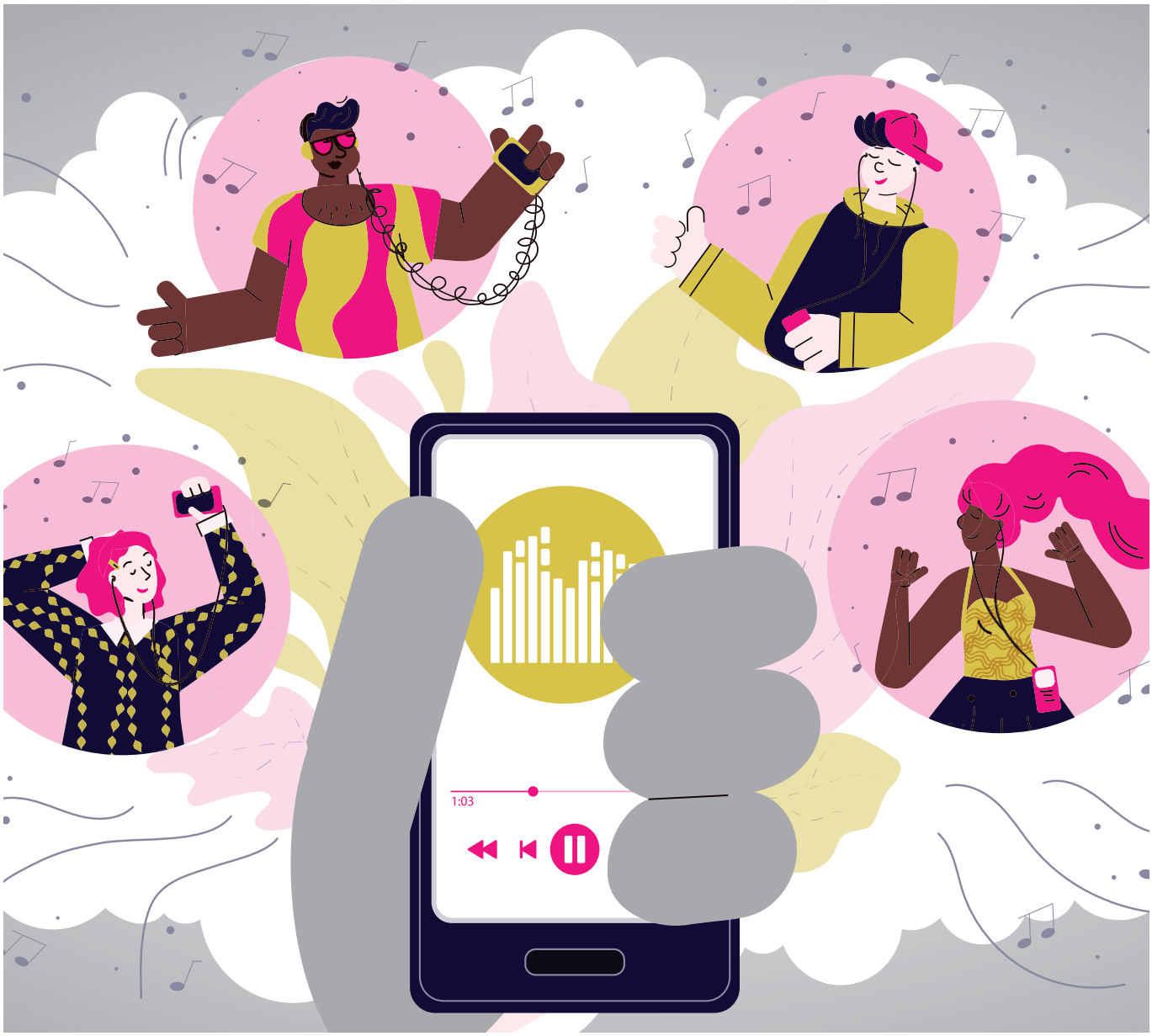
GEC INTEGRATED GRADE 9 PROJECT

TEACHER'S PROJECT NOTES



3 ENTREPRENEURSHIP
EMPLOYABILITY
EDUCATION

PROJECT-BASED LEARNING | TECH, MATH & NS

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

Read to Lead
A Reading Nation is a Leading Nation

2030 NDP

GRADE 9
2023

Table of contents

Dear Teacher

We would like to welcome you as an integral part and research partner in a representative sample group for piloting the new, revised General Education Certificate, or GEC.

