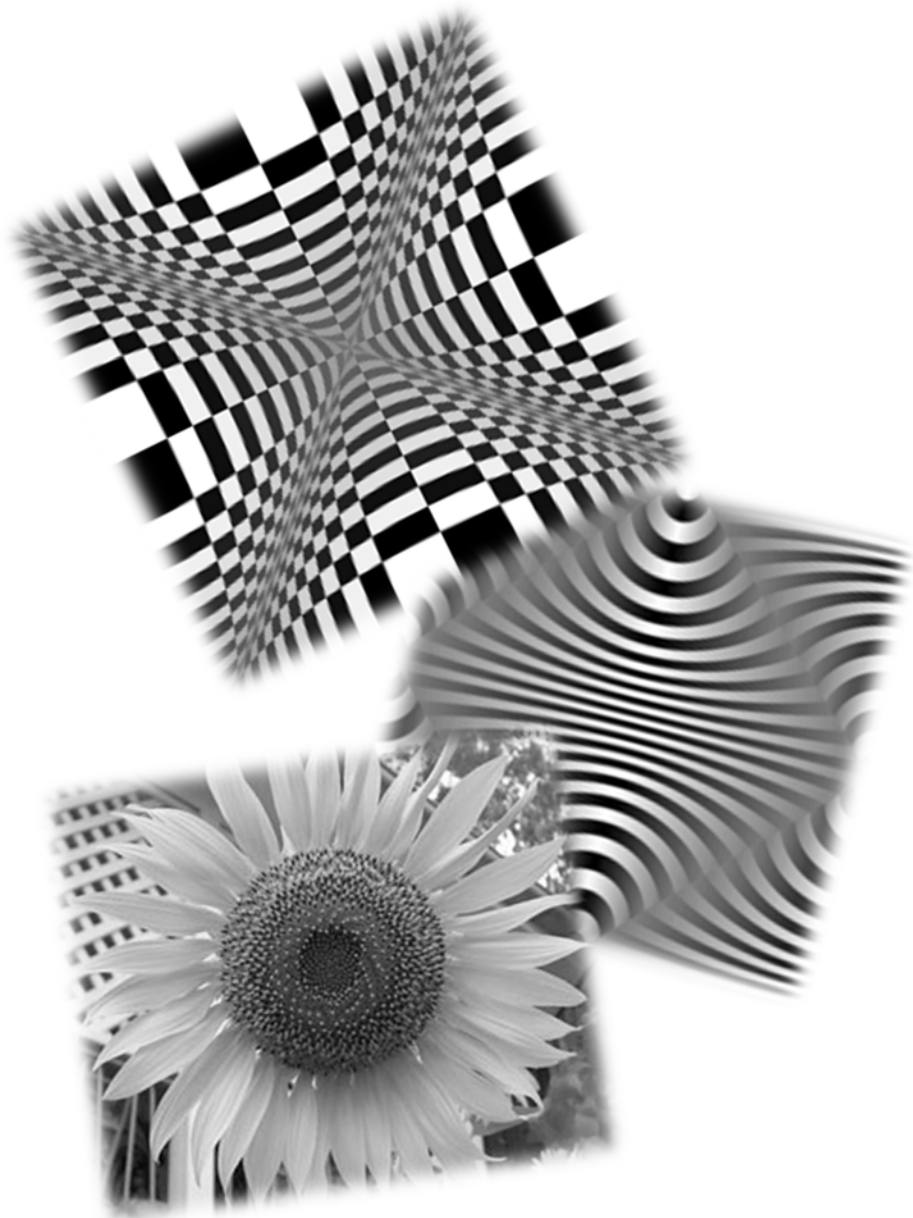


Project Maths Workshop 4

Focus on Patterns



Name: _____

School: _____



Development Team

WS4.2 Key Outcomes and Words

- identify patterns and describe different situations using tables, graphs, words and formulae
- predict
- generalise in words and symbols
- justify
- relationship
- start amount: from a table
- constant rate of change: from a table
- a variable
- inputs and outputs
- linear graph
- start amount on graph: y - intercept
- constant rate of change on graph: called slope
- parallel lines \leftrightarrow same slope \leftrightarrow same rate of change
- constant rate of change characterises a linear function
- change column in table shows constant increasing rate of change
- formula
- start amount and slope/rate of change also observable from formula
- $y = mx$ or $y = mx + c$ or $y = c + mx$
- compare and contrast
- steepness of slope reflects the rate of change
- slope: rise over run
- intersection
- common value
- increasing rate of change: positive slope
- decreasing rate of change: negative slope
- quadratic relationships:
 - story / diagram
 - table: first change varies
 second change constant
 - graph
- exponential relationships:
 - story
 - table: first change develops in a ratio
 - graph

A full treatment of this topic is to be found in: "A Functions based approach to Algebra" available on <http://www.projectmaths.ie>.

WS4.3 Student Activity 1B (Extract from Teaching & Learning Plan on Patterns)

Represent this repeating pattern - yellow, black, green, yellow, black, green - by building it with blocks or colouring it in on a number strip or drawing a table or in any other suitable way.

