

Unit 3

The Burning Candle: Patterns and Graphs

Standards

Pre-Algebra

1.1 Represent relations among variables in a variety of way, including the use of words, tables, graphs, and symbols.

Algebra I

7.4 Graph sets of ordered pairs linear equations in two variables by using intercepts, slope and a point, and point—plotting.

7.5 Find images for transformations.

7.6 Graph equations of the form $y = ax^2 + bx + c$, where a , b , and c are real numbers.

Day 1
The Burning Candle

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Evaluate variable expressions for specified values. 	<ul style="list-style-type: none"> Graphs sets of ordered pairs. 	<ul style="list-style-type: none"> Graph linear equations in two variables.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch</p> <p>8-10 minutes</p>	<ul style="list-style-type: none"> Follow teacher's instructions. Read BC-1. 	<ul style="list-style-type: none"> Modify Algebra Walk (if preferred) as a classroom activity. Use large-scale coordinate axes on grid. Make index cards with integers between -6 to 6 distinguishable by color. Use the same rules as Algebra Walk. Change the "human graphing" to students plotting given points on large coordinate system. 	<ul style="list-style-type: none"> The 'Burning Candle' video may be purchased. The video is difficult to use. If needed, the data needed is in the teacher guide
<p>Explore</p> <p>20-30 minutes</p>	<p>Complete BC-1.</p>	<ul style="list-style-type: none"> Assign each study team one of the problems identified by color. Each team should have the index cards identified with the color of the problem assigned. 	<ul style="list-style-type: none"> Check students' arithmetic in working with positive and negative integers.

Steps	Student Activity	Teacher Support	Comment/Evaluation
		<ul style="list-style-type: none"> • Work on part a with students by completing the output portion of the table together. • Ask individual students to locate and mark the ordered pairs on the large-scale coordinate system. • Have students work in study teams to complete BC-1. • Guide students in completing tables for parts a, b, c, d, and e. • A vertical table may be easier to use in finding ordered pairs. • Some students may need help in plotting the ordered pairs. 	
<p>Summarize 10-15 minutes</p>	<ul style="list-style-type: none"> • Discussion of part f of BC-1. • Presentation of part g of BC-1. 	<ul style="list-style-type: none"> • Select students for discussion of part f of BC-1. • Select students for presentation of part g of BC-1. 	<ul style="list-style-type: none"> • Give guidelines for starting BC-2 for homework.
<p>Homework</p>	<ul style="list-style-type: none"> • BC-2 through BC-6. 		

Day 2
Tables and Graphs

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Evaluate variables expressions for specified values. 	<ul style="list-style-type: none"> Graphs for given equations represent solutions for the equations. Each ordered pair of the graph of an equation represent pairs of numbers which makes the open sentence true. 	<ul style="list-style-type: none"> Determining specified linear equations.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch</p> <p>8-10 minutes</p>	<ul style="list-style-type: none"> Follow teacher in completing on BC-8. 	<ul style="list-style-type: none"> Complete BC-8 with together with students. Discuss BC-2. 	<ul style="list-style-type: none"> Guide students in seeing that the graph represents the solutions for the given equations.
<p>Explore</p> <p>20-25 minutes</p>	<ul style="list-style-type: none"> Complete BC-9, BC-10, BC-11, and BC-12 with study team. Start BC-15. 	<ul style="list-style-type: none"> Guide students in starting BC-9. Emphasize the idea that when the value of one variable is given, the graph may be used to find the value of the other. Do students understand that often integers are used as input values because it is easier to work with? 	<ul style="list-style-type: none"> Guide students in understanding that the ordered pairs for the graph include both rational and irrational numbers. BC-15 is a good review for area and perimeter. Ground work for the idea of

Steps	Student Activity	Teacher Support	Comment/Evaluation
		<ul style="list-style-type: none"> • Do students understand why the points are connected to represent the solution? • Do students understand that the graph is just a partial representation of the solution set? • Do students understand what 	finding solutions to the equations.
Summarize 10-12 minutes	<ul style="list-style-type: none"> • Summarize BC-9 part d for the tool kit. 	<ul style="list-style-type: none"> • Discuss the summarization of BC-9 for the tool kit. 	
Homework	<ul style="list-style-type: none"> • BC-13 through BC15, BC-17, BC-18. 	<ul style="list-style-type: none"> • BC-13 only require students to write the expression. • BC-13 does not require student to 'solve' anything. 	<ul style="list-style-type: none"> • Students often confuse equations with expressions.

Day 3
Graphing Input/Output Relationships

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Graph equations in two variables by making tables of ordered pairs. 	<ul style="list-style-type: none"> Graph equations in two variables by making tables of ordered pairs. 	<ul style="list-style-type: none"> Determine equations for specified conditions.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch</p> <p>8-10 minutes