THE JOHN LYON SCHOOL

2011 Entrance Examination at 13+

MATHEMATICS

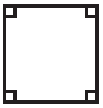
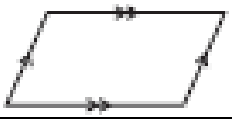
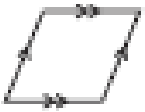
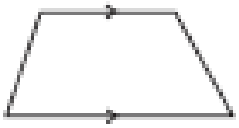
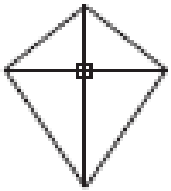
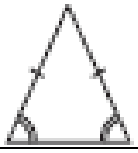
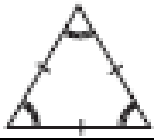
January 2011

Time allowed – 60 minutes

100 Marks

SURNAME:	**FIRST NAME:**
SCHOOL:	**DATE OF BIRTH:**

- **Calculators may NOT be used.**
- **Make sure you have attempted to answer all the questions in Part A before attempting Part B.**
- **Work steadily through the exam doing as much as you can straight away.**
- **Then go back and try the more difficult questions.**
- **Write your answers in the spaces provided in this booklet.**
- **Show your working so it is clear how you obtained your answers.**

Rectangle		All angles are right angles (90º). Opposite sides have the same length.
Square		All angles are right angles. All sides have the same length.
Parallelogram		Opposite sides have the same length.
Rhombus		Diagonals bisect at right angles. All sides have the same length.
Trapezium		One pair of parallel sides.
Kite		Diagonals intersect at right angles.
Isosceles Triangle		Two sides have the same length and the angles opposite these two sides are equal.
Equilateral Triangle		All angles are 60º.

Part A

1 Solve the following equations.

a) $4x = 12$

b) $15 + x = 20$ .....

c) $x + 7 = 22$ .....

d) $2x + 1 = 11$ .....

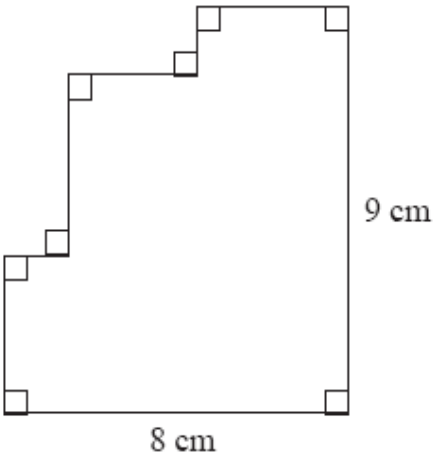
e) $5x - 9 = 26$ .....

f) $\frac{x}{2} + 3 = 4$ .....

g) $x + 6 = 5$ .....

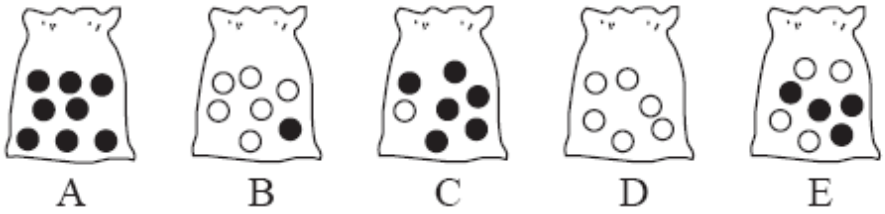
h) $2(5x + 3) = 12x - 3$ .....

(13 Marks)

2	State whether each of the following statements is true or false. You can use the table at the beginning of this paper to help you. a) A square is also a rhombus. …… b) A square is also a kite. …… c) A rectangle is also a kite. …… d) A parallelogram is also a kite. …… e) A rectangle is also a parallelogram. …… (5 Marks)	
3	Calculate the perimeter of the shape below.  ……cm (2 Marks)	
4	Put the correct sign, < or = or >, into each sentence. a) -7 ……. -2 b) 3 – 2 ……. -5 c) 3 – 5 ……. 4 – 6 (3 Marks)	
5	One number is missing from the following sequence: 1, 6, 11, ☐, 21, 26, 31 a) Fill in the missing number. b) Calculate the difference between successive terms. …… c) Determine the formula that generates the sequence. …… (4 Marks)	

6 Bryn has some bags with some black beads and some white beads. He is going to take a bead from each bag without looking.

