	MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
L-Università ta' Malta	**SECONDARY EDUCATION CERTIFICATE LEVEL** **2022 MAIN SESSION**

SUBJECT: **Mathematics**	PAPER: I – Section A (Non-Calculator Section)
DATE: 7th May 2022	TIME: 20 minutes

Attempt **ALL** questions.

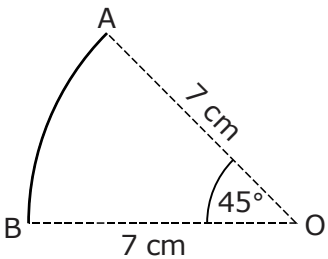Write your answers in the space available on the examination paper.
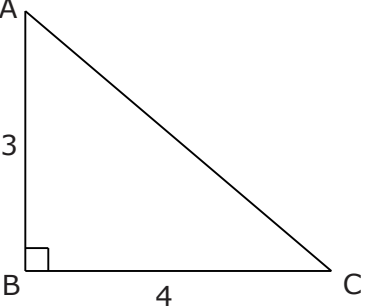The use of calculators and protractors is **not** allowed.
It is not necessary to show your working.
This paper carries a total of 20 marks.

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
1 Write down the number two million and twentyfive in figures. **Ans** _____	
2 Karl was born on the 20th August 1975. How old is he today? **Ans** _____	
3 Estimate the value of $$\frac{79.8 \times 60.1}{3.89}$$ **Ans** _____	
4 A movie starts at 21:20. If it is 1 hour 55 mins long, at what time does it finish? **Ans** _____	

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

5
$$\frac{15.6 \times 3700}{12} = 4810$$

Use the result above to find the value of:

$$\frac{1.56 \times 370}{120}$$

Ans _____

6 Fifty students took a test. Use the table below to work out the range of marks where the median lies.

Range of marks	0-20	21-40	41-60	61-80	81-100
Frequency	5	6	11	13	15

Ans _____

7 A rectangle and a square have an equal perimeter. If the rectangle is 10 cm long and 6 cm wide, what is the length of each side of the square?

Ans _____

8 Which **TWO** of the following expressions will give the same answer?

(a) $3 \times 6 + 4 \times 5$ (b) $(3 \times 6 + 4) \times 5$

(c) $3 \times (6 + 4) \times 5$ (d) $(3 \times 6) + (4 \times 5)$

Ans _____

9 Which of the following numbers is **not** prime?

$$7, \quad 17, \quad 27, \quad 37$$

Ans _____

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
10 The temperature on a cold winter morning was $-4\,°C$. It rises by $6\,°C$ by midday before dropping by $9\,°C$ at midnight. What is the temperature at the end of the day? **Ans** _____	
11 What is the value of k when $2^k = 64$. **Ans** _____	
12 An arc AB of a circle centre O and radius 7 cm subtends an angle of 45° at O. Work out its length. Take π to be $\frac{22}{7}$. **Ans** _____	
13 A racing boat covers a distance of 90 km in 20 mins. Find its average speed in m/s during this journey. **Ans** _____	
14 Mia is x years old. Her mum is three times as old. Write down an expression in terms of x for the mother's age in five years' time. **Ans** _____	
15 Samantha works from 8:45 am to 4:30 pm five days a week. Each day she takes 45 minutes break. How many hours a week does she work? **Ans** _____	

DO NOT WRITE ABOVE THIS LINE

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
16 Maria obtained the following marks in five tests: 80 79 78 85 83 Work out her mean mark over these tests. **Ans** _____	
17 In the figure below, what is the value of cos ∠BAC? A 3 *Diagram not drawn to scale* B 4 C **Ans** _____	
18 The cost of 12 hot dogs and 8 portions of fries cost €52. The cost of 8 hot dogs and 12 portions of fries cost €48. What is the total cost of a hot dog and a portion of fries? **Ans** _____	
19 Which **ONE** of the following is **not** exactly equal to $\frac{1}{3}$? $\frac{27}{81}$, 3^{-1}, 0.33, $33\frac{1}{3}\%$ **Ans** _____	
20 Write down the equation of a line passing through the origin and parallel to the line $3y - 2x = 5$. **Ans** _____	

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2022 MAIN SESSION

SUBJECT: **Mathematics**
PAPER NUMBER: I – Section B (Calculator Section)
DATE: 7th May 2022
TIME: 1 hr 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.

For Office Use Only											
Sec A	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**

1   The table below shows the population of 5 countries around the world as well as the number of positive cases each country had from the start of a particular pandemic up to the end of December 2021. All figures have been rounded off to the nearest thousand.

Country	Population	Number of Positive Cases	Total cases / million population
Australia	25,739,000	396,000	
India	1,400,236,000	34,839,000	24,881
Malta	443,000	52,000	
UK	68,418,000	12,748,000	186,325
USA	333,898,000	55,253,000	

(a)   In the list above which is the highest population? Express this number in standard form correct to 2 significant figures.

(3)

(b)   Using values given in the table above, work out the total number of positive cases per million of the population for Australia, Malta and USA. Give your answers to the nearest whole number.

(3)

(c)   Which country would you consider to have been least affected in this pandemic? Explain your answer.

(2)

(Total: 8 marks)

2   (a)   The price of a computer is reduced by 5%. If the actual reduction is 17 euro, find the original price of the computer.

(2)

(b)   The scale on a map is 1:250,000. Find the actual distance, in km, between two cities which are 22 cm apart on the map.

(3)

(Total: 5 marks)

3   ABCDE is a pentagon such that:

- the sides BC and ED are equal
- $\angle$ADC and $\angle$ACD are both equal to 70º
- $\angle$EDA = 40º
- $\angle$AED = $\angle$ABC = 90º

(a)   Prove that ΔADE is congruent to ΔACB.

Diagram not drawn to scale

(4)
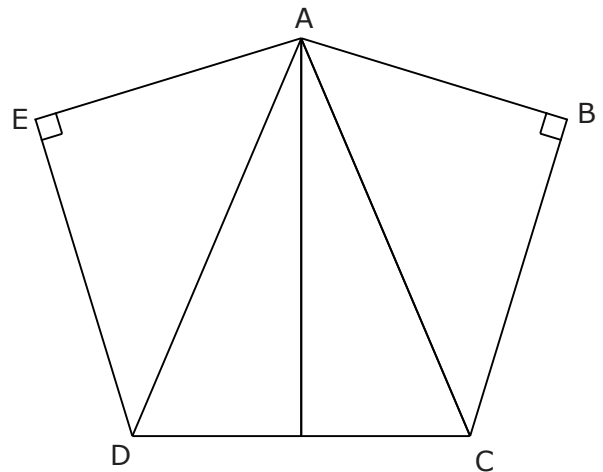
(b)   Find the size of $\angle$EAB.

(2)

(c)   Given that CB = 5.5 cm, find the length of AD.

