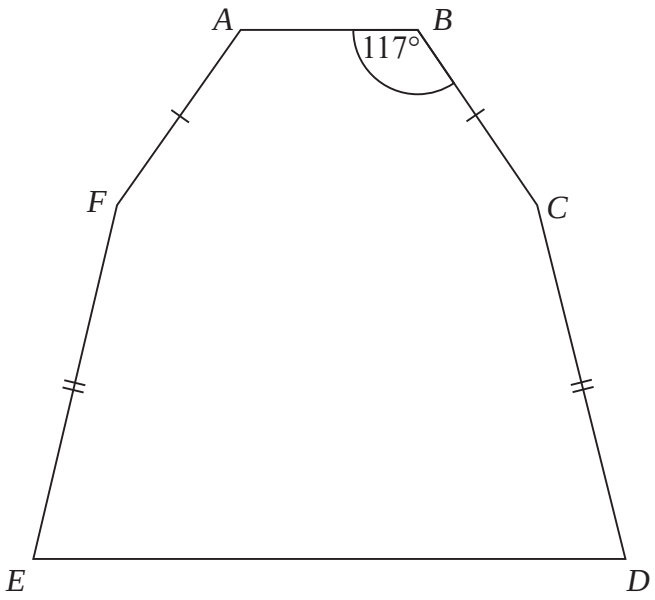
$$DM : MA = 2 : 3$$

Calculate the size of the angle between *EM* and the base of the prism.
Give your answer correct to 1 decimal place.

.....°

(Total for Question 19 is 4 marks)

5 The diagram shows a hexagon.
The hexagon has one line of symmetry.



$FA = BC$
$EF = CD$
Angle $ABC = 117°$

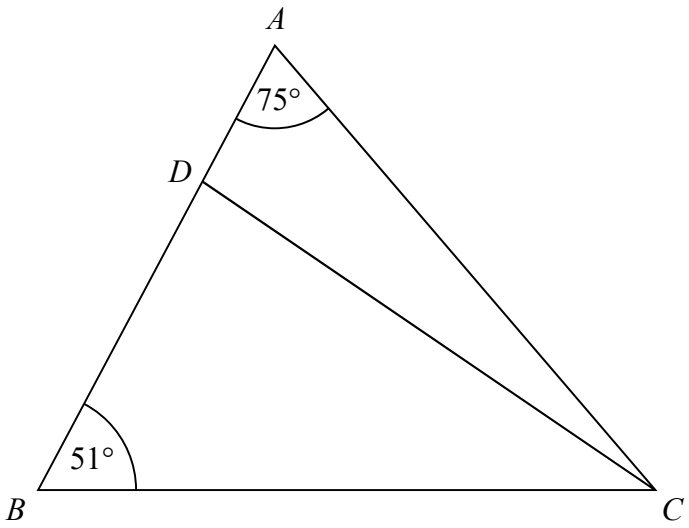
Angle $BCD = 2 \times$ angle CDE

Work out the size of angle AFE.
You must show all your working.

.....°

(Total for Question 5 is 4 marks)

5 The diagram shows triangle ABC.



ADB is a straight line.

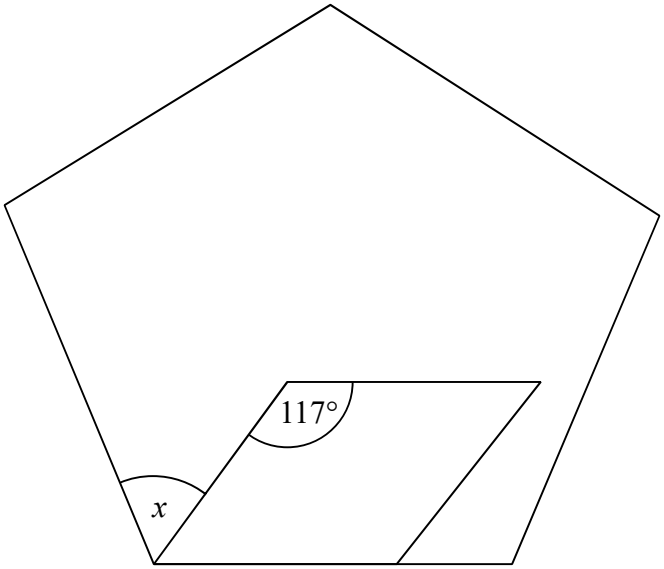
the size of angle DCB : the size of angle ACD = 2 : 1

Work out the size of angle BDC.