Match the pictures to the statements. The first is done for you.



a) It is impossible that Bryn will take a black bead from bag D.

b) It is unlikely that Bryn will take a black bead from bag …….. .

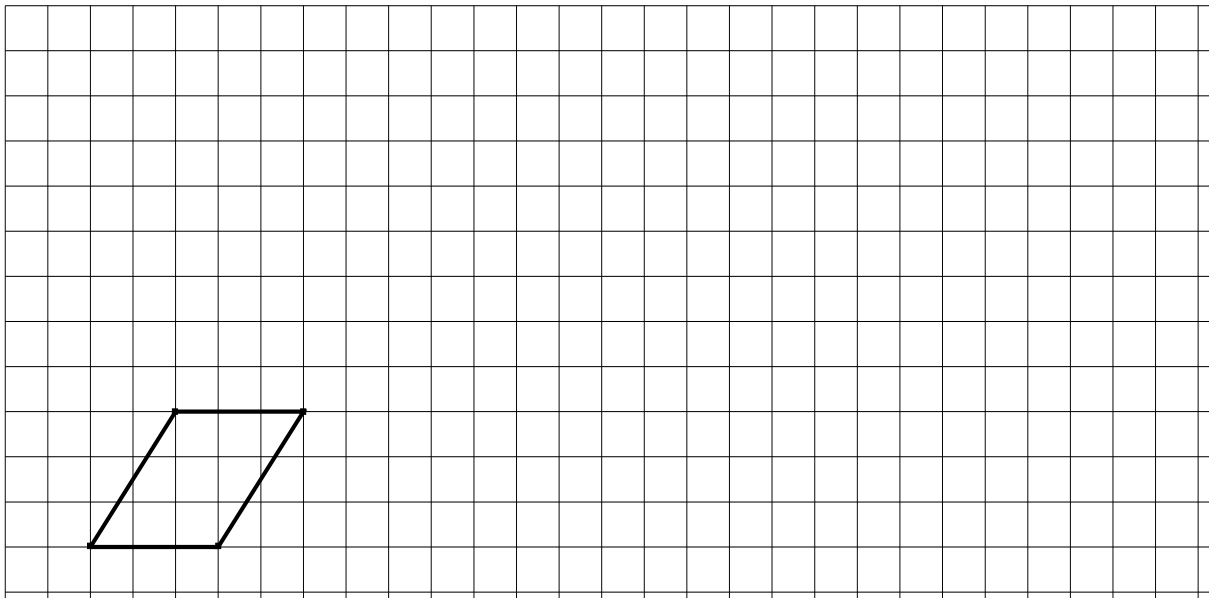
c) It is equally likely that Bryn will take a black bead or a white bead from bag …….. .

d) It is likely that Bryn will take a black bead from bag …….. .

e) It is certain that Bryn will take a black bead from bag ……. .

(4 Marks)

7 Enlarge the shape with a scale factor of 2.



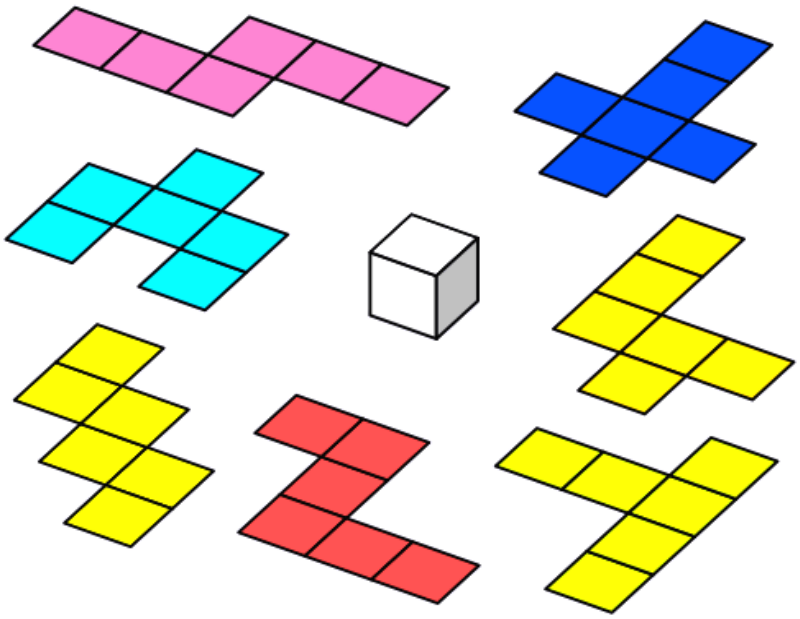
(3 Marks)

8 Write the following fractions in order of size, with the smallest first:

$$\frac{1}{5} \quad \frac{1}{4} \quad \frac{2}{9} \quad \frac{1}{2} \quad \frac{5}{9}$$

(2 Marks)

9 a) Circle each of the patterns that are the net of a cube.

