Attempt **ALL** questions.

Write your answers in the space available on the examination paper.
The use of calculators and protractors is **not** allowed.
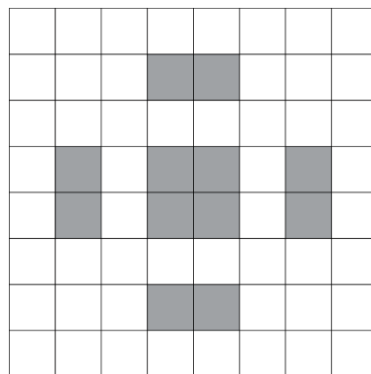It is not necessary to show your working.
This paper carries a total of 20 marks.

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)

1 The figure below has reflective symmetry.
   Show clearly **ALL** its lines of symmetry.

2 The population of a country is 2 673 840 000.
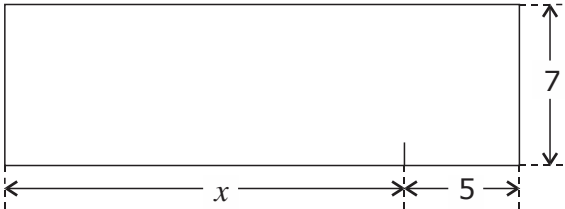
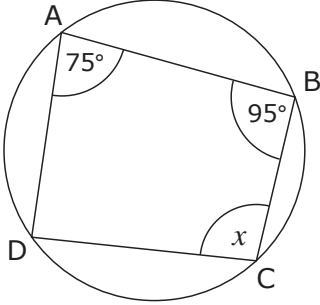   Write this number correct to the nearest million.

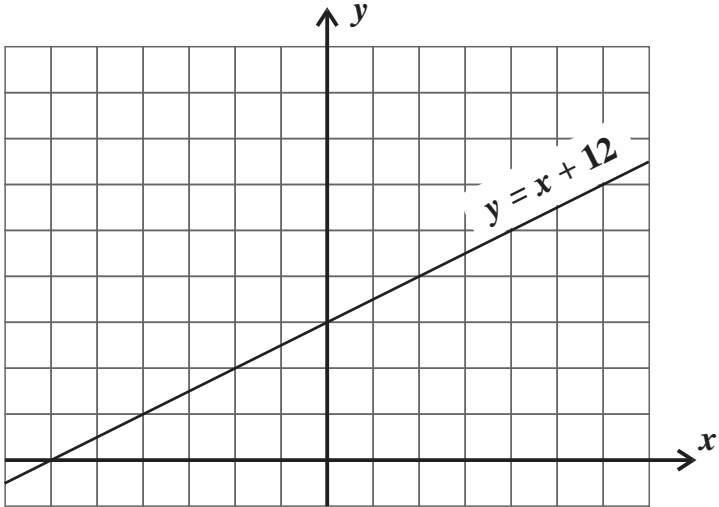   **Ans** _____
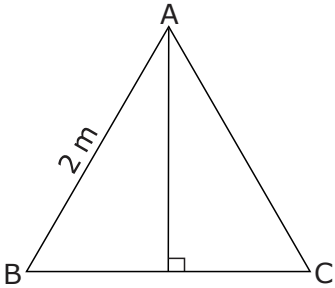
3 Write 38% as a fraction in its lowest terms.

   Ans _____

4 Solve the equation $3x - 15 = 1 - x$

   Ans _____

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
5 Write down **FOUR** factors of 18. Ans _____	
6 Write down a prime number which lies between 20 and 30. Ans _____	
7 Write an expression for the area of the following rectangle in terms of x. Ans _____	
8 Work out the value of: $$\sqrt[3]{\dfrac{64}{27}}$$ Ans _____	
9 The probability that Lee is late for work is 0.12. What is the probability that Lee arrives at work on time? Ans _____	
10 In a lottery, the winning number is selected at random from the integers 1 to 90. Maria buys all consecutive tickets from 30 to 39. What is the probability that Maria wins the lottery? Ans _____	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF Necessary)
11 The exterior angle of a regular polygon is 24°. How many sides does the polygon have? Ans _____	
12 ABCD is a cyclic quadrilateral. *Diagram not drawn to scale* Use the information in the diagram to determine the size of the angle marked x. Ans _____	
13 Work out 35×2.01 Ans _____	
14 Bob is planning a party for 27 girls and 23 boys. He orders food costing €7.50 per child. What is the total cost of his order? Ans _____	
15 Underline the **TWO** quadrilaterals below whose diagonals always intersect at right angles. (a) kite (b) parallelogram (c) rectangle (d) rhombus	
16 A cube has a total surface area of 150 cm². What is the length of its side? Ans _____	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
17 Find the value of x when: $2x + y = 13$ and $x - y = 2$ **Ans** _____	
18 The graph of $y = x + 12$ is shown below. On the same axes, draw the graph of $y = 2x$	
19 A radio costing €75 was then sold for €84. What was the percentage profit made? **Ans** _____	
20 ABC is an equilateral triangle of side 2 m. Use the diagram to find cos 60°. **Ans** _____	

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2020 MAIN SESSION

SUBJECT:	**Mathematics**
PAPER NUMBER:	I – Section B (Calculator Section)
DATE:	2nd May 2020
TIME:	1hr and 45 minutes

Answer **ALL** questions.

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and of mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 80 marks.

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Sec A	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**

1   (a)   Use your calculator to find the value of:

(i) $\sqrt{125.44}$

(1)

(ii) $\dfrac{189.6 \times 41.28}{0.0059 + 0.00298}$

(2)

(b)   Find the value of $5^0 + 5^2 + (5^2)^3$

(2)

(c)   Write down the next two terms of the following sequences:

(i)   1,   −4,   9,   −16,   25,   _____ ,   _____

(1)

(ii)   27,   9,   3,   1,   _____ ,   _____

(1)

(iii)   0.01,   0.002,   0.0003,   _____ ,   _____

(1)

(Total: 8 marks)

2   (a)   Expand and simplify:

$5(a + b) - 3(a - 2b)$

(2)

(b)   Using the algebraic equation $d(s + a) = c(s + b),$
find the value of d when $s = 1, \ a = 2, \ b = -1$ and $c = 5$

(2)

(c)   Rewrite the equation $V = \dfrac{\pi r^2 h}{3}$ to make:

(i) h the subject;

(1)

(ii) r the subject.

(2)

(Total: 7 marks)

3   The table below shows the value of coffee (in US dollars) exported by 4 different countries in **2018**.

Country	Coffee Export (US $)	
	Ordinary Number	Standard Form
Belgium	867 900 000	
Brazil	4 371 000 000	4.371×10^9
Peru	667 900 000	
Vietnam	3 261 000 000	3.261×10^9

(a)   Fill in the empty cells in the table above.   (1)

(b)   The value of coffee exported by Belguim is 867 900 000. Write this as an ordinary number in words.

                                                                                         (1)
(c)   Which countries in the table above registered the highest and lowest value of exported coffee in 2018?

         Highest: _____

         Lowest: _____
                                                                                         (2)

(d)   Work out the difference between the coffee export of Belgium and that of Brazil giving your answer in standard form.

                                                                                         (1)

(e)   In **2018**, Brazil's coffee export increased by an estimated 3.7% from the previous year. Calculate Brazil's coffee export in **2017**.

                                                                                         (3)

(Total: 8 marks)

