

Lesson Research Proposal

For the lesson 17/01/18
At St.Colmans Community College, Midleton,
Teacher's name: Michael Barrett
Class: Rang Fergal
Instructor: Enda O Connell

Lesson plan developed by: Anne O'Connor, Margaret O'Connell, Sarah Fitzpatrick, Michael Barrett

1. Title of the Lesson: **Subway Substitution**

2. Brief description of the lesson

Students will be introduced to the chapter of Algebra. Students will recap over key words such as variable, term, Constant, coefficient and Expression. They will be able to derive an expression off a menu. They will then be able to substitute values into the given expression.

Research Theme

➤ Learner Experiences

- (a.) We hope that students get a great sense of **enjoyment** out of meaningful learning.
- (b.) We aim for students to **challenge and support** one another in their learning interactions.
- (c.) We will strive for students to **reflect** on their learning throughout.

➤ Teachers Collective/ Collaborative Approach

- (a.) We, as teachers, hope to enhance the **range of teaching methodologies** that we can use in the day to day classroom.
- (b.) Working together will allow us to partake in **professional collaboration** with our colleagues.
- (c.) Collaboration will then allow us to **devise learning opportunities** to meet the varying needs present in the classroom.

3. Background & Rationale

a) Why did we choose algebra as a research topic?

We at St.Colmans Community College, Middleton have identified Algebra as a problem area amongst our students. Common problems include trying to relate Algebra to their everyday life. Problems also arise when trying to relate their knowledge in Algebra to other topics present in the Mathematics curriculum.

b) Our Research findings:

When looking at the 2015 ordinary level junior cert results we noticed that when algebra was put with a secondary topic the mean results were quiet high. In contrast, when algebra was examined as a singular question, the mean results were considerably lower. (SEE APPX 1) On future discussion, we felt that the rote learning approach around algebra wasn't working effectively. Students weren't retaining the steps required to complete the algebraic questions correctly. When algebra is put with a secondary topic, for example- distance, speed and time, students feel better equipped to answer the question. We put this down to teaching approaches such as the use of imagery, graphs and estimation techniques.

4. Relationship of the Unit to the Syllabus

Related prior learning Outcomes	Learning outcomes for this unit	Related later learning outcomes
<ul style="list-style-type: none"> ● number sentences with a frame into word problems and vice versa ● word problems with a variable into number sentences ● Solve one-step number sentences and equations ● Explore the concept of a variable in the context of simple patterns, tables and simple formulae and substitute values for 	<ul style="list-style-type: none"> ● Generating arithmetic expressions from repeating patterns ● Representing situations with tables, diagrams and graphs ● Expressions ● Finding formulae Examining algebraic relationships ● Using graphs to represent phenomena quantitatively. ● Equations and 	<ul style="list-style-type: none"> ● Generating arithmetic expressions from repeating patterns ● Representing situations with tables, diagrams and graphs ● Expressions ● Finding formulae Examining algebraic relationships ● Using graphs to represent phenomena quantitatively. ● Equations and

variables	inequalities	inequalities • Expressions
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5. Goals of the Unit

- Evaluate Algebraic expressions.
- Add and Subtract algebraic terms.
- Multiply algebraic expressions.
- Multiply algebraic terms.
- Students will develop problem solving skills and appreciate that there are multiple approaches to problem solving.
- Students will gain the value and respect of each other's work.

6. Unit Plan

Lesson	Learning goal(s) and tasks
1	Introduction to algebra – Evaluating Algebraic Expressions (x2) Research Lesson
2	Adding and Subtracting like terms (x1)
	Multiplication of terms (x2)
4	Multiplication of brackets (x2)
5	Multiplication of two expressions (x2)
6	Revision and assessment (x2)

7. Goals of the Research Lesson:

- Recap over key words – Expression, Coefficient, Term, Constant, Variable.
- Derive Algebraic expressions.
- Substitute different values into the given algebraic expressions.

a) Key Skills and Statements of Learning

- Students will develop problem solving skills.
- Students will be able to derive expressions.
- Students will be able to evaluate given expressions.

