IGCSE CLASSIFIED PAST PAPERS

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Cambridge International Education CIE
Extended mathematics 0580

PAPER2

Part 2

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MATHS

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Paper 2 (2)

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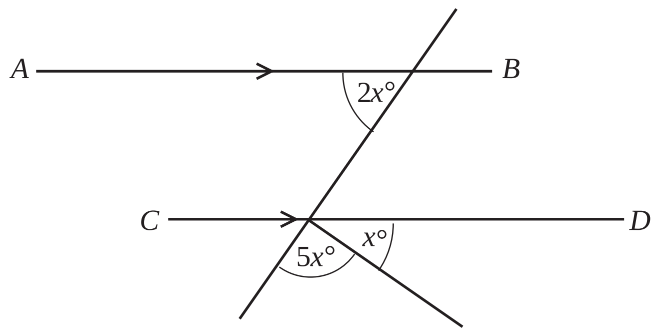
Angle Pairs

1) June 2011 V1

9



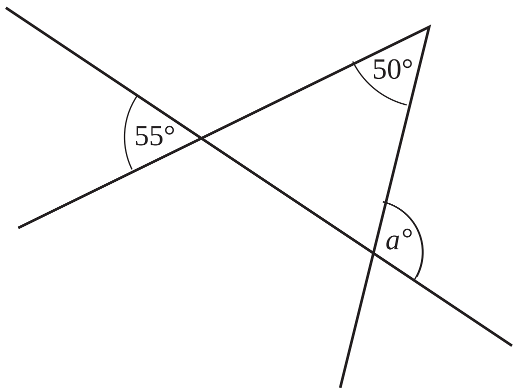
NOT TO SCALE

AB is parallel to *CD*.
Calculate the value of x

Answer x = ... [3]

2) June 2013 V1

4



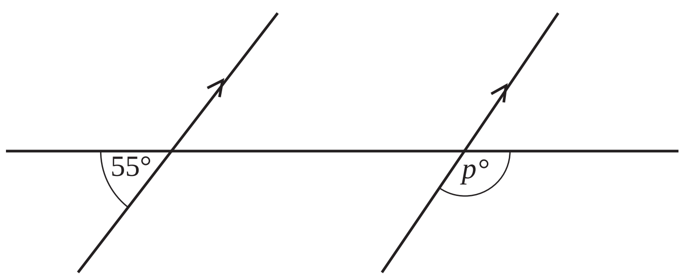
NOT TO SCALE

Use the information in the diagram to find the value of a.

Answer a = ... [2]

3) November 2013 V1

3



NOT TO SCALE

Find the value of p.

Answer p = ... [2]

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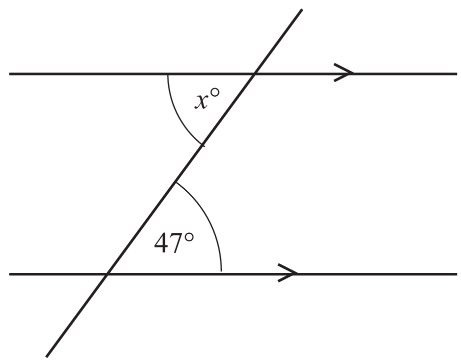
4) March 2016 V2

18 **(a)**



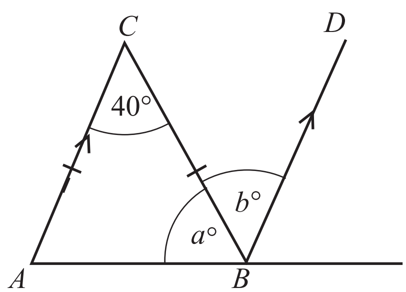
NOT TO SCALE

Find the value of x.

x = ... [1]

5) June 2016 V1

9



NOT TO SCALE

Triangle ABC is isosceles and AC is parallel to BD.

Find the value of a and the value of b.

a = ...

b = ... [2]

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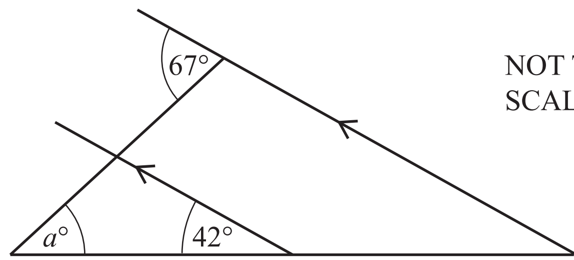
6) November 2016 V2

2



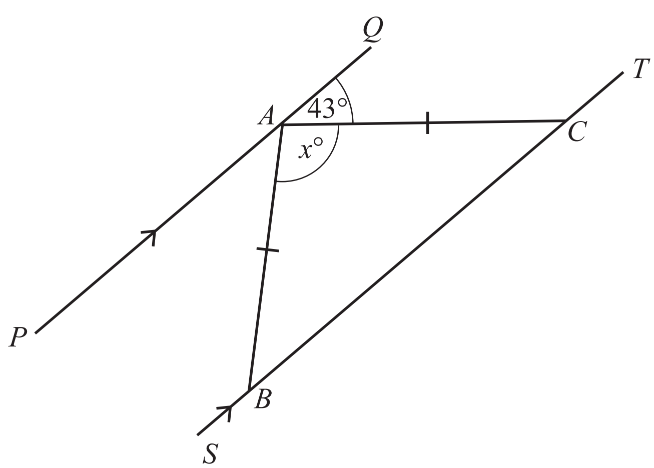
NOT TO SCALE

Find the value of *a*.

$a =$ .... [2]

7) June 2018 V1

5



NOT TO SCALE

The diagram shows two parallel lines *PAQ* and *SBCT*.
$AB = AC$ and angle $QAC = 43°$.

Find the value of *x*.

$x =$ .... [2]

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Polygons

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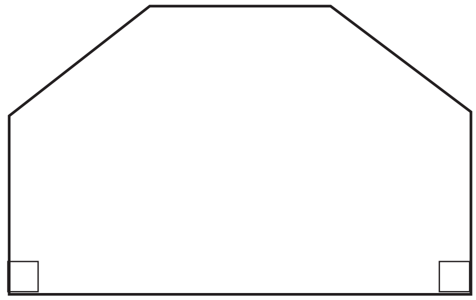
1) November 2011 V1

6



NOT TO
SCALE

The front of a house is in the shape of a hexagon with two right angles.
The other four angles are all the same size.

Calculate the size of one of these angles.

Answer .... [3]

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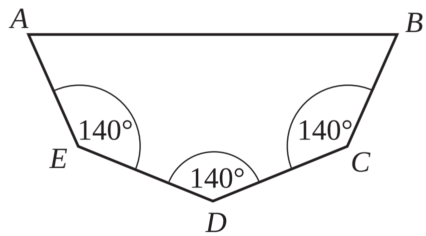
10



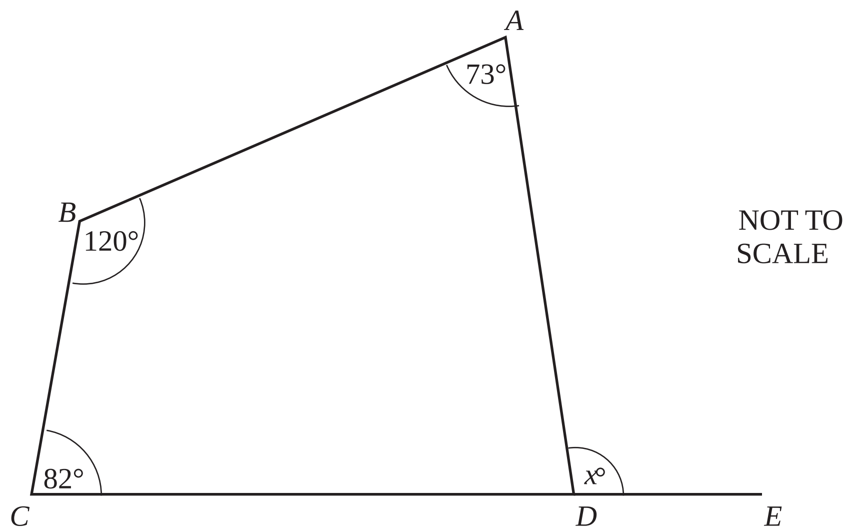
NOT TO SCALE

The pentagon has three angles which are each 140°.
The other two interior angles are equal.
Calculate the size of one of these angles.

Answer .... [3]

3) June 2012 V3

1



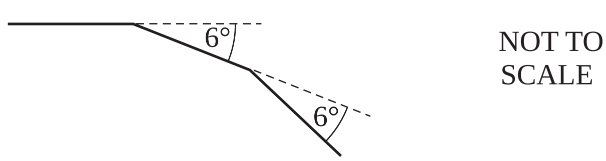
The diagram shows a quadrilateral *ABCD*
CDE is a straight line.

Calculate the value of x.

Answer x = ... [2]

4) November 2012 V2

4



The diagram shows two of the exterior angles of a regular polygon with n sides.
Calculate n.

Answer n = ... [2]

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5) November 2013 V2

9 The exterior angle of a regular polygon is 36°.

What is the name of this polygon?

Answer .... [3]

6) November 2014 V3

7 Find the interior angle of a regular polygon with 18 sides.

Answer .... [3]

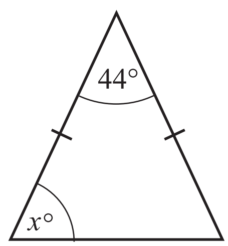
7) November 2015 V3

8 Find the sum of the interior angles of a 25-sided polygon.

Answer .... [2]

8) March 2015 V2

8 **(a)**



NOT TO SCALE

The diagram shows an isosceles triangle.

Find the value of x.

Answer(a) x = ... [1]

(b) The exterior angle of a regular polygon is 24°.

Find the number of sides of this regular polygon.

Answer(b) .... [2]

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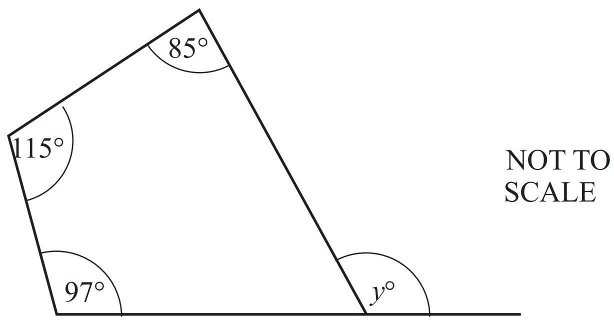
9) March 2016 V2

18

(b)



Find the value of y.

y = [2]

10) June 2016 V1

17 Five angles of a hexagon are each 115°.

Calculate the size of the sixth angle.

.... [3]

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11) June 2016 V2

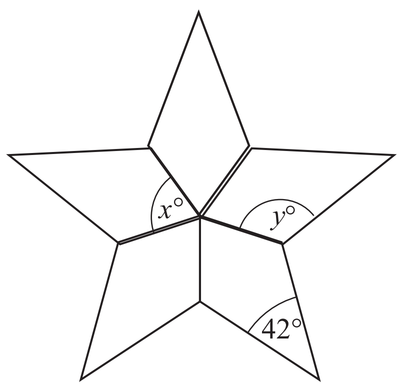
9 A regular polygon has an interior angle of 172°.

Find the number of sides of this polygon.

.... [3]

12) June 2016 V3

13



NOT TO SCALE

The diagram is made from 5 congruent kites.

Work out the value of

(a) x,

x = ... [1]

(b) y

y = ... [2]

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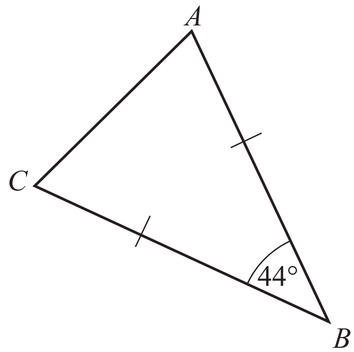
15 (a)



NOT TO SCALE

Triangle ABC is an isosceles triangle with $AB = CB$.
Angle $ABC = 44°$.

Find angle ACB.

Angle ACB = ... [1]

(b) A regular polygon has an exterior angle of 40°.

Work out the number of sides of this polygon.

.... [2]

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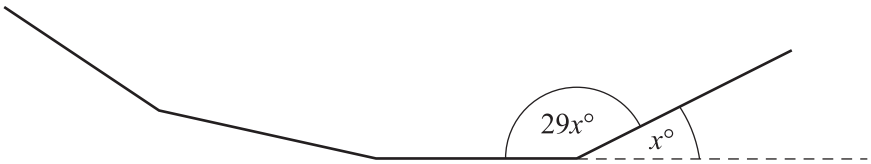
14) November 2017 V2

17



The diagram shows part of a regular polygon.
The exterior angle is $x°$.
The interior angle is $29x°$.

Work out the number of sides of this polygon.

.... [3]

15) November 2020 V2

8 Calculation the size of one interior angle of a regular polygon with 40 sides.

.... [2]

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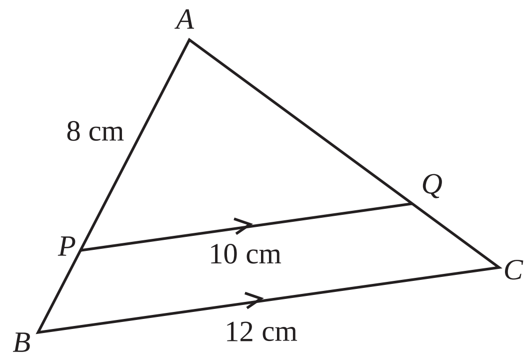
Similarity

9



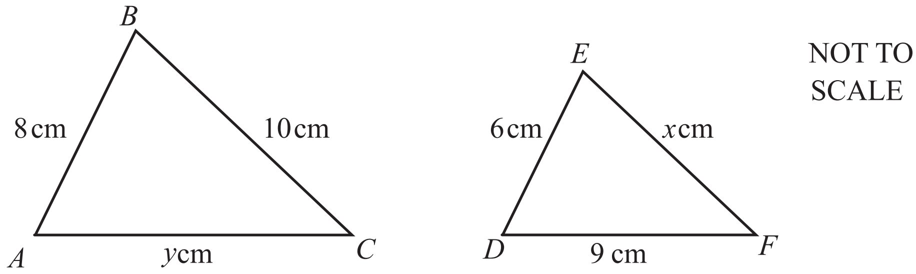
NOT TO SCALE

APB and AQC are straight lines. PQ is parallel to BC
AP = 8 cm, PQ = 10 cm and BC = 12 cm.
Calculate the length of AB

Answer AB = ... cm [2]

2) June 2015 V1

19



Triangle *ABC* is similar to triangle *DEF*

Calculate the value of

(a) x,

Answer(a) x = ... [2]

(b) y

Answer(b) y = ... [2]

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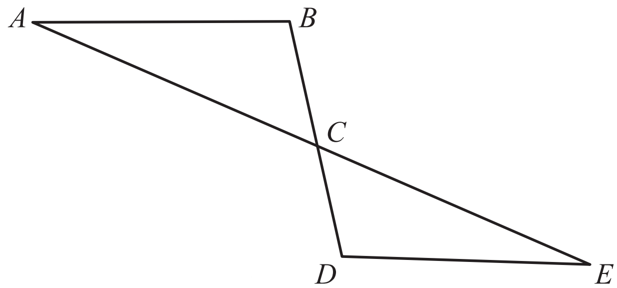
7



NOT TO SCALE

The diagram shows two straight lines, *AE* and *BD*, intersecting at *C*.
Angle *ABC* = angle *EDC*.
Triangles *ABC* and *EDC* are congruent.

Write down **two** properties of line segments *AB* and *DE*.

Answer AB and *DE* are ....

and .... [2]

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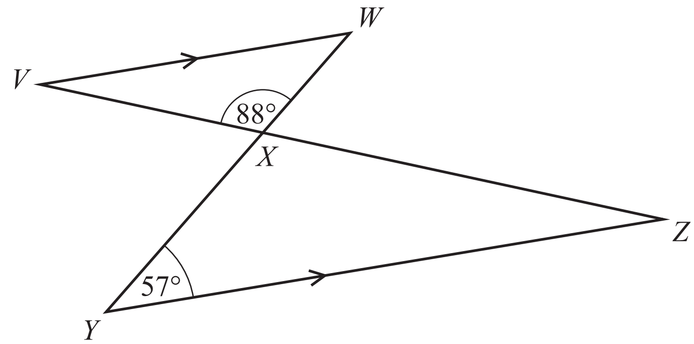
20 **(a)**

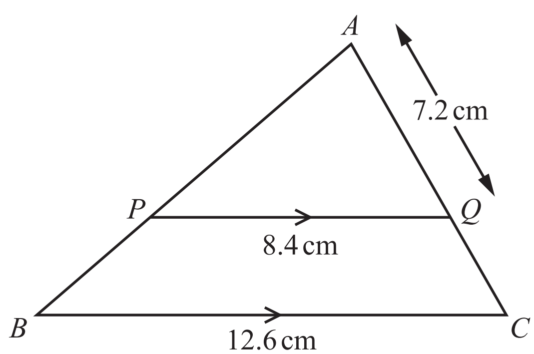


Two straight lines *VZ* and *YW* intersect at *X*.
VW is parallel to *YZ*, angle *XYZ* = 57° and angle *VXW* = 88°.

Find angle *WVX*.

Answer(a) Angle *WVX* = ... [2]

(b)



ABC is a triangle and *PQ* is parallel to *BC*.
BC = 12.6 cm, *PQ* = 8.4 cm and *AQ* = 7.2 cm.

Find *AC*.

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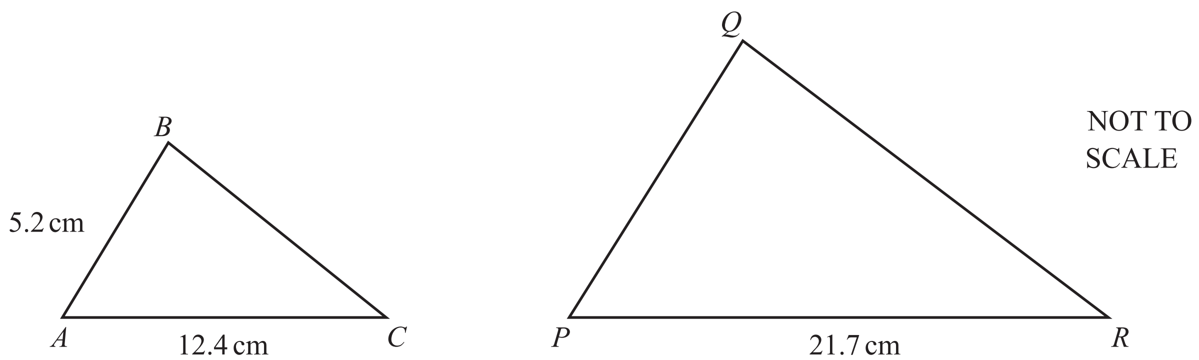
Answer(b) *AC* = ... cm [2]

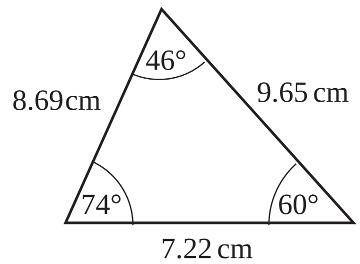
5 Triangle *ABC* is similar to triangle *PQR*.

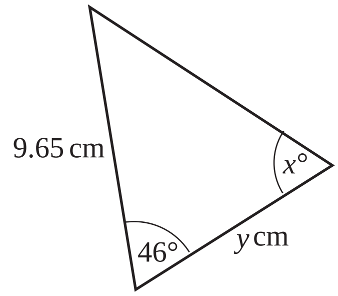


Find *PQ*

PQ = ... cm [2]

7





NOT TO
SCALE

These two triangles are congruent.
Write down the value of

(a) x,

Answer(a) x = ... [1]

(b) y.

Answer(b) y = ... [1]

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19 A model of a car is made to a scale of 1 : 40.
The volume of the model is 45 cm^3
Calculate the volume of the car.
Give your answer in m^3

Answer .... m^3 [3]

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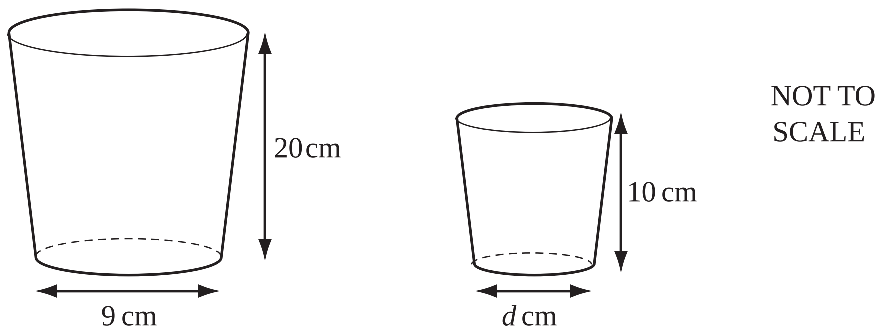
8) June 2011 V3

11 The volume of a solid varies directly as the **cube** of its length.
When the length is 3 cm, the volume is 108 cm^3.

Find the volume when the length is 5 cm.

Answer .... cm^3 [3]

17



The diagrams show two mathematically similar containers.
The larger container has a base with diameter 9 cm and a height 20 cm.
The smaller container has a base with diameter d cm and a height 10 cm.

(a) Find the value of d.

Answer(a) d = ... [1]

(b) The larger container has a capacity of 1600 ml.

Calculate the capacity of the smaller container.

Answer(b) .... ml [2]

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10) June 2012 V2

8 A car company sells a scale model $\frac{1}{10}$ of the size of one of its cars.

Complete the following table.

	Scale Model	Real Car
Area of windscreen (cm^2)	135	
Volume of storage space (cm^3)		408000

[3]

11) November 2012 V3

15 A model of a ship is made to a scale of 1 : 200.
The surface area of the model is 7500 cm^2.

Calculate the surface area of the ship, giving your answer in square metres.

Answer .... m^2 [3]

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12

A company sells cereals in boxes which measure 10 cm by 25 cm by 35 cm.

They make a special edition box which is mathematically similar to the original box.

The volume of the special edition box is 15 120 cm^3.

Work out the dimensions of this box.

Answer .... cm by .... cm by .... cm [3]

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13) June 2013 V2

9 A car, 4.4 metres long, has a fuel tank which holds 65 litres of fuel when full.
The fuel tank of a mathematically similar model of the car holds 0.05 litres of fuel when full.

Calculate the length of the model car in centimetres.

Answer .... cm [3]

14) November 2013 V1

11 The volume of a child's model plane is 1200 cm^3.
The volume of the full size plane is 4050 m^3.

Find the scale of the model in the form 1 : *n*.

Answer 1: .... [3]

15) June 2013 V3

6 The volumes of two similar cones are $36\pi\,\text{cm}^3$ and $288\pi\,\text{cm}^3$.
The base radius of the smaller cone is 3 cm.

Calculate the base radius of the larger cone.

Answer .... cm [3]

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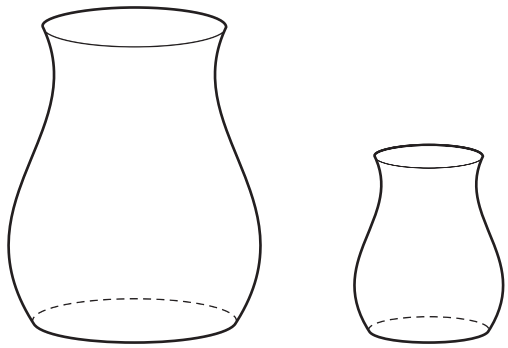
18



NOT TO SCALE

The two containers are mathematically similar in shape.
The larger container has a volume of $3456\,cm^3$ and a surface area of $1024\,cm^2$.
The smaller container has a volume of $1458\,cm^3$.

Calculate the surface area of the smaller container.

Answer .... cm^2 [4]

17) June 2014 V3

8 Hans draws a plan of a field using a scale of 1 centimetre to represent 15 metres.
The actual area of the field is $10\,800\,m^2$.

Calculate the area of the field on the plan.

Answer .... cm^2 [2]

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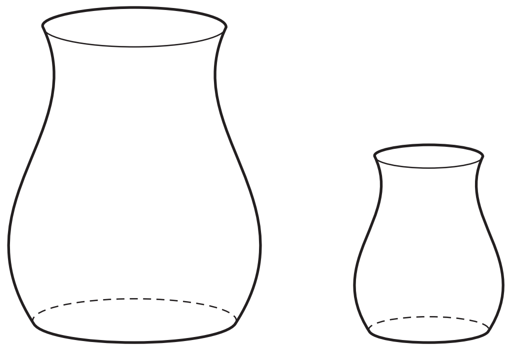
18



The two containers are mathematically similar in shape.
The larger container has a volume of $3456\,\text{cm}^3$ and a surface area of $1024\,\text{cm}^2$.
The smaller container has a volume of $1458\,\text{cm}^3$.

Calculate the surface area of the smaller container.

Answer .... cm^2 [4]

9 The scale on a map is 1 : 50 000.
The area of a field on the map is 1.2 square centimetres.

Calculate the actual area of the field in square kilometres.

Answer .... km^2 [2]

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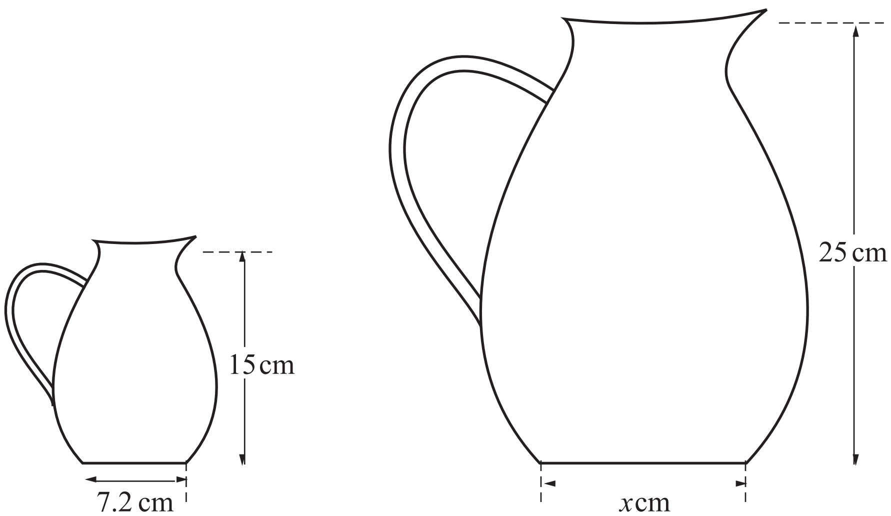
21 (a)

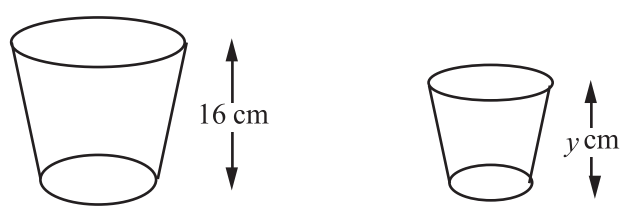


The diagram shows two jugs that are mathematically similar.

Find the value of x.

Answer(a) x = ... [2]

(b)



The diagram shows two glasses that are mathematically similar.
The height of the larger glass is 16 cm and its volume is 375 cm^3.
The height of the smaller glass is y cm and its volume is 192 cm^3

Find the value of y.

Answer(b) y = ... [3]

21) November 2015 V3

14 Two containers are mathematically similar.
Their volumes are $54\,\text{cm}^3$ and $128\,\text{cm}^3$
The height of the smaller container is 4.5 cm.

Calculate the height of the larger container.

Answer .... cm [3]

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10 The scale on a map is 1 : 20 000.
The area of a lake on the map is 1.6 square centimetres.

Calculate the actual area of the lake.
Give your answer in square metres.

....m^2 [3]

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23) June 2016 V2

7 A map is drawn to a scale of 1 : 1 000 000.
A forest on the map has an area of 4.6 cm^2.

Calculate the actual area of the forest in square kilometres.

.... km^2 [2]

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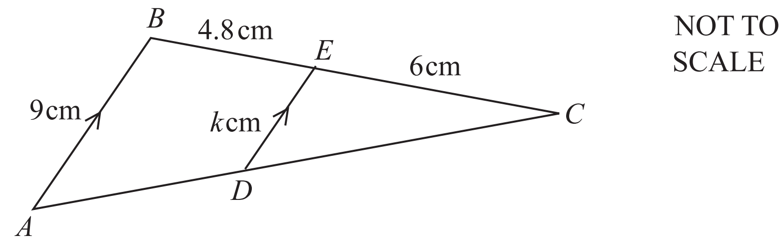
24) June 2016 V3

21 **(a)**



Triangles CBA and CED are similar
AB is parallel to DE.
$AB = 9$ cm, $BE = 4.8$ cm, $EC = 6$ cm and $ED = k$ cm.

Work out the value of k

$k =$ .... [2]

(b)

Vase A   Vase B

The diagram shows two mathematically similar vases.
Vase A has height 20 cm and volume 1500cm^3.
Vase B has volume 2592 cm^3.

Calculate h, the height of vase B.

$h =$ .... cm [3]

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25) November 2016 V1

16 Two cups are mathematically similar.
The larger cup has capacity 0.5 litres and height 8 cm.
The smaller cup has capacity 0.25 litres.

Find the height of the smaller cup.

.... cm [3]

26) November 2016 V2

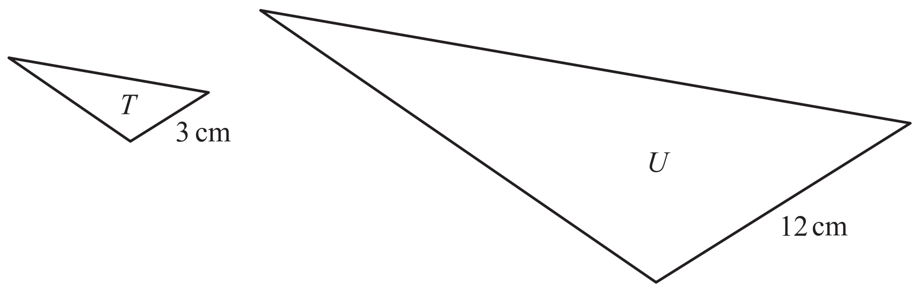
10 The length of a backpack of capacity 30 litres is 53 cm.

Calculate the length of a mathematically similar backpack of capacity 20 litres.

.... cm [3]

27) June 2018 V2

11



The diagram shows two mathematically similar triangles, T and U.
Two corresponding side lengths are 3 cm and 12 cm.
The area of triangle T is $5\,cm^2$.

Find the area of triangle U.

.... cm^2 [2]

28) November 2020 V2

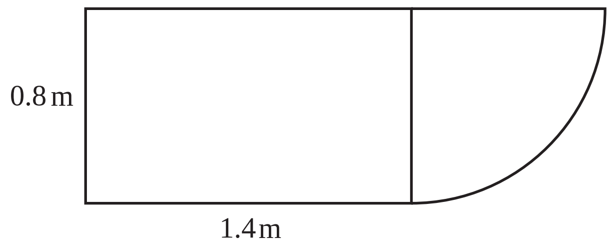
20 A model of a statue has a height of 4 cm.
The volume of the model is $12\,cm^3$.
The volume of the statue is $40\,500\,cm^3$.

Calculate the height of the statue.

.... cm [3]

Area and Perimeter

7



NOT TO SCALE

The top of a desk is made from a rectangle and a quarter circle.
The rectangle measures 0.8m by 1.4m.

Calculate the surface area of the top of the desk.

Answer .... m^2 [3]

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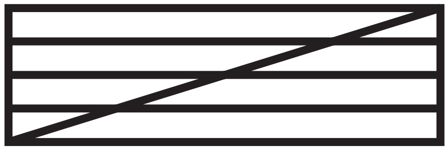
10



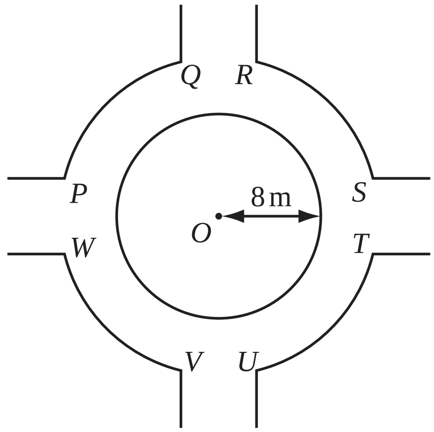
The diagram represents a rectangular gate measuring 1.5m by 3.5m.
It is made from eight lengths of wood.

Calculate the total length of wood needed to make the gate.

Answer .... m [3]

3) June 2010 V2

17



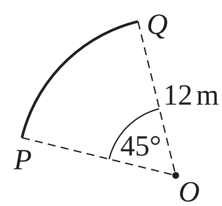
NOT TO SCALE

The diagram shows the junction of four paths.
In the junction there is a circular area covered in grass.
This circle has centre O and radius 8 m.

(a) Calculate the area of grass.

Answer(a) .... m^2 [2]

(b)



NOT TO SCALE

The arc PQ and the other three identical arcs, RS, TU and VW are each part of a circle, centre O, radius 12m.
The angle POQ is 45°.
The arcs PQ, RS, TU, VW and the circumference of the circle in **part(a)** are painted white.
Calculate the total length painted white.

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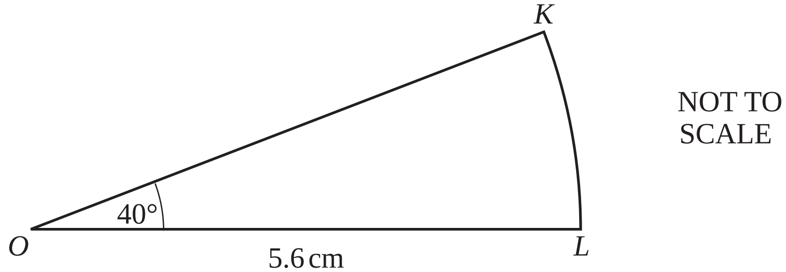
Answer(b) .... m [4]

17



OKL is a sector of a circle, centre *O*, radius 5.6 cm.
Angle *KOL* = 40°.

Calculate

(a) the area of the sector,

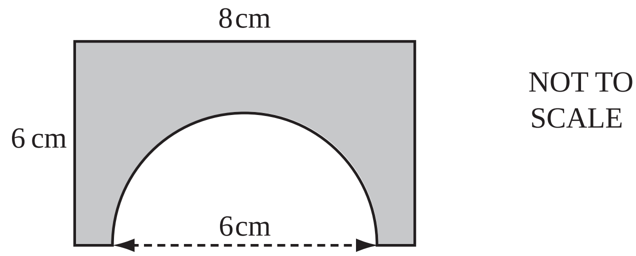
Answer(a) .... cm^2 [2]

(b) the perimeter of the sector.

Answer(b) .... cm [2]

5) November 2010 V1

15



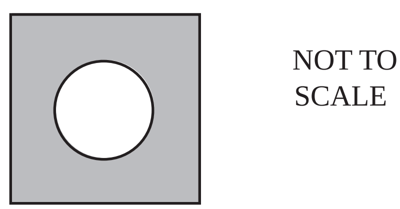
A semicircle of diameter 6 cm is cut from a rectangle with sides 6 cm and 8cm.

Calculate the perimeter of the shaded shape, correct to 1 decimal place.

Answer .... cm [3]

6) November 2010 V2

13



The diagram shows a circle of radius 5cm in a square of side 18cm.

Calculate the shaded area.

Answer .... cm^2 [3]

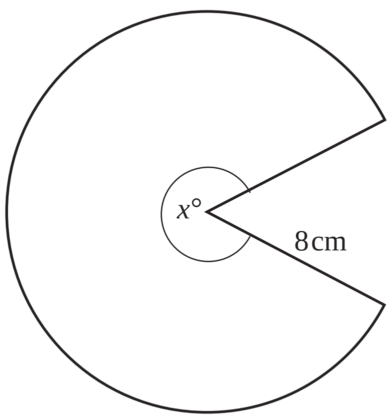
7) November 2010 V3

8 A large rectangular card measures 80 centimetres by 90 centimetres.
Maria uses **all** this card to make small rectangular cards measuring 40 **millimetres** by 15 **millimetres**.
Calculate the number of small cards.

Answer .... [2]

8) November 2010 V3

18



NOT TO SCALE

The diagram shows a sector of a circle of radius 8 cm.
The angle of the sector is $x°$.
The perimeter of the sector is $(16 + 14\pi)$ cm.

Find the value of x.

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

11 A rectangular photograph measures 23.3 cm by 19.7 cm, each correct to 1 decimal place.
Calculate the lower bound for

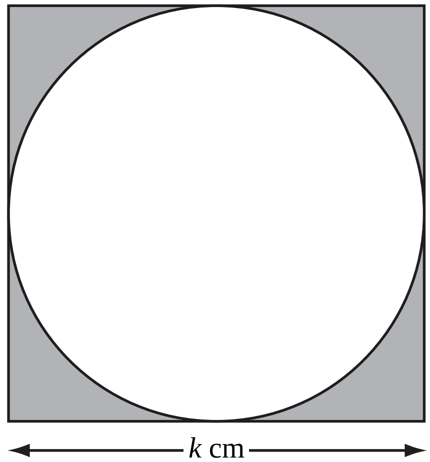
(a) the perimeter,

Answer(a) .... cm [2]

(b) the area.

Answer(b) .... cm^2 [1]

16



The diagram shows a square of side k cm.

The circle inside the square touches all four sides of the square.

(a) The shaded area is A cm^2.

Show that $4A = 4k^2 - \pi k^2$.

Answer (a)

[2]

(b) Make k the subject of the formula $4A = 4k^2 - \pi k^2$.

Answer(b) k = ... [3]

11) November 2011 V1

5 A circle has a radius of 50cm.

(a) Calculate the area of the circle in cm^2.

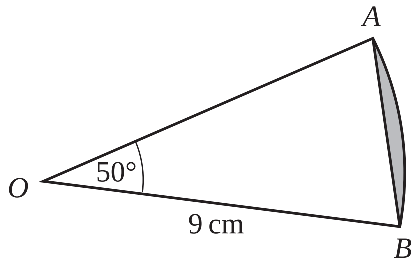
Answer(a) .... cm^2 [2]

(b) Write your answer to **part (a)** in m^2.

Answer(b) .... m^2 [1]

12) November 2011 V3

19



NOT TO SCALE

The diagram shows a sector *AOB* of a circle, centre *O*, radius 9 cm with angle $AOB = 50°$.

Calculate the area of the segment shaded in the diagram.

Answer .... cm^2 [4]

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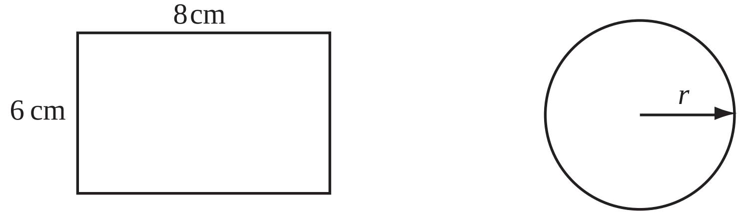
13) June 2012 V2

7



NOT TO SCALE

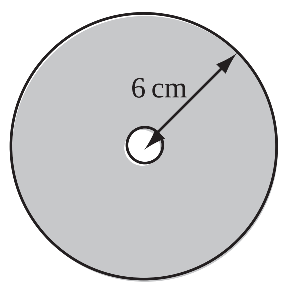
The perimeter of the rectangle is the same length as the circumference of the circle.

Calculate the radius, r, of the circle.

Answer r = ... cm [3]

14) November 2012 V1

12



NOT TO SCALE

The diagram shows a circular disc with radius 6 cm.
In the centre of the disc there is a circular hole with radius 0.5 cm.

Calculate the area of the shaded section.

Answer .... cm^2 [3]

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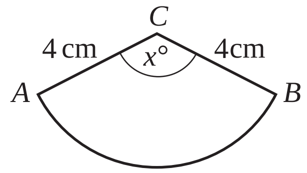
14



NOT TO SCALE

ABC is a sector of a circle, radius 4 cm and centre *C*
The length of the arc *AB* is 8cm and angle $ACB = x°$.

Calculate the value of x.

Answer x = ... [3]

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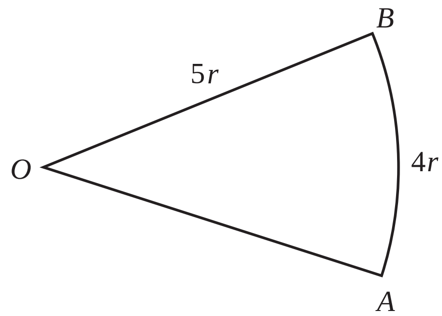
16) November 2012 V3

17



NOT TO SCALE

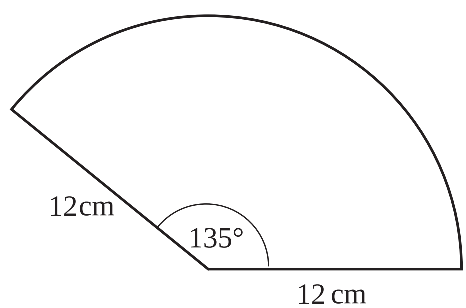
The diagram shows a sector of a circle, centre O, radius $5r$.
The length of the arc AB is $4r$.

Find the area of the sector in terms of r, giving your answer in its simplest form.

Answer .... [3]

17) June 2013 V1

21



NOT TO SCALE

The diagram shows a sector of a circle of radius 12 cm with an angle of 135°.

Calculate the perimeter of the sector.

Answer .... cm [3]

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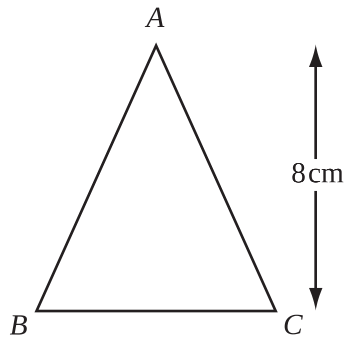
5

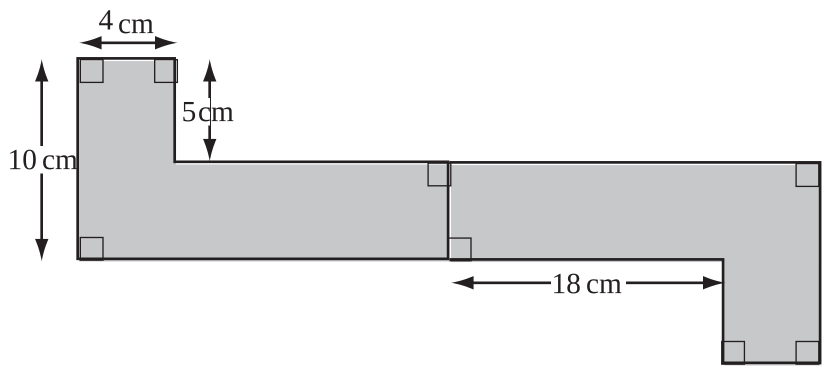


Triangle *ABC* has a height of 8 cm and an area of 42 cm^2.

Calculate the length of *BC*

Answer BC = ... cm [2]

7



The shaded shape has rotational symmetry of order 2.

Work out the shaded area.

Answer .... cm^2 [3]

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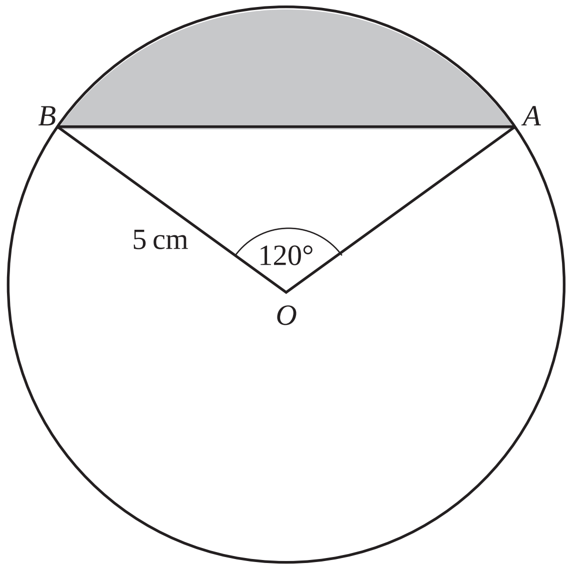
20) June 2013 V3

18



NOT TO SCALE

A and *B* lie on a circle centre *O*, radius 5 cm.
Angle *AOB* = 120°.

Find the area of the shaded segment.

Answer .... cm^2 [4]

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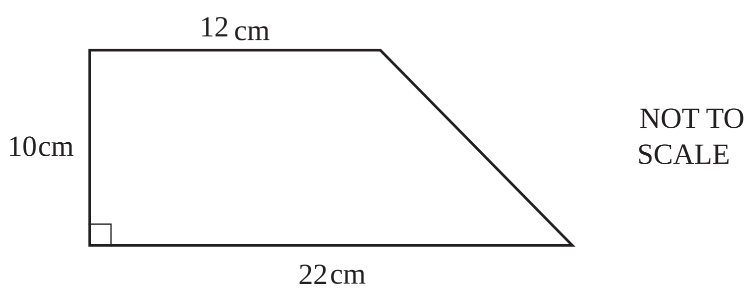
21) November 2013 V2

3 Find the circumference of a circle of radius 2.5cm.

Answer .... cm [2]

22) November 2013 V2

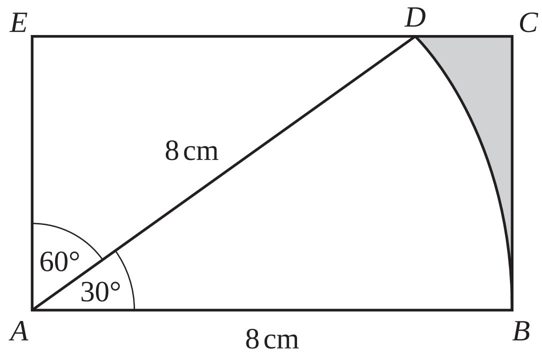
7



Find the area of the trapezium.

Answer .... cm^2 [2]

19



NOT TO SCALE

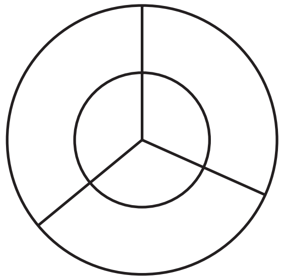
The diagram shows a rectangle *ABCE*.
D lies on *EC*.
DAB is a sector of a circle radius 8 cm and sector angle 30°.

Calculate the area of the shaded region.

Answer .... cm^2 [7]

24) June 2014 V3

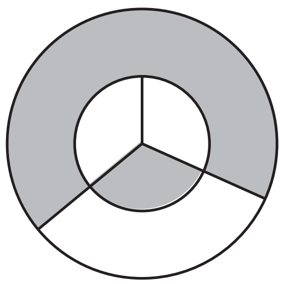
21



NOT TO
SCALE

The diagram shows two concentric circles and three radii.
The diagram has rotational symmetry of order 3.

A club uses the diagram for its badge with some sections shaded.
The radius of the large circle is 6 cm and the radius of the small circle is 4 cm.



NOT TO
SCALE

Calculate the total perimeter of the shaded area.

Answer .... cm [5]

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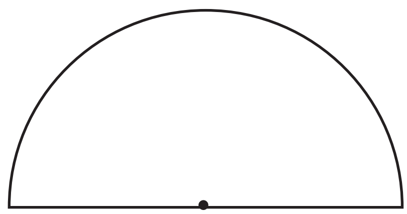
25) June 2015 V3

15 The circumference of a circle is 30 cm.

(a) Calculate the radius of the circle.

Answer(a) .... cm [2]

(b)



The length of the arc of the semi-circle is 15 cm.

Calculate the area of the semi-circle.

Answer(b) .... cm^2 [2]

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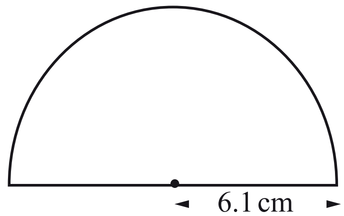
26) November 2015 V1

11



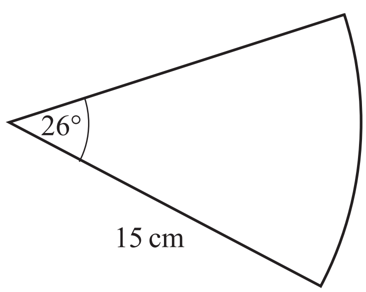
A protractor is a semi-circle of radius 6.1 cm.

Calculate the **perimeter** of the protractor.

Answer .... cm [3]

27) November 2015 V2

16



The diagram shows a sector of a circle with radius 15 cm.

Calculate the perimeter of this sector.

Answer .... cm [3]

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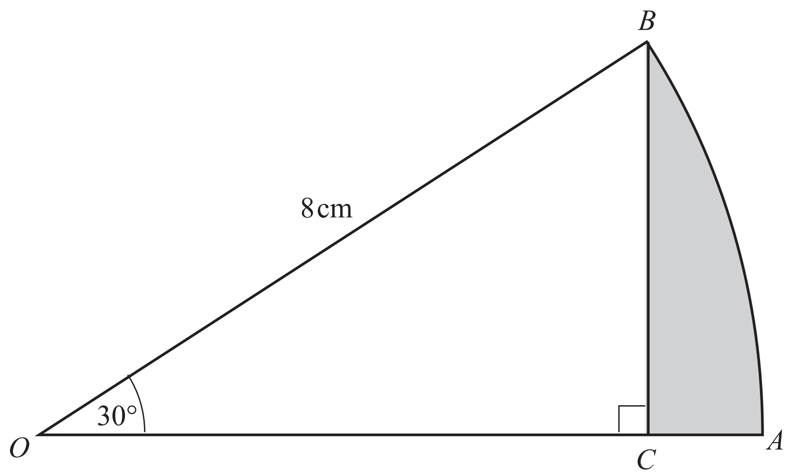
25

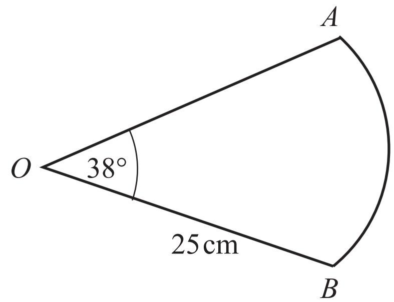


OAB is the sector of a circle, centre O, with radius 8 cm and sector angle 30°.
BC is perpendicular to OA.

Calculate the area of the region shaded on the diagram.

Answer .... cm^2 [5]

11



NOT TO SCALE

The diagram shows a sector of a circle, centre O, radius 25 cm.
The sector angle is 38°.

Calculate the length of the arc AB
Give your answer correct to 4 significant figures.

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

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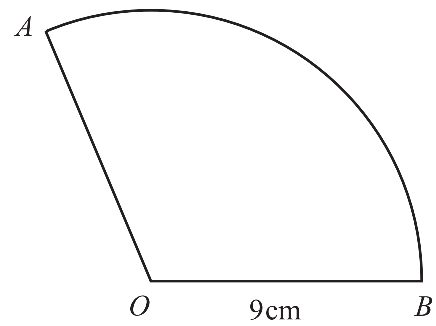
30) June 2016 V1

20 AB is an arc of a circle, centre O, radius 9cm.
The length of the arc AB is 6π cm.
The area of the sector AOB is $k\pi$ cm^2.