(3)

(Total: 9 marks)

4   A gold earring is in the form of a segment of a circle, centre O and with radius 5 mm.
    The angle subtended by the chord AB is 90°.
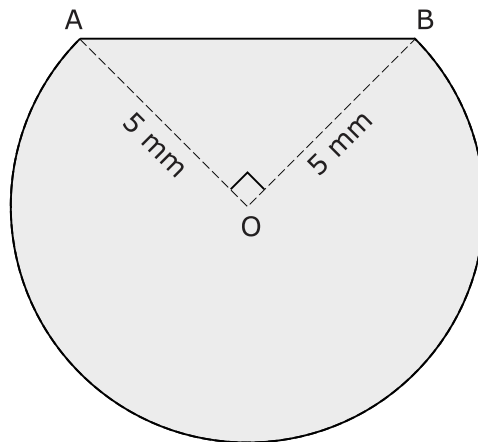
(a)   Work out the area of the earring.

(3)

(b)   The earring is flat and has a uniform thickness of 1.5 mm.
      Work out its volume.

(1)

(c)   Gold costs €1.80 per mm³.
      Determine the cost of a **pair** of earrings.

(2)

(Total: 6 marks)

5   A piece of land is in the shape of a quadrilateral ABCD.
     The sides AB, BC, CD and DA are 18 m, 16 m, 15.4 m and 17.6 m long.
     The diagonal AC is 22 m long.

     (a)   Using compasses and ruler only, construct the quadrilateral ABCD, using a scale of
           1 cm for 2 m.

                                                                                              (6)

     (b)   Measure ∠ABC.   _____

                                                                                              (1)
   **(Total: 7 marks)**

6   Bertu and Toni are taxi drivers and they work for different companies. The graph below shows the cost **C** Bertu charges for trips according to the distance travelled **s**.

Toni charges customers a fixed charge of €3 and an extra 50c for every km travelled.

(a)   On the same axes and using the information above, complete the graph showing the total cost **C** charged by Toni.

(3)
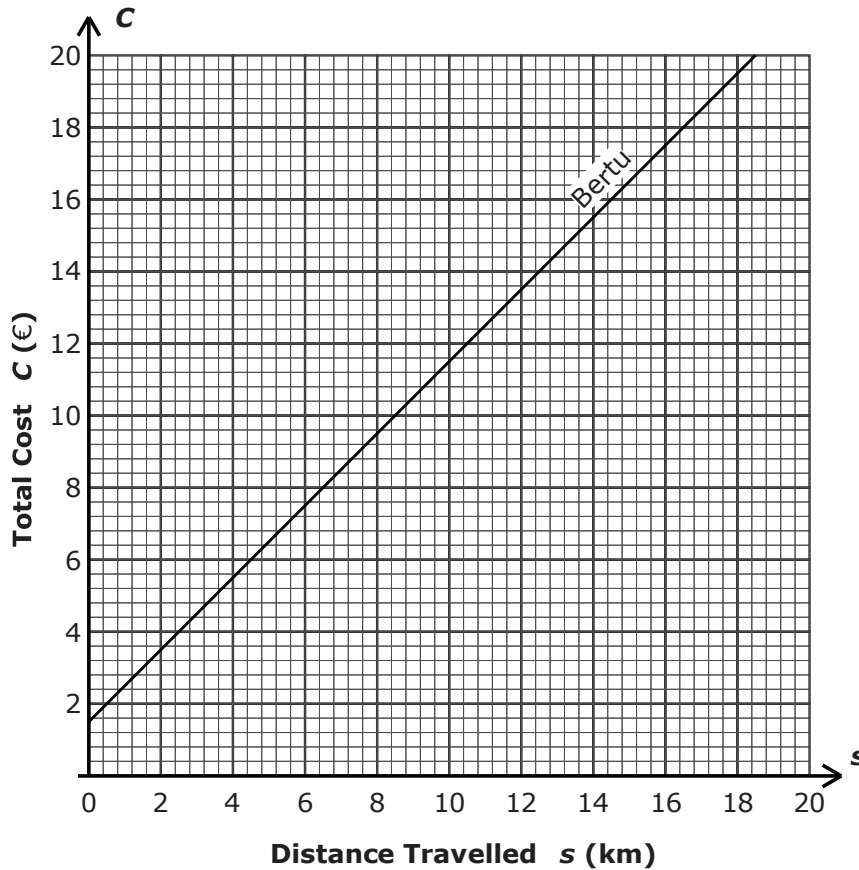
(b)   Toni charges a customer €7.
How far was the journey made by this customer?   _____   (1)

(c)   How much does a 12 km journey cost when using Bertu's taxi?   _____   (1)

(d)   How far does a customer have to travel for both Toni and Bertu to charge the same amount?   _____   (1)

(e)   Write down an equation for the total cost in euro, **C**, which Toni charges for a journey of distance **s**.

(3)
(Total: 9 marks)

7   In this question x and y could be any two numbers.
     The letter n stands for a positive whole number.

     Four statements are given in the table below. For each statement, determine whether the
     statement is true or false. Explain your reasoning.

Statement	True or False	Reason	
When $x < 5$, the maximum value that x can take is 4.			(2)
When $x^2 = 25$, the only value that x can take is 5.			(2)
The number 56 is one of the terms in the sequence $3n + 2$.			(2)
When y is positive, the value of y^2 is always greater than the value of y.			(2)

(Total: 8 marks)

8   John buys liquid fuel in cylindrical cans of diameter 6 cm and height 12 cm.
     Each can contains 320 cm^3 of liquid.

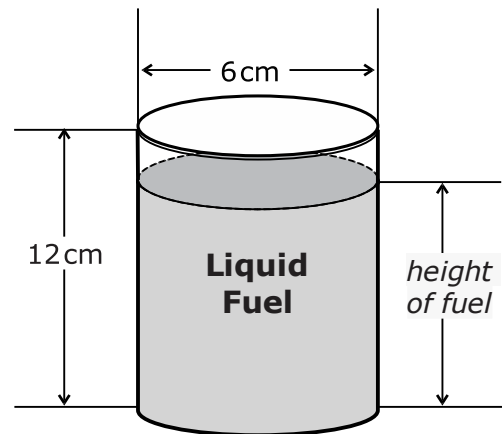   (a)   (i)   Calculate the volume of the can.

Diagram not drawn to scale

(3)

           (ii)   What is the volume of the empty space in each can?

(1)

           (iii) The can is placed upright as shown in the diagram.
                  What is the height of the gap from the liquid surface to the top of the can?

(3)

     (b)   An open empty tank has a uniform cross-section
           in the form of a rectangle 12 cm by 22 cm.
           The tank is 17 cm high.

           John is opening cans to fill this tank with liquid
           fuel.