8. Flow of the Research Lesson:

TITLE: Subway's Substitution

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	Teacher Support	Assessment
The pupils are welcomed, a roll call is taken, and the guidelines for this class are re-enforced. <i>(3 mins)</i>	The seating plan for the class will allow for students to be in groups of three. Each group will be given a plastic pocket full of resources for the class.	
Introduction Prior knowledge on key words of Algebra will be discussed. Pupils are reminded to be mindful that a variable can always be different. Pupils are asked to have their hardbacks, calculators and a pen on their desk. <i>(4 mins)</i>	I will refer students to the word wall to identify all of the different meanings of the key word. (Variable, term, algebraic expression, substitution, co-efficient).	I will orally examine students on the words.
Task 1: (1.) I will introduce the task on the PowerPoint. We will collaboratively examine the menu. I will then assign students to outline the different ways in which they could spend the €15. <i>(6 mins)</i>	Working individually in their groups students will compile their different ways of spending the €15. (2 – 4 mins) Solutions will then be discussed within the group. (2 mins)	I will circulate around the room assessing that each student is participating in the group work and examine the different ways in which they are spending the €15.

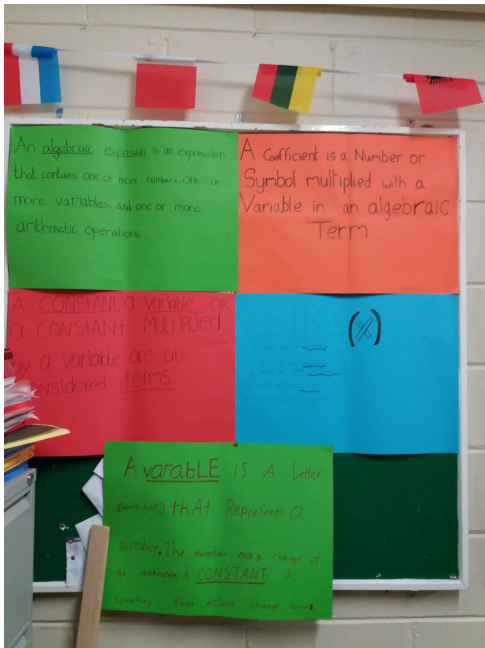
<p>(2.) Review – A member of selected groups will present a way of spending the €15 on the whiteboard.</p> <p>(6 mins)</p>	<p>Each of the identified groups will have a separate part of the whiteboard to write out their nominated solution.</p>	<p>I will identify certain solutions that will be presented on the whiteboard.</p>
<p><u>Task 2:</u></p> <p>Students will rejoin their groups again. Using their three different solutions from task 1 above, groups will have to write a simplified expression for their three solutions.</p> <p>Review – I will select a member from the class to come to the whiteboard to write a simplified version of an equation that was presented on the whiteboard from task 1.</p> <p>(5 mins)</p>	<p>A member in each group will pick a particular way of spending the €15 and write a simplified expression.</p> <p>I will generate a discussion on how students simplified their expressions.</p>	<p>I will move around the room again to ensure that each student is writing a simplified expression.</p> <p>Assessing the solutions on the whiteboard.</p>
<p><u>Task 3:</u></p> <p>I will pose task three to the class. In task three students will have to prove that their order is equivalent to €15. I will remind students of what a variable is and how it may vary.</p> <p>Review – A member from each group will be brought to the whiteboard for the final time to</p>	<p>Students will have to refer back to the menu to find the different values for the different options. They will ensure that the three selected options add up to €15.</p> <p>Selected students will present their calculations on the whiteboard.</p>	<p>I will ensure that students in each group are substituting values into one of the groups chosen expressions.</p> <p>I will ensure that each expression adds up to €15.</p>