The GEC forms part of the National Assessment Framework (NAF) and our hope is that it will assist learners in developing a holistic skill set after ten years of schooling, and to test and learn how best we can enable Districts and Provinces to prepare for the actual GEC roll out in a few years time. Therefore we are testing and implementing the 360 degree assessment model which will include an Inclinations Quiz, School-based assessment for Term 3 (the Integrated Project) and Curriculum tests.

This Integrated Project forms part of the school-based assessment. It is one of two projects that will replace the 9 projects (one for each subject) in the third term. The integrated projects are modeled on a Project-based learning methodology, creating activities that more closely replicate real-life experiences, and thus develop real-life competencies.

The integrated project includes SBA project marks for all subjects (as per the amended ATP) and is aligned to the CAPS amended ATP in each subject. This means that teachers will not have to do any extra work.
To assist teachers in implementing the Integrated Project, there is a step-by-step guide (Teacher's Project Notes), a Resource Pack with extra information, Electronic resources (like instructional videos) and a Learner's Workbook.

All rubrics have been added to the Teacher's Project Notes to simplify implementation and create less work for teachers who are stepping into uncharted territory.

Teachers from all the subjects integrated into this project, will have to plan and work together towards a common goal. We suggest that you form a PLC at school where teachers can support and assist each other during the third term.

Thank you for taking on this important role in the holistic development of our learners. You will enjoy much support from the district, province and nationally, as well as the E^3 team in each province.

We acknowledge your commitment and honour all your hard work.

The DBE-E^3 team

Project summary

Revise your knowledge on electrical circuits, learn more about resistance in circuits and use this new knowledge to research, design and build a simple device that solves the problem for one of these two scenarios

1. Amy works in a small clothing shop and she loves to read. She often gets so engrossed in her book that she doesn't notice when clients enter the store. Help Amy to build a small door alarm that sounds a buzzer when clients enter.
2. Khotso sometimes looks after his sick grandmother in the afternoons. When he plays soccer with his friends outside the house, he cannot hear when she calls for him. Please help him to create a calling bell so he can hear his grandmother calling him when she needs him.

Present your solution to an audience. Explain your outputs using graphs and calculated values.

OBSERVING 21ST CENTURY SKILLS DURING THE IMPLEMENTATION OF GEC-INTEGRATED PROJECTS

As a teacher you already know that you play an **essential role as a facilitator of learning**. You know that rather than simply giving knowledge to learners, you create an environment in which your learners can **explore, discover**, and **construct** their own understanding of the subject matter. As a facilitator you

- create an **emotionally and psychologically safe learning environment** so that learners feel safe to participate in the lesson,
- provide **prompts** when learners get stuck,
- provide **constructive and timely feedback** to learners,
- and make adjustments to your lesson based on what you observe (this is assessment as learning) so that learners can grow their understanding and grow their skills and competencies.

While learners are working on this project, your role as a facilitator is to **observe, listen, and record the process of their learning (21st century skills)** during the project. If you're new to formally observing these skills, we have provided guidance for each task by suggesting particular 21st century skills you might focus on. You will find these suggestions in the boxes entitled *'21st century skills to look out for.'* These suggestions are not exclusive; they're intended to simplify your observation process so you do not need to try and observe everything all at once. Once the process becomes more familiar to you, you can begin to explore ways to observe additional or different skills. To find out more about the 21st Century Skills please read the 'Teachers guide to 21st Century Skills" as well as the GEC Manual, under the section 21st century skills.

PART 1 EXPLORING THE WORLD
(INQUIRY-BASED LEARNING)

Please note: This project covers 100% of the Technology third term task mark (70 marks), 50% of Mathematics third term task marks (50 marks) and 50% of the Natural Sciences third term task marks (30 marks).

STEP 1: Prior knowledge

Think about what you already know

Purpose of this step: The learner reflects on and shares his/her own knowledge, experiences and perspectives (stimulating prior knowledge and evaluating baseline knowledge).