4   A scale drawing of a field EFGH is shown below.
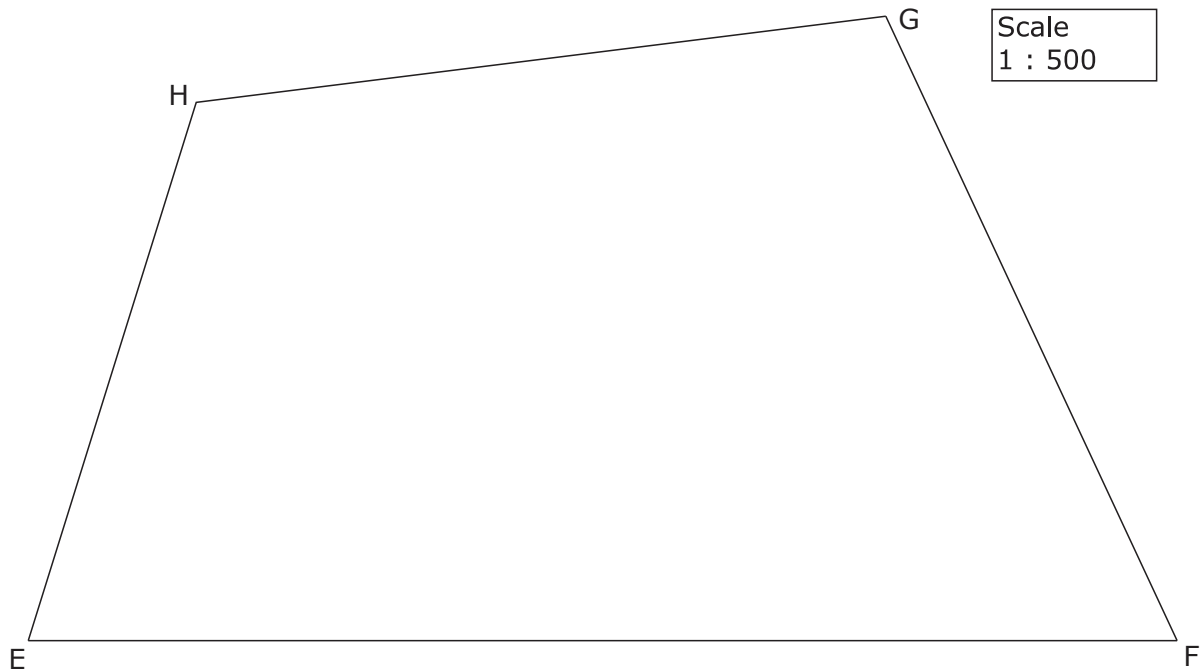
Scale
1 : 500

(a)   Use the given scale diagram to determine the actual length of the side HG of the field.

(2)

(b)   Using ruler and compasses only, draw constructions on the scale diagram above to represent the following:

(i)   The locus of points within the field at a distance of 50 m from point F.

(2)

(ii)   The locus of points which are equidistant from the points E and G.

(2)

(iii)   Label the point of intersection of the two loci as X.

(1)

(Total: 7 marks)

5   (a)   Show that the interior angle of a regular octagon is 135°.

(2)

(b)   A flower design is made up by placing four regular octagons of the same size as shown in the diagram.

(i)   Explain why the space at the centre of these four octagons is always a square.
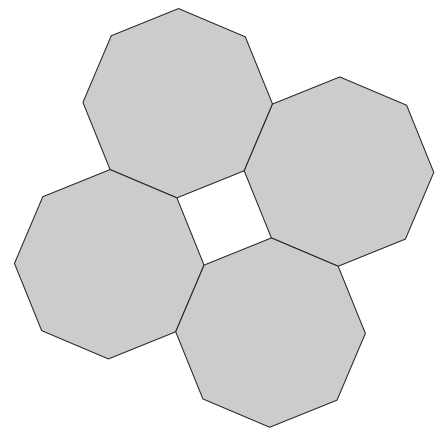
(3)

If the area of the square at the centre of the design is 132.25 cm², work out:

(ii)   the length of the sides of the octagons;

(2)

(iii)   the length of the outer perimeter of the flower design.

(2)

(Total: 9 marks)

6   The diagram below represents a flag with two colours.
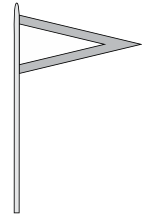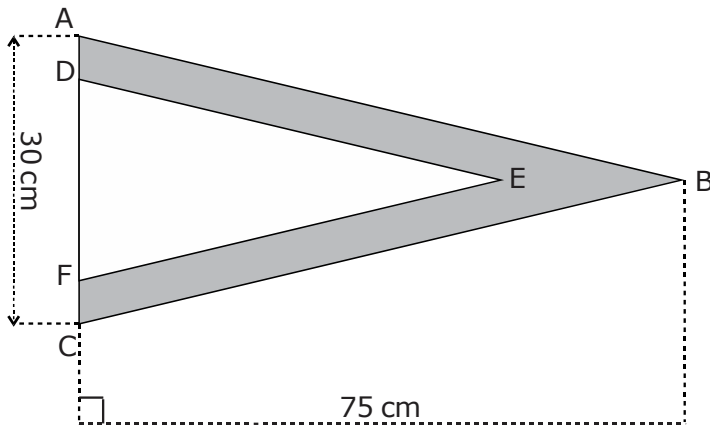
Diagram not drawn to scale

Triangles ABC and DEF are similar triangles.
AC = 30 cm and the perpendicular distance from B to AC is 75 cm.

(a)   Find the area of triangle ABC.

(2)

(b)   If DF = 25 cm, calculate the perpendicular distance from E to DF.

(3)

(c)   Find the area of the shaded part of the flag.

(4)

(Total: 9 marks)

7   A sequence of nested squares is formed starting with a square of length 1 cm at the centre. The distance between the sides of one square and the next is also 1 cm. The diagram below shows the first three squares in this sequence and is drawn to scale.
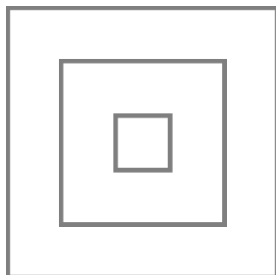
(a)   What is the perimeter of each of the first four squares in this sequence?

(2)

(b)   What is the perimeter of the nth square in this sequence?

(3)

(Total: 5 marks)

8   (a)   The diagram below shows the reading on a thermometer.
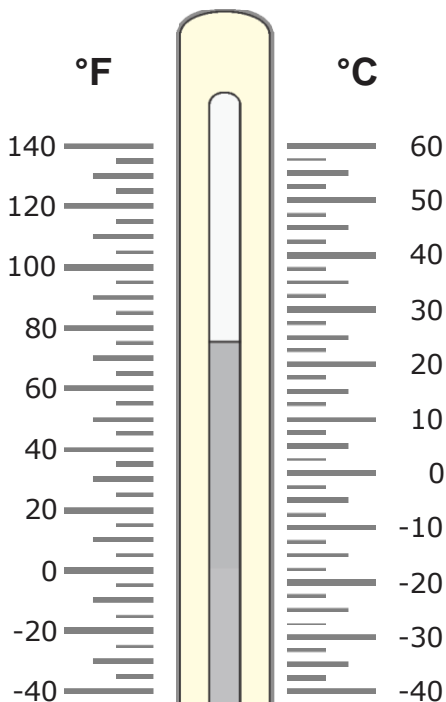
(i)   Write the thermometer reading in degrees Fahrenheit (°F).

(1)

(ii)   Write the thermometer reading in degrees Celsius (°C).

(1)

This question continues on next page.

DO NOT WRITE ABOVE THIS LINE

(b)   The graph represents how F, the temperature in degrees Fahrenheit varies with C, the temperature in degrees Celsius.
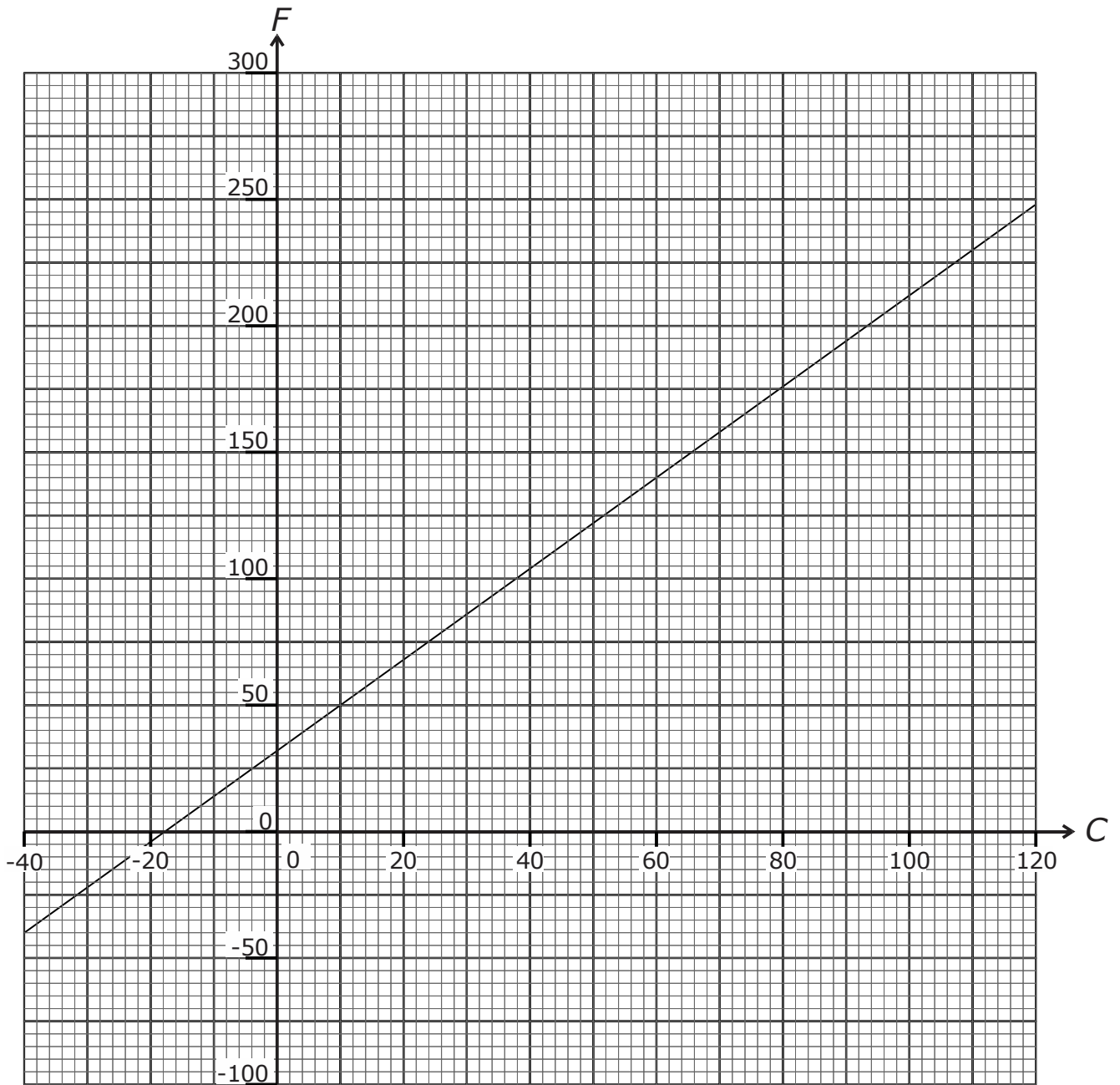
Use the graph provided to fill in the table below:

Temperature C in degrees Celsius	−40	0			100
Temperature F in degrees Fahrenheit			50	100	

(4)

(c)   Use the graph to find the equation connecting *F* and *C*.

(4)

(Total: 10 marks)

9   (a)   The speed of a train is 40 m/s. What is this speed in km/h?

(3)

(b)   Between 8:00 and 8:45, the train travels at an average speed of 40 m/s. Work out the distance travelled in km during this time.

(2)

(c)   From 8:45 to 9:15, the train travels 112 km.

Work out the average speed of the train during the whole time interval between 8:00 and 9:15.

(3)

(Total: 8 marks)

10 Class 3A took a test marked out of 10. The table shows the marks of these students.

Mark	Frequency
4	1
5	2
6	10
7	9
8	5
9	3

(a) (i)   How many students took the test?

(1)

(ii) Find the range of marks for this class.

(2)

(b) Show that the mean mark obtained by this class is 6.8

(3)

(c) Class 3B took the same test. The mean mark for the students in Class 3B is 7.5.

Anna in Class 3A and Bridget in Class 3B both sat for this test.

"Bridget **must have** done better than Anna on this test because she is in Class 3B".

Is this statement correct? Explain your reasoning.

(3)

(Total: 9 marks)

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2020 MAIN SESSION**

SUBJECT:	**Mathematics**
PAPER NUMBER:	IIA
DATE:	2nd May 2020
TIME:	4:00 p.m. to 6:05 p.m.

Answer **ALL** questions.

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and of mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 100 marks.

Table of formulae

Area of triangle	$\frac{1}{2}ab\sin C$
Curved Surface Area of Right Circular Cone	πrl
Surface Area of a Sphere	$4\pi r^2$
Volume of a Pyramid / Right Circular Cone	$\frac{1}{3}$ base area × perpendicular height
Volume of a Sphere	$\frac{4}{3}\pi r^3$
Solutions of the equation $ax^2 + bx + c = 0$	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Sine Formula	$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$
Cosine Formula	$a^2 = b^2 + c^2 - 2bc\cos A$

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1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**

1   (a)   Find the value of t which satisfies the following equations:

(i) $2^t = \frac{1}{16}$

(1)

(ii) $9^t = \sqrt[5]{3}$

(3)

(b)   Expand and simplify: $x(1 + x + x^2 + x^3 + x^4) - (1 + x + x^2 + x^3 + x^4)$

(2)
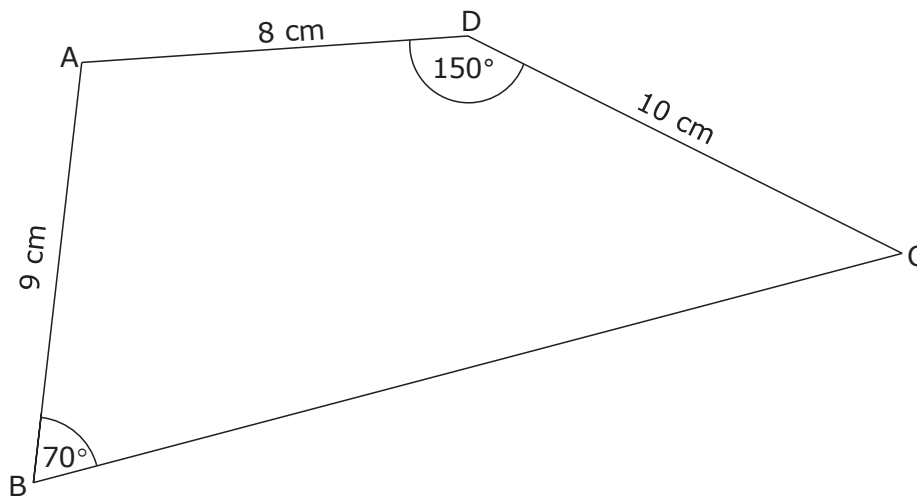
(c)   Simplify $\frac{2x^2 - 3x - 9}{x^2 - 9}$

(3)

(Total: 9 marks)

2   ABCD is a quadrilateral so that AB = 9 cm, CD =10 cm and AD = 8 cm. Angle ADC is 150°
     and angle ABC is 70°.

Diagram not drawn to scale

(a)   Work out the length of AC.

(4)

(b)   Find the size of ∠ACB.

(4)

(Total: 8 marks)

3 A new car was bought for €15,000.
   The value of the car depreciates by 16% after the first year and by 10% after each of the following years.

   (a) Calculate the value of the car after 2 years.

(3)

   (b) After how many years does the car depreciate to around half its original value?
        Show clearly your working.

(4)

(Total: 7 marks)

4 (a) (i) The variables p and q are directly proportional.
             Complete the table below.

p	1	10	
q		3	5

(2)

(ii) The variables x and y are inversely proportional.
Complete the table below.

x	1	10	
y		3	5

(2)

(iii) The variable H is inversely proportional to R^2.
Complete the table below.

H	1	4	5
R	20		

(4)

(b) Two water supplies are connected to a large water reservoir.
Supply A fills the reservoir completely in 2 hours.
Supply B fills the reservoir completely in 3 hours.
How long does it take to fill the reservoir when using both supplies at the same time?

(4)

(Total: 12 marks)