           What is the largest number of fuel cans that can
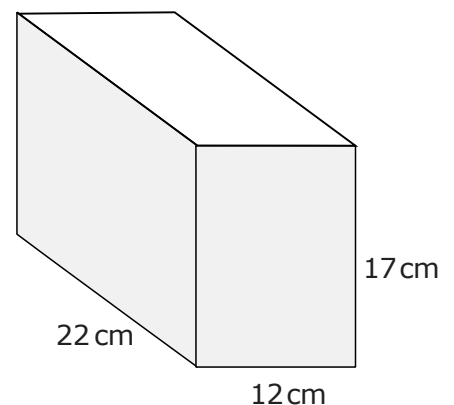   be emptied completely into the tank?
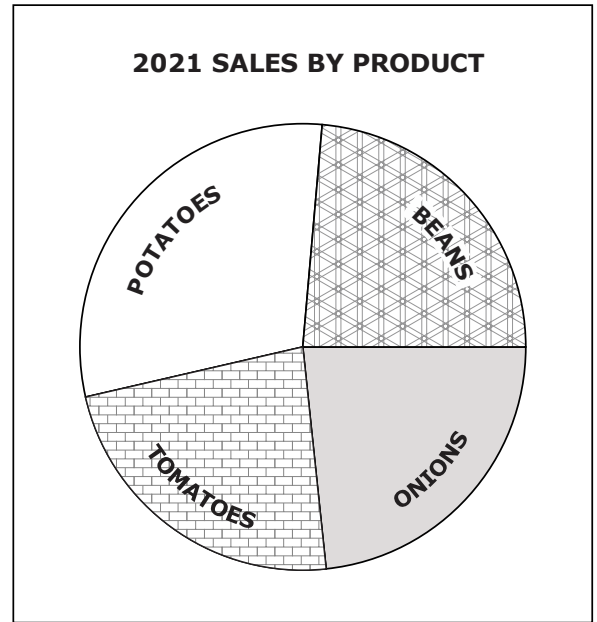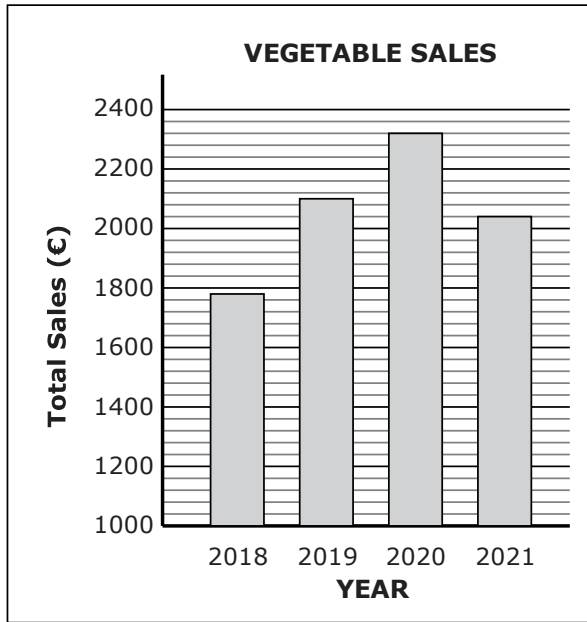

Diagram not drawn to scale

(3)
(Total: 10 marks)

9   (a)   Paul sells potatoes, beans, onions and tomatoes.

The bar chart shows his annual income from the sale of these vegetables for the last four years.

The pie-chart shows how the income from sales was shared between the four vegetables, in the year 2021.

Work out the income from potatoes for the year 2021.

(4)

(b)   Ms Abela gave a test to her two classes Form 4A and Form 4B.
      The following bar chart shows the distribution of marks for the two classes.
      Ms Abela set the passmark at 50.

Mathematics Results: Form 4A & Form 4B
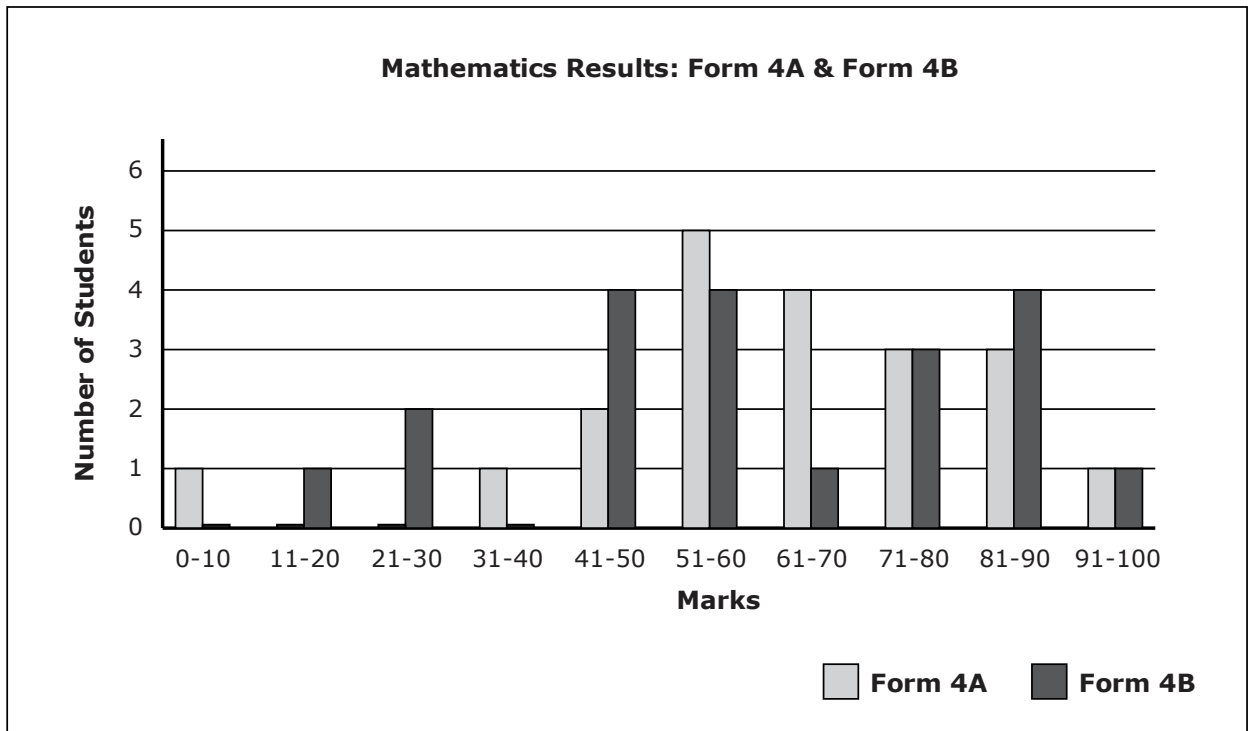
(i)   What is the maximum number of students who passed the test in Form 4A?

(2)

(ii)   What is the minimum number of students who passed the test in Form 4B?

(2)

(iii) From the bar chart, is it possible to say which class had more passes?
       Explain.

(2)
(Total: 10 marks)

10 There are 800 students in a school.

$\frac{2}{5}$ of the students are boys.

70% of the girls can swim.

The ratio of boys that **cannot** swim to the girls that **cannot** swim is 2:3.

Complete the table:

	Boys	Girls	Total
Can swim			
Cannot swim			
Total			800

(Total: 8 marks)

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2022 MAIN SESSION**

SUBJECT:	**Mathematics**
PAPER NUMBER:	IIA
DATE:	7th May 2022
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.