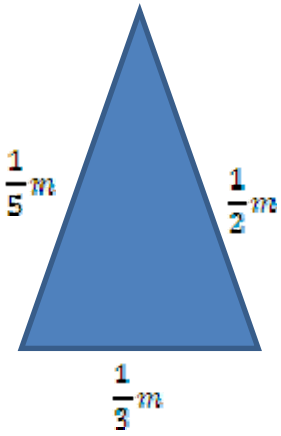


On the isometric dots below, draw a cuboid with sides of lengths 4 cm, 3 cm and 2 cm.

(4 Marks)

10

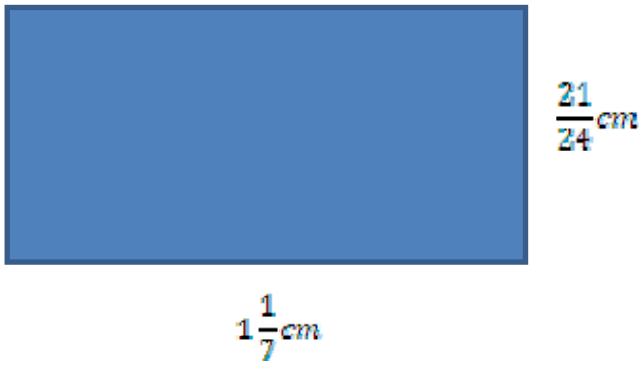
a) What is the perimeter of the triangle?
Leave your answer as a fraction in its simplest form.



#

……m

b) What is the area of the rectangle?



……cm^2

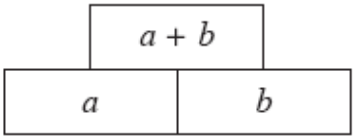
c) The area of the following rectangle is $1\frac{1}{2}m^2$.
What is the length of the rectangle?

……m

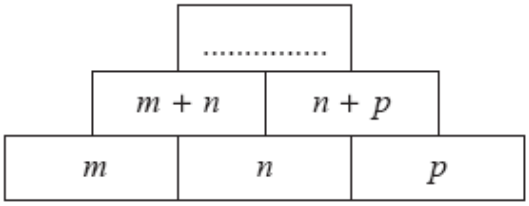
(8 Marks)

11

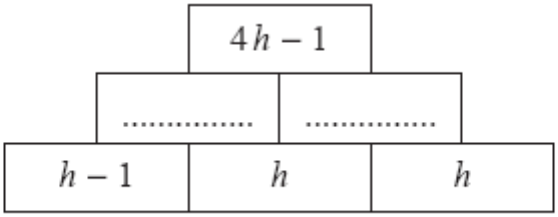
In these walls each brick is made by adding the two bricks underneath it.

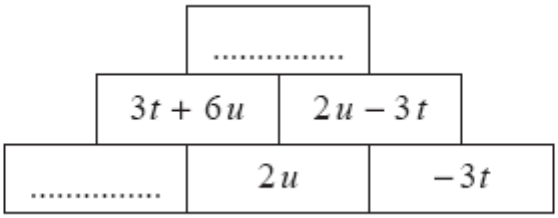


a) Write an expression for the top brick in this wall.
Write your expression as simply as possible.



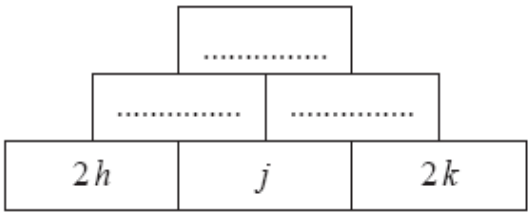
b) Fill in the missing expressions as simply as possible.





c) In the wall below, h, j and k can be any whole numbers.

Explain why the top brick of the wall must always be an even number.