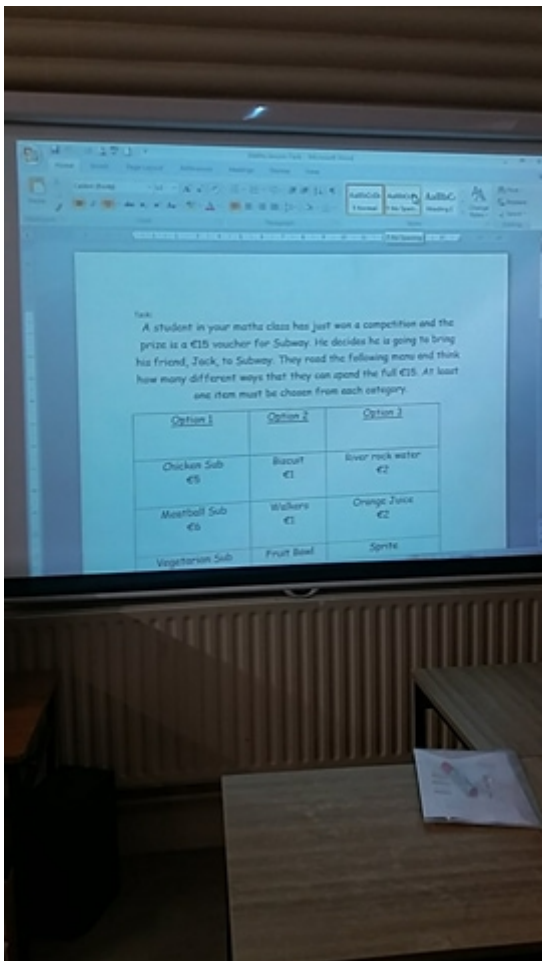
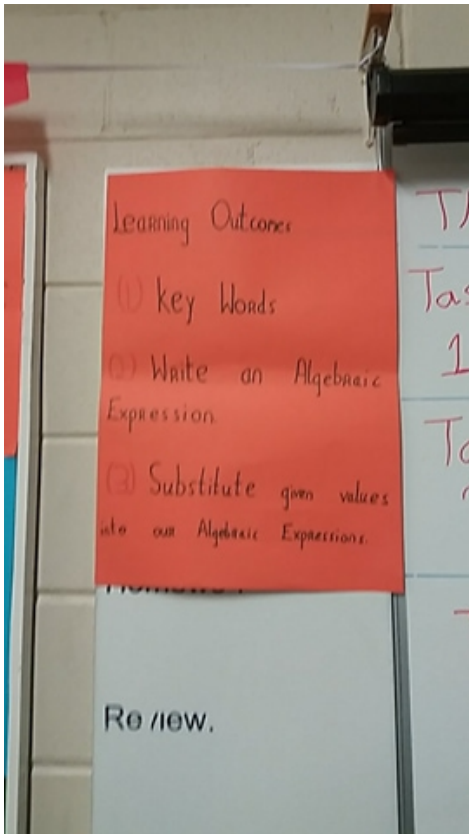
<p>ensure that the expressions presented on the whiteboard add up to €15.</p> <p>(8 mins)</p>		
<p><u>Comparing and Discussing:</u></p> <p>Collaboratively, we will go through the different tasks from the lesson. We will discuss the material presented on the board.</p> <p>As a class we will agree on one notation for the options on the menu.</p> <p>Homework assignment handed out now and students will note their homework in their journals.</p> <p>(4 mins)</p>		
<p><u>Summing up & Reflection:</u></p> <p>Students will review their learning using the traffic lights system. I.e. how confident they are in writing an expression and filling in values for different expressions.</p> <p>(4 mins)</p>	<p>I will ascertain the students understanding of this topic by using this assessment of learning (AOL) tool.</p> <p>This will provide valuable information for planning tomorrow's lesson.</p>	

NOTES re in-between desk work

- When students are writing their expression on the whiteboard I will highlight any misconceptions of the work then. By doing this students get to analysis where they might potentially go wrong.
- I will move around the classroom when students are filling in their expressions. This way I can monitor any mistakes made. If there is a recurring mistake I will highlight it on the whiteboard.
- Throughout the lesson I will ensure that I stick to my time plan.

9. Board Plan





Evaluation:

As a group we felt the goals of the lessons were met. The seating plan allowed for group discussion. Firstly, students worked on the task themselves before discussing the task collaboratively. Students weren't afraid to engage with each other throughout the lesson. Students used various approaches such as the listing method, tabulating, abbreviating the words using variables while displaying their work vertically and horizontally.

10. Reflection

Learner Experiences:

From the post lesson reflection, that the students completed, it was evident that the students thoroughly enjoyed and engaged in the lesson and could see the everyday relevance of Algebra. Students enjoyed the opportunity to discuss the different tasks. Each student had a voice. The class took pride in the work that they displayed. The class appreciated the different approaches taken to the different problems. The lesson was student lead. Students had control of their own learning by deciding which solution would be put forward as an agreed solution. As a class they debated the merits of each solution presented and decided which method they would use going forward, with a clear understanding of why this method was chosen. The traffic lights system gave an immediate visual demonstration of understanding. This was further supported in the post lesson reflection. Students had a great sense of respect of each other's work. There was a willingness to listen and learn from one another. From a teacher point of view, the advanced preparation and planning allowed for the lesson to flow easily.

Appendix:

Appx 1 (a.)