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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	$\pi r l$
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)   Factorise completely: $ax + ab + 2yx + 2yb$

(3)

(b)   Express as a single fraction: $\dfrac{3}{x} - \dfrac{4}{x+1}$

(3)

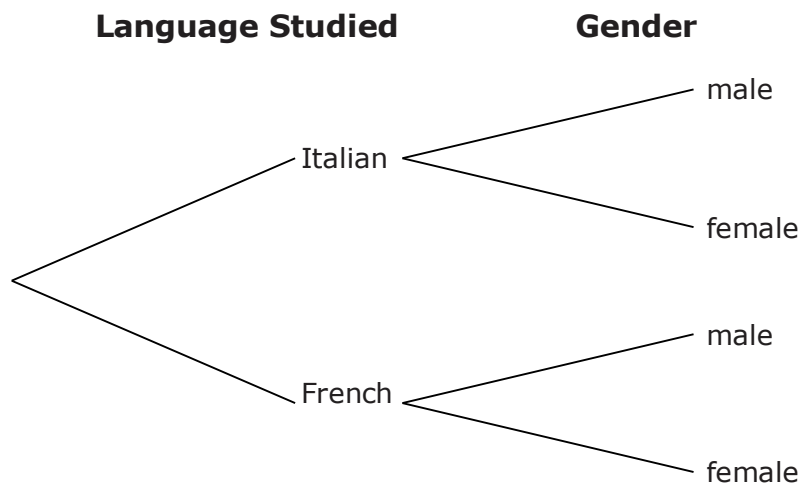(c)   Make x subject of the formula: $y = (x-2)^2 + 3$

(3)
(Total: 9 marks)

2   At the beginning of the year 2022, Sandro opened a bank account with an initial deposit of €2000. The investment pays 3% annual interest, compounded at the end of the year. He plans to continue to invest €2000 at the beginning of every year in the same account.

What will his balance be in this account at the end of 2024?

(Total: 5 marks)

3   In a school, 80 students study one language only; either French or Italian.

There are 20 more students studying French than Italian.

60% of those studying French are female.

30% of those studying Italian are male.

A student is chosen at random from this group of students.

(a)   Complete the probability tree to show the probabilities associated with each branch.

Language Studied   **Gender**

```
                                    male
                    Italian
                                    female

                                    male
                    French
                                    female
```

(4)

(b)   What is the probability that the chosen student studies Italian and is a female?
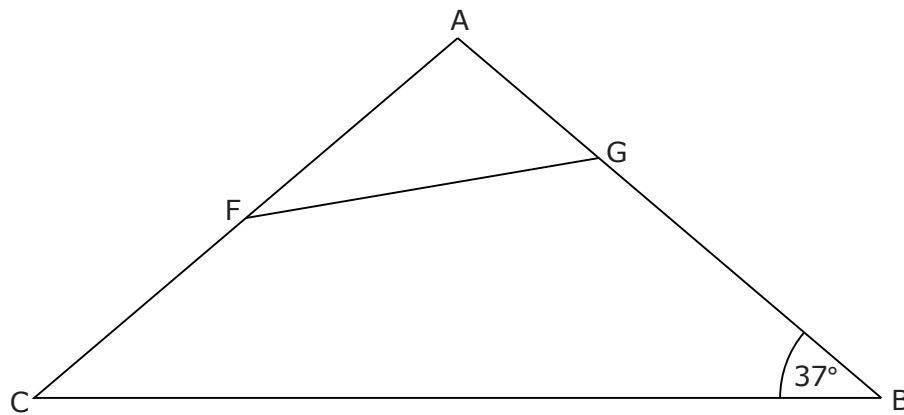
(2)

(c)   What is the probability that the chosen student is female?

(3)

(Total: 9 marks)

4

Diagram not drawn to scale

ABC is an isosceles triangle with AB = AC and ∠ABC = 37°.
AB = 75 cm long, G lies on AB so that AG:GB in the ratio 1:2
F lies on AC so that AF = FC.

(a) Use trigonometry to find the length of FG, correct to the nearest millimetre.

(5)

At C, a line is drawn parallel to FG to meet the line AB at H.

(b) Explain why triangle AFG is similar to triangle ACH.
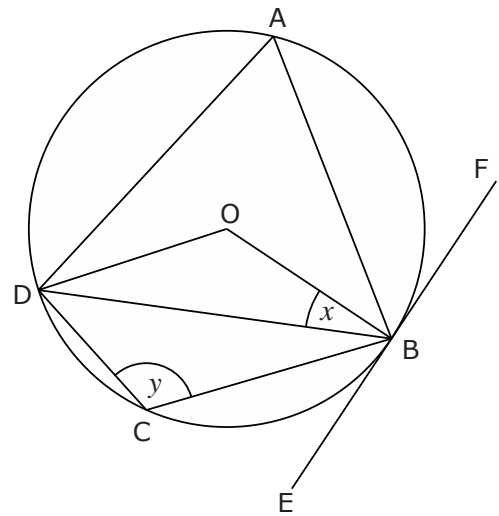
(2)

(c) Explain why HB = AG.

(2)

(d) Describe fully the single transformation that maps triangle ACH to triangle AFG.

(2)

(Total: 11 marks)

5   The diagram shows a circle, centre O.

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

EF is a tangent to the circle touching the circle at B.

$\angle DBO = x$ and $\angle BCD = y$.


(a)   Write down an expression for $\angle ODB$ in terms of x. Explain your reasoning.

(2)

(b)   Write down an expression for $\angle BAD$ in terms of x. Explain your reasoning.

(4)

(c)   Write down an expression for $\angle BAD$ in terms of y. Explain your reasoning.

(2)

(d)   Show that $y - x = 90°$

(2)

(e)   If $\angle CBE = 40°$ and $\angle DCB = 110°$, work out the value of $\angle DBC$.
      Explain your answer.

(2)

(Total: 12 marks)

6 Sonya makes necklaces.
   Each necklace costs Sonya 56 euro to make.
   The necklaces are sold through an Internet shop at a selling price of 80 euro.

   (a) (i) The internet shop charges her 7% of the selling price.
             Find the amount that Sonya receives from the shop for a necklace.

   (2)

        (ii) The shop increases the charge to 12% of the selling price of 80 euro.
              Calculate the reduction in percentage profit due to the charge increase.

   (4)

   (b) Sonya also makes silver rings.
        Each ring contains 22 g of silver.
        During the last year the cost of silver has increased by 2% to 64 euro per 100 g.

        (i) Find the cost of 100 g of silver before the increase.

   (2)

        (ii) Find the increase in the cost of the silver in a ring.

   (2)

(Total: 10 marks)

7   The patterns in this sequence consist of grey and white circles.

1st pattern   2nd pattern   3rd pattern   4th pattern
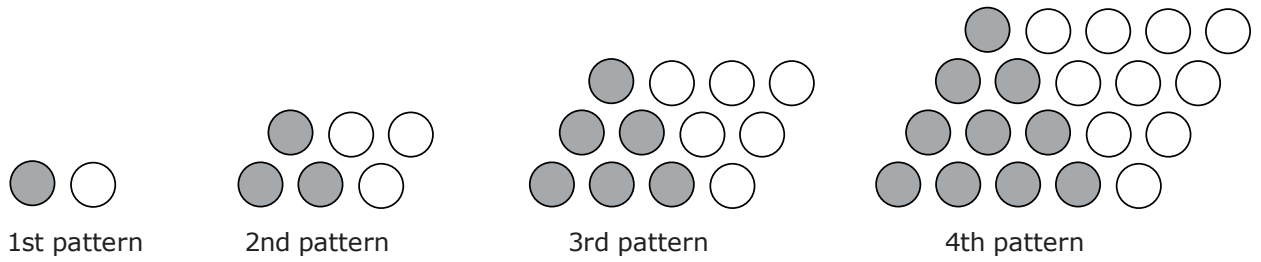
(a)   Complete the table below for the number of circles in each pattern.

Pattern Number	1	2	3	4	5	n
Total Number of Circles	2	6	12			
Number of Grey Circles	1	3	6			

(4)

(b)   The number of grey circles in each pattern represent successive triangular numbers. So 1 is the first triangular number and 3 is the second triangular number.