5   (a)   Complete the following table of values for the equation
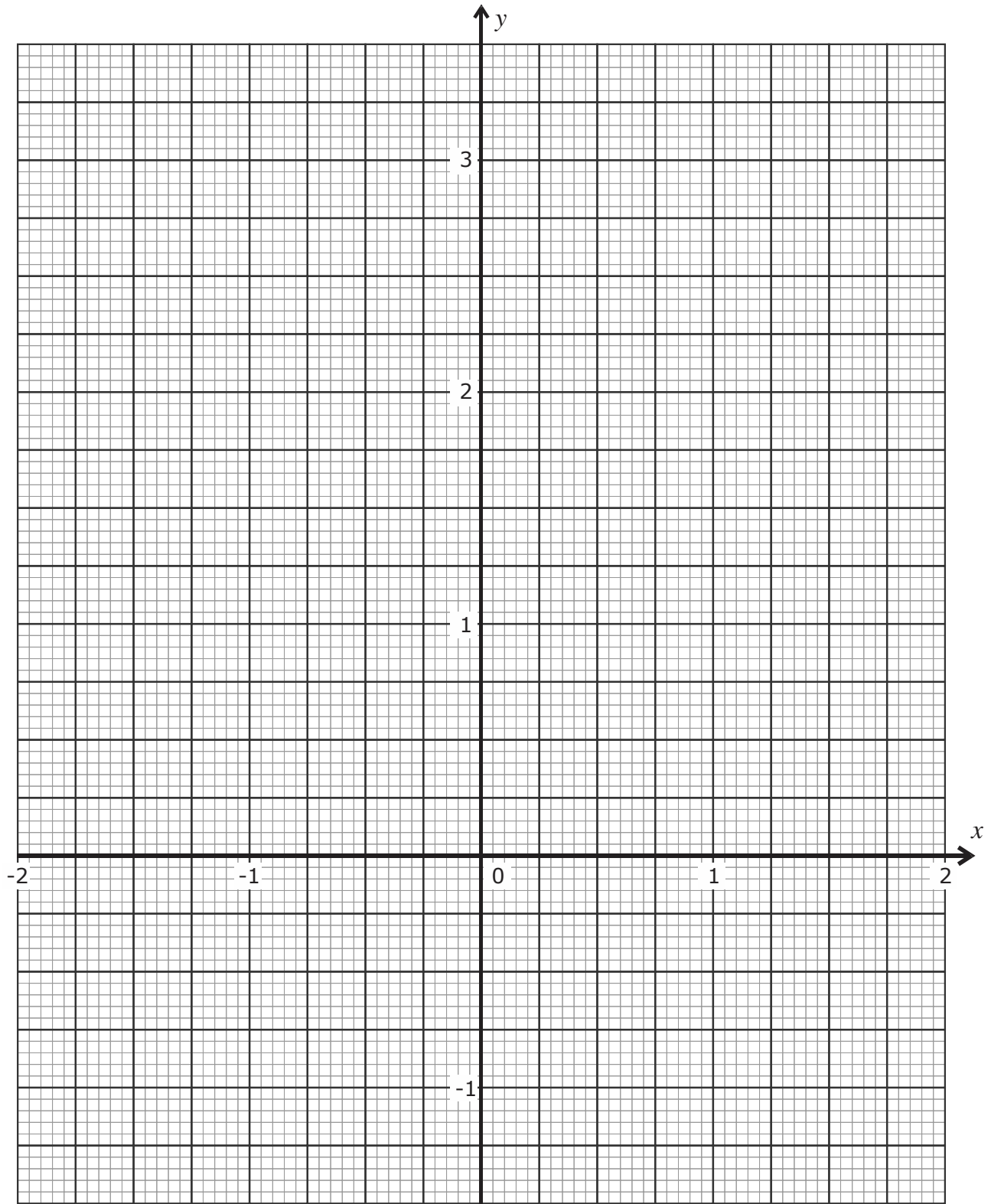
$$y = 1 + x - \frac{x^3}{2}$$

x	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y	3	1.19			1	1.44	1.5		

(2)

(b)   Use the axes provided to plot the graph of $y = 1 + x - \frac{x^3}{2}$ for values of x between -2 and 2.

(4)

(c)   Use your graph to solve the equation $x - \frac{x^3}{2} = -0.5$

(2)

(d)   Use your graph to complete the following statement:

$1 + x - \frac{x^3}{2} = k$ has three different solutions when   _____ $< k <$ _____

(2)

(Total: 10 marks)

6   Ian buys a number of the monthly magazine "Robotika" to sell in his shop.

Last June he bought 40 euro worth of this magazine.
In July, he again bought 40 euro worth of this magazine but the price had gone up by 2 euro per magazine. In June, Ian bought one more magazine than in July.

(a) Let x euro be the cost of each magazine in June. Use the given information to form an equation and show that this simplifies to $x^2 + 2x - 80 = 0$

(5)

(b) Solve the equation $x^2 + 2x - 80 = 0$

(2)
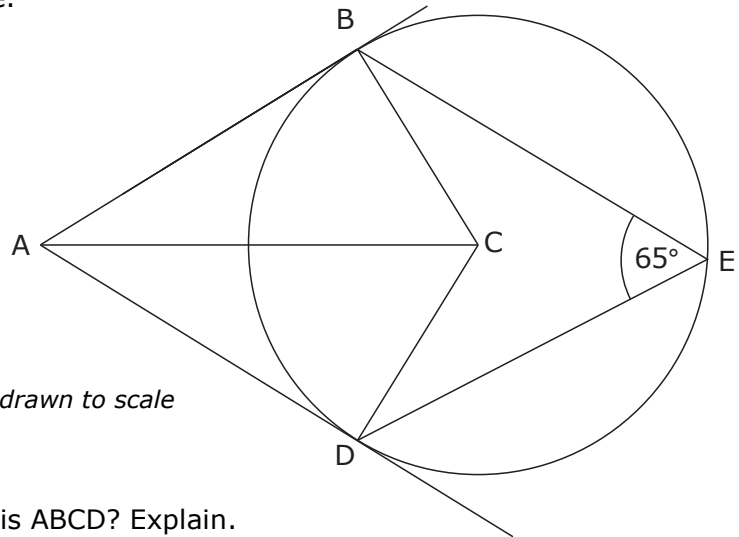
(c) Determine the cost of the magazines in July.

(1)

(Total: 8 marks)

7   C is the centre of a circle.
    BA and DA are tangents to the circle touching the circle at B and D respectively.
   E is a point on the circumference.

Diagram not drawn to scale

(a)   What type of quadrilateral is ABCD? Explain.

(3)

(b)   If ∠BED = 65°, determine the sizes of the following angles, giving reasons for your answers:

    (i)   ∠BCD

(2)

    (ii)   ∠CBD

(2)

(c)   Work out the size of ∠BAD. Explain your reasoning.

(2)

(Total: 9 marks)

8   (a)   The figure below shows an equilateral triangle ABC of side 12 cm which is inscribed in a circle centre X.
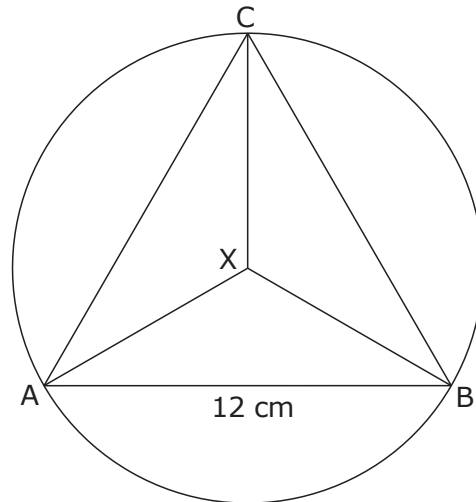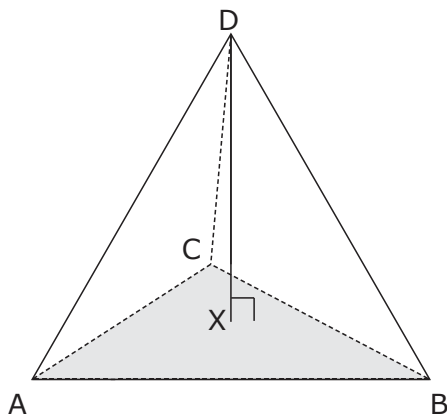

(i)   What is the order of rotational symmetry of this figure?

(1)

(ii)   Work out the length of the radius of the circle.

(3)

(b) The figure below shows a tetrahedron whose base is an equilateral triangle of side 12 cm. The perpendicular from D to the base of the tetrahedron meets the face ABC at X, the centre of rotational symmetry of triangle ABC. DX is 18 cm long.

Diagram not drawn to scale

(i) Find the length of the side AD of the tetrahedron.
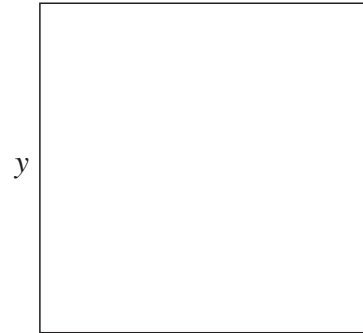
(3)

(ii) Find the size of ∠DAX.

(2)

(Total: 9 marks)

9   A farmer has two fields; one in the shape of a rectangle and the other has a square shape. Let x metres be the width of the rectangle and y metres be the length of the square.

x [rectangle]

Diagram not drawn to scale

y [square]

The length of the rectangle is three times its width.
The TOTAL SUM of the perimeters around the two fields is 700m.

(a)   Use the above information to express y in terms of $x.$

(3)

(b)   Given that these two fields are equal in area, show that $x^2 - 700x + 30625 = 0$

(3)

(c)   Solve the equation $x^2 - 700x + 30625 = 0,$ giving your answers correct to two decimal places.

(3)

(d)   Write down the width of the rectangle.

(1)

(Total: 10 marks)

10 The face of a spinner is divided into four sectors as shown in the diagram.

On spinning, the relative probability of the spinner landing
on each sector is given in the table below.

SECTOR	1	2	3	4
Probability of landing on sector	x	$2x$	$3x$	$4x$

(a) Show that the value of x is $\dfrac{1}{10}$

(1)

The spinner is spun twice.