.....°

(Total for Question 5 is 4 marks)

8 The diagram shows a regular pentagon and a parallelogram.

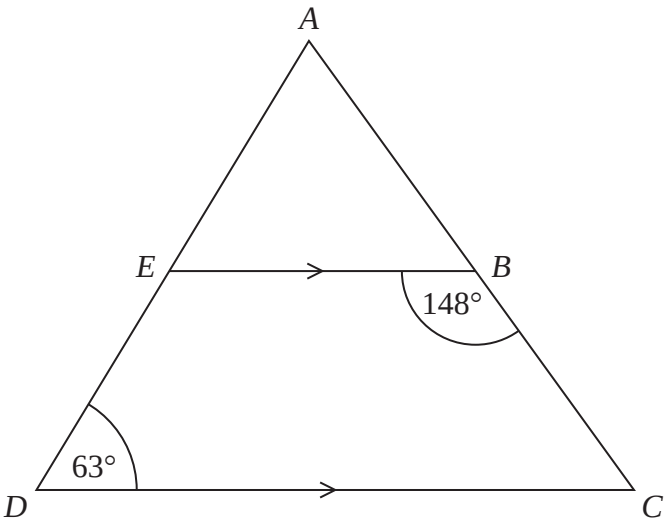


Work out the size of the angle marked x.
You must show all your working.

.....°

(Total for Question 8 is 4 marks)

6 *ADC* is a triangle.



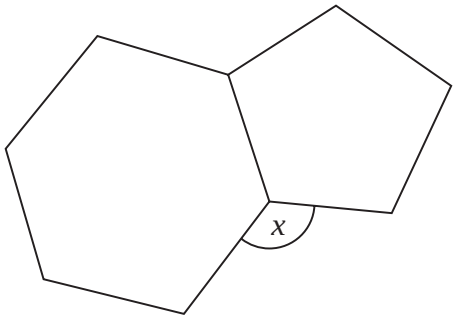
AED and *ABC* are straight lines.
EB is parallel to *DC*.

Angle *EBC* = 148°
Angle *ADC* = 63°

Work out the size of angle *EAB*.
You must give a reason for each stage of your working.

(Total for Question 6 is 5 marks)

5 Here is a regular hexagon and a regular pentagon.

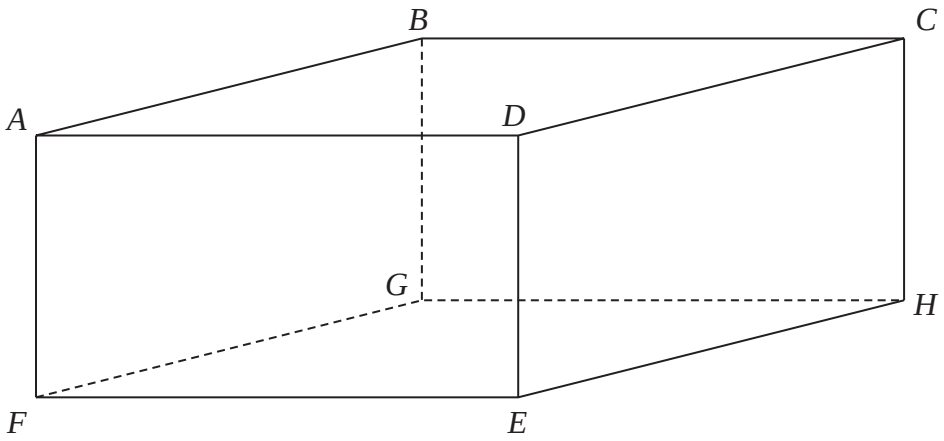


Work out the size of the angle marked x.
You must show all your working.

.....°

(Total for Question 5 is 3 marks)

20 *ABCDEFGH* is a cuboid.