……

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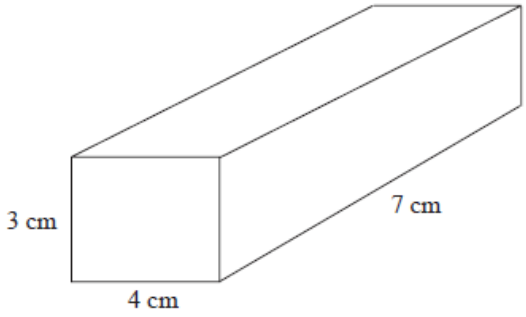
……

(8 Marks)

12

a) What is the volume of this cuboid?
You must show each step in your working.

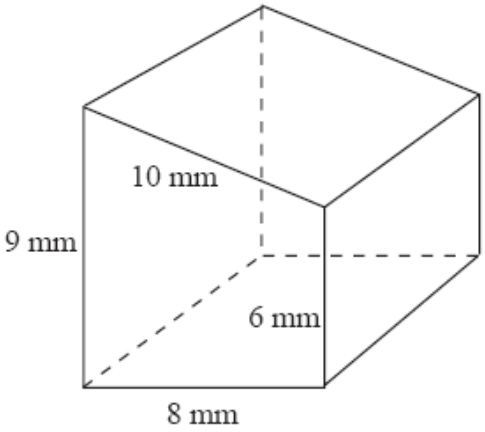


……cm^3

The formula for the volume of a prism is

Volume = (Area of cross-section) x Length

The volume of the prism shown is 720 mm^3.



b) Find the area of the cross-section of the prism.

……cm^2

c) Determine the length of the prism.