(b) Complete the tree diagram.

FIRST SPIN   SECOND SPIN

Even

Even

0.6

Odd

Odd

Even

Odd

(3)

(c) Work out the following probabilities:
    (i)   both spins land on an even number;

(2)

    (ii) one of the spins lands on an even number and the other lands on an odd one.

(2)

(d) The spinner is spun 200 times. How many times is it expected that it lands on sector 4?

(1)
(Total: 9 marks)

11   A school is planning a trip for 280 students.

A company has been chosen to provide transport.
This company has 10 buses each seating 40 persons and 5 minivans each seating 20 persons.
On the day of the trip, 11 drivers will be available.

Let x be the number of buses used and let y be the number of minivans used.

(a)   In this situation $x \geq 0$, $y \geq 0$, $x \leq 10$ and $y \leq 5$.
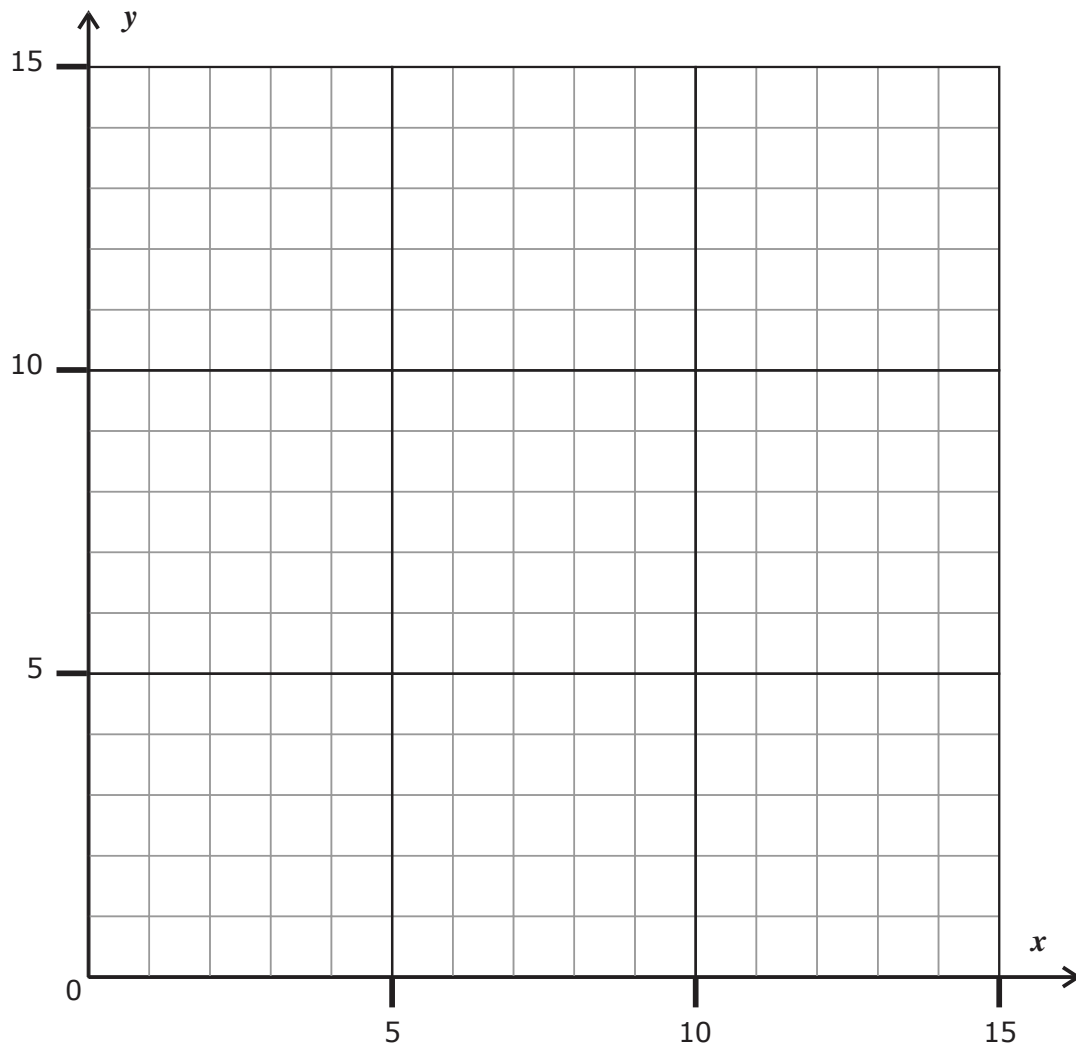Use the information given above to write two more inequalities involving x and y.

(3)

(b)   Using the axes provided on the following page, draw the necessary graphs and indicate the region in which all the given conditions are satisfied.

(5)

(c)   Write down **TWO** combinations of the number of buses and minivans, that the school might use for the trip.

(1)

(Total: 9 marks)

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2020 MAIN SESSION

Answer **ALL** questions.

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

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Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 100 marks.

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Question No	1	2	3	4	5	6	7	8	9	10
Mark										

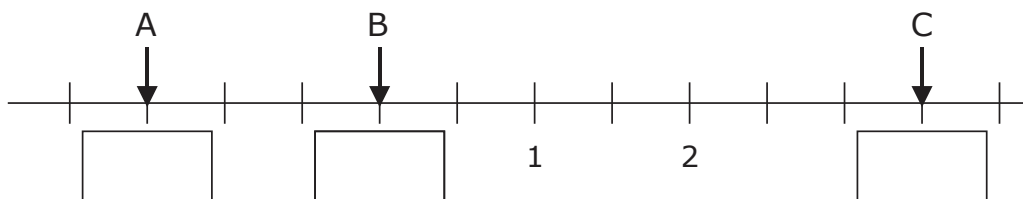| Question No	11	12	13	14	15	16	17	18	19	20
Mark										

Total Mark

1   Write out the following:

(a)   4648 correct to the nearest 100   _____   (1)

(b)   2.6651 correct to 2 decimal places   _____   (1)

(c)   5.0845 correct to 3 significant figures _____   (1)

(d)   23.56781 m correct to the nearest cm   _____   (1)

(Total: 4 marks)

2   Label the positions of A, B and C on the number line below.

(Total: 3 marks)

3   A record was made of the temperature at midnight at a particular place in Norway. The table shows the temperature on six consecutive days.
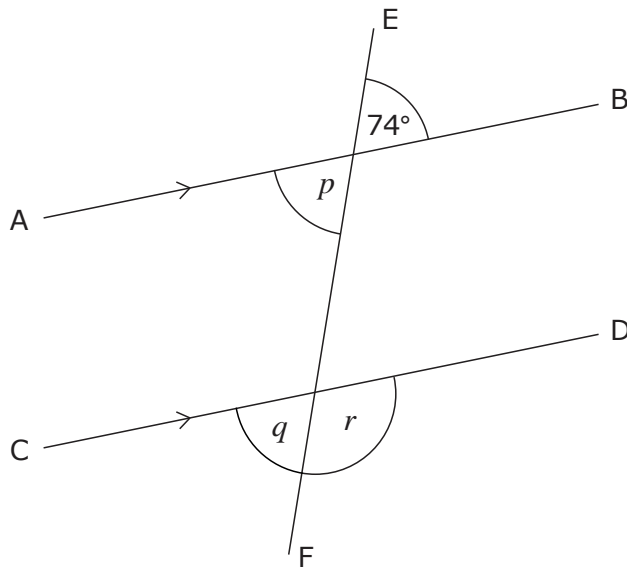
Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Temperature	−13°C	−17°C	−10°C	−13°C	−8°C	−5°C

During this six-day period, work out:

(a)   the range in temperature   (1)

(b)   the mean temperature   (2)

(c)   the median temperature   (2)

(Total: 5 marks)

4   In this diagram, AB is parallel to CD. EF is a straight line cutting AB and CD.

Diagram not drawn to scale

Find the size of the following angles, giving reasons for your answers.