1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	----

1. List the numbers of the first 3 yellow blocks. Is there a pattern in these numbers?

2. List the numbers of the first 3 black blocks. Is there a pattern in these numbers?

3. List the numbers of the first 3 green blocks. Is there a pattern in these numbers?

4. What colour is the 6th block? _____

5. What colour is the 18th block? _____

6. What colour is the 25th block? _____

7. What colour is the 13th block? _____

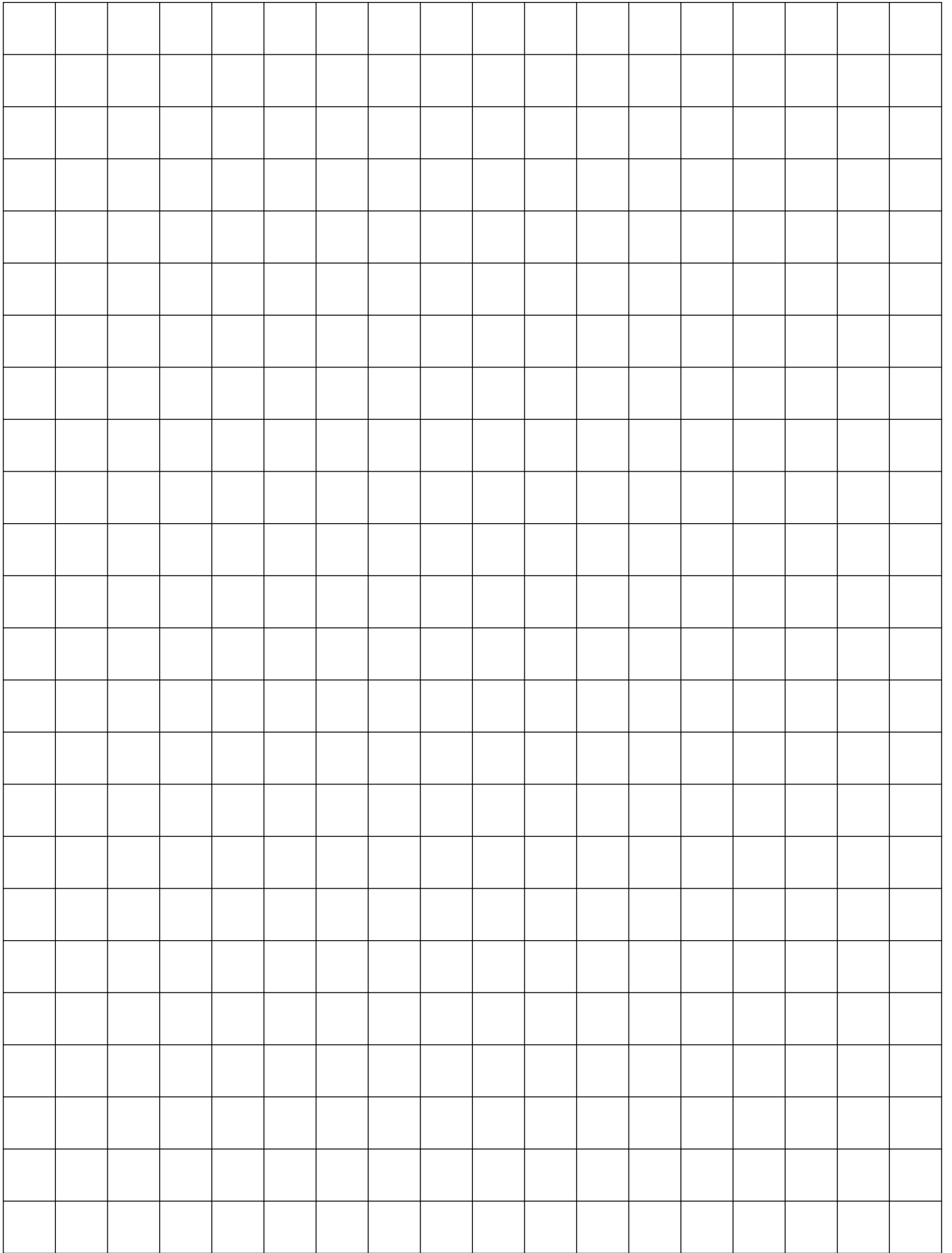
8. What colour will the 100th block be in the sequence? _____

9. What colour will the 500th block be in this sequence? _____

10. Explain how you found your answers to questions 8 and 9.

11. What rule could you use to work out the position number of any of the (i) yellow blocks, (ii) black blocks, (iii) green blocks?

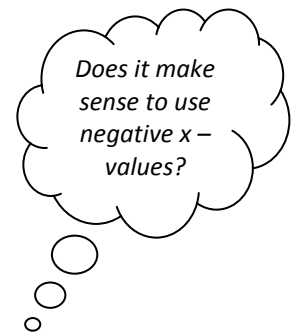
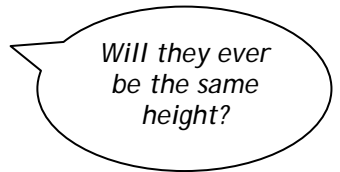
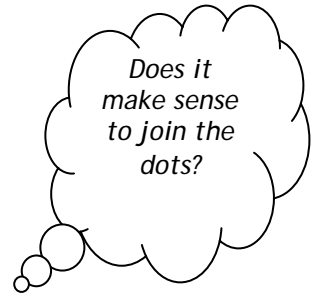
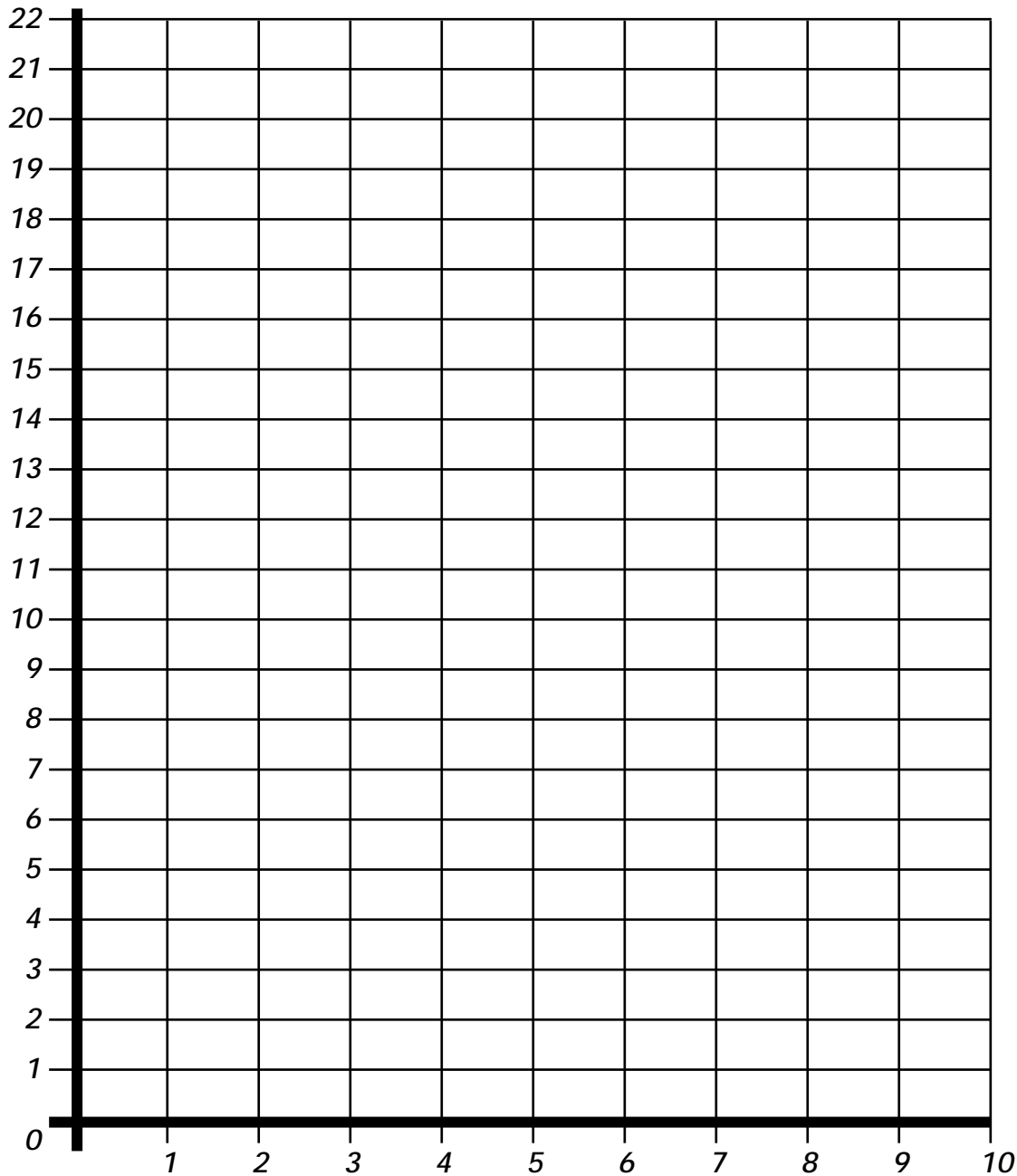
WS4.4 Money Box Problem Graph