JUNIOR CERTIFICATE EXAMINATION 2015 MATHEMATICS CHIEF EXAMINER'S REPORT

Analysis of Candidate Performance Ordinary Level

Paper	Q	Mean Mark / Total Mark	Mean Mark (%)	Mark Ranking (Examination)	Main Topic
1	1	20.3 / 25	81	6	3.1, 3.2 Number
1	2	13.7 / 20	69	14	3.5 Number
1	3	21.0 / 25	84	3	3.3, 3.6 Number
1	4	16.4 / 25	66	15	3.3, 3.4 Number
1	5	9.4 / 10	94	1	3.5 Number
1	6	18.7 / 20	94	2	3.3, 3.6 Number
1	7	8.3 / 20	42	23	5.2 Functions
1	8	14.3 / 20	72	11	4.5 Algebra 3.4 Number
1	9	12.7 / 40	32	24	4.6 Algebra
1	10	24.8 / 35	71	12	5.2, 5.3 Function 4.2 Algebra
1	11	17.0 / 40	43	22	4.7 Algebra
1	12	16.6 / 20	83	4	3.1, 3.6 Number 4.6 Algebra
2	1	12.3 / 20	62	16	1.1, 1.3 Stats & Prob.
2	2	16.0 / 20	80	7	3.4 Number
2	3	18.4 / 30	61	17	2.1, 2.2, 2.4 Geom. & Trig.
2	4	20.4 / 25	82	5	1.6 Stats & Prob.
2	5	11.6 / 15	77	8	1.6, 1.8 Stats & Prob.
2	6	23.8 / 40	60	18	2.3 Geom. & Trig.
2	7	12.0 / 25	48	21	2.1 Geom. & Trig.
2	8	21.5 / 30	72	9	1.6 Stats & Prob.
2	9	17.9 / 25	72	10	3.4 Number
2	10	17.3 / 30	58	19	3.4 Number
2	11	14.0 / 20	70	13	2.4 Geom. & Trig.
2	12	9.8 / 20	49	20	2.3 Geom. & Trig.

Appx 1 (b.)

Analysis of Candidate Performance
Higher Level

Paper	Q	Mean Mark / Total Mark	Mean Mark (%)	Mark Ranking (Examination)	Main Topic ⁴
1	1	12·0 / 15	80	5	3.5 Number
1	2	10·9 / 15	73	11	3.3 Number
1	3	11·8 / 25	47	27	3.3 Number
1	4	6·0 / 10	60	20	5.1 Functions
1	5	12·0 / 15	80	4	4.6, 4.7 Algebra
1	6	22·9 / 30	76	9	5.2, 5.3 Functions
1	7	15·3 / 20	77	8	4.6 Algebra
1	8	12·3 / 15	82	3	4.7, 4.8 Algebra
1	9	14·4 / 20	72	12	4.6, 4.7 Algebra
1	10	19·9 / 25	80	6	3.5 Number
1	11	25·3 / 40	63	17	2.1 Geom. & Trig. 4.2, 4.7 Algebra 5.2 Functions
1	12	13·7 / 20	69	14	4.6, 4.7 Algebra
1	13	6·9 / 20	35	28	5.1, 5.2, 5.3 Functions
1	14	18·3 / 30	61	19	3.1, 3.6 Number
2	1	14·1 / 15	94	1	1.6, 1.8 Stats & Prob.
2	2	17·6 / 20	88	2	1.1, 1.6, 1.8 Stats & Prob.
2	3	12·7 / 20	64	16	1.4, 1.5 Stats & Prob.
2	4	18·5 / 30	62	18	3.4 Applied measure
2	5	18·7 / 25	75	10	2.2, 2.3 Geom. & Trig.
2	6	11·9 / 20	60	21	2.3 Geom. & Trig.
2	7	7·8 / 15	52	25	2.1 Geom. & Trig.
2	8	7·7 / 15	51	26	2.1, 2.4 Geom. & Trig.
2	9	19·6 / 30	65	15	1.3, 1.6, 1.8 Stats & Prob.
2	10	10·6 / 15	71	13	1.6, 1.8 Stats & Prob.
2	11	11·4 / 20	57	22	2.1 Geom. & Trig.
2	12	15·4 / 20	77	7	2.1 Geom. & Trig.
2	13	18·3 / 35	52	24	2.4 Geom. & Trig. 3.4 Applied measure
2	14	11·1 / 20	56	23	3.2 Number 3.4 Applied measure

Appx 2 (a.)