(a)   angle p

(2)

(b)   angle q
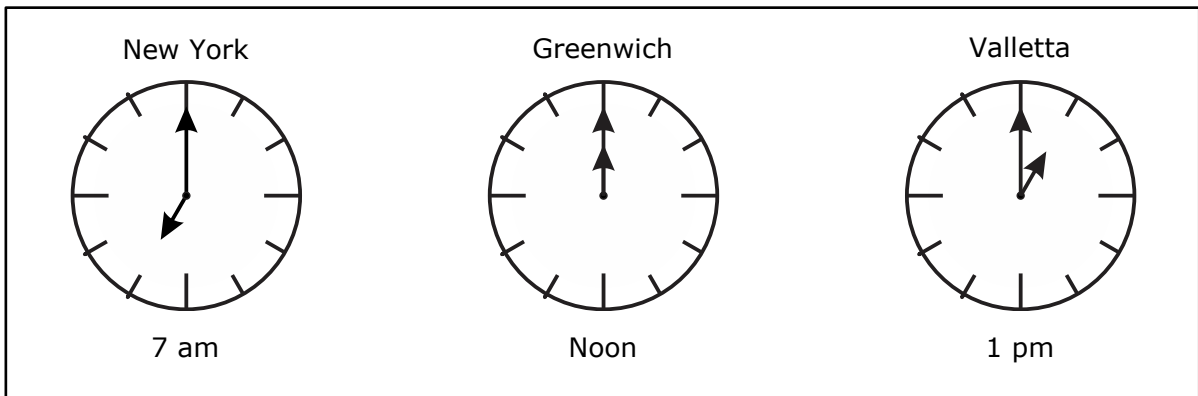
(2)

(c)   angle r

(2)

(Total: 6 marks)

5   Write in order of size, starting with the smallest number:

$$\frac{3}{5}, \quad 55\%, \quad 0.59, \quad 0.5^2$$

(Total: 2 marks)

6   The diagram below shows the local time in three different places.

| New York | Greenwich | Valletta |
| 7 am | Noon | 1 pm |

The time in Valletta is ahead of the time in Greenwich which is ahead of that of New York.

(a)   What day and time is it in Greenwich on Monday at 07:30 in Valletta?

(2)

(b)   What day and time is it in Valletta on Monday at 19:00 in New York?

(2)

(Total: 4 marks)

7   Sam makes a paint mixture by mixing red, blue and green paints in the ratio 8:3:1 by weight.

(a)   How much red paint does he use to make 600 g of paint mixture?

(2)

(b)   One day Sam has only 20 g of blue paint left but he has plenty of red and green paint. How much paint mixture can he make?

(3)

(Total: 5 marks)

8   A shop has a sale.
  (a)   Daniel buys a jacket which had a price of €65 before the sale.
        There is an offer of 15% sale on this jacket.
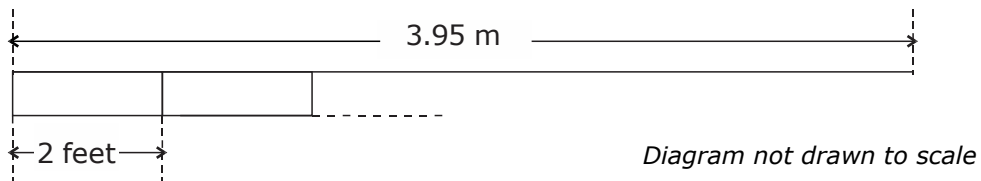   How much does Daniel pay for this jacket? Show your working.

(3)

  (b)   Jane buys a cardigan with a sale price of €45.50.
        Its price before the sale was €70.
        Work out the percentage reduction on the price of the cardigan.

(3)
(Total: 6 marks)

9

Diagram not drawn to scale

Karl can make use of some storage cabinets that are 2 feet wide.

One foot equals 0.3048 metres.

  (a)   How many of these storage cabinets can he fit side by side along a wall that is 3.95 m long?
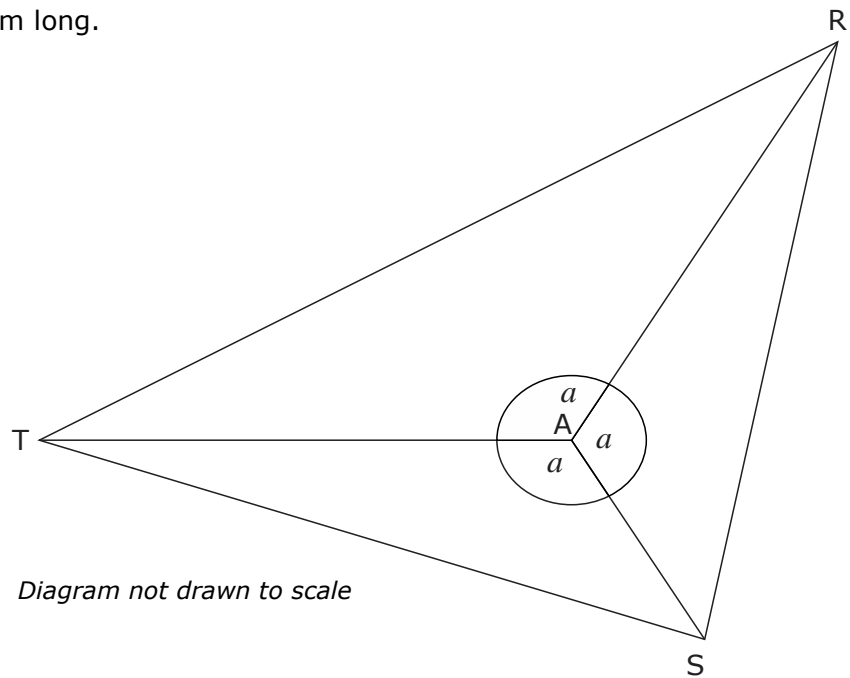
(3)

  (b)   Karl decides to use as many cabinets as he could fit along the wall.
        What length of wall remains uncovered by the cabinets? Give your answer in cm.
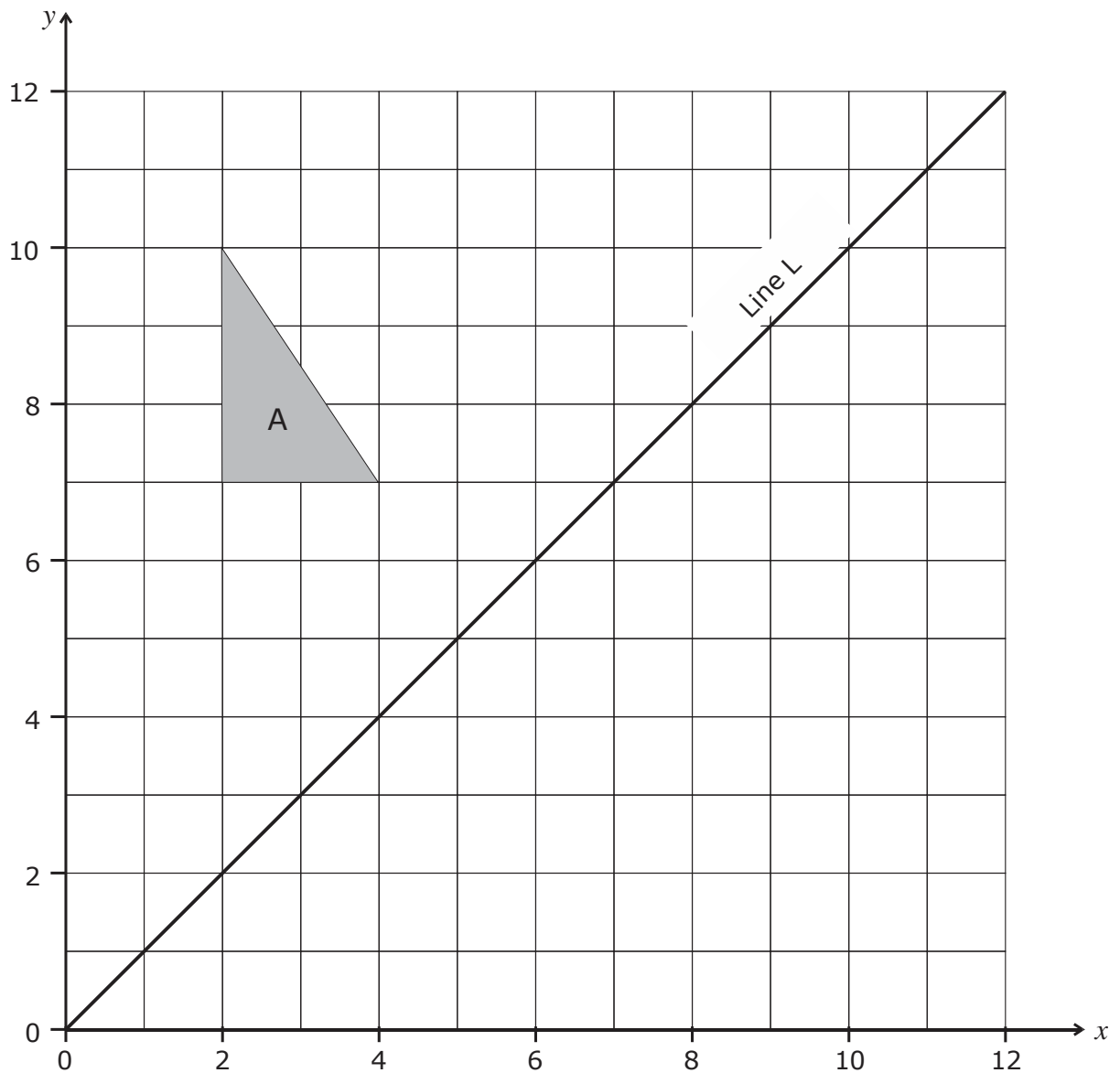
(2)
(Total: 5 marks)

10   In the figure below, the three angles at A are all equal.
     AR and AT are both 20 cm long.
     AS is 10 cm long.