21st century skills to look out for
In this step, learners are reflecting on and sharing his/her own knowledge, experiences, and perspectives. In this step, you may have the opportunity to observe elements of **Metacognition.** Metacognition is about being aware of how we think, what we know, and how we know it. Metacognition helps us to reflect on our thinking, set goals, and monitor and evaluate our learning. Some of the Sub-skills that make up Metacognition include ***5.1 Setting goals and planning:*** Did the learner set goals and make a plan during the project? ***5.2 Monitoring progress against plans:*** Did the learner monitor their progress against their plans? ***5.3 Reflecting on planned work:*** Did the learner reflect on their project and or their prior knowledge?

1.1 (+NS +TECH) Learners start with Circle Map on ***Worksheet 1***: They list the electronic components used in the different appliances in the provided space.

STEP 2: New knowledge

Build on what you already know and add new knowledge

Purpose of this step: Learner observes or takes part in something new that is an extension / expansion of prior knowledge.

21st Century skills development
In this step, learners observe or take part in something new that is an extension/expansion of their prior knowledge. In this step, you may have the opportunity to observe elements of **Critical Thinking**. Critical thinkers ask questions, find the right information, and apply it to solve a problem. Some of the sub-skills that make up critical thinking include ***1.1 Asking questions:*** did the learner ask appropriate questions to find out more information? ***1.2 Evaluating ideas/information***: was the learner able to identify what information was useful to solve the problem? ***1.3 Identifying patterns***: did the learner use tools (e.g. mind maps and diagrams) to help them to organise information?

2.1 (+NS+TECH) Now is the time to revise what learners know/have learnt about circuits. Learners use the circuit drawing on ***Worksheet 2*** to add labels to the items they already recognize.

2.2 (+NS+TECH) Items they don't recognize in the circuit drawing, need to be researched. They can be allowed to do this research by using their handbooks, the internet, asking each other or any other method to identify the new components.

2.3 (+TECH) This is a good time to introduce new knowledge and practice investigative skills. On ***Worksheet 3*** learners study the electronic/electrical components in the left column, draw the symbol and give the function of each component in the space provided.

STEP 3: Order

Order and categorise your existing knowledge

Purpose of this step: To order and make sense of information and knowledge that emerged in *Knowledge* and *New knowledge* steps.

21st century skills to look out for

In this step, learners order and make sense of information and knowledge that emerged in the previous two steps.

In this step, you may have the opportunity to observe elements of **Critical Thinking**. Critical thinkers ask questions, find the right information, and apply it to solve a problem. Some of the sub-skills that make up critical thinking include ***1.1 Asking questions, 1.2 Evaluating ideas/information, 1.3 Identifying patterns.***

3.1 (+NS) Learners use ***Worksheet 4*** to formulate an investigative question for the project. They write down an initial research question and then try to improve on it.

STEP 4: Apply

Apply your knowledge to your context (driving question)

Purpose of this step: To use knowledge to answer the driving question

21st century skills to look out for

In this step learners use knowledge to answer the driving question.

In this step, you may have the opportunity to observe elements of **Critical Thinking**. Critical thinkers ask questions, find the right information, and apply it to solve a problem. Some of the sub-skills that make up critical thinking include ***1.1 Asking questions, 1.2 Evaluating ideas/information, 1.3 Identifying patterns.***

4.1 (+NS+TECH) Learners study the two scenarios. They choose one of the scenarios to work on.

PART 2 EMBRACING THE CHALLENGE
(PROBLEM-BASED LEARNING)

STEP 5: Define

Ask lots of questions to help you define your problem

Purpose of this step: Push for clarity on the problem/questions.

21st century skills to look out for
In this step learners will be defining their problem. In this step, you may have the opportunity to observe elements of **Communication.** Communication is the process of sharing information, attitudes, and values. Both "what we say" (verbal communication) and "how we say it" (non-verbal communication) are important). Some of the sub-skills that make up Communication include: ***2.1 Non-verbal communication***: did the learner recognises nonverbal cues such as tone of voice and expression? ***2.2 Articulation***: Did the learner uses the correct language for the situation? ***2.3 Empathising***: Did the learner try to understand how others were feeling?

5.1 On ***Worksheet 5*** learners write a design brief (TECH) for the identified problem or scenario, followed by specifications ***5.2*** and constraints ***5.3***. Learners draw a relevant circuit diagram on ***Worksheet 5: 5.4*** (+NS+TECH) to solve the problem from the selected scenario.
On ***Worksheet 5: 5.5*** learners draw a 3D freehand sketch (TECH) of the structure (housing) that will enclose the electronic circuit.

