Number & Algebra: Strands 3 & 4

#1
A Relations Approach to Algebra: Linear Functions
#2
A Relations Approach to Algebra: Quadratic, Cubic & Exponential Functions
#3
Applications of Sequences & Series
#4
Applications of Sequences & Series

Project Maths
Tionscadal Mata
Development Team

1

Name: ______________________________

School: ______________________________

1.1 THE GYM

(a) Given that membership to a gym costs €50 and the cost per visit is €10, complete the total cost c in € column in following table, showing how a receptionist in this gym would calculate the cost to a client using the gym:

Number of visits to the gym	Total cost c in €	Change
0		
1		
2		
3		
4		
5		
6		

(b) Represent the data in the above table on a graph.

(c) Which is the independent variable and which is the dependent variable? Why?

(d) Describe the pattern in your own words.

(e) Write down a formula to represent the total cost of the gym in relationship to the number of visits. State clearly the meaning of any letters used in the formula.

(f) Complete the change column in the table in part **(b)** of this question.

(g) What is the rate of change between any points on your graph?

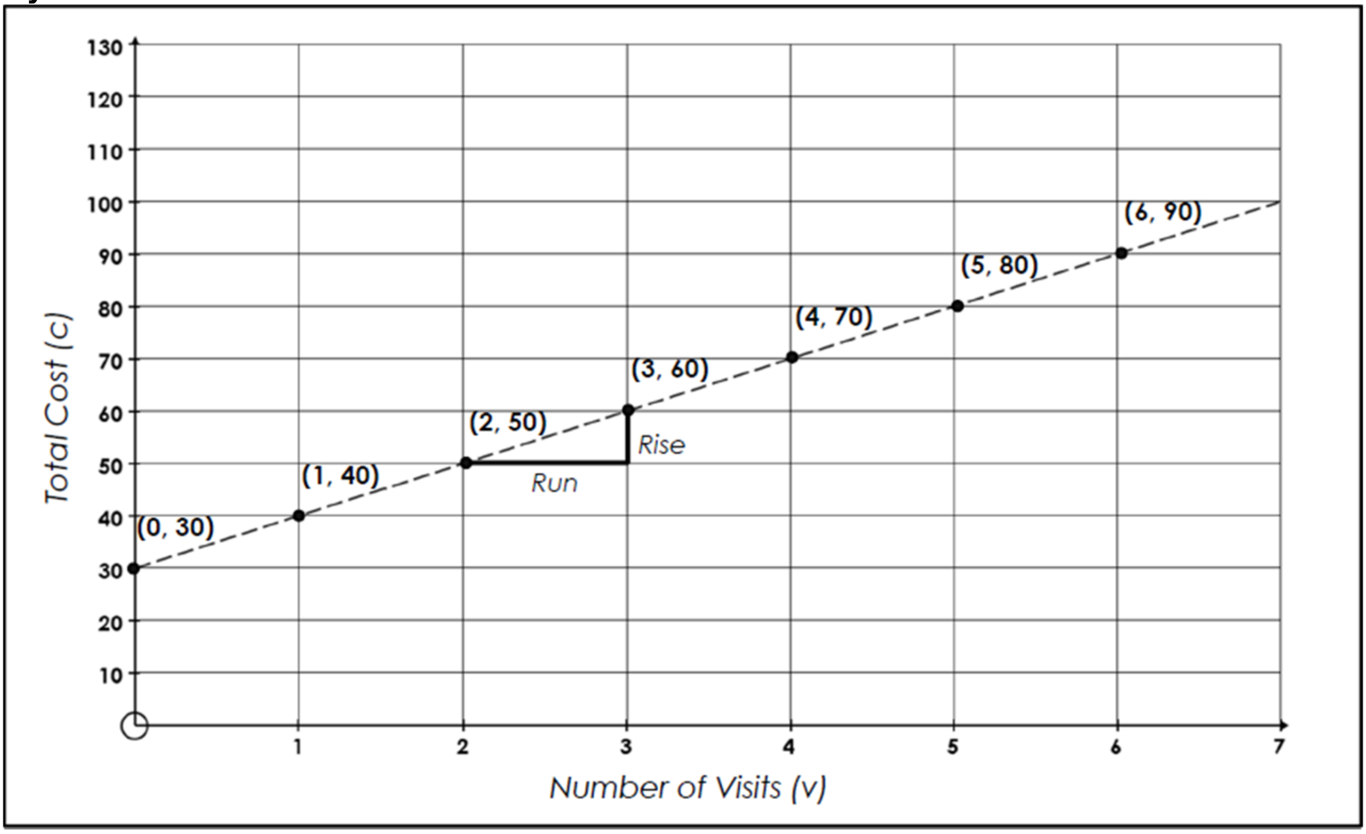
(h) What is another name for rate of change?

(i) Is there a pattern modelled in the table and graph of this question and if so what type? Justify your answer.