WS4.5A Sunflowers Problem

Student Activity

Using pencil label axes clearly draw a graph of your first sunflower.
Using a different colour pencil draw a graph of the second sunflower.



<i>Sunflower A</i> Starting height 3 cm and grows 2 cm per day each day afterwards			
<i>Time/d</i>	<i>Height/cm</i>		

<i>Sunflower B</i> Starting height 6 cm and grows 2 cm per day each day afterwards			
<i>Time/d</i>	<i>Height/cm</i>		

When you have completed the table and drawn the graph of your first sunflower answer the following questions:

1. What values are varying?
Does one depend on the other?
Explain.
2. Identify the starting height in the table.
What time does it correspond to?
Where is the starting height on the graph?
3. Identify the rate of change of growth with time in the table.
Use the same reasoning to identify it in the graph.
4. What values are staying the same?

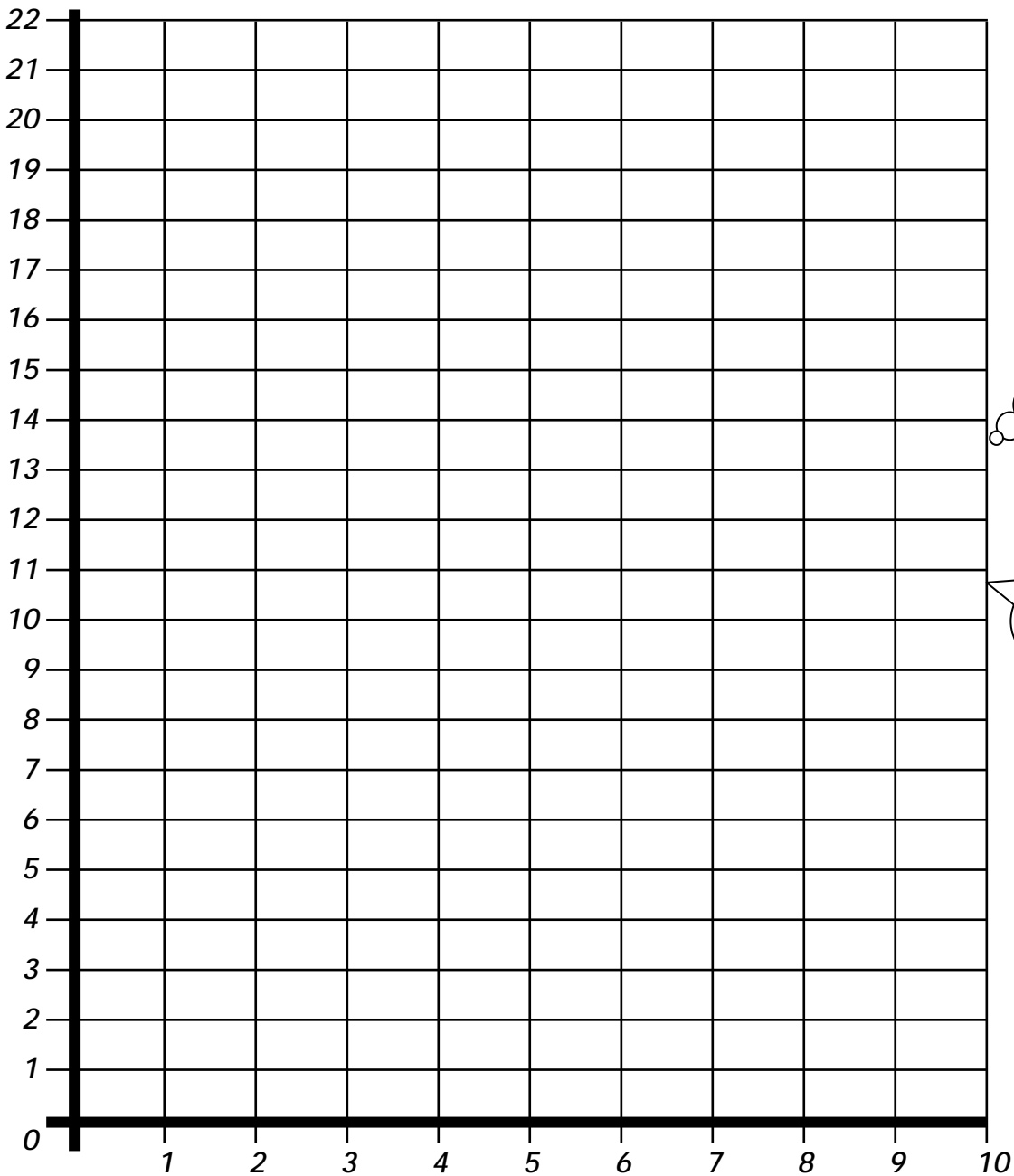
After you have the table and graph of your second sunflower completed answer the following:

5. Predict the height of each sunflower on day 9, if they continue to grow at the same rate each day. Can you think of more than one way to do this?
6. Express in words the relationship between the height of each sunflower on any day, its starting height, its rate of growth and the time in days elapsed since its starting height.
7. Express the above relationships in symbols.