Find the value of k

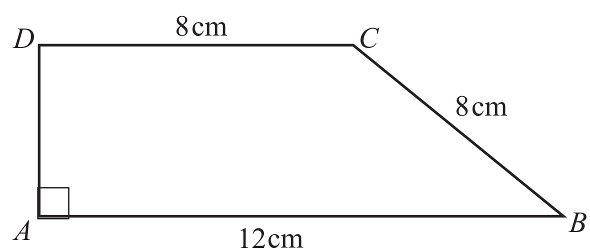


NOT TO SCALE

$k =$ .... [3]

31) June 2016 V1

23



NOT TO SCALE

Calculate the area of this trapezium.

.... cm^2 [4]

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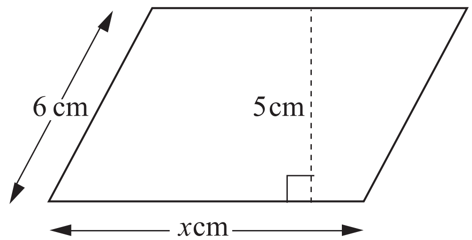
32) June 2016 V2

3



NOT TO SCALE

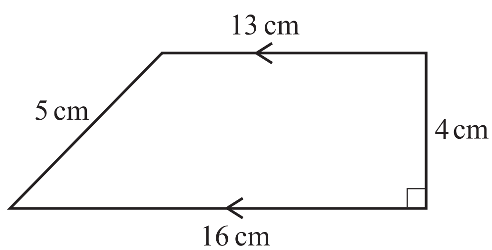
The area of this parallelogram is 51.5 cm^2.

Work out the value of x.

x = ... [2]

33) November 2016 V2

4



NOT TO SCALE

Calculate the area of this trapezium.

.... cm^2 [2]

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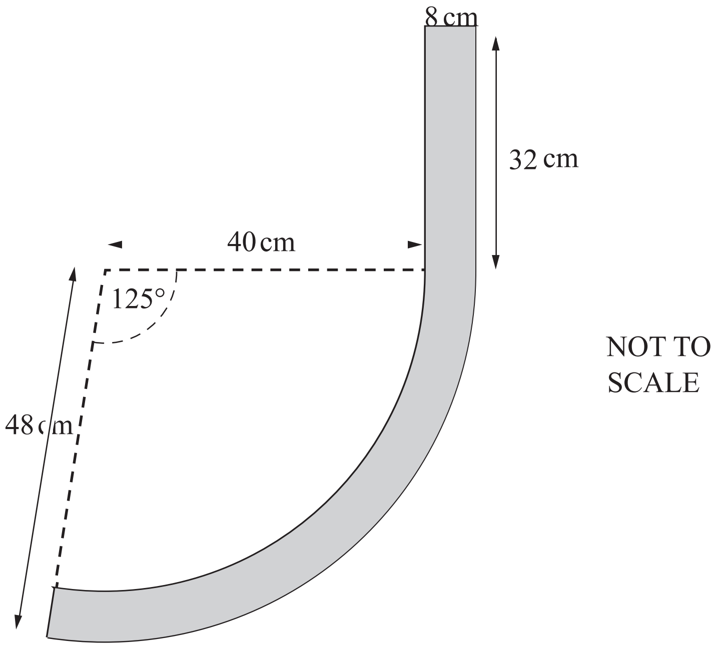
17

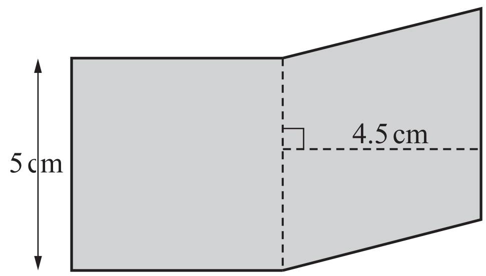


The diagram shows the cross section of part of a park bench.
It is made from a rectangle of length 32 cm and width 8 cm and a curved section.
The curved section is made from two concentric arcs with sector angle 125°.
The inner arc has radius 40 cm and the outer arc has radius 48 cm.

Calculate the area of the cross section correct to the nearest square centimetre.

.... cm^2 [5]

14 The shaded shape is made by joining a square and a rhombus.



NOT TO SCALE

Work out

(a) the perimeter of the shaded shape,

.... cm [1]

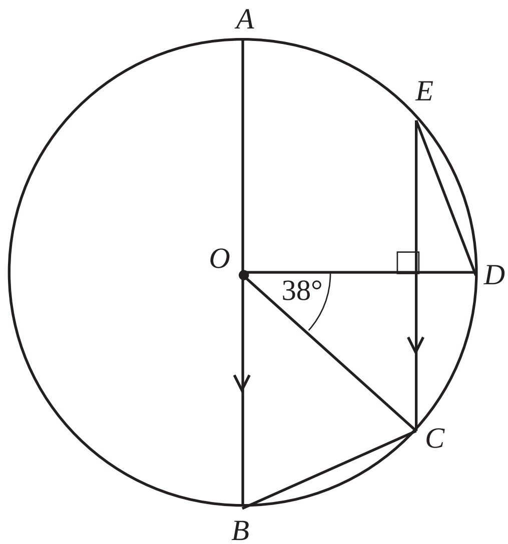
(b) the area of the shaded shape.

.... cm^2 [2]

Circles

1) June 2010 V1

17



NOT TO SCALE

AB is the diameter of a circle, centre O. C, D and E lie on the circle.
EC is parallel to AB and perpendicular to OD. Angle DOC is 38°.

Work out

(a) angle BOC ,

Answer(a) Angle BOC = ... [1]

(b) angle CBO,

Answer(b) Angle CBO = ... [1]

(c) angle EDO .

Answer(c) Angle EDO = ... [2]

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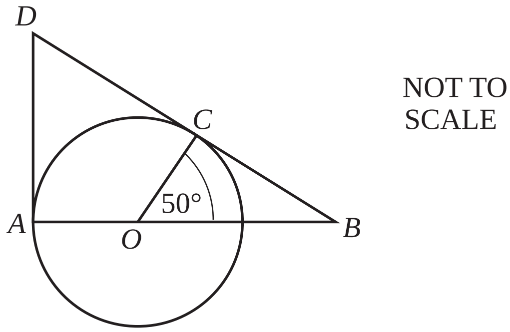
4



O is the centre of the circle.
DA is the tangent to the circle at *A* and *DB* is the tangent to the circle at *C*
AOB is a straight line. Angle *COB* = 50°.
Calculate

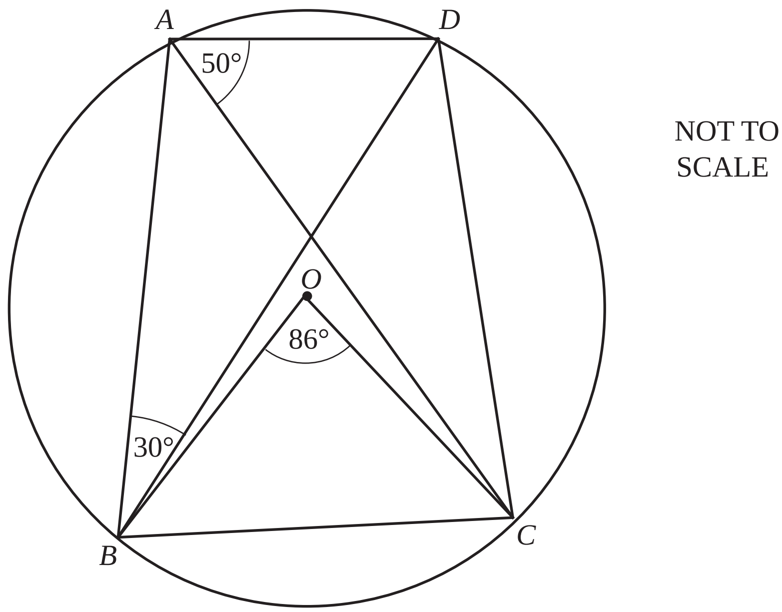
(a) angle *CBO*,

Answer(a) Angle *CBO* = ... [1]

(b) angle *DOC*

Answer(b) Angle *DOC* = ... [1]

23



The points A, B, C and D lie on the circumference of the circle, centre O.

Angle $ABD = 30°$, angle $CAD = 50°$ and angle $BOC = 86°$.

(a) Give the reason why angle $DBC = 50°$.

Answer(a) .... [1]

(b) Find

(i) angle ADC,

Answer(b)(i) Angle ADC = ... [1]

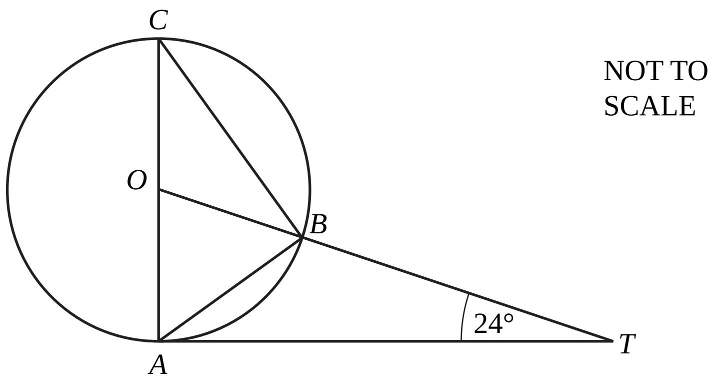
(ii) angle BDC,

Answer(b)(ii) Angle BDC = ... [1]

(iii) angle OBD.

Answer(b)(iii) Angle OBD = ... [2]

17



A, *B* and *C* are points on a circle, centre *O*.
TA is a tangent to the circle at *A* and *OBT* is a straight line.
AC is a diameter and angle *OTA* = 24°.

Calculate

(a) angle *AOT*,

Answer(a) Angle *AOT* = ... [2]

(b) angle *ACB*,

Answer(b) Angle *ACB* = ... [1]

(c) angle *ABT*.

Answer(c) Angle *ABT* = ... [2]

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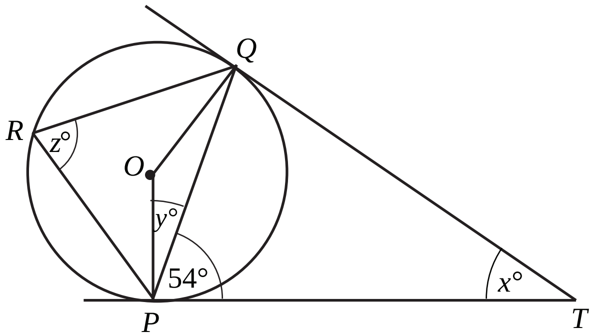
13



The points P, Q and R lie on a circle, centre O
TP and TQ are tangents to the circle.
Angle $TPQ = 54°$.

Calculate the value of

(a) x,

Answer(a) x = ... [1]

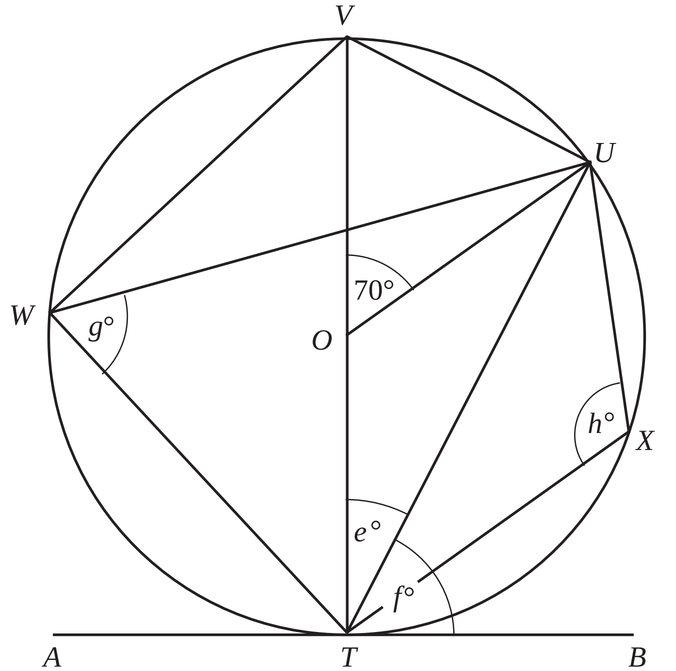
(b) y,

Answer(b) y = ... [1]

(c) z.

Answer(c) z = ... [2]

20



NOT TO SCALE

The diagram shows a circle, centre O.
VT is a diameter and ATB is a tangent to the circle at T.
U, V, W and X lie on the circle and angle $VOU = 70°$.

Calculate the value of

(a) e,

Answer(a) e = ... [1]

(b) f,

Answer(b) f = ... [1]

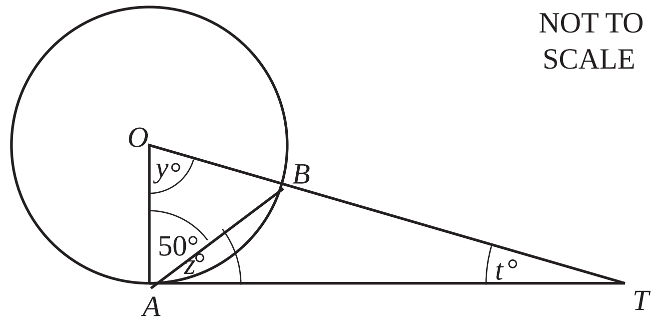
(c) g,

Answer(c) g = ... [1]

(d) h.

Answer(d) h = ... [1]

7



TA is a tangent at *A* to the circle, centre *O*
Angle *OAB* = 50°.

Find the value of

(a) y,

Answer(a) y = ... [1]

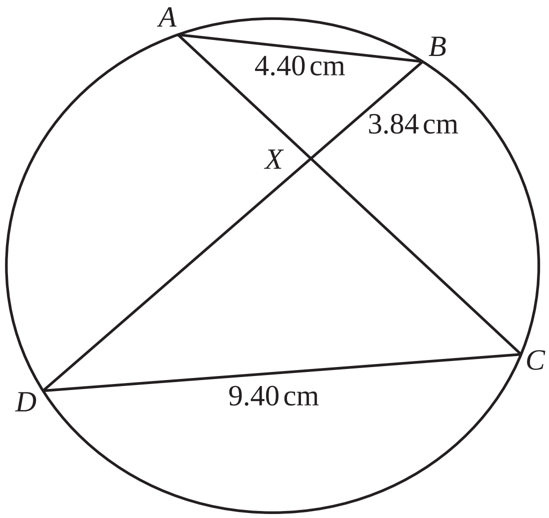
(b) z,

Answer(b) z = ... [1]

(c) t

Answer(c) t = ... [1]

22



NOT TO SCALE

A, *B*, *C* and *D* lie on a circle.
AC and *BD* intersect at *X*.

(a) Give a reason why angle *BAX* is equal to angle *CDX*.

Answer(a) .... [1]

(b) $AB = 4.40$ cm, $CD = 9.40$ cm and $BX = 3.84$ cm.

(i) Calculate the length of *CX*.

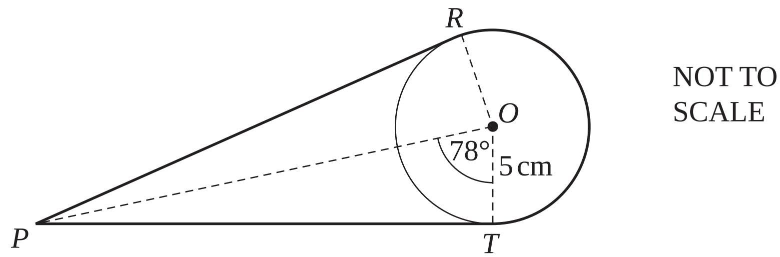
Answer(b)(i) $CX =$ .... cm [2]

(ii) The area of triangle *ABX* is 5.41 cm^2.

Calculate the area of triangle *CDX*.

Answer(b)(ii) .... cm^2 [2]

20



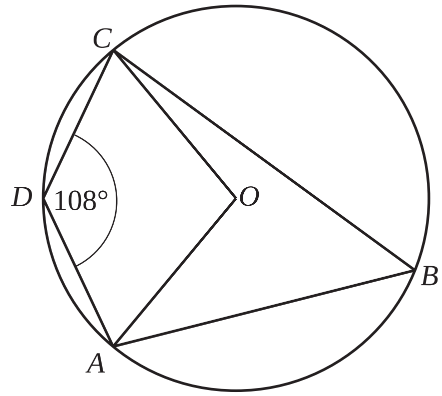
R and *T* are points on a circle, centre *O*, with radius 5 cm.
PR and *PT* are tangents to the circle and angle *POT* = 78°.

A thin rope goes from *P* to *R*, around the major arc *RT* and then from *T* to *P*.

Calculate the length of the rope.

Answer .... cm [6]

6

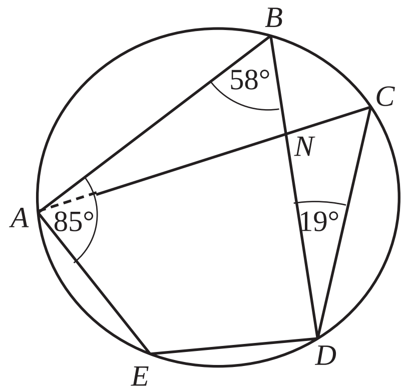


A, B, C and D lie on a circle centre O. Angle $ADC = 108°$.

Work out the obtuse angle AOC.

Answer Angle AOC = ... [2]

10



NOT TO SCALE

A, B, C, D and E are points on a circle.
Angle $ABD = 58°$, angle $BAE = 85°$ and angle $BDC = 19°$.
BD and CA intersect at N.

Calculate

(a) angle BDE,

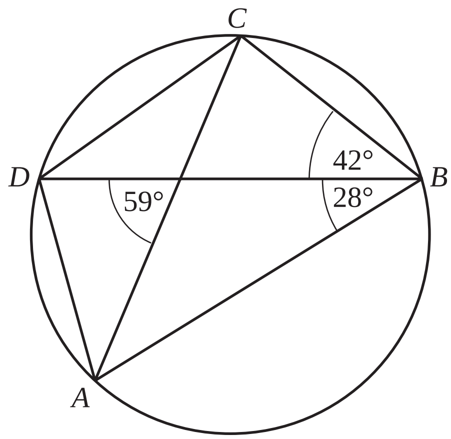
Answer(a) Angle BDE = ... [1]

(b) angle AND

Answer(b) Angle AND = ... [2]

12) November 2013 V1

12



NOT TO SCALE

A, B, C and D lie on the circle.

Find

(a) angle ADC,

Answer(a) Angle ADC = ... [1]

(b) angle ADB.

Answer(b) Angle ADB = ... [2]

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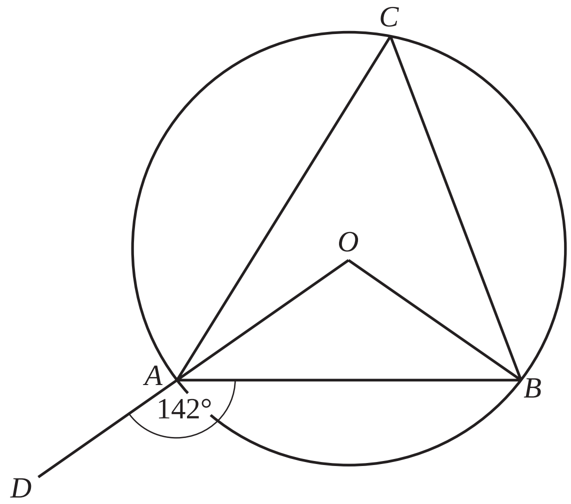
13) November 2013 V2

14



NOT TO SCALE

A, *B* and *C* are points on the circumference of a circle centre *O*.
OAD is a straight line and angle *DAB* = 142°.

Calculate the size of angle *ACB*.

Answer Angle *ACB* = ... [3]

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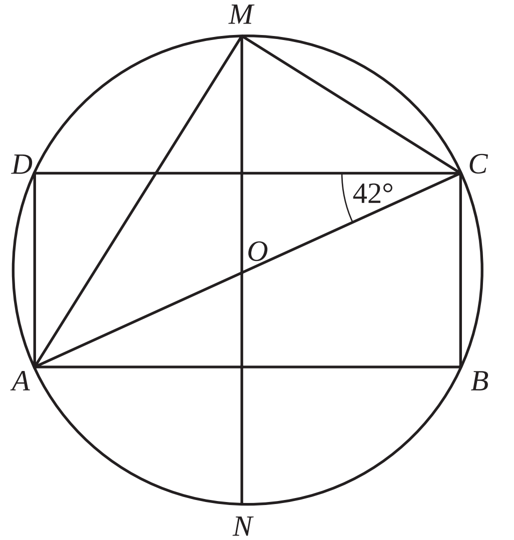
13



NOT TO SCALE

The vertices of the rectangle *ABCD* lie on a circle centre *O*
MN is a line of symmetry of the rectangle.
AC is a diameter of the circle and angle *ACD* = 42°.

Calculate

(a) angle *CAM*,

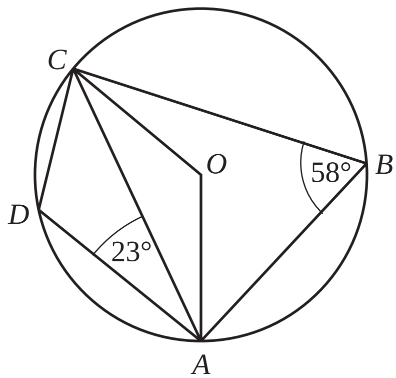
Answer(a) Angle *CAM* = ... [2]

(b) angle *DCM*.

Answer(b) Angle *DCM* = ... [2]

15) June 2014 V1

13



NOT TO SCALE

A, B, C and D lie on a circle centre O
Angle ABC = 58° and angle CAD = 23°.

Calculate

(a) angle OCA,

Answer(a) Angle OCA = ... [2]

(b) angle DCA

Answer(b) Angle DCA = ... [2]

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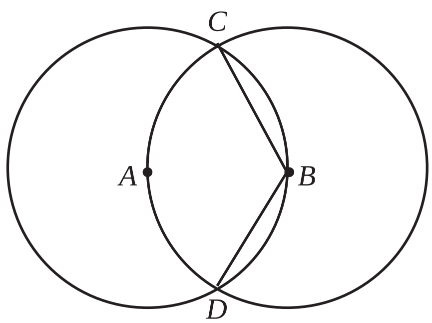
16) November 2014 V1

19



NOT TO SCALE

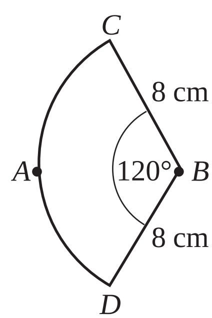
Two circles, centres A and B, are each of radius 8 cm and intersect at C and D.
Each circle passes through the centre of the other circle.

(a) Explain why angle CBD is 120°.

Answer(a)

[1]

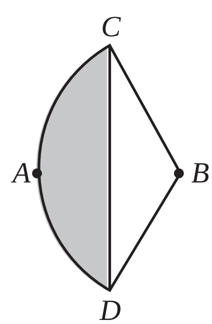
(b) For the circle, centre B, find the area of the sector BCD



NOT TO SCALE

Answer(b) .... cm^2 [2]

(c) **(i)** Find the area of the shaded segment CAD



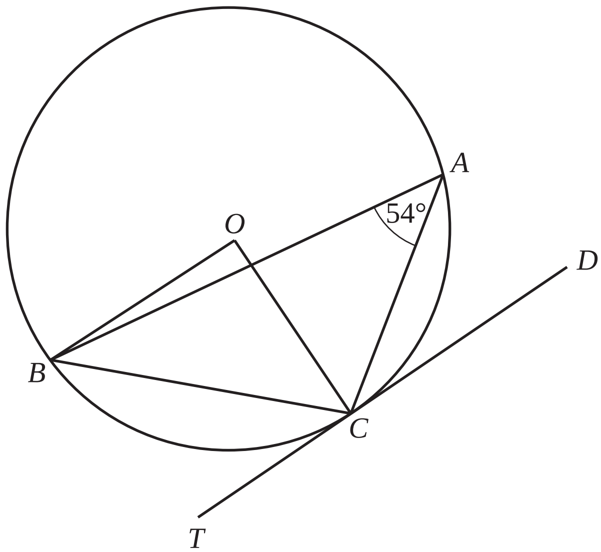
NOT TO SCALE

Answer(c)(i) .... cm^2 [3]

(ii) Find the area of overlap of the two circles.

Answer(c)(ii) .... cm^2 [1]

16 A, B and C are points on a circle, centre O.
TCD is a tangent to the circle.
Angle BAC = 54°.



NOT TO
SCALE

(a) Find angle BOC, giving a reason for your answer.

Answer(a) Angle BOC = ... because ....

.... [2]

(b) When O is the origin, the position vector of point C is $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$.

(i) Work out the gradient of the radius OC.

Answer(b)(i) .... [1]

(ii) D is the point $(7, k)$.

Find the value of k.

Answer(b)(ii) k = ... [1]

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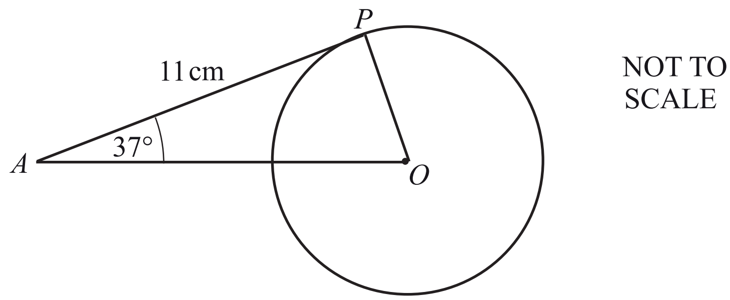
8



In the diagram, AP is a tangent to the circle at P.
O is the centre of the circle, angle $PAO = 37°$ and $AP = 11$ cm.

(a) Write down the size of angle OPA.

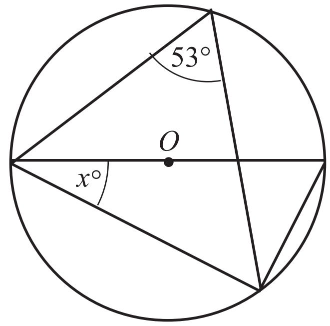
Answer(a) Angle OPA = ... [1]

(b) Work out the radius of the circle.

Answer(b) .... cm [2]

19) March 2015 V2

7



NOT TO SCALE

The diagram shows a circle, centre O

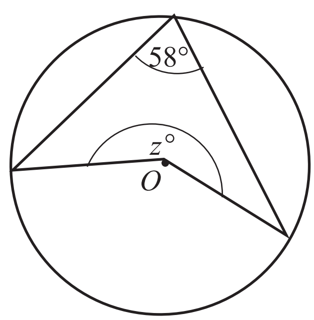
Find the value of x

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

20) March 2016 V2

18

(c)



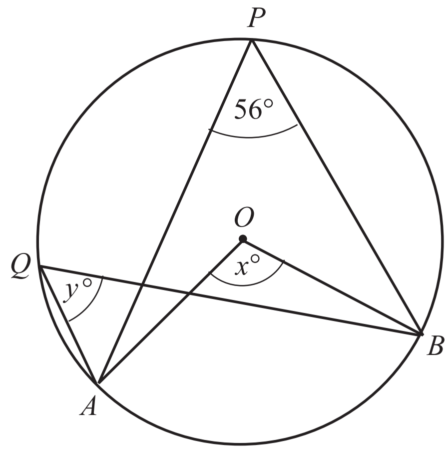
NOT TO SCALE

The diagram shows a circle, centre O

Find the value of z.

$z =$ .... [2]

11



NOT TO SCALE

A, B, P and Q lie on the circle, centre O.
Angle $APB = 56°$.

Find the value of

(a) x,

$x =$ [1]

(b) y.

$y =$ .... [1]

12 Simplify $\left(16p^{16}\right)^{\frac{1}{4}}$

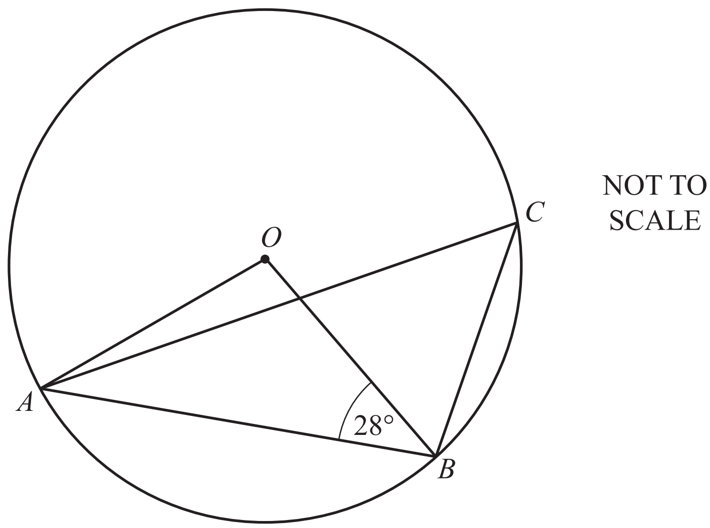
.... [2]

13 Solve the inequality.

$$n + 7 < 5n - 8$$

.... [2]

21



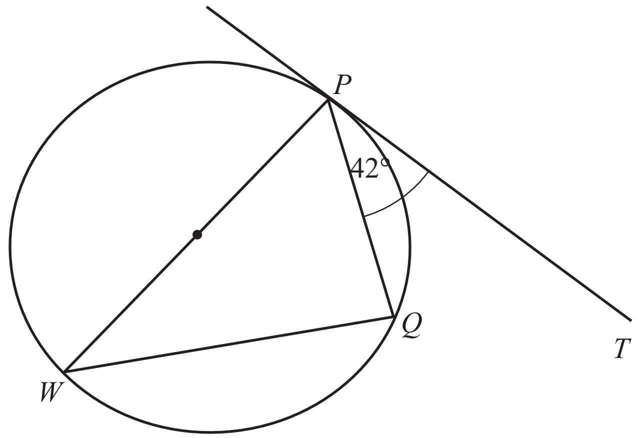
In the diagram, A, B and C lie on the circumference of a circle, centre O.

Work out the size of angle ACB.
Give a reason for each step of your working.

Angle ACB = ... [4]

23) November 2016 V1

6



NOT TO
SCALE

In the diagram, PT is a tangent to the circle at P.
PW is a diameter and angle $TPQ = 42°$.

Find angle PWQ.

Angle PWQ = ... [2]

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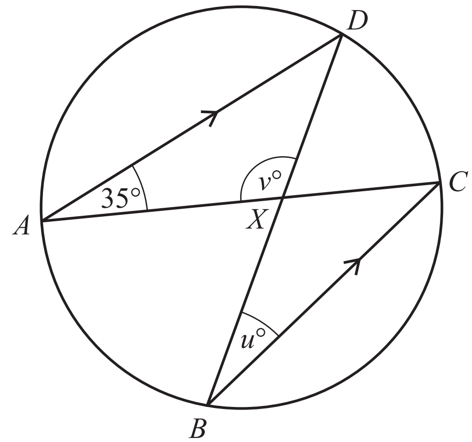
21 **(a)**



NOT TO SCALE

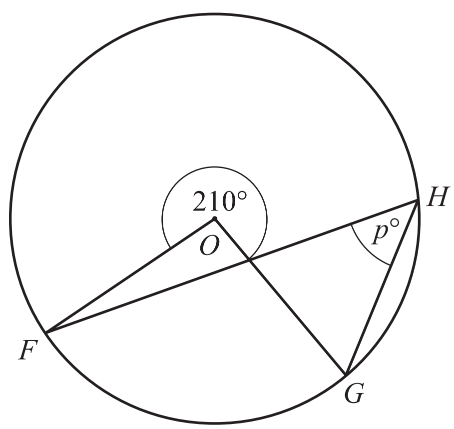
A, *B*, *C* and *D* are points on the circle.
AD is parallel to *BC*.
The chords *AC* and *BD* intersect at *X*.

Find the value of *u* and the value of *v*.

u = ...

v = ... [3]

(b)



NOT TO SCALE

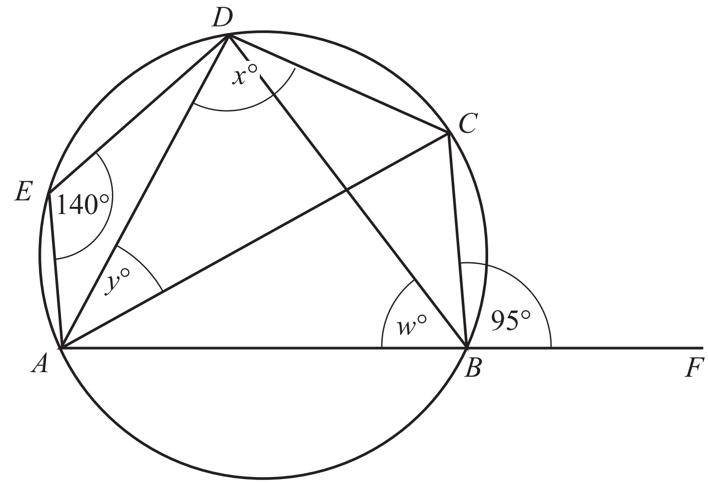
F, *G* and *H* are points on the circle, centre *O*.

Find the value of *p*.

p = ... [2]

25) June 2017 V2

26



NOT TO SCALE

A, *B*, *C*, *D* and *E* lie on the circle.
AB is extended to *F*.
Angle $AED = 140°$ and angle $CBF = 95°$.

Find the values of *w*, *x* and *y*.

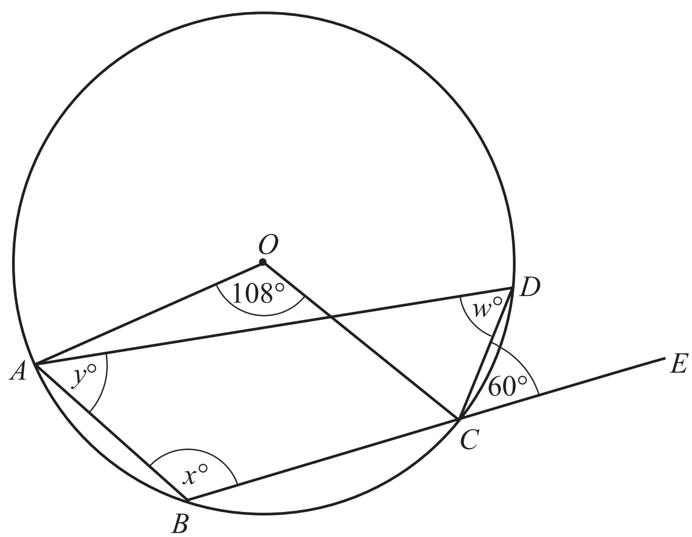
$w =$ ....

$x =$ ....

$y =$ .... [5]

26) November 2017 V2

22



NOT TO SCALE

A, *B*, *C* and *D* are points on the circle, centre *O*.
BCE is a straight line.
Angle $AOC = 108°$ and angle $DCE = 60°$.

Calculate the values of *w*, *x* and *y*.

$w =$ ....

$x =$ ....

$y =$ .... [3]

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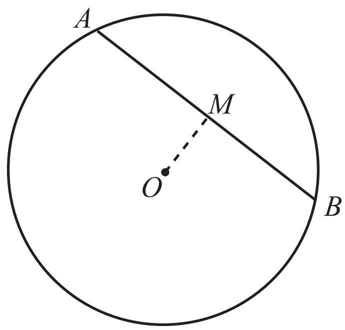
27) June 2018 V2

16



NOT TO SCALE

The diagram shows a circle, centre O.
AB is a chord of length 12 cm.
M is the mid-point of AB and $OM = 4.5$ cm.

Calculate the radius of the circle.

.... cm [3]

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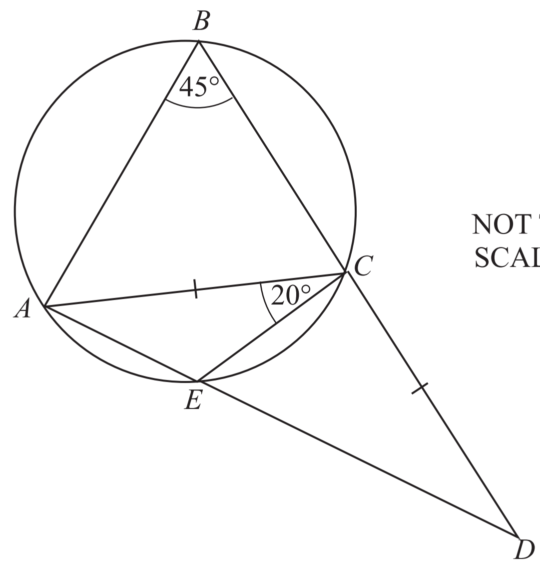
12



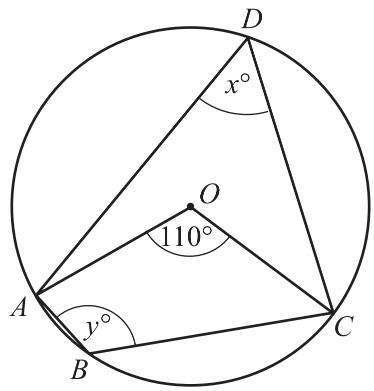
NOT TO SCALE

$ABCE$ is a cyclic quadrilateral.
AED and BCD are straight lines.
$AC = CD$, angle $ABC = 45°$ and angle $ACE = 20°$.

Work out angle ECD.

Angle ECD = ... [3]

9



NOT TO SCALE

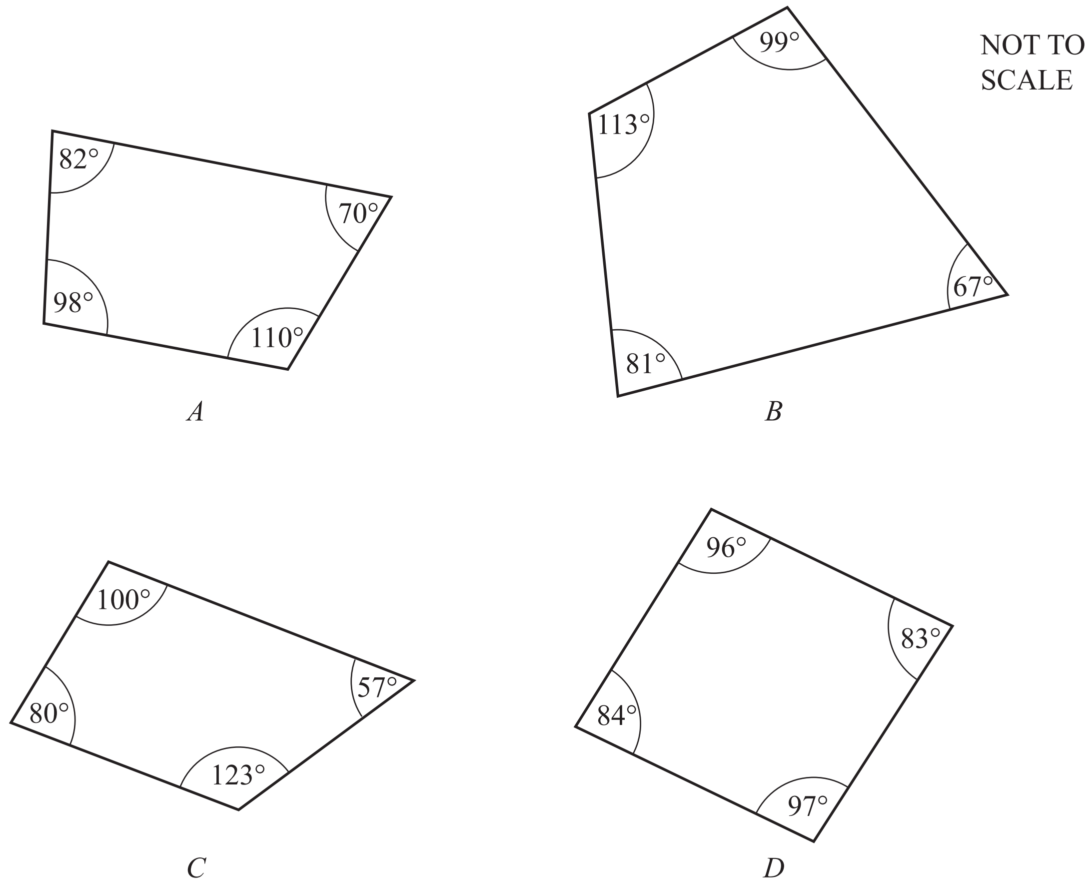
A, *B*, *C* and *D* lie on the circle, centre *O*.

Find the value of x and the value of y.

x = ...

y = ... [2]

3



The diagram shows four quadrilaterals *A*, *B*, *C* and *D*.

Which one of these could be a cyclic quadrilateral?

.... [1]

Loci

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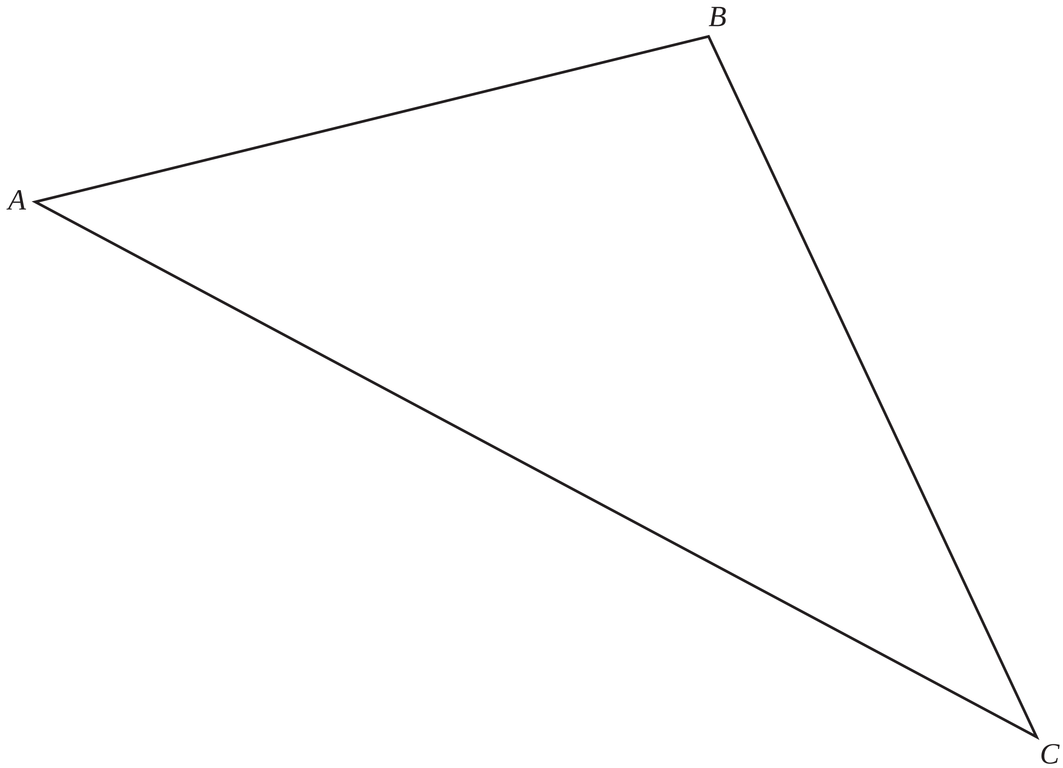
22



The diagram shows a farmer's field *ABC*.

The farmer decides to grow potatoes in the region of the field which is

- nearer to *A* than to *C*

and

- nearer to *AB* than to *AC*

Using **a straight edge and compasses only**, construct two loci accurately and shade this region on the diagram.

[5]

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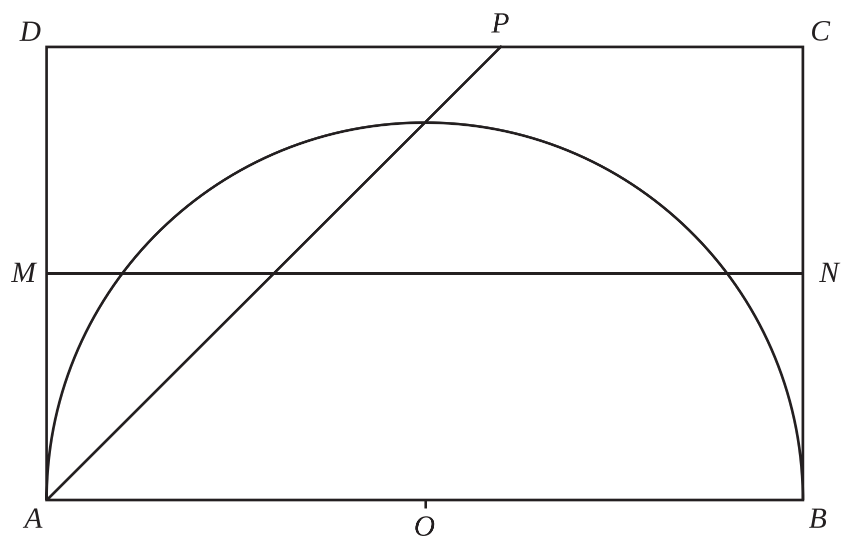
11 $ABCD$ is a rectangle with $AB = 10$ cm and $BC = 6$ cm. MN is the perpendicular bisector of BC.

AP is the bisector of angle BAD.

O is the midpoint of AB and also the centre of the semicircle, radius 5 cm.

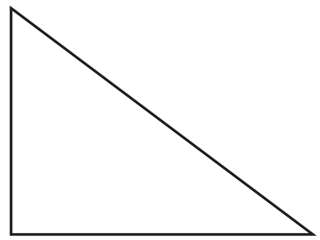


Write the letter R in the region which satisfies **all** three of the following conditions.

- nearer to AB than to AD
- nearer to C than to B
- less than 5 cm from O

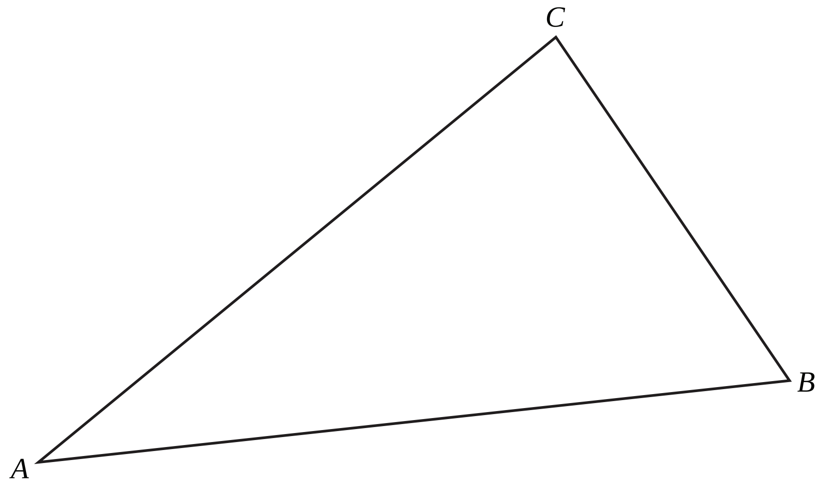
[3]

14



Draw, accurately, the locus of all the points **outside** the triangle which are 3 centimetres away from the triangle. [3]

20



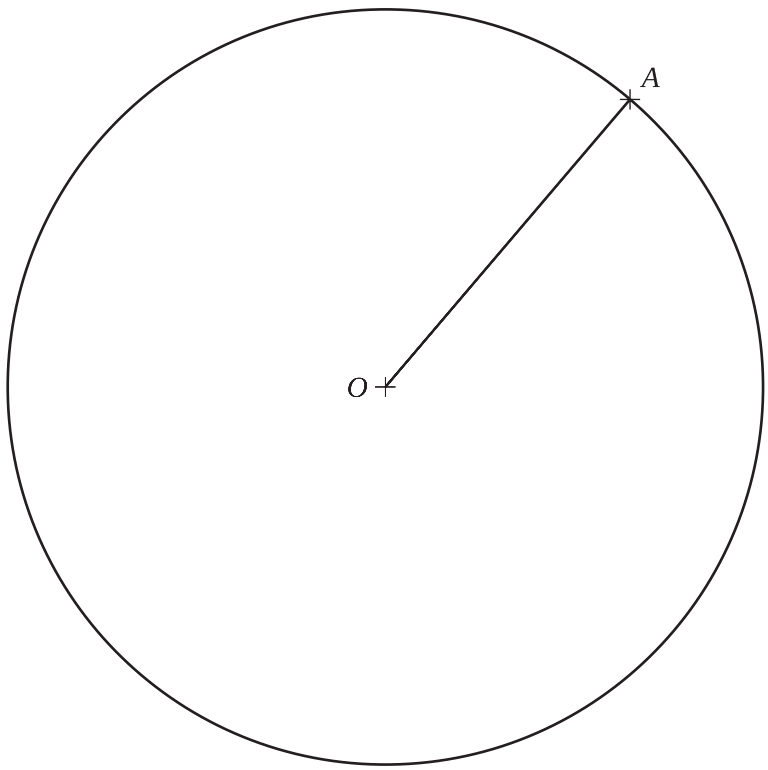
(a) On the diagram above, **using a straight edge and compasses only**, construct

(i) the bisector of angle ABC, [2]

(ii) the locus of points which are equidistant from A and from B. [2]

(b) Shade the region inside the triangle which is nearer to A than to B **and** nearer to AB than to BC. [1]

9



The point A lies on the circle centre O, radius 5 cm.

(a) **Using a straight edge and compasses only,** construct the perpendicular bisector of the line OA. [2]

(b) The perpendicular bisector meets the circle at the points C and D.

Measure and write down the size of the angle AOD.

Answer(b) Angle AOD = ... [1]

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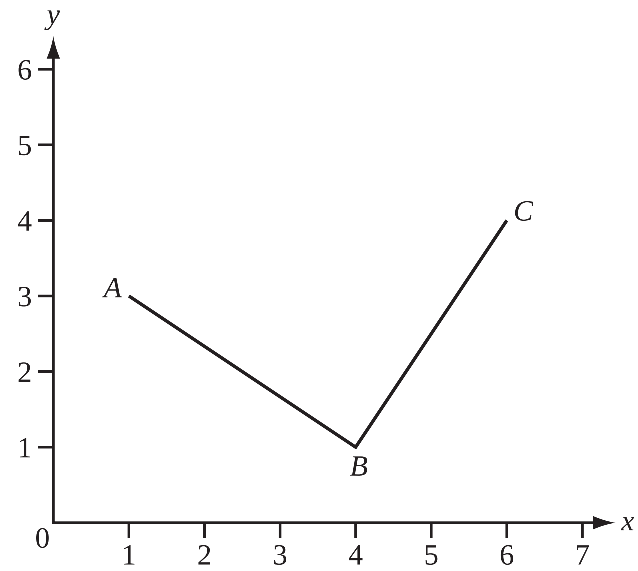
19



$A(1, 3)$, $B(4, 1)$ and $C(6, 4)$ are shown on the diagram.

(a) **Using a straight edge and compasses only,** construct the angle bisector of angle ABC. [2]

(b) Work out the equation of the line BC.