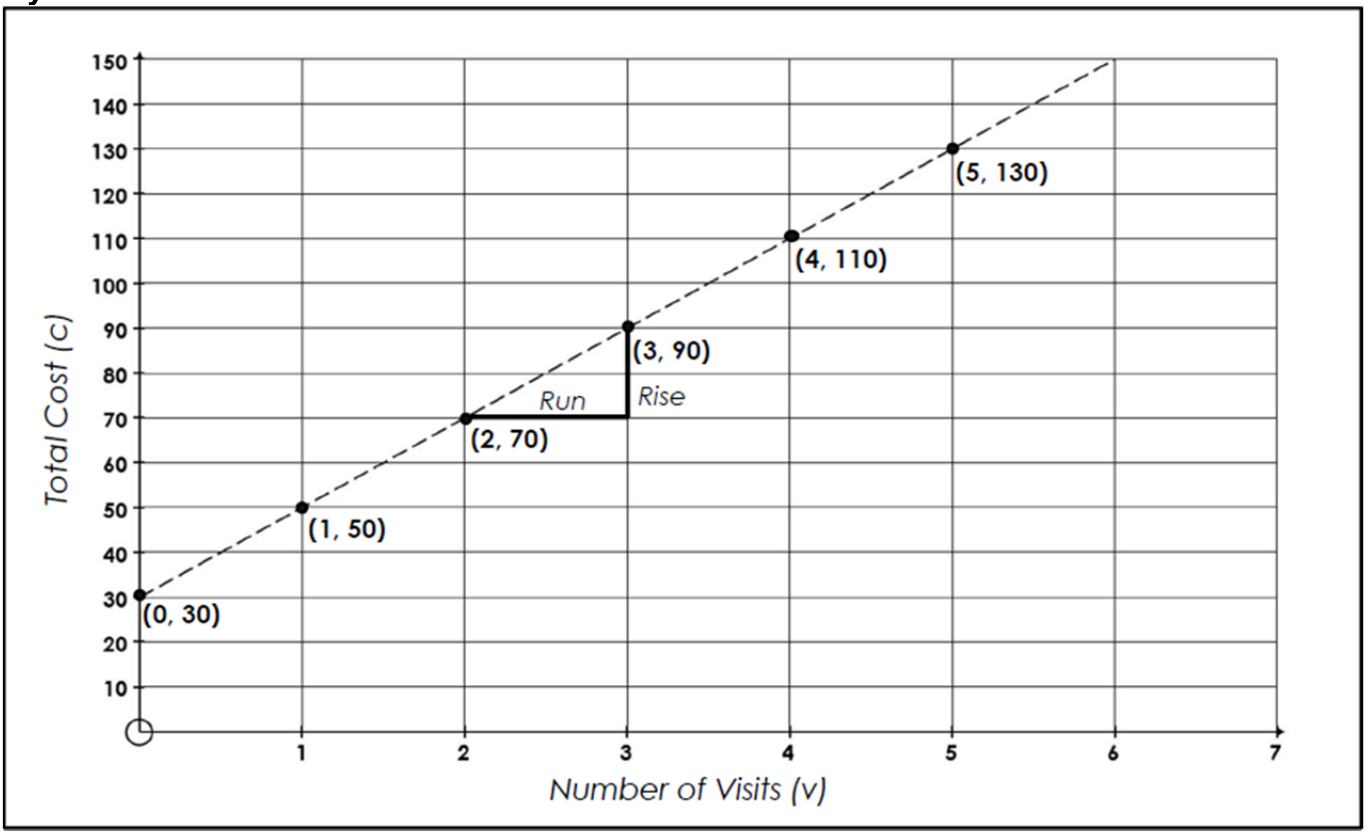
1.2 TWO MORE GYMS

The following two diagrams models the costs of two other gyms called Gym B and Gym C. Describe in your own words the total cost of each of these gyms and write down a formula to represent the total cost of each gym in relationship to the number of visits.

Gym B



Gym C



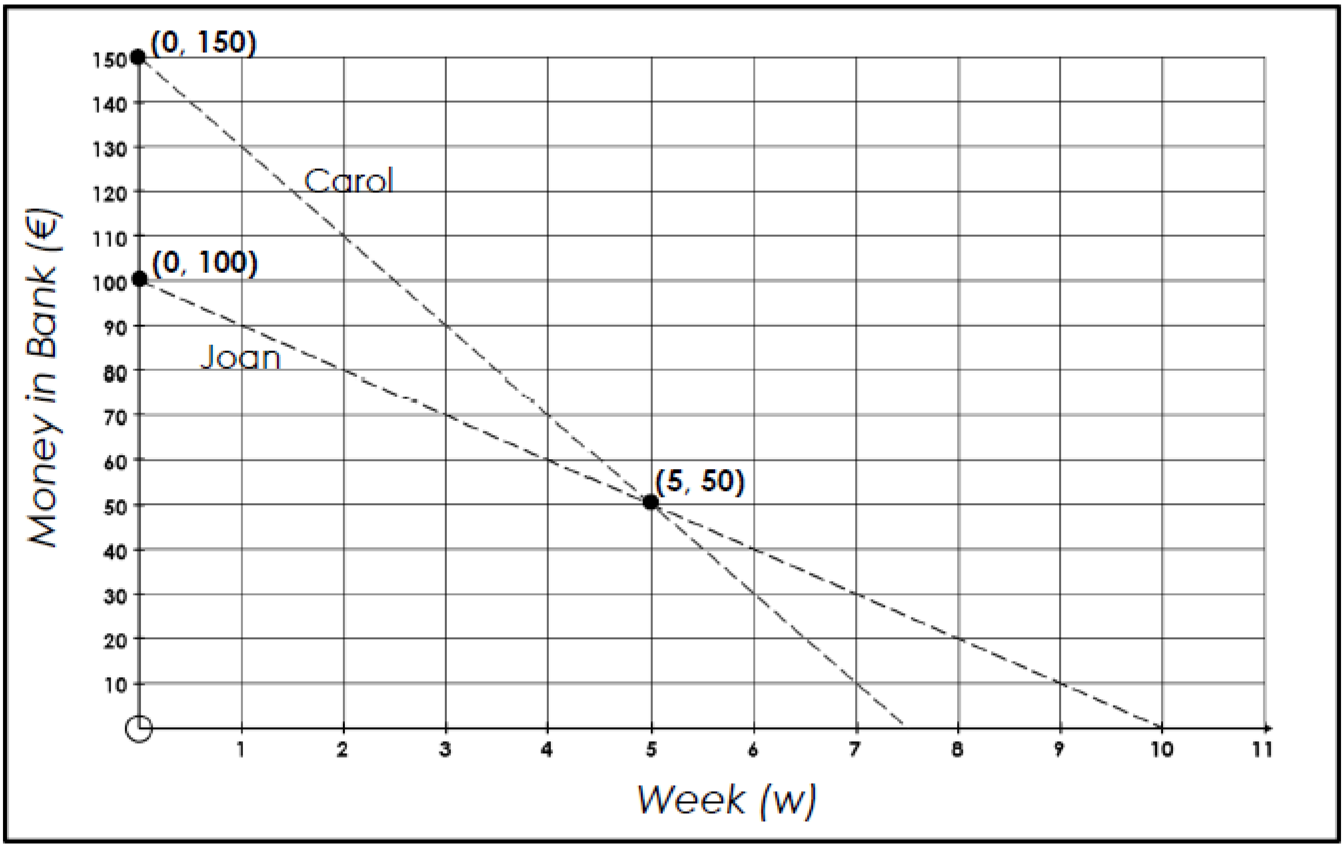
1.3 BOX OF SWEETS

Joan got a present of a box of 100 sweets. She decides to eat 5 sweets per day from the box. Represent this information in a table, a graph and a formula. After how many days will she have exactly 40 sweets left?

Day Number	Sweets in Box	Change
0		
1		
2		
3		
4		
5		
6		

1.4 SPENDING HABITS

(a) Given Carol's and Joan's spending habits are modelled by the pattern in the diagram below describe each of their spending habits?



(b) At the beginning of which week will Joan have no money and at the beginning of which week will Carol have no money?

1.5 PATTERNS

Complete the next term of the following pattern and complete a table, graph and formula for the pattern.

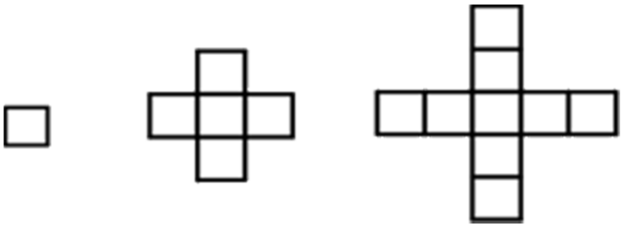


Diagram No	No of squares	Pattern
1	1	
2	5	
3		
4		
5		
6		

1.6 DVD CLUB

Joan joins a DVD club. It costs €12.00 to join the club and any DVD she rents will cost an extra €2. Jonathan joins a different DVD club where there is no initial charge, but it costs €4 to rent a DVD. Represent these 2 situations in a table.

Number of DVDs (x)	Cost to Joan (y)	Cost to Jonathan (y)	Term
0			1

(a) **(i)** List the sequence that represents the cost of the DVDs to Joan.
(ii) Is this sequence an arithmetic sequence and why?
(iii) In terms *of a* the first term, *d* the common difference and *n* the number of the terms, derive a formula for T_n for this sequence.

