

The Asian International School
Unit Backward Design
Mathematics, Intermediate, 2018-2019
Chapter 1: Circles, Unit 1 Introduction to Circles

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>This chapter will introduce students to circles and the basic properties of circle. Students should understand the basic terminology and processes related to circles; center, radius, chord, diameter, arc, arc length, sector, intercepted arc, central angle, and inscribed angle.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Chords and the distance of a chord from the center of a circle • The properties of lines tangent to circles • The relative position of two circles. 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • What are the mathematical concepts that apply to circles?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> • The proper terminology for discussing circles • What relative position of two circles means • What chords are and how to work with them 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Define <ul style="list-style-type: none"> ○ Center ○ Radius ○ Diameter ○ Chord ○ Arc
Stage 2 - Assessment Evidence	
<p>Performance Task(s):</p> <p>To assess student progress made in this course, student work in the following activities will be clearly recorded and evaluated according to criteria, rubrics, and the teacher's discretion. Homework assignments will be given 10% and all the others will be given 30% of student grades.</p> <ul style="list-style-type: none"> • Comprehension (true/false, definitions, identifying topics and themes, etc.) • Solving pure mathematical problems as well as 	<p>Other Evidence:</p> <p>The following will also be observed, recorded, and considered for the final grade of students in each lesson activity</p> <ul style="list-style-type: none"> • Motivation • Engagement • Collaboration • Communication pattern among peers and with the teacher • Reactions

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word problems.

- Discussions and presentations
- Group project that involves research and report writing
- Homework assignments

- Respect to others and different opinions

Stage 3 – Learning Plan

Learning Activities:

In this course, students are involved in a variety of class activities to understand mathematics at a deeper level, to transfer their knowledge to other contexts, and to improve their skills of working with mathematics in the form of discussion, presentation, and interaction. In so doing, students demonstrate their ability to use English mathematical language and notation appropriate to their grade level. The following is a summary of lesson activities for the course.

1. Individual/pair/small group activity

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2. Discussion and presentation:

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3. Critical Thinking Activities

Students are involved in more challenging discussions and activities at grade level that are related to higher-order thinking skills according to the revised Bloom's Taxonomy as below:

Applying

Students can apply their knowledge on mathematical concepts to other contexts in their lives after reading. Student application of their knowledge will be demonstrated during the class activities, such as discussion, presentation, peer-review, and problem-solving.

Analyzing

Students can compare and contrast different methods for solving problems. Students also analyze different types of problems without a clearcut solution laid out for them. Finally, students will also analyze their peers board work and presentations. Students will gain an appreciation for peer-review, which is a fundamental element of both mathematics and science.

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Evaluating

Students can evaluate possible solutions to a problem and settle on the one that will best solve the problem at hand. Students will also evaluate the work of their peers and suggest alternative methods for solving problems. In doing so, students will gain a deeper understanding and appreciation for mathematics and mathematical thinking.

Creating

Students can demonstrate their creativity and imagination by working challenging problems based on their lesson. Some activities will involve solving real-world problems from a variety of disciplines. These problems will be different from the standard word problem as they will draw on the student's ability to link various aspects of mathematics together in order to solve the problem.

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Chapter 1: Circles, Unit 2: Arc length and Area of Sectors

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>This unit will introduce students to calculating arc length and the area of sectors of a circle. For all the calculations in this unit, students should be asked to give the “answer” in the form of π as well as a numerical estimate using $\pi \approx 3.14$. Solutions should not be considered correct if only a numerical estimate is given. Students will typically estimate π immediately, this should not be allowed—see the examples below for “correct” solutions.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Circumference and Area of a circle • The length of an arc on a circle • The area of a sector of a circle 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • How do we calculate the basic properties of circles? • What are arcs and sectors?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> • What Circumference and Area are • What an arc is • What a sector is 	<p>Skills: <i>Student will be able to calculate:</i></p> <ul style="list-style-type: none"> • Circumference and Area of a circle • The length of an arc on a circle • The area of a sector of a circle
Stage 2 - Assessment Evidence	
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- Discussions and presentations
- Group project that involves research and report writing
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Chapter 1: Circles, Unit 3: Angles Related to a Circle