(i)   What is the 150th triangular number?

(1)

(ii)   Show that 5050 is a triangular number.

(3)
(Total: 8 marks)

8   x and y are two positive numbers, so that y is bigger than x.

The difference between these two numbers is 12.

The sum of their squares is 4304.

(a)   Write **TWO** equations connecting x and y.

(2)

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

(4)
(Total: 6 marks)

9   Fill in the empty cells of the tables below.

(a) y is proportional to x:

x	1	20	x
y	9		

In this cell, write an expression for y in terms of x.

(2)

(b) t is inversely proportional to s:

s	10	5	s
t	1		

In this cell, write an expression for t in terms of s.

(3)

(c) A is proportional to r^2:

r	2	5		r
A	20		245	

In this cell, write an expression for A in terms of r.

(4)
(Total: 9 marks)

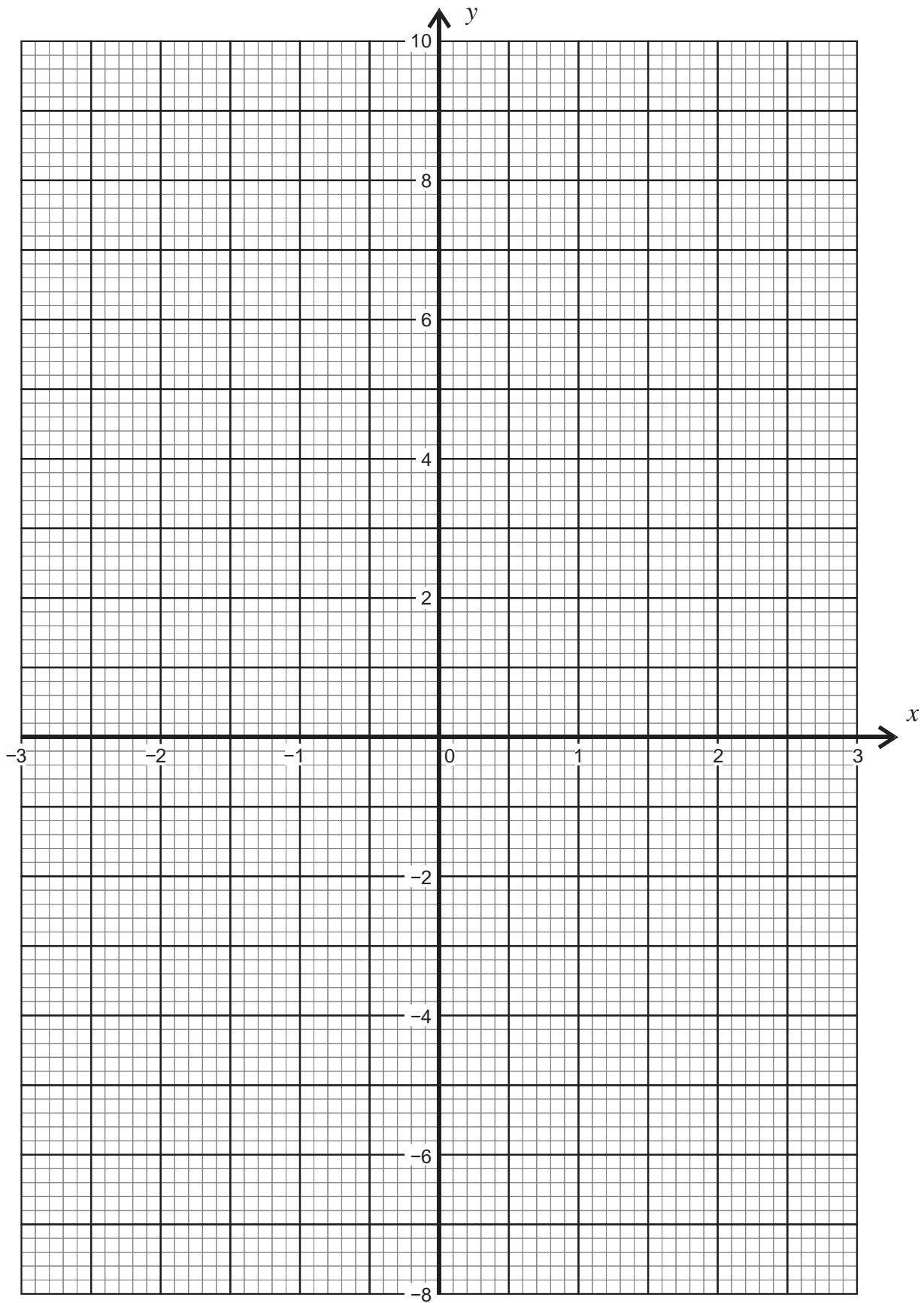10 (a) Complete the table of values for $y = \frac{3}{4}x^3 - 4x + 1$.

x	−3.0	−2.5	−2.0	−1.5	−1.0	0	1.0	1.5	2.0	2.5	3.0
y	−7.25	−0.72		4.47			−2.25		−1	2.72	9.25

(2)

(b) Use the axes provided to plot the graph of $y = \frac{3}{4}x^3 - 4x + 1$ for values of x between −3.0 and 3.0.

(4)

(c) Use your graph to solve the equation $3x^3 - 16x = 0$.

(3)

(d) By first factorising $3x^3 - 16x$, solve the equation $3x^3 - 16x = 0$ in another way.
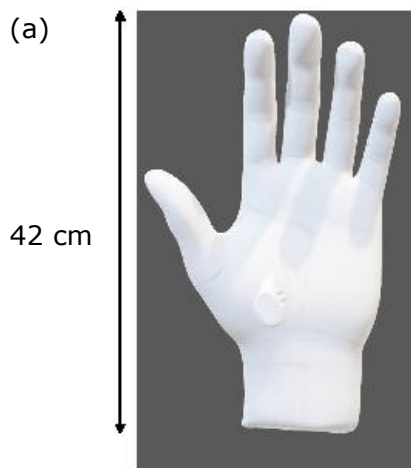
(3)

(Total: 12 marks)

11 (a)

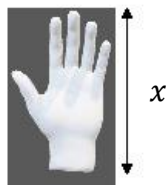42 cm

x

Figure B   *Diagram not drawn to scale*

Figure A

A sculptor makes a trophy in the shape of a hand palm of height 42 cm (Figure A).
He also makes smaller trophies with exactly the same shape (Figure B).
One large trophy has the same volume as 27 of the smaller ones.

(i)   What is the height, marked x in Figure B, of each of the small trophies?

(3)

(ii)   The surface area of the base of the larger trophy is 40 cm². Work out the surface area
       of the base of a smaller trophy.

