Project-Based Instruction

Multi-Day Planner

Use this document and edit to fit your PBL unit needs (adding and subtracting days as needed). Provide a brief summary of what the lesson will entail, standards to include, and assessments that will be gathered on those days. Try to obtain formative assessments as often as possible during the progression of your unit.

Your "driving question" can be presented on any of the days, but you only need one.

Overall Summary of PBL Project

We want our students to understand the connection between functions and the real world. We will introduce what a function is, the different characteristics of functions, and how students can see functions in the real world. Students will be having to complete multiple projects. These projects consists of coming up with their own scenario on how a function could be portrayed in the real world. The students will be grouped up and asked to create their own roller however they please. We are asking the students to provide detailed explanation on a separate sheet of paper the characteristics of their function (absolute max/mins, zeros, increasing/ decreasing intervals, etc.) Students will present these roller coasters to the class at the end of the unit.

"Driving question"/problem to be solved
How can we as a math class model a roller coaster that describes characteristics of a function?

Student Learning Objectives (SWBAT)
SWBAT: graph a polynomial function
SWBAT: identify zeros, critical point, extremas, points of inflections
SWBAT: describe end behavior of functions
SWBAT: identify symmetry of graphs of functions
SWBAT: determine average rate of change
SWBAT: using linear equations to determine final budgets

Standards (full text not just numbers and letters)
A2:F-IF.B.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship
A2:F-IF.B.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
A2:F-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

A2:F-IF.C.9: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, determine which has the larger maximum.
A2:F-BF.B.3: Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them to understand operations on, and the general properties and behavior of classes of functions.

A2:A-REI.C.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), limited to systems of at most three equations and three variables. With graphic solutions, systems are limited to two variables.

How will you get to know your students and foster a sense of community?

Students will be able to create a rollercoaster that they would like to ride.

Students will create a function story similar to our bell ringer airplane story of what they notice a function being used in the real world.

Both of these will help us teachers connect with students by learning what they like and listening to their own ideas.

Week 1 Day 1- See full 5e lesson plan.

week 1 Day 2- see full 5e lesson plan

week 1 Day 3

Driving question/problem

How can functions be modeled in real life applications?

Student Learning Objectives (SWBAT)

SWBAT: look at different parent functions.

SWBAT: determine parent functions with their transformations.

Standards (full text not just numbers and letters)
A2:F-IF.B.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship

Lesson/inquiry/investigation ideas

Students will investigate various parent functions of functions with their transformations.

Student artifacts/assessment (Would a project notebook be one?)

Students will have a worksheet to determine parent functions with their transformations.

Resources

Notes on transformations.

week 2 Day 1

Driving question/problem

How can functions be modeled in real life application?

Student Learning Objectives (SWBAT)

SWBAT: determine what the graphs of various functions look like.

SWBAT: map out their roller coasters on a sheet of paper.

Standards (full text not just numbers and letters)

A2:F-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Lesson/inquiry/investigation ideas

This allows students to be creative and have a choice in what their function will be represented by.

Student artifacts/assessment (Would a project notebook be one?)

Students original draft of their roller coaster will be graded for participation.

Resources

Notes on functions.

week 2 Day 2

Driving question/problem

How do you write a piecewise function?

Student Learning Objectives (SWBAT)

SWBAT: correctly write a piecewise function.

Standards (full text not just numbers and letters)
A2:F-IF.B.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship

Lesson/inquiry/investigation ideas

Students will use functions to write a piecewise function of their rollercoaster.

Student artifacts/assessment (Would a project notebook be one?)

The piecewise function the students write would be an artifact and part of project assessment.

Resources

The sheet of paper that has their rollercoaster on it. Examples of what piecewise functions look like.

week 2 Day 3

Driving question/problem

How can we use systems of equations to determine the cost of your roller coaster using the cost of materials and amount of materials needed?

Student Learning Objectives (SWBAT)

Students will be able to determine the cost of their rollercoaster using linear equations.

Standards (full text not just numbers and letters)

A2:A-REI.C.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), limited to systems of at most three equations and three variables. With graphic solutions, systems are limited to two variables.