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>This unit will introduce students to angles relating to circles and the concept of intercepting arcs and inscribed angles.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Intercepted arc • Central angle • Inscribed angle 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • What are some properties of arcs and the angles they generate?
<p>Knowledge: <i>Students will know how to ...</i></p> <ul style="list-style-type: none"> • Determine the relationship of the central angle to its intercepted arc and inscribed angle to its intercepted arc • Solve unknown angles in the circle 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Define and understand the concept of intercepted arc, central angle and inscribed angle • Determine the relationship of the central angle to its intercepted arc and inscribed angle to its intercepted arc • Solve unknown angles in the circle
Stage 2 - Assessment Evidence	
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- Homework assignments

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Chapter 1: Circles, Unit 4 Circle Theorems

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will be introduced to some basic theorems relating to circles.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Basic theorems related to circles 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • What are some well-known results relating to circles?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> • the relationship of the angle with its vertex inside the circle with its intercepted arcs and angles with its vertex outside the circle to its intercepted arcs • the concept of angle whose vertex is inside or outside the circle 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Define and understand the concept of angle whose vertex is inside or outside the circle • Determine the relationship of the angle with its vertex inside the circle with its intercepted arcs and angles with its vertex outside the circle to its intercepted arcs • Solve unknown angles in the circle
Stage 2 - Assessment Evidence	
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Chapter 2: Cylinders, Cones, and Spheres, Unit 1 Cylinders

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will be introduced to cylinders and their basic properties.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Cylinders • Lateral surface area • Height • Volume 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • What are the properties of cylinders?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> • Lateral surface area • Height • Volume 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Define and understand lateral surface, height or altitude of cylinder and volume • Calculate the lateral area and volume of a cylinder
Stage 2 - Assessment Evidence	
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Chapter 2: Cylinders, Cones, and Spheres, Unit 2 Cones

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will be introduced to cones and their basic properties.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Cones • Parts of a cone • Lateral area • Volume • Truncated Cones • Volume of a truncated Cone 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • What are the basic properties of cones?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> • Definitions and Construction of Cones and Truncated Cones • Basic Formulas for Cones and Truncated Cones 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Identify the parts of a cone • Calculate the lateral area of a cone • Calculate the volume of a cone • Calculate the volume of a truncated cone
Stage 2 - Assessment Evidence	
<p>Performance Task(s):</p> <p>To assess student progress made in this course, student work in the following activities will be clearly recorded and evaluated according to criteria, rubrics, and the teacher’s discretion. Homework assignments will be given 10% and all the others will be given 30% of student grades.</p> <ul style="list-style-type: none"> • Comprehension (true/false, definitions, identifying topics and themes, etc.) • Solving pure mathematical problems as well as word problems. • Discussions and presentations • Group project that involves research and 	<p>Other Evidence:</p> <p>The following will also be observed, recorded, and considered for the final grade of students in each lesson activity</p> <ul style="list-style-type: none"> • Motivation • Engagement • Collaboration • Communication pattern among peers and with the teacher • Reactions • Respect to others and different opinions

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report writing

- Homework assignments

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Chapter 2: Cylinders, Cones, and Spheres, Unit 3 Spheres

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will be introduced to spheres and their basic properties.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Spheres • Surface area • Volume 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • What are the basic properties of spheres?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> • The basic properties of spheres 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Calculate the surface area of a sphere • Calculate the volume of a sphere
Stage 2 - Assessment Evidence	
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Chapter 3: Linear Functions, Unit 1 Graphs of Linear Functions

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will learn about linear functions and how to graph linear functions.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> Linear functions and how to graph them 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> What are the simplest functions to work with?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> What linear functions are The different means for representing linear functions How to graph linear functions 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> Define and understand the meaning of slope, x- and y- coordinates, x- and y-intercepts, points or coordinates Graphing linear functions by; <ul style="list-style-type: none"> slope-intercept method x- and y-intercepts slope and a point Determine a linear function from a given graph
Stage 2 - Assessment Evidence	
<p>Performance Task(s):</p> <p>To assess student progress made in this course, student work in the following activities will be clearly recorded and evaluated according to criteria, rubrics, and the teacher's discretion. Homework assignments will be given 10% and all the others will be given 30% of student grades.</p> <ul style="list-style-type: none"> Comprehension (true/false, definitions, identifying topics and themes, etc.) Solving pure mathematical problems as well as word problems. Discussions and presentations Group project that involves research and report writing 	<p>Other Evidence:</p> <p>The following will also be observed, recorded, and considered for the final grade of students in each lesson activity</p> <ul style="list-style-type: none"> Motivation Engagement Collaboration Communication pattern among peers and with the teacher Reactions Respect to others and different opinions