STEP 6: Explore

Consider different points of view to help you understand more

Purpose of this step: Research phase – what do we need to answer the question/solve the problem?

21st century skills to look out for
In this step learners carry out research to consider different points of view to help them to understand more about the problem or task. In this step, you may have the opportunity to observe elements of **collaboration** and **metacognition.**

6.1 (+NS) Groupwork. On ***Worksheet 6a*** learners note the decisions the group must make and/or problems they need to solve to build their device.

6.2 (+TECH) Learners use ***Worksheet 6b*** to require and practice new knowledge, calculate values in circuits, and solve everyday problems by applying their knowledge.

Your concern: *It might concern you that your learners might not have access to these electrical components or even recycled/second-hand sourced ones. This should not matter. Even if there is ONE working example of each device that you can build and use to demonstrate to all classes, the learning experience would be worthwhile. The curiosity is there ✓, the research has been done ✓ and even the construction of the 3D circuit can take place ✓ because they must study what these components look like to reproduce them specifically ✓. In other words, some active learning has taken place.*

STEP 7: Brainstorm*

Brainstorm as many solutions to your problem as possible

Purpose of this step: Discuss and share possible solutions

21st century skills to look out for

In this step, learners discuss and share possible solutions to their problems. In this step, you may have the opportunity to observe elements of **Critical thinking** and **Metacognition.**

7.1 (+TECH+NS) Groupwork. Using the criteria in ***Worksheet 7***, learners analyse and evaluate their individual designs according to the requirements mentioned in the scenario. They suggest improvement and select a final idea which they will build.

7.2 (+TECH) Learners use the isometric grid (***Worksheet 7: 7.3***) to make an exploded view of the device to show how the model fits together.

7.3 (+MATH) Groupwork. This is a great opportunity to introduce practical mathematics and how it will help solve the research problem, or aspects of it. Learners use ***Worksheet 8a: Activity 1*** to work on pricing of components. Activity 2 (***Worksheet 8a***) is also done in groups. Activity 3 is for individual work.

7.4 (+MATH) Learners now continue to ***Worksheet 8b***. In groups, they study ohm's law and use it in follow-up calculations. They plot points on a linear graph and interpret the graph according to the worksheet questions.

7.5 (+MATH) In groups, learners use ***Worksheet 8c*** to design packaging solutions for similar devices and they calculate surface area and the volume of paint needed to finish the designed package.

7.6 (+NS) Learners use the calculations they have practiced in ohm's law (MATH worksheets) to complete ***Worksheet 9*** on their own. Please note, if they can use the real values on their built circuits, is would be perfect. But some values are provided to assist in calculations where learners do not have access to a multimeter/ammeter/voltmeter

STEP 8: Present

Present the point of view and options to an audience

Purpose of this step: Presenting the possible solutions for iteration/change

21st century skills to look out for
In this step learners present possible solutions to their problem. In this step, you may have the opportunity to observe elements of **Communication** and **Metacognition.**

8.1 In this step learners can present their ideas to a panel of Technology, Natural Science and Mathematics teachers. They are seeking feedback on their viability of working design, design presentation, calculated values and graph presentations.
8.2 The panel uses ***Worksheet 11*** to give feedback for iteration.

PART 3 DESIGNING THE FUTURE
(DESIGN-BASED LEARNING)

STEP 9: Evaluate

Evaluate and select your best solution

Purpose of this step: Look at the best solution for the problem/choose the best option.

21st century skills to look out for
In this step, learners determine the best solution to their chosen problem. In this step, you may have the opportunity to observe elements of **Metacognition.**

9.1 All feedback is considered and small adjustments are made to parts of the plan where necessary.
9.2 Learners also finalise their plans before they start building their product.

STEP 10: Prototype

Make the prototype of your best solution

21st century skills to look out for
In this step, learners build or make a prototype based on their design. In this step, you may have the opportunity to observe elements of **Collaboration.**

Purpose of this step: Build or make the prototype based on the design

10.1 Learners build their device/circuit with real components (or create mock components from recycled material). They use the instructions on ***Worksheet 10***. Please also make the build rubric available to them.
10.2 Learners test their product (if they are building the real one).
10.3 Learners build a housing for the device.