(b) **(i)** List the sequence that represents the cost of the DVDs to Jonathan.
(ii) Is this sequence an arithmetic sequence and why?
(iii) In terms *of a* the first term, *d* the common difference and *n* the number of the terms, derive a formula for T_n for this sequence.

1.7 ARITHMETIC SEQUENCE

An arithmetic sequence is such that $T_n = 4n+3$. Is it possible to find three consecutive terms of this sequence such that their sum is equal to 117 and if so find these terms.

1.8 WORK

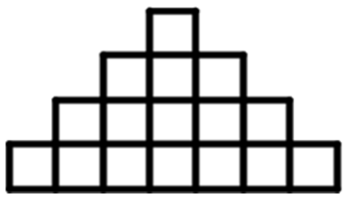
Emma earns €300 during her first week in the job and each week after that she earns an extra €20 per week. How much does she earn during her tenth week in this job? How much does she earn in total during the first ten weeks in this job?

1.9 SUMMING THE NATURAL NUMBERS

(i) Find the sum of the first 100 Natural numbers.
(ii) Find the sum of all integers, from 5 to 1550 inclusive that are divisible by 5.

1.10 DESIGNER TILES

Caroline bought 400 designer tiles at an end of line sale. She wants to use them as a feature in her new bathroom. If she decides on a pattern of the format shown, how many tiles will be on the bottom row of the design if she uses all the tiles?

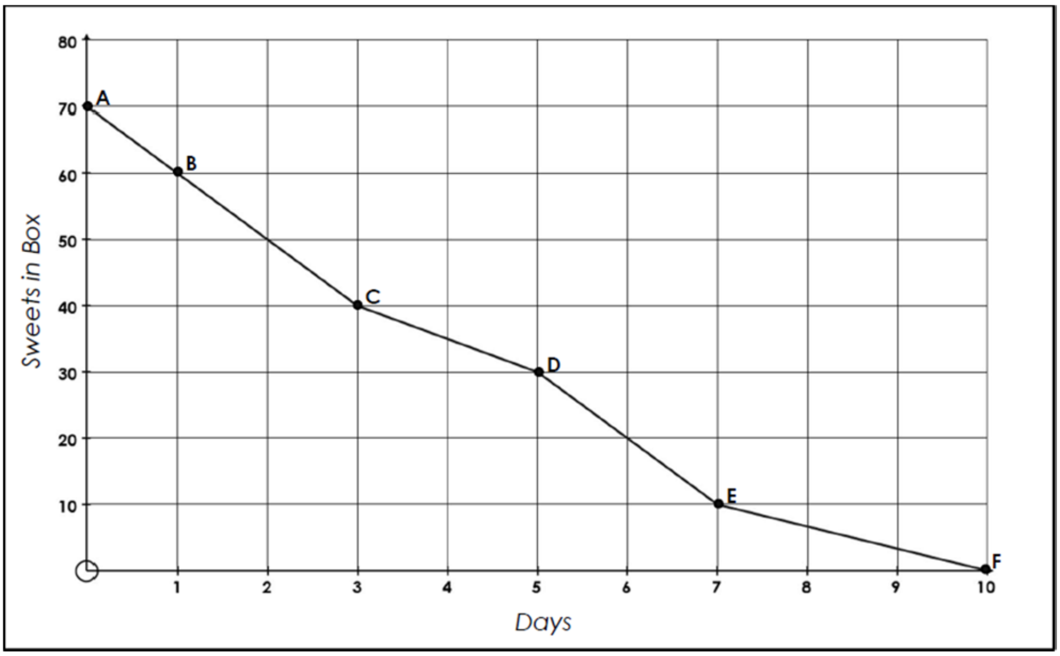


1.11 BUYING A CAR

Denise has no savings and wants to purchase a car costing €6000. She starts saving in January 2012 and saves €200 that month. Every month after January 2012 she saves €5 more than she saved the previous month. When will Denise be able to purchase the car of her choice? Ignore any interest she may receive on her savings.

1.12 ANALYSING A GRAPH

Does the following graph model a sequence of numbers that form an arithmetic sequence? Explain your reasoning.



1.13 TEACHERS' SWEETS

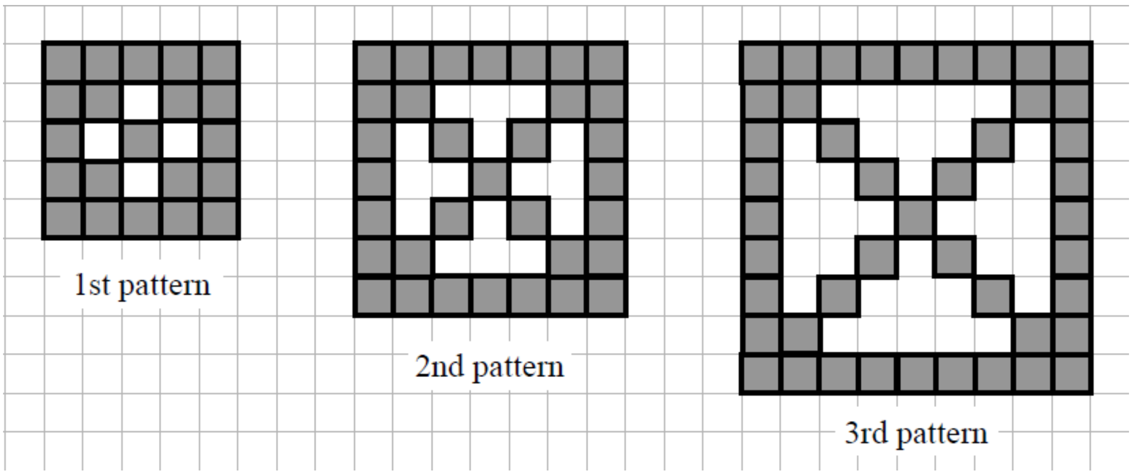
A teacher is distributing sweets to 120 students. She gives each child a unique number starting at 1 and going to 120. She then distributed the sweets as follows, if the student has an odd on their ticket she gives them twice the number of sweets as their ticket number and if the number on their ticket is even she gives then three times the number of sweets as their ticket number. How many sweets does she distribute?

1.14 SAVINGS

Joe had been saving regularly for some months when he discovered he had lost his savings records. He found two records that showed he saved €260 on the fifth month and had a total of €3300 on the eleventh month. He knows he increased the amount he saved each month by a constant amount and had some savings before he commence this savings plan. How much did he increase his savings by each month and how much had he in his account when he started this savings plan?

1.15 SAMPLE PAPER PHASE 2 LEAVING CERTIFICATE ORDINARY LEVEL PAPER 1 QUESTION 5

Síle is investigating the number of square grey tiles needed to make patterns in a sequence. The first three patterns are shown below, and the sequence continues in the same way. In each pattern, the tiles form a square and its two diagonals. There are no tiles in the white areas in the patterns – there are only the grey tiles.



(a) In the table below, write the number of tiles needed for each of the first five patterns.

Pattern	1	2	3	4	5
No. of tiles	21	33			

(b) Find, in terms of *n*, a formula that gives the number of tiles needed to make the *n*th pattern.

(c) Using your formula, or otherwise, find the number of tiles in the tenth pattern.