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- Homework assignments

Stage 3 – Learning Plan

Learning Activities:

In this course, students are involved in a variety of class activities to understand mathematics at a deeper level, to transfer their knowledge to other contexts, and to improve their skills of working with mathematics in the form of discussion, presentation, and interaction. In so doing, students demonstrate their ability to use English mathematical language and notation appropriate to their grade level. The following is a summary of lesson activities for the course.

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Students in pair or in small groups will discuss a topic or an issue given. After a certain time, they will share their ideas with the class. This activity will boost student imagination and creativity, help them understand that mathematics is more than calculating, and improve cooperation and collaboration with peers.

3. Critical Thinking Activities

Students are involved in more challenging discussions and activities at grade level that are related to higher-order thinking skills according to the revised Bloom's Taxonomy as below:

Applying

Students can apply their knowledge on mathematical concepts to other contexts in their lives after reading. Student application of their knowledge will be demonstrated during the class activities, such as discussion, presentation, peer-review, and problem-solving.

Analyzing

Students can compare and contrast different methods for solving problems. Students also analyze different types of problems without a clearcut solution laid out for them. Finally, students will also analyze their peers board work and presentations. Students will gain an appreciation for peer-review, which is a fundamental element of both mathematics and science.

Evaluating

Students can evaluate possible solutions to a problem and settle on the one that will best solve the problem at hand. Students will also evaluate the work of their peers and suggest alternative methods for solving problems. In doing so, students will gain a deeper understanding and appreciation for mathematics and mathematical thinking.

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Creating

Students can demonstrate their creativity and imagination by working challenging problems based on their lesson. Some activities will involve solving real-world problems from a variety of disciplines. These problems will be different from the standard word problem as they will draw on the student's ability to link various aspects of mathematics together in order to solve the problem.

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Chapter 3: Linear Functions, Unit 2 Linear Equations in Two Variables

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will learn how to solve systems of linear equations in two variables.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Solving Linear equations in two variables without the use of a calculator 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • How do we solve linear equations with two variables?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> • How to solve linear equations by <ol style="list-style-type: none"> a. Graphing b. Substitution 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Graph linear equations using the different methods • Solve word problems involving solutions to system of linear equations
Stage 2 - Assessment Evidence	
<p>Performance Task(s):</p> <p>To assess student progress made in this course, student work in the following activities will be clearly recorded and evaluated according to criteria, rubrics, and the teacher's discretion. Homework assignments will be given 10% and all the others will be given 30% of student grades.</p> <ul style="list-style-type: none"> • Comprehension (true/false, definitions, identifying topics and themes, etc.) • Solving pure mathematical problems as well as word problems. • Discussions and presentations • Group project that involves research and report writing • Homework assignments 	<p>Other Evidence:</p> <p>The following will also be observed, recorded, and considered for the final grade of students in each lesson activity</p> <ul style="list-style-type: none"> • Motivation • Engagement • Collaboration • Communication pattern among peers and with the teacher • Reactions • Respect to others and different opinions

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Stage 3 – Learning Plan

Learning Activities:

In this course, students are involved in a variety of class activities to understand mathematics at a deeper level, to transfer their knowledge to other contexts, and to improve their skills of working with mathematics in the form of discussion, presentation, and interaction. In so doing, students demonstrate their ability to use English mathematical language and notation appropriate to their grade level. The following is a summary of lesson activities for the course.

1. Individual/pair/small group activity

Students practice and improve solving pure mathematical problems for the general topic, looking for connections with previous topics, using notation and terminology, identifying a sequence to solve a problem, inferring mathematics from written English, and solving real-world problems.

2. Discussion and presentation:

Students in pair or in small groups will discuss a topic or an issue given. After a certain time, they will share their ideas with the class. This activity will boost student imagination and creativity, help them understand that mathematics is more than calculating, and improve cooperation and collaboration with peers.