STEP 11: Feedback

Speak to experts or the community to get REAL feedback

Purpose of this step: To get expert feedback about possible improvements or design changes

21st century skills to look out for
In this step, learners seek expert feedback on their work. In this step, you may have the opportunity to observe elements of **Creativity** and **Metacognition.**

11.1 Learners show their prototypes (the actual build, not only plans) to members of their family, or community who would be able to give real feedback ***Worksheet 12.***
11.2 They make the final changes as per feedback and practice their presentation.

STEP 12: Integration

Integration in The MADD Space – present your work using Music, Art, Drama, Dance

Purpose of this step: To iterate learning in a fun way, but also an opportunity for another creative arts assessment activity if the activity is designed by your Creative Arts colleague.

21st century skills to look out for
In this step, learners will present their work using, Music, Art, Dance, or Drama. In this step, you may have the opportunity to observe elements of **Creativity** and **Collaboration.**

12.1 Groups can choose to create their own composition (song, rap song, etc.) to use during the demonstration of their device.

STEP 13: Present

Public exhibition

Purpose of this step: Present and celebrate the products

21st century skills to look out for
This step might present an opportunity to observe elements of **Communication, Collaboration** and **Metacognition.**

13.1 At this event (which can be an exhibition in class or in the school hall/library) learners exhibit their device.
13.2 They present their process, actual product and calculations as a group (they can take turns to present parts of it).
13.3 Learners interact with members of the audience (parents, teachers, other learners, even community members) to demonstrate their product.
13.4 Learners take time in class after the public exhibition to reflect on their experience of the project. They use ***Worksheet 13*** for this reflection.

GRADE 9 INTEGRATED PROJECT – NATURAL SCIENCES RUBRIC 30 MARKS

Worksheet marks				
Worksheet 4: Assess the research question developed by learner				/ 5
Worksheet 5: number 5.4: Draw final circuit diagram (Design 2, Labeling 3)				/ 5
Subtotal Worksheets				/ 10
Circuit construction and Build (Worksheet 9)				
Item	Excellent 5	Good 4	Adequate 3	Poor 1-2
Identify dependent and independent variables.	-	-	-	-
Model of circuit construction	Excellent understanding of circuit construction. Innovative use of found materials to create mock components.	Good understanding of circuit construction. Good use of found materials to create mock components.	Adequate understanding of circuit construction. Could be more creative in the use of found materials to create mock components.	Limited understanding of circuit construction. Unsuccessful use of found materials to create mock components.
Output voltage vs input voltage – Graphical representation.	Neatly laid out. Axes clearly labelled. All points plotted correctly as well as linked.	Everything neatly plotted according to calculations, with small errors for example not giving a heading, or could have been neater.	In general, neatly done but due to some calculations errors, the graph is not a true presentation.	Untidy work, wrong calculations, missing the relationship between input voltage and output voltage completely.
Drawing conclusion on the relationship of variables	Hypothesis evaluated and correct relationship between variables stated, including control variables.	Hypothesis evaluated and correct relationship between variables stated.	Correct relationship between variables stated, but hypothesis not evaluated	Meaningful relationship between variables stated but incorrect (2) No valid relationship stated but mentions one variable (1)
Subtotal circuit construction and build				/ 20
FINAL MARK				**/ 30**

GRADE 9 INTEGRATED PROJECT – TECHNOLOGY RUBRIC 70 MARKS

Worksheet marks	
Worksheet 3: Investigation skills	15 ÷ 3 = 5
Worksheet 5: 5.1, 5.2, 5.3	3 + 3 + 2 = 8

WORKSHEET 5.4: RUBRIC TO ASSESS THE CIRCUIT DIAGRAM & FREEHAND SKETCH

Level	Criteria	Marks
1	Learner did not complete drawing. No or minimal labelling and or notes were provided. Learners need much help and motivation to draw properly. Incorrect selection of material for the labelling. No or little evidence of specifications being covered	0 - 2
2	Learners were able to complete the drawing with some labelling and guiding notes although it is not very clear. Drawing is not fully complete. Selection of material and specifications is fairly well presented in the labelling.	3 - 6
3	The drawing is aesthetically pleasing and mostly covers the design specifications with correct labelling and guiding notes that are properly structured. Good selection of material is evident.	7 - 9
4	Drawing is aesthetically pleasing with relevant creativity and covers design specifications completely. The labelling and guiding notes are well explained and fully covers all specifications. Well considered (spot - on) selection of material.	10 - 12