Lesson/inquiry/investigation ideas

Students will determine the cost of their rollercoaster.

Student artifacts/assessment (Would a project notebook be one?)

The cost of their rollercoaster will be an assessment for the final project. Students should be within the budget given for the roller coaster.

Resources

Calculator.

week 3 Day 1

Driving question/problem

How does the characteristics of the function affect the rollercoaster?

Student Learning Objectives (SWBAT)

SWBAT: identify characteristics of their function.

SWBAT: describe how the characteristics affect their rollercoaster.

Standards (full text not just numbers and letters)

A2:F-IF.B.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship

Lesson/inquiry/investigation ideas

Students will evaluate their own roller coaster at various points (ex: what does it mean for f(5) on their rollercoaster?- it means as the roller coaster is at time (x axis) 5 the cart is on this part of the rollercoaster)

Student artifacts/assessment (Would a project notebook be one?)

The different characteristics will be asked to be stated on a seperate worksheet clearly. This worksheet will be apart of the final assessment.

Resources

Worksheet on the characteristics of their function.

week 3 Day 2

Driving question/problem

How can we determine the average rate of change on the rollercoaster?

Student Learning Objectives (SWBAT)

SWBAT: determine the average rate of change from their rollercoaster.

Standards (full text not just numbers and letters)

A2:F-IF.B.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph

Lesson/inquiry/investigation ideas

Determining the average rate of change will let them elaborate on how rate of change affects their rollercoaster.

Student artifacts/assessment (Would a project notebook be one?)

Students will need to identify the function and how the average rate of change affects the function.

Resources

Calculator.

week 3 Day 3

Driving question/problem

What is a continuous function?

Student Learning Objectives (SWBAT)

SWBAT: identify if a function is continuous or not.

Standards (full text not just numbers and letters)
A2:F-IF.B.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship

Lesson/inquiry/investigation ideas

Show students what the graphs of various functions looks like.

Students will map a plan of their rollercoaster of a sheet of paper, combining different types of continuous functions.

Student artifacts/assessment (Would a project notebook be one?)

Map of a roller coaster would be an artifact of a continuous function learning.

Resources

Graphing paper, notes on continuous functions.

week 4 Day 1

Driving question/problem

How are functions used to model real world applications?

Student Learning Objectives (SWBAT)

SWBAT: fully complete their rollercoaster.
SWBAT: will identify all characteristics, costs, rate of change, etc. on a separate sheet of paper for their function.

Standards (full text not just numbers and letters)
A2:F-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Lesson/inquiry/investigation ideas

This will allow students to transfer what they have learned into a real life scenario.

Student artifacts/assessment (Would a project notebook be one?)

Poster as well as a sheet of paper with the different characteristics of their function.

Resources

Poster, calculator, markers.

week 4 Day 2

Driving question/problem

How are functions used to model real world applications?

Student Learning Objectives (SWBAT)

SWBAT: conduct a gallery walk.

SWBAT: look at other functions and clearly identify the max, mins, zeros, rate of change, and other characteristics of each rollercoaster.

Standards (full text not just numbers and letters)
A2:F-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Lesson/inquiry/investigation ideas

This investigation will allow students to get more practice with identifying characteristics of different functions.

Student artifacts/assessment (Would a project notebook be one?)

Students will have a gallery walk packet that allows them to clearly state the characteristics of each rollercoaster. This will be a grade that is seperate from the project.

Resources

Calculator and gallery walk packet.

week 4 Day 3

Driving question/problem

How are functions used to model real world applications?

Student Learning Objectives (SWBAT)

SWBAT: Present their posters to the class and clearly state the correct answers.

Standards (full text not just numbers and letters)

A2:F-IF.C.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Lesson/inquiry/investigation ideas

This will allow for the entire class to ask questions about a function as well as allowing the teacher to monitor student progress.

Student artifacts/assessment (Would a project notebook be one?)

Students will be correcting their gallery walk packet.

Resources

Posters and gallery walk packets.