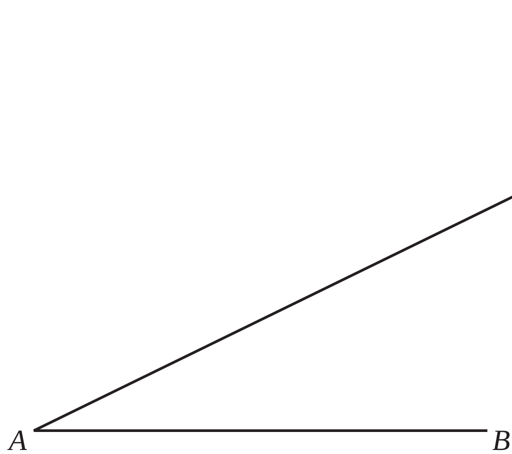
Answer(b) .... [3]

(c) ABC forms a **right-angled isosceles** triangle of area $6.5\,\text{cm}^2$.

Calculate the length of AB.

Answer(c) AB = ... cm [2]

9

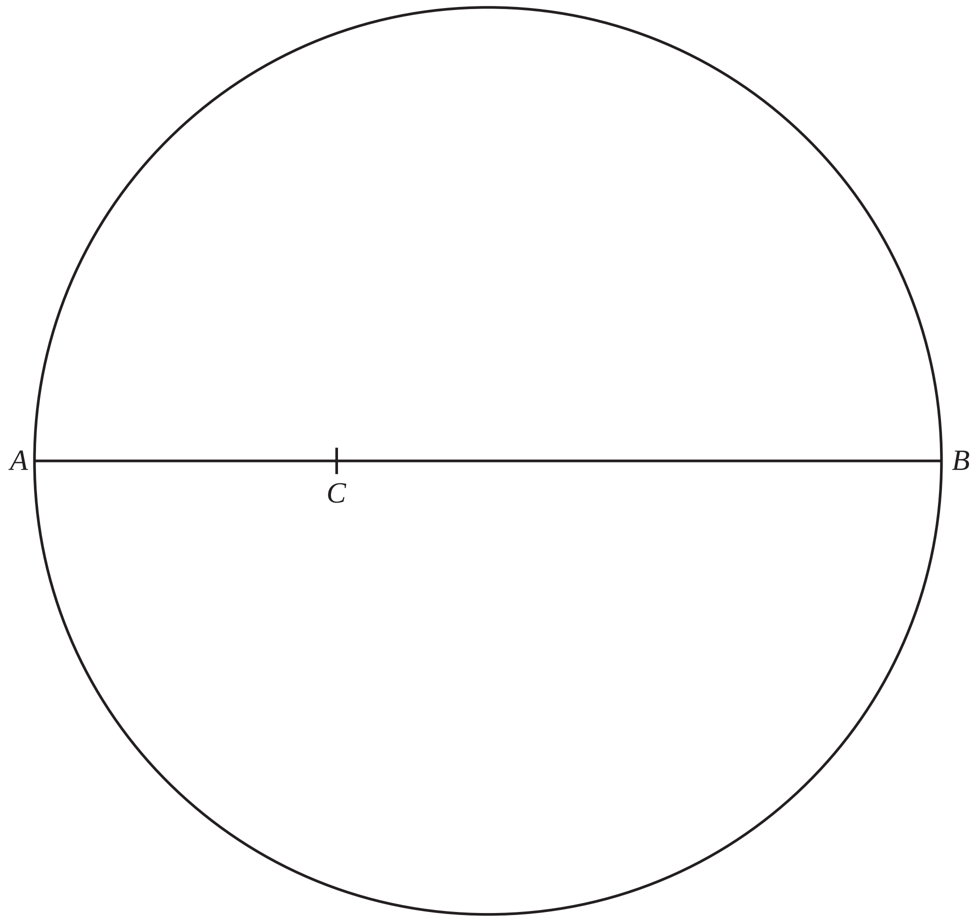


(a) The point C lies on AD and angle $ABC = 67°$.

Draw accurately the line BC. [1]

(b) **Using a straight edge and compasses only**, construct the perpendicular bisector of AB.
Show clearly all your construction arcs. [2]

17



AB is the diameter of a circle.
C is a point on AB such that $AC = 4$ cm.

(a) **Using a straight edge and compasses only**, construct

(i) the locus of points which are equidistant from A and from B, [2]

(ii) the locus of points which are 4 cm from C. [1]

(b) Shade the region in the diagram which is

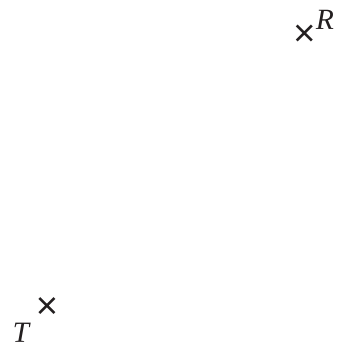
- nearer to B than to A

and

- less than 4 cm from C. [1]

9) November 2012 V3

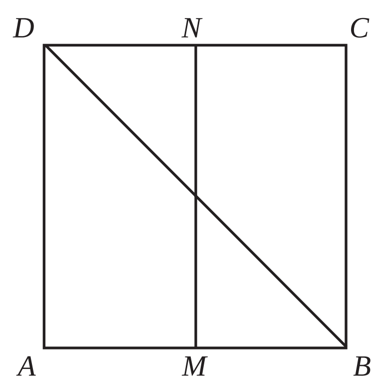
6



Using a straight edge and compasses only, construct the locus of points which are equidistant from R and from T. [2]

10) June 2013 V1

7



The diagram shows a square $ABCD$.
M is the midpoint of AB and N is the midpoint of CD.

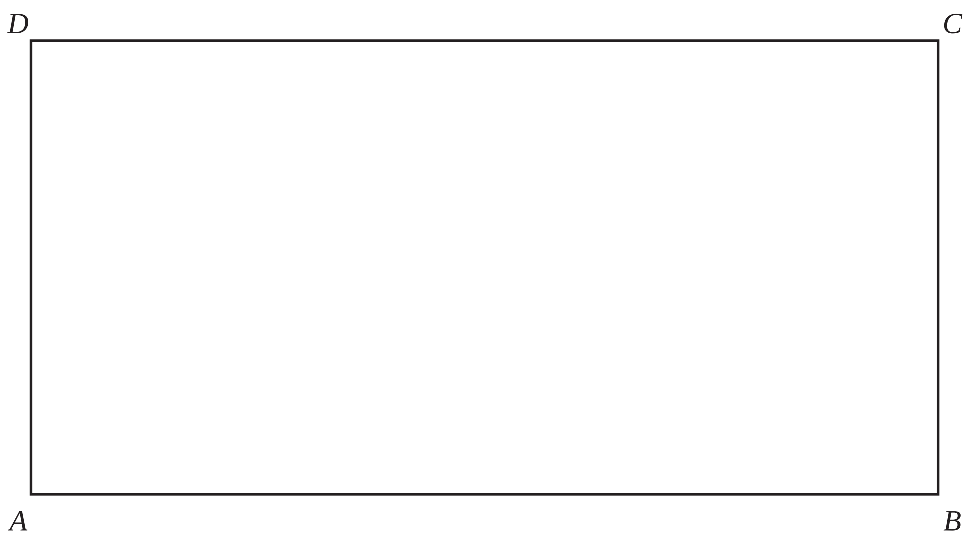
(a) Complete the statement.

The line MN is the locus of points inside the square which are

.... [1]

(b) Shade the region inside the square containing points which are nearer to AB than to BC **and** nearer to A than to B. [1]

19



Scale: 1 cm to 8 m

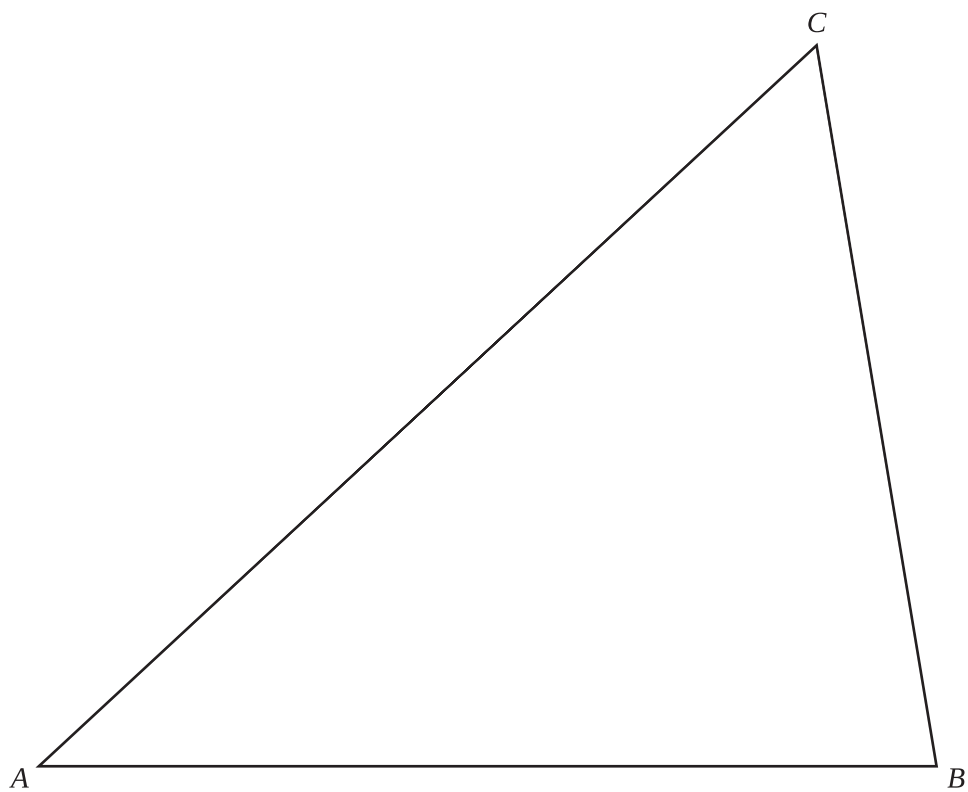
The rectangle *ABCD* is a scale drawing of a rectangular football pitch.
The scale used is 1 centimetre to represent 8 metres.

(a) Construct the locus of points 40 m from *A* and inside the rectangle. [2]

(b) Using a straight edge and compasses only, construct the perpendicular bisector of *DB*. [2]

(c) Shade the region on the football pitch which is more than 40 m from *A* **and** nearer to *D* than to *B*. [1]

20



(a) **In this part, use a straight edge and compasses only and show your construction arcs.**

Construct accurately

(i) the bisector of angle *B*, [2]

(ii) the locus of points equidistant from *B* and from *C*. [2]

(b) Shade the region inside triangle *ABC* containing the points which are

nearer to *BC* than to *BA* **and** nearer to *C* than to *B*. [1]

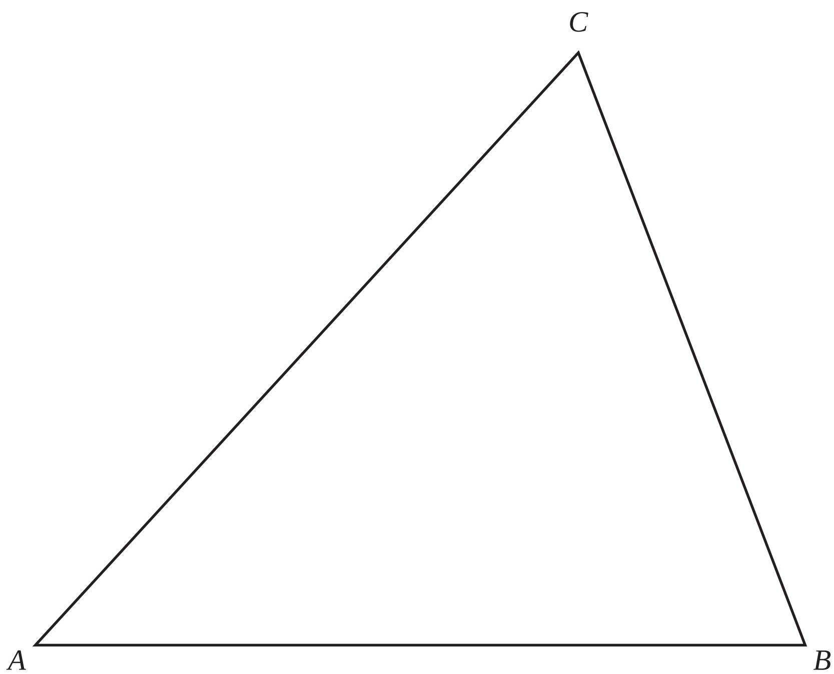
13) November 2013 V3

15

(a) Construct the locus of all the points which are 3 cm from vertex A **and** outside the rectangle. [2]

(b) Construct, **using a straight edge and compasses only**, one of the lines of symmetry of the rectangle. [2]

15



(a) **Using compasses and straight edge only**, construct

(i) the perpendicular bisector of AC, [2]

(ii) the bisector of angle ACB. [2]

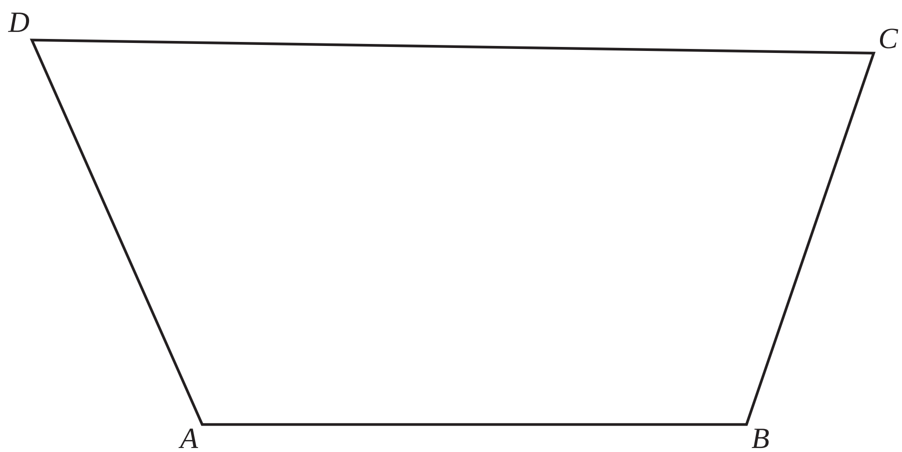
(b) Shade the region inside the triangle which is

- nearer to A than to C

and

- nearer to AC than to BC. [1]

20 The diagram shows the plan, *ABCD*, of a park.
The scale is 1 centimetre represents 20 metres.



Scale: 1 cm to 20 m

(a) Find the actual distance *BC*.

Answer(a) .... m [2]

(b) A fountain, *F*, is to be placed

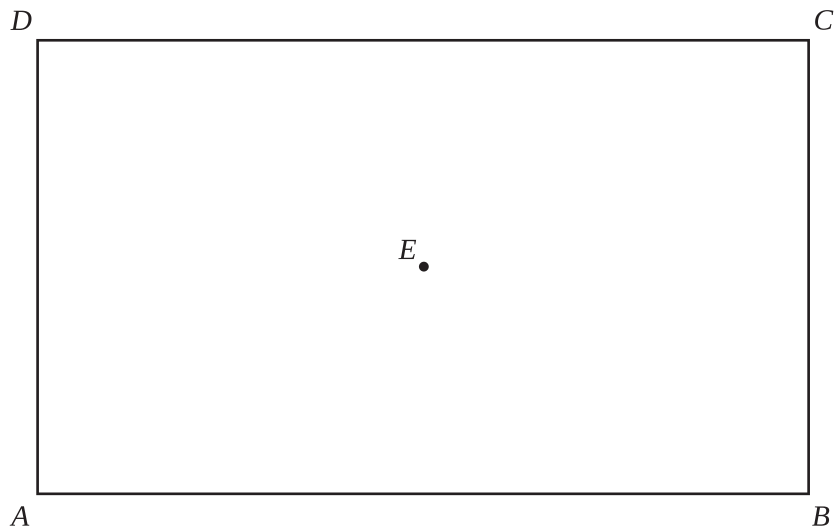
- 160 m from *C*

and

- equidistant from *AB* and *AD*

On the diagram, **using a ruler and compasses only**, construct and mark the position of *F*
Leave in all your construction lines. [5]

12



(a) Draw the locus of the points which are 3cm from E. [1]

(b) **Using a straight edge and compasses only**, construct the bisector of angle DCB. [2]

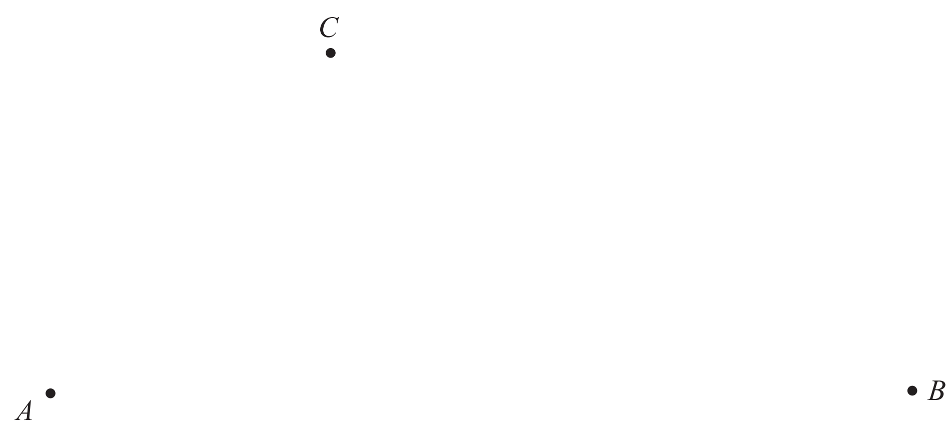
(c) Shade the region which is

- less than 3cm from E

and

- nearer to CB than to CD. [1]

19 The diagram shows the positions of three points A, B and C.



(a) Draw the locus of points which are 4 cm from C. [1]

(b) **Using a straight edge and compasses only**, construct the locus of points which are equidistant from A and B. [2]

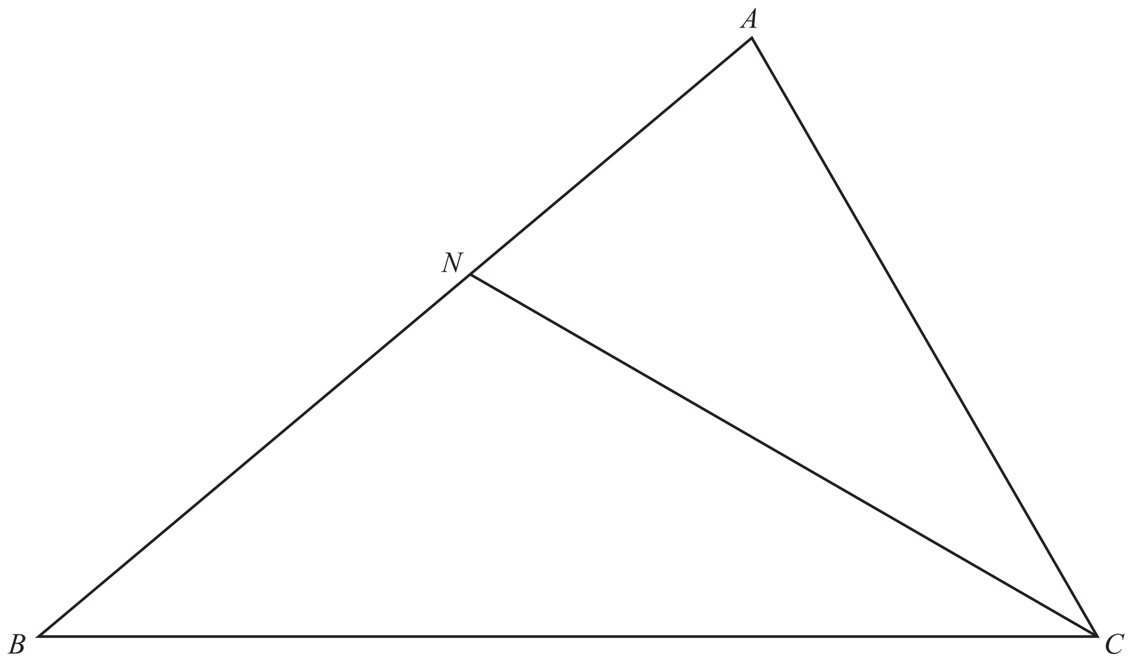
(c) Shade the region which is

- less than 4 cm from C

and

- nearer to B than to A. [1]

6



In triangle ABC, CN is the bisector of angle ACB.

(a) **Using a ruler and compasses only**, construct the locus of points inside triangle ABC that are 5.7 cm from B. [1]

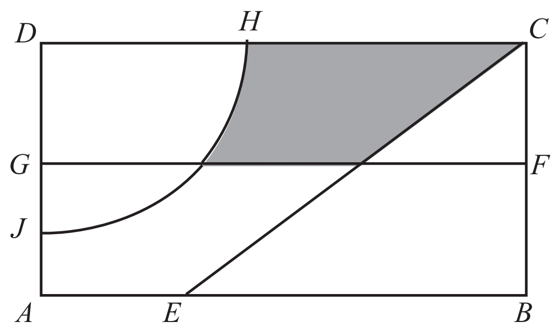
(b) Shade the region inside triangle ABC that is

- more than 5.7 cm from B

and

- nearer to BC than to AC. [1]

14



NOT TO SCALE

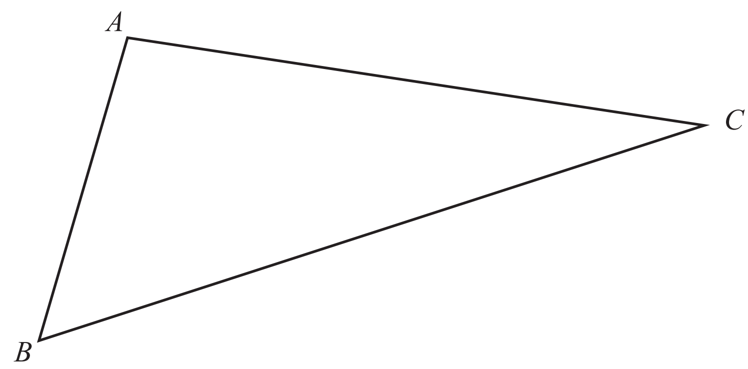
The diagram shows a rectangular garden divided into different areas.
FG is the perpendicular bisector of BC.
The arc HJ has centre D and radius 20 m.
CE is the bisector of angle DCB.

Write down two more statements using loci to describe the shaded region inside the garden.

The shaded region is

- nearer to C than to B
- ....
- .... [2]

17 The diagram shows triangle *ABC*.



(a) **Using a straight edge and compasses only**, construct the bisector of angle *ABC*. [2]

(b) Draw the locus of points **inside** the triangle that are 3 cm from *AC*. [1]

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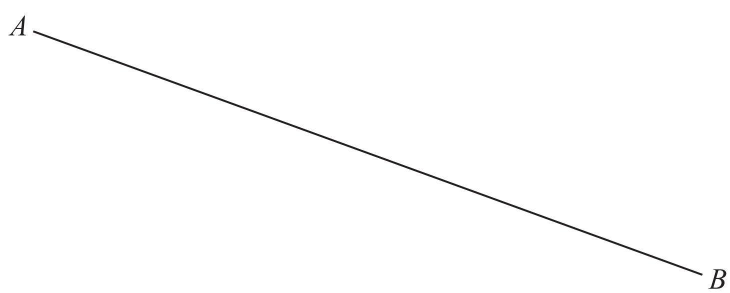
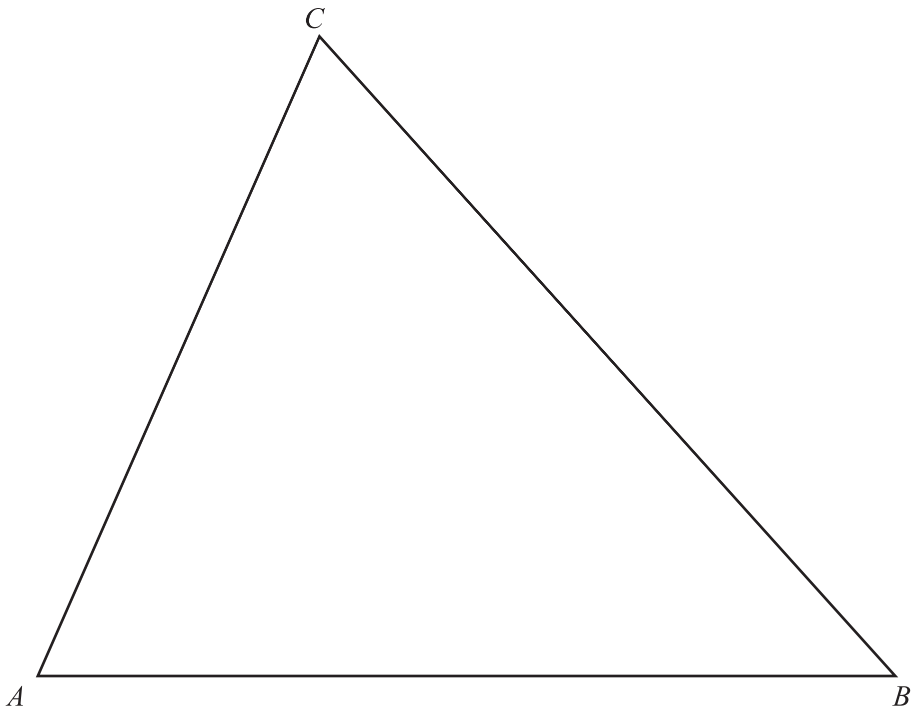
6 **Using a straight edge and compasses only**, construct the perpendicular bisector of the line AB.



[2]

22) November 2016 V1

17



(a) Construct the locus of points, inside the triangle, that are 5 cm from *B*. [1]

(b) Construct the locus of points, inside the triangle, that are equidistant from *AB* and *BC*. [2]

(c) Shade the region, inside the triangle, containing points that are

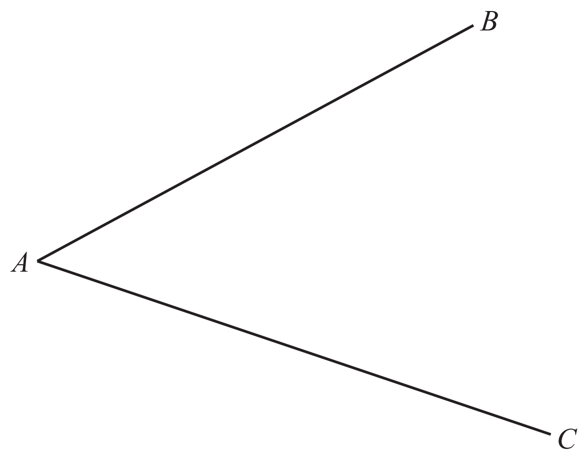
- more than 5 cm from *B*

and

- nearer to *AB* than to *BC*. [1]

23) November 2016 V2

11



(a) **Using compasses and a straight edge only**, construct the bisector of angle *BAC*. [2]

(b) Complete the statement.

The bisector of angle *BAC* is the locus of points that are ....

.... [1]

24) June 2018 V2

9 **Using a straight edge and compasses only**, construct the locus of points that are equidistant from *A* and *B*.

[2]

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Trigonometry

1) June 2010 V2

2 Calculate $3\sin 120° - 4(\sin 120°)^3$.

Answer .... [2]

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2) November 2011 V1

3 Write the following in order of size, **largest** first.

sin 158° cos 158° cos 38° sin 38°

Answer .... > .... > .... > .... [2]

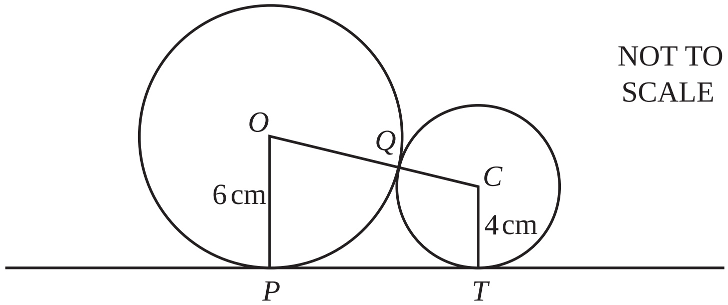
2*) November 2020 V2

25 Solve the equation $\tan x = 2$ for $0° \leqslant x \leqslant 360°$.

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

3) June 2010 V2

11



Two circles, centres O and C, of radius 6 cm and 4cm respectively, touch at Q
PT is a tangent to both circles.

(a) Write down the distance OC

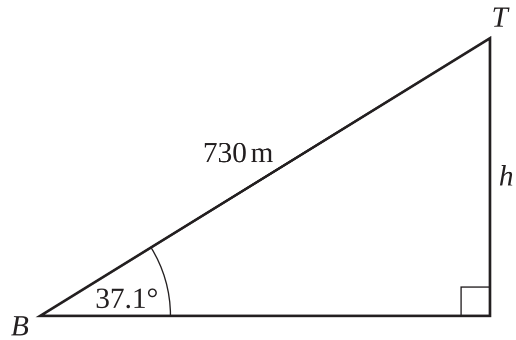
Answer(a) OC= ………………………………… cm [1]

(b) Calculate the distance PT.

Answer(b) PT= ………………………………… cm [3]

4) June 2010 V2

12 The diagram represents the ski lift in Queenstown New Zealand.



NOT TO SCALE

(a) The length of the cable from the bottom, *B*, to the top, *T*, is 730 metres.

The angle of elevation of *T* from *B* is 37.1°.

Calculate the change in altitude, *h* metres, from the bottom to the top.

Answer(a) .... m [2]

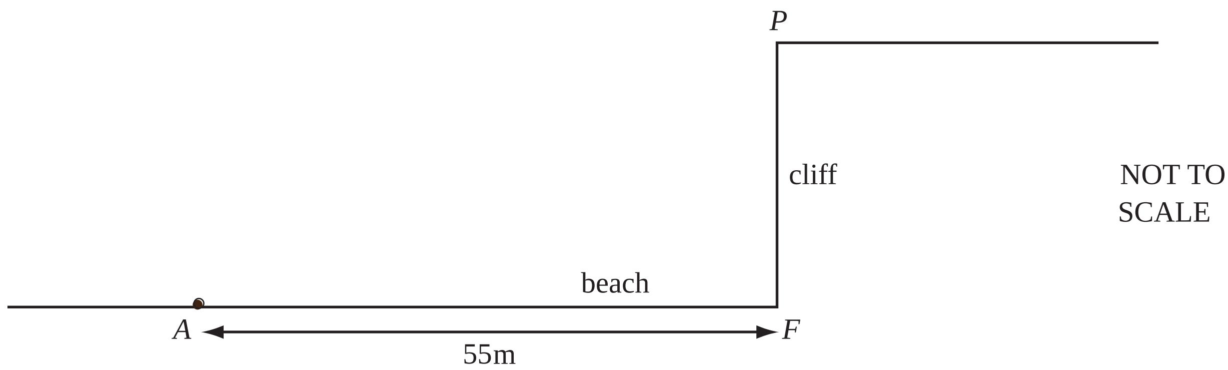
(b) The lift travels along the cable at 3.65 metres per second.

Calculate how long it takes to travel from *B* to *T*.

Give your answer in minutes and seconds.

Answer(b) .... min .... s [2]

11



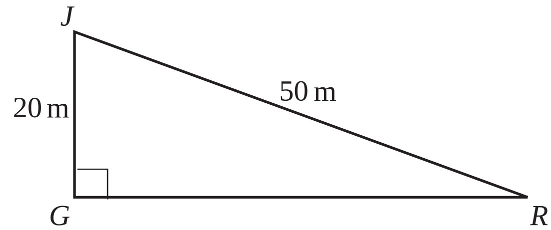
The diagram shows a point P at the top of a cliff.
The point F is on the beach and vertically below P.
The point A is 55m from F, along the horizontal beach.
The angle of elevation of P from A is 17°.

Calculate PF, the height of the cliff.

Answer PF = ... m [3]

6) November 2010 V2

5



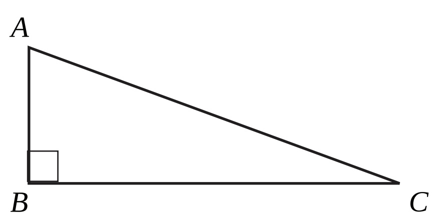
NOT TO
SCALE

JGR is a right-angled triangle. $JR = 50$m and $JG = 20$m.
Calculate angle *JRG*.

Answer Angle $JRG =$ .... [2]

7) June 2011 V2

1 In the right-angled triangle *ABC*, $\cos C = \frac{4}{5}$. Find angle *A*



NOT TO
SCALE

Answer Angle $A =$ .... [2]

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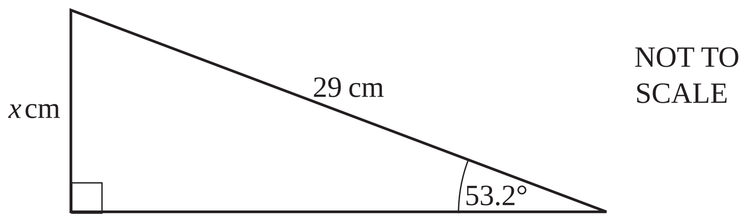
8) June 2012 V1

5



Calculate the value of x.

Answer x = ... [2]

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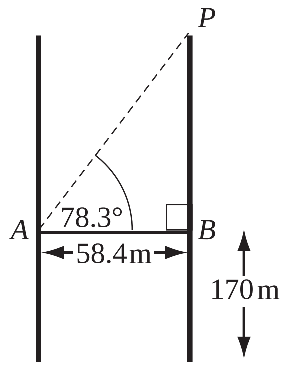
9



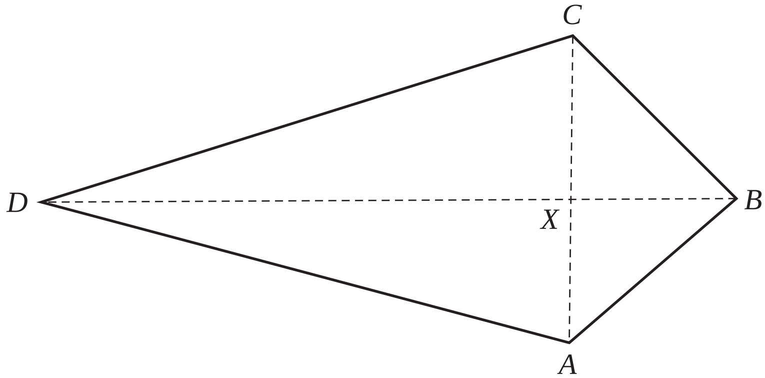
NOT TO SCALE

The line AB represents the glass walkway between the Petronas Towers in Kuala Lumpur.
The walkway is 58.4 metres long and is 170 metres above the ground.
The angle of elevation of the point P from A is 78.3°.

Calculate the height of P above the ground.

Answer .... m [3]

21



NOT TO SCALE

ABCD is a kite.
The diagonals *AC* and *BD* intersect at *X*.
$AC = 12$ cm, $BD = 20$ cm and $DX : XB = 3 : 2$.

(a) Calculate angle *ABC*.

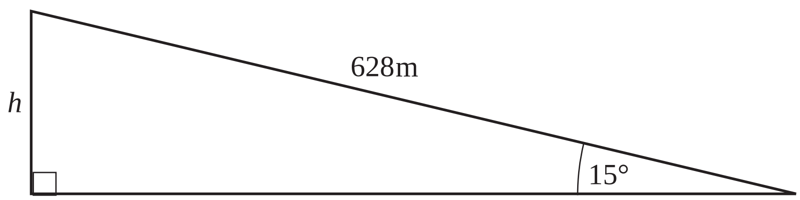
Answer(a) Angle *ABC* = ... [3]

(b) Calculate the area of the kite.

Answer(b) .... cm^2 [2]

11) November 2013 V3

10



NOT TO SCALE

Calculate the length h.
Give your answer correct to 2 significant figures.

Answer h = ... m [3]

12) June 2014 V1

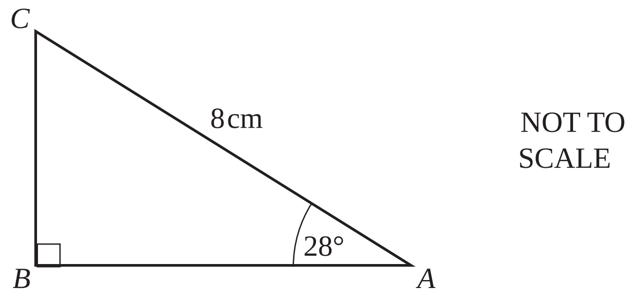
11 A triangle has sides of length 2 cm, 8 cm and 9 cm.

Calculate the value of the largest angle in this triangle.

Answer .... [4]

13) June 2014 V2

4

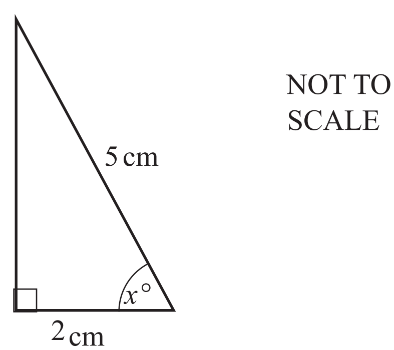


Calculate the length of AB.

Answer AB = ... cm [2]

14) June 2015 V3

3



Calculate the value of x.

Answer x = ... [2]

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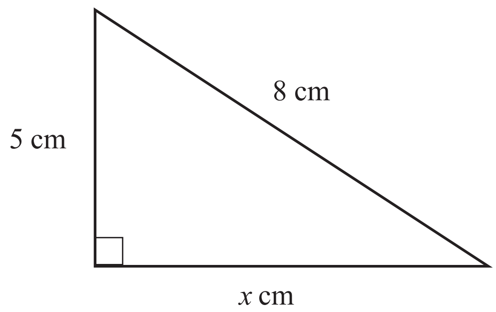
11

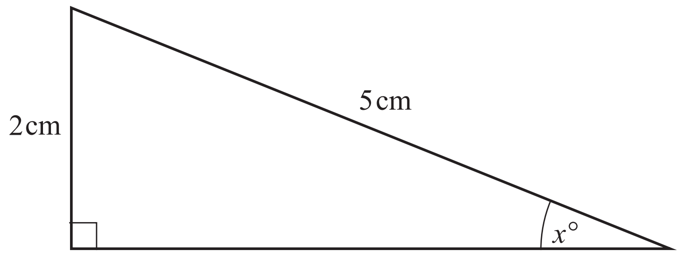


Calculate the value of x.

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

16) November 2015 V3

9

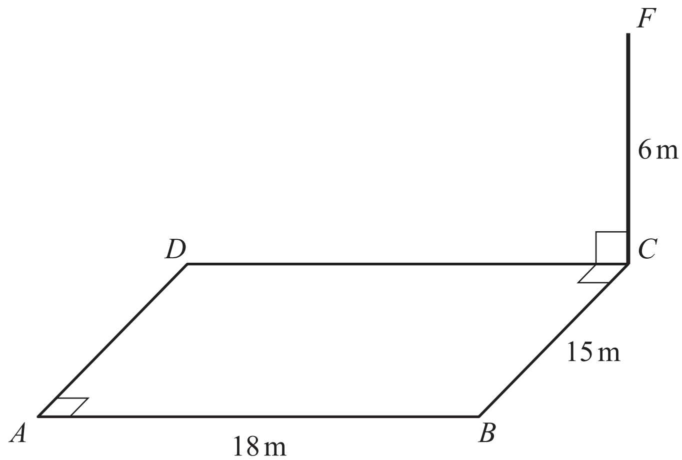


NOT TO SCALE

Calculate the value of x.

Answer x = ... [2]

18



NOT TO SCALE

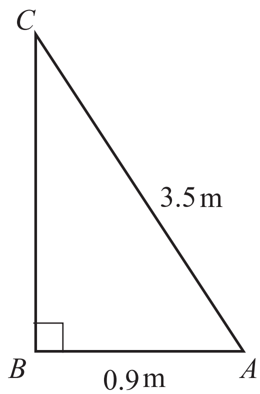
The diagram shows a rectangular playground *ABCD* on horizontal ground.
A vertical flagpole *CF*, 6 metres high, stands in corner *C*.
AB = 18 m and *BC* = 15 m.

Calculate the angle of elevation of *F* from *A*.

Answer .... [4]

18) March 2016 V2

3



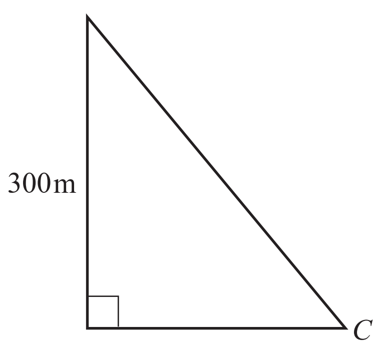
NOT TO SCALE

Calculate angle BAC.

Angle BAC = ... [2]

19) November 2016 V2

9 From the top of a building, 300 metres high, the angle of depression of a car, C, is 52°.



NOT TO SCALE

Calculate the horizontal distance from the car to the base of the building.

.... m [3]

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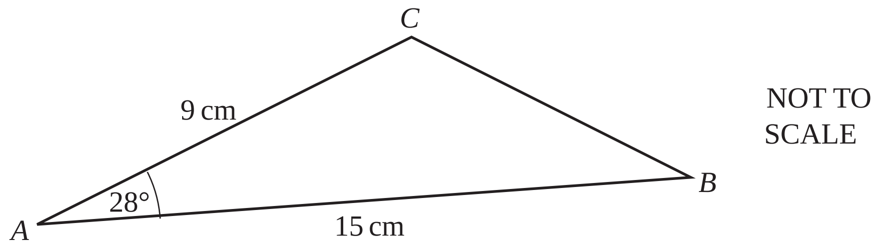
20) June 2012 V3

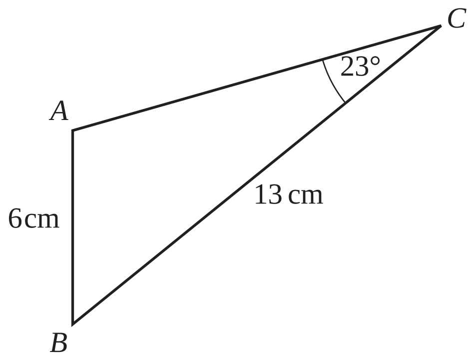
6



Calculate the area of triangle *ABC*.

Answer .... cm^2 [2]

18



NOT TO SCALE

In triangle ABC, $AB = 6\text{cm}$, $BC = 13\text{cm}$ and angle $ACB = 23°$.
Calculate angle BAC, which is obtuse.

Answer Angle BAC = ... [4]

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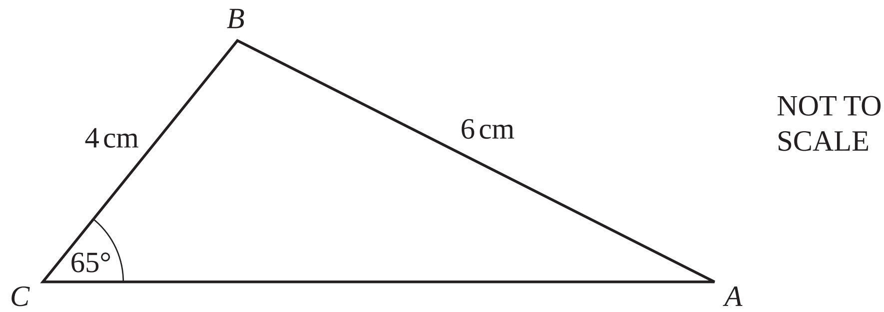
21



In triangle *ABC*, *AB* = 6 cm, *BC* = 4 cm and angle *BCA* = 65°.

Calculate

(a) angle *CAB*,

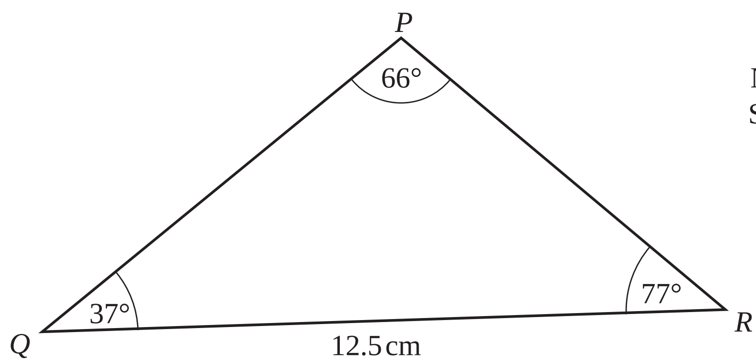
Answer(a) Angle *CAB* = ... [3]

(b) the area of triangle *ABC*.

Answer(b) .... cm^2 [3]

23) June 2014 V3

14



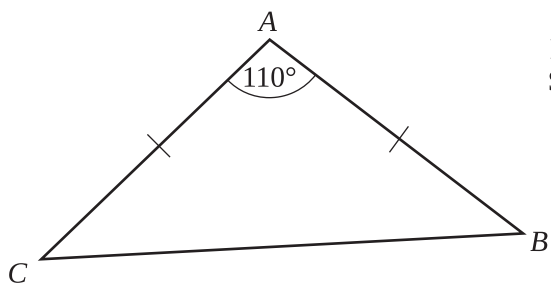
NOT TO
SCALE

Calculate *PR*

Answer PR = ... cm [3]

24) November 2014 V2

13



NOT TO SCALE

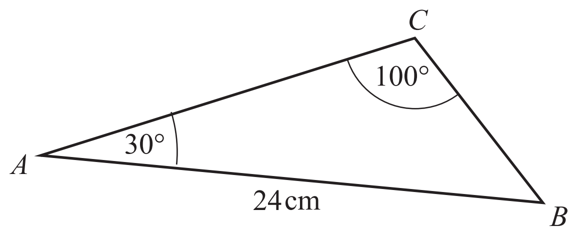
Triangle ABC is isosceles with $AB = AC$
Angle $BAC = 110°$ and the area of the triangle is $85\,cm^2$.

Calculate AC

Answer AC = ... cm [3]

25) June 2015 V3

11

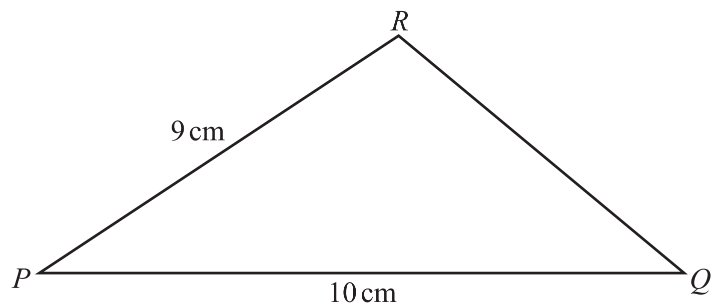


NOT TO SCALE

Use the sine rule to calculate *BC*.

Answer BC = ... cm [3]

20



NOT TO SCALE

The area of triangle PQR is $38.5\ \text{cm}^2$.

Calculate the length QR.

Answer QR = ... cm [6]

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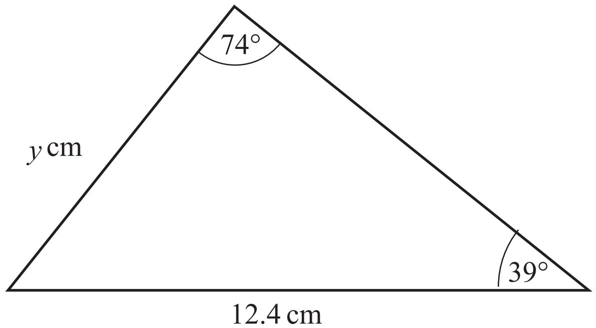
27) November 2015 V2

13



NOT TO SCALE

Calculate the value of y.

Answer y = ... [3]

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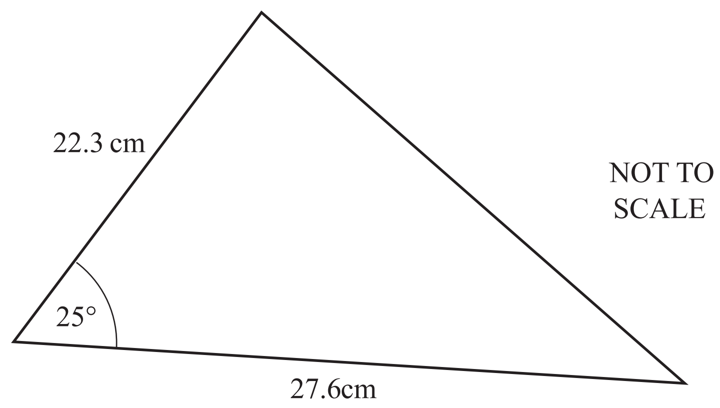
28) March 2016 V2

7



Calculate the area of this triangle.

cm^2 [2]

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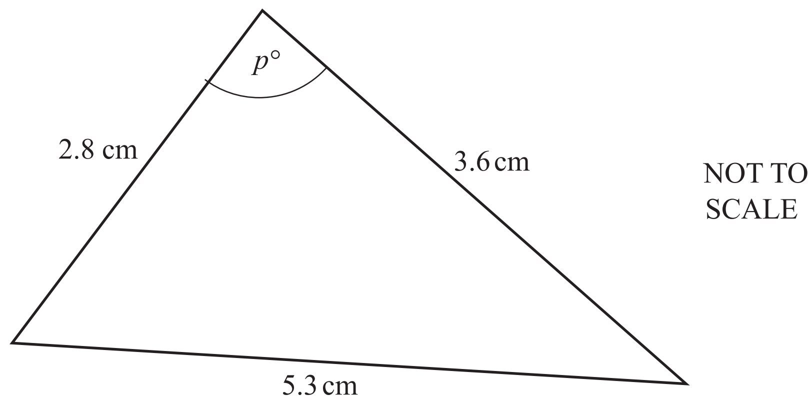
15



Find the value of p.

p = ... [4]

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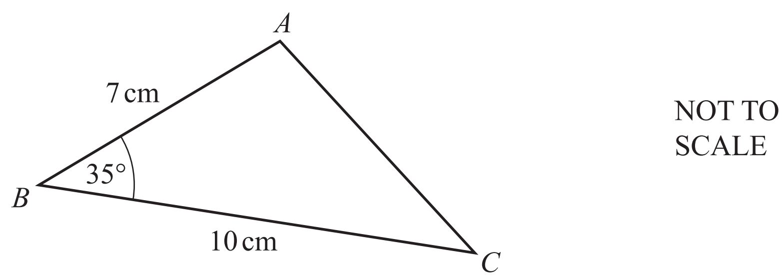
26



(a) Calculate the area of triangle *ABC*.

.... cm^2 [2]

(b) Calculate the length of *AC*.