WS4.5B Sunflowers Problem

Student Activity

Using pencil label axes clearly draw a graph of your first sunflower.
Using a different colour pencil draw a graph of the second sunflower.



Does it make sense to join the dots?

Will they ever be the same height?

Does it make sense to use negative x -values?

<i>Sunflower B</i> Starting height 6 cm and grows 2 cm per day each day afterwards			
<i>Time/d</i>	<i>Height/cm</i>		

<i>Sunflower C</i> Starting height 6 cm and grows 3 cm per day each day afterwards			
<i>Time/d</i>	<i>Height/cm</i>		

When you have completed the table and drawn the graph of your first sunflower answer the following questions:

1. What values are varying?
Does one depend on the other?
Explain.
2. Identify the starting height in the table.
What time does it correspond to?
Where is the starting height on the graph?
3. Identify the rate of change of growth with time in the table.
Use the same reasoning to identify it in the graph.
4. What values are staying the same?

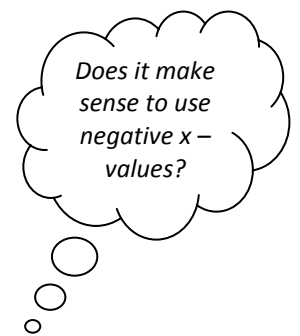
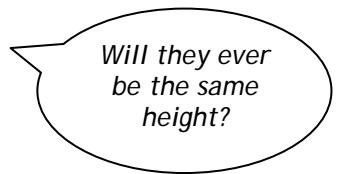
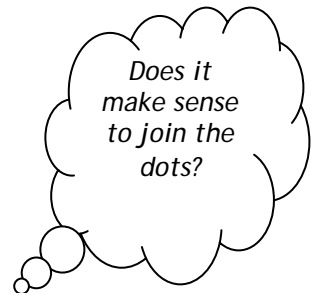
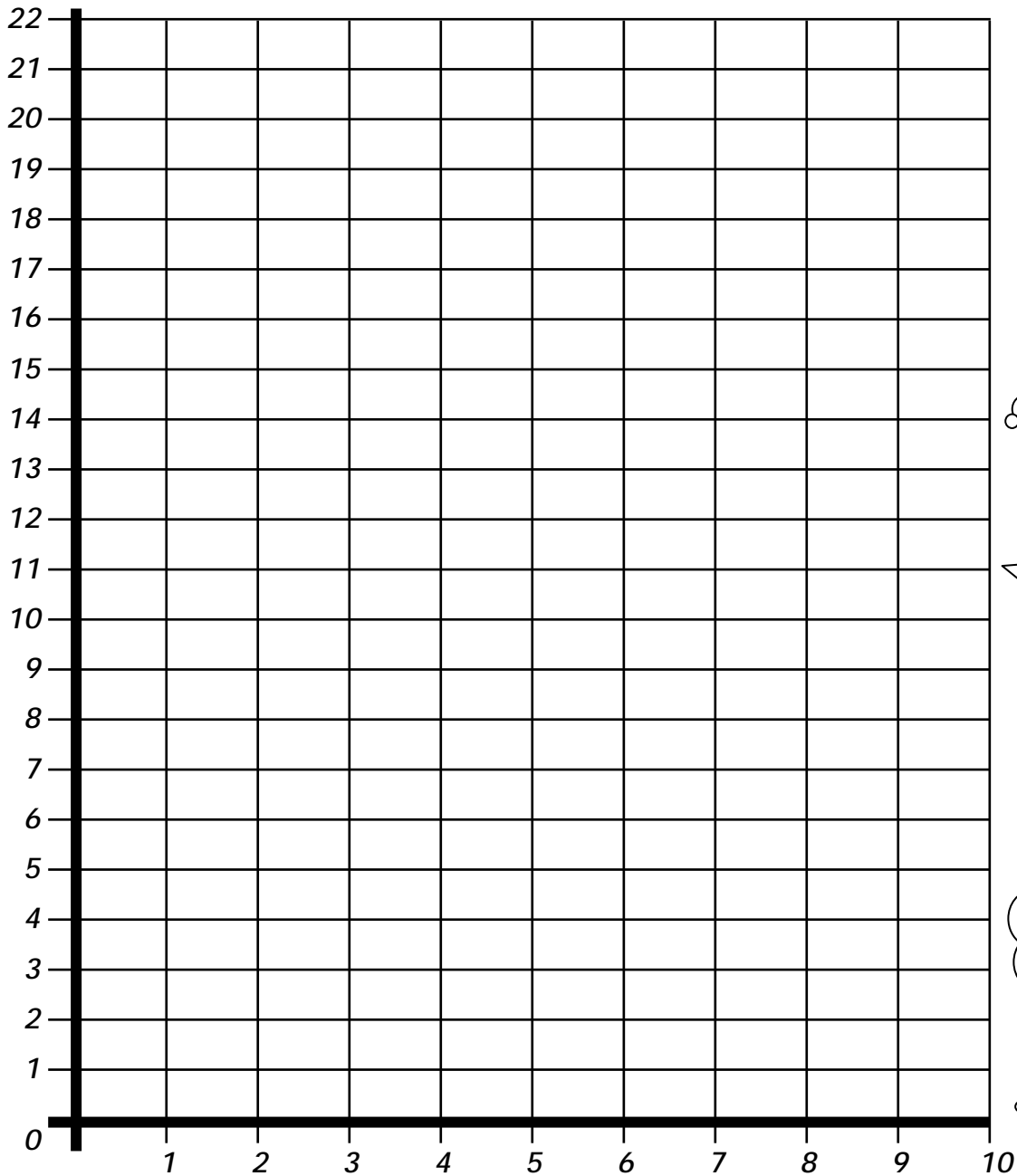
After you have the table and graph of your second sunflower completed answer the following:

5. Predict the height of each sunflower on day 9, if they continue to grow at the same rate each day. Can you think of more than one way to do this?
6. Express in words the relationship between the height of each sunflower on any day, its starting height, its rate of growth and the time in days elapsed since its starting height.
7. Express the above relationships in symbols.

WS4.5C Sunflowers Problem

Student Activity

Using pencil label axes clearly draw a graph of your first sunflower.
Using a different colour pencil draw a graph of the second sunflower.