(2)

(b)   The shape PQRSTUVW is a cuboid. Length PQ is 35 cm, length QU is 21 cm and length
       UV is 26 cm. Calculate the length PV.
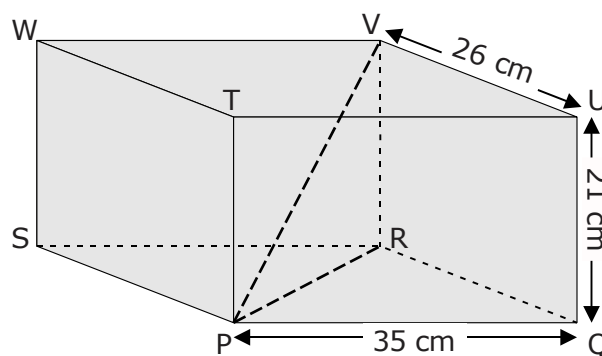

Diagram not drawn to scale

(4)
(Total: 9 marks)

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SUBJECT:	**Mathematics**
PAPER NUMBER:	IIB
DATE:	7th May 2022
TIME:	4:00 p.m. to 6:05 p.m.

Answer **ALL** questions.

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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 the missing numbers in the empty boxes.

$$\frac{1}{5} = \frac{\boxed{}}{10} = \frac{20}{\boxed{}} = \boxed{}\,\%$$

(3)
(Total: 3 marks)

2   Simplify:

(a) $p \times p \times p + q + q$

(2)

(b) $4(x + 3) - x + 5$

(2)
(Total: 4 marks)

3   For each real-life object in the table below, only one of the given measures is reasonable.
Mark **ONE** reasonable measure for each object with a tick (✓) in the appropriate box.

OBJECT	POSSIBLE MEASURE			
The weight of a car	☐ 17500 mg	☐ 1.3 tonnes	☐ 8500 g	☐ 125 kg
The length of a washing machine	☐ 60 mm	☐ 60 cm	☐ 2.5 m	☐ 20 cm
The floor area of a classroom	☐ 120cm²	☐ 16 m³	☐ 18000 mm²	☐ 17.5 m²
The volume of a tin of baked beans	☐ 215 cm³	☐ 21.5 ml	☐ 215 mm³	☐ 215 cm²
The length of a football pitch	☐ 100 cm	☐ 90 m	☐ 1 km	☐ 100 km

(Total: 5 marks)

4   (a)   A regular polygon has exterior angles of 30°.
            Show that this polygon has 12 sides.
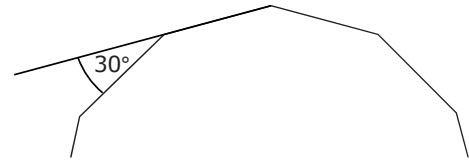
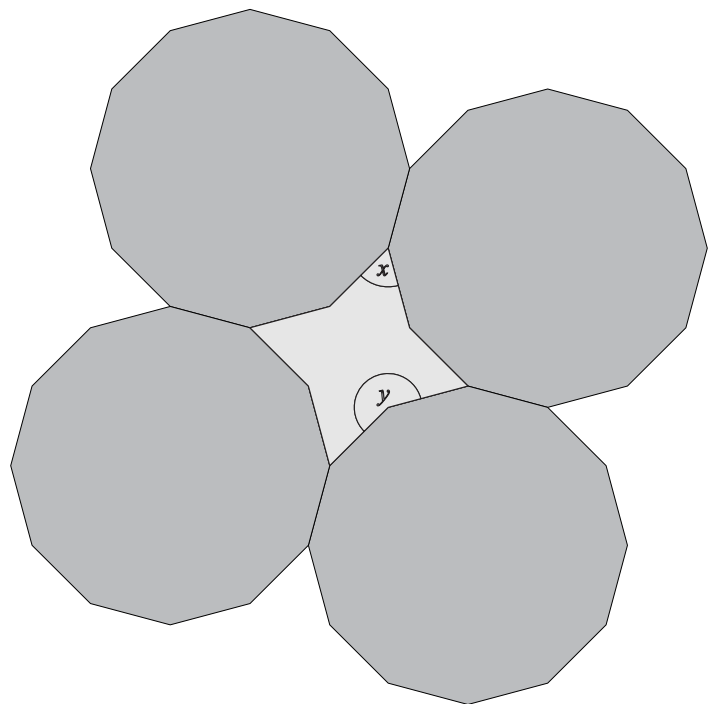(1)

     (b)   The diagram below shows five tiles which fit together.
            The four outer tiles are identical regular 12-sided polygons.

            (i)   Work out the size of:

                   • The angle marked x

                   • The angle marked y

                   x = _____ y = _____

(4)

            (ii)   Consider the whole shape comprising of the five tiles.
                   How many lines of reflective symmetry does this shape have?

(1)
(Total : 6 marks)

5

| 1 South Korean Won (KRW) = 0.000728 Euro |

    (a)   What is the value in euro of 50,000 KRW?

(2)

    (b)   What is the value in KRW of €100? Give your answer to the nearest 1000 KRW.

(3)
(Total: 5 marks)

6   An oven is sold for €590 when paid in cash.
      It can also be bought for a down payment of €50 together with 24 installments of €30 each.
      By how much is it cheaper to pay by cash than by instalments?

(3)
(Total: 3 marks)

7   A car travels 40 km at an average speed of 30 km/h.
      It then travels 60 km at an average speed of 60 km/h.
      Calculate the total time in minutes of this 100 km journey.

(4)
(Total: 4 marks)

8   The diagram shows a circle with points A, B, C, D and E lying on its circumference.

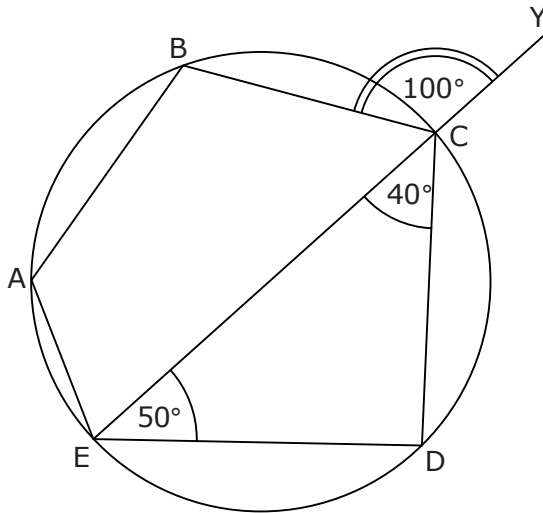ECY is a straight line.

∠BCY = 100°, ∠ECD = 40° and ∠CED = 50°

Diagram not drawn to scale

(a)   Work out the value of the following angles, giving reasons for your answers.

(i)   ∠BCE;

(2)

(ii)   ∠BAE.

(2)

(b)   Mandy says that line EC must be the diameter of the circle.
Is Mandy correct? Explain your reasoning.

(2)

(Total: 6 marks)

9   Consider the following four numbers:

$$0.00314; \quad 0.00314 \times 10^2; \quad 1000\,\pi; \quad 3.14 \times 10^{-2}$$

(a)   One of these numbers is written in standard form. Write down this number.

(1)

(b)   Write down the smallest of the four numbers.

(1)

(c)   Write down the value of $(0.00314 \times 10^2) + (3.14 \times 10^{-2})$.
       Give your answer as an ordinary number.

(2)

(d)   Give your answer to part (c) to 3 significant figures.

(1)

(Total: 5 marks)

10   A biased spinner has numbers from 1 to 6.
   The table below shows the probability of a spinner landing on each of these numbers.

Numbers on the spinner	1	2	3	4	5	6
Probability of spinner landing on this number	0.05	0.1	0.15	0.3	x	x

(a)   The probabilities of obtaining a 5 and a 6 are unknown, but they have the same value.
       What is the probability of obtaining a 6?