OL Algebra Questions

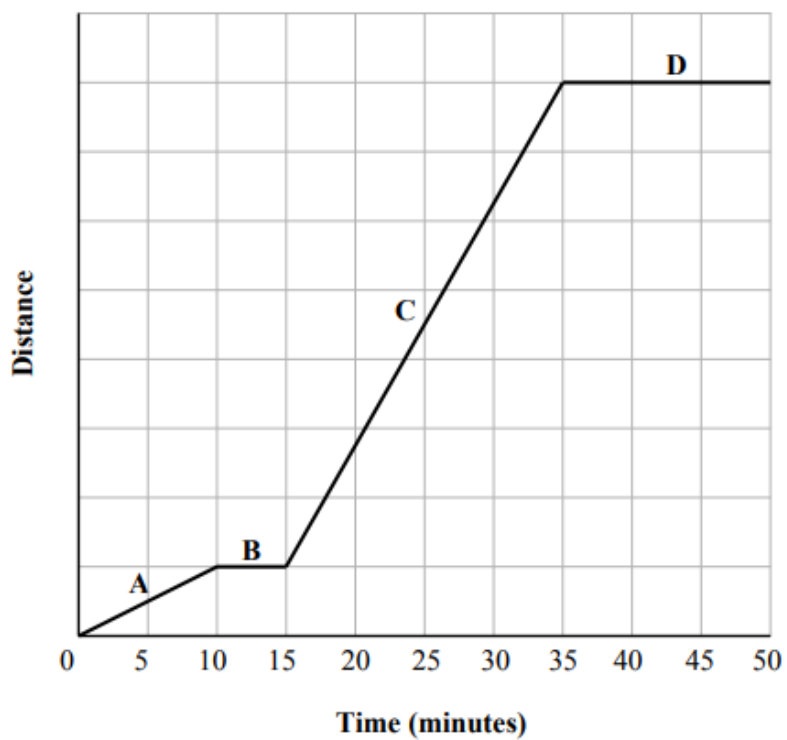
Question 8

(Suggested maximum time: 10 minutes)

Gráinne is taking part in a training session.

The graph shows the distance she travelled during the session.

The four parts of the graph are labelled **A**, **B**, **C**, and **D**.



- (a) Write the letters **A**, **B**, **C**, and **D** into the table to match each description with the correct part of the graph.

Description	Part of the Graph
Gráinne runs for 20 minutes	
Gráinne stops for 15 minutes	
Gráinne walks for 10 minutes	
Gráinne stops for 5 minutes	

- (b) Gráinne runs 4 km in 20 minutes at a steady pace.
Find her speed in km per hour.

A grid consisting of 20 columns and 10 rows, used for calculations.

Question 9

(Suggested maximum time: 5 minutes)

Factorise fully each of the following.

(a) $7x - 21y$

A grid consisting of 20 columns and 10 rows, used for calculations.

(b) $x^2 - 25$

A grid consisting of 20 columns and 10 rows, used for calculations.

(c) $x^2 - x - 6$

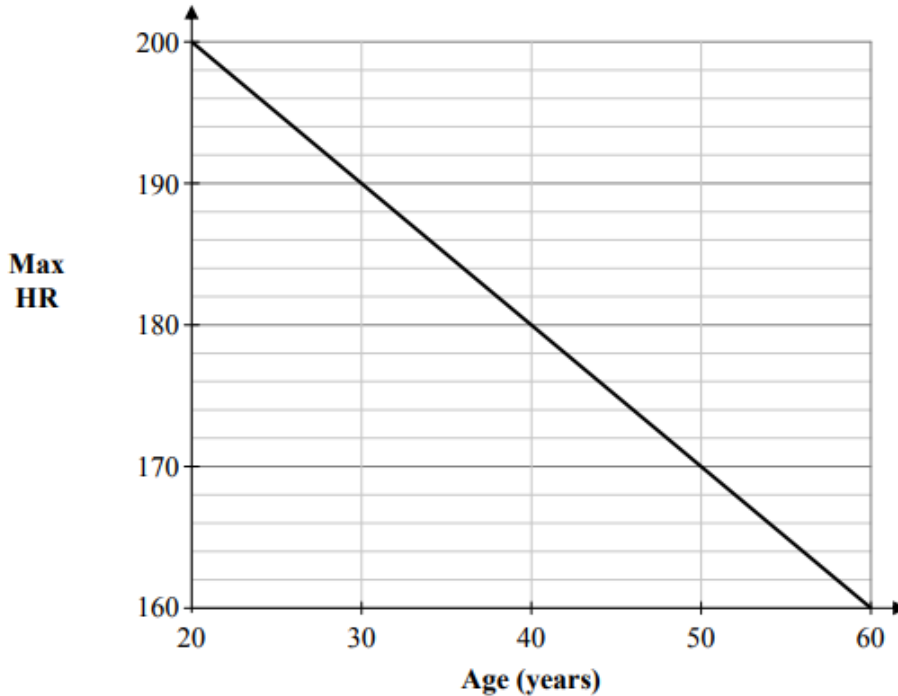
A grid consisting of 20 columns and 10 rows, used for calculations.