<i>Sunflower C</i> Starting height 6 cm and grows 3 cm per day each day afterwards			
<i>Time/d</i>	<i>Height/cm</i>		

<i>Sunflower D</i> Starting height 8 cm and grows 2 cm per day each day afterwards			
<i>Time/d</i>	<i>Height/cm</i>		

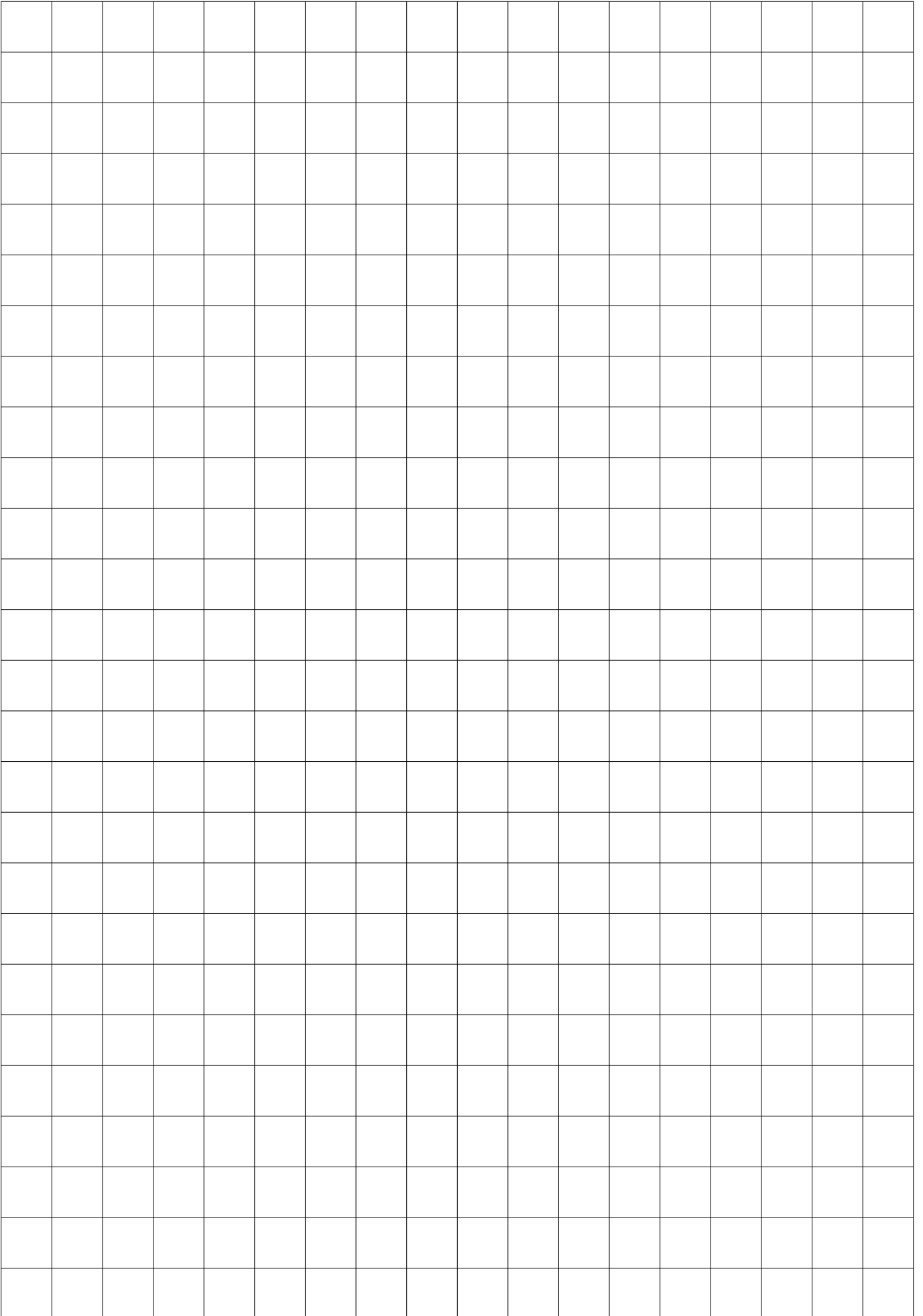
When you have completed the table and drawn the graph of your first sunflower answer the following questions:

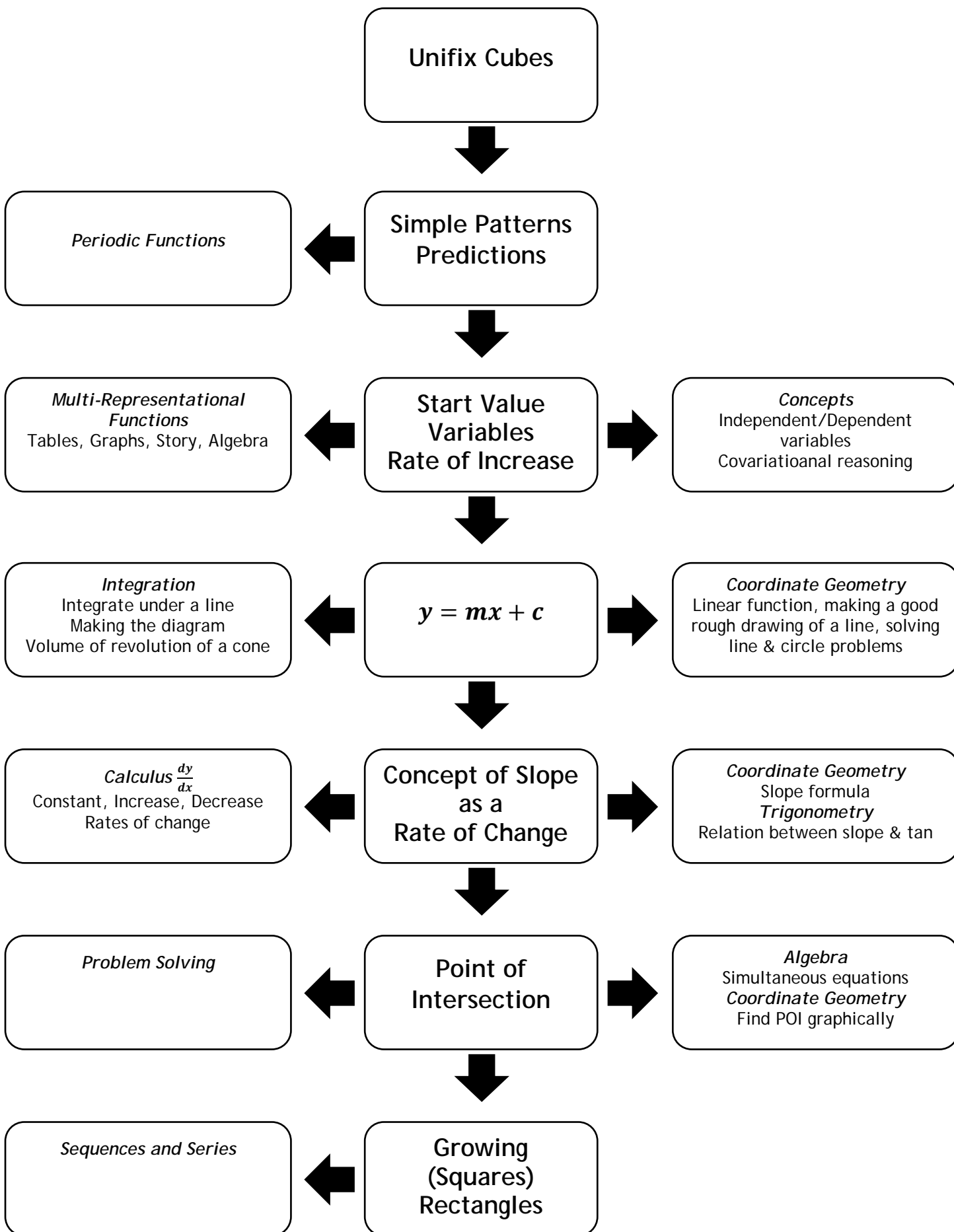
1. What values are varying?
Does one depend on the other?
Explain.
2. Identify the starting height in the table.
What time does it correspond to?
Where is the starting height on the graph?
3. Identify the rate of change of growth with time in the table.
Use the same reasoning to identify it in the graph.
4. What values are staying the same?