AC = ... cm [4]

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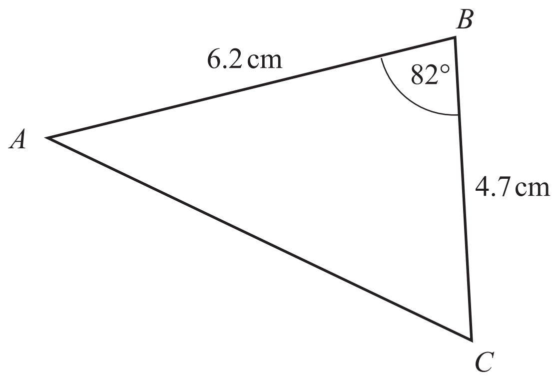
31) November 2016 V3

21 **(a)**

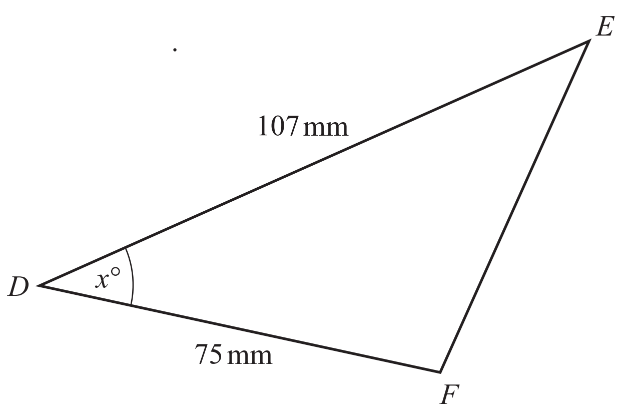


NOT TO SCALE

Calculate the area of triangle ABC.

.... cm^2 [2]

(b)



NOT TO SCALE

The area of triangle DEF is $2050\,mm^2$

Work out the value of x

x = ... [2]

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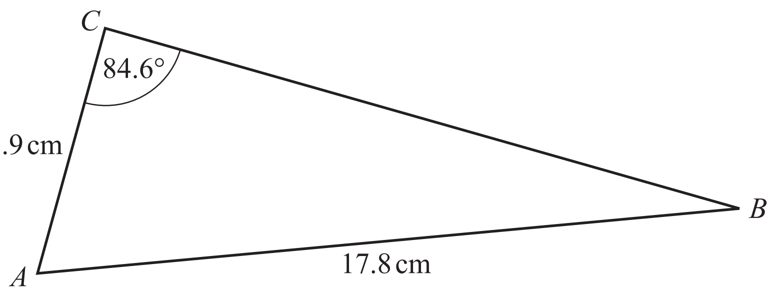
32) June 2018 V1

14



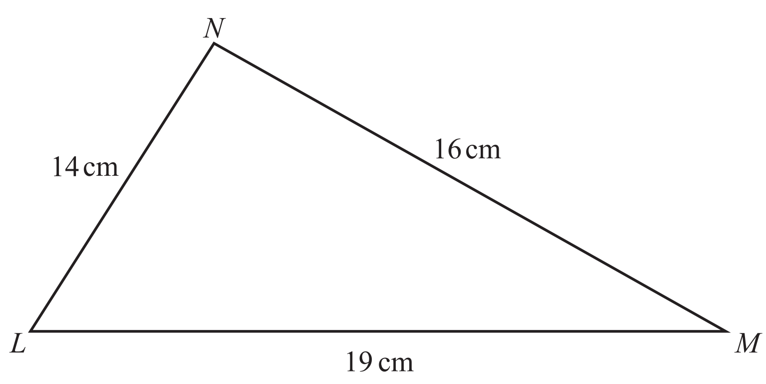
NOT TO SCALE

Use the sine rule to find angle *ABC*.

Angle *ABC* = ... [3]

33) June 2018 V1

19



NOT TO SCALE

Calculate angle *LMN*.

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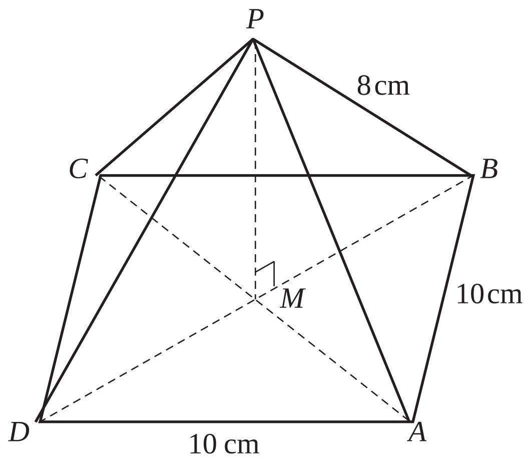
Angle *LMN* = ... [4]

19



NOT TO SCALE

The diagram represents a pyramid with a square base of side 10 cm.

The diagonals AC and BD meet at M P is vertically above M and PB = 8cm.

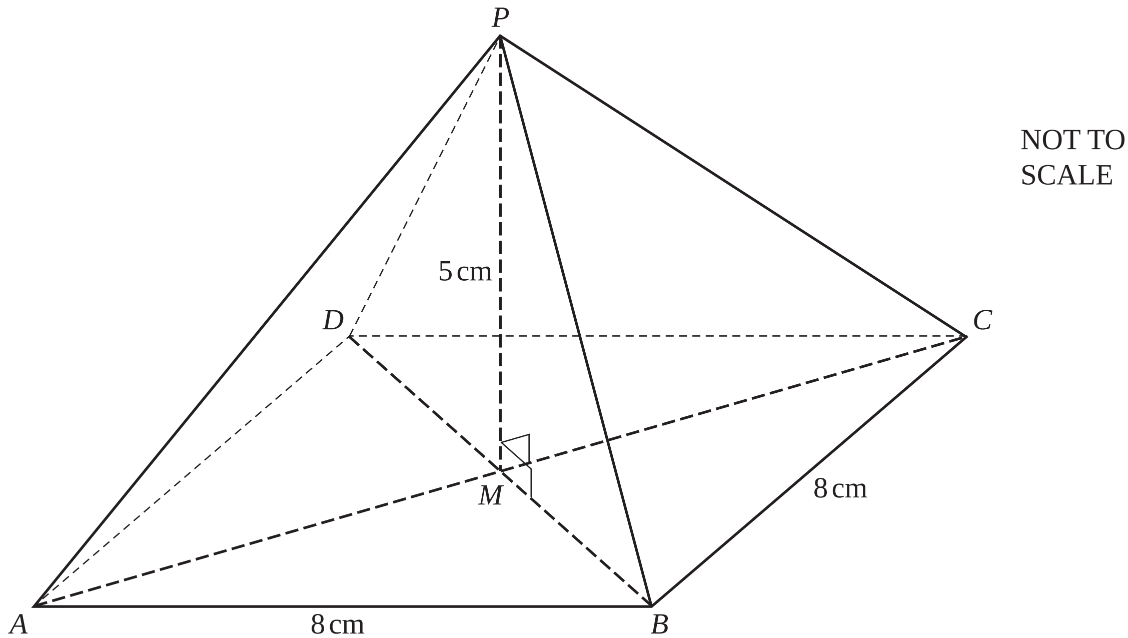
(a) Calculate the length of BD.

Answer(a) BD = ... cm [2]

(b) Calculate MP, the height of the pyramid.

Answer(b) MP = ... cm [3]

21



The diagram shows a pyramid on a square base *ABCD*.
The diagonals of the base, *AC* and *BD*, intersect at *M*.
The sides of the square are 8 cm and the vertical height of the pyramid, *PM*, is 5 cm.

Calculate

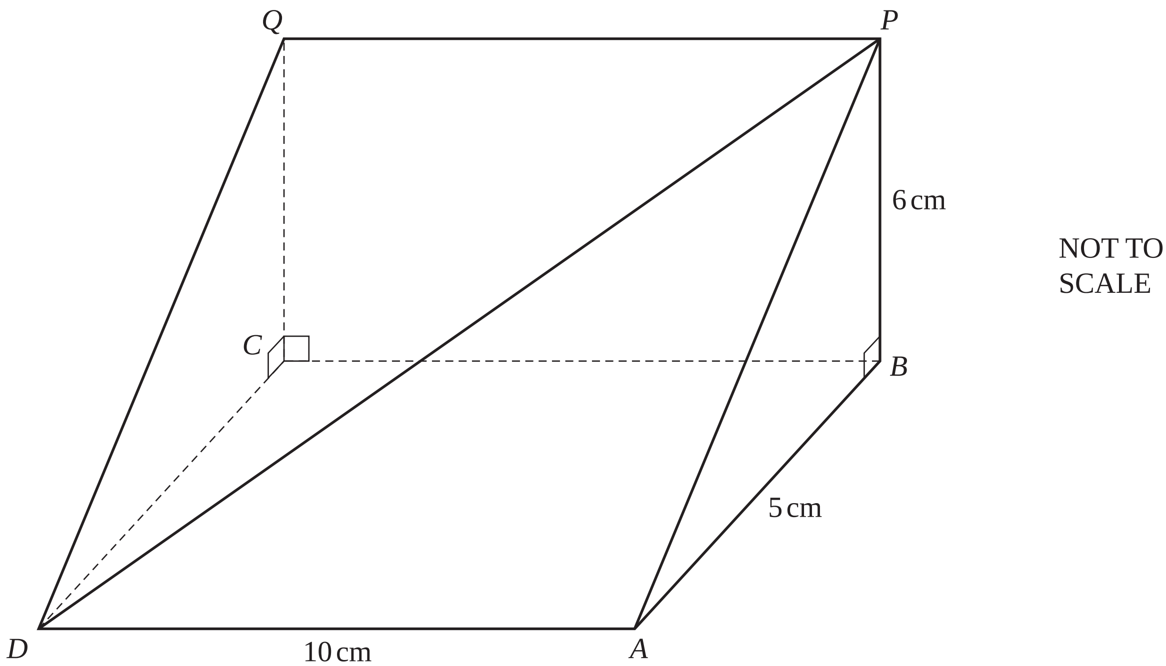
(a) the length of the edge *PB*,

Answer(a) PB = ... cm [3]

(b) the angle between *PB* and the base *ABCD*.

Answer(b) .... [3]

24



The diagram shows a triangular prism.
ABCD is a horizontal rectangle with *DA* = 10 cm and *AB* = 5 cm.
BCQP is a vertical rectangle and *BP* = 6 cm.

Calculate

(a) the length of *DP*,

Answer(a) DP = ... cm [3]

(b) the angle between *DP* and the horizontal rectangle *ABCD*.

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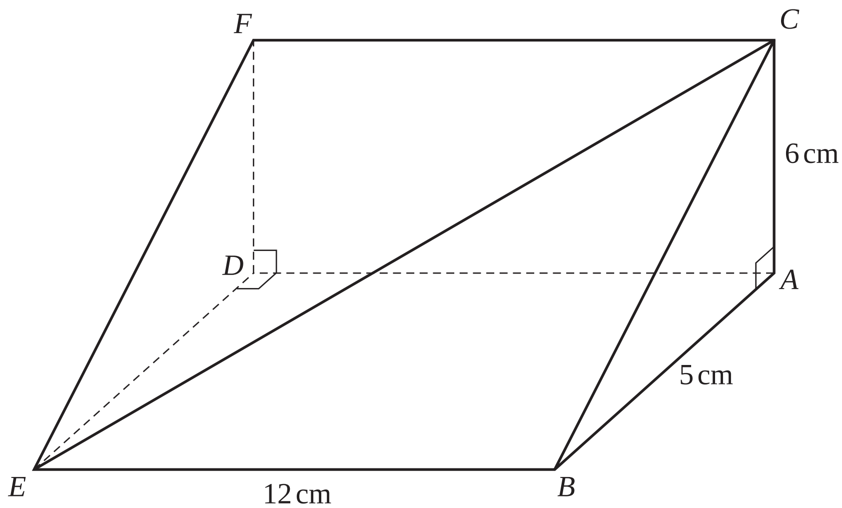
Answer(b) .... [3]

23



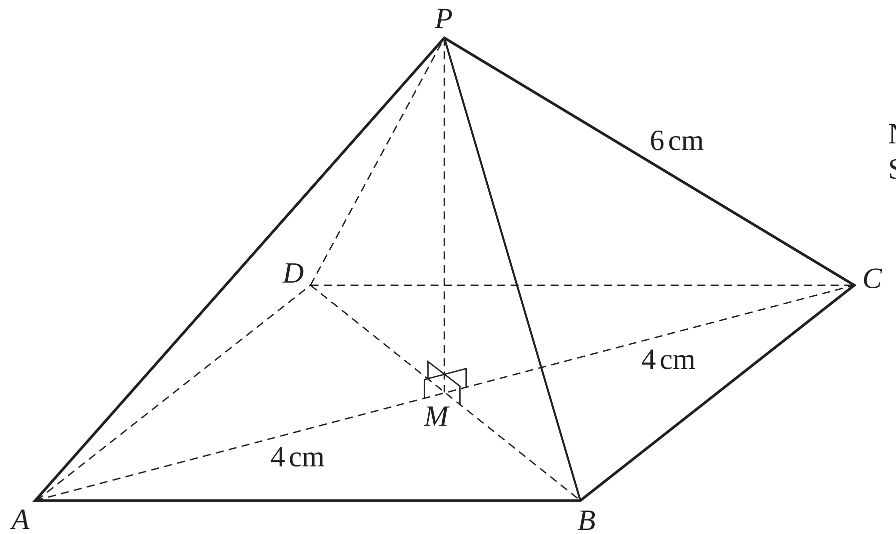
NOT TO SCALE

The diagram shows a triangular prism of length 12 cm.
Triangle ABC is a cross section of the prism.
Angle $BAC = 90°$, $AC = 6$ cm and $AB = 5$ cm.

Calculate the angle between the line CE and the base $ABED$.

Answer .... [4]

21



The diagram shows a pyramid on a square base *ABCD* with diagonals, *AC* and *BD*, of length 8 cm.
AC and *BD* meet at *M* and the vertex, *P*, of the pyramid is vertically above *M*.
The sloping edges of the pyramid are of length 6 cm.

Calculate

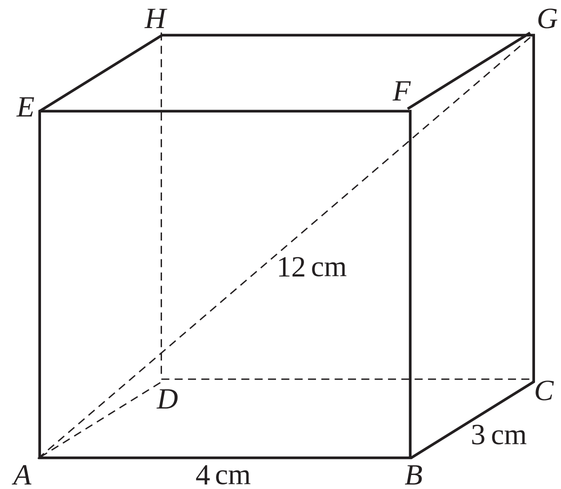
(a) the perpendicular height, *PM*, of the pyramid,

Answer(a) PM = ... cm [3]

(b) the angle between a sloping edge and the base of the pyramid.

Answer(b) .... [3]

16



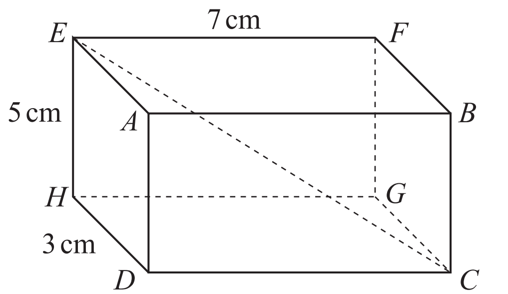
NOT TO SCALE

ABCDEFGH is a cuboid.
$AB = 4$ cm, $BC = 3$cm and $AG = 12$cm.

Calculate the angle that *AG* makes with the base *ABCD*.

Answer .... [4]

23



NOT TO SCALE

The diagram shows a cuboid.
$HD = 3$ cm, $EH = 5$ cm and $EF = 7$ cm.

Calculate

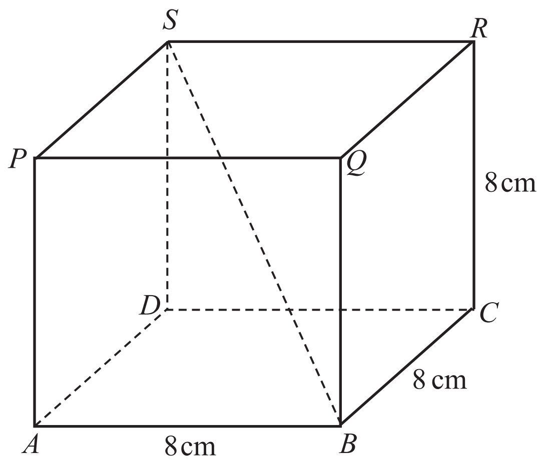
(a) the length CE,

CE = ... cm [4]

(b) the angle between CE and the base $CDHG$.

.... [3]

24



NOT TO SCALE

The diagram shows a cube of side length 8 cm.

(a) Calculate the length of the diagonal *BS*.

BS = ... cm [3]

(b) Calculate angle *SBD*.

Angle *SBD* = ... [2]

Bearing

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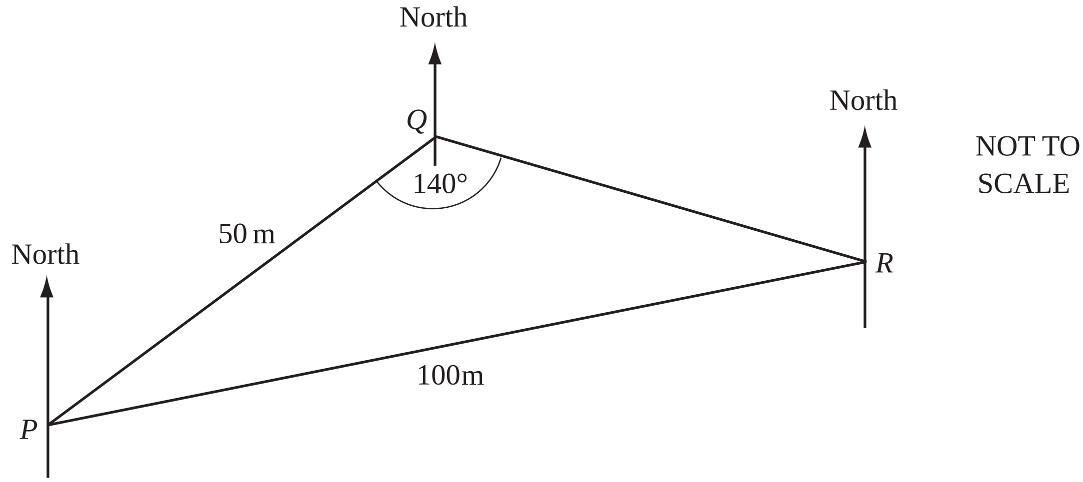
1) June 2010 V3

21



The diagram shows three points P, Q and R on horizontal ground.

$PQ = 50$ m, $PR = 100$ m and angle $PQR = 140°$.

(a) Calculate angle PRQ.

Answer(a) Angle PRQ = ... [3]

(b) The bearing of R from Q is 100°.

Find the bearing of P from R.

Answer(b) .... [2]

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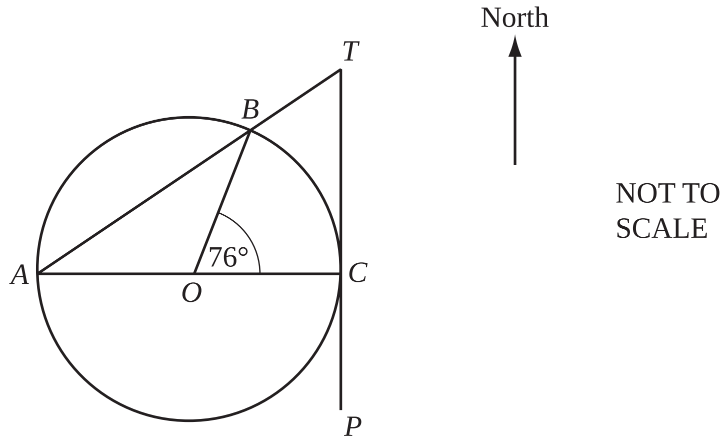
13



AOC is a diameter of the circle, centre *O*.
AT is a straight line that cuts the circle at *B*.
PT is the tangent to the circle at *C*.
Angle *COB* = 76°.

(a) Calculate angle *ATC*.

Answer(a) Angle *ATC* = ... [2]

(b) *T* is due north of *C*.

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

Answer(b) .... [2]

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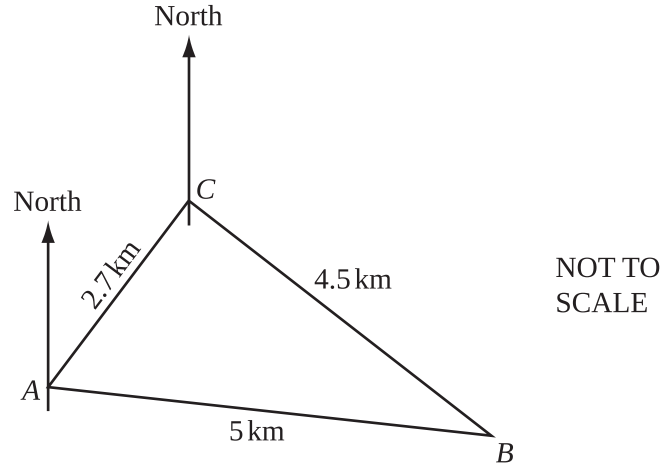
21



The diagram shows 3 ships A, B and C at sea.

$AB = 5$ km, $BC = 4.5$ km and $AC = 2.7$ km.

(a) Calculate angle ACB.
Show all your working.

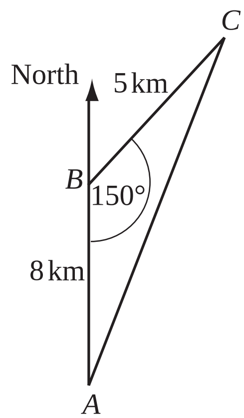
Answer(a) Angle ACB = ... [4]

(b) The bearing of A from C is 220°.

Calculate the bearing of B from C.

Answer(b) .... [1]

12



NOT TO SCALE

A helicopter flies 8 km due north from A to B. It then flies 5 km from B to C and returns to A.
Angle $ABC = 150°$.

(a) Calculate the area of triangle ABC.

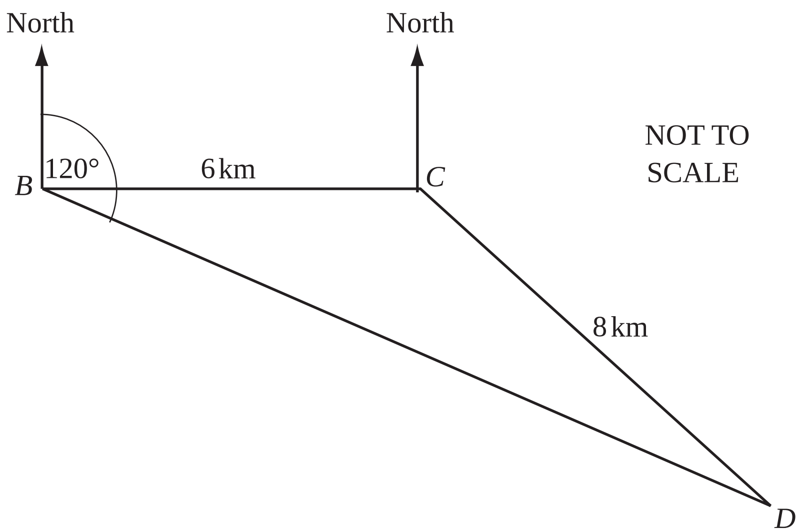
Answer(a) .... km^2 [2]

(b) Find the bearing of B from C.

Answer(b) .... [2]

5) November 2014 V1

16 A helicopter flies from its base B to deliver supplies to two oil rigs at C and D.
C is 6 km due east of B and the distance from C to D is 8 km.
D is on a bearing of 120° from B.



Find the bearing of D from C

Answer .... [5]

6) June 2018 V2

7 A and B are two towns on a map.
The bearing of A from B is 140°.

Work out the bearing of B from A.

.... [2]

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Solid Geometry

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2) June 2011 V1

8 Calculate the radius of a sphere with volume 1260 cm^3

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

Answer .... cm [3]

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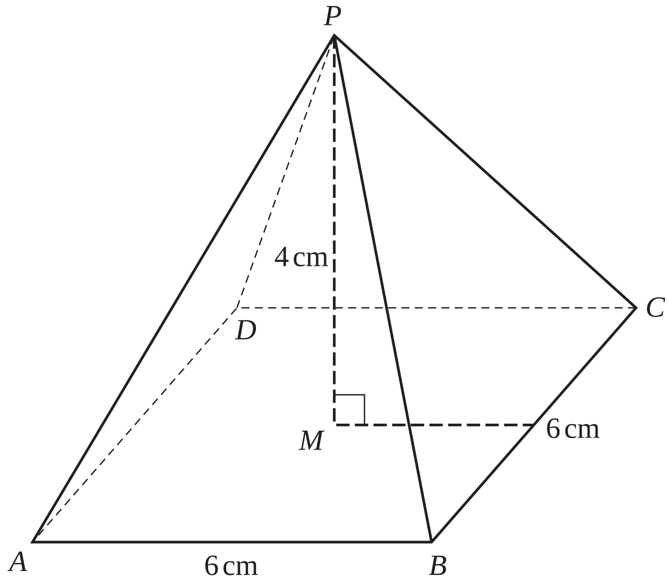
3) June 2011 V3

15 A cylinder has a height of 12 cm and a volume of 920 cm^3.

Calculate the radius of the base of the cylinder.

Answer .... cm [3]

21



NOT TO SCALE

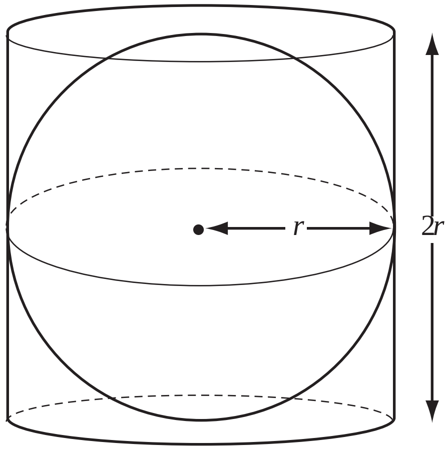
The diagram shows a pyramid with a square base *ABCD* of side 6 cm.

The height of the pyramid, *PM*, is 4 cm, where *M* is the centre of the base.

Calculate the total surface area of the pyramid.

Answer .... cm^2 [5]

14



NOT TO SCALE

The sphere of radius r fits exactly inside the cylinder of radius r and height $2r$.
Calculate the percentage of the cylinder occupied by the sphere.

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

Answer .... % [3]

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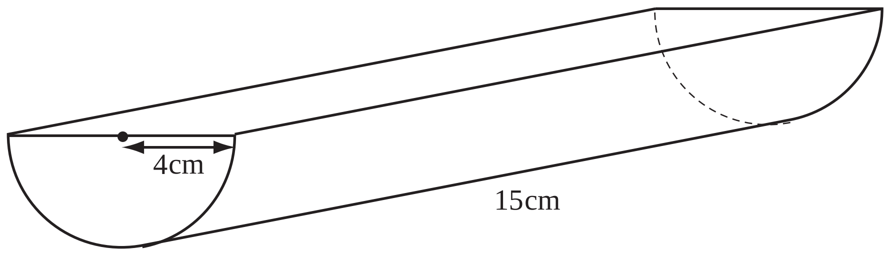
16



NOT TO SCALE

The diagram shows a **solid** prism of length 15 cm.
The cross-section of the prism is a semi-circle of radius 4 cm.

Calculate the total surface area of the prism.

Answer .... cm^2 [4]

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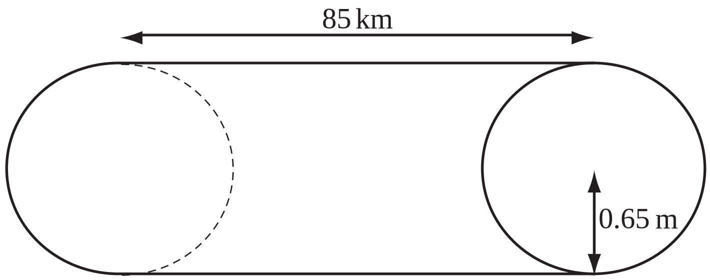
8



A water pipeline in Australia is a cylinder with **radius** 0.65 **metres** and length 85 **kilometres**.

Calculate the volume of water the pipeline contains when it is full.
Give your answer in cubic metres.

Answer .... m^3 [3]

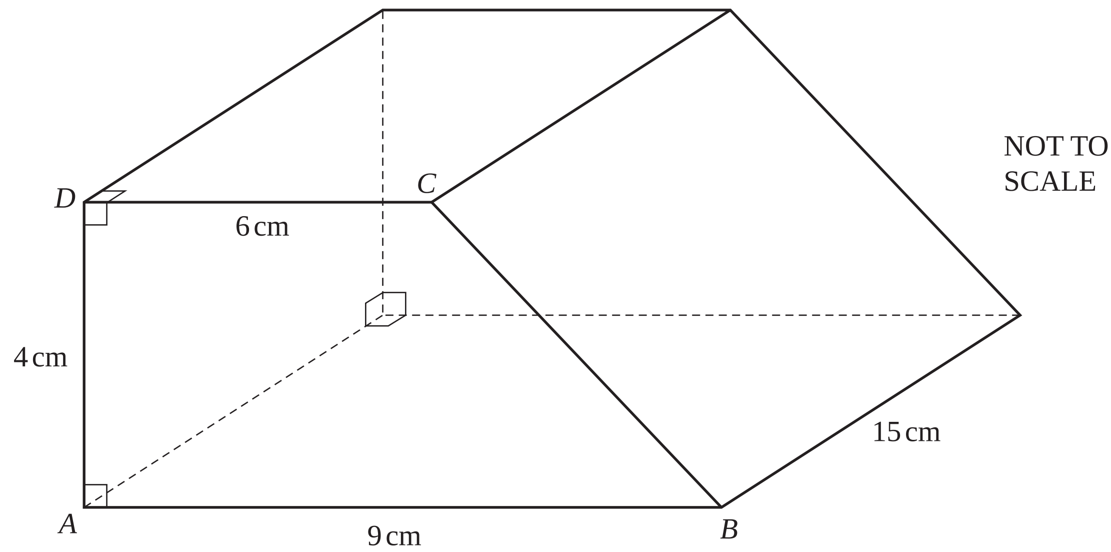
15 A sphere has a volume of 80 cm^3.

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

Answer .... cm [3]

10) June 2013 V1

26



The diagram shows a solid prism of length 15 cm.
The cross section of the prism is the trapezium *ABCD*.
Angle *DAB* = angle *CDA* = 90°.
AB = 9 cm, *DC* = 6 cm and *AD* = 4 cm.

Calculate the **total** surface area of the prism.

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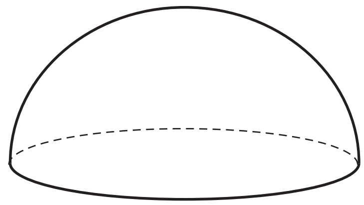
Answer .... cm^2 [5]

18 The diagram shows a solid hemisphere.



The **total** surface area of this hemisphere is 243π
The volume of the hemisphere is $k\pi$

Find the value of k

[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Answer k = ... [4]

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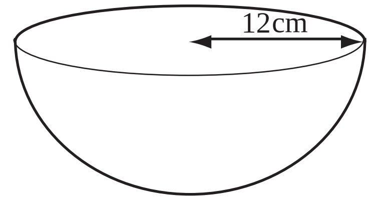
12) November 2013 V2

8 A **hemisphere** has a radius of 12 cm.



Calculate its volume.

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

Answer .... cm^3 [2]

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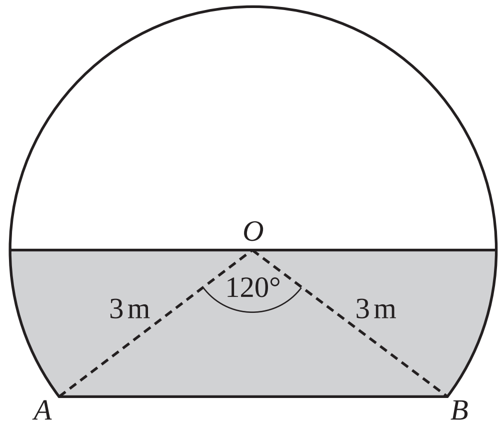
16 The diagram shows the entrance to a tunnel.
The circular arc has a radius of 3 m and centre *O*.
AB is horizontal and angle *AOB* = 120°.



NOT TO SCALE

During a storm the tunnel filled with water, to the level shown by the shaded area in the diagram.

(a) Calculate the shaded area.

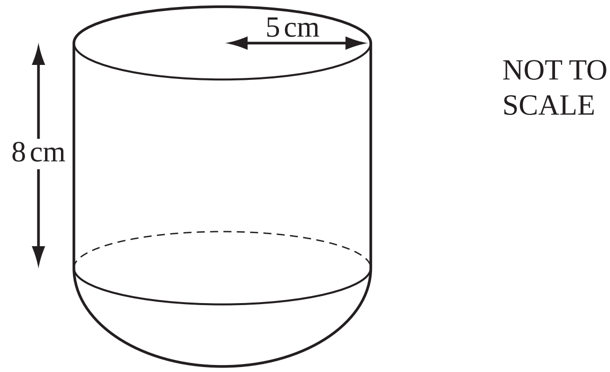
Answer(a) .... m^2 [4]

(b) The tunnel is 50 m long.

Calculate the volume of water in the tunnel.

Answer(b) .... m^3 [1]

17 The diagram shows a child's toy.

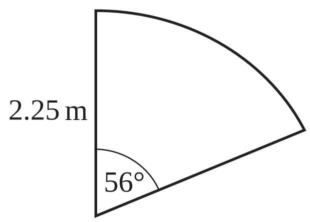


The shape of the toy is a cylinder of radius 5 cm and height 8 cm on top of a hemisphere of radius 5 cm.

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

Answer .... cm^3 [5]

14



The diagram shows a sand pit in a child's play area.
The shape of the sand pit is a sector of a circle of radius 2.25 m and sector angle 56°.

(a) Calculate the area of the sand pit.

Answer(a) .... m^2 [2]

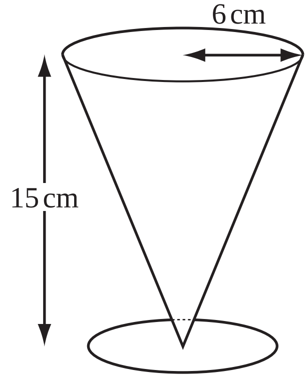
(b) The sand pit is filled with sand to a depth of 0.3 m.

Calculate the volume of sand in the sand pit.

Answer(b) .... m^3 [1]

16) November 2014 V3

18



NOT TO SCALE

The diagram shows a glass, in the shape of a cone, for drinking milk.
The cone has a radius of 6 cm and height 15 cm.
A bottle of milk holds 2 litres.

(a) How many times can the glass be completely filled from the bottle?
[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

Answer(a) .... [4]

(b) Calculate the volume of milk left in the bottle.
Give your answer in cm^3.

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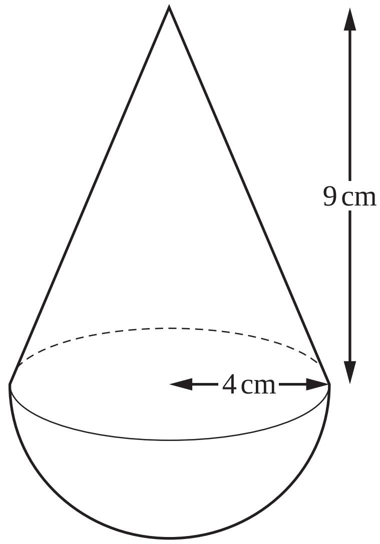
Answer(b) .... cm^3 [3]

21



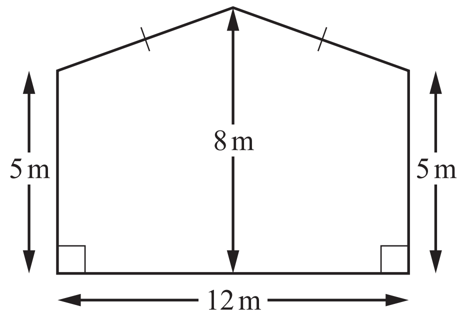
The diagram shows a toy.
The shape of the toy is a cone, with radius 4 cm and height 9 cm, on top of a hemisphere with radius 4 cm.

Calculate the volume of the toy.
Give your answer correct to the nearest cubic centimetre.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]
[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Answer .... cm^3 [4]

18



NOT TO SCALE

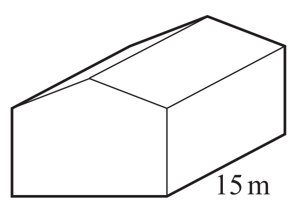
The diagram shows the front face of a barn.
The width of the barn is 12 m.
The height of the barn is 8 m.
The sides of the barn are both of height 5 m.

(a) Work out the area of the front face of the barn.

Answer(a) .... m^2 [3]

(b) The length of the barn is 15 m.

Work out the volume of the barn.



NOT TO SCALE

Answer(b) .... m^3 [1]

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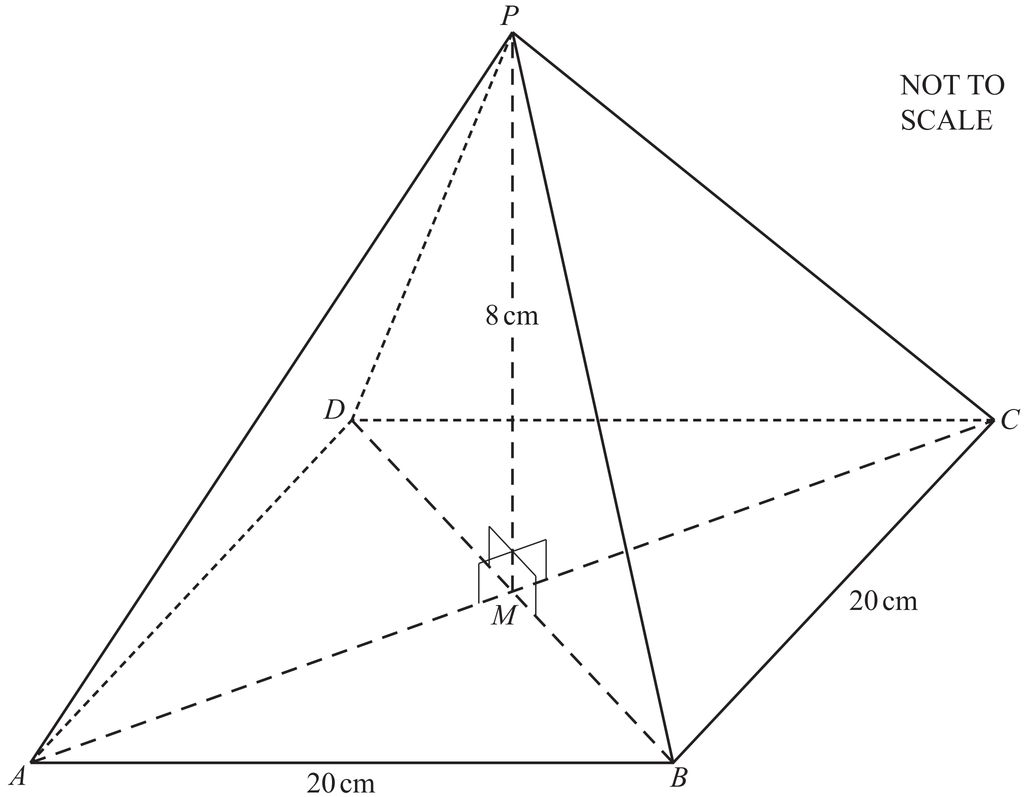
19) June 2015 V3

18



The diagram shows a solid pyramid on a square horizontal base *ABCD*.
The diagonals *AC* and *BD* intersect at *M*.
P is vertically above *M*.
$AB = 20$ cm and $PM = 8$ cm.

Calculate the total surface area of the pyramid.

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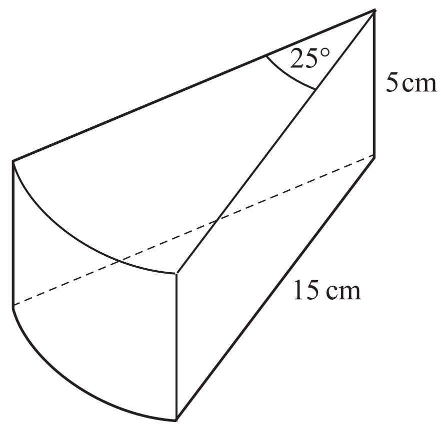
Answer .... cm^2 [5]

19



The diagram shows a wooden prism of height 5 cm.
The cross section of the prism is a sector of a circle with sector angle 25°.
The radius of the sector is 15 cm.

Calculate the **total** surface area of the prism.

Answer .... cm^2 [5]

5 Calculate the volume of a hemisphere with radius 5 cm.

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

Answer .... cm^3 [2]

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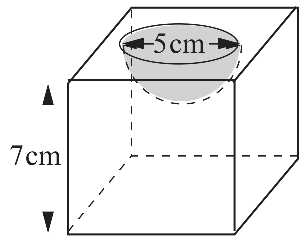
22) March 2015 V2

3 The base of a rectangular tank is 1.2 metres by 0.9 metres.
The water in the tank is 53 **centimetres** deep.

Calculate the number of litres of water in the tank.

Answer .... litres [2]

15 A solid consists of a metal cube with a hemisphere cut out of it.



NOT TO SCALE

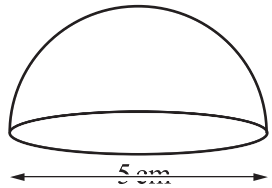
The length of a side of the cube is 7 cm.
The diameter of the hemisphere is 5 cm.

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

.... cm^3 [3]

24) November 2016 V3

12



NOT TO SCALE

The diagram shows a hemisphere with diameter 5 cm.

Calculate the volume of this hemisphere.

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

.... cm^3 [2]

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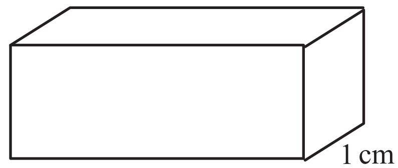
26) June 2018 V2

14



NOT TO SCALE

The diagram shows a solid cuboid with base area $7\,cm^2$.
The volume of this cuboid is $21\,cm^3$.

Work out the total surface area.

.... cm^2 [3]

26) June 2018 V2

15 Find the volume of a cylinder of radius 5 cm and height 8 cm.
Give the units of your answer.

.... [3]

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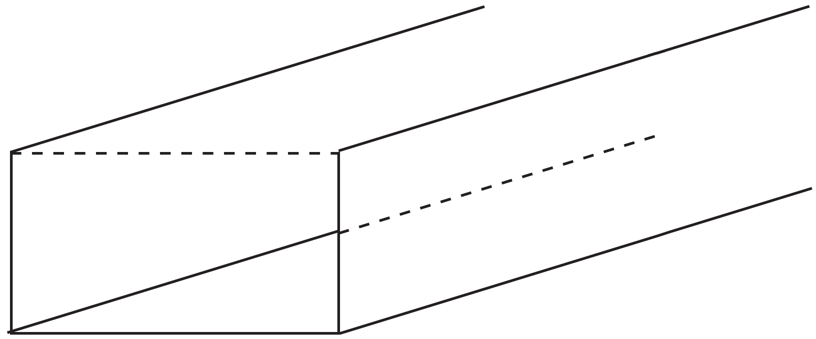
25) June 2013 V1

16 A water pipe has a circular cross section of radius 0.75 cm.
Water flows through the pipe at a rate of 16 cm/s.

Calculate the time taken for 1 litre of water to flow through the pipe.

Answer .... s [3]

14



The diagram shows a channel for water.
The channel lies on horizontal ground.
This channel has a constant rectangular cross section with area 0.95 m^2.
The channel is full and the water flows through the channel at a rate of 4 metres/**minute**

Calculate the number of cubic metres of water that flow along the channel in 3 **hours**

Answer .... m^3 [3]

Vectors

19 The position vector **r** is given by $\mathbf{r} = 2\mathbf{p} + t(\mathbf{p} + \mathbf{q})$.

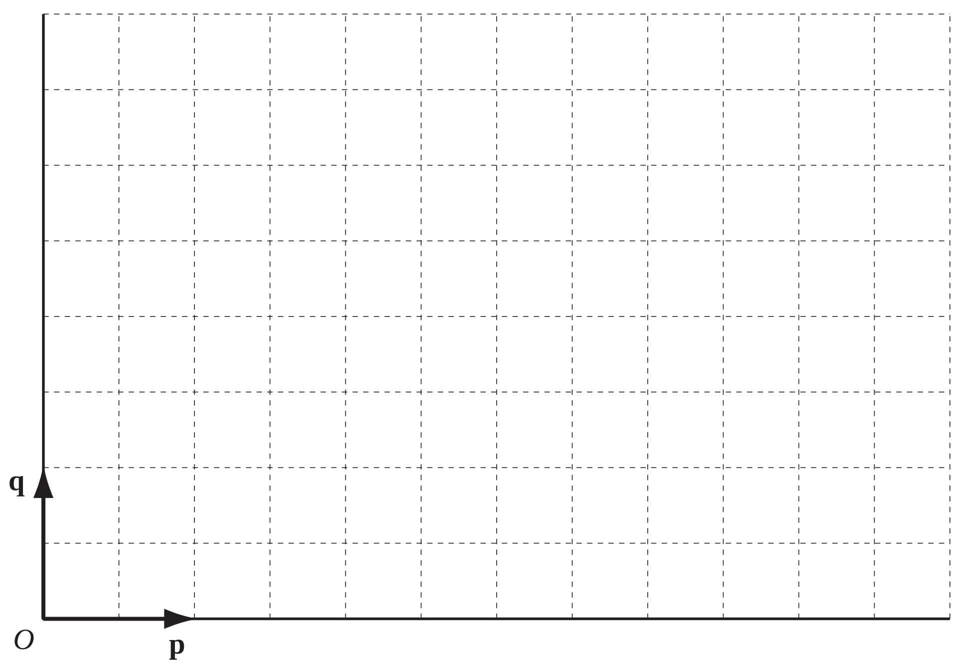
(a) Complete the table below for the given values of t.
Write each vector in its simplest form.
One result has been done for you.

t	0	1	2	3
r			$4\mathbf{p} + 2\mathbf{q}$	

[3]

(b) O is the origin and **p** and **q** are shown on the diagram.

(i) Plot the 4 points given by the position vectors in the table.



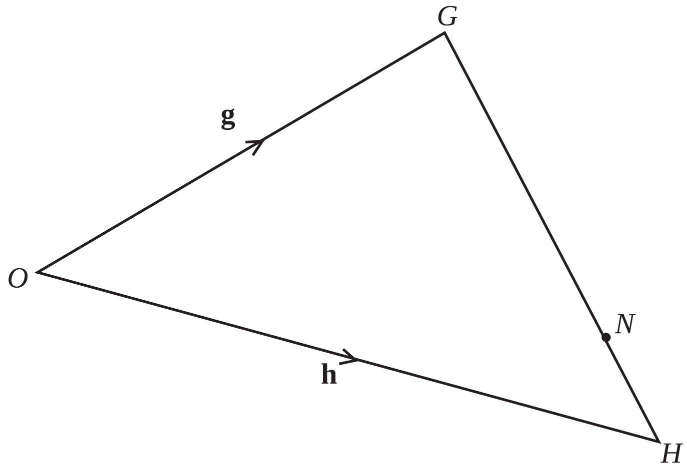
[2]

(ii) What can you say about these four points?

Answer(b)(ii) .... [1]

2) June 2010 V3

15



NOT TO SCALE

In triangle OGH, the ratio $GN : NH = 3 : 1$.

$\overrightarrow{OG} = \mathbf{g}$ and $\overrightarrow{OH} = \mathbf{h}$.

Find the following in terms of $\mathbf{g}$ and $\mathbf{h}$, giving your answers in their simplest form.

(a) $\overrightarrow{HG}$

Answer(a) $\overrightarrow{HG}$ = ... [1]

(b) $\overrightarrow{ON}$

Answer(b) $\overrightarrow{ON}$ = ... [2]

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3) November 2010 V2

7 $\overrightarrow{AB} = \mathbf{a} + t\mathbf{b}$ and $\overrightarrow{CD} = \mathbf{a} + (3t - 5)\mathbf{b}$ where t is a number.

Find the value of t when $\overrightarrow{AB} = \overrightarrow{CD}$

Answer $t =$ .... [2]

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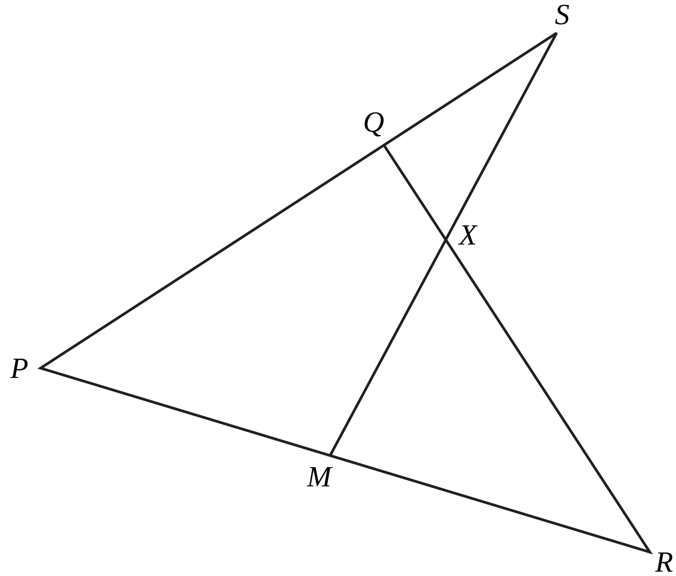
18



NOT TO SCALE

In the diagram, PQS, PMR, MXS and QXR are straight lines.

$PQ = 2\ QS$.
M is the midpoint of PR.
$QX : XR = 1 : 3$.

$\overrightarrow{PQ} = \mathbf{q}$ and $\overrightarrow{PR} = \mathbf{r}$.

(a) Find, in terms of **q** and **r**,

(i) $\overrightarrow{RQ}$,

Answer(a)(i) $\overrightarrow{RQ}$ = ... [1]

(ii) $\overrightarrow{MS}$.

Answer(a)(ii) $\overrightarrow{MS}$ = ... [1]

(b) By finding $\overrightarrow{MX}$, show that X is the midpoint of MS.