Diagram not drawn to scale

(a)   Work out the size of ∠RAT.

(1)

(b)   Explain why triangle ARS is congruent to triangle ATS.

(3)

(c)   Name **TWO** triangles in the figure which are isosceles.

(2)

(Total: 6 marks)

11

Use the figure above to answer the following questions.

(a)   Translate triangle A by $\begin{pmatrix} 8 \\ -2 \end{pmatrix}$ and label the image shape B.

(2)

(b)   Rotate triangle A by 90° clockwise about (2, 7) and label the image shape C.

(2)

(c)   Reflect triangle A in Line L and label the image shape D.
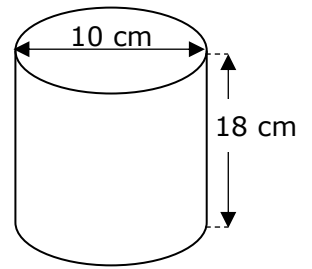
(2)

(d)   Write down the equation of Line L.

(1)

(Total: 7 marks)

DO NOT WRITE ABOVE THIS LINE

12 An empty cylinder has diameter 10 cm and height of 18 cm.

(a) Find the area of its circular face.

10 cm

18 cm

Diagram not drawn to scale

(2)

(b) A litre of water is poured into the cylinder. Work out the height of water in the cylinder.

(3)

(Total: 5 marks)

13 A magazine has 24 pages, all of the same thickness.

A pile of 20 magazines is 16.8 cm high.

(a) What is the thickness of one of the pages of the magazine? Give your answer in mm.

(4)

(b) What would be the thickness of a magazine made from 36 pages of the same thickness?
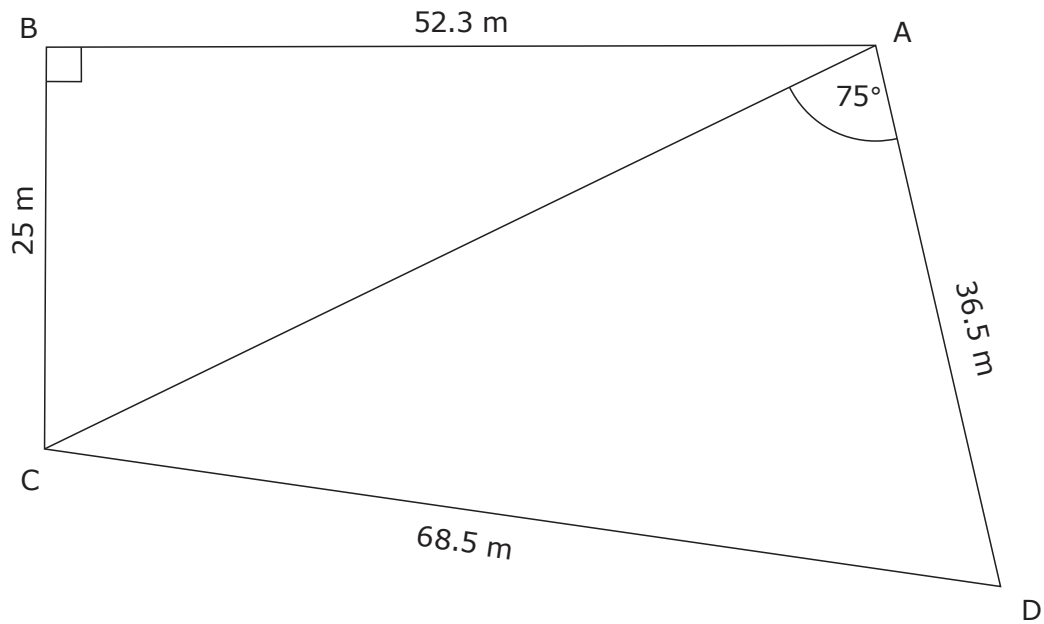
(1)

(Total: 5 marks)

14   A plot of land is in the shape of a quadrilateral ABCD. The diagram shows the length of its four sides. Angle ABC is a right angle and angle CAD is 75°.

Diagram not drawn to scale

(a)   Work out the length of the diagonal AC of the plot. Give your answer to the nearest metre.

(3)

(b)   Determine the size of ∠BAD.

(4)

(Total: 7 marks)

15 A bag contains only purple beads and orange beads.

The probability that a bead chosen at random from the bag is orange is $\frac{1}{3}$.

(a) Write down the ratio of the number of orange beads to the number of purple beads in the bag.

(1)

(b) There are 8 more purple beads than orange beads.
What is the total number of beads in the bag?

(2)

(Total: 3 marks)

16 Let x and y be two numbers.
The difference between these two numbers is 8.
The sum of three times the larger one and twice the smaller one is 59.

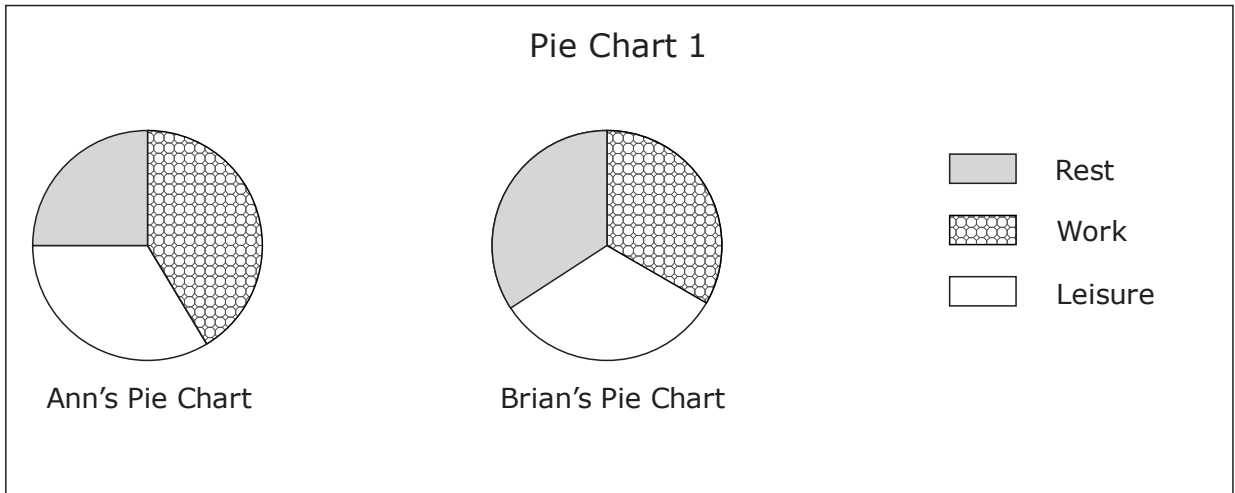(a) Use the given information to form two equations in x and y.

(2)

(b) Solve your equations to find the values of x and y.
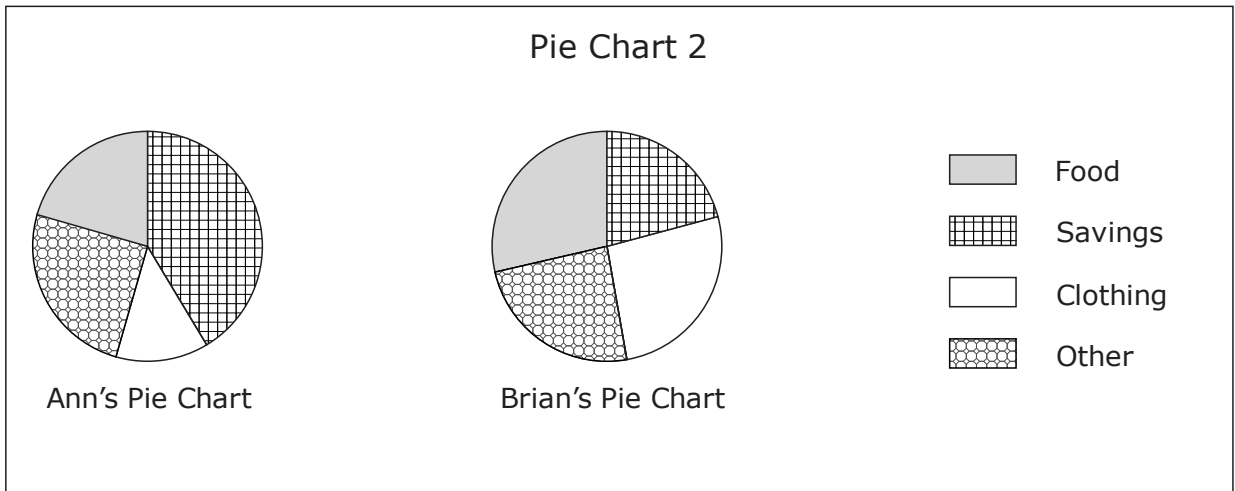
(3)

(Total: 5 marks)

17   (a)   Pie Chart 1 shows how Ann and Brian spent their time on the 31st of January.