After you have the table and graph of your second sunflower completed answer the following:

5. Predict the height of each sunflower on day 9, if they continue to grow at the same rate each day. Can you think of more than one way to do this?
6. Express in words the relationship between the height of each sunflower on any day, its starting height, its rate of growth and the time in days elapsed since its starting height.
7. Express the above relationships in symbols.

WS4.6 Growing Squares/Rectangles





WS4.9 Contents of "A function based approach to algebra"

Introduction and unit learning outcomes

Linear function investigations

Proportional versus non proportional

Quadratic function Investigations

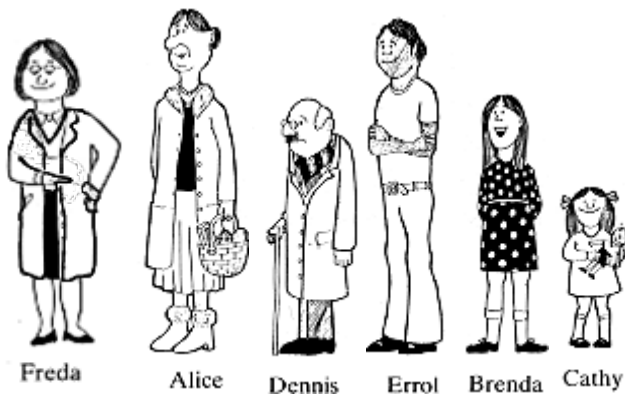
Exponential function Investigations

Inverse proportion investigations

Cubic function investigations

Appendix - notes and some solutions

WS4.10 Bus Problem



WS4.11 Bath Problem

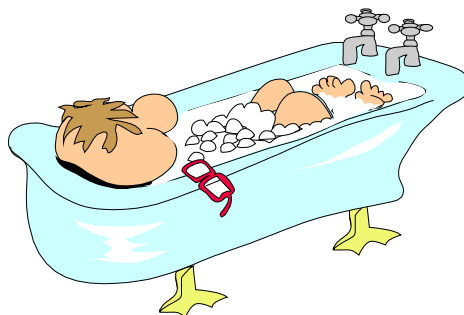
A. Relaxes in bath.

C. Cold tap turned off, gets undressed.

E. Gets out of bath.

B. Pulls the plug.

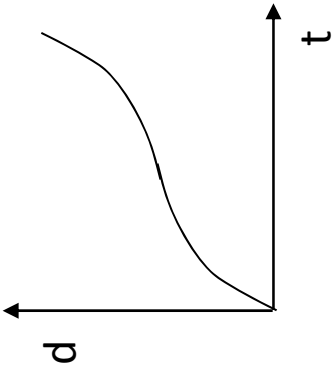
F. Turns off hot tap.



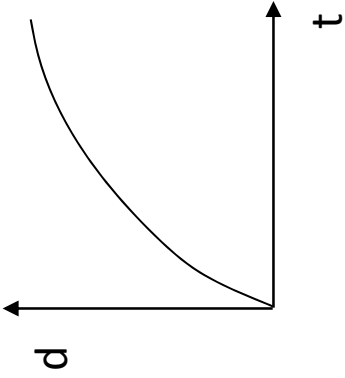
D. Gets into bath.

G. Hot and cold taps turned on.

1-1



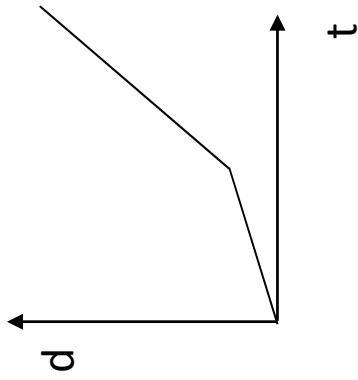
1-2



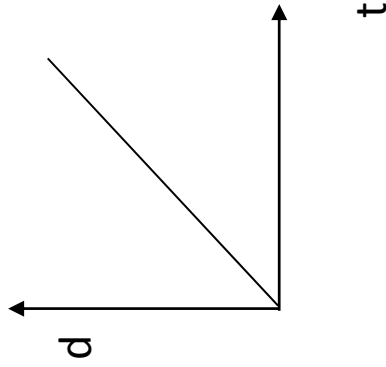
1-A : Moving at a steady constant pace.

1-B : Moving at a fast pace changing to a slower pace.