3. Critical Thinking Activities

Students are involved in more challenging discussions and activities at grade level that are related to higher-order thinking skills according to the revised Bloom's Taxonomy as below:

Applying

Students can apply their knowledge on mathematical concepts to other contexts in their lives after reading. Student application of their knowledge will be demonstrated during the class activities, such as discussion, presentation, peer-review, and problem-solving.

Analyzing

Students can compare and contrast different methods for solving problems. Students also analyze different types of problems without a clearcut solution laid out for them. Finally, students will also analyze their peers board work and presentations. Students will gain an appreciation for peer-review, which is a fundamental element of both mathematics and science.

Evaluating

Students can evaluate possible solutions to a problem and settle on the one that will best solve the problem at hand. Students will also evaluate the work of their peers and suggest alternative methods for solving problems. In doing so, students will gain a deeper understanding and appreciation for mathematics and mathematical thinking.

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Creating

Students can demonstrate their creativity and imagination by working challenging problems based on their lesson. Some activities will involve solving real-world problems from a variety of disciplines. These problems will be different from the standard word problem as they will draw on the student's ability to link various aspects of mathematics together in order to solve the problem.

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Chapter 3: Linear Functions, Unit 3: Solution to System of Linear Equations

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will learn how to solve systems of linear equations in more than two variables.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> Solving Linear equations in more than two variables without the use of a calculator 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> How do we solve linear equations with more than two variables?
<p>Knowledge: <i>Students will know ...</i></p> <ul style="list-style-type: none"> How to solve linear equations with more than two variables by <ol style="list-style-type: none"> Graphing Substitution 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> Graph linear equations using the different methods Solve word problems involving solutions to system of linear equations
Stage 2 - Assessment Evidence	
<p>Performance Task(s):</p> <p>To assess student progress made in this course, student work in the following activities will be clearly recorded and evaluated according to criteria, rubrics, and the teacher's discretion. Homework assignments will be given 10% and all the others will be given 30% of student grades.</p> <ul style="list-style-type: none"> Comprehension (true/false, definitions, identifying topics and themes, etc.) Solving pure mathematical problems as well as word problems. Discussions and presentations Group project that involves research and report writing Homework assignments 	<p>Other Evidence:</p> <p>The following will also be observed, recorded, and considered for the final grade of students in each lesson activity</p> <ul style="list-style-type: none"> Motivation Engagement Collaboration Communication pattern among peers and with the teacher Reactions Respect to others and different opinions
Stage 3 – Learning Plan	

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Learning Activities:

In this course, students are involved in a variety of class activities to understand mathematics at a deeper level, to transfer their knowledge to other contexts, and to improve their skills of working with mathematics in the form of discussion, presentation, and interaction. In so doing, students demonstrate their ability to use English mathematical language and notation appropriate to their grade level. The following is a summary of lesson activities for the course.

1. Individual/pair/small group activity

Students practice and improve solving pure mathematical problems for the general topic, looking for connections with previous topics, using notation and terminology, identifying a sequence to solve a problem, inferring mathematics from written English, and solving real-world problems.

2. Discussion and presentation:

Students in pair or in small groups will discuss a topic or an issue given. After a certain time, they will share their ideas with the class. This activity will boost student imagination and creativity, help them understand that mathematics is more than calculating, and improve cooperation and collaboration with peers.

3. Critical Thinking Activities

Students are involved in more challenging discussions and activities at grade level that are related to higher-order thinking skills according to the revised Bloom's Taxonomy as below:

Applying

Students can apply their knowledge on mathematical concepts to other contexts in their lives after reading. Student application of their knowledge will be demonstrated during the class activities, such as discussion, presentation, peer-review, and problem-solving.

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Students can compare and contrast different methods for solving problems. Students also analyze different types of problems without a clearcut solution laid out for them. Finally, students will also analyze their peers board work and presentations. Students will gain an appreciation for peer-review, which is a fundamental element of both mathematics and science.

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Creating

Students can demonstrate their creativity and imagination by working challenging problems based on their

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lesson. Some activities will involve solving real-world problems from a variety of disciplines. These problems will be different from the standard word problem as they will draw on the student's ability to link various aspects of mathematics together in order to solve the problem.