Answer (b)

[3]

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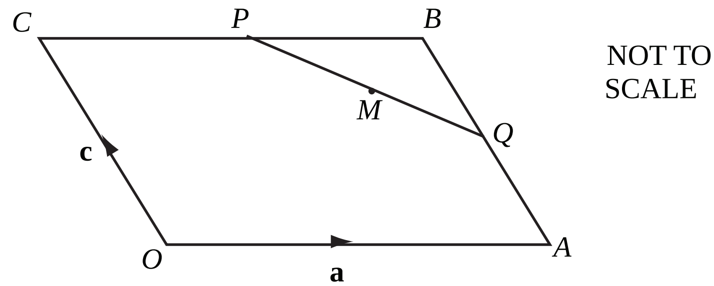
5) June 2011 V2

16



O is the origin and $OABC$ is a parallelogram.
$CP = PB$ and $AQ = QB$.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.
Find in terms of **a** and **c**, in their simplest form,

(a) $\overrightarrow{PQ}$,

Answer(a) $\overrightarrow{PQ} =$ .... [2]

(b) the position vector of M, where M is the midpoint of PQ

Answer(b) .... [2]

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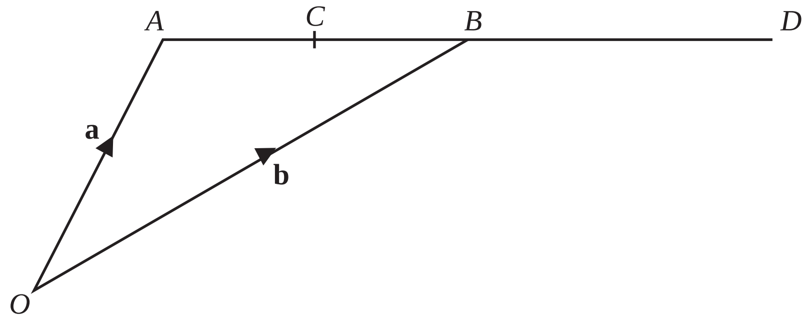
13



A and B have position vectors $\mathbf{a}$ and $\mathbf{b}$ relative to the origin O.
C is the midpoint of AB and B is the midpoint of AD.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in their simplest form

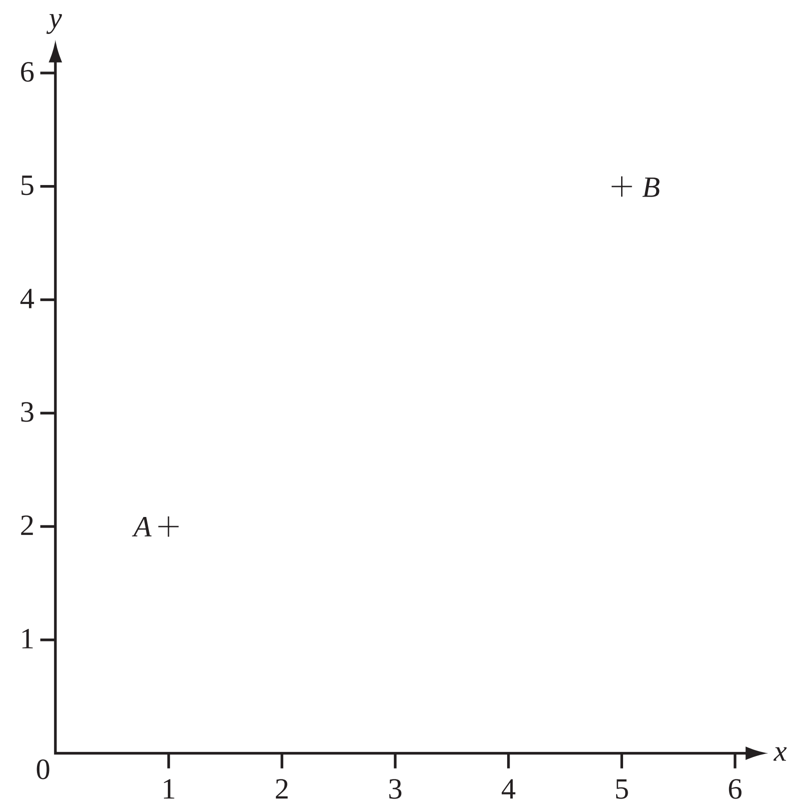
(a) the position vector of C,

Answer(a) .... [2]

(b) the vector $\overrightarrow{CD}$.

Answer(b) .... [2]

15



The points $A(1, 2)$ and $B(5, 5)$ are shown on the diagram .

(a) Work out the co-ordinates of the midpoint of AB.

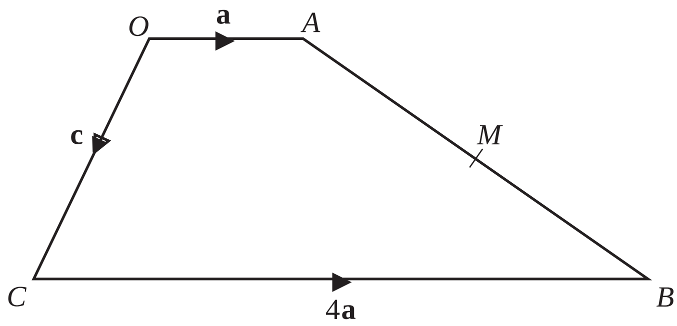
Answer(a) (.............. , ...) [1]

(b) Write down the column vector $\overrightarrow{AB}$.

Answer(b) $\overrightarrow{AB} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

(c) **Using a straight edge and compasses only,** draw the locus of points which are equidistant from A and from B. [2]

17



O is the origin, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{CB} = 4\mathbf{a}$.
M is the midpoint of AB.

(a) Find, in terms of **a** and **c**, in their simplest form

(i) the vector $\overrightarrow{AB}$,

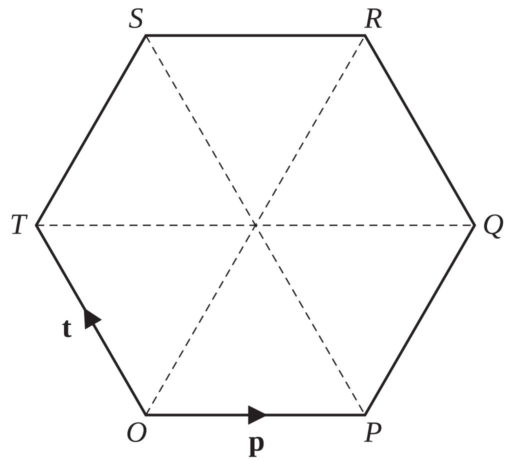
Answer(a)(i) $\overrightarrow{AB} =$ .... [2]

(ii) the position vector of M.

Answer(a)(ii) .... [2]

(b) Mark the point D on the diagram where $\overrightarrow{OD} = 3\mathbf{a} + \mathbf{c}$. [2]

19



O is the origin and $OPQRST$ is a regular hexagon.

$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OT} = \mathbf{t}$.

Find, in terms of **p** and **t**, in their simplest forms,

(a) $\overrightarrow{PT}$,

Answer(a) $\overrightarrow{PT} =$ .... [1]

(b) $\overrightarrow{PR}$,

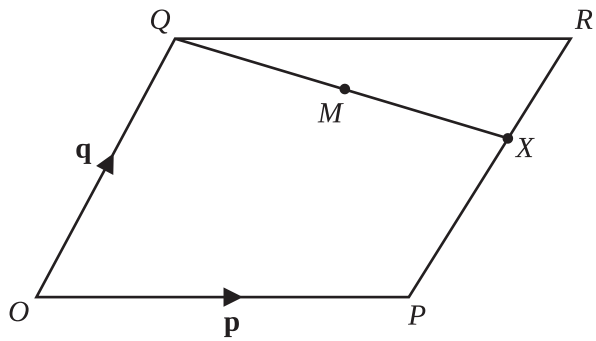
Answer(b) $\overrightarrow{PR} =$ .... [2]

(c) the position vector of R.

Answer(c) .... [2]

10) June 2012 V3

18



NOT TO SCALE

O is the origin and $OPRQ$ is a parallelogram.
The position vectors of P and Q are $\mathbf{p}$ and $\mathbf{q}$.
X is on PR so that $PX = 2XR$.

Find, in terms of $\mathbf{p}$ and $\mathbf{q}$, in their simplest forms

(a) $\overrightarrow{QX}$,

Answer(a) $\overrightarrow{QX} =$ .... [2]

(b) the position vector of M, the midpoint of QX.

Answer(b) .... [2]

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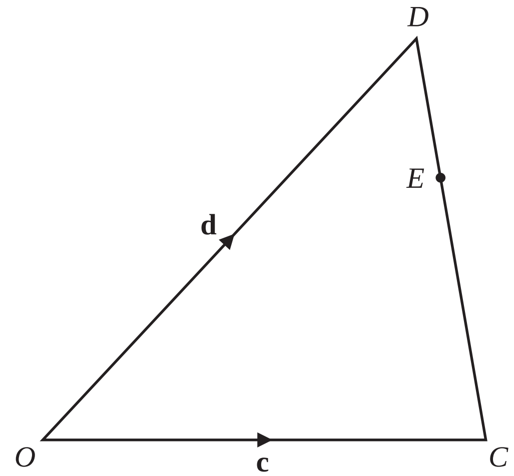
20



NOT TO SCALE

In the diagram, O is the origin.
$\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{OD} = \mathbf{d}$.
E is on CD so that $CE = 2ED$.

Find, in terms of **c** and **d**, in their simplest forms,

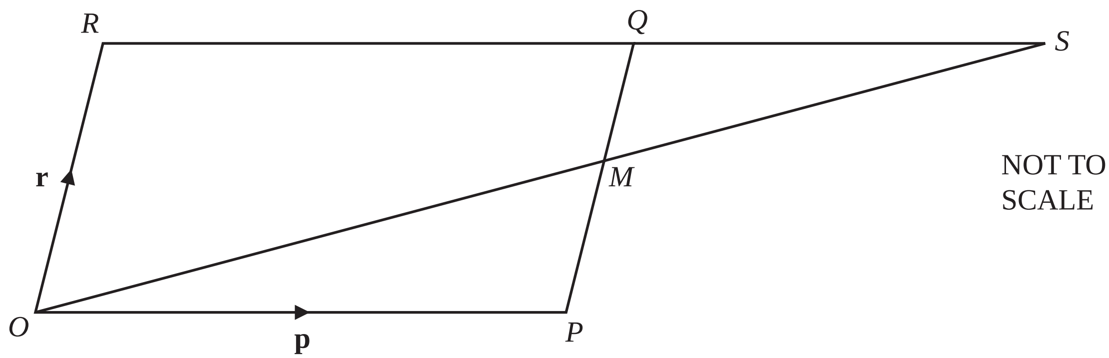
(a) $\overrightarrow{DE}$,

Answer(a) $\overrightarrow{DE} =$ .... [2]

(b) the position vector of E.

Answer(b) .... [2]

20



OPQR is a parallelogram, with *O* the origin.
M is the midpoint of *PQ*.
OM and *RQ* are extended to meet at *S*.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OR} = \mathbf{r}$.

(a) Find, in terms of **p** and **r**, in its simplest form,

(i) $\overrightarrow{OM}$,

Answer(a)(i) $\overrightarrow{OM} =$ .... [1]

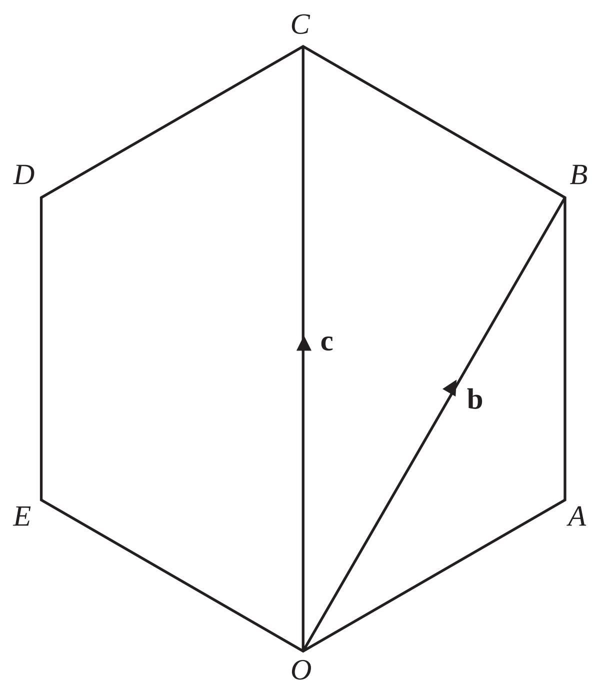
(ii) the position vector of *S*.

Answer(a)(ii) .... [1]

(b) When $\overrightarrow{PT} = -\frac{1}{2}\mathbf{p} + \mathbf{r}$, what can you write down about the position of *T*?

Answer(b) .... [1]

19



OABCDE is a regular polygon.

(a) Write down the geometrical name for this polygon.

Answer(a) .... [1]

(b) O is the origin. $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$.

Find, in terms of **b** and **c**, in their simplest form,

(i) $\overrightarrow{BC}$,

Answer(b)(i) $\overrightarrow{BC} =$ .... [1]

(ii) $\overrightarrow{OA}$,

Answer(b)(ii) $\overrightarrow{OA} =$ .... [2]

(iii) the position vector of E.

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Answer(b)(iii) .... [1]

16

NOT TO SCALE

A is the point (–1, 1) and B is the point (8, 7).

(a) Write $\overrightarrow{AB}$ as a column vector.

Answer(a) $\overrightarrow{AB} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) Find $|\overrightarrow{AB}|$.

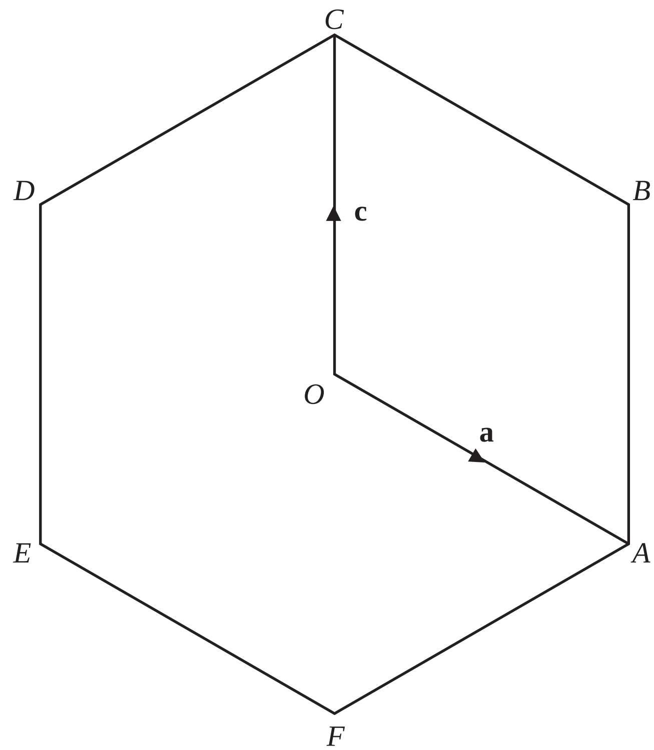
Answer(b) $|\overrightarrow{AB}|$ = ... [2]

(c) $\overrightarrow{AC} = 2\overrightarrow{AB}$.

Write down the co-ordinates of C.

Answer(c) (................ , ...) [1]

19



O is the origin.
$ABCDEF$ is a regular hexagon and O is the midpoint of AD.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$

Find, in terms of **a** and **c**, in their simplest form

(a) $\overrightarrow{BE}$,

Answer(a) $\overrightarrow{BE}$ = ... [2]

(b) $\overrightarrow{DB}$,

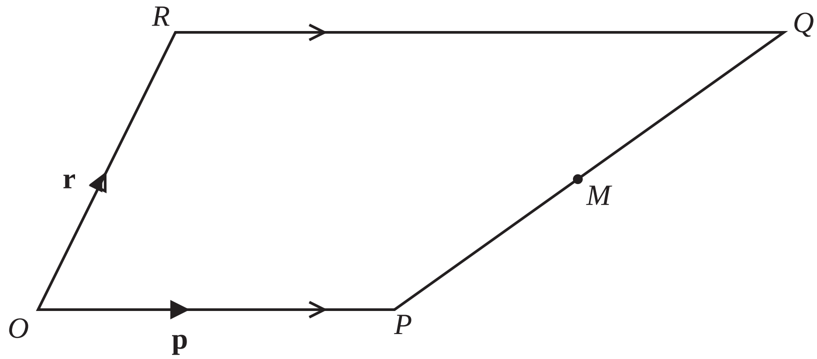
Answer(b) $\overrightarrow{DB}$ = ... [2]

(c) the position vector of E

Answer(c) .... [2]

16) June 2014 V2

14



NOT TO SCALE

OPQR is a trapezium with *RQ* parallel to *OP* and $RQ = 2OP$.
O is the origin, $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OR} = \mathbf{r}$.
M is the midpoint of *PQ*

Find, in terms of **p** and **r**, in its simplest form

(a) $\overrightarrow{PQ}$,

Answer(a) $\overrightarrow{PQ}$ = ... [1]

(b) $\overrightarrow{OM}$, the position vector of *M*.

Answer(b) $\overrightarrow{OM}$ = ... [2]

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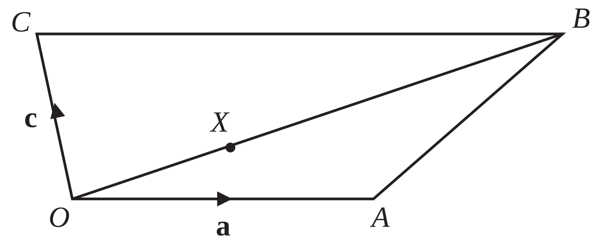
19



NOT TO SCALE

The diagram shows a quadrilateral $OABC$
$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{CB} = 2\mathbf{a}$
X is a point on OB such that $OX : XB = 1 : 2$.

(a) Find, in terms of **a** and **c**, in its simplest form

(i) $\overrightarrow{AC}$,

Answer(a)(i) $\overrightarrow{AC}$ = ... [1]

(ii) $\overrightarrow{AX}$.

Answer(a)(ii) $\overrightarrow{AX}$ = ... [3]

(b) Explain why the vectors $\overrightarrow{AC}$ and $\overrightarrow{AX}$ show that C, X and A lie on a straight line.

Answer(b) ....

.... [2]

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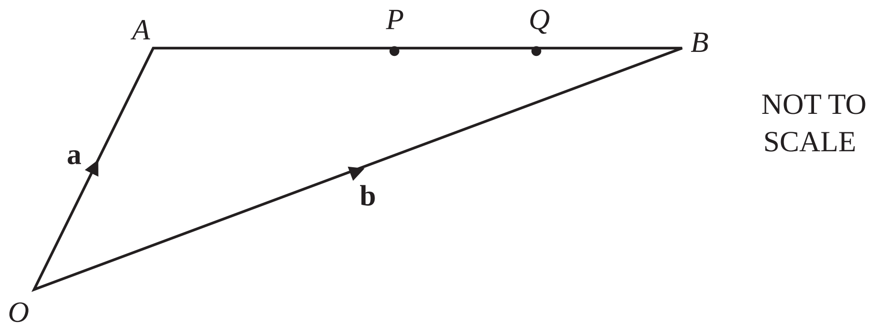


The diagram shows two points, P and Q, on a straight line AB
P is the midpoint of AB and Q is the midpoint of PB.
O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

Write down, in terms of **a** and **b**, in its simplest form

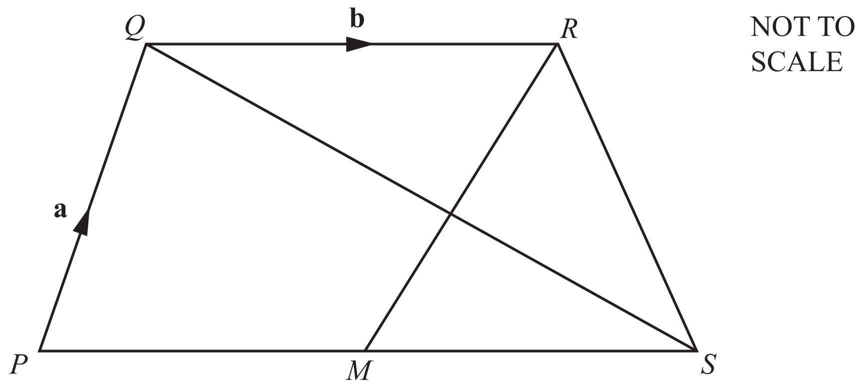
(a) $\overrightarrow{AP}$,

Answer(a) $\overrightarrow{AP}$ = ... [2]

(b) the position vector of Q

Answer(b) .... [2]

14



PQRS is a quadrilateral and *M* is the midpoint of *PS*.
$\overrightarrow{PQ} = \mathbf{a}$, $\overrightarrow{QR} = \mathbf{b}$ and $\overrightarrow{SQ} = \mathbf{a} - 2\mathbf{b}$.

(a) Show that $\overrightarrow{PS} = 2\mathbf{b}$.

Answer(a)

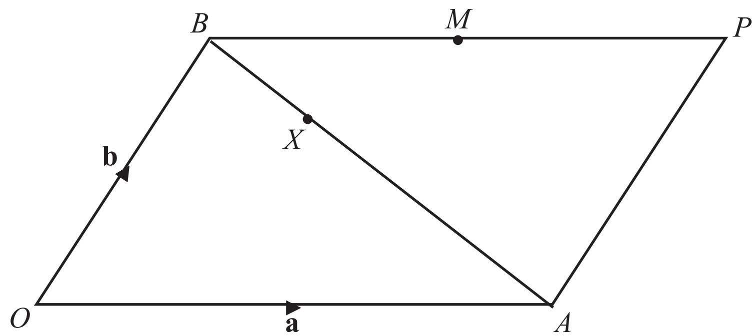
[1]

(b) Write down the mathematical name for the quadrilateral *PQRM*, giving reasons for your answer.

Answer(b) .... because ....

.... [2]

19



NOT TO SCALE

$OAPB$ is a parallelogram.
O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$
M is the midpoint of BP

(a) Find, in terms of **a** and **b**, giving your answer in its simplest form,

(i) $\overrightarrow{BA}$,

Answer(a)(i) $\overrightarrow{BA}$ = ... [1]

(ii) the position vector of M.

Answer(a)(ii) .... [1]

(b) X is on BA so that $BX : XA = 1 : 2$.

Show that X lies on OM.

Answer(b)

[4]

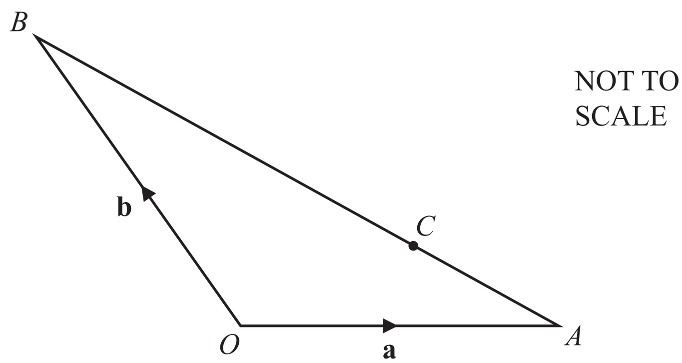
21) November 2015 V2

4 $\overrightarrow{AB} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

Find $|\overrightarrow{AB}|$.

Answer .... [2]

23



In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
C is on the line AB so that $AC : CB = 1 : 2$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form,

(a) $\overrightarrow{AC}$,

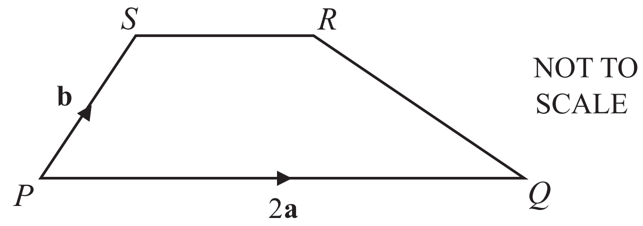
Answer(a) $\overrightarrow{AC}$ = ... [2]

(b) the position vector of C.

Answer(b) .... [2]

23) March 2015 V2

17 (a)

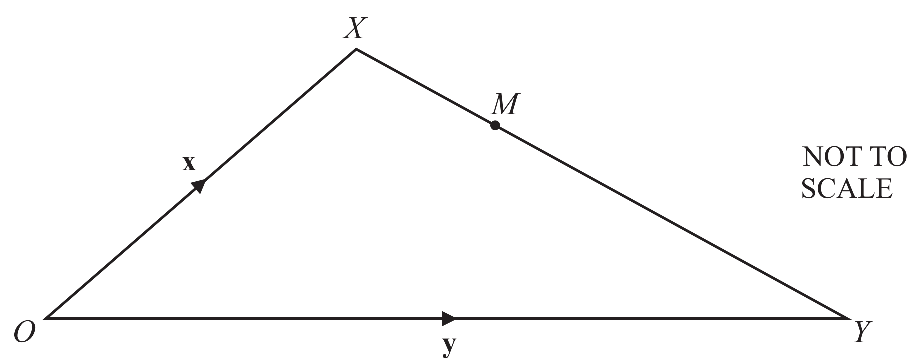


$PQRS$ is a trapezium with $PQ = 2SR$
$\overrightarrow{PQ} = 2\mathbf{a}$ and $\overrightarrow{PS} = \mathbf{b}$.

Find $\overrightarrow{QR}$ in terms of $\mathbf{a}$ and $\mathbf{b}$ in its simplest form.

Answer(a) $\overrightarrow{QR}$ = ... [2]

(b)



$\overrightarrow{OX} = \mathbf{x}$ and $\overrightarrow{OY} = \mathbf{y}$.
M is a point on XY such that $XM : MY = 3 : 5$.

Find $\overrightarrow{OM}$ in terms of $\mathbf{x}$ and $\mathbf{y}$ in its simplest form.

Answer(b) $\overrightarrow{OM}$ = ... [2]

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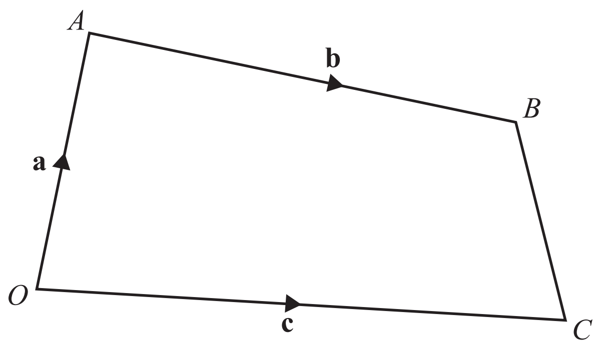
24



In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$ and $\overrightarrow{AB} = \mathbf{b}$.
P is on the line AB so that $AP : PB = 2 : 1$.
Q is the midpoint of BC.

Find, in terms of **a**, **b** and **c**, in its simplest form

(a) $\overrightarrow{CB}$,

$\overrightarrow{CB}$ = ... [1]

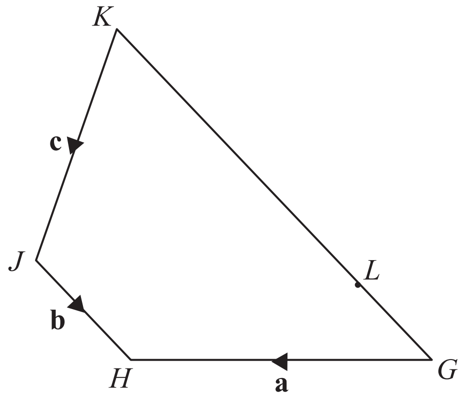
(b) the position vector of Q,

.... [2]

(c) $\overrightarrow{PQ}$.

$\overrightarrow{PQ}$ = ... [2]

9



NOT TO SCALE

GHJK is a quadrilateral.
$\overrightarrow{GH} = \mathbf{a}$, $\overrightarrow{JH} = \mathbf{b}$ and $\overrightarrow{KJ} = \mathbf{c}$.
L lies on GK so that $LK = 3GL$.

Find an expression, in terms of **a**, **b** and **c**, for $\overrightarrow{GL}$.

$\overrightarrow{GL}$ = ... [2]

26) November 2017 V3

14 **(a)** D is the point (2, –5) and $\overrightarrow{DE} = \begin{pmatrix} 7 \\ 1 \end{pmatrix}$.

Find the co-ordinates of the point E.

(.................... , ...) [1]

(b) $\mathbf{v} = \begin{pmatrix} t \\ 12 \end{pmatrix}$ and $|\mathbf{v}| = 13$.

Work out the value of t, where t is negative.

t = ... [2]

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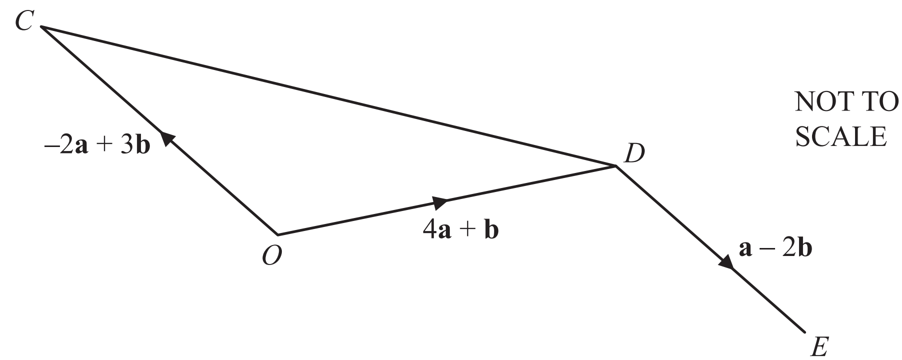
22



In the diagram, O is the origin, $\overrightarrow{OC} = -2\mathbf{a} + 3\mathbf{b}$ and $\overrightarrow{OD} = 4\mathbf{a} + \mathbf{b}$.

(a) Find $\overrightarrow{CD}$, in terms of **a** and **b**, in its simplest form.

$\overrightarrow{CD} =$ .... [2]

(b) $\overrightarrow{DE} = \mathbf{a} - 2\mathbf{b}$

Find the position vector of E, in terms of **a** and **b**, in its simplest form.

.... [2]

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Matrices

21 **(a)** **A** is a (2×4) matrix, **B** is a (3×2) matrix and **C** is a (1×3) matrix.

Which two of the following matrix products is it possible to work out?

$\mathbf{A}^2$ $\mathbf{B}^2$ $\mathbf{C}^2$ **AB** **AC** **BA** **BC** **CA** **CB**

Answer(a) .... and .... [2]

(b) Find the inverse of $\begin{pmatrix} \frac{1}{2} & \frac{3}{4} \\ \frac{1}{8} & \frac{1}{4} \end{pmatrix}$.

Simplify your answer as far as possible.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [3]

(c) Explain why the matrix $\begin{pmatrix} 4 & 2 \\ 6 & 3 \end{pmatrix}$ does not have an inverse.

Answer(c) .... [1]

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2) June 2010 V2

13

$$\mathbf{M} = \begin{pmatrix} 6 & -3 \\ 4 & 5 \end{pmatrix}\begin{pmatrix} x \\ 1 \end{pmatrix}$$

(a) Find the matrix **M**

Answer(a) **M** = [2]

(b) Simplify $\begin{pmatrix} x & 1 \end{pmatrix}\mathbf{M}$.

Answer(b) [2]

3) June 2010 V3

23 $\mathbf{A} = \begin{pmatrix} 1 & 4 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 3 & -1 \\ -2 & 2 \end{pmatrix}$

Find

(a) **AB**,

Answer(a) **AB** = [2]

(b) the inverse matrix $\mathbf{B}^{-1}$,

Answer(b) $\mathbf{B}^{-1}$ = [2]

(c) $\mathbf{BB}^{-1}$

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Answer(c) $\mathbf{BB}^{-1}$ = [1]

17

$$\mathbf{A} = \begin{pmatrix} 2 & 2 \\ 2 & -2 \end{pmatrix}$$

Work out

(a) $\mathbf{A}^2$,

Answer(a) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) $\mathbf{A}^{-1}$, the inverse of **A**.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

18

$$\mathbf{A} = \begin{pmatrix} 2 & 4 \\ 5 & 3 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} 3 & -4 \\ -5 & 2 \end{pmatrix}$$

(a) Work out **AB**.

Answer(a) [2]

(b) Find | **B** |, the determinant of **B**.

Answer(b) .... [1]

(c) **I** is the (2×2) identity matrix.
Find the matrix **C**, where $\mathbf{C} = \mathbf{A} - 7\mathbf{I}$.

Answer(c) [2]

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21 **(a)**

$$\mathbf{A} = \begin{pmatrix} 2 & 3 \end{pmatrix} \qquad \mathbf{B} = \begin{pmatrix} 6 \\ -4 \end{pmatrix}$$

(i) Work out **AB**.

Answer(a)(i) [2]

(ii) Work out **BA**.

Answer(a)(ii) [2]

(b) $\mathbf{C} = \begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$

Find $\mathbf{C}^{-1}$, the inverse of **C**.

Answer(b) [2]

11 Work out.

(a) $\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}^2$

Answer(a) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) $\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}^{-1}$

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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7 $\begin{pmatrix} 0 & 2 \\ -3 & 4 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 8 \\ 25 \end{pmatrix}$

Find the value of a and the value of b

Answer a = ...

b = ... [3]

20 **(a)** $\mathbf{N} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$. The order of the matrix **N** is 2×1.

$\mathbf{P} = (1 \quad 3)$. The order of the matrix **P** is 1×2.

(i) Write down the order of the matrix **NP**.

Answer(a)(i) .... [1]

(ii) Calculate **PN**.

Answer(a)(ii) [1]

(b) $\mathbf{M} = \begin{pmatrix} 2 & 3 \\ 2 & 4 \end{pmatrix}$.

Find $\mathbf{M}^{-1}$, the inverse of **M** .

Answer(b) $\mathbf{M}^{-1} =$ [2]

16 $\mathbf{M} = \begin{pmatrix} 5 & 2 \\ -3 & 4 \end{pmatrix}$ $\mathbf{N} = \begin{pmatrix} -1 & -2 \\ 2 & 6 \end{pmatrix}$

Calculate

(a) **MN**,

Answer(a) **MN** = [2]

(b) $\mathbf{M}^{-1}$, the inverse of **M**.

Answer(b) $\mathbf{M}^{-1}$ = [2]

19 Find the values of x for which

(a) $\begin{pmatrix} 1 & 0 \\ 0 & 2x-7 \end{pmatrix}$ has no inverse,

Answer(a) x = ... [2]

(b) $\begin{pmatrix} 1 & 0 \\ 0 & x^2-8 \end{pmatrix}$ is the identity matrix,

Answer (b) x = ... or $x =$ .... [3]

(c) $\begin{pmatrix} 1 & 0 \\ 0 & x-2 \end{pmatrix}$ represents a stretch with factor 3 and the x axis invariant.

Answer (c) x = ... [2]

12) June 2012 V3

17 $\mathbf{A} = \begin{pmatrix} 2 & 4 \\ 1 & 3 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 1 & 2 \end{pmatrix}$

(a) Calculate **BA**.

Answer(a) [2]

(b) Find $\mathbf{A}^{-1}$, the inverse of **A**.

Answer(b) [2]

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19

$$\mathbf{M} = \begin{pmatrix} 5 & -4 \\ 2 & 3 \end{pmatrix}$$

Find

(a) $\mathbf{M}^2$,

Answer(a) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) $2\mathbf{M}$,

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

(c) $|\mathbf{M}|$, the determinant of $\mathbf{M}$,

Answer(c) .... [1]

(d) $\mathbf{M}^{-1}$.

Answer(d) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

22 **(a)** $\mathbf{M} = \begin{pmatrix} 3 & 2 \\ -1 & 1 \end{pmatrix}$

Find $\mathbf{M}^{-1}$, the inverse of **M**.

Answer(a) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) **D**, **E** and **X** are 2×2 matrices.
I is the identity 2×2 matrix.

(i) Simplify **DI**.

Answer(b)(i) .... [1]

(ii) **DX** = **E**
Write **X** in terms of **D** and **E**.

Answer(b)(ii) **X** = ... [1]

24 $\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 4 & 3 \\ 1 & 2 \end{pmatrix}$

Find

(a) **AB**,

Answer(a) **AB** = [2]

(b) $\mathbf{B}^{-1}$, the inverse of **B**

Answer(b) $\mathbf{B}^{-1}$ = [2]

17 $\mathbf{M} = \begin{pmatrix} 2 & 3 \\ 3 & 6 \end{pmatrix}$ $\mathbf{N} = \begin{pmatrix} 2 & 1 & 5 \\ 1 & 7 & 2 \end{pmatrix}$

(a) Work out **MN**.

Answer(a) [2]

(b) Find $\mathbf{M}^{-1}$, the inverse of **M**.

Answer(b) [2]

17

$$\mathbf{M} = \begin{pmatrix} 2 & 1 \\ 4 & 6 \end{pmatrix} \qquad \mathbf{N} = \begin{pmatrix} 5 & 0 \\ 1 & 5 \end{pmatrix}$$

(a) Work out **MN**.

Answer(a) **MN** = [2]

(b) Find $\mathbf{M}^{-1}$.

Answer(b) $\mathbf{M}^{-1}$ = [2]

11 $\mathbf{A} = \begin{pmatrix} 3 & -1 \\ 4 & 2 \end{pmatrix}$ $\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Work out the following.

(a) **AI**

Answer(a) **AI** = [1]

(b) $\mathbf{A}^{-1}$

Answer(b) $\mathbf{A}^{-1}$ = [2]

19) June 2014 V2

15 $\mathbf{M} = \begin{pmatrix} 4 & 2 \\ 3 & 5 \end{pmatrix}$

Find

(a) $\mathbf{M}^2$,

Answer(a) [2]

(b) the determinant of **M**.

Answer(b) .... [1]

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20) June 2014 V3

18 $$\mathbf{A} = \begin{pmatrix} 5 & 2 \\ 4 & 3 \end{pmatrix}$$

(a) Calculate $\mathbf{A}^2$.

Answer(a) [2]

(b) Calculate $\mathbf{A}^{-1}$, the inverse of $\mathbf{A}$.

Answer(b) [2]

21) November 2014 V1

14 $\mathbf{A} = \begin{pmatrix} 2 & 8 \\ 1 & 4 \end{pmatrix}$

Work out $\mathbf{A}^2 - 4\mathbf{A}$

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [3]

22) November 2014 V2

11 $\mathbf{A} = \begin{pmatrix} 3 & -2 \\ 1 & 4 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 2 & 0 \\ -5 & 7 \end{pmatrix}$

(a) Calculate **BA**

Answer(a) **BA** = [2]

(b) Find the determinant of **A**.

Answer(b) .... [1]

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23) June 2015 V1

22 **(a)** Calculate $\begin{pmatrix} 3 & 7 \\ -1 & 4 \end{pmatrix}\begin{pmatrix} -2 & 1 \\ 4 & 2 \end{pmatrix}$.

Answer(a) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) Calculate the inverse of $\begin{pmatrix} 5 & 3 \\ 6 & 4 \end{pmatrix}$.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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24) June 2015 V2

11 $\mathbf{M} = \begin{pmatrix} 3 & 1 \\ -11 & -2 \end{pmatrix}$

Find $\mathbf{M}^{-1}$, the inverse of $\mathbf{M}$.

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

25) November 2015 V1

18 **(a)** Work out $\begin{pmatrix} 1 & -2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} -5 & -3 \\ 2 & 1 \end{pmatrix}$.

Answer(a) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) Find the inverse of $\begin{pmatrix} 1 & -2 \\ 3 & 4 \end{pmatrix}$.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) Explain why it is not possible to work out $\begin{pmatrix} 1 & -2 \\ 3 & 4 \end{pmatrix} + \begin{pmatrix} 3 \\ 2 \end{pmatrix}$.

Answer(c) .... [1]

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26) November 2015 V2

7 $\mathbf{M} = \begin{pmatrix} 3 & -4 \\ -2 & 4 \end{pmatrix}$ $\mathbf{N} = \begin{pmatrix} 5 & 0 \\ 1 & 2 \end{pmatrix}$

Calculate **MN**.

Answer $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

27) November 2015 V3

13 $\mathbf{M} = \begin{pmatrix} 7 & u \\ 2 & 3 \end{pmatrix}$ and $|\mathbf{M}| = 1$.

Find the value of u.

Answer u = ... [2]

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15 $\mathbf{A} = \begin{pmatrix} 8 & 3 \\ 4 & 2 \end{pmatrix}$

Find

(a) $\mathbf{A}^2$,

Answer(a) $\mathbf{A}^2 = \begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) $\mathbf{A}^{-1}$.

Answer(b) $\mathbf{A}^{-1} = \begin{pmatrix} & \\ & \end{pmatrix}$ [2]

29) March 2016 V2

8 Find the inverse of the matrix $\begin{pmatrix} 3 & -2 \\ -8 & 7 \end{pmatrix}$

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

30) June 2016 V2

22 $\mathbf{M} = \begin{pmatrix} 5 & 1 \\ -3 & -2 \end{pmatrix}$

(a) Work out $4\mathbf{M}$.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

(b) Work out $\mathbf{M}^2$.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) Find $\mathbf{M}^{-1}$, the inverse of $\mathbf{M}$.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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31) November 2016 V1

15 Work out.

(a) $2\begin{pmatrix} 3 \\ 5 \end{pmatrix} \quad \begin{pmatrix} 1 \\ 2 \end{pmatrix}$

.... [1]

(b) $\begin{pmatrix} 1 & 2 \end{pmatrix}\begin{pmatrix} 2 \\ 3 \end{pmatrix}$

.... [2]

32) November 2016 V1

16 $\overrightarrow{BC} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \qquad \overrightarrow{BA} = \begin{pmatrix} -5 \\ 6 \end{pmatrix}$

(a) Find $\overrightarrow{CA}$.

$\overrightarrow{CA} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(b) Work out $|\overrightarrow{BA}|$.

.... [2]

33) November 2016 V2

19 **(a)** Find the inverse of $\begin{pmatrix} 2 & 3 \\ 5 & -4 \end{pmatrix}$

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(b) The matrix $\begin{pmatrix} w & -9 \\ 4 & w-12 \end{pmatrix}$ does not have an inverse.

Calculate the value of w.

w = ... [4]

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25 $\mathbf{A} = \begin{pmatrix} 4 & 2 \\ 2 & 1 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 7 & -3 \\ 4 & 5 \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} -2 & 3 & 1 \\ 4 & 5 & -1 \end{pmatrix}$ $\mathbf{D} = \begin{pmatrix} -9 \\ 0 \end{pmatrix}$

(a) Which of these four matrix calculations is **not** possible?

A + B **3C** **CB** **AD**

.... [1]

(b) Calculate **AB**

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) Work out $\mathbf{B}^{-1}$, the inverse of **B**.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(d) Explain why matrix **A** does not have an inverse.

.... [1]

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20 $\mathbf{A} = \begin{pmatrix} 1 & 1 \\ 9 & 9 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 0 & 1 \\ 9 & 8 \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} 1 & 1 \\ 3 & 3 \end{pmatrix}$ $\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

(a) Here are four matrix calculations.

AI **IA** $\mathbf{C}^2$ **B + I**

Work out which matrix calculation does **not** give the answer $\begin{pmatrix} 1 & 1 \\ 9 & 9 \end{pmatrix}$.

.... [2]

(b) Find $|\mathbf{B}|$.

.... [1]

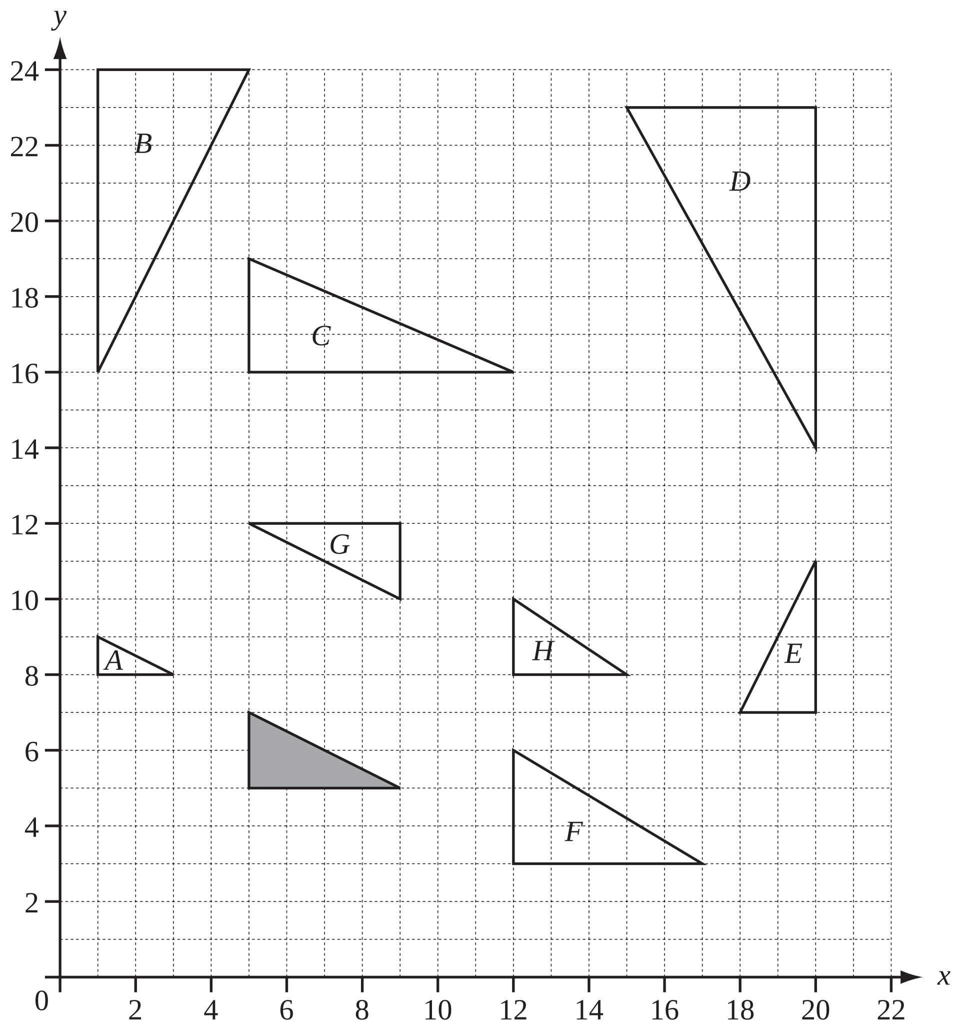
(c) Explain why matrix **A** has no inverse.

.... [1]

Transformations

1) June 2010 V1

18



Write down the letters of all the triangles which are

(a) congruent to the shaded triangle,

Answer(a) .... [2]

(b) similar, but not congruent, to the shaded triangle.

Answer(b) .... [2]

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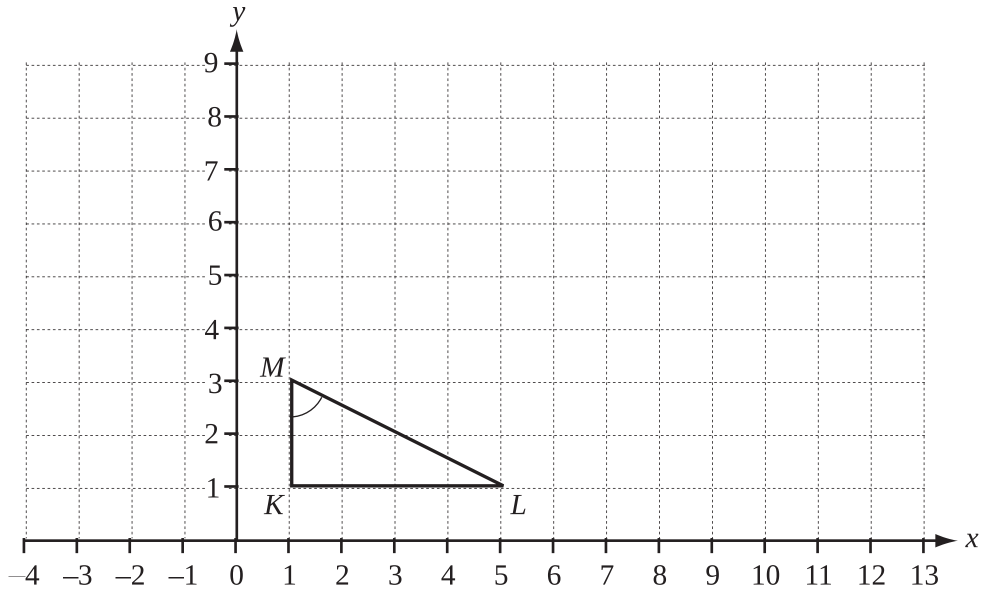
20



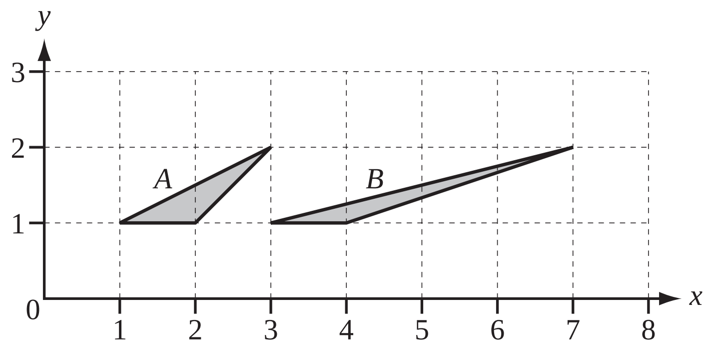
The triangle KLM is shown on the grid.

(a) Calculate angle KML

Answer(a) Angle KML = ... [2]

(b) On the grid, draw the shear of triangle KLM, with a shear factor of 3 and the x-axis invariant. [2]

14



(a) Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

Answer(a) .... [3]

(b) Find the 2 × 2 matrix which represents this transformation.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

13 Find the matrix which represents the combined transformation of a reflection in the x axis **followed by** a reflection in the line $y = x$.

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [3]

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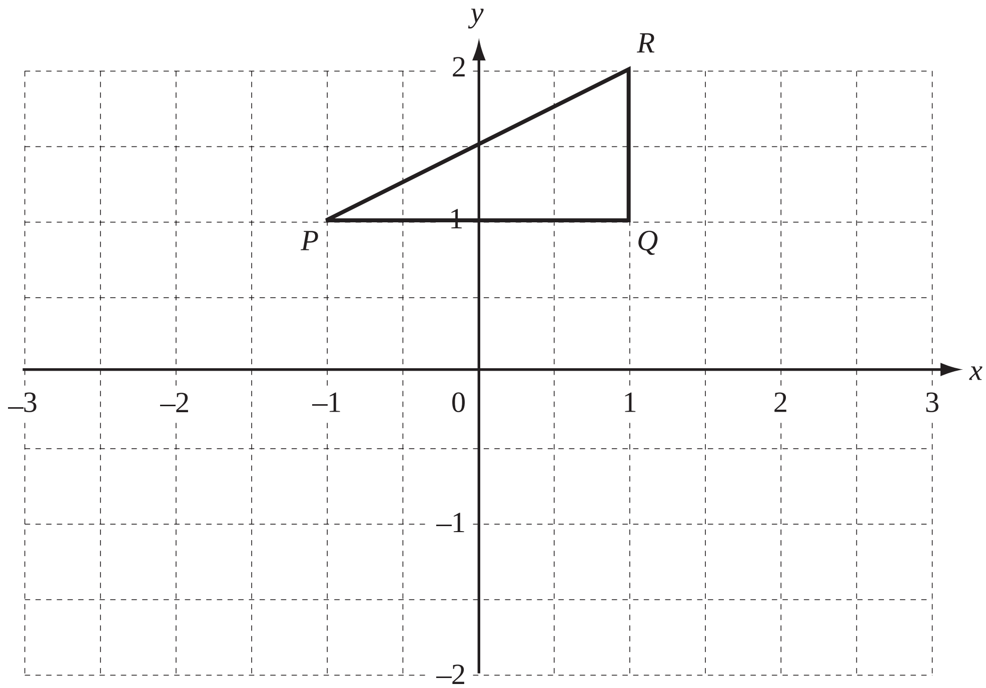
21



The triangle PQR has co-ordinates $P(-1, 1)$, $Q(1, 1)$ and $R(1, 2)$.