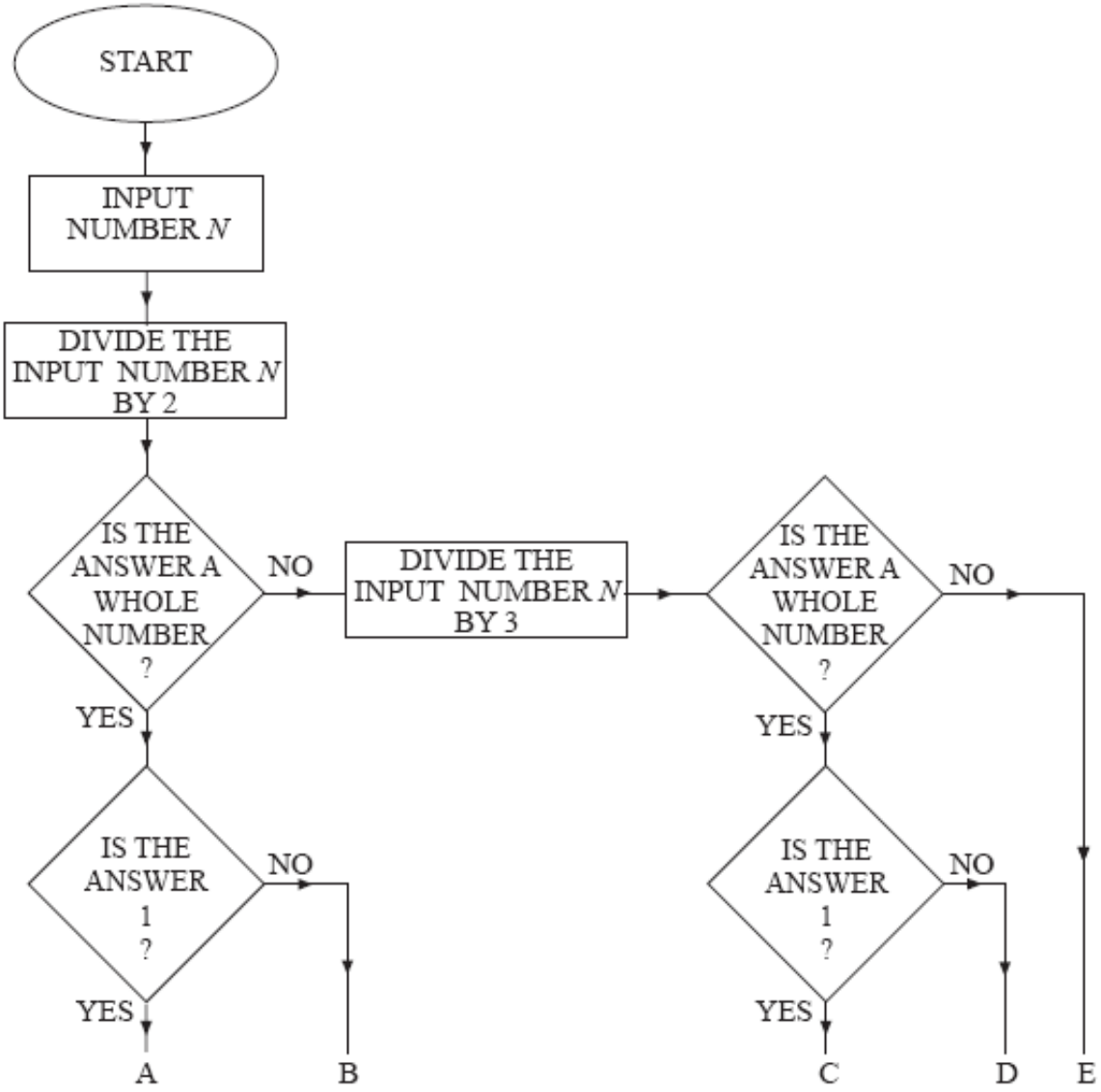
……mm

d) Calculate the surface area of the prism

……mm^2

(11 Marks)

13 This Flow Chart will sort out numbers. The numbers one to ten are put in. Where does each come out?



Numbers at A …….

Numbers at B …….

Numbers at C …….

Numbers at D …….

Numbers at E …….

(5 Marks)

14 Alan knows that x =2, y = -6 and z = -4. He calculates that Q = ¼.
Calculate each formula to decide which he used.

Formula A $Q = \frac{xy + yz}{xyz}$

Formula B $Q = \frac{yz - xy}{xyz}$

Formula C $Q = \frac{1}{x} - \frac{1}{z}$

Formula D $Q = \frac{1}{z} + \frac{1}{x}$

Formula E $Q = \frac{1}{x} + \frac{1}{y}$

……

(6 Marks)

15 Jeff makes a sequence of patterns with black and grey triangular tiles.

The rule for finding the number of tiles in pattern number N in Jeff's sequence is:

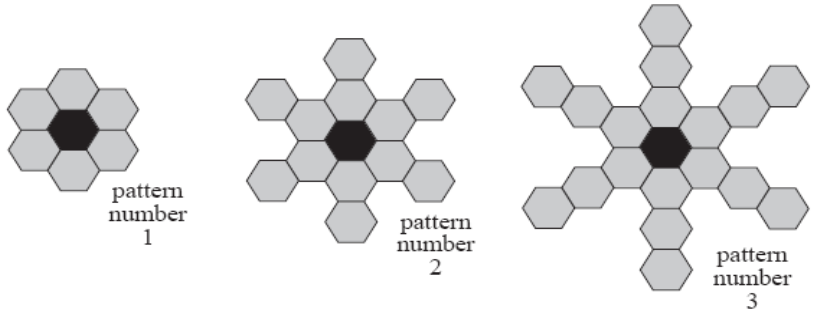
$$\text{number of tiles} = 1 + 3N$$

a) The 1 in this rule represents the ***black tile***.
What does the 3N represent? ……

b) Jeff makes ***pattern number*** 12 in his sequence.
How many ***black tiles*** and how many ***grey*** tiles does he use? ……

c) Jeff uses 61 tiles altogether to make a pattern in his sequence.
What is the number of the pattern he makes? ……

d) Barbara makes a sequence of patterns with ***hexagonal*** tiles.



Each pattern in Barbara's sequence has 1 black tile in the middle.

Each new pattern has 6 more grey tiles than the pattern before.

Complete the rule for finding the number of tiles in pattern N in Barbara's sequence.

$$\text{number of tiles} = \ldots\ldots\ldots + \ldots\ldots\ldots\ldots\ldots$$

e) Gwenno uses some tiles to make a different sequence of patterns.

The rule for finding the number of tiles in pattern number N in Gwenno's sequence is:

$$\text{number of tiles} = 1 + 4N$$

Draw what you think the first 3 patterns in Gwenno's sequence could be.

(7 Marks)

16 Wolfgang Amadeus Mozart was born in Salzburg, Austria, on 27 January 1756 and died in Vienna on 5 December 1791. He is one of the best known composers in the history of western music.