(3)

(b)   Which is the number from 1 to 6 most likely to be obtained?

(1)

(c)   Mark with an arrow on the scale shown below the probability of:
       (i)   the spinner landing on 1. Label this position as A.   (1)
       (ii)   the spinner landing on 4. Label this position as B.   (1)
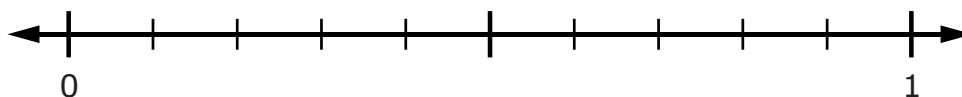
(Total: 6 marks)

11   A sequence of patterns is made up of grey squares and white squares.

The diagram below shows the first three patterns, drawn on squared paper.

1ˢᵗ pattern   2ⁿᵈ pattern   3ʳᵈ pattern   4ᵗʰ pattern
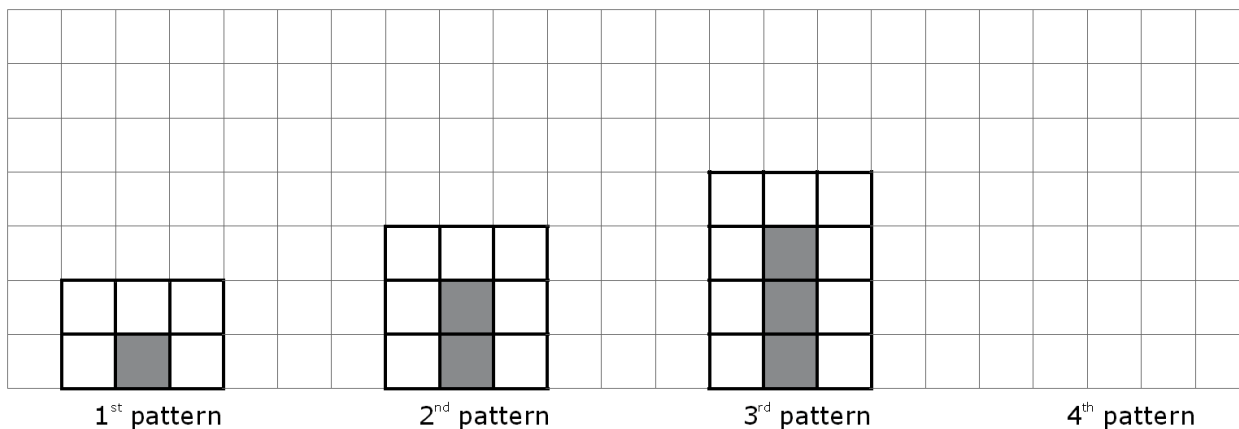
(a)   On the diagram above, draw the 4ᵗʰ pattern of this sequence.

(1)

(b)   What is the number of grey squares in the 100ᵗʰ pattern?

(1)

(c)   Calculate the **total** number of squares in the 100ᵗʰ pattern.

(2)

(d)   Find an expression, in terms of n, which represents the total number of squares in the nᵗʰ pattern.

(2)

(e)   Is there a pattern in this sequence with a total of 261 squares? Show your working.

(2)

(Total: 8 marks)

12   Each team in a 4 × 400 m race consists of four runners. The race is divided into four laps, each 400 m long. The members of a team take turns to run along each lap. When the first runner arrives at the end of the first lap, the second runner comes in and runs along the second lap. The race finishes when the fourth runner completes the fourth lap.

The tables show the results of two competing teams.

TEAM A	
Runner	**Time taken**
Anna	1 min 55 sec
Clara	1 min 31 sec
Sandra	2 min 3 sec
Brenda	1 min 35 sec
Total time	

TEAM B	
Runner	**Time taken**
Vera	1 min 22 sec
Petra	1 min 57 sec
Katya	
Hannah	1 min 40 sec
Total time	6 min 5 sec

(a)   Complete the table for Team A by finding the total time for Team A to complete the race.

(2)

(b)   Complete the table for Team B by finding the time taken by Katya to complete her lap.

(3)

(Total: 5 marks)

13   An ordinary die and a special die were thrown at the same time.

The six faces of the special die show 1, 3, 4, 5, 5 and a blank.

(a)   Complete the table below to show **all** the possible outcomes.

Special Die

	1	3	4	5	5	Blank B
1	(1,1)	(3,1)	(4,1)	(5,1)	(5,1)	(B,1)
2	(1,2)	(3,2)	(4,2)	(5,2)	(5,2)	(B,2)
3	(1,3)	(3,3)	(4,3)	(5,3)	(5,3)	(B,3)
4	(1,4)	(3,4)	(4,4)	(5,4)	(5,4)	(B,4)
5						
6						

Ordinary Die

(1)

(b)   What is the probability of getting the same score when these two dice are tossed together?

(2)

(c)   What is the probability of getting the same score when two ordinary dice are tossed together?

(1)

(d)   Compare the answers of parts (b) and (c) above. When is it more likely to get the same score?

(1)
(Total: 5 marks)

14   Solve the simultaneous equations below.

$$3x + 10y = 7$$

$$x - 4y = 6$$

(5)
(Total: 5 marks)

15   (a)   Find the value of x when $5^3 \times 5^x = 5^7$.

(1)

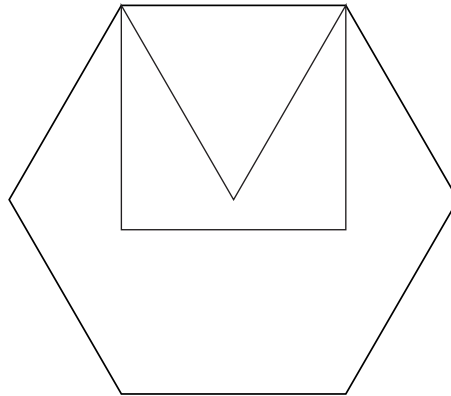(b)   Simplify $\dfrac{a^3 b^5}{ab^3}$

(2)

(c)   Find the value of x when $7^x = (7^2)^3$

(1)
(Total: 4 marks)

16 The outside border in the design below consists of a regular hexagon.
    An equilateral triangle and a square are drawn on one side of the hexagon as shown in the diagram.

    What is the ratio, by Perimeter, of the equilateral triangle to the square to the regular hexagon?

(3)
(Total: 3 marks)

17 Sharon estimates the height of buildings h, in metres, as follows.

    She drops a stone from the top of the building.
    Using a stop watch, she measures the time t, in seconds, for the stone to hit the ground.
    She then uses the formula $h = 5t^2$ to work out the height.

    (a) What is the height of a building when t = 6 seconds?

(1)
    (b) A building is 300 m high. Use this formula to find the time taken by the stone to reach the ground. Give your answer to the nearest second.