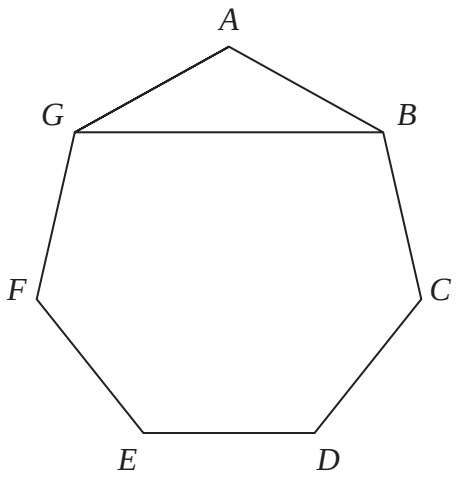
$AD = 9\,\text{cm}$
$FD = 13\,\text{cm}$
Angle $GHF = 49°$

Work out the size of angle FAH.
Give your answer correct to the nearest degree.

.....°

(Total for Question 20 is 4 marks)

26 *ABCDEFG* is a regular heptagon.



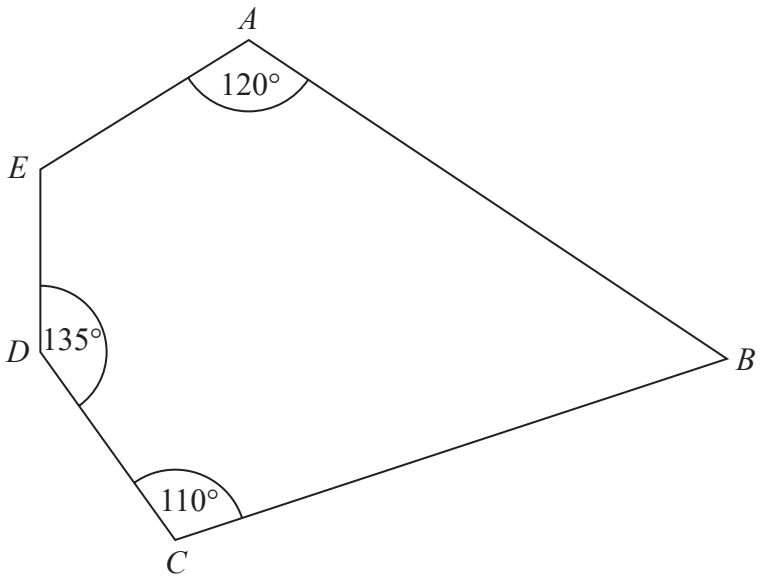
The area of triangle *ABG* is 30 cm^2

Calculate the length of *GB*.
Give your answer correct to 3 significant figures.
You must show all your working.

..... cm

(Total for Question 26 is 5 marks)

10 Here is a pentagon.



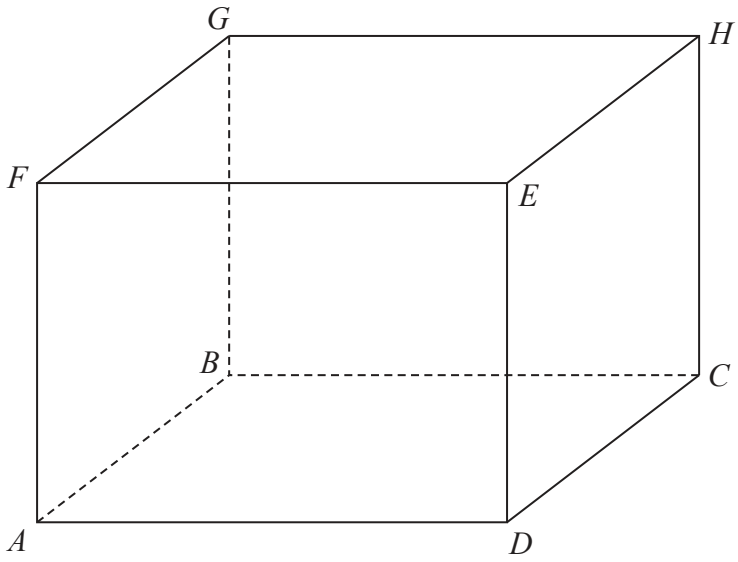
Angle $AED = 4 \times$ angle ABC

Work out the size of angle AED.
You must show all your working.

.....°

(Total for Question 10 is 4 marks)

22 *ABCDEFGH* is a cuboid.