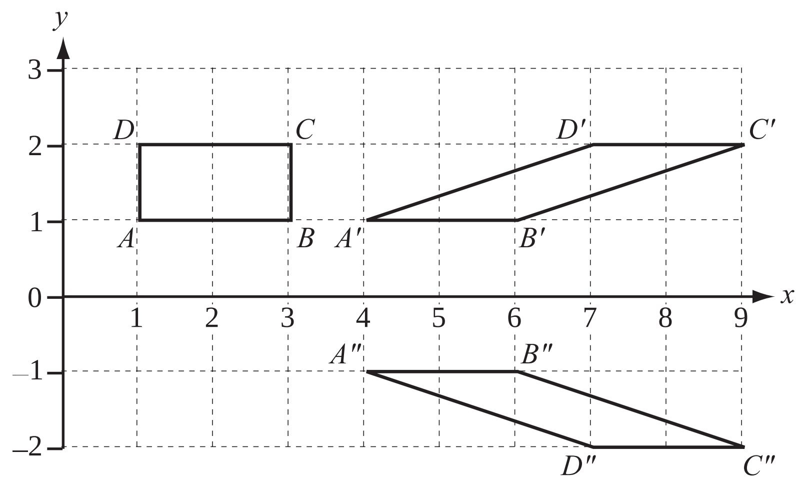
(a) Rotate triangle PQR by 90° clockwise about (0, 0).
Label your image $P'Q'R'$. [2]

(b) Reflect **your triangle** $P'Q'R'$ in the line $y = -x$.
Label your image $P''Q''R''$. [2]

(c) Describe fully the **single** transformation which maps triangle PQR onto triangle $P''Q''R''$.

Answer(c) .... [2]

17



(a) Describe the **single** transformation which maps $ABCD$ onto $A'B'C'D'$.

Answer(a) .... [3]

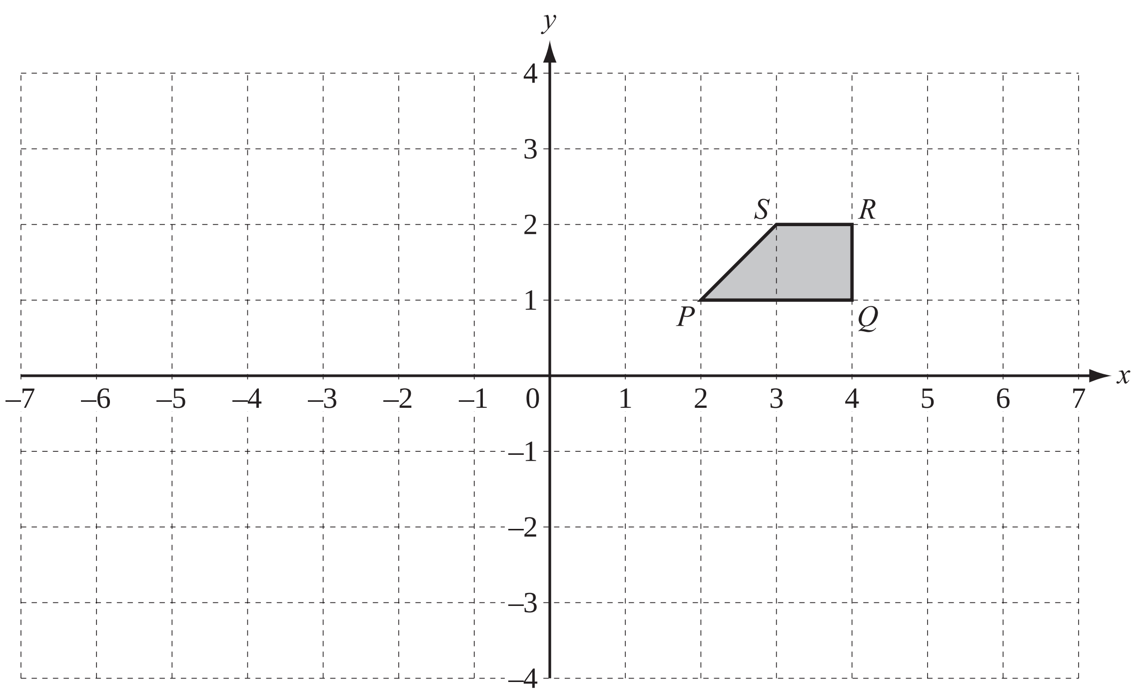
(b) A single transformation maps $A'B'C'D'$ onto $A''B''C''D''$
Find the matrix which represents this transformation.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

7) November 2012 V2

18 $\mathbf{A} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$

On the grid on the next page, draw the image of *PQRS* after the transformation represented by **BA**.



[5]

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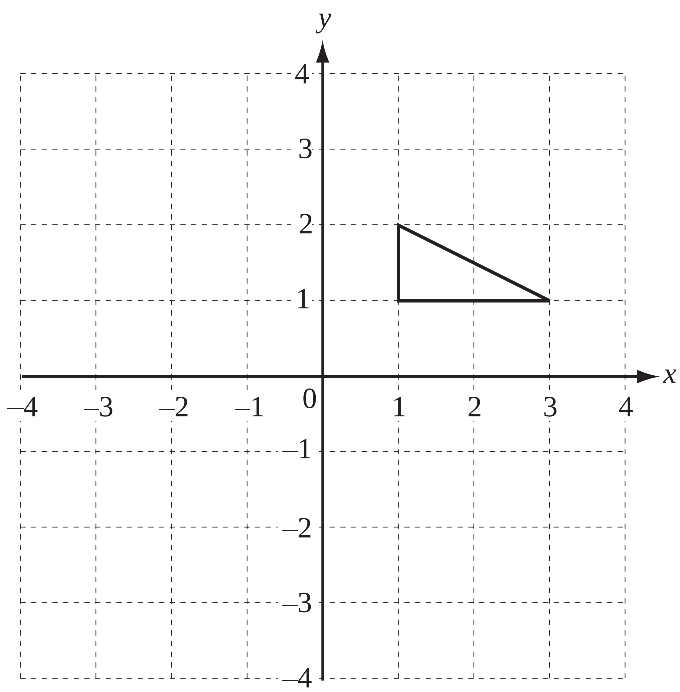
8) November 2013 V3

17 (p, q) is the image of the point (x, y) under this combined transformation.

$$\begin{pmatrix} p \\ q \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

(a) Draw the image of the triangle under the combined transformation.



[3]

(b) Describe fully the **single** transformation represented by $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$.

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Answer (b) .... [2]

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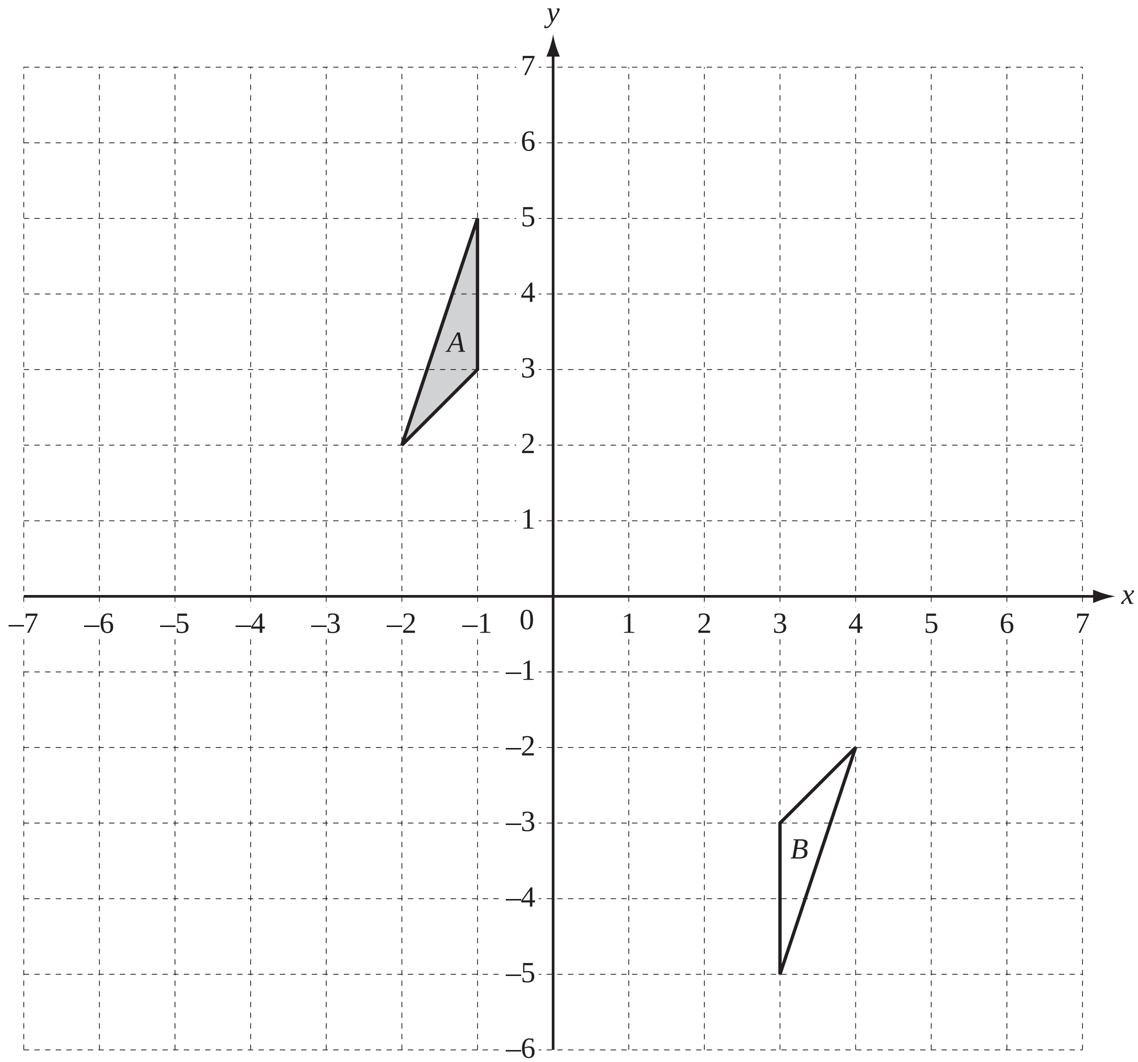
9) June 2014 V3

22



(a) Draw the image of triangle *A* after a translation by the vector $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$. [2]

(b) Describe fully the **single** transformation which maps triangle *A* onto triangle *B*.

Answer(b) ....

.... [3]

(c) Draw the image of triangle *A* after the transformation represented by the matrix $\begin{pmatrix} -2 & 0 \\ 0 & 1 \end{pmatrix}$. [3]

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10) November 2014 V3

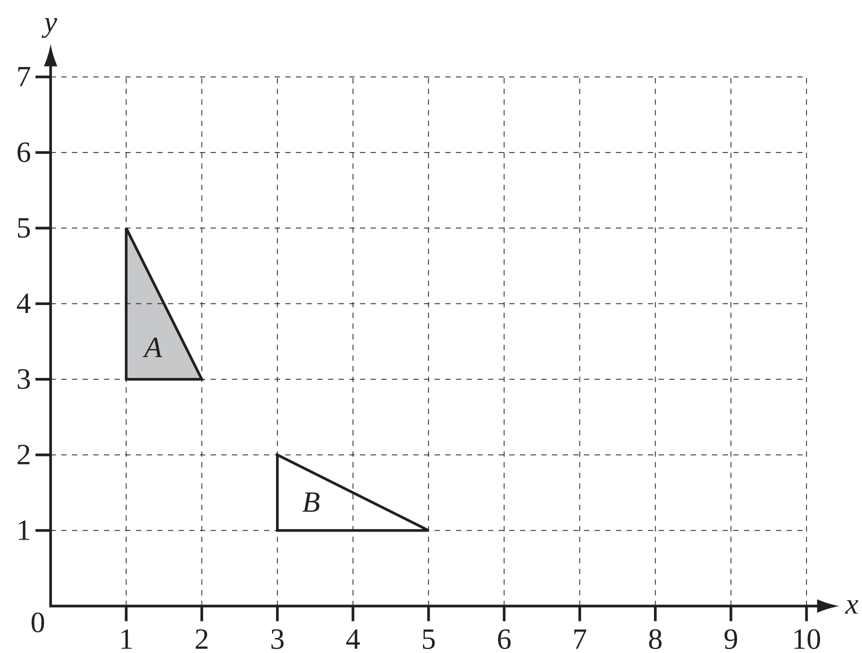
19 **(a)** $\mathbf{N} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

Describe fully the **single** transformation represented by **N**.

Answer(a) ....

.... [3]

(b) Find the matrix which represents the **single** transformation that maps triangle *A* onto triangle *B*.



Answer(b) $\begin{pmatrix} \quad & \quad \\ \quad & \quad \end{pmatrix}$ [2]

(c) On the grid, draw the image of triangle *A* under a stretch, factor 3, with the *y*-axis invariant. [2]

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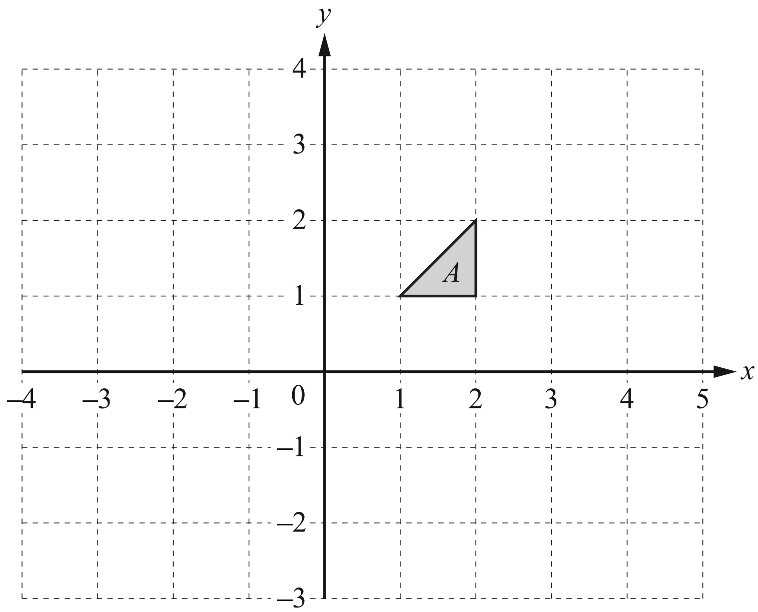
11) June 2015 V3

6 Find the 2 × 2 matrix that represents a rotation through 90° clockwise about (0, 0).

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

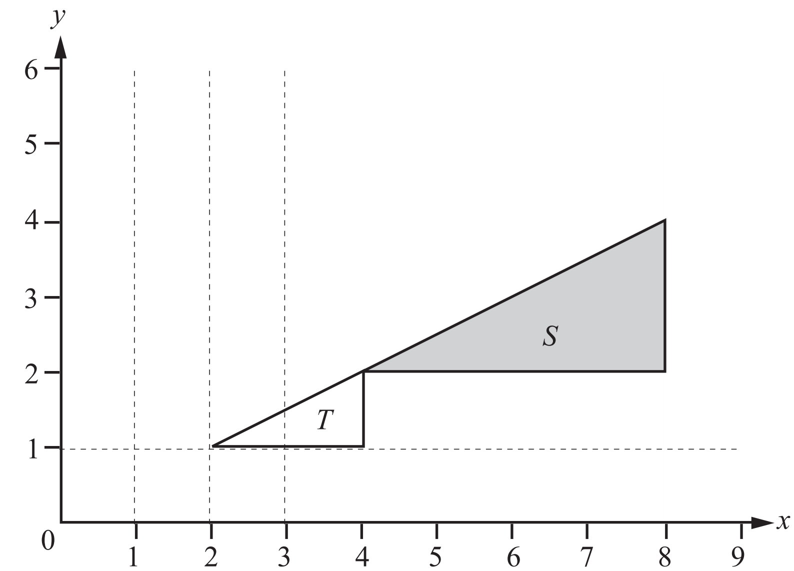
12) November 2015 V1

3



Draw the image of shape *A* after a translation by the vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$. [2]

17



(a) Describe fully the **single** transformation that maps triangle S onto triangle T

Answer(a)

.... [3]

(b) Find the matrix which represents the transformation that maps triangle S onto triangle T.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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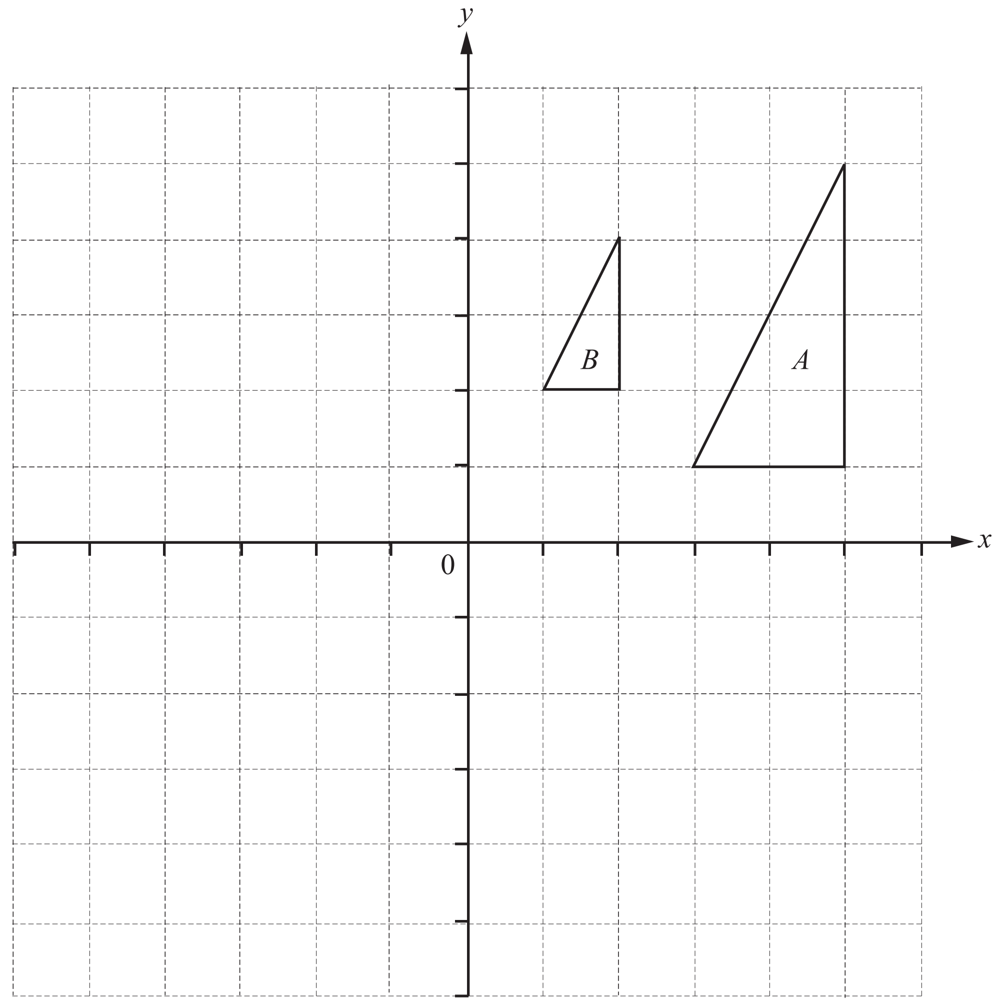
14) November 2016 V2

18



(a) Describe fully the **single** transformation that maps triangle A onto triangle B

....

.... [3]

(b) Draw the image of triangle A after the transformation represented by $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. [3]

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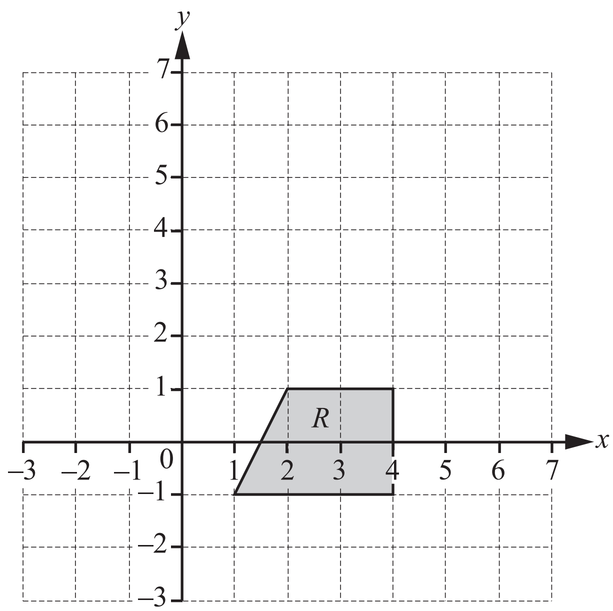
15) June 2018 V1

16



On the grid, draw the image of shape R after the transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. [3]

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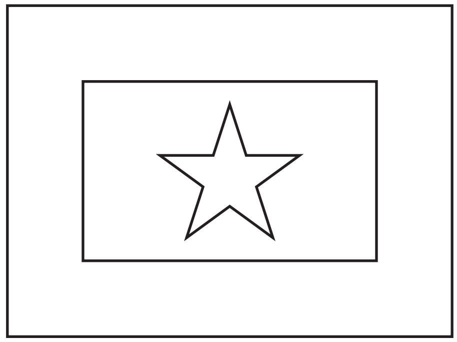
Symmetry

1) June 2010 V2

1



For the **diagram**, write down

(a) the order of rotational symmetry,

Answer(a) .... [1]

(b) the number of lines of symmetry.

Answer(b) .... [1]

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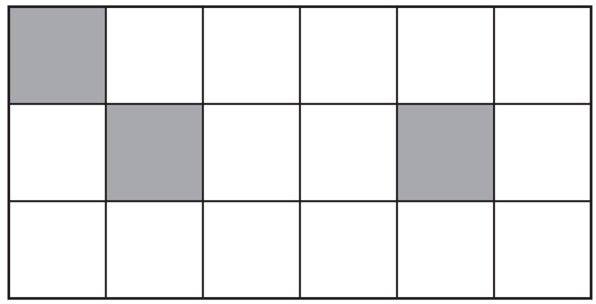
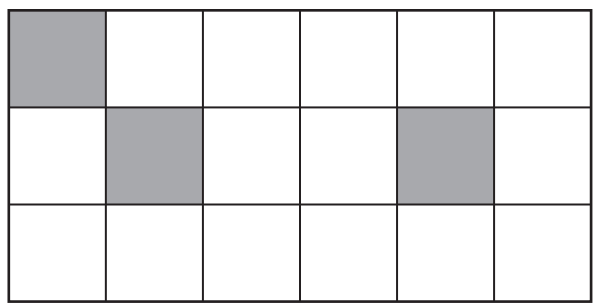
8 **(a)** Shade **one** square in each diagram so that there is

(i) one line of symmetry,



[1]

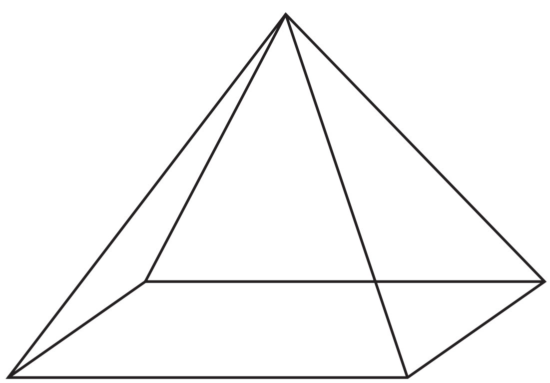
(ii) rotational symmetry of order 2.



[1]

(b) The pyramid below has a rectangular base.
The vertex of the pyramid is vertically above the centre of the base.

Write down the number of **planes** of symmetry for the pyramid.



Answer(b) .... [1]

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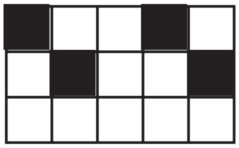
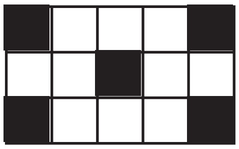
3) June 2010 V3

13 **(a)** Write down the number of lines of symmetry for the diagram below.



Answer(a) .... [1]

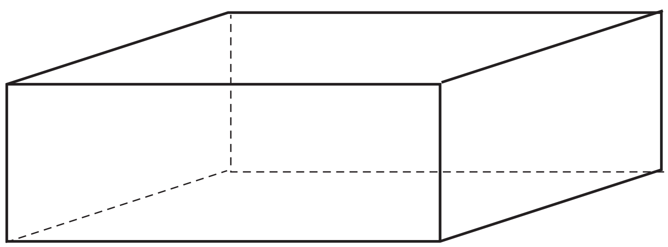
(b) Write down the order of rotational symmetry for the diagram below.



Answer(b) .... [1]

(c) The diagram shows a cuboid which has no square faces.

Draw one of the **planes** of symmetry of the cuboid on the diagram.



[1]

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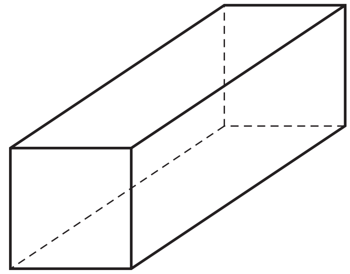
5 **(a)**

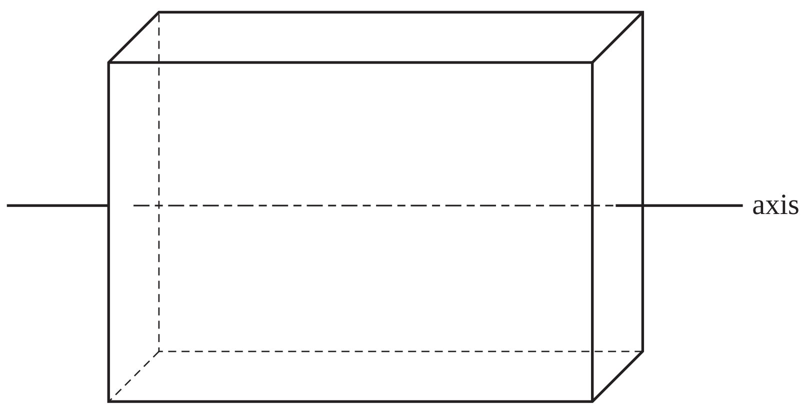


This cuboid has a **square** cross-section.

Write down the number of planes of symmetry.

Answer(a) .... [1]

(b)



This cuboid has a **rectangular** cross-section.

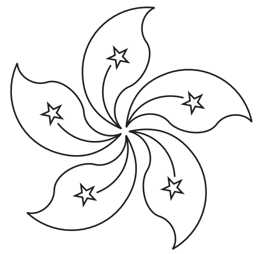
The axis shown passes through the centre of two opposite faces.

Write down the order of rotational symmetry of the cuboid about this axis.

Answer(b) .... [1]

5) November 2010 V2

1



For the diagram, write down

(a) the order of rotational symmetry,

Answer(a) .... [1]

(b) the number of lines of symmetry.

Answer(b) .... [1]

6) June 2012 V2

2

T R I G O N O M E T R Y

From the above word, write down the letters which have

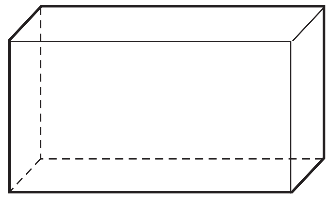
(a) exactly two lines of symmetry,

Answer(a) .... [1]

(b) rotational symmetry of order 2.

Answer(b) .... [1]

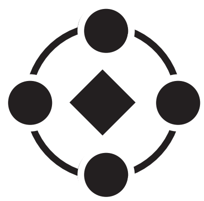
3 **(a)** The diagram shows a cuboid.



How many planes of symmetry does this cuboid have?

Answer(a) .... [1]

(b) Write down the order of rotational symmetry for the following diagram.



Answer(b) .... [1]

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8) November 2013 V2

5 **(a)** Add **one** line to the diagram so that it has two lines of symmetry.

[1]

(b) Add **two** lines to the diagram so that it has rotational symmetry of order 2.

[1]

9) November 2014 V1

3

Z E B R A

Write down the letters in the word above that have

(a) exactly one line of symmetry,

Answer(a) .... [1]

(b) rotational symmetry of order 2.

Answer(b) .... [1]

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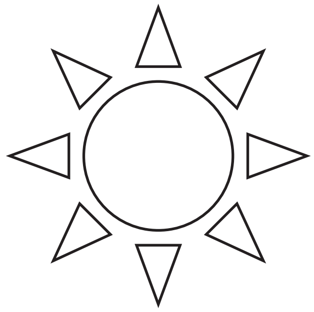
10) November 2014 V2

3

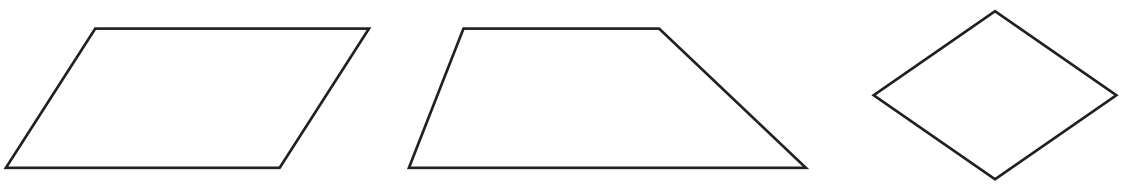


Write down the order of rotational symmetry of this shape.

Answer .... [1]

11) November 2015 V2

2



Parallelogram Trapezium Rhombus

Write down which one of these shapes has

- rotational symmetry of order 2

and

- no line symmetry.

Answer .... [1]

12) June 2016 V2

4 A quadrilateral has rotational symmetry of order 2 and no lines of symmetry.

Write down the mathematical name of this quadrilateral.

.... [1]

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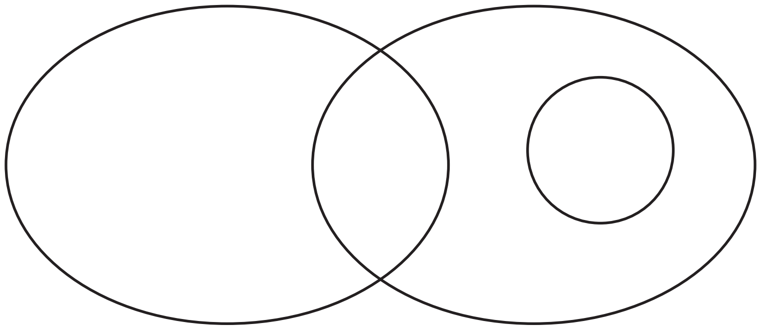
Sets

1) June 2010 V1

12 $Q = \{2, 4, 6, 8, 10\}$ and $R = \{5, 10, 15, 20\}$.
$15 \in P$, $n(P) = 1$ and $P \cap Q = \varnothing$.

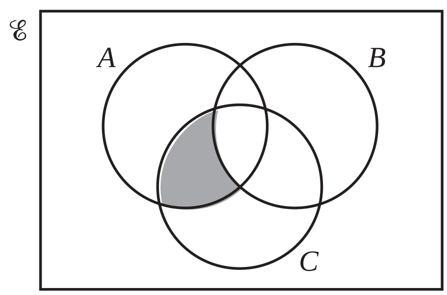
Label each set and complete the Venn diagram to show this information.



[3]

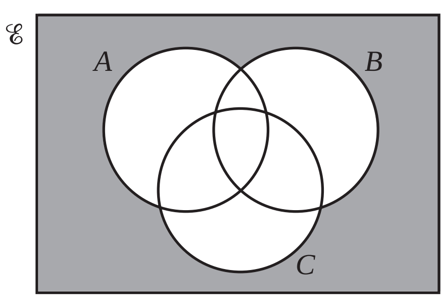
2) June 2010 V2

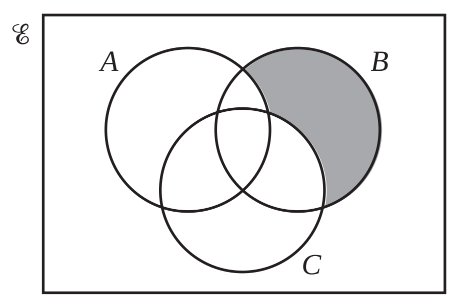
7



The shaded area in the diagram shows the set $(A \cap C) \cap B'$.

Write down the set shown by the shaded area in each diagram below.





....

[2]

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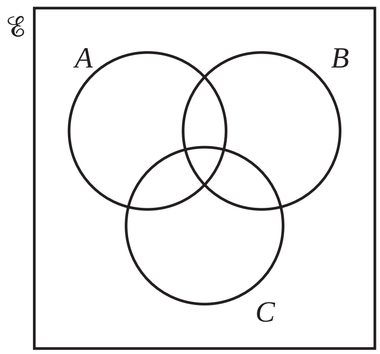
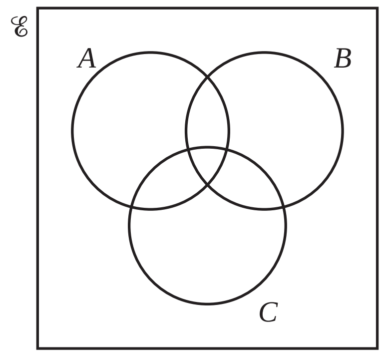
7 Shade the required regions in the Venn diagrams below.



$(A \cup B)' \cap C$



$(A \cap B) \cup C$

[2]

4) November 2010 V1

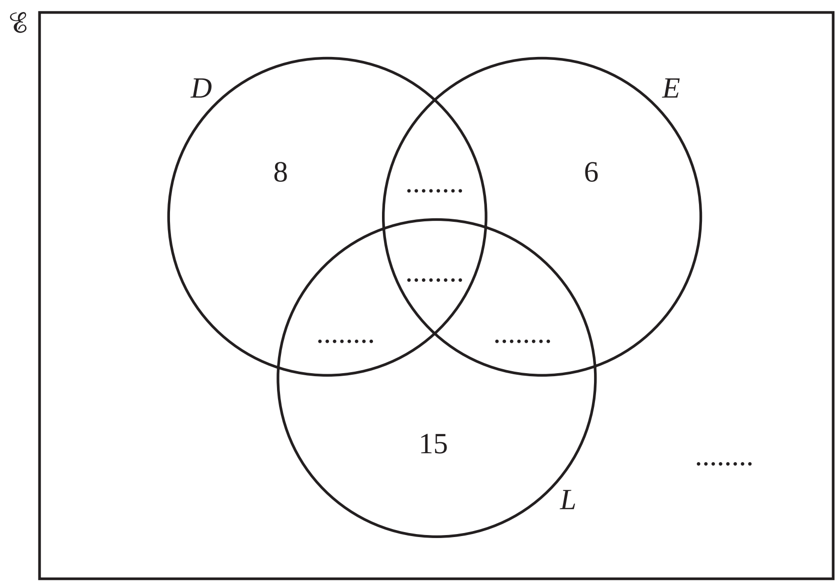
22 In a survey of 60 cars, 25 use diesel, 20 use liquid hydrogen and 22 use electricity.

No cars use all three fuels and 14 cars use both diesel and electricity.

There are 8 cars which use diesel only, 15 cars which use liquid hydrogen only and 6 cars which use electricity only.

In the Venn diagram below

$\mathscr{E}$ = {cars in the survey},
D = {cars which use diesel},
L = {cars which use liquid hydrogen},
E = {cars which use electricity}.



(a) Use the information above to fill in the five missing numbers in the Venn diagram. [4]

(b) Find the number of cars which use diesel but not electricity.

Answer(b) .... [1]

(c) Find n($D' \cap (E \cup L)$).

Answer(c) .... [1]

5) November 2010 V2

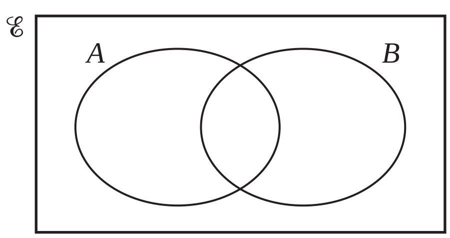
2 In a group of 30 students, 18 have visited Australia, 15 have visited Botswana and 5 have not visited either country.

Work out the number of students who have visited Australia but not Botswana.

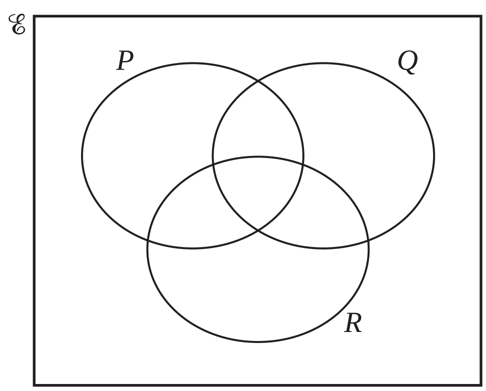
Answer .... [2]

6) November 2010 V3

4 Shade the required region on each Venn diagram.



$A \cap B'$



$(P \cup Q) \cap R'$

[2]

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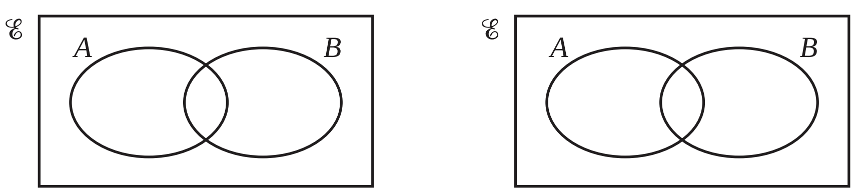
7) November 2010 V3

11 In a group of 24 students, 21 like football and 15 like swimming.
One student does **not** like football and does **not** like swimming.
Find the number of students who like **both** football and swimming.

Answer .... [2]

8) June 2011 V1

2 Shade the required region on each Venn diagram.



$A \cup B'$ $(A \cap B)'$

[2]

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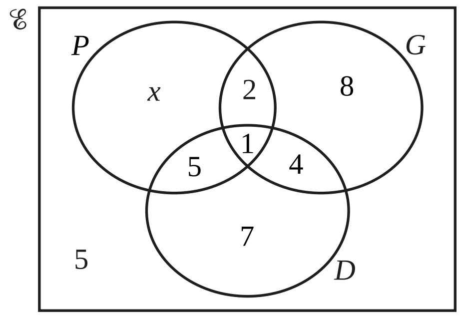
15 A teacher asks 36 students which musical instruments they play.

P = {students who play the piano}
G = {students who play the guitar}
D = {students who play the drums}

The Venn diagram shows the results.



(a) Find the value of x.

Answer(a) x = ... [1]

(b) A student is chosen at random.

Find the probability that this student

(i) plays the drums but **not** the guitar,

Answer(b)(i) .... [1]

(ii) plays only 2 different instruments.

Answer(b)(ii) .... [1]

(c) A student is chosen at random from those who play the guitar.

Find the probability that this student plays no other instrument.

Answer(c) .... [1]

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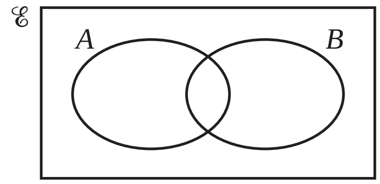
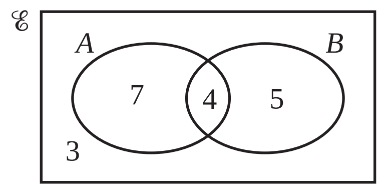
3 **(a)**



Shade the region $A \cap B'$. [1]

(b)



This Venn diagram shows the number of elements in each region.

Write down the value of n $(A \cup B')$.

Answer(b) n $(A \cup B')$ = ... [1]

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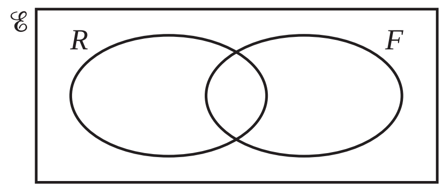
17



In the Venn diagram, ℰ = {students in a survey}, R = {students who like rugby} and F = {students who like football}.

$n(\mathscr{E}) = 20$ $\quad n(R \cup F) = 17$ $\quad n(R) = 13$ $\quad n(F) = 11$

(a) Find

(i) $n(R \cap F)$,

Answer(a)(i) .... [1]

(ii) $n(R' \cap F)$.

Answer(a)(ii) .... [1]

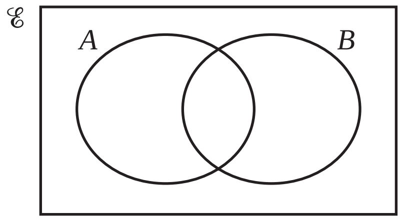
(b) A student who likes rugby is chosen at random.

Find the probability that this student also likes football.

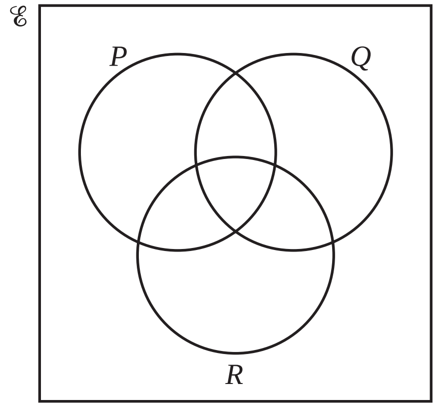
Answer(b) .... [1]

12) November 2012 V3

9 Shade the required region in each of the Venn diagrams.



A'

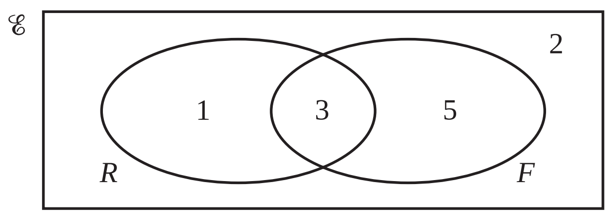


$(P \cap R) \cup Q$

[2]

13) June 2013 V1

12



11 students are asked if they like rugby (R) and if they like football (F).
The Venn diagram shows the results.

(a) A student is chosen at random.

What is the probability that the student likes rugby **and** football?

Answer(a) .... [1]

(b) On the Venn diagram shade the region $R' \cap F'$. [1]

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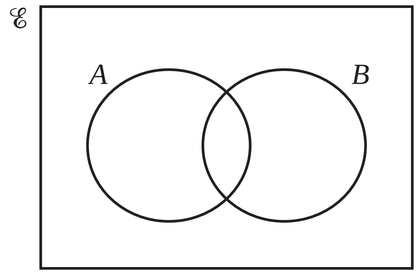
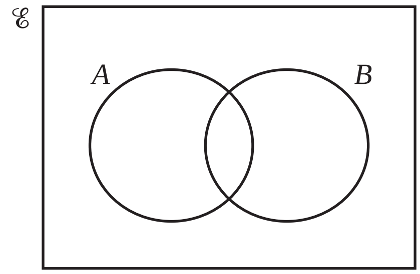
14) June 2013 V2

1 Shade the required region on each Venn diagram.



$A' \cup B$

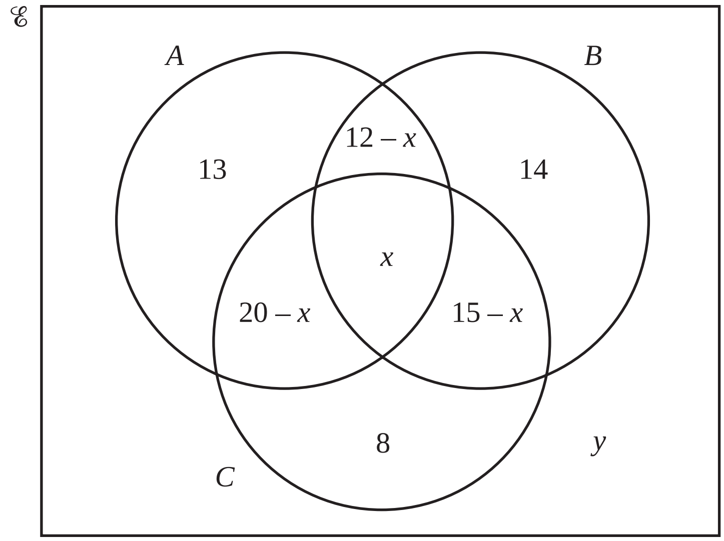


$A' \cap B'$

[2]

15) June 2013 V3

15



The Venn diagram shows the number of elements in sets A, B and C.

(a) $n(A \cup B \cup C) = 74$

Find x.

Answer(a) x = ... [2]

(b) $n(\mathscr{E}) = 100$

Find y.

Answer(b) y = ... [1]

(c) Find the value of $n((A \cup B)' \cap C)$.

Answer(c) .... [1]

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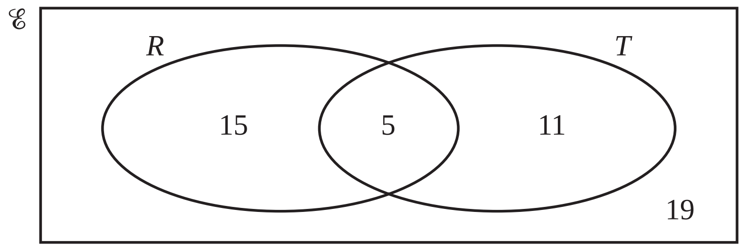
22



The Venn diagram shows the number of red cars and the number of two-door cars in a car park.
There is a total of 50 cars in the car park.
R = {red cars} and T = {two-door cars}.

(a) A car is chosen at random.

Write down the probability that

(i) it is red and it is a two-door car,

Answer(a)(i) .... [1]

(ii) it is not red and it is a two-door car.

Answer(a)(ii) .... [1]

(b) A two-door car is chosen at random.

Write down the probability that it is not red.

Answer(b) .... [1]

(c) Two cars are chosen at random.

Find the probability that they are both red.

Answer(c) .... [2]

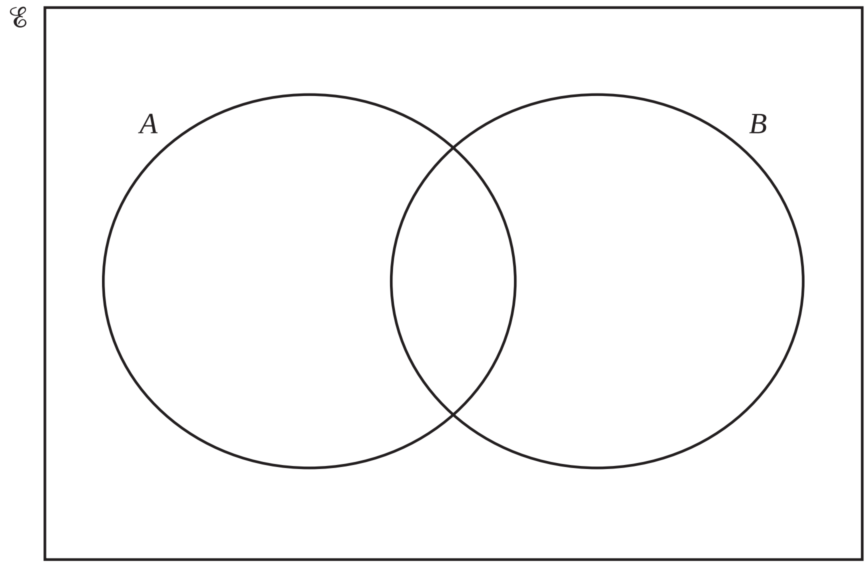
(d) On the Venn diagram, shade the region $R \cup T'$. [1]

17 $\mathscr{E} = \{x : 1 \leqslant x \leqslant 10, \text{ where } x \text{ is an integer}\}$

$A = \{\text{square numbers}\}$

$B = \{1, 2, 3, 4, 5, 6\}$

(a) Write all the elements of $\mathscr{E}$ in their correct place in the Venn diagram.



[2]

(b) List the elements of $(A \cup B)'$

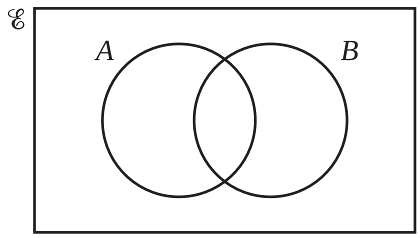
Answer(b) .... [1]

(c) Find $n(A \cap B')$.

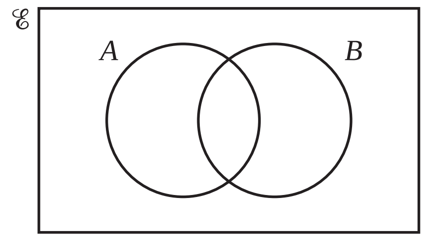
Answer(c) .... [1]

18) November 2014 V2

4 Shade the region required in each Venn diagram.



$(A \cup B)'$



$A' \cap B$

[2]

19) November 2014 V3

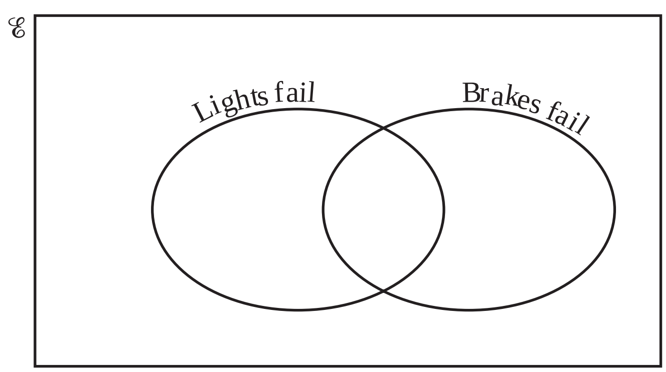
15 The lights and brakes of 30 bicycles are tested.
The table shows the results.

	Lights	Brakes
Fail test	3	9
Pass test	27	21

The lights and brakes both failed on one bicycle only.

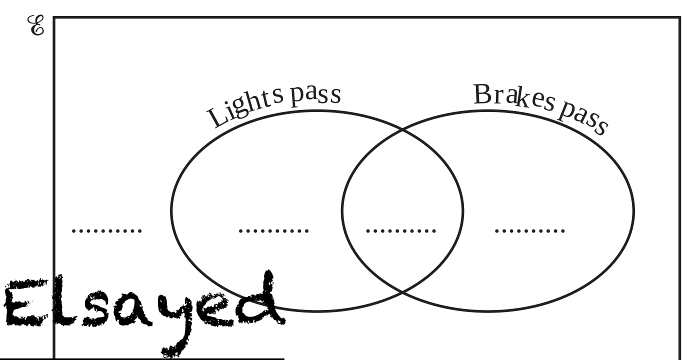
$\mathscr{E}$ = {30 bicycles}
Complete the Venn diagrams.

(a)



[2]

(b)

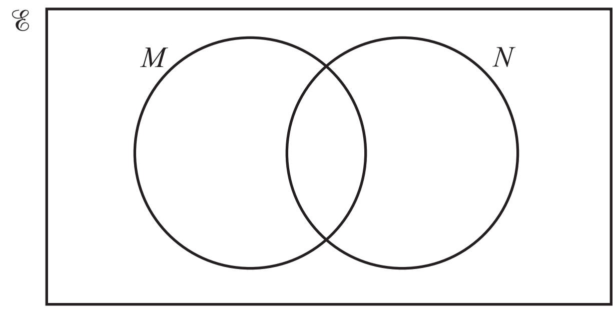


[2]

20) June 2015 V2

20 **(a)** You may use this Venn diagram to help you answer **part (a)**.