Chapter 4: Quadratic Functions, Unit 1: Introduction

Stage 1 - Desired Results

Established Goal(s):

Students will learn about quadratic functions and how to create tables of values.

<p>Understanding(s): <i>Students will understand ...</i></p> <ul style="list-style-type: none"> • Construct table of values for a given quadratic function • Tell whether a given table of values is quadratic or not • Determine a quadratic function given its table of values 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • What are quadratic functions? • How do we determine the values of a quadratic function? • How can we know if a set of values defines a quadratic function?
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<p>Knowledge: <i>Students will know how to ...</i></p> <ul style="list-style-type: none"> • Create tables of values from a quadratic function • Construct a quadratic function from a table of values 	<p>Skills: <i>Student will be able to:</i></p> <ul style="list-style-type: none"> • Construct table of values for a given quadratic function • Tell whether a given table of values is quadratic or not • Determine a quadratic function given its table of values
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Stage 2 - Assessment Evidence

<p>Performance Task(s):</p> <p>To assess student progress made in this course, student work in the following activities will be clearly recorded and evaluated according to criteria, rubrics, and the teacher's discretion. Homework assignments will be given 10% and all the others will be given 30% of student grades.</p> <ul style="list-style-type: none"> • Comprehension (true/false, definitions, identifying topics and themes, etc.) 	<p>Other Evidence:</p> <p>The following will also be observed, recorded, and considered for the final grade of students in each lesson activity</p> <ul style="list-style-type: none"> • Motivation • Engagement • Collaboration • Communication pattern among peers and with the teacher
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- | | |
|---|--|
| <ul style="list-style-type: none">• Solving pure mathematical problems as well as word problems.• Discussions and presentations• Group project that involves research and report writing• Homework assignments | <ul style="list-style-type: none">• Reactions• Respect to others and different opinions |
|---|--|

Stage 3 – Learning Plan

Learning Activities:

In this course, students are involved in a variety of class activities to understand mathematics at a deeper level, to transfer their knowledge to other contexts, and to improve their skills of working with mathematics in the form of discussion, presentation, and interaction. In so doing, students demonstrate their ability to use English mathematical language and notation appropriate to their grade level. The following is a summary of lesson activities for the course.

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Chapter 4: Quadratic Functions, Unit 2: Graphs of Quadratic Functions

Stage 1 - Desired Results	
<p>Established Goal(s):</p> <p>Students will be introduced to the concept of graphing quadratic functions and will learn how to graph several types of quadratic functions.</p>	
<p>Understanding(s): <i>Students will understand ...</i></p> <p>Graphing quadratic functions of the form;</p> <ul style="list-style-type: none"> • $y = ax^2$ • $y = ax^2 + c$ • $y = ax^2 + bx$ 	<p>Essential Question(s):</p> <ul style="list-style-type: none"> • How do we graph quadratic functions?
<p>Knowledge: <i>Students will know how to ...</i></p> <ul style="list-style-type: none"> • Graph quadratic functions • Identify the parts of the graph of a quadratic function 	<p>Skills: <i>Student will be able to calculate:</i></p> <ul style="list-style-type: none"> • Identify the different parts of the graph of quadratic functions • Graph quadratic functions of the form; <ul style="list-style-type: none"> ○ $y = ax^2$ ○ $y = ax^2 + c$ ○ $y = ax^2 + bx$ •
Stage 2 - Assessment Evidence	
<p>Performance Task(s):</p> <p>To assess student progress made in this course, student work in the following activities will be clearly recorded and evaluated according to criteria, rubrics, and the teacher's discretion. Homework assignments will be given 10% and all the others will be given 30% of student grades.</p> <ul style="list-style-type: none"> • Comprehension (true/false, definitions, identifying topics and themes, etc.) • Solving pure mathematical problems as well as word problems. • Discussions and presentations 	<p>Other Evidence:</p> <p>The following will also be observed, recorded, and considered for the final grade of students in each lesson activity</p> <ul style="list-style-type: none"> • Motivation • Engagement • Collaboration • Communication pattern among peers and with the teacher • Reactions • Respect to others and different opinions

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- Group project that involves research and report writing
- Homework assignments

Stage 3 – Learning Plan

Learning Activities:

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