09 Linear Equations

Content Area: **Mathematics**
Course(s):
Time Period: **Week1**
Length: **7 Weeks**
Status: **Published**

Stage 1: Desired Results

Unit Overview/ Rationale

Successful students will be able to solve and graph the solution sets of linear equations, inequalities and systems of linear equations and to use words, tables, graphs, and symbols to represent, analyze, and model with linear functions. In contextual problems students graph and interpret their solutions in terms of the context. They apply such problem solving heuristics as: identifying missing or irrelevant information; testing ideas; considering analogous or special cases; making appropriate estimates; using inductive or deductive reasoning; analyzing situations using symbols, tables, graphs, or diagrams; evaluating progress regularly; checking for reasonableness of results; using technology appropriately; deriving independent methods to verify results; and using the symbols and terms of mathematics correctly and precisely. Function notation should be introduced and used regularly but not exclusively.

Standards & Indicators

Big Ideas - Students will understand that...

-Graphs and equations are alternative (and often equivalent) ways for depicting and analyzing patterns of change.

-Functional relationships can be expressed in real contexts, graphs, algebraic equations, tables, and words; each representation of a given function is simply a different way of expressing the same idea.

-The value of a particular representation depends on its purpose.

-A variety of families of functions can be used to model and solve real world situations.

Essential Questions - What provocative questions will foster inquiry and transfer of

learning

-How can patterns, relations, and functions be used as tools to best describe and help explain real-life situations?

-How are patterns of change related to the behavior of functions?

-How are functions and their graphs related?

-How can technology be used to investigate properties of linear functions and their graphs?

Content - Students will know...

-slope of a line

-rate of change

-direct variation

-modeling linear equations

-graphing linear equations

-slope-intercept form

-point-slope form

-standard form of a line

-x- and y-intercepts

-parallel and perpendicular lines

-scatter plots

-line of best fit

-interpolation

-extrapolation

-vertical and horizontal lines

-zero and undefined slope

-linear inequalities

-absolute value functions

Skills - Students will be able to...

-Construct scatter plots

-Determine correlation and describe relationships between dependent and independent variables.

-Use a line of best fit to make predictions on data

-Determine the equation for a line of best fit and use the equation to extrapolate data

-Graph horizontal and vertical lines

-Graph linear equations by finding the x-and y-intercepts

-Find the slope of a line using 2 points

-Interpret slope as rate of change

-Write linear equations that represent direct variation

-Use ratio to write an equation for direct variation

-Graph a linear equation using slope-intercept form

-Graph linear inequalities by hand and by using technology

-Model real-world problems using linear equations and their graphs

-Determine the equation of a line given 2 points, given a point and the slope, or given the y-intercept and slope.

-Give examples of ordered pairs that are included in solution sets of linear inequalities

-Use technology to model absolute value graphs representing motion

Stage 2: Assessment Evidence

Assessment

Stage 3: Learning Plan

Learning Activities

Activity:

Scatter Plot Activity (attached):

Students should collect data on the average high temperatures in April for different cities around the world, along with their latitudes. By graphing the data, they will determine the relationship between a city's latitude and the average high April temperature. They will use a line of best fit to predict the average high April temperature for cities at different latitudes and check their estimates by looking up the statistics on the internet.

Assessment:

Teacher observation of student work in small-group and independent practice.

For graphs, the student is required to label axes and scales. The labels and scales must be appropriate according to the context. Teachers should watch for misconceptions and common errors in graphing

Activity:

Spaghetti and Marbles Lab.

Students will investigate linear and correlation by discovering patterns when experimenting with spaghetti strands and the number of marbles it takes to break different numbers of strands. Students will graph data and use a line of best fit to make future predictions

Assessment:

Teacher observation of student work in small-group and independent practice.

Lab report may be submitted for assessment.

Students predict the number of marbles it would take to break 20 strands of spaghetti. Conclusions include an explanation of how they determined the estimate and how accurate the student believes their estimate is based on the line of best fit. Graphs must have an appropriate scale that accommodates this estimate and other predictions they may make.

Activity:

Students will investigate intercepts through real-life problems. Determine the maximum value for x if y is zero and determine the maximum value for y if x is zero.

Students will complete activities on finding intercepts.

Assessment:

Teacher observation of student work in small group and independent practice.

Sample Assessment Question: Determine a quick method for creating a graph for 2x+ 50y = 3000.