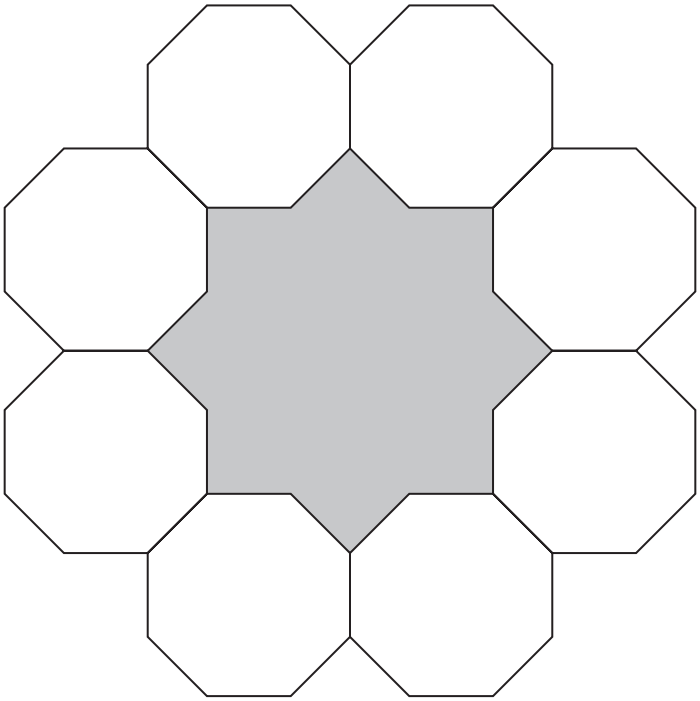
$AF = 6.8\,\text{cm}$
$FC = 13.6\,\text{cm}$

Work out the size of the angle between FC and the plane $ABCD$.

.....°

(Total for Question 22 is 2 marks)

24 The diagram shows 8 identical regular octagons joined to enclose a shaded shape.



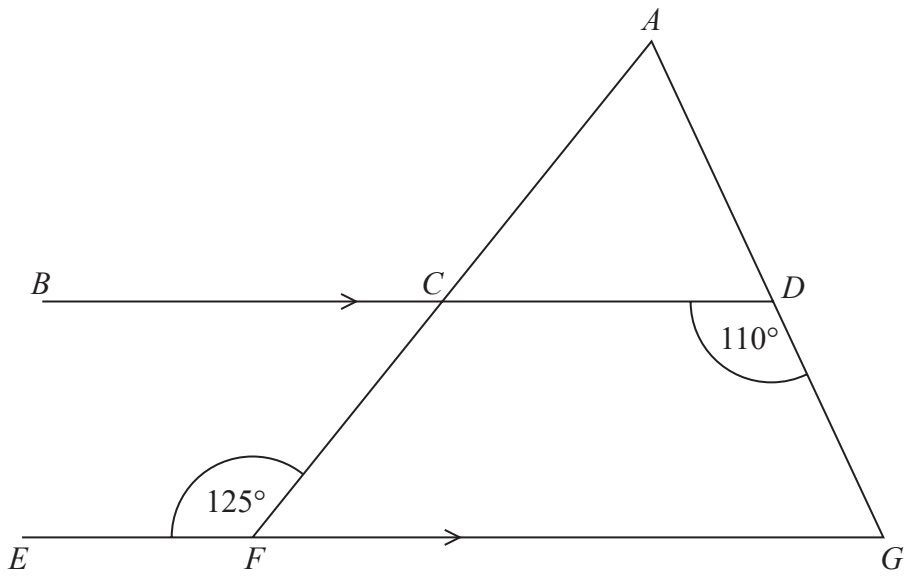
Each octagon has sides of length a.

Find, in terms of a, an expression for the area of the shaded shape.
Give your answer in the form $p\left(2+\sqrt{2}\right)a^2$ where p is an integer.
You must show all your working.

.....