1-3



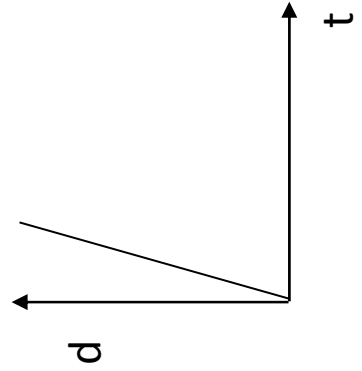
1-4



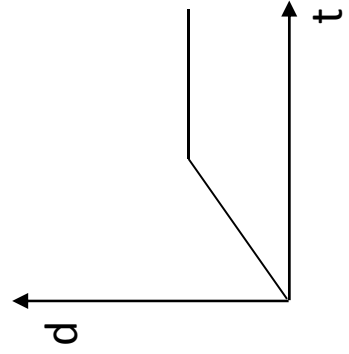
1-C : Moving at a fast steady pace.

1-D : Moving fast, then slowing slightly, then going faster again.

1-5



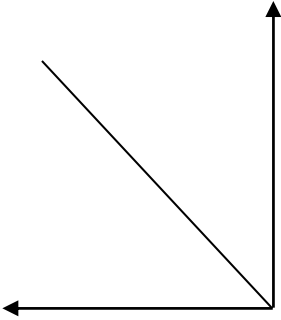
1-6



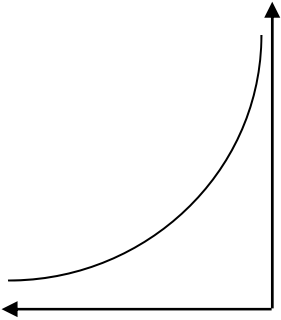
1-E : Moving at a steady pace, then stops for a period of time.

1-F : Moving at a slow pace and then rapidly increases.

2-1



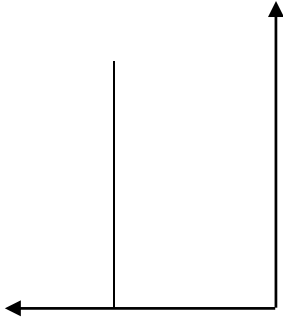
2-2



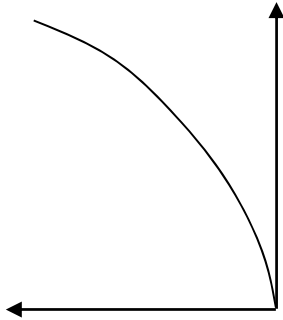
2-A : The graph shows the cost of hiring an electrician per hour including a fixed call out fee.

2-B : The graph shows the connection between the length and width of a rectangle of a fixed area

2-3



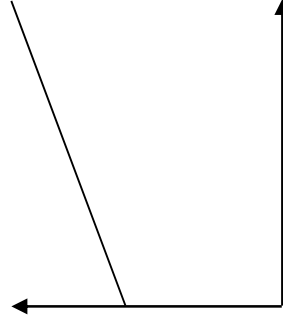
2-4



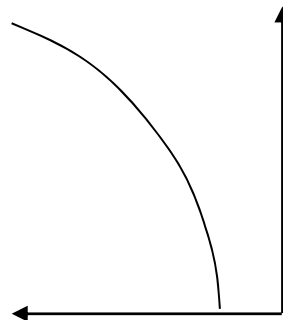
2-C : The graph shows speed against time for a car travelling at a constant speed.

2-D : The graph shows the area of a circle as the radius increases.

2-5



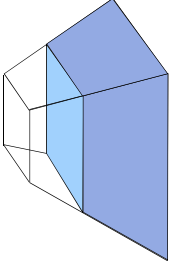
2-6



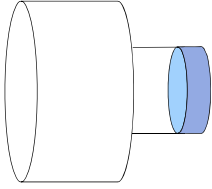
2-E : The graph shows the width of a square as the length of the square increases

2-F : The population increased slowly at first, but then increased more quickly.