Question 10

(Suggested maximum time: 15 minutes)

A gym has three different formulas to estimate your maximum heart rate (Max HR), given your age in years. Different formulas can give different estimates.

The **first formula** is shown in the graph below.



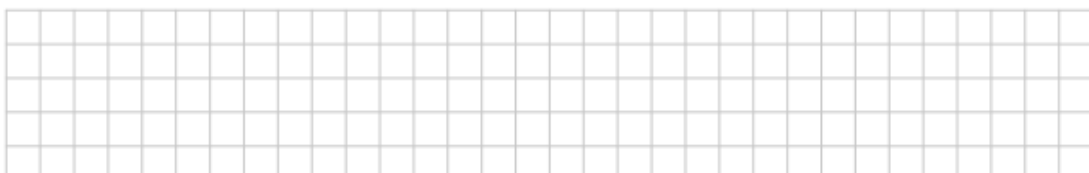
- (a) Use the graph above to find the Max HR for someone aged 30 years and someone aged 50 years. Show your work on the graph.

Max HR for 30 years =

Max HR for 50 years =

- (b) Part of the formula that gives this graph is shown below. Fill in the missing number in the formula.

Max HR = minus your Age.



The **second formula** for finding Max HR is:

$$\text{Max HR} = 210 \text{ minus Half your Age.}$$

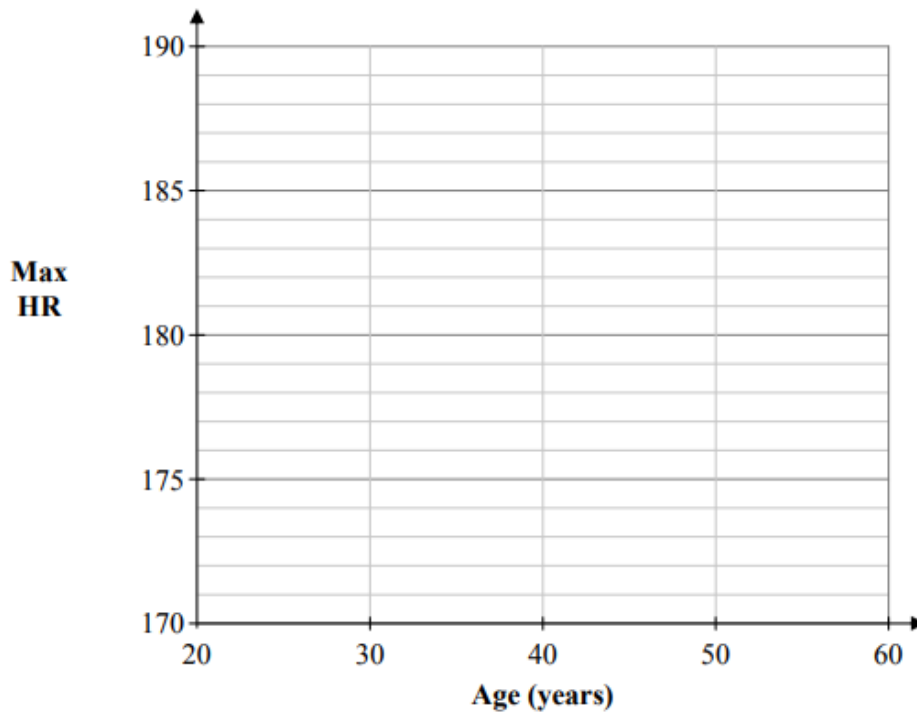
(c) Use this formula to find the Max HR for someone aged 60 years.

The **third formula** is shown in the table on the right.
The pattern in the Max HR column is a **linear** pattern.