(d) Síle has 399 tiles. What is the biggest pattern in the sequence that she can make?

(e) Find, in terms of *n*, a formula for the total number of tiles in the first *n* patterns.

(f) Síle starts at the beginning of the sequence and makes as many of the patterns as she can. She does not break up the earlier patterns to make the new ones. For example, after making the first two patterns, she has used up 54 tiles, (21 + 33). How many patterns can she make in total with her 399 tiles?

1.16 SAMPLE PAPER PHASE 2 LEAVING CERTIFICATE ORDINARY LEVEL PAPER 1 QUESTION 5

John is given two sunflower plants. One plant is 16 cm high and the other is 24 cm high. John measures the height of each plant at the same time every day for a week. He notes that 16 cm plant grows 4 cm each day, and the 24 cm plant grows 3·5 cm each day.

(a) Draw up a table showing the heights of the two pants each day for the week, starting on the day that John got them.

(b) Write down two formulas – one for each plant – to represent the plant's height on any given day. State clearly the meaning of any letters used in your formulas.

(c) John assumes that the plants will continue to grow at the same rates. Draw graphs to represent the heights of the two plants over the first *four weeks*.

(d) **(i)** From your diagram, write down the point of intersection of the two graphs.
(ii) Explain what the point of intersection means, with respect to the two plants. Your answer should refer to the meaning of *both* co-ordinates.

(e) Check your answer to part **(d)(i)** using your formulae from part **(b)**.

(f) The point of intersection can be found either by reading the graph or by using algebra. State one advantage of finding it using algebra.

(g) John's model for the growth of the plants might not be correct. State one limitation of the model that might affect the point of intersection and its interpretation.

EXTRA QUESTIONS

1.17 TICK TOCK

Each hour, a clock chimes the number of times that corresponds to the time of day. For example, at three o'clock, it will chime 3 times. How many times does the clock chime in a day (24 hours)?

1.18 THE THEATRE

A theatre has 15 seats on the first row, 20 seats on the second row, 25 seats on the third row, and so on and has 24 rows of seats. How many seats are in the theatre?

1.19 "T TERMS"

The T-shaped figure are in the table below is called T_{13} as it has 13 as initial value.

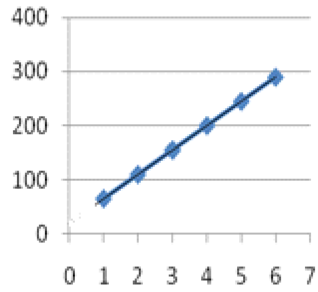
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	48	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

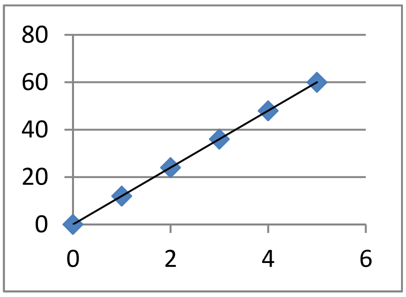
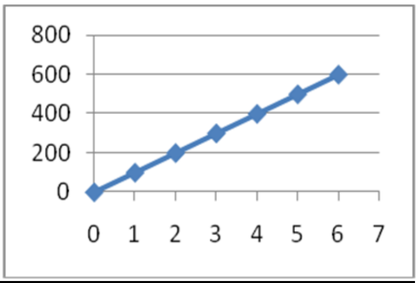
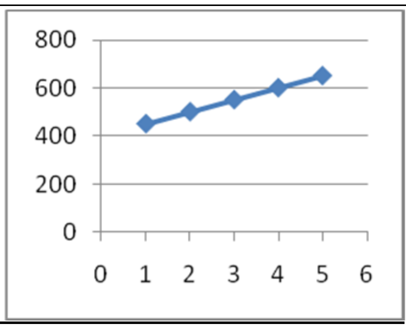
(a) Find the value of T_{26} .

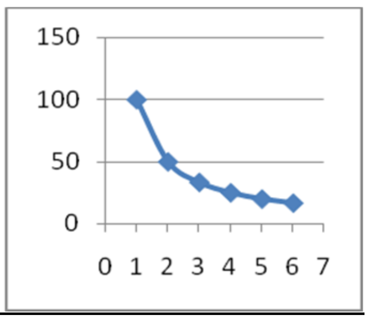
(b) Find the sum of the numbers in the n^{th} T in terms of n.

(c) The set of numbers from which you can choose n.

MATCH UP THE STORIES TO THE TABLES, GRAPH, AND FORMULAE

<table>
<tr><th>Story</th><th>Table</th><th>Graph</th><th>Formula</th><th>Which of the following apply? Linear, non linear, proportional or non proportional? Justify</th></tr>
<tr>
<td>A cookbook recommends 45 minutes per kg to cook a turkey plus an additional 20 minutes.</td>
<td><table><tr><th>kg</th><th>mins</th></tr><tr><td>1</td><td>65</td></tr><tr><td>2</td><td>110</td></tr><tr><td>3</td><td>155</td></tr><tr><td>4</td><td>200</td></tr><tr><td>5</td><td>245</td></tr><tr><td>6</td><td>290</td></tr></table></td>
<td>
</td>
<td>$y = 20 + 45x$</td>
<td>Linear but not proportional