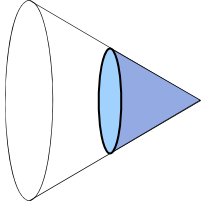
3-A



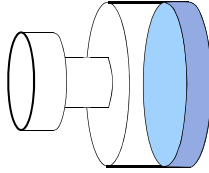
3-B



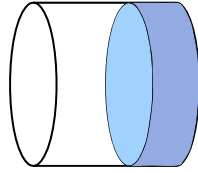
3-C



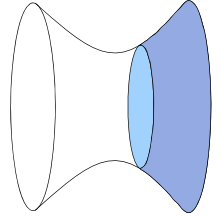
3-D



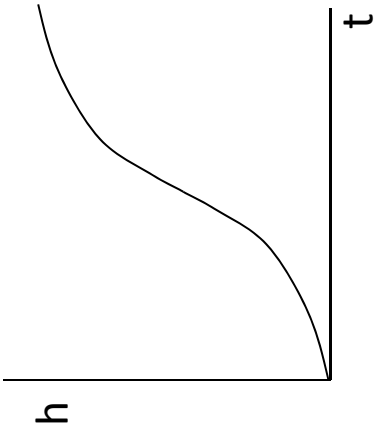
3-E



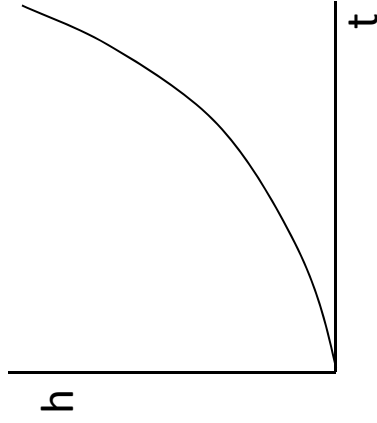
3-F



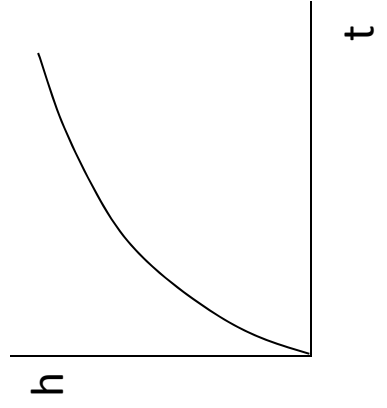
3-2



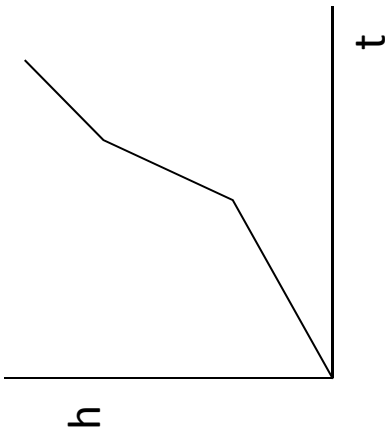
3-4



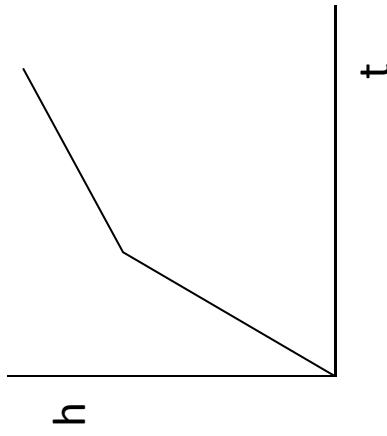
3-6



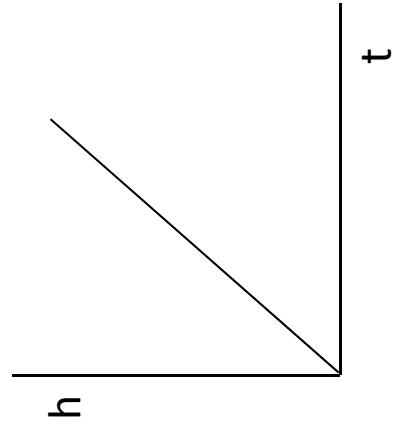
3-1



3-3



3-5



WS4.12 Resources available for Strands 1 and 2

Please note a more comprehensive document is to be found on <http://www.projectmaths.ie>

Topic	Description of topic Students learn about	Learning outcomes Students should be able to
1.1 Counting	Listing outcomes of experiments in a systematic way.	<ul style="list-style-type: none"> - <i>list all possible outcomes of an experiment</i> - <u>apply the fundamental principle of counting</u>
1.2 Concepts of probability	<p>The probability of an event occurring: student progress from informal to formal descriptions of probability.</p> <p>Predicting and determining probabilities. Difference between experimental and theoretical probability.</p>	<ul style="list-style-type: none"> - <i>decide whether an everyday event is likely or unlikely to occur</i> - <u>recognise that probability is a measure on a scale of 0-1 of how likely an event is to occur</u> - use set theory to discuss experiments, outcomes, sample spaces - <i>use the language of probability to discuss events, including those with equally likely outcomes</i> - <i>estimate probabilities from experimental data</i> - <i>recognise that, if an experiment is repeated, there will be different outcomes and that increasing the number of times an experiment is repeated generally leads to better estimates of probability</i> - <u>associate the probability of an event with its long-run, relative frequency</u>
1.3 Outcomes of simple random processes	Finding the probability of equally likely outcomes	<ul style="list-style-type: none"> - <i>apply the principle that, in the case of equally likely outcomes, the probability is given by the number of outcomes of interest divided by the total number of outcomes (examples using coins, dice, spinners, urns with different coloured objects, playing cards, etc.)</i> - use binary / counting methods to solve problems involving successive random events where only two possible outcomes apply to each event
1.4 Statistical reasoning with an aim to becoming a statistically aware consumer	The use of statistics to gather information from a selection of the population with the intention of making generalisations about the whole population. They consider situations where statistics are misused and learn to evaluate the reliability and quality of data and data sources.	<ul style="list-style-type: none"> - <i>engage in discussions about the purpose of statistics and recognise misconceptions and misuses of statistics</i> - <i>work with different types of data (categorical/numerical/ordinal discrete/continuous) in order to clarify the problem at hand</i> - evaluate reliability of data and data sources
1.5 Finding, collecting and organising data	Formulating a statistics question based on data that vary allows for distinction between different types of data.	<ul style="list-style-type: none"> - <i>clarify the problem at hand</i> - <i>formulate one (or more) questions that can be answered with data</i> - <i>explore different ways of collecting data</i> - <i>generate data, or source data from other sources including the internet</i> - select a sample (Simple Random Sample) - recognise the importance of representativeness so as to avoid biased samples - <i>design a plan and collect data on the basis of above knowledge</i> - <i>summarise data in diagrammatic form including spread sheets</i>

1.1, 1.2, 1.3 *Italics* => T & Ls 1,2,4,5

1.4, 1.5 *Italics* => Data Handling Cycle

Underlined => Student CD

WS4.12 Strands 1 & 2

Have you...

...registered for Census at School and have your students inputted their data?

[<http://www.censusatschool.ie>]

...attended the modular course for ICT for Strands 1 and 2 or accessed the resources for the same on the website? [<http://www.projectmaths.ie>]

...attended the modular course for content for Strand 1 or accessed the resources for the same on the website? [<http://www.projectmaths.ie>]

...read the Bridging Document for Mathematics produced by the NCCA and shown in Workshop 3?

[<http://www.ncca.ie/projectmaths>]

...printed the Guide to Axioms, Theorems and Constructions for all levels?

[<http://www.projectmaths.ie>]

...used the Student's CD with the Student Activities in class? [<http://www.projectmaths.ie>]

...given your students a copy of the Student's CD?

...accessed the Leaving Cert. 2010 Sample Papers? [<http://www.examinations.ie>]

...accessed the Leaving Cert. 2010 Project Maths Papers? [<http://www.examinations.ie>]

...accessed the Leaving Cert. 2011 Sample Papers? [<http://www.examinations.ie>]

...accessed the Junior Cert. 2011 Sample Papers? [<http://www.examinations.ie>]

...accessed the Pre-Leaving Cert. 2010 papers? [<http://www.ncca.ie/projectmaths>]

...used any of the Teaching and Learning plans in class? [<http://www.projectmaths.ie>]

...read the Report on the Trialling of the Sample Paper? [<http://www.examinations.ie>]

...accessed the NCCA Student Resource Materials? [<http://www.ncca.ie/projectmaths>]

...used any of the Teacher Handbooks? [<http://www.projectmaths.ie>]

...shared more resources with the rest of the teachers in your maths team in recent months?

...completed $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, or all of the Common Introductory Course? (JC syllabus pages 23 and 24)

...noticed that Paper 2 is changing for your current 1st years in 2013?

...noticed that Paper 2 is changing for your current 5th years in 2012?

...got your students to use concrete resources (e.g. unifix cubes, dice, geometry set, geostrips, clinometers etc.) more often in recent months?

...used the search engine on the Project Maths website? [<http://www.projectmaths.ie>]

...searched the internet for ideas on specific topics?

...copies of the syllabuses?