(d) Complete the table.

Age (years)	Max HR
20	190
30	186
40	
50	
60	

(e) Using the values in the table, draw a graph on the grid below to show the Max HR for all ages from 20 years to 60 years.



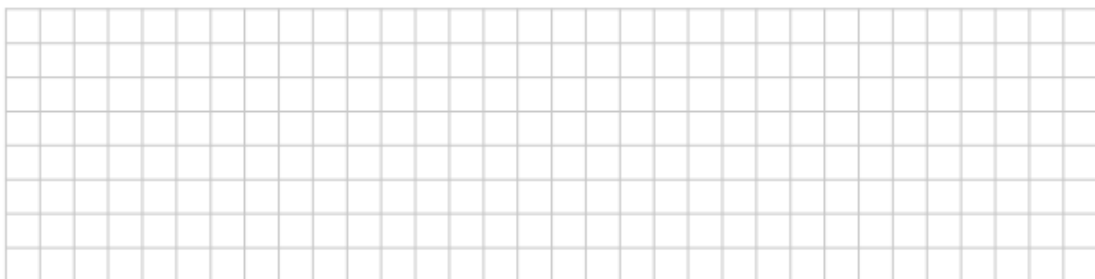
Question 11

(Suggested maximum time: 10 minutes)

- (a) Solve the equation $5x - 10 = 3x + 2$.



- (b) John says that $x = 4$ is a solution of $x^2 - 2x - 8 = 0$. Show that John is correct.



- (c) Solve the simultaneous equations:

$$\begin{aligned}x + y &= 11 \\x - y &= -5.\end{aligned}$$



Question 12**(Suggested maximum time: 10 minutes)**

Martin creates a pattern of numbers using the instructions in the table below.
The first number is filled in.

(a) Complete the table.

Instruction	First Number	Second Number	Third Number
Starting Number	5	6	7
Multiply by 3	5×3		
Subtract 5 from your answer	$15 - 5$		
Outcome	10		


(b) Martin picks a starting number and, using the instructions, gets an outcome of 1.
Find the **starting number** he picked.

(c) When the starting number is k , what is the **outcome**? Give your answer in terms of k .

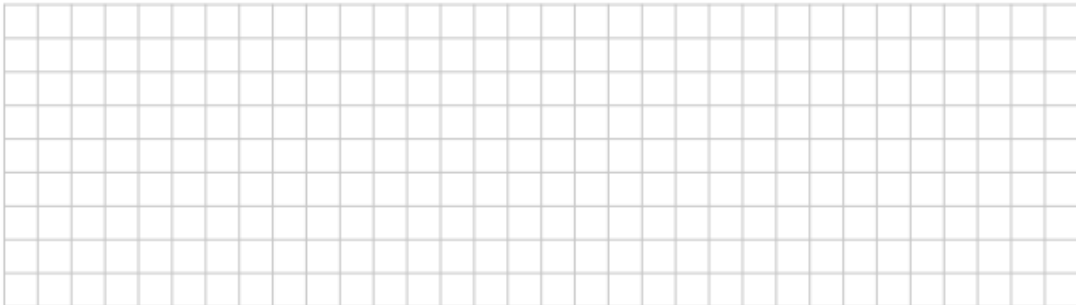
Question 7

(Suggested maximum time: 5 minutes)

- (a) Multiply out and simplify $(x + 5)(x^2 - 2x + 6)$.



- (b) Factorise fully $ac - ad - bd + bc$.



- (c) Write the following as a single fraction in its simplest form.

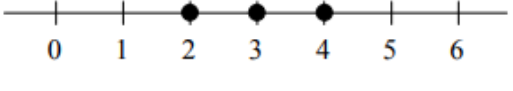
$$\frac{x+2}{3} - \frac{x-3}{4}$$



Question 8

(Suggested maximum time: 5 minutes)

(a) Complete the inequality in n below so that it has the solution set shown.

Inequality	Solution Set
$\boxed{} \leq n \leq \boxed{}, n \in \mathbb{N}.$	 <p>A number line with tick marks at 0, 1, 2, 3, 4, 5, and 6. Solid black dots are placed at the positions 2, 3, and 4.</p>

(b) Complete the inequality in x below so that there is only **one** possible value of x , where $x \in \mathbb{R}$.

$$\boxed{} \leq x \leq \boxed{}, x \in \mathbb{R}.$$

Question 9

(Suggested maximum time: 10 minutes)

- (a) (i) Factorise $x^2 + 7x - 30$.