(3)
(Total: 4 marks)

18   The diagram shows triangle ABC.

E and F are points on CA and CB respectively such that EF is parallel to AB.
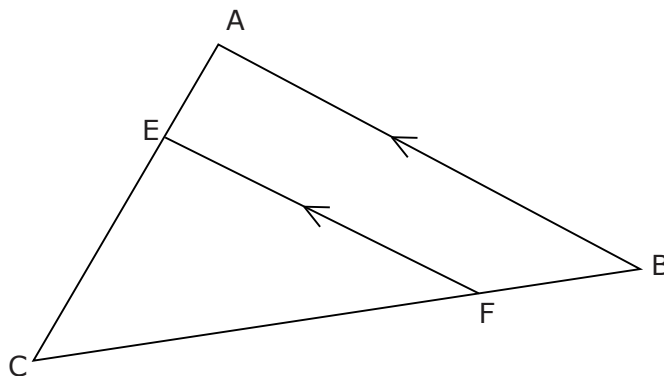

Diagram not drawn to scale
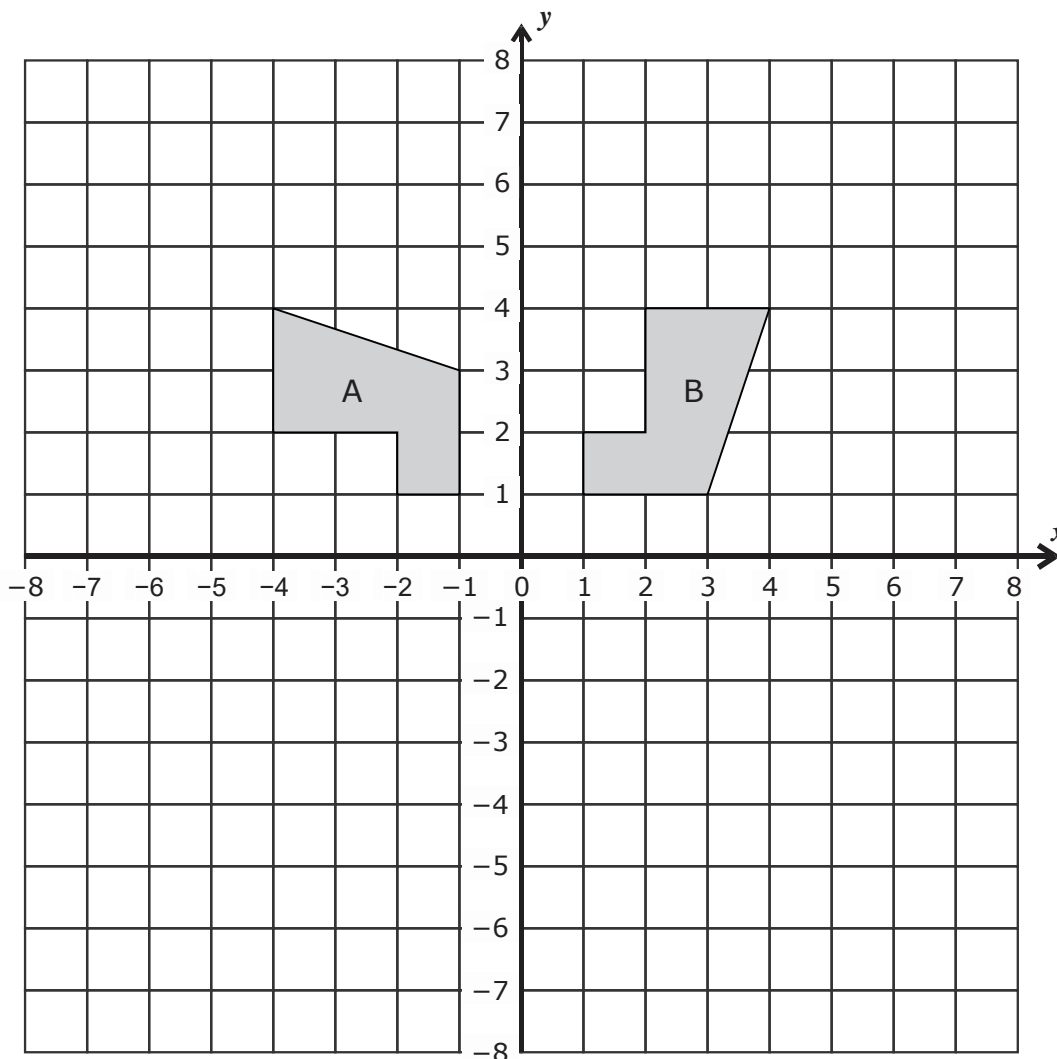
(a)   Prove that triangles CAB and CEF are similar.

(2)

(b)   AE = 2.8 cm, AC = 8.4 cm and AB = 9.6 cm.
Find the length of EF.

(3)
(Total: 5 marks)

19

(a)   Translate shape A by $\begin{pmatrix} 8 \\ -9 \end{pmatrix}$ to obtain shape C.

(1)

(b)   Reflect shape A in the x-axis to obtain shape D.

(1)

(c)   Rotate shape A by 180° about (0, 0) to obtain shape E.

(1)

(d)   Describe the transformation that maps shape A onto shape B.

(2)

(e)   Describe the transformation that maps shape B onto shape E.

(2)

(Total: 7 marks)

20   The diagram is an incomplete sketch, showing the position of three towns P, Q and R.

North

Town Q

North

North

Diagram not drawn to scale
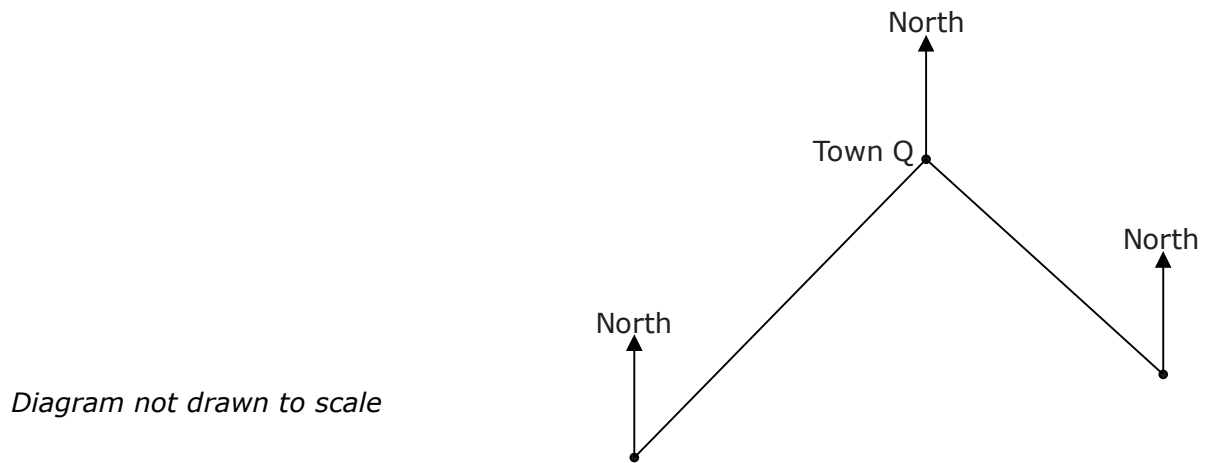
Town Q is on a bearing of 046° from Town P. The distance between Towns P and Q is 135 km.
Town R is on a bearing of 136° from Town Q. The distance between Towns R and Q is 78 km.

(a)   Complete the sketch by filling in **all** the information given in the paragraph above.

(2)

(b)   Show that ∠PQR is equal to 90°.

(2)

(c)   Find the distance between Town P and Town R.
       Round your answer to the nearest km.

(3)
(Total: 7 marks)

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