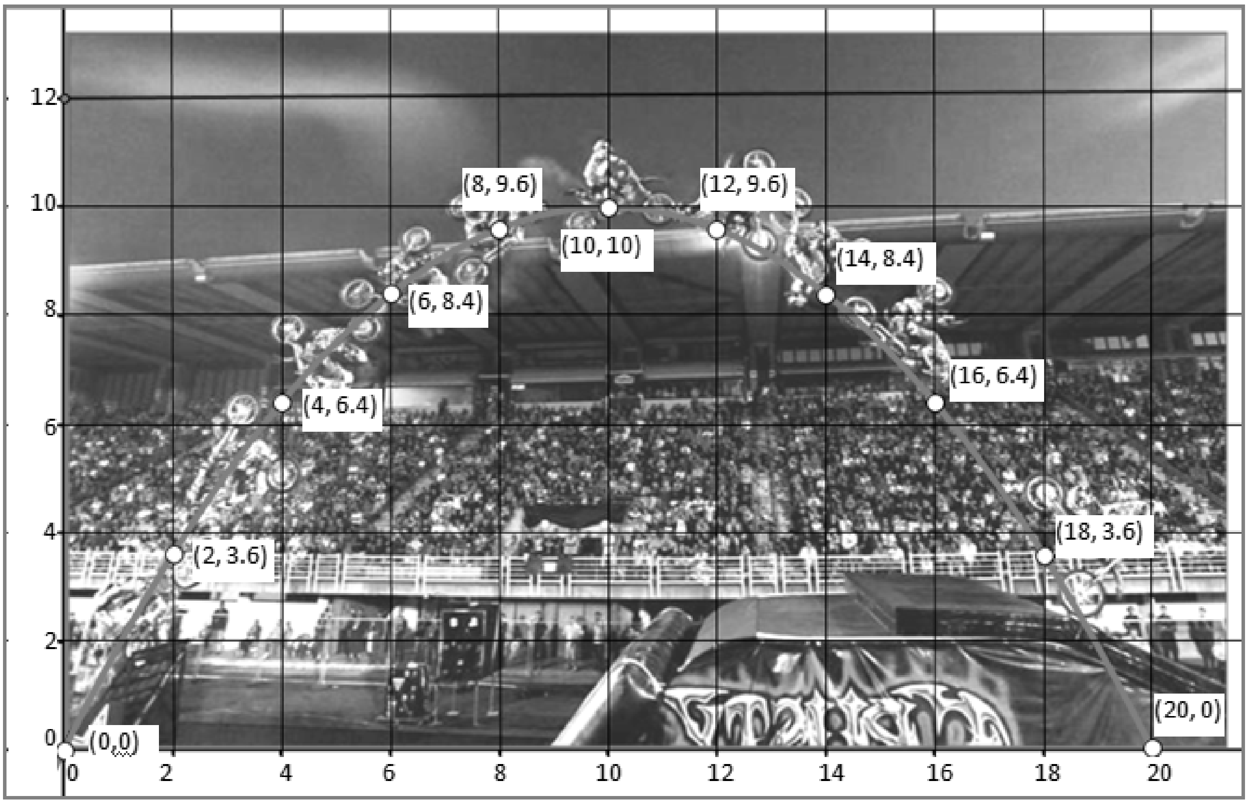
The graph is a line but it does not pass through (0, 0)</td>
</tr>
<tr>
<td>John works for €12 per hour. The graph and table show how much money he earns for the hours he has worked.</td>
<td><table><tr><th>h</th><th>€</th></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>12</td></tr><tr><td>2</td><td>24</td></tr><tr><td>3</td><td>36</td></tr><tr><td>4</td><td>48</td></tr><tr><td>5</td><td>60</td></tr></table></td>
<td>
</td>
<td>$y = 12x$</td>
<td>Relationship is linear and proportional</td>
</tr>
<tr>
<td>Changing euro to cent.</td>
<td><table><tr><th>euro</th><th>cent</th></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>100</td></tr><tr><td>2</td><td>200</td></tr><tr><td>3</td><td>300</td></tr><tr><td>4</td><td>400</td></tr><tr><td>5</td><td>500</td></tr></table></td>
<td>
</td>
<td>$y = 100x$</td>
<td>Relationship is linear and proportional</td>
</tr>
<tr>
<td>Salesman gets paid €400 per week plus an additional €50 for every car sold.</td>
<td><table><tr><th>Cars sold</th><th>€</th></tr><tr><td>0</td><td>400</td></tr><tr><td>1</td><td>450</td></tr><tr><td>2</td><td>500</td></tr><tr><td>3</td><td>550</td></tr><tr><td>4</td><td>600</td></tr><tr><td>5</td><td>650</td></tr></table></td>
<td>
</td>
<td>$y = 400 + 50x$</td>
<td>Relationship is linear but not proportional

The graph is a line but it does not pass through (0, 0).</td>
</tr>
<tr>
<td>Henry has a winning ticket for a lottery for a prize of €100. The amount he receives depends on how many others have winning tickets.</td>
<td><table><tr><th>n</th><th>€</th></tr><tr><td>1</td><td>100</td></tr><tr><td>2</td><td>50</td></tr><tr><td>3</td><td>33.33</td></tr><tr><td>4</td><td>25</td></tr><tr><td>5</td><td>20</td></tr><tr><td>6</td><td>16.67</td></tr></table></td>
<td>
</td>
<td>$y = \frac{100}{x}$

Can you write this formula another way?</td>
<td>Relationship is non linear and hence non proportional.
(In this case it is inversely proportional.)</td>
</tr>
</table>

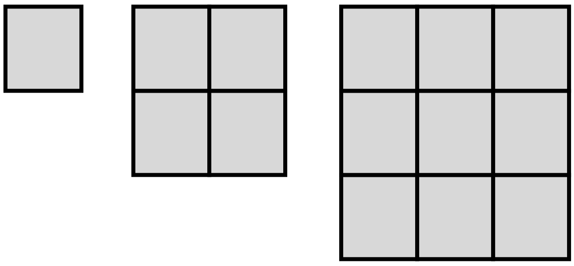
2.1 MOTORBIKE STUNT

Using the information provided in the graph below;
Find out if the graph is quadratic and give a reason for your answer.



2.2 GROWING SQUARES PATTERN

Draw the next two patterns of growing squares.



We wish to investigate how the number of tiles in each pattern is related to the side length of each square. Identify the independent and dependent variables.

Complete the table below:

Side of length of each square	*Number of tiles to compete each square*
1	1
2	4
3	9
4	
5	
6	
7	
8	
9	
10	

(a) How are the number of tiles used to make each square related to the side length of the square? Write the answer in words and symbols.

(b) What difference do you notice about this formula and the formulae for linear relationships?

(c) Looking at the table, do you think is the relationship linear? Explain your answer.

(d) Predict what a graph of this situation will look like. Will it be a straight line? Explain your answer. Plot a graph to check your prediction.

(e) What shape is the graph? Does the rate of change of the number of tiles constant as the side length of each square increases? Explain using both the table and graph.

(f) Why is the graph not a straight line? How can you recognise whether or not a graph will be a straight line using a table?

Let's Investigate:

We will redraw our first table, but we will put in some extra columns:

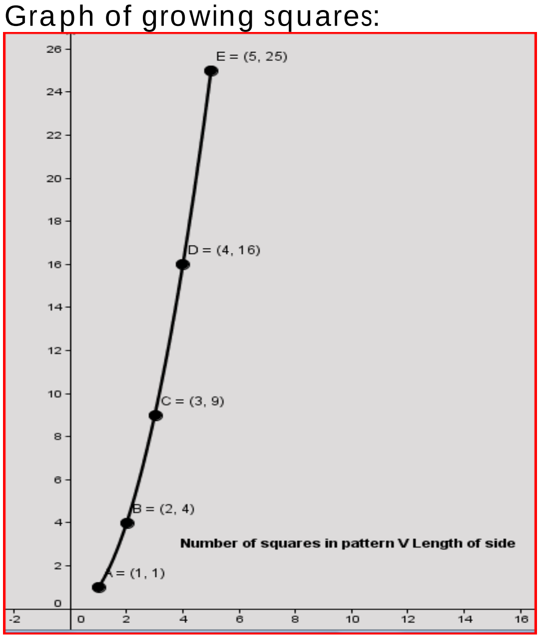
Side of length of each square	***Number of tiles to compete each square***	***Difference in Value (Change)***	***Next Difference in Value (2nd Change)***
1	1		
2	4	3	2
3	9	5	
4			
5			
6			
7			
8			
9			
10			

We saw that the changes in the table were not constant. Is there a pattern to them? Complete the table above and calculate the change of the changes.

Can you see a pattern in the last two columns of the table above? What do you notice about the last column (the 2nd change)

When the change of the changes is constant we call this relationship between variables a quadratic relationship.

Graph of growing squares:



Does your graph look like this?