(Total for Question 24 is 5 marks)

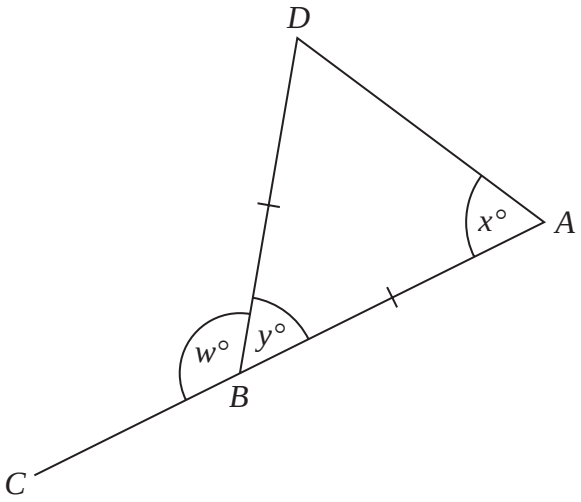
3 ACF and ADG are straight lines.
BCD and EFG are parallel lines.



Show that triangle ACD is isosceles.
Give a reason for each stage of your working.

(Total for Question 3 is 5 marks)

6 The diagram shows an isosceles triangle *ABD* and the straight line *ABC*.



$BA = BD$

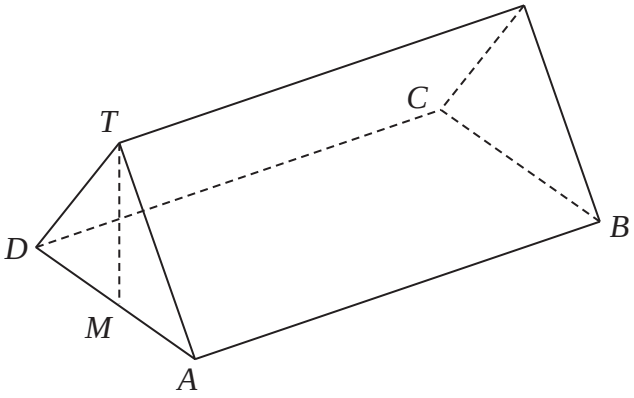
$x : y = 2 : 1$

Work out the value of w.

$w =$ .....

(Total for Question 6 is 4 marks)

24 The diagram shows a triangular prism with a horizontal rectangular base $ABCD$.



M is the midpoint of AD.
The vertex T of the prism is vertically above M.

$AB = 14.7\,\text{cm}$ $BC = 3.8\,\text{cm}$ $MT = 2.3\,\text{cm}$

P is the point on AB such that

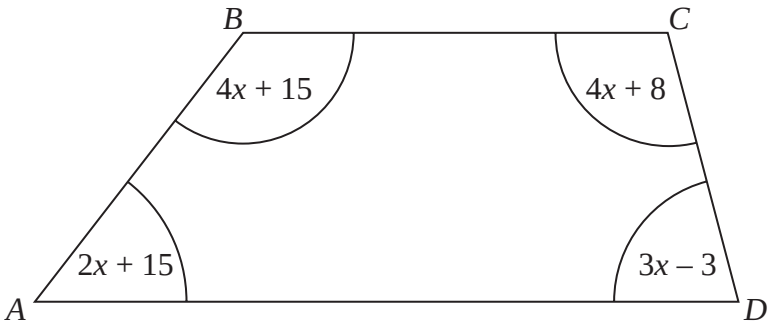
$$AP : PB = 5 : 2$$

Calculate the size of the angle between TP and the base $ABCD$ of the prism.
Give your answer correct to 1 decimal place.

.....°

(Total for Question 24 is 4 marks)

7 *ABCD* is a quadrilateral.

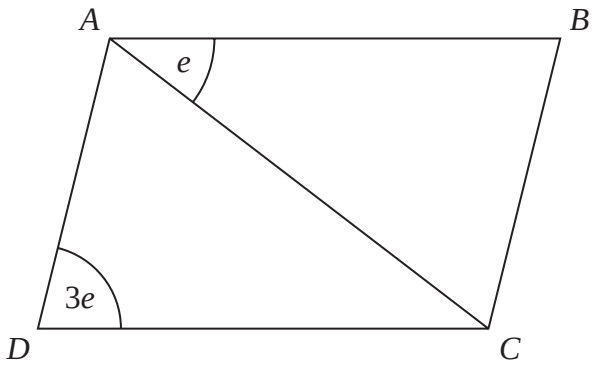


All angles are measured in degrees.

Show that *ABCD* is a trapezium.

(Total for Question 7 is 4 marks)

4 *ABCD* is a parallelogram.