Pie Chart 1

Ann's Pie Chart   Brian's Pie Chart

Rest
Work
Leisure

Can you say that Ann worked more than Brian on this day? Explain.

(2)

(b)   Pie Chart 2 shows how Ann and Brian used their salary in January.

Pie Chart 2

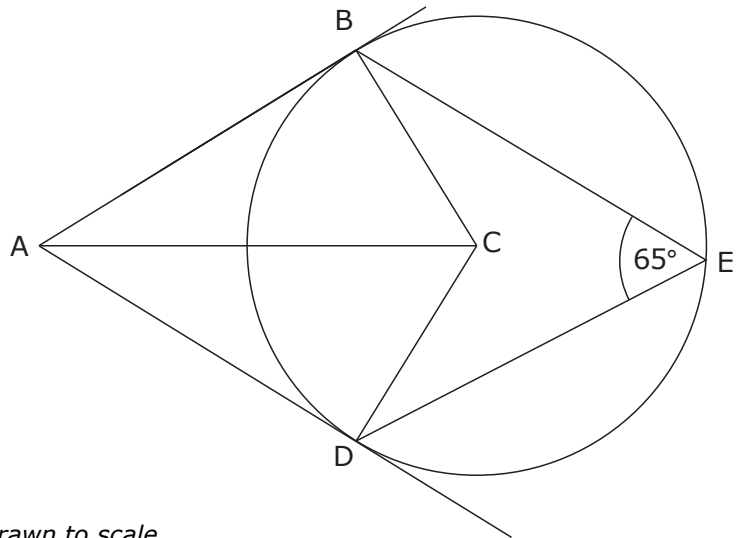Ann's Pie Chart   Brian's Pie Chart

Food
Savings
Clothing
Other

Can you say that Ann spent less money than Brian on food in January? Explain.

(2)
(Total: 4 marks)

18 C is the centre of a circle.
    BA and DA are tangents to the circle touching the circle at B and D respectively.
    E is a point on the circumference.

Diagram not drawn to scale

If ∠BED = 65°, determine the sizes of the following angles, giving reasons for your answers:
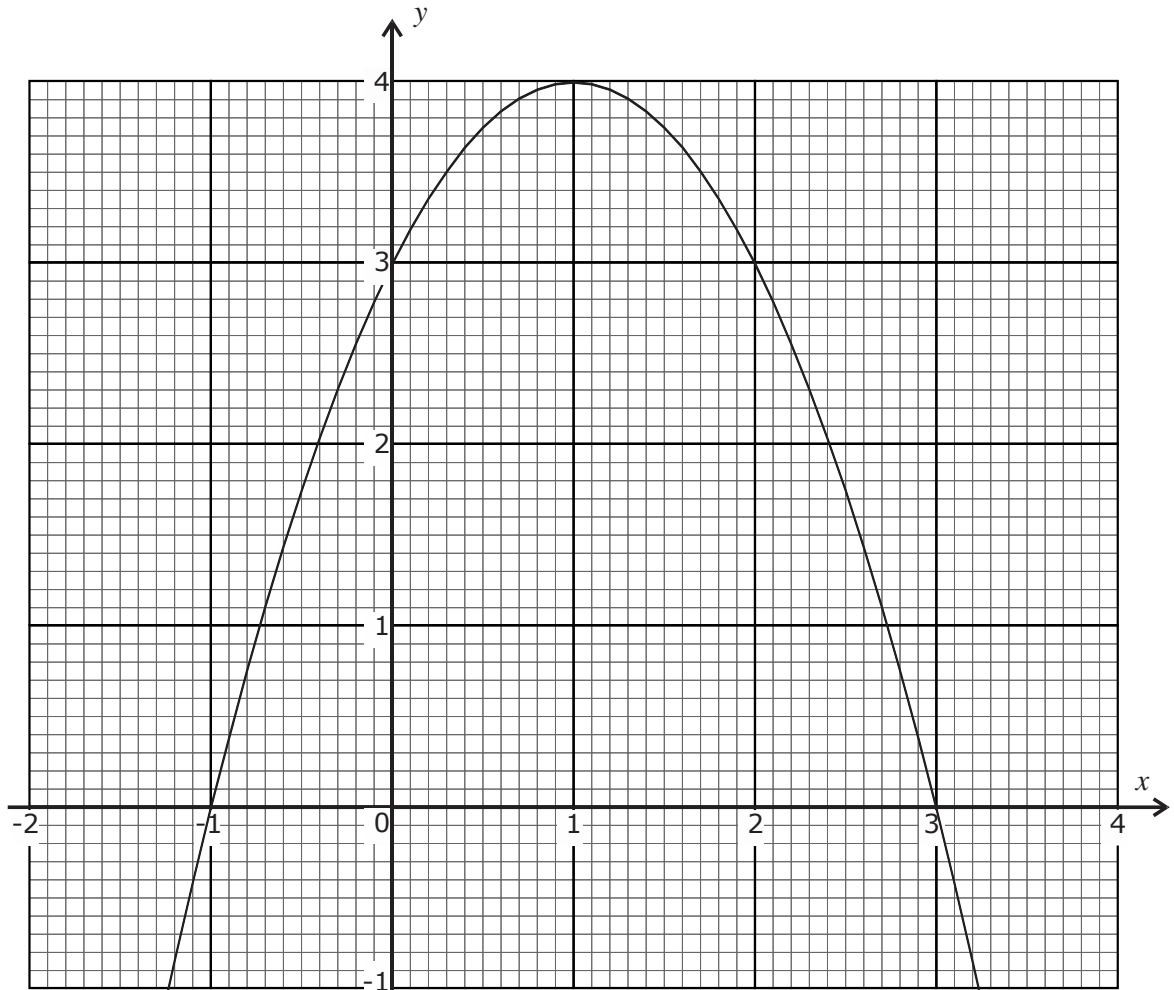
(a) ∠BCD

(2)

(b) ∠ABC

(2)

(c) ∠BAD

(2)

(Total: 6 marks)

19

(a)   Which of the following equations is represented by the curved graph above?

(i) $y = 3x + 3$ (ii) $3y = x + 3$

(iii) $y = 3 + 2x - x^2$ (iv) $y = 3x^2 + 3$

(1)

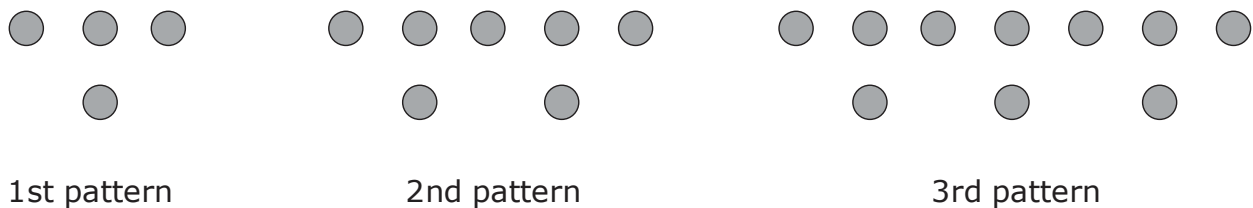(b)   On the same axes draw the graph of the equation $2y + x = 3$.

(3)

(c)   Write down the coordinates of the points of intersection of the curve and the graph you plotted in part (b).

(2)

(Total: 6 marks)

20   The figure shows a sequence of patterns with counters.

1st pattern   2nd pattern   3rd pattern

(a)   How many counters are there in the 4th pattern?

(1)

(b)   How many counters are there in the 10th pattern?

(1)

(c)   Find an expression, in terms of n, which represents the number of counters
      in the nth pattern.

(2)

(d)   Is there a pattern in this sequence with 195 counters? Show your working.

(2)

(Total: 6 marks)

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