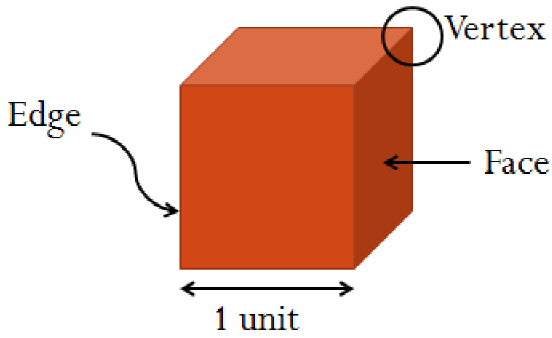
List 3 properties (characteristics) of a quadratic relationship which you have discovered from this exercise.

2.3 GRAPHING & INVESTIGATING

Part 1: PERIMETER

Complete a table for the perimeter of the base for cubes with different edge lengths

Edge Length (cm)	***Perimeter of the base of the cube (cm)***
1	
2	
3	
7	



(a) Predict the shape of the graph.

(b) Explain your prediction.

(c) Write a formula for the perimeter of the base in terms of edge length.

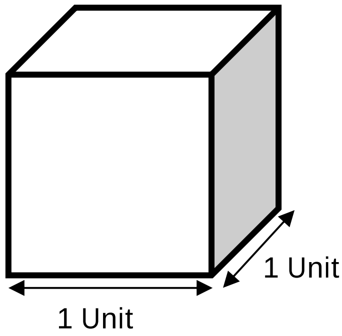
(d) Plot a graph to show the above relationship.

(e) Check if values for perimeter predicted by the formula agree with values predicted by the graph.

Part 2: SURFACE AREA

Complete the table below for total surface area of the cube

Edge Length (cm)	*Surface Area of the cube (cm^2)*
1	1
2	
3	
7	



(a) Predict the shape of graph for the above relationship.

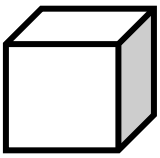
(b) Explain your prediction.

(c) Write a formula for the total surface area in terms of the edge length.

(d) Plot a graph to show the above relationship.

Part 3: VOLUME

Complete the table below to find the volume of the cube.



Volume of the cube: This refers to the total size, or how much space the cube occupies.
Volume = *Length x Width x Height*

Edge Length (cm)	*Volume of the cube (cm^3)*	*1st Change*	*2nd Change*	*3rd Change*
1	1			
2				
3				
7				

(a) Predict the shape of graph for the above relationship.

(b) Explain your prediction.

(c) Write a formula for the volume of the cube in terms of the edge length.

(d) Plot a graph to show the above relationship.

(e) Check if values for volume predicted by the formula agree with values predicted by the graph.

RELATIONSHIP BETWEEN SURFACE AREA AND VOLUME FOR A CUBE

Do you think the volume and surface area of a cube will ever be equal numerically?
Do you think the volume will ever be numerically greater than the surface area?
Check by completing the following table:

Edge	1	2	3	4	5	6	7	8	9	n
Area of Base										
Total surface Area										
Volume										
$\frac{\text{Surface Area}}{\text{Volume}}$										

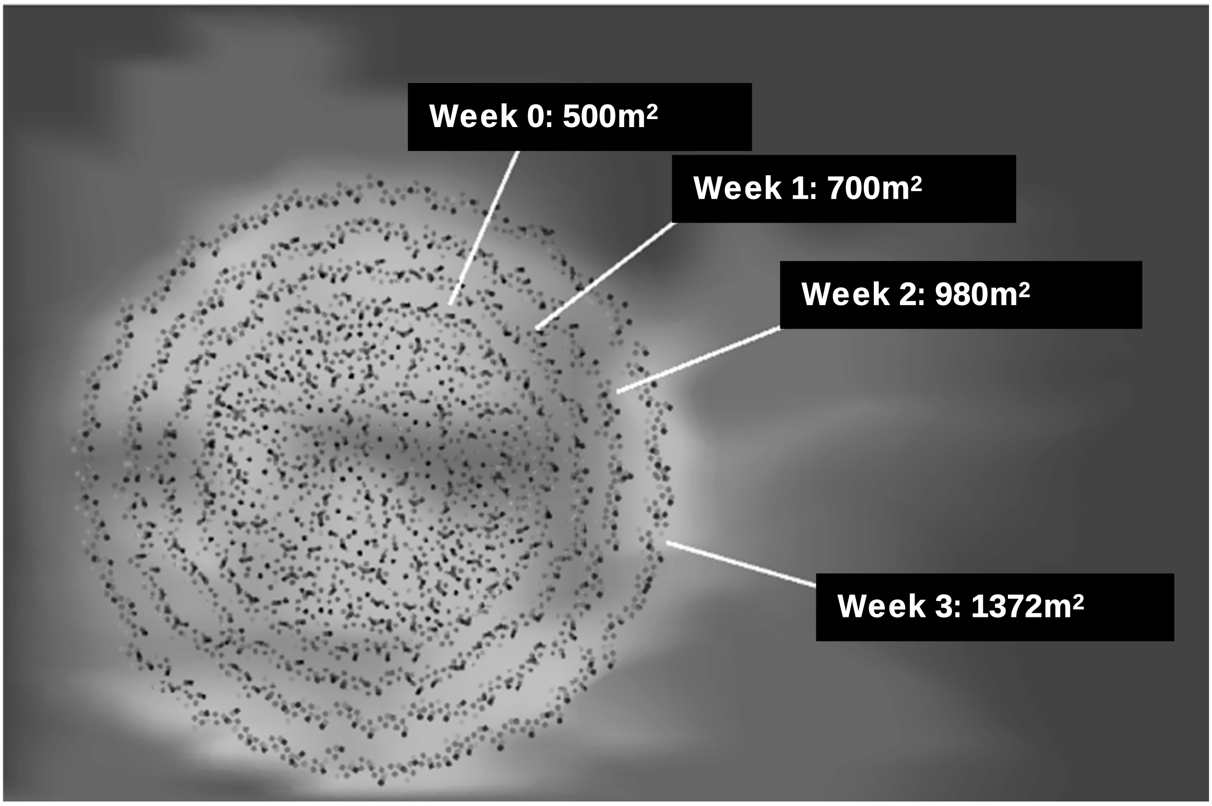
(a) At what point is the ratio of surface area to volume equal to 1?

(b) When is volume less than surface area?

(c) When is volume greater than surface area?

(d) How can you explain the rapid growth of volume and the slower growth of surface area?

2.4 ALGAE BLOOM



(a) Is the pattern linear or quadratic? Explain your reasoning.

(b) At what rate is the surface area covered by the Algae Bloom increasing?

(c) Use a graph to extend the pattern to 8 weeks. Then make a scatter plot of the data and describe the graph.

(d) The surface area of the lake is about 100,000 square metres. How many weeks does it take the Algae Bloom to cover the entire lake?

Extension Activity:
Use a spreadsheet to extend the pattern to 20 weeks. Then make a scatter plot of the data and describe the graph.