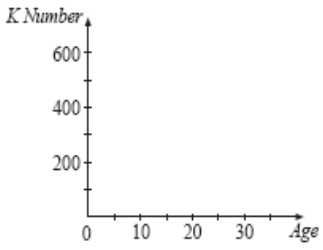
He was a child prodigy and composed a large number of works, using every type of musical composition, and travelling to many countries to perform.

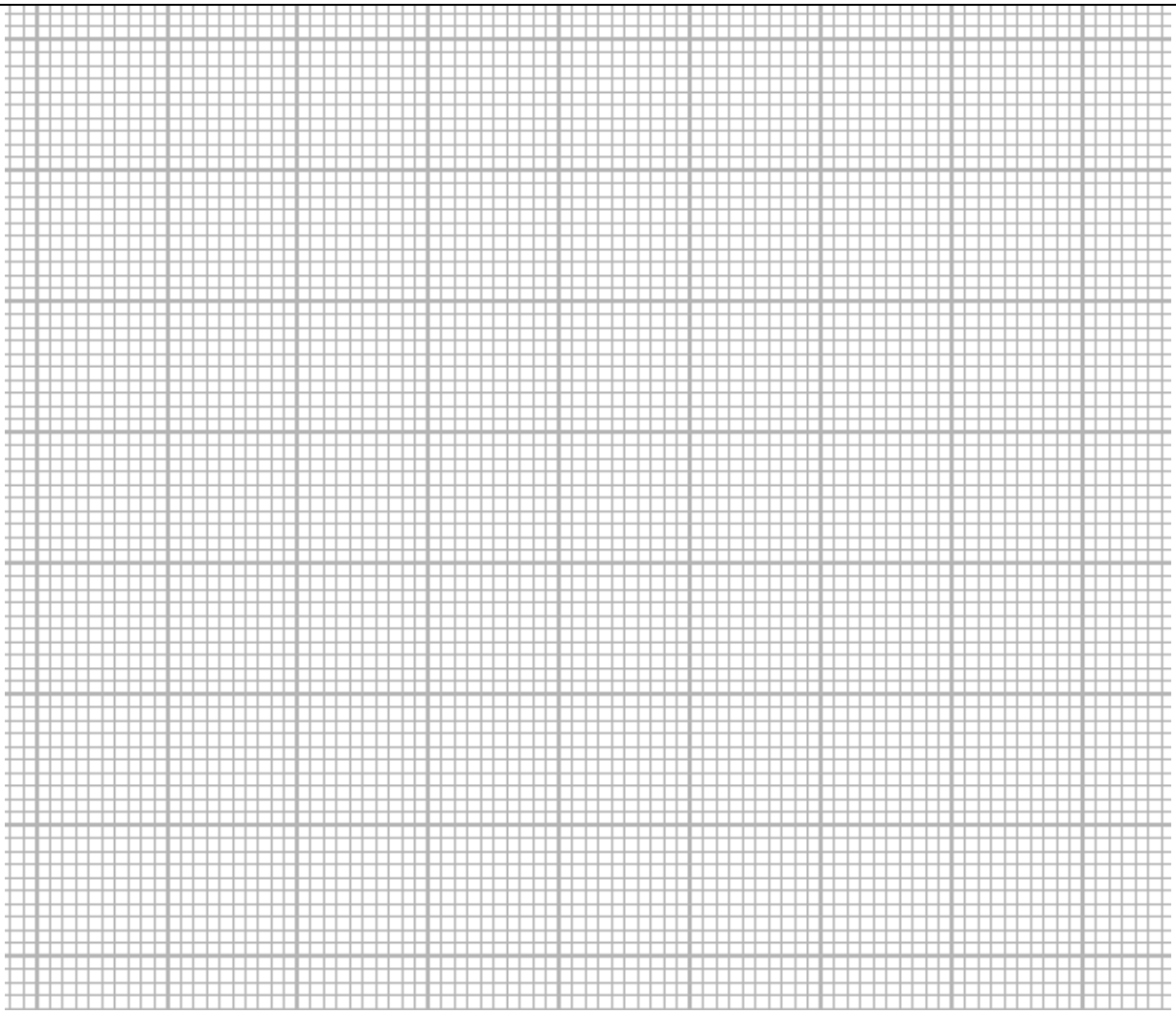
His works were numbered chronologically by a biologist, Ludwig Ritter von Kochel, whose catalogue was published in 1862. The following table lists some of Mozart's compositions, each denoted by a 'K' (Kochel) number.