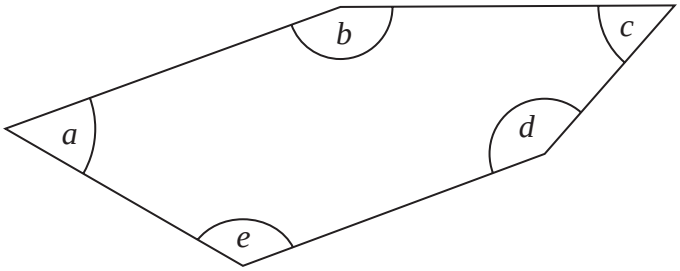
All angles are measured in degrees.

Find an expression, in terms of e, for the size of angle *CAD*.
Give a reason for each stage of your working.

.....

(Total for Question 4 is 3 marks)

6 Here is a pentagon.



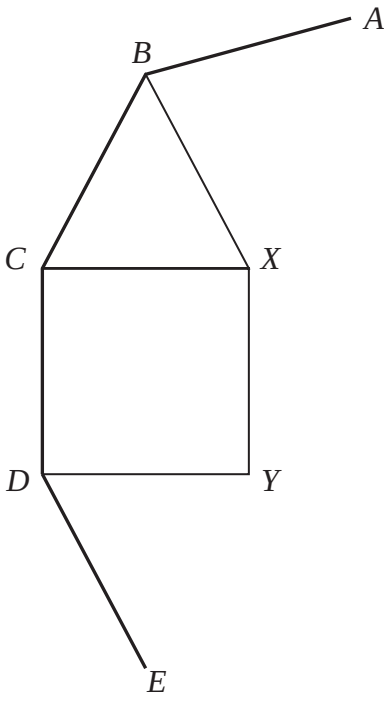
Angle a = angle c
Angle b = 155°
Angle d is three times the size of angle c
Angle e is two times the size of angle c

Work out the size of angle a

.....°

(Total for Question 6 is 4 marks)

6 *AB*, *BC*, *CD* and *DE* are four sides of a regular polygon with *n* sides.



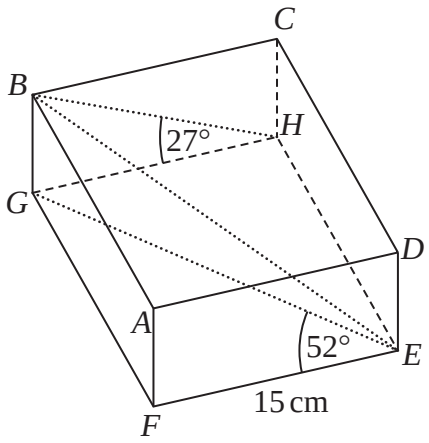
BCX is an equilateral triangle.
CDYX is a square.

Work out the value of *n*.
You must show all your working.

n = ...

(Total for Question 6 is 4 marks)

19 *ABCDEFGH* is a cuboid.



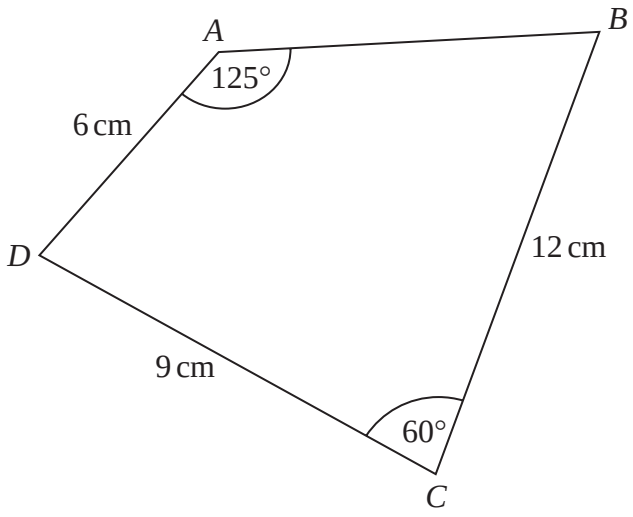
Angle *GEF* = 52°
Angle *BHG* = 27°
EF = 15 cm

Work out the size of angle *GEB*.
Give your answer to the nearest degree.

.....°

(Total for Question 19 is 4 marks)

23 *ABCD* is a quadrilateral.



Find the size of angle *ABC*.
Give your answer correct to the nearest degree.

.....°

(Total for Question 23 is 5 marks)