Activity:

Graphing Vertical and Horizontal lines:

Students may investigate graphing horizontal and vertical lines by using a table of values.

Sample Assessment:

Graph the vertical line through (4, 5). Graph the horizontal line through (-2, 1)

Activity:

Oil Changes Activity

Students will complete an "oil changes" activity. They will create a scatter plot which relates the number of oil changes a car gets per year and the cost of repairs per year. Class will discuss the meaning of the intercepts and slope of the graph, as well as predictions using the line of best fit.

Assessment:

Teacher observations and student explanations of work. Look for correct interceps, slope, and representations of each.

Activity:

Scatter Plot Activity (attached):

Students may work in small groups to complete the scatter plot activity. They will use the slope of the best fit line to explain the future trends of the data.

Assessment:

Groups should present their arguments to the class. This activity may be used as a quiz or formative assessment. (see attached file)

Activity:

Graphing Calculator Exploration:

Graphing absolute value equations. Students will graph absolute value equations on the graphing calculator and compare the graphs to p(x)=|x|. Students will determine characteristics of the graph such as the vertex, slope of each branch, intercepts, domain and range, maximum, minimum, opening direction, and transformations.

Formative Assessment:

Journal Entry: Explain the characteristics of the graph of f(x) = -2|x-3|+8. Explain how the values of a, b, and c, affect the characteristics of the graph of

$f(x) = a|x - b| + c$, when compared to $p(x) = |x|$.

Suggested Activities:

Lab Activity: Students work in groups using CBL/CBR units to generate absolute value graphs by walking in front of a sonic ranger. Topics include intercepts of the graph, vertex, and slope of each branch. Students will write the equation of the graph, given its characteristics and describe real-life situations that may be modeled by absolute value equations.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Also, students will produce a written lab report complete with a hypothesis, materials, procedures, calculations, and conclusion paragraph. Students will model their motion with a graph and equation in the form

$f(x) = a|x - b| + c.$

Suggested Activities:

Students will graph linear inequalities using a graphing calculator and by hand. Students will understand when to use a broken or solid line and which side of the line to shade. Also, they will be able to describe a point which is contained in the solution set of the inequality

Students will be asked to model problems using linear inequalities and describe their solution sets.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Activity:

Match-it Graph-it Lab Day 2:

Students will begin by constructing a 4 part graph. They will then use CBL/CBR units to attempt to duplicate the

graph. After graphing the motion on the calculators, students are to determine the equation for each of the lines

Assessment:

Students may submit a lab report with calculations and conclusion. Assess understanding based on the calculations and answers to the conclusion questions.

Activity:

Direct Variation:

Students will explore direct variation by determining the constant in a function. They will generalize equations that represent situations with variables that vary directly with each other.

Sample Assessment:

If the variables x and y vary directly with each other, find the value of the constant if x = 3 and y = -18.

Activity:

Slope-Intercept form

Students will investigate the equation for a line by finding the slope and y-intercept of the line. Class will practice graphing using slope-intercept form. Students should be able to convert any equation to an equation written in slope-intercept form.

Sample assessment:

Graph the equation 3x + 4y = 16 on a coordinate grid.

Activity:

Slope-Intercept Form of a Line:

Students will explore methods for finding the equation for a line using graphs, slope and intercept, given a point and a slope, and given 2 points. Students will graph equations in slope-intercept form. Also, students will model real-life

examples in slope-intercept form

Sample Assessment:

Between the years 2000 and 2010, Springfield has been increasing in population at a constant rate. The population of Springfield in 2000 was 235,000. By 2007, the population was 458,000. Write an equation to model the population of Springfield (y) for the number of years after 2000 (x). Determine the population of Springfield in the year 2010.

Activity:

Slope and rate of change

Class will determine the slope of a line through 2 points by using a graph and by using the formula. Also, students will investigate zero and negative slope.

Sample assessment:

Determine the slope of the line through (-3, 5) and (4, -7). Provide an example of a line that would have zero slope and give a real life example.

Activity:

Match it graph it day 1

Students may investigate the slope of a line through the match it-graph it activity. Class may work in small groups to match given graphs by walking in front of a sonic ranger. Class discussion should revolve around the speed and direction that a person must walk to match the given lines.

Assessment:

Students will describe the slope of the lines on motion graphs and extend this into explaining how a person would have to walk to match more complex graphs.

Resources

Prentice Hall, Algebra I - Unit