Further information:
One of the greatest difficulties facing the aquaculture industry in Ireland is the threat of harmful algae blooms. A bloom results in high populations of microscopic plant cells known as phytoplankton in the water. When a bloom dies off there can be depletion of oxygen in the water column, and this kill in both fin-fish and shellfish populations, explains Mary Hensey, Glan-Uisce.
Source: *http://www.inshore-ireland.com/*

2.5 WHO GETS THE BETTER DEAL?

- You and your friend have both been offered a job on a construction site.
- You will both have to work 28 consecutive days to finish the project.
- Your friend is offered €25,000 per week (for 4 weeks)
- You negotiates your contact as follows;
- You will get paid 2 cent for the first day, 4 cent for the second day, 8 cent for the third day, and so on, your pay will double each day for 28 days.

Who has negotiated the better deal?
Create a table to show how much money you will get for the first10 days of the project.

(a) Using the table would you expect a graph of this relationship to be linear? Explain.

(b) Using the table would you expect a graph of this relationship to be quadratic? Explain.

(c) Check changes, change of the changes, change of the change of the changes etc.

(d) What do you notice? Is there a pattern to the differences? If so what is it?

(e) Predict the type of graph you will get if you plot money in cent against time in days.

(f) Make a graph to check your prediction. What do you notice?

(g) Can you come up with a formula for the amount of money you will have after *n* days?

(h) Using your calculator find out how much money you would get on the 5th day, the 10th day, the 20th day, 28th day?

(i) What are the variables in the situation? What is constant in this situation?

(j) Where is the factor of 2(the doubling) in the table? Where is it in the graph?

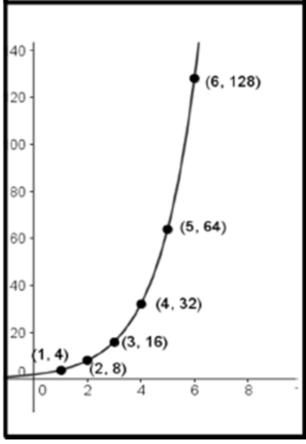
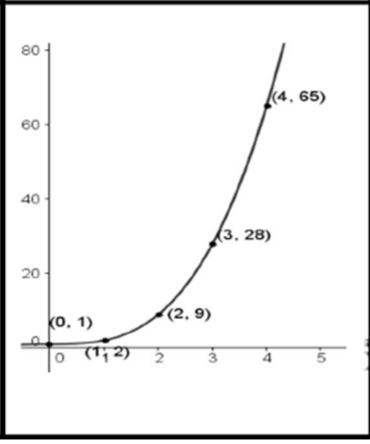
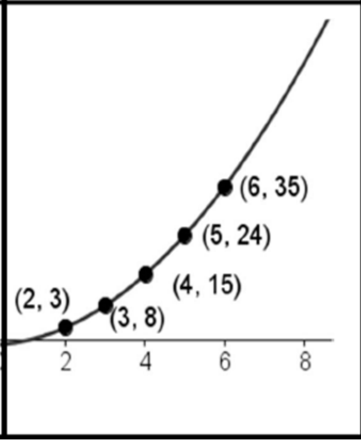
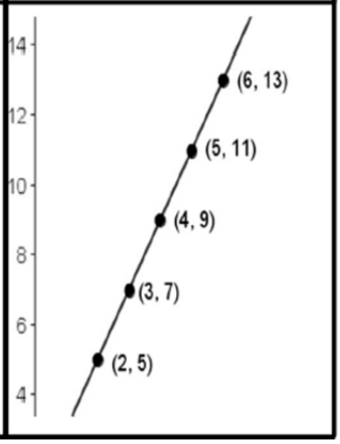
(k) Contrast this situation with adding 2 cent every day. How much would you have on day 31?

(l) How would the formula change if your pay trebled each day, starting by giving you 2 cents on the first day, 6 cent on the second day, 18 cents on the third day, and so on as described above? Make a table and come up with the formula for this new situation.

(m) When people speak of ‘exponential growth’ in everyday terms, what key idea are they trying to communicate?

2.6 IDENTIFYING GRAPHS

Below are 4 sections of 4 different graphs:

Graph 1	Graph 2	Graph 3	Graph 4
			

You must decide which one is a linear, a quadratic, a cubic and an exponential is using the information provided.

In each case, give a reason for your answer.

2.7 GENERAL FORMULA 1

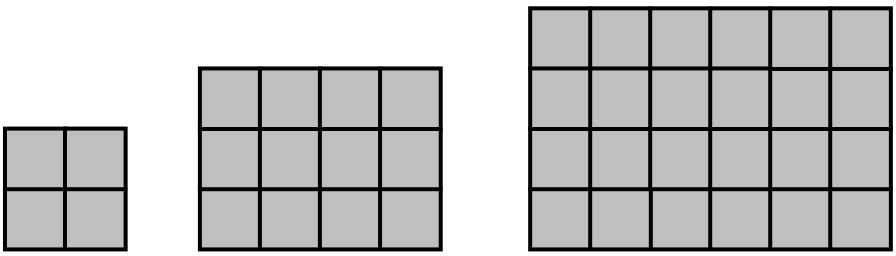
Write the general formula for the following patterns.

(a) 3, 12, 27, 48, 75,…
(b) 0.25, 1, 2.25, 4, 6.25,…

2.8 GENERAL FORMULA 2

Write the general formula for the following patterns.
(a) 5, 12, 21, 32, 45,…
(b) 5, 15, 31, 53, 81,…

2.9 MORE PATTERNS



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

(b) Write a general formula to find the number of in the nth pattern.

(c) How many blocks are in the 8th pattern?

2.10 GEOMETRIC SEQUENCES 1

Given the sequence $3 + 12 + 48 + \cdots$

(a) Show that it is Geometric
(b) Find the T_n, S_n of the sequence
(c) Find the T_{10} , S_{10} of the sequence

2.10 GEOMETRIC SEQUENCES 2

The five numbers 48, p, q, t, 3 are in a Geometric Sequence.
Find p, q and t.

2.11 GEOMETRIC SEQUENCES 3

A ball is dropped from a height of 8 m. The ball bounces to 80% of its previous height with each bounce. How high (*to the nearest cm*) does the ball bounce on the fifth bounce.

FINANCIAL APPLICATIONS TO SEQUENCES AND SERIES

3.1 THE SNOWMAN [JCHL 2007 PAPER 1]

A snowman has a mass of 12 kg. It melts at a rate of 0.2% of its mass per minute.
What will be the mass of the snowman after 3 minutes?
Give your answer correct to 2 decimal places.

3.2 DEPOSIT IN THE BANK

€650 is deposited in a fixed interest rate bank account. The amount in the account at the end of each year is shown in the following table:

End of year	1	2	3	4	5
Final value	€676.00	€703.04	€731.16	€760.41	€790.82

(a) How can you tell from the table if the above relationship is linear, quadratic or exponential? Explain.

(b) If you plot a graph of final value against time what does the graph look like for this limited range of times?

(c) What formula expresses the final value after t years if this pattern continues given an initial value of €650?

(d) What would be the effect of increasing the interest rate? Make a table showing the final values for the first five years using an interest rate of 10% per annum compound interest.

Plot a graph for this data. Compare the graph to the graph produced for the lower interest rate.

3.3 NEW JOB

Joan gets a new job as a trainee. She starts on €40 per day. She is told that in 6 months she will get a 50% rise and in another 6 months she will get another 50% rise. She says "Great, in one year's time I will have doubled my money." Discuss.