Assessment rubrics

GRADE 9 INTEGRATED PROJECT – TECHNOLOGY RUBRIC 70 MARKS

WORKSHEET 10 RUBRIC: MAKE

Level	Criteria	Marks
1	● Learners could not complete the device / prototype / model. ● Little to no consideration for specifications and constraints. ● Learners and group needed a lot of help and motivation. ● The device / prototype / model does not work at all, and the components were not connected. ● The device / prototype / model was not made to scale. ● Safe working practices were not followed while learners attempt to make the device / prototype / working model.	**1 - 7**
2	● Learners were able to complete the device / prototype / model. ● Some specifications and constraints were adhered to. ● All learners in the group attempted to put in effort to complete the model. ● The device / prototype / model was partially made to scale. ● Evidence of some safe working practices were illustrated while learners attempted to make the device / prototype / working model. ● Model appears acceptable and the components, buzzer/ LED are functioning.	**8 - 17**
3	● Learners were able to build a functional device / prototype / model. ● All specifications and constraints were adhered to. ● The model was neat, the components, buzzer / LED are functioning. ● All learners in the group attempted to put in effort to complete the model. ● Evidence of good safe working practices were illustrated while learners attempted to make the device / prototype / working model.	**18 - 27**
4	● Learners were able to build a functional and creative device / prototype / model. ● All specifications and constraints were adhered to. ● The model was accurately built to scale, the components, buzzer / LED are functioning. ● All learners in the group contributed the necessary effort to complete the model. ● Evidence of excellent safety and working practices were illustrated while learners attempted to make the device / prototype / working model.	**28 - 35**

Assessment rubrics

GRADE 9 INTEGRATED PROJECT – MATHEMATICS RUBRIC **50 MARKS**

WORKSHEET #	CONTENT AREA	TOPIC	CONCEPTS AND SKILLS
8A	Numbers, Operations and Relationships	Whole numbers	Calculations with whole numbers and decimal fractions
			Solving problems in financial context such as: • Discount and VAT • Simple Interest • Compound Interest • Rentals
		Decimal fractions	Calculations with whole numbers and decimal fractions
8B		Whole numbers	Direct and indirect proportion
	Patterns, Functions and Algebra	Numeric and geometric patterns	• Investigate and extend numeric patterns represented in tables Describe general rules for patterns
		Functions and relationships	Justify equivalence represented by: • tables, • equations • by graphs on a Cartesian plane
		Algebraic equations	Solve equations using additive and multiplicative inverses
		Graphs	Determine equations from linear graphs
8C	Space and Shape	Geometry of 2D shapes	Classifying 2 D shapes
		Geometry of 3D objects	Classifying 2 D shapes
	Measurement	Area and perimeter of 2D shapes	Area of polygons and circles
		Surface area and volume of 3D objects	Surface area of rectangular prisms
		the Theorem of Pythagoras	Solve problems using the Theorem of Pythagoras

GRADE 9 INTEGRATED PROJECT – MATHEMATICS RUBRIC 50 MARKS

Worksheet 10				
Item	Excellent 5	Good 4	Adequate 3	Poor 1-2
Conceptual understanding geometric shapes	Shows in-depth understanding of different geometric shapes.	Shows understanding of different geometric shapes.	Shows adequate understanding of different geometric shapes.	Shows little or no understanding of geometric shapes.
Procedural knowledge in drawing shapes, applying formulas	No errors in drawing shapes and applying formulas	Few errors or omissions in drawing shapes and applying formulas.	Frequent minor problems in drawing shapes and application of formulas.	Not efficient in drawing shapes and application of formulas.
Problem-solving skills in building shapes.	Uses appropriate and highly innovative strategies to replicate shapes in chosen material.	Uses appropriate strategies to replicate shapes in chosen material.	Needed some help to replicate shapes in chosen material.	Unable to find solutions to replicate shapes in the chosen material.
Final product	Beautifully built product that depicts the geometric shape chosen, very good choice of material to support design.	Well-built product depicting the chosen geometric shape, good choice of material to support design.	Adequate final product depicting the chosen geometric shape, generally smart choice of material to support design	Unable to produce a final product from the chosen geometric design. Material choice insufficient to support design.
Subtotal Worksheet 8				/ 20
FINAL MARK				**/ 50**