$\mathscr{E} = \{x : 1 \leqslant x \leqslant 12,\ x \text{ is an integer}\}$
$M = \{\text{odd numbers}\}$
$N = \{\text{multiples of } 3\}$



(i) Find n(N).

Answer(a)(i) .... [1]

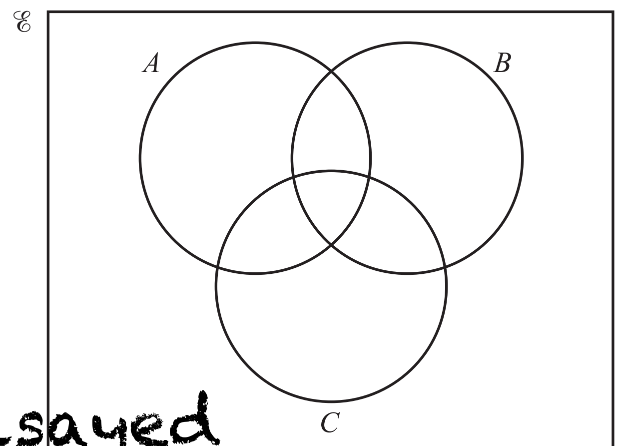
(ii) Write down the set $M \cap N$

Answer(a) (ii) $M \cap N = \{$...$\}$ [1]

(iii) Write down a set P where $P \subset M$

Answer(a)(iii) $P = \{$...$\}$ [1]

(b) Shade $(A \cup C) \cap B'$ in the Venn diagram below.



[1]

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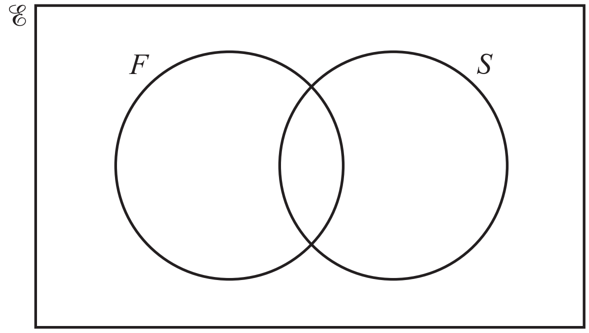
16 **(a)** In this part, you may use this Venn diagram to help you answer the questions.



In a class of 30 students, 25 study French (F), 18 study Spanish (S).
One student does not study French or Spanish.

(i) Find the number of students who study French and Spanish.

Answer(a)(i) .... [2]

(ii) One of the 30 students is chosen at random.

Find the probability that this student studies French but not Spanish.

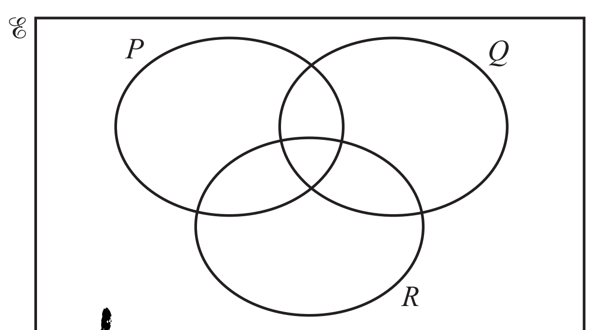
Answer(a)(ii) .... [1]

(iii) A student who does not study Spanish is chosen at random.

Find the probability that this student studies French.

Answer(a)(iii) .... [1]

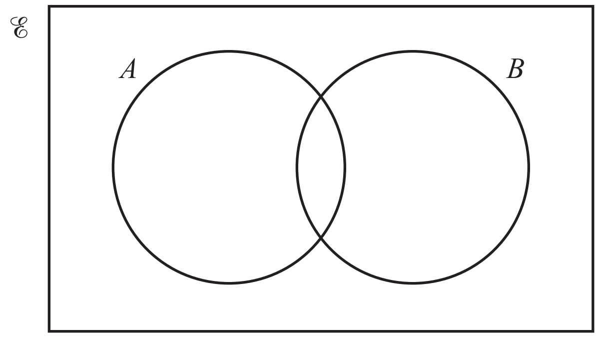
(b)



On this Venn diagram, shade the region $R \cap (P \cup Q)'$. [1]

22) November 2015 V1

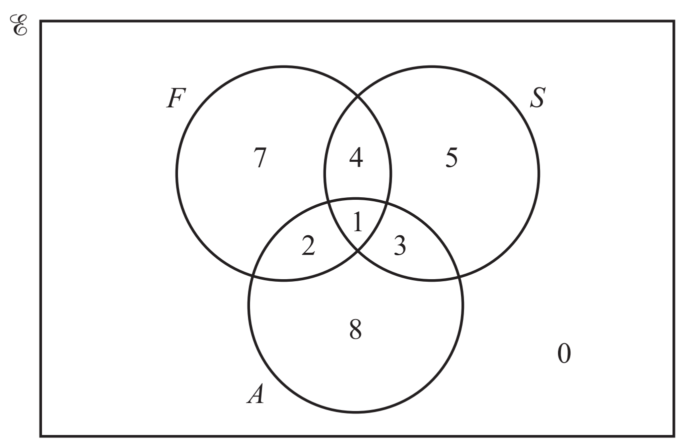
2



In the Venn diagram shade the region $A \cup B'$. [1]

23) November 2015 V2

6 The Venn diagram shows the number of students who study French (F), Spanish (S) and Arabic (A).



(a) Find $n(A \cup (F \cap S))$.

Answer(a) .... [1]

(b) On the Venn diagram, shade the region $F' \cap S$. [1]

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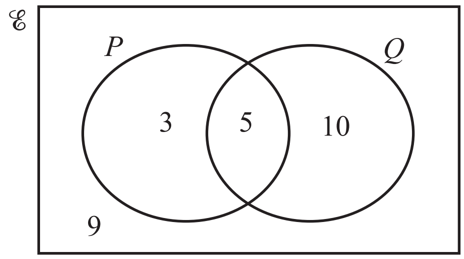
24) November 2015 V3

12



The Venn diagram shows the number of elements in each set.

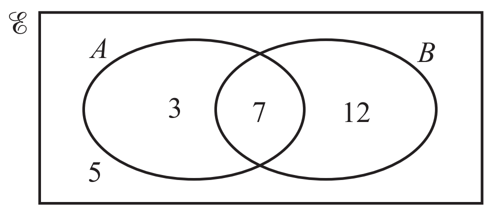
(a) Find n$(P' \cap Q)$.

Answer(a) .... [1]

(b) Complete the statement n(.................................) = 17. [1]

25) June 2016 V1

22



The Venn diagram shows the numbers of elements in each region.

(a) Find n$(A \cap B')$

.... [1]

(b) An element is chosen at random.

Find the probability that this element is in set B

.... [1]

(c) An element is chosen at random from set A.

Find the probability that this element is also a member of set B

[1]

(d) On the Venn diagram, shade the region $(A \cup B)'$. [1]

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14 **(a)** $\mathscr{E} = \{x: 2 \leqslant x \leqslant 16, x \text{ is an integer}\}$
$M = \{\text{even numbers}\}$
$P = \{\text{prime numbers}\}$

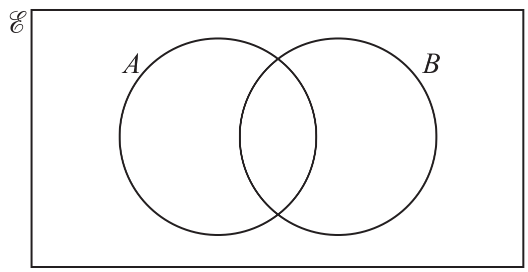
(i) Find $n(M)$.

[1]

(ii) Write down the set $(P \cup M)'$.

$(P \cup M)' = \{$...$\}$ [1]

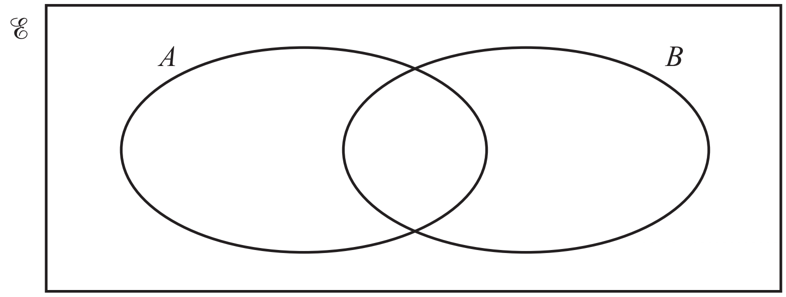
(b) On the Venn diagram, shade $A \cap B'$.



[1]

27) November 2016 V1

22 **(a)** $n(\mathscr{E}) = 10$, $n(A) = 7$, $n(B) = 6$, $n(A \cup B)' = 1$.



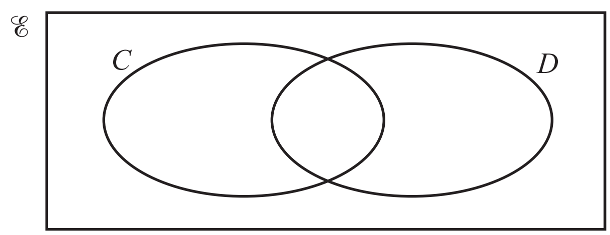
(i) Complete the Venn diagram by writing the number of elements in each subset. [2]

(ii) An element of ℰ is chosen at random.

Find the probability that this element is an element of $A' \cap B$.

.... [1]

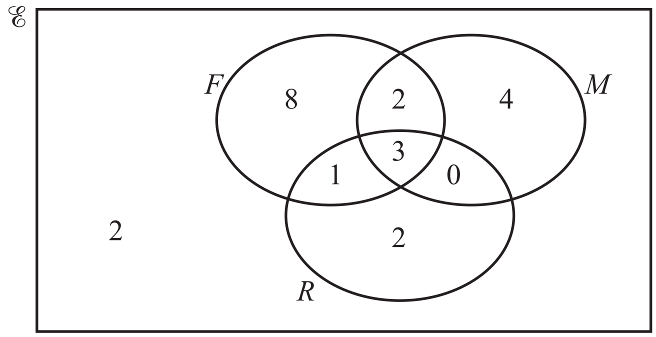
(b) On the Venn diagram below, shade the region $C' \cap D'$.



[1]

28) November 2016 V2

15



The Venn diagram shows the number of people who like films (F), music (M) and reading (R).

(a) Find

(i) $n(M)$,

.... [1]

(ii) $n(R \cup M)$.

.... [1]

(b) A person is chosen at random from the people who like films.

Write down the probability that this person also likes music.

.... [1]

(c) On the Venn diagram, shade $M' \cap (F \cup R)$. [1]

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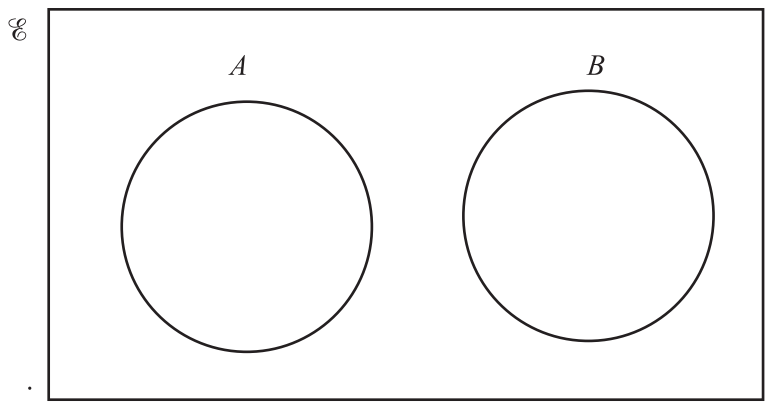
20 **(a)** $\mathscr{E} = \left\{7,\ 9.3,\ \pi,\ \frac{5}{9},\ 2\sqrt{8}\right\}$

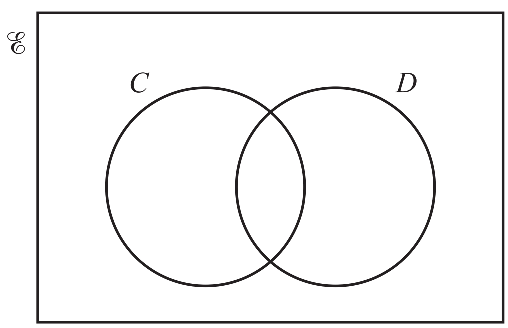
$A = \{\text{integers}\}$
$B = \{\text{irrational numbers}\}$

Write all the elements of $\mathscr{E}$ in their correct place on the Venn diagram.

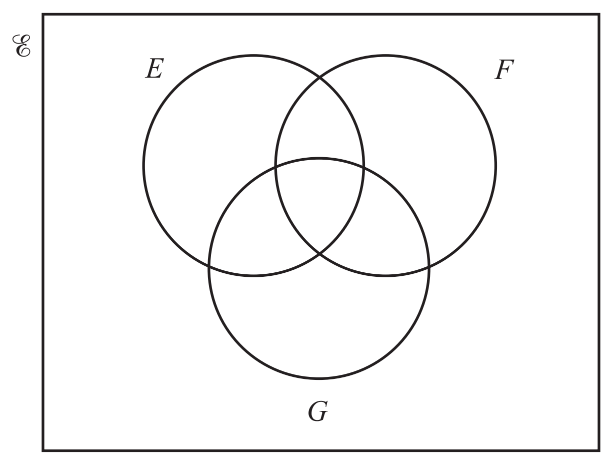


[2]

(b) Shade the region in each of the Venn diagrams below.



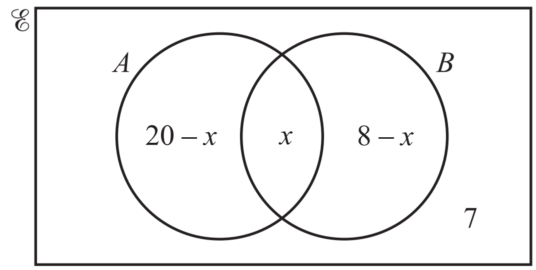
$C' \cup D$



$E \cap F' \cap G$

[2]

23 The Venn diagram shows information about the number of elements in sets A, B and $\mathscr{E}$.



(a) $n(A \cup B) = 23$

Find the value of x.

$x =$ .... [3]

(b) An element is chosen at random from $\mathscr{E}$.

Find the probability that this element is in $(A \cup B)'$.

.... [2]

Probability

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1) November 2010 V2

17

	Boys	Girls	Total
Asia	62	28	
Europe	35	45	
Africa		17	
Total			255

For a small international school, the holiday destinations of the 255 students are shown in the table.

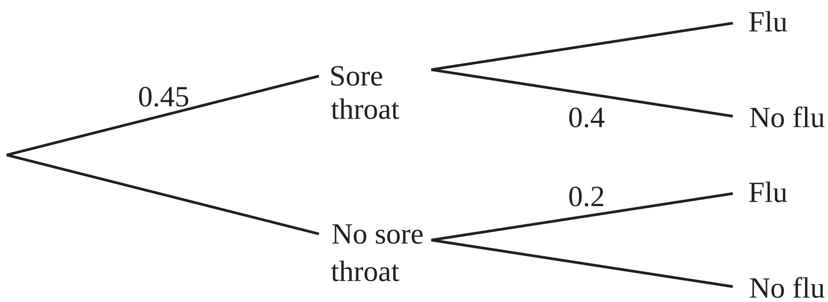
(a) Complete the table. [3]

(b) What is the probability that a student chosen at random is a girl going on holiday to Europe?

Answer(b) .... [1]

2) November 2011 V1

10 In a flu epidemic 45% of people have a sore throat.
If a person has a sore throat the probability of **not** having flu is 0.4.
If a person does not have a sore throat the probability of having flu is 0.2.



Calculate the probability that a person chosen at random has flu.

Answer .... [4]

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21 **In this question, give all your answers as fractions**.

A box contains 3 red pencils, 2 blue pencils and 4 green pencils.
Raj chooses 2 pencils at random, without replacement.

Calculate the probability that

(a) they are both red,

Answer(a) .... [2]

(b) they are both the same colour,

Answer(b) .... [3]

(c) exactly one of the two pencils is green.

Answer(c) .... [3]

4) June 2013 V3

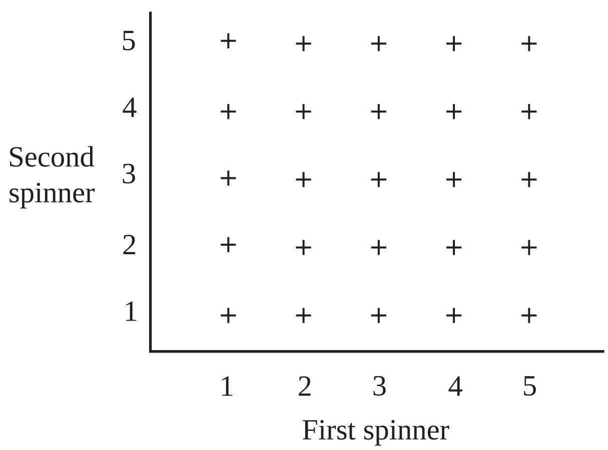
2 The Ocean View Hotel has 300 rooms numbered from 100 to 399.
A room is chosen at random.

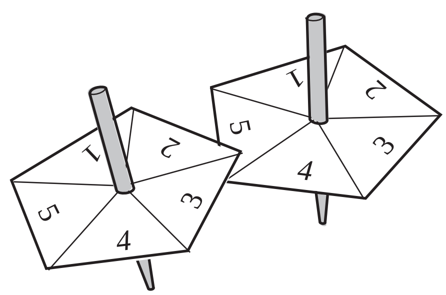
Find the probability that the room number ends in zero.

Answer .... [2]

5) June 2013 V3

12 Two spinners have sections numbered from 1 to 5.
Each is spun once and each number is equally likely.
The possibility diagram is shown below.





Find the probability that

(a) both spinners show the same number,

Answer(a) .... [2]

(b) the sum of the numbers shown on the two spinners is 7.

Answer(b) .... [2]

6

S	P	A	C	E	S

One of the 6 letters is taken at random.

(a) Write down the probability that the letter is S.

Answer(a) .... [1]

(b) The letter is replaced and again a letter is taken at random.
This is repeated 600 times.

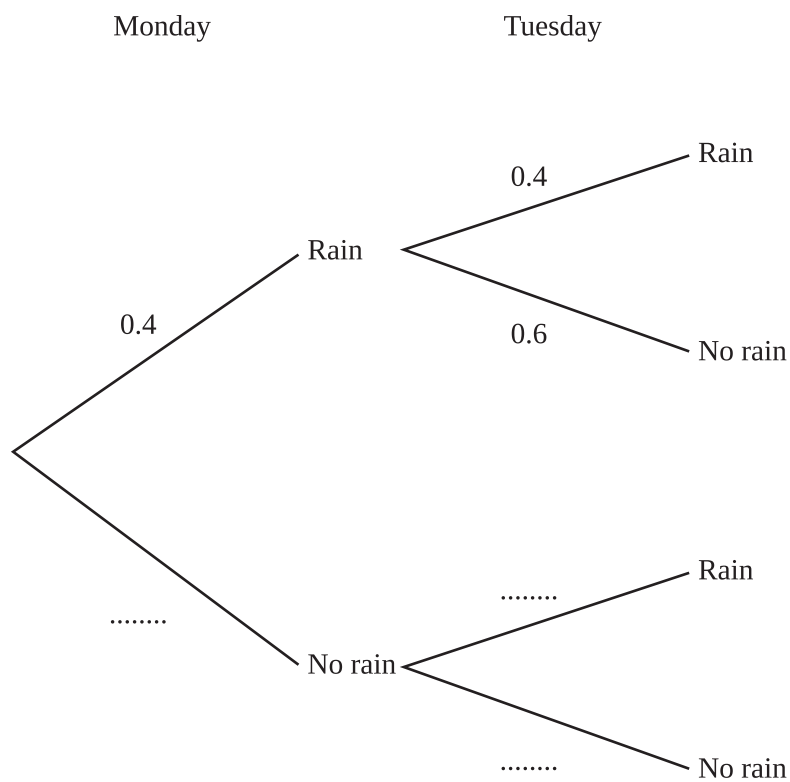
How many times would you expect the letter to be S?

Answer(b) .... [1]

7) November 2014 V1

18 If it rains today the probability that it will rain tomorrow is 0.4 .
If it does not rain today the probability that it will rain tomorrow is 0.2 .
On Sunday it rained.

(a) Complete the tree diagram for Monday and Tuesday.



[2]

(b) Find the probability that it rains on at least one of the two days shown in the tree diagram.

Answer(b) .... [3]

8) June 2015 V1

5 Paul and Sammy take part in a race.

The probability that Paul wins the race is $\frac{9}{35}$.

The probability that Sammy wins the race is 26%.

Who is more likely to win the race?
Give a reason for your answer.

Answer .... because .... [2]

9) June 2015 V2

5 A biased 4-sided dice is rolled.
The possible scores are 1, 2, 3 or 4.
The probability of rolling a 1, 3 or 4 is shown in the table.

Score	1	2	3	4
Probability	0.15		0.3	0.35

Complete the table. [2]

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10) November 2015 V1

20 The table shows the probability that a person has blue, brown or green eyes.

Eye colour	Blue	Brown	Green
Probability	0.4	0.5	0.1

Use the table to work out the probability that two people, chosen at random,

(a) have blue eyes,

Answer(a) .... [2]

(b) have different coloured eyes.

Answer(b) .... [4]

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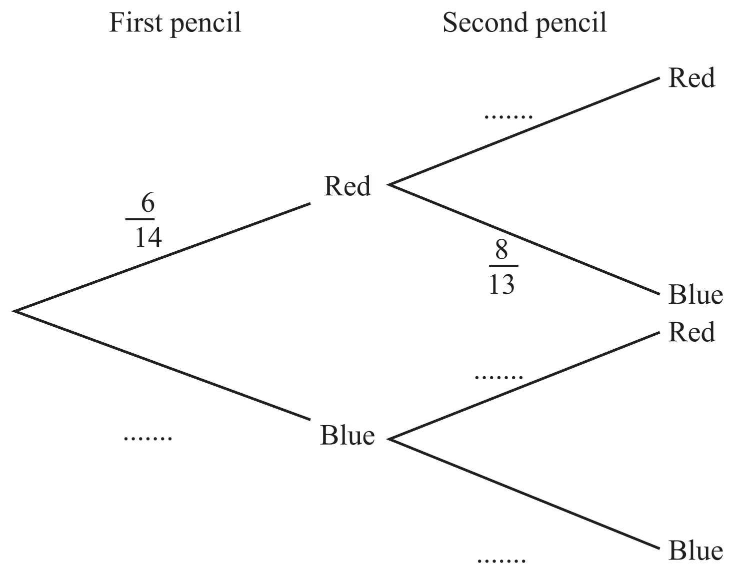
23 A box contains 6 red pencils and 8 blue pencils.
A pencil is chosen at random and not replaced.
A second pencil is then chosen at random.

(a) Complete the tree diagram.



[2]

(b) Calculate the probability that

(i) both pencils are red,

Answer(b)(i) .... [2]

(ii) at least one of the pencils is red.

Answer(b)(ii) .... [3]

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12) November 2015 V3

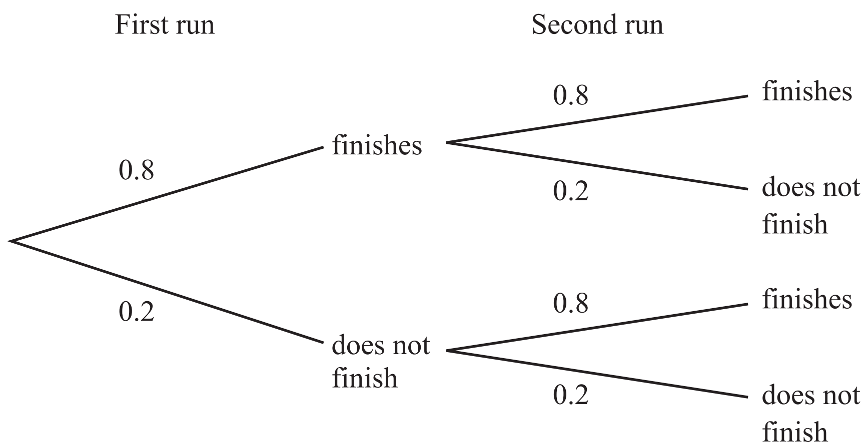
4 The probability that it will rain on any day is $\frac{1}{5}$.

Calculate an estimate of the number of days it will rain in a month with 30 days.

Answer .... [1]

13) November 2015 V3

18 Samira takes part in two charity runs.
The probability that she finishes each run is 0.8 .



Find the probability that Samira finishes at least one run.

Answer .... [3]

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21 Dan either walks or cycles to school.
The probability that he cycles to school is $\frac{1}{3}$.

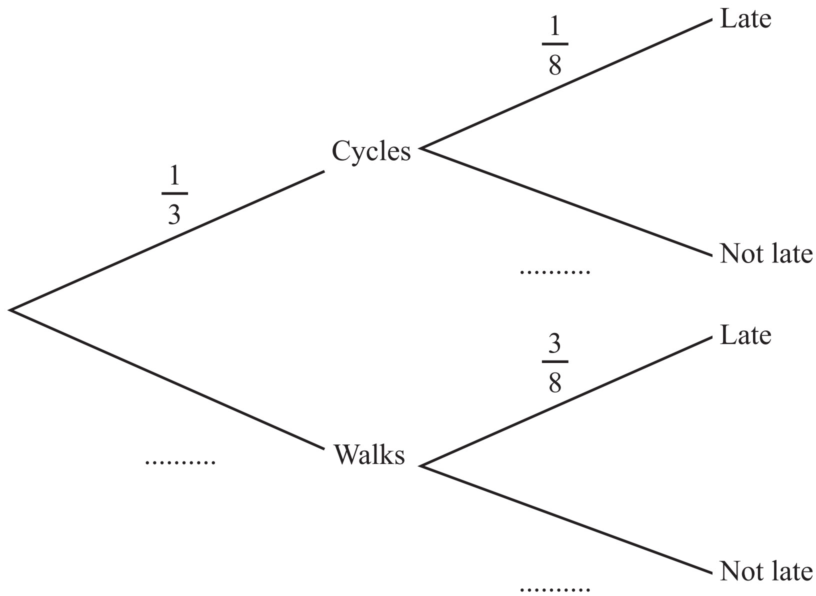
(a) Write down the probability that Dan walks to school.

.... [1]

(b) When Dan cycles to school the probability that he is late is $\frac{1}{8}$.

When Dan walks to school the probability that he is late is $\frac{3}{8}$.

Complete the tree diagram.



[2]

(c) Calculate the probability that

(i) Dan cycles to school and is late,

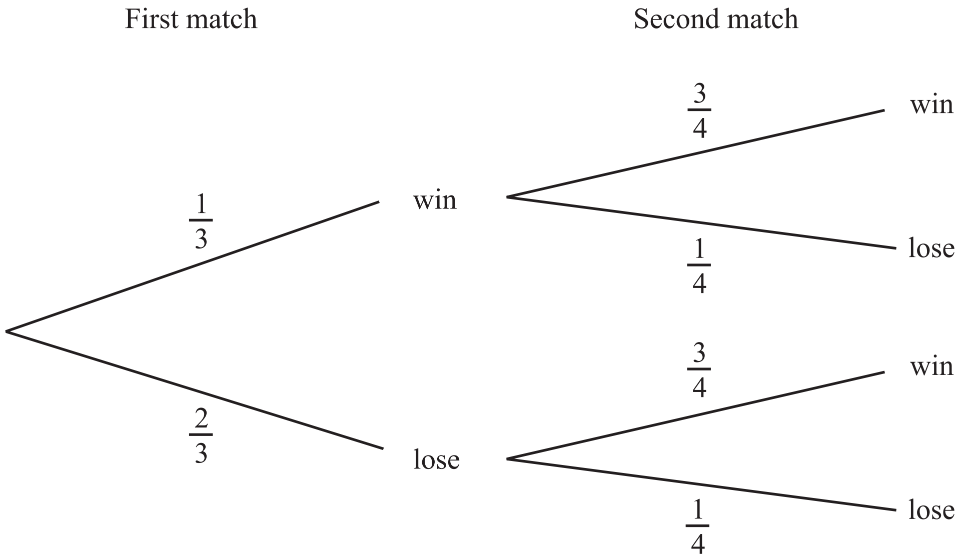
.... [2]

(ii) Dan is not late.

.... [3]

15) June 2016 V1

19 The probability of a cricket team winning or losing in their first two matches is shown in the tree diagram.



Find the probability that the cricket team wins at least one match.

.... [3]

16) June 2016 V3

11 Hattie has a box of coloured pens.
She takes a pen at random from the box.
The probability that she takes a red pen is 0.4 .

(a) Work out the probability that she does not take a red pen.

.... [1]

(b) The box contains only blue, red and green pens.
There are 15 blue pens and 15 green pens.

Complete the table.

Colour of pen	Blue	Red	Green
Number of pens	15		15
Probability		0.4	

[2]

17) June 2017 V1

8 Simon has two boxes of cards.
In one box, each card has one shape drawn on it that is either a triangle or a square.
In the other box, each card is coloured either red or blue.

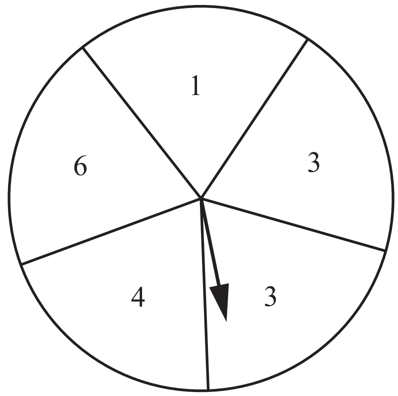
Simon picks a card from each box at random.
The probability of picking a triangle card is t.
The probability of picking a red card is r.

Complete the table for the cards that Simon picks, writing each probability in terms of r and t.

Event	Probability
Triangle and red	
Square and red	$(1-t)r$
Triangle and blue	
Square and blue	

[3]

20 The diagram shows a fair spinner.



Anna spins it twice and adds the scores.

(a) Complete the table for the total scores.

		Score on first spin				
		1	3	3	4	6
Score on second spin	1	2	4	4	5	7
	3	4	6	6	7	9
	3	4	6	6	7	9
	4					
	6					

[1]

(b) Write down the most likely total score.

.... [1]

(c) Find the probability that Anna scores

(i) a total less than 6,

.... [2]

(ii) a total of 3.

.... [1]

24) June 2017 V3

6 The probability that Pedro scores a goal in any match is $\frac{2}{5}$.

Calculate the probability that Pedro scores a goal in each of the next two matches.

.... [2]

25) June 2018 V1

20 **(a)** A box contains 3 blue pens, 4 red pens and 8 green pens only.
A pen is chosen at random from the box.

Find the probability that this pen is green.

.... [1]

(b) Another box contains 7 black pens and 8 orange pens only.
Two pens are chosen at random from this box without replacement.

Calculate the probability that at least one orange pen is chosen.

.... [3]

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24 Box A and box B each contain blue and green pens only.
Raphael picks a pen at random from box A and Paulo picks a pen at random from box B.
The probability that Raphael picks a blue pen is $\frac{2}{3}$.
The probability that both Raphael and Paulo pick a blue pen is $\frac{8}{15}$.

(a) Find the probability that Paulo picks a blue pen.

.... [2]

(b) Find the probability that both Raphael and Paulo pick a green pen.

.... [3]

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.... [3]

Statistics

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1) June 2010 V3

1 During one week in April, in Quebec, the daily minimum temperatures were

–5°C, –1°C, 3°C, 2°C, –2°C, 0°C, 6°C.

Write down

(a) the lowest of these temperatures,

Answer(a) .... °C [1]

(b) the range of these temperatures.

Answer(b) .... °C [1]

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2) November 2011 V3

9 In Vienna, the mid-day temperatures, in °C, are recorded during a week in December.
This information is shown below.

–2 2 1 –3 –1 –2 0

Calculate

(a) the difference between the highest temperature and the lowest temperature,

Answer(a) .... °C [1]

(b) the mean temperature.

Answer(b) .... °C [2]

3) June 2012 V1

6 Leon scores the following marks in 5 tests.

8 4 8 y 9

His mean mark is 7.2.

Calculate the value of y.

Answer y = ... [2]

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4 Cheryl recorded the midday temperatures in Seoul for one week in January.

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Temperature (°C)	–4	–5	–3	–11	–8	–3	–1

(a) Write down the mode.

Answer(a) .... °C [1]

(b) On how many days was the temperature lower than the mode?

Answer(b) .... [1]

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5) June 2015 V2

4 7 9 20 3 9

(a) A number is removed from this list and the median and range do not change.

Write down this number.

Answer(a) .... [1]

(b) An extra number is included in the original list and the mode does not change.

Write down a possible value for this number.

Answer(b) .... [1]

5 Jim scores the following marks in 8 tests.

7 8 8 y 6 9 10 5

His mean mark is 7.5 .

Calculate the value of y.

Answer y = ... [2]

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11 Shahruk plays four games of golf.
His four scores have a mean of 75, a mode of 78 and a median of 77.

Work out his four scores.

.... [3]

6 James is an animal doctor.
The table shows some information about the cats he saw in one week.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Number of cats seen	2	4	1	3	2
Mean mass of a cat (kg)	1.9	0.9	2.1	1.8	2

One of the cats James saw had a mass of 4 kg.

On which day did he see this cat?

.... [2]

6 In a traffic survey of 125 cars the number of people in each car was recorded.

Number of people in each car	1	2	3	4	5
Frequency	50	40	10	20	5

Find

(a) the range,

Answer(a) .... [1]

(b) the median,

Answer(b) .... [1]

(c) the mode.

Answer(c) .... [1]

20 The heights, in metres, of 200 trees in a park are measured.

Height (h m)	$2 < h \leqslant 6$	$6 < h \leqslant 10$	$10 < h \leqslant 13$	$13 < h \leqslant 17$	$17 < h \leqslant 19$	$19 < h \leqslant 20$
Frequency	23	47	45	38	32	15

(a) Find the interval which contains the median height.

Answer(a) .... [1]

(b) Calculate an estimate of the mean height.

Answer(b) .... m [4]

(c) Complete the cumulative frequency table for the information given in the table above.

Height (h m)	$2 < h \leqslant 6$	$h \leqslant 10$	$h \leqslant 13$	$h \leqslant 17$	$h \leqslant 19$	$h \leqslant 20$
Cumulative frequency	23					

[2]

22 The table shows information about the numbers of pets owned by 24 students.

Number of pets	0	1	2	3	4	5	6
Frequency	1	2	3	5	7	3	3

(a) Calculate the mean number of pets.

Answer(a) .... [3]

(b) Jennifer joins the group of 24 students.
When the information for Jennifer is added to the table, the new mean is 3.44 .

Calculate the number of pets that Jennifer has.

Answer(b) .... [3]

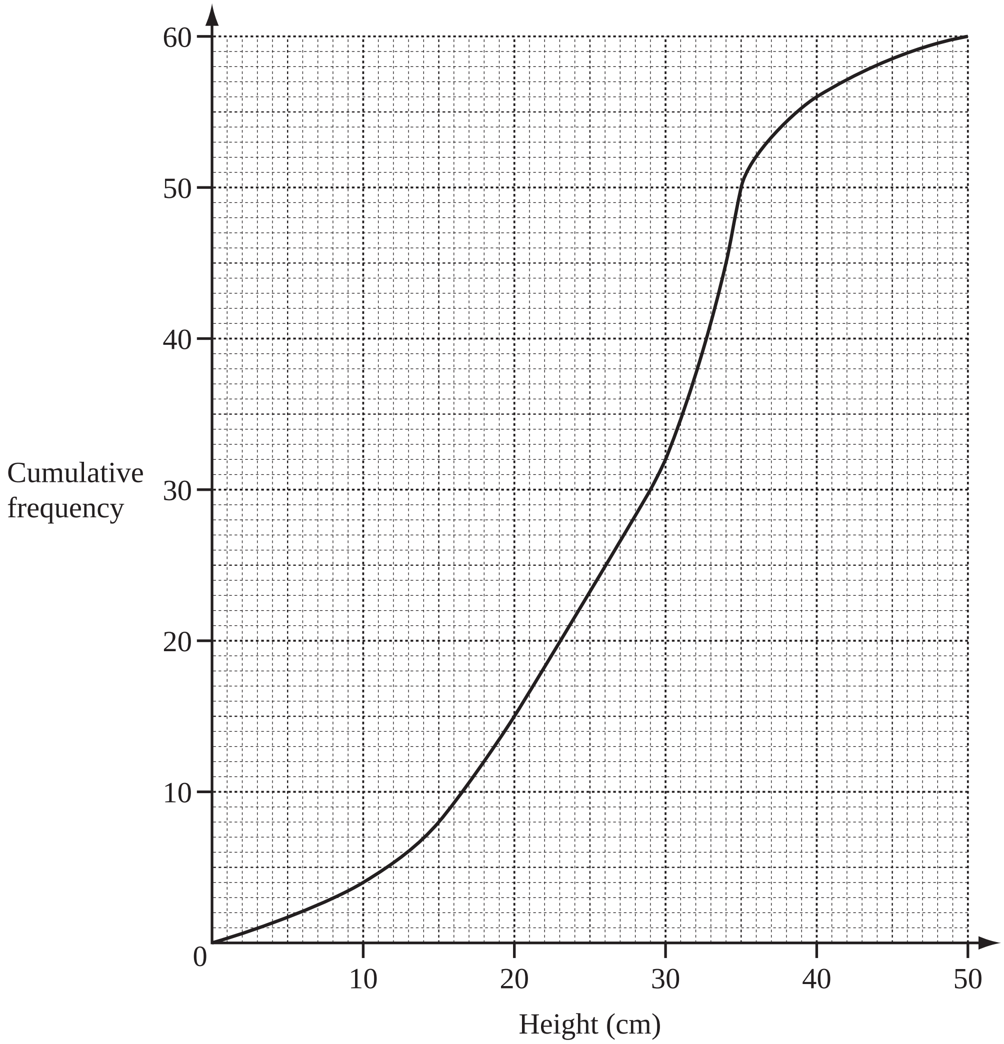
16 Raj measures the height, h cm, of 70 plants.
The table shows the information.

Height (h cm)	$10 < h \leqslant 20$	$20 < h \leqslant 40$	$40 < h \leqslant 50$	$50 < h \leqslant 60$	$60 < h \leqslant 90$
Frequency	7	15	27	13	8

Calculate an estimate of the mean height of the plants.

.... cm [4]

15



The cumulative frequency diagram shows information about the heights of 60 tomato plants.
Use the diagram to find

(a) the median,

Answer(a) .... cm [1]

(b) the lower quartile,

Answer(b) .... cm [1]

(c) the interquartile range,

Answer(c) .... cm [1]

(d) the probability that the height of a tomato plant, chosen at random, will be more than 15 cm.

Answer(d) .... [2]

13) November 2012 V1

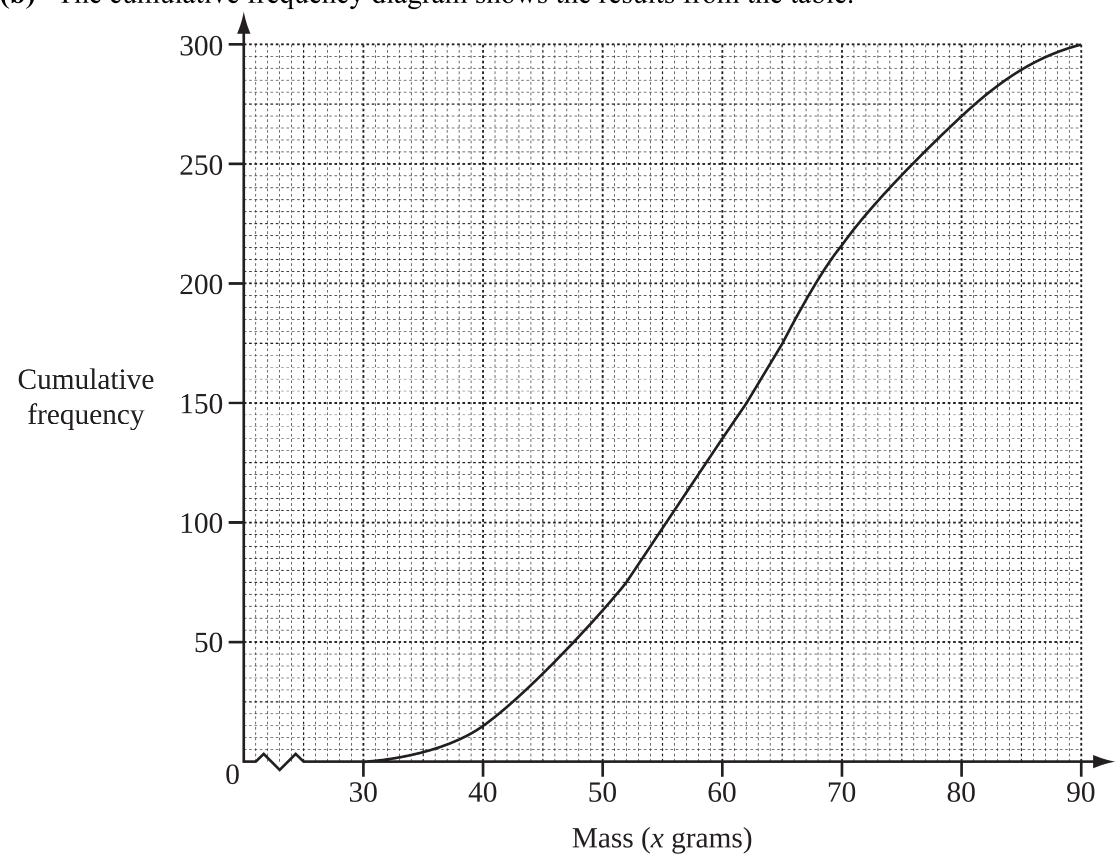
18 Lauris records the mass and grade of 300 eggs. The table shows the results.

Mass (x grams)	$30 < x \leqslant 40$	$40 < x \leqslant 50$	$50 < x \leqslant 60$	$60 < x \leqslant 70$	$70 < x \leqslant 80$	$80 < x \leqslant 90$
Frequency	15	48	72	81	54	30
Grade	small		medium	large	very large	

(a) Find the probability that an egg chosen at random is graded very large.

Answer(a) .... [1]

(b) The cumulative frequency diagram shows the results from the table.



Use the cumulative frequency diagram to find

(i) the median,

Answer(b)(i) .... g [1]

(ii) the lower quartile,

Answer(b)(ii) .... g [1]

(iii) the inter-quartile range,

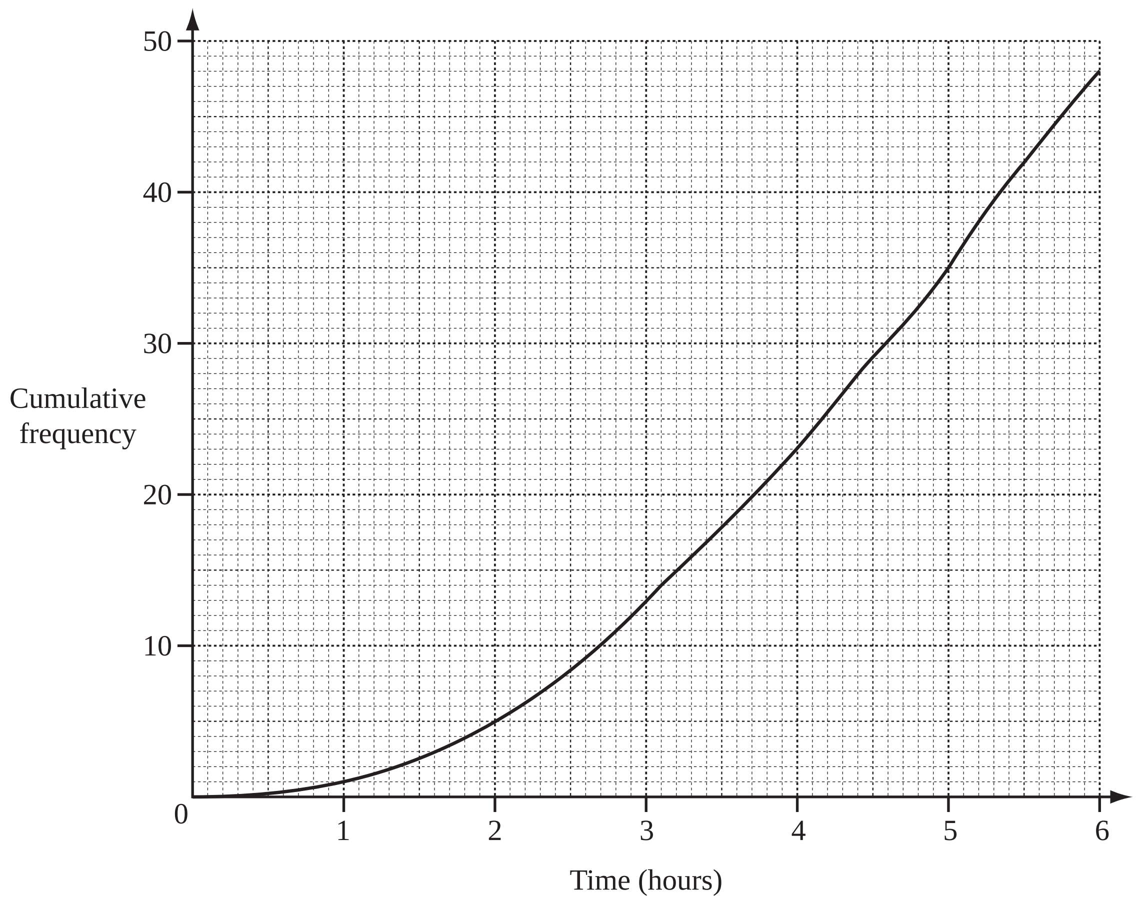
Answer(b)(iii) .... g [1]

(iv) the number of eggs with a mass greater than 65 grams.

Answer(b)(iv) .... [2]

14) November 2013 V2

20 During one day 48 people visited a museum.
The length of time each person spent in the museum was recorded.
The results are shown on the cumulative frequency diagram.



Work out

(a) the median,

Answer(a) .... h [1]

(b) the 20th percentile,

Answer(b) .... h [2]

(c) the inter-quartile range,

Answer(c) .... h [2]

(d) the probability that a person chosen at random spends 2 hours or less in the museum.

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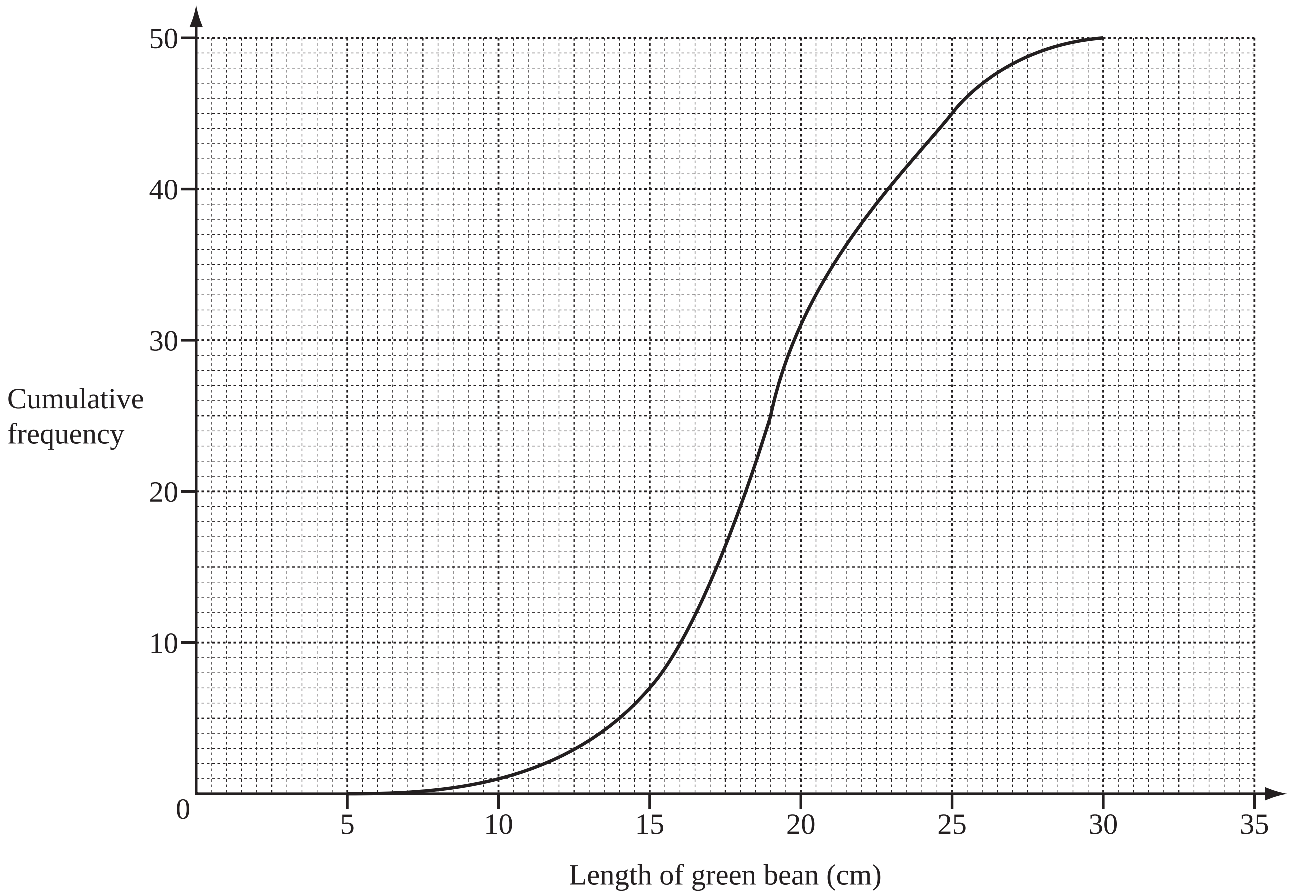
Answer(d) .... [2]

18 A gardener measured the lengths of 50 green beans from his garden.
The results have been used to draw this cumulative frequency diagram.