3.4 TECHNOLOGY INNOVATIONS

An item was being produced for €16 twenty years ago. Due to technology innovations it was reduced by 50% ten years ago and reduced again by 50% recently. Is the item now free? Discuss.

3.5 MONEY IN THE BANK

John put €200 into the bank for 1 year and got 10% interest during that year. At the end of the year he had €220. This means that he had gained €20 on his original money.
Task: Match John's figures to each of the words in the table below:

Principal	Interest rate as a percentage	Interest rate as a decimal	Final Value	Number of years	Interest

3.6 SAVINGS

The following figures represent a certain amount of money put into a bank for a certain number of years at a certain interest rate. Using all of the words in the table above, write out a few sentences which would explain all of the figures.

Figures: €472.05 4 years €300 12% 0.12 €172.05

3.7 INVESTMENTS

The table below shows money invested by various people for a differing number of years. Some of the figures are missing. Complete the missing figures:
Note: p.a. means per annum (per year)

Name	***Principal***	***Interest rate % (p.a.)***	***Final Value***	***Number of years***	***Interest***
Anne	€1 000	6%	€1338.23	5	
Michael	€1 000	7%		9	€838.46
Dominic		8%	€5 038.85	3	€1 038.85

3.8 CONVERSIONS

Below are some annual interest rates expressed as decimals. Convert these to annual rates expressed as percentage rates.		Below are some annual interest rates expressed as percentages. Convert these to annual rates expressed as decimals.	
0.07		6%	
0.045		2.3%	
0.12		103.2%	
0.18		15%	
0.0375		0.35%	
0.00275		0.0246%	
0.00035		0.00035%	
This is the "*i*" in the "Formulae and Tables" book.			

3.9 PATRICK'S INVESTMENT

Patrick invests €400 in a savings account for 1 year and gets a fixed annual equivalent rate (AER) of 4.3%. At the end of the year he asks the bank how much money he has in total and how much interest he made. Fill out the table below to see what figures the bank might leave him.

Method 1	
Principal	
Interest for the year (calculate 4.3% of €400)	
Final Value	

3.10 MARY'S GIFT

Mary has received a gift of €5000. She is hoping to buy a car for €6 000 with her savings in 3 years' time. She intends to save the gift money until then. The bank is offering her 4% AER on her money if she leaves it in for the 3 years. Will she be able to afford to buy the car from her savings at the end of the three years?

Method 1	
Value of the gift (P)	
Interest for the 1st year (I_1) (4% of €5 000)	
F_1 = Final value (end of year 1)	
Interest for the 2nd year (I_2)	
F_2 = Final Value (end of year 2)	
Interest for the 3rd year (I_3)	
F_3 = Final Value (end of year 3)	

Fill in the table on the right.
What do you notice?

I_1	I_2	I_3

3.11 JOHN'S SAVINGS

John wants to have €10 000 saved in 10 years' time to pay for his child's education. The bank is offering him an annual interest rate of 7% AER. How much money would he need to invest now in order to have €10 000 in 10 years' time?

First fill in as many variables as you can into the table below:

P	F	$(1 + i)$	t

3.12 FIONA'S SAVINGS

Fiona has €7,000 to put into a savings account. She would like €10 000 in 4 years' time in order to build an extension to her house. She decides to ask a few banks, building societies etc. what rate of interest they are willing to offer. What annual rate of interest does Fiona need to have enough saved to build the extension?
First fill in as many variables as you can into the table below and then calculate i:

P	i	$(1 + i)$	t	F

3.13 GAME CONSOLES

Jillian and Noel are each going to buy games console. It costs € 500 and they are getting a loan from the credit union to do it. Jillian says "I have loads of work at present so I can afford to pay €100 per month." Noel says he can only afford €80 per month. The bank is charging them a monthly interest rate of 1%.

(a) Complete the first three months' transactions on the loan using the boxes below.

Jillian's First 3 Months

Initial Loan	
Interest 1	
Total (500 x 0.01)	
Payment	
Balance	

Interest 2	
Total	
Payment 2	
Balance 2	

Interest 3	
Total	
Payment 3	
Balance 3	

Noel's first 3 months

Initial Loan	
Interest 1	
Total (500 x 0.01)	
Payment	
Balance	

Interest 2	
Total	
Payment 2	
Balance 2	

Interest 3	
Total	
Payment 3	
Balance 3	

(b) Compare: Interest 1, Interest 2 and Interest 3 for Jillian or Noel. What do you notice? Explain.

(c) Explain what is meant by the term "Reducing Balance in the context of either Jillian's or Noel's situation ?

(d) Investigate the effects of their loan repayments under two headings

- Time taken to repay
- Interest paid.

3.14 SALE OF LORRY

A company buys a new lorry for €50 000. After 4 years it needs to sell the lorry. The value of the lorry reduces by 15% each year. What is the value of the lorry after 4 years?

Method 1	
Original value of the lorry *P*	
Depreciation in year 1 = €50000(0.15)	
F_1 = Value at end of year 1	
Depreciation in year 2	
F_2 = Value at end of year 2	
Depreciation in year 3	
F_3 = Value at end of year 3	

3.15 LCOL NCCA 2011

A machine depreciates in value by 40% in its first year of use. During its second year it depreciates by 25% of its value at the beginning of that year. Thereafter, for each year, it depreciates by 10% of its value at the beginning of the year.

Calculate:
(i) the value after eight years of equipment costing €500 new
(ii) the value when new of equipment valued at €100 after five years of use.

3.16 LEAVING CERTIFICATE 2010 SAMPLE PAPER 1 FOUNDATION LEVEL Q2

A sum of €5000 is invested in an eight year government bond with an annual equivalent rate (AER) of 6%.
Find the value of the investment when it matures in eight years' time.

3.17 LEAVING CERTIFICATE 2010 SAMPLE PAPER 1 ORDINARY LEVEL Q2

(a) A sum of €5000 ia invested in an eight-year government bond with an annual equivalent rate (AER) of 6%. Find the value of the investment when it matures in eight years' time.

(b) A different investment bond gives 20% interest after 8 years. Calculate the AER for this bond.

3.18 COMPOUND INTEREST 1

€100 earns 0.287% per month compound interest.
(i) What is its final value after 1 year?
(ii) If interest was added annually what is the annual equivalent rate?

3.19 COMPOUND INTEREST 2

The €100 is left on deposit for 15 months at 0.287% per month compound interest.

(i) Calculate the final value. Give the answer to the nearest 10 c.

(ii) What is the interest rate for the 15 months?

(iii) What is this interest rate called?

3.20 AER ADVERTIMENT

Verify the following AER:

3.21 COMPOUND INTEREST 3

(i) Find, correct to three significant figures, the rate of interest per month that would, if paid and compounded monthly, be equivalent to an effective annual rate of 3.5%?

(ii) Find, correct to three significant figures, the rate of interest per day that would, if paid and compounded daily, be equivalent to an effective annual rate of 3.5%?

3.22 FUNDS

A bank has offered a 9 month fixed term reward account paying 2.55% on maturity, for new funds from €10,000 to €500,000. (That is, you get your money back in 9 months' time, along with 2.55% interest.)
Confirm that this is, as advertised, an EAR of 3.4%