- (ii) Hence, or otherwise, solve the equation $x^2 + 7x - 30 = 0$.

- (b) Solve the equation $2x^2 - 7x - 10 = 0$.
Give each answer correct to two decimal places.

Quality Framework for Post-Primary Schools – Teaching & Learning

Learner outcomes	<p>Students enjoy their learning, are motivated to learn, and expect to achieve as learners <input type="checkbox"/></p> <p>Students have the necessary knowledge and skills to understand themselves and their relationships <input type="checkbox"/></p> <p>Students demonstrate the knowledge, skills and understanding required by the post-primary curriculum <input type="checkbox"/></p> <p>Students attain the stated learning outcome for each subject, course and programme <input type="checkbox"/></p>
Learner experiences	<p>Students engage purposefully in meaningful learning activities <input type="checkbox"/></p> <p>Students grow as learners through respectful interactions and experiences that are challenging and supportive <input type="checkbox"/></p> <p>Students reflect on their progress as learners and develop a sense of ownership of and responsibility for their learning <input type="checkbox"/></p> <p>Students experience opportunities to develop the skills and attitudes necessary for lifelong learning <input type="checkbox"/></p>
Teachers' individual practice	<p>The teacher has the requisite subject knowledge, pedagogical knowledge and classroom management skills <input type="checkbox"/></p> <p>The teacher selects and uses planning, preparation and assessment practices that progress students' learning <input type="checkbox"/></p> <p>The teacher selects and uses teaching approaches appropriate to the learning intention and the students' learning needs <input type="checkbox"/></p> <p>The teacher responds to individual learning needs and differentiates teaching and learning activities as necessary <input type="checkbox"/></p>
Teachers' collective / collaborative practice	<p>Teachers value and engage in professional development and professional collaboration <input type="checkbox"/></p> <p>Teachers work together to devise learning opportunities for students across and beyond the curriculum <input type="checkbox"/></p> <p>Teachers collectively develop and implement consistent and dependable formative and summative assessment practices <input type="checkbox"/></p> <p>Teachers contribute to building whole-staff capacity by sharing their expertise <input type="checkbox"/></p>

Junior Cycle Key Skills and Statements of Learning

Key Skills

KS1	Managing myself
KS2	Staying well
KS3	Monitoring information & thinking
KS4	Being numerate
KS5	Being creative
KS6	Working with others
KS7	Communicating
KS8	Being literate

Statements of Learning

	The student
SL1	communicates effectively using a variety of means in a range of contexts in L1*
SL2	listens, speaks, reads and writes in L2* and one other language at a level of proficiency that is appropriate to her or his ability
SL3	creates, appreciates and critically interprets a wide range of texts
SL4	creates and presents artistic works and appreciates the process and skills involved
SL5	has an awareness of personal values and an understanding of the process of moral decision making
SL6	appreciates and respects how diverse values, beliefs and traditions have contributed to the communities and culture in which she/he lives
SL7	values what it means to be an active citizen, with rights and responsibilities in local and wider contexts
SL8	values local, national and international heritage, understands the importance of the relationship between past and current events and the forces that drive change
SL9	understands the origins and impacts of social, economic, and environmental aspects of the world around her/him
SL10	has the awareness, knowledge, skills, values and motivation to live sustainably
SL11	takes action to safeguard and promote her/his wellbeing and that of others
SL12	is a confident and competent participant in physical activity and is motivated to be physically active
SL13	understands the importance of food and diet in making healthy lifestyle choices
SL14	makes informed financial decisions and develops good consumer skills
SL15	recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning
SL16	describes, illustrates, interprets, predicts and explains patterns and relationships
SL17	devises and evaluates strategies for investigating and solving problems using mathematical knowledge, reasoning and skills
SL18	observes and evaluates empirical events and processes and draws valid deductions and conclusions
SL19	values the role and contribution of science and technology to society, and their personal, social and global importance

SL20	uses appropriate technologies in meeting a design challenge
SL21	applies practical skills as she/he develop models and products using a variety of materials and technologies
SL22	takes initiative, is innovative and develops entrepreneurial skills
SL23	brings an idea from conception to realisation
SL24	uses technology and digital media tools to learn, communicate, work and think collaboratively and creatively in a responsible and ethical manner

L1 is the language medium of the school (Irish in Irish-medium schools). L2 is the second language (English in Irish-medium schools).