Work out

(a) the median,

Answer(a) .... cm [1]

(b) the number of green beans that are longer than 26 cm,

Answer(b) .... [2]

(c) the inter-quartile range,

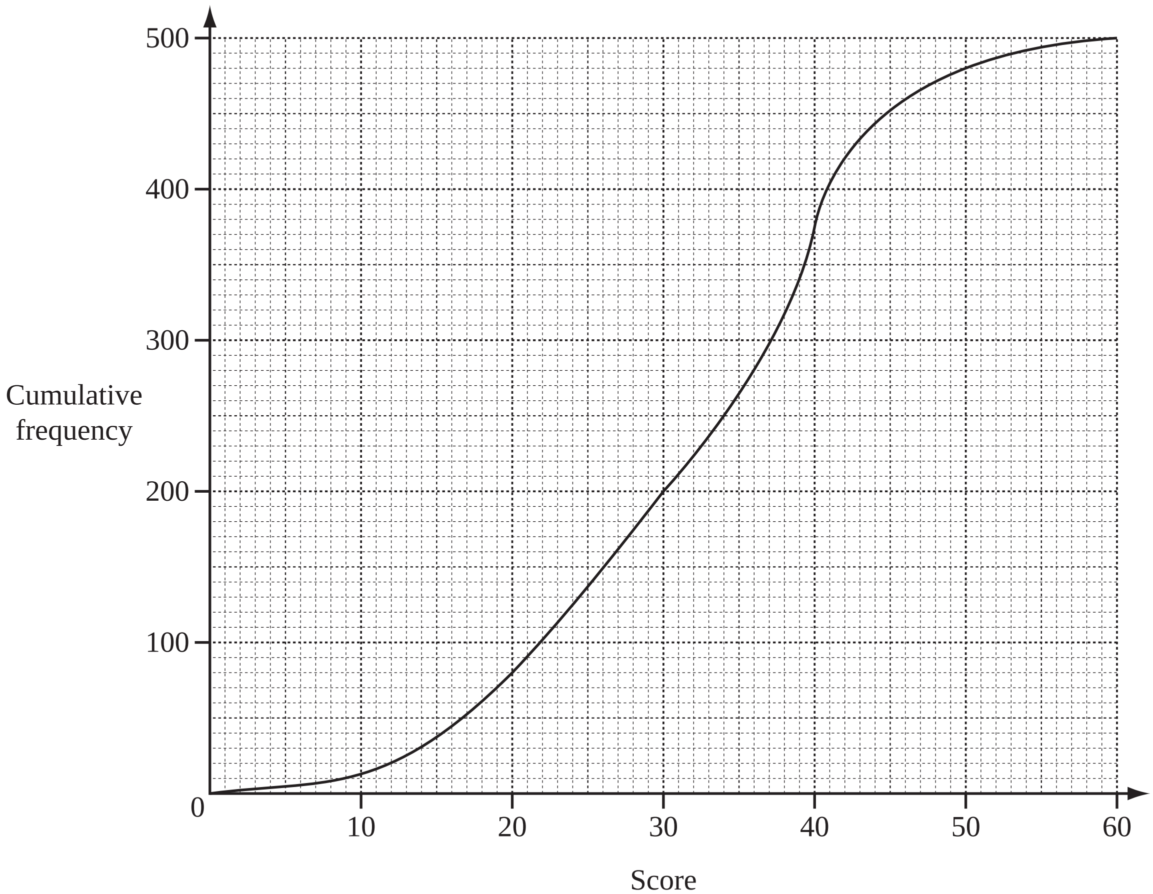
Answer(c) .... cm [2]

(d) the probability that a green bean chosen at random is more than 14 cm long.

Answer(d) .... [2]

16) June 2014 V3

20 Jenna draws a cumulative frequency diagram to show information about the scores of 500 people in a quiz.



Use the diagram to find

(a) the median score,

Answer(a) .... [1]

(b) the inter-quartile range,

Answer(b) .... [2]

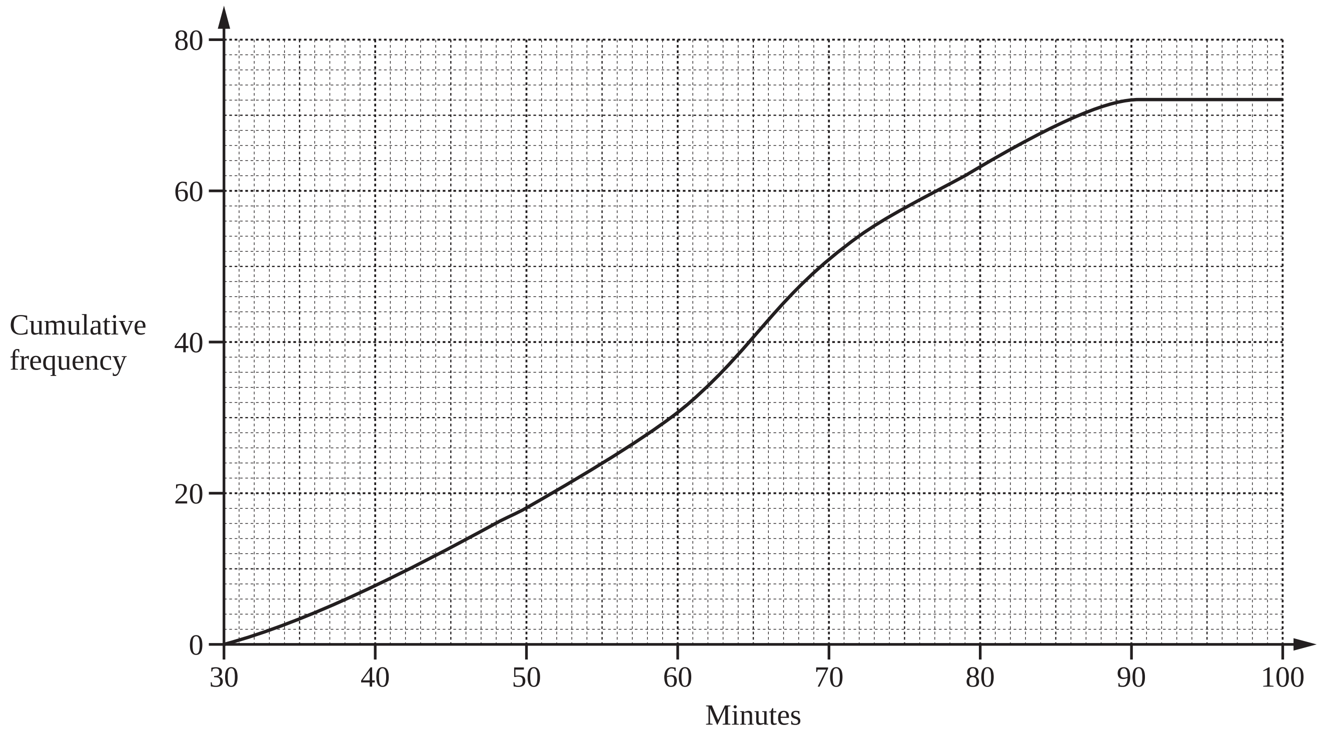
(c) the 40th percentile,

Answer(c) .... [1]

(d) the number of people who scored 30 or less but more than 20.

Answer(d) .... [1]

18 72 students are given homework one evening.
They are told to spend no more than 100 minutes completing their homework.
The cumulative frequency diagram shows the number of minutes they spend.



(a) How many students spent more than 48 minutes completing their homework?

Answer(a) .... [2]

(b) Find

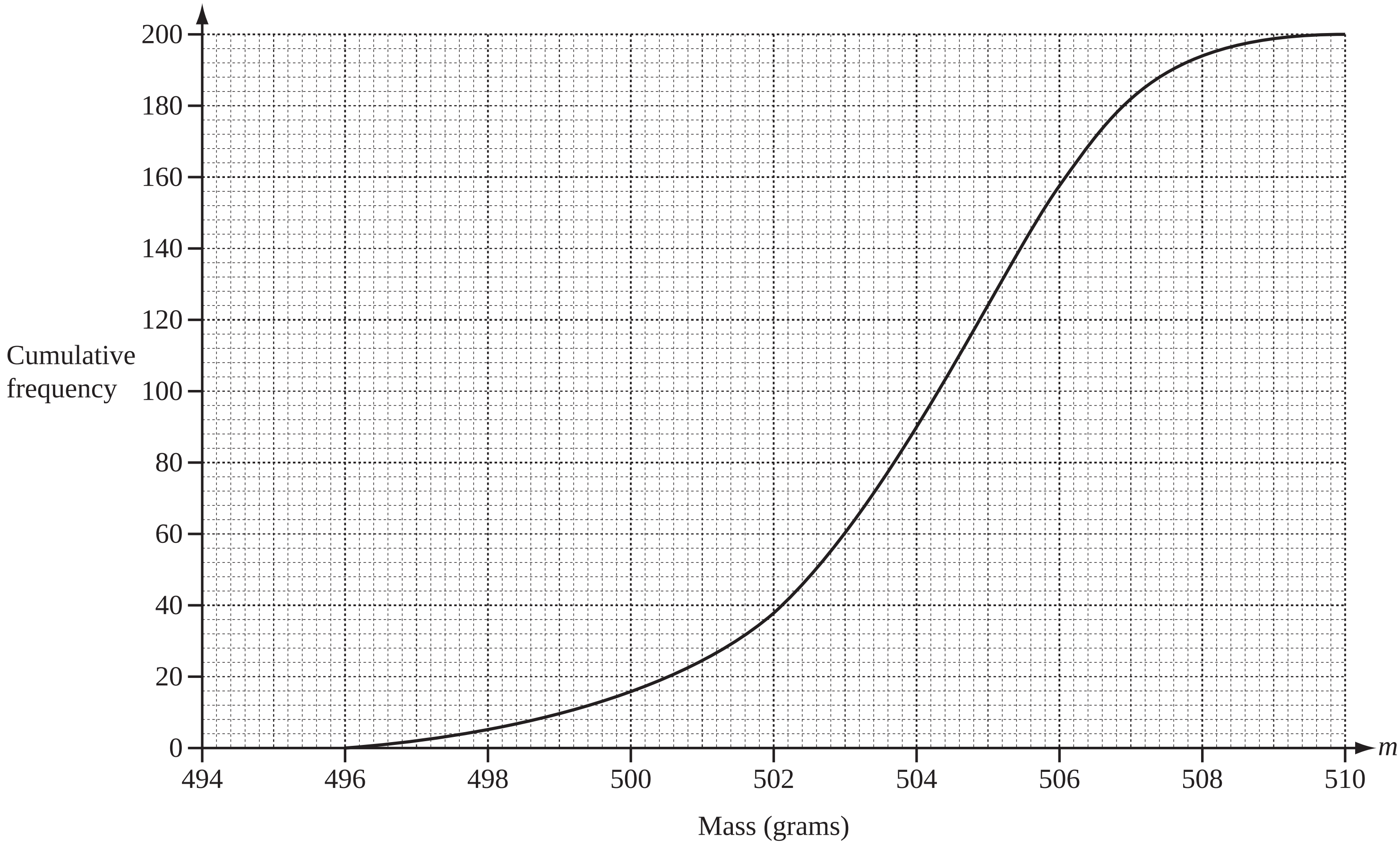
(i) the median,

Answer(b)(i) .... [1]

(ii) the inter-quartile range.

Answer(b)(ii) .... [2]

17 The mass, m grams, of cornflakes in each of 200 boxes is recorded.
The cumulative frequency diagram shows the results.



(a) Use the diagram to estimate the inter-quartile range.

Answer(a) .... g [2]

(b) Find the probability that a box chosen at random has a mass of 500 grams or less.

Answer(b) .... [2]

(c)

Mass (m grams)	$496 < m \leqslant 500$	$500 < m \leqslant 504$	$504 < m \leqslant 508$	$508 < m \leqslant 510$
Frequency	16	74	104	6

The data in this frequency table is to be shown in a histogram.

Complete the frequency density table below.

Mass (m grams)	$496 < m \leqslant 500$	$500 < m \leqslant 504$	$504 < m \leqslant 508$	$508 < m \leqslant 510$
Frequency density	4			

[2]

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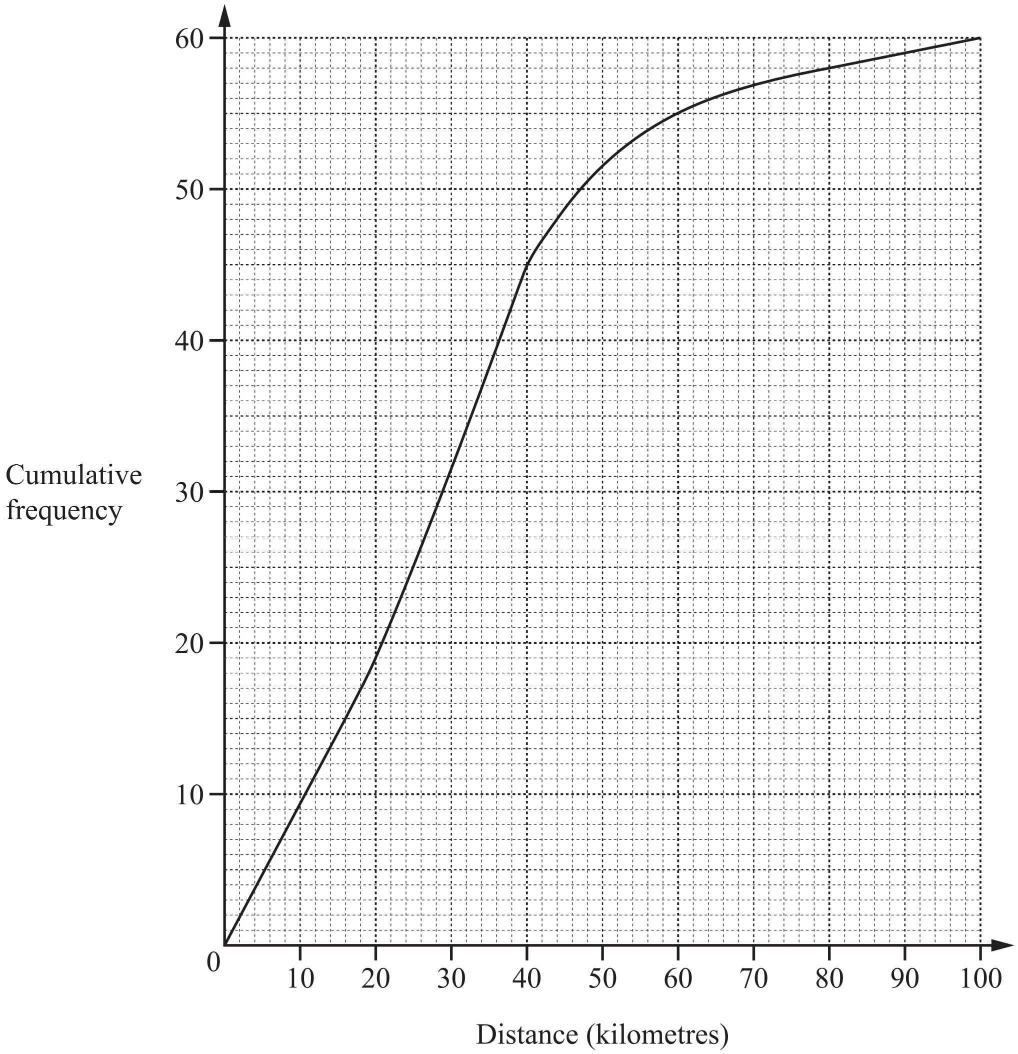
22 The cumulative frequency diagram shows information about the distances travelled, in kilometres, by 60 peop



Find

(a) the 80th percentile,

Answer(a) .... km [2]

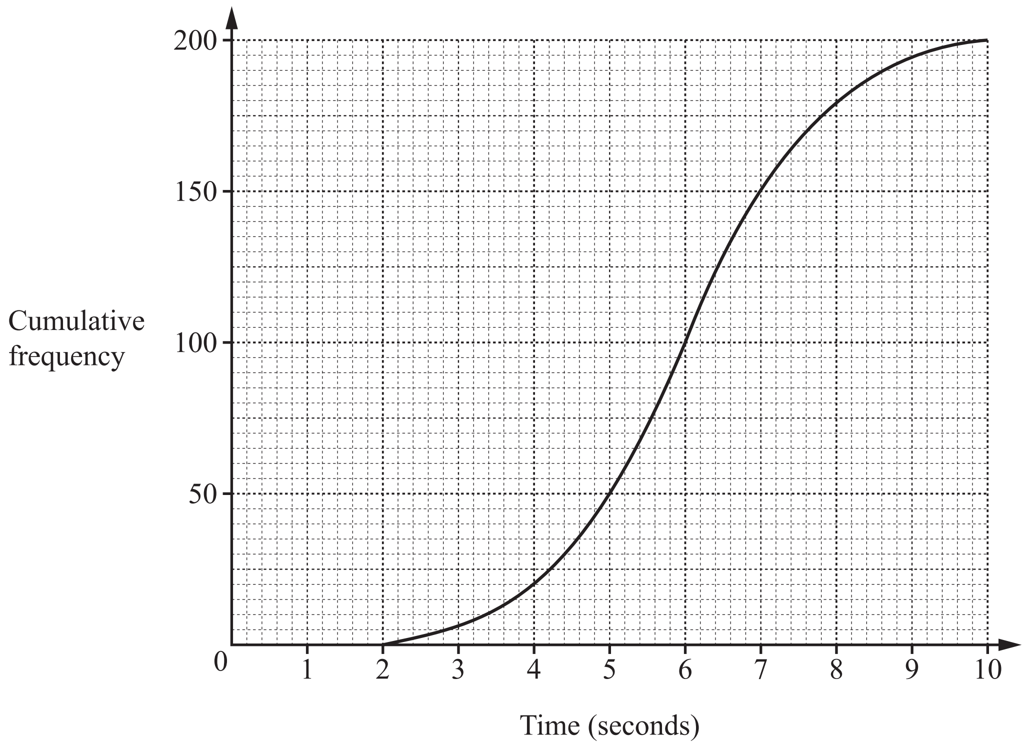
(b) the inter-quartile range,

Answer(b) .... km [2]

(c) the number of people who travelled more than 60 km.

Answer(c) .... [2]

17



200 students take a reaction time test.
The cumulative frequency diagram shows the results.

Find

(a) the median,

Answer(a) .... s [1]

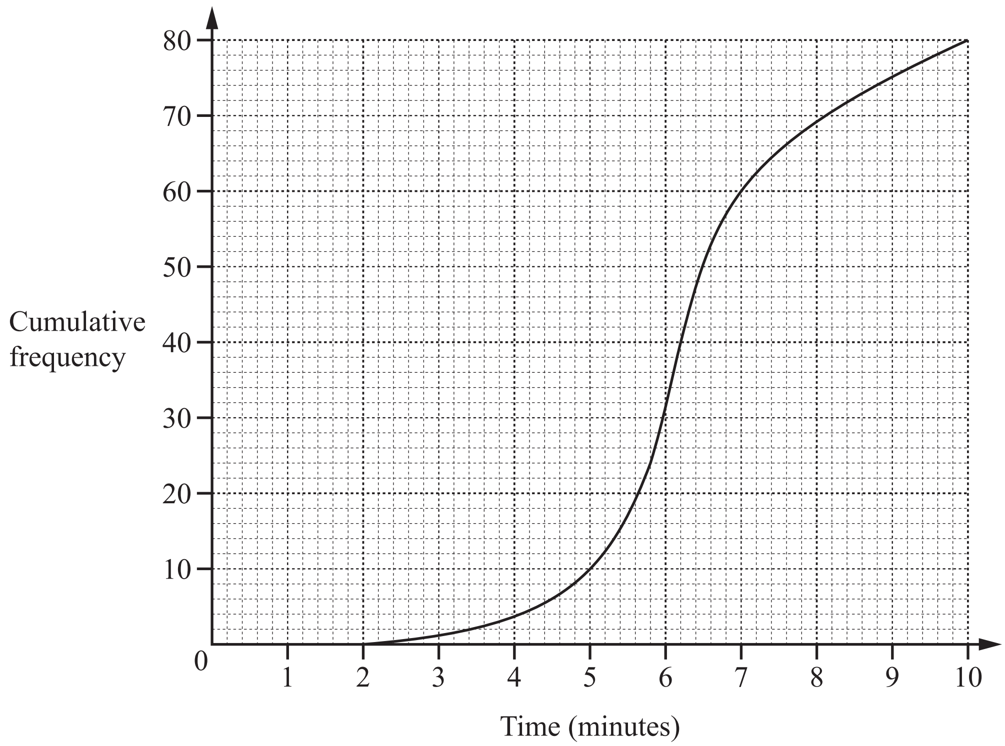
(b) the inter-quartile range,

Answer(b) .... s [2]

(c) the number of students with a reaction time of more than 4 seconds.

Answer(c) .... [2]

24



The cumulative frequency diagram shows information about the times, in minutes, taken by 80 students to complete a short test.

Find

(a) the median,

Answer(a) .... min [1]

(b) the 30th percentile,

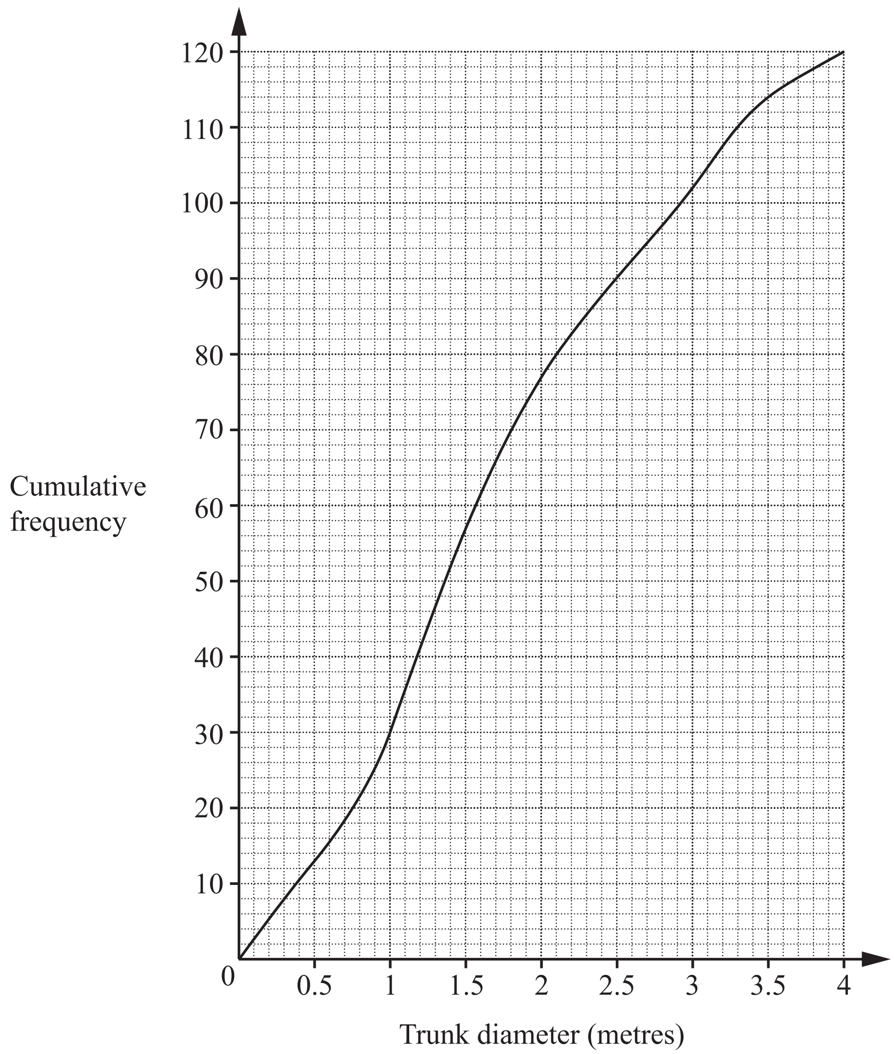
Answer(b) .... min [2]

(c) the number of students taking more than 5 minutes.

Answer(c) .... [2]

22) June 2016 V3

22 The cumulative frequency diagram shows information about the trunk diameter, in metres, of 120 trees.



Find

(a) the inter-quartile range,

.... m [2]

(b) the 95th percentile,

.... m [2]

(c) the number of trees with a trunk diameter greater than 3 metres.

.... [2]

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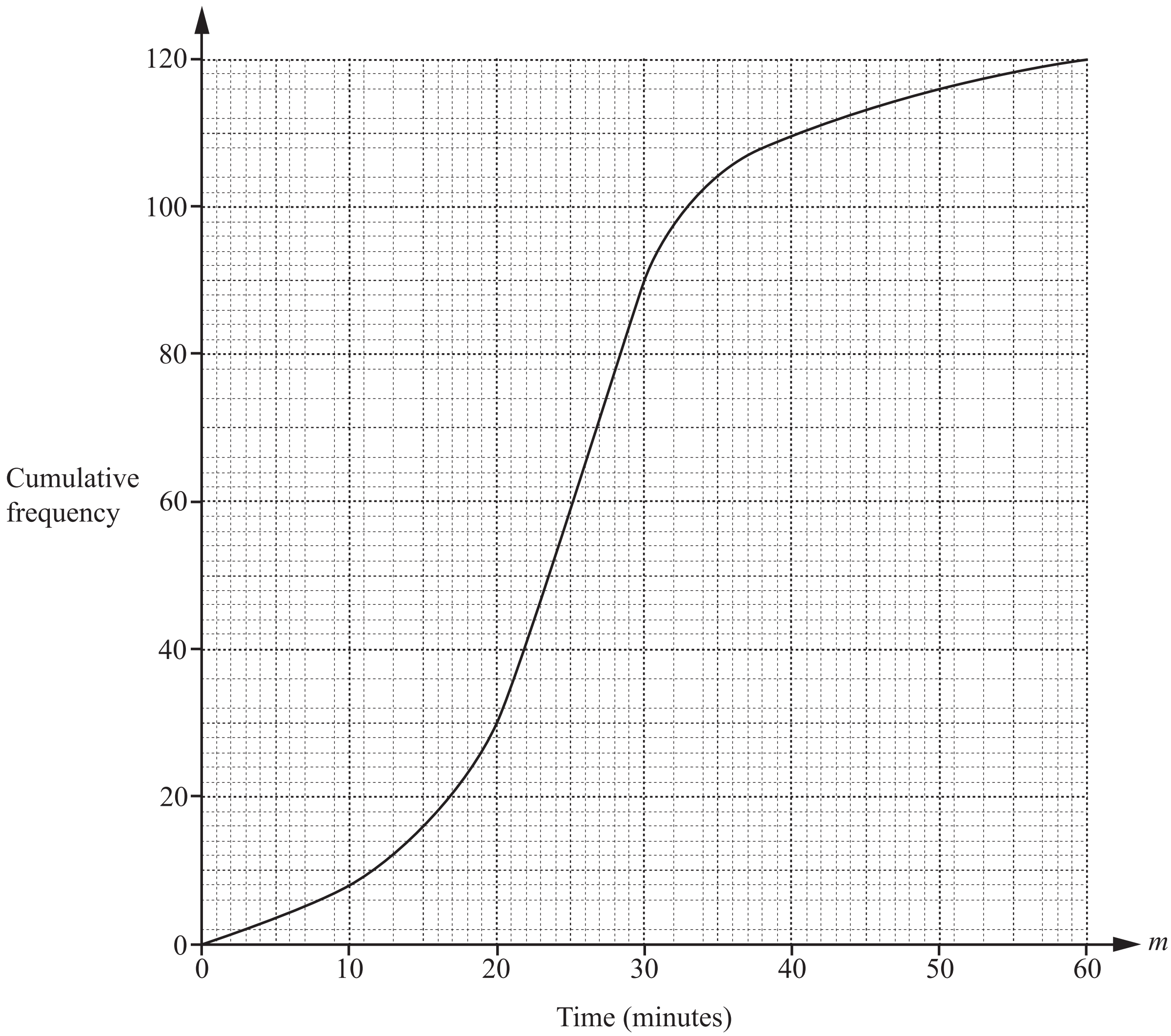
18 The cumulative frequency diagram shows information about the time, m minutes, taken by 120 students to complete some homework.



Use the cumulative frequency diagram to find an estimate of

(a) the interquartile range,

.... min [2]

(b) the number of students who took more than 50 minutes to complete the homework.

.... [2]

24) June 2012 V3

7

Height (h cm)	$0 < h \leqslant 10$	$10 < h \leqslant 15$	$15 < h \leqslant 30$
Frequency	25	u	9
Frequency density	2.5	4.8	v

The table shows information about the heights of some flowers.

Calculate the values of u and v.

Answer u = ...

v = ... [2]

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Mass of parcel (m kilograms)	$0 < m \leqslant 0.5$	$0.5 < m \leqslant 1.5$	$1.5 < m \leqslant 3$
Frequency	20	18	9

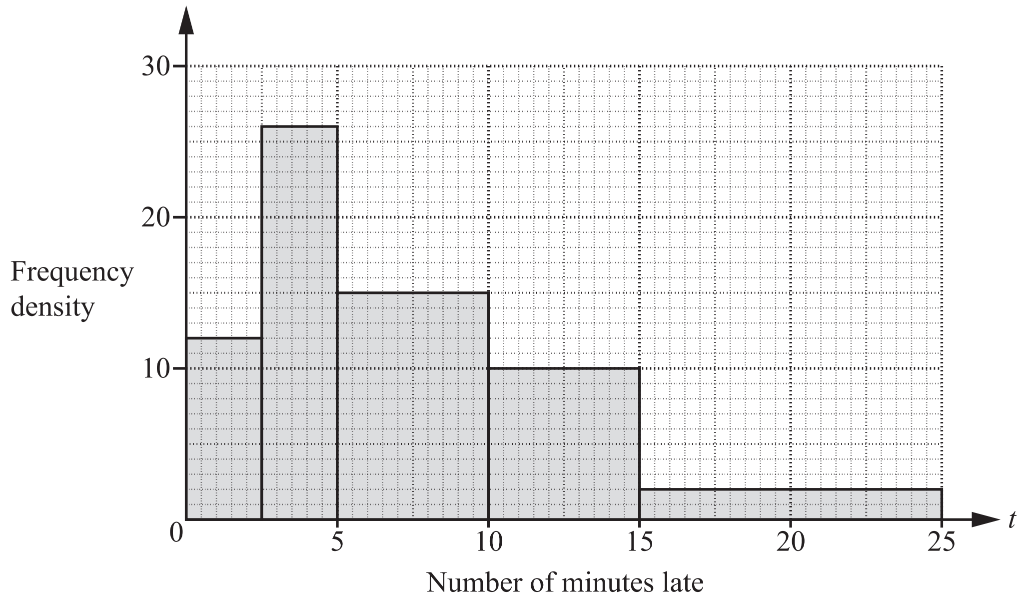
The table above shows information about parcels in a delivery van.

John wants to draw a histogram using this information.
Complete the table below.

Mass of parcel (m kilograms)	$0 < m \leqslant 0.5$	$0.5 < m \leqslant 1.5$	$1.5 < m \leqslant 3$
Frequency density		18	

[2]

20 Deborah records the number of minutes late, t, for trains arriving at a station.
The histogram shows this information.



(a) Find the number of trains that Deborah recorded.

.... [2]

(b) Calculate the percentage of the trains recorded that arrived more than 10 minutes late.

....% [2]

27) November 2016 V3

22 The table shows some information about the mass, m grams, of 200 bananas.

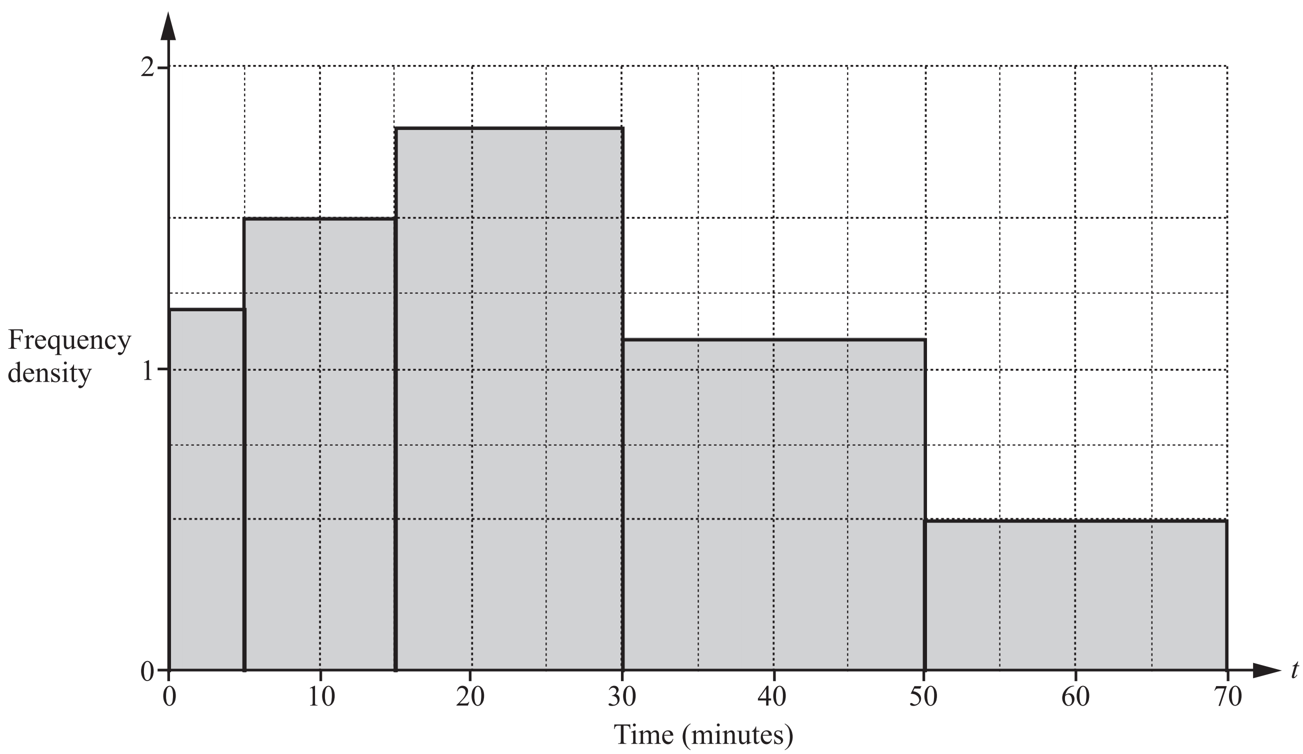
Mass (m grams)	$90 < m \leqslant 110$	$110 < m \leqslant 120$	$120 < m \leqslant 125$	$125 < m \leqslant 140$
Frequency	40	70	60	30
Height of column in histogram (cm)			6	

Complete the table.

[4]

28) June 2018 V2

13 The histogram shows information about the time, t minutes, spent in a shop by each of 80 people.



Complete the frequency table.

Time (t minutes)	$0 < t \leqslant 5$	$5 < t \leqslant 15$	$15 < t \leqslant 30$	$30 < t \leqslant 50$	$50 < t \leqslant 70$
Number of people	6		27		10

[2]

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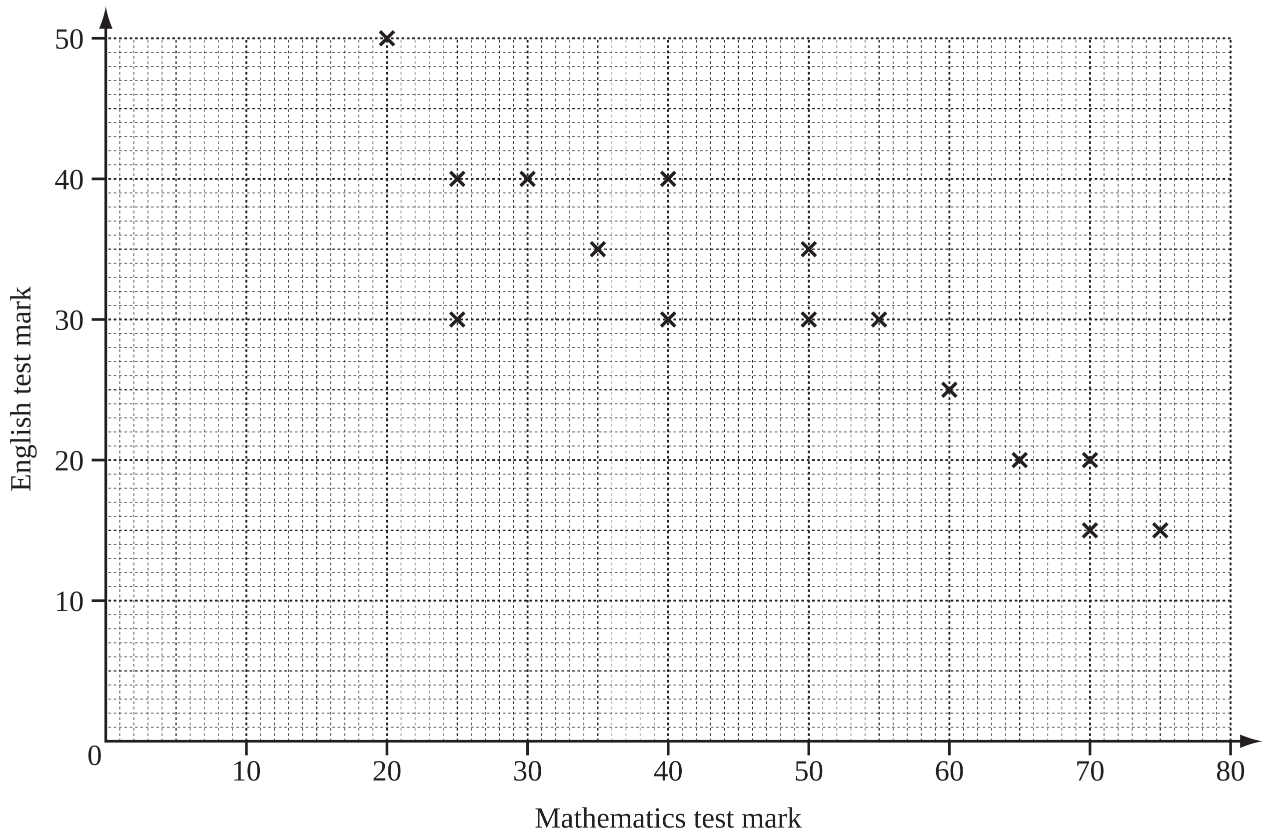
12



The scatter diagram shows the marks obtained in a Mathematics test and the marks obtained in an English test by 15 students.

(a) Describe the correlation.

Answer(a) .... [1]

(b) The mean for the Mathematics test is 47.3 .
The mean for the English test is 30.3 .

Plot the mean point (47.3, 30.3) on the scatter diagram above. [1]

(c) **(i)** Draw the line of best fit on the diagram above. [1]

(ii) One student missed the English test.
She received 45 marks in the Mathematics test.

Use your line to estimate the mark she might have gained in the English test.

Answer(c)(ii) .... [1]

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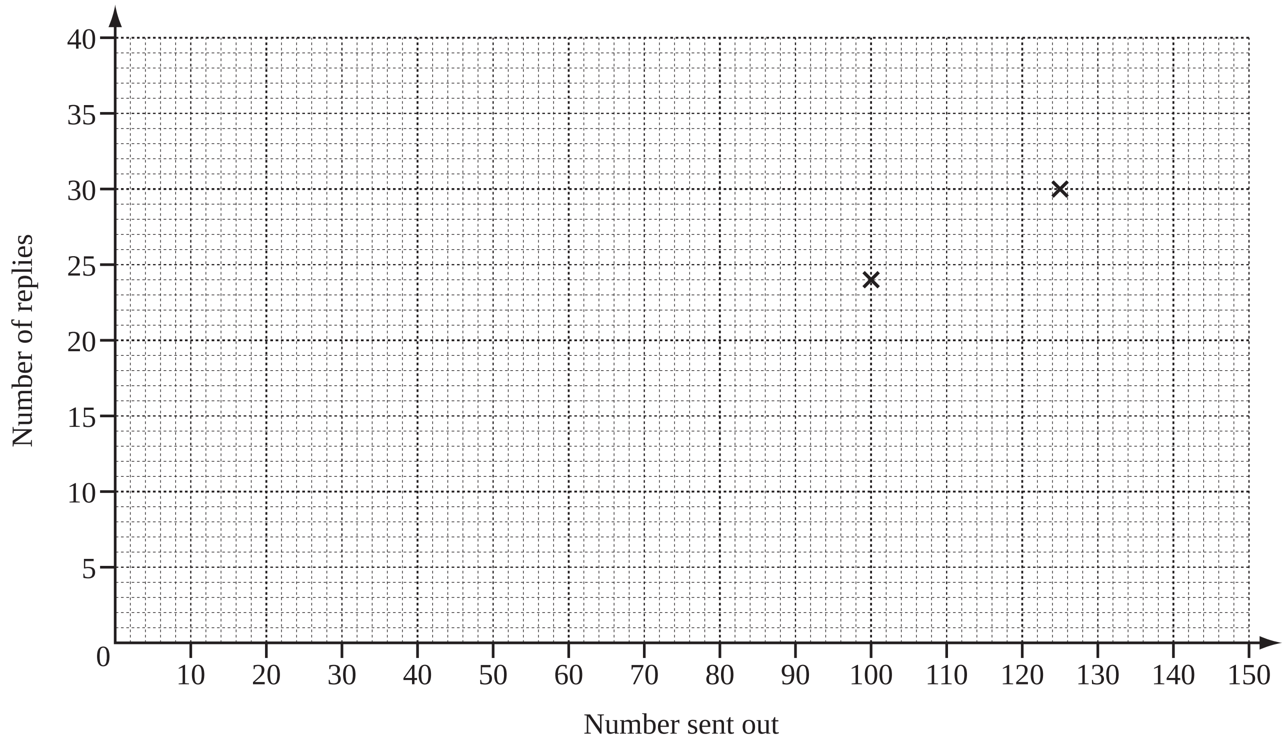
16 A company sends out ten different questionnaires to its customers.
The table shows the number sent and replies received for each questionnaire.

Questionnaire	A	B	C	D	E	F	G	H	I	J
Number sent out	100	125	150	140	70	105	100	90	120	130
Number of replies	24	30	35	34	15	25	22	21	30	31



(a) Complete the scatter diagram for these results.
The first two points have been plotted for you. [2]

(b) Describe the correlation between the two sets of data.

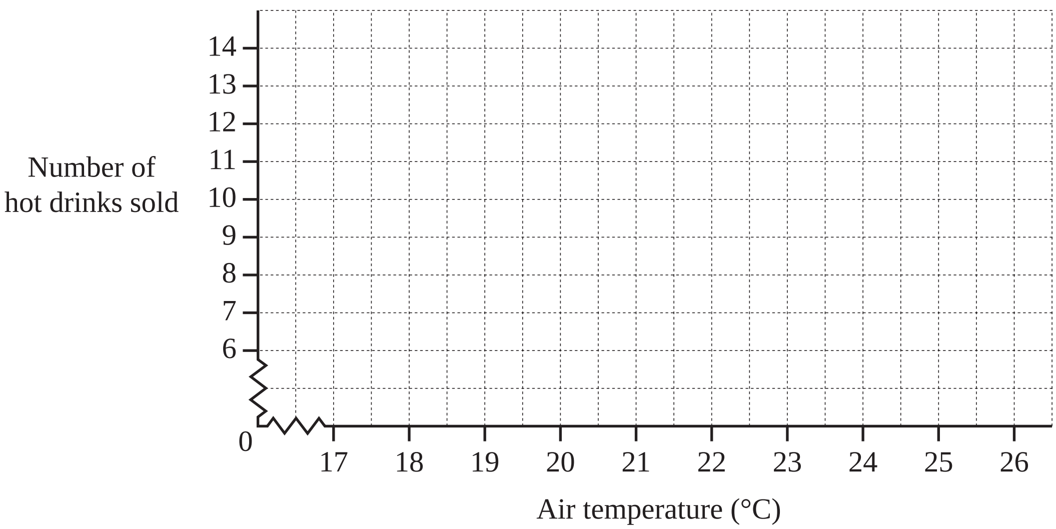
Answer(b) .... [1]

(c) Draw the line of best fit. [1]

17 The owner of a small café records the average air temperature and the number of hot drinks he sells each day for a week.

Air temperature (°C)	18	23	19	23	24	25	20
Number of hot drinks sold	12	8	13	10	9	7	12

(a) On the grid, draw a scatter diagram to show this information.



[2]

(b) What type of correlation does your scatter diagram show?

Answer(b) .... [1]

(c) Draw a line of best fit on the grid. [1]

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32) March 2015 V2

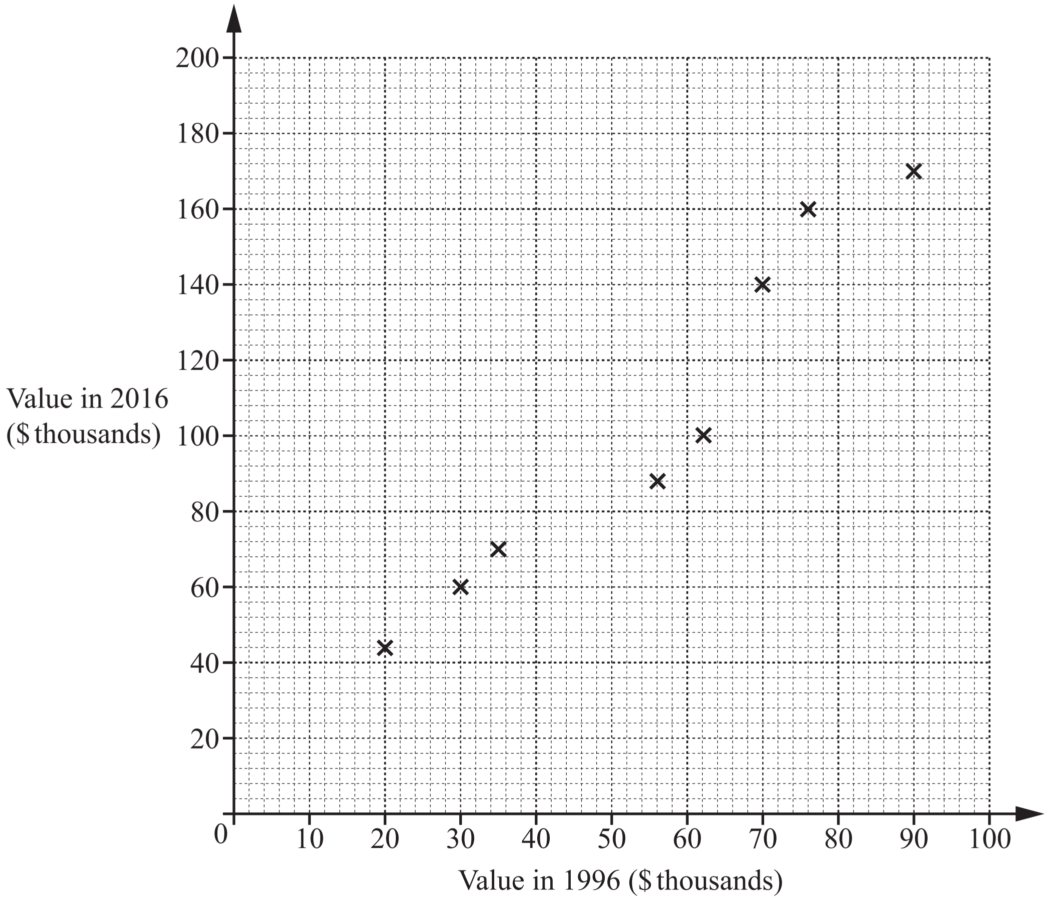
1 The number of hot drinks sold in a café decreases as the weather becomes warmer.

What type of correlation does this statement show?

Answer .... [1]

33) June 2018 V2

21 The scatter diagram shows the value, in thousands of dollars, of eight houses in 1996 and the value of the same houses in 2016.



(a) One of these eight houses had a value of $70 000 in 1996.

Write down the value of this house in 2016.

$ .... [1]

(b) The values of two more houses are shown in the table.

Value in 1996 ($ thousands)	40	80
Value in 2016 ($ thousands)	80	150

On the scatter diagram, plot these values. [1]

(c) On the scatter diagram, draw a line of best fit. [1]

(d) Another house had a value of $50 000 in 1996.

Find an estimate of the value of this house in 2016.

$ .... [1]

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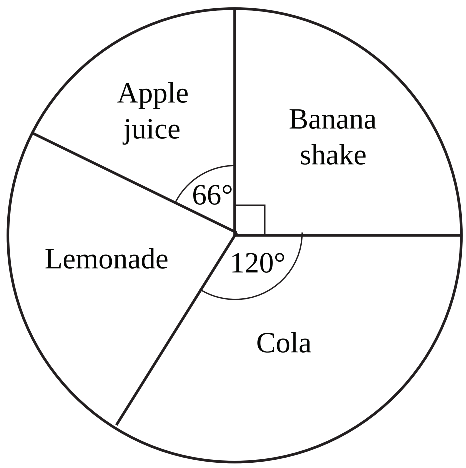
34) June 2011 V2

14 60 students recorded their favourite drink.
The results are shown in the pie chart.



NOT TO SCALE

(a) **Calculate** the angle for the sector labelled Lemonade.

Answer(a) .... [1]

(b) Calculate the number of students who chose Banana shake.

Answer(b) .... [1]

(c) The pie chart has a radius of 3 cm.
Calculate the arc length of the sector representing Cola.

Answer(c) .... cm [2]

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16 In a survey of 60 cars, the type of fuel that they use is recorded in the table below.

Each car only uses one type of fuel.

Petrol	Diesel	Liquid Hydrogen	Electricity
40	12	2	6

(a) Write down the mode.

Answer(a) .... [1]

(b) Olav drew a pie chart to illustrate these figures.

Calculate the angle of the sector for Diesel.

Answer(b) .... [2]

(c) Calculate the probability that a car chosen at random uses Electricity.

Write your answer as a fraction in its simplest form.

Answer(c) .... [2]

4 Bruce plays a game of golf.
His scores for each of the 18 holes are shown below.

2	3	4	5	4	6	2	3	4
4	5	3	4	3	5	4	4	4

The information is to be shown in a pie chart.

Calculate the sector angle for the score of 4.

Answer .... [2]

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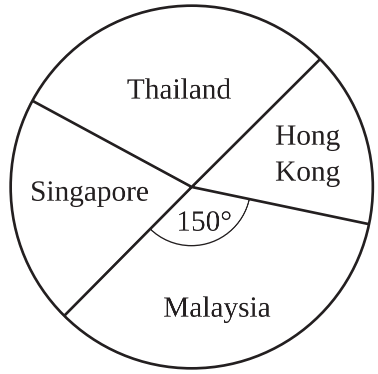
37) June 2014 V1

17



NOT TO SCALE

A travel brochure has 72 holidays in four different countries.
The pie chart shows this information.

(a) There are 24 holidays in Thailand.

Show that the sector angle for Thailand is 120°.

Answer(a)

[2]

(b) The sector angle for Malaysia is 150°.
The sector angle for Singapore is twice the sector angle for Hong Kong.

Calculate the number of holidays in Hong Kong.

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Answer(b) .... [3]

2 Michelle sells ice cream.
The table shows how many of the different flavours she sells in one hour.

Flavour	Vanilla	Strawberry	Chocolate	Mango
Number sold	6	8	9	7

Michelle wants to show this information in a pie chart.

Calculate the sector angle for mango.

Answer .... [2]

39) November 2014 V3

4 The four sector angles in a pie chart are $2x°$, $3x°$, $4x°$ and $90°$.

Find the value of x.

Answer x = ... [2]

40) June 2018 V1

23 40 people were asked how many times they visited the cinema in one month.
The table shows the results.

Number of cinema visits	0	1	2	3	4	5	6	7
Frequency	5	5	6	6	7	3	6	2

(a) **(i)** Find the mode.

.... [1]

(ii) Calculate the mean.

.... [3]

(b) Omar wants to show the information from the table in a pie chart.

Calculate the sector angle for the people who visited the cinema 5 times.

.... [2]

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