K number	*Date Completed*	*Age* (Years)	*Title*
1	*January 1762*	*6*	*Minuet*
33	*June 1766*	*10*	*Kyrie*
65	*January 1769*		*Dance Music*
123	*April 1770*		*Contredanse*
176	*December 1773*		*Dance Music*
192	*June 1774*		*Missa Brevis (Mass)*
238	*January 1776*		*Piano Concerto No. 6*
271	*January 1777*		*Piano Concerto No. 9*
317	*March 1779*		*Missa (Mass)*
385	*July 1782*		*Symphony No. 35 (Haffner)*
425	*November 1783*		*Symphony No. 36 (Linz)*
470	*April 1785*		*Andante for Strings*
525	*August 1787*		*Serenade (Eine Kleine Nachtmusik)*
551	*August 1788*		*Symphony No. 41 (Jupiter)*
588	*January 1790*		*Opera (Cosi fan tutte)*
620	*September 1791*		*Opera (Die Zauberflote - The Magic Flute)*
626	*December 1791*		*Requiem*

a) Complete the 'Age' Column.

b) Plot the data of age (x-axis) against K number (y-axis), and by eye, draw a line of best fit.





c) Use the graph to estimate Mozart's age when he completed the piano concertos:

1) K453 ……..

2) K491 ……..

d) Estimate how many compositions he had completed by the time he was 30 years old.

……

e) Estimate the K number for his quartet which was finished on Christmas Day, 1777.

…….

f) Find the equation of your line in the form y = mx + c. Use the equation to answer questions d) and e) again. Does it give accurate answers?

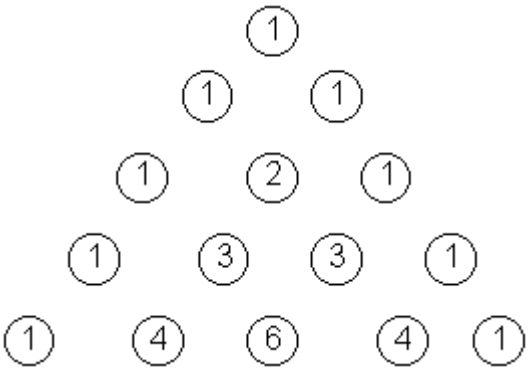
…….
…….
…….
…….
…….

(15 Marks)

Part B

Pascal's Triangle

This picture shows the first five lines of Pascal's triangle.



- Can you work out how it is made?

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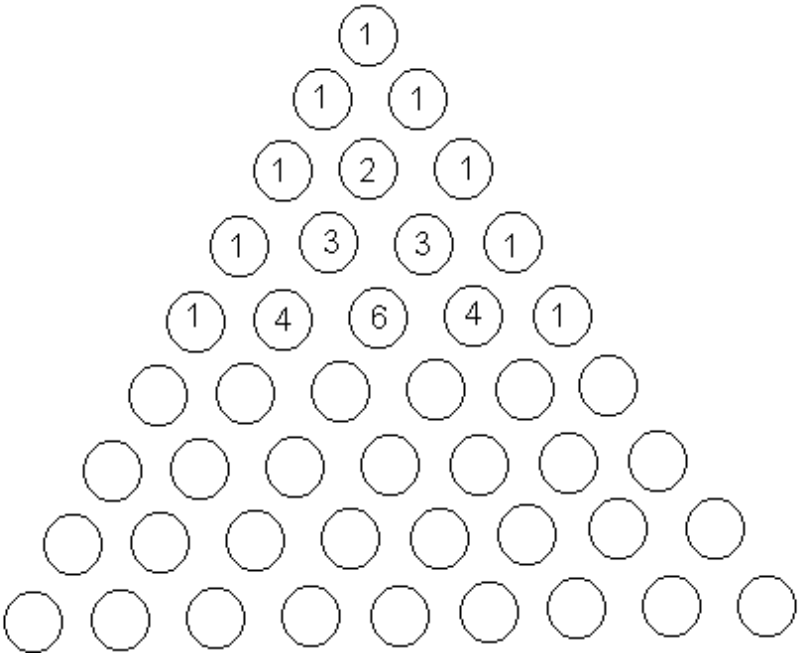
- Complete the next four lines.



- Shade in the odd numbers. How are they arranged in the triangle?

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- Predict how the next line would be shaded without calculating the numbers.

- Investigate the totals of the numbers in each horizontal row. Is there a pattern? Can you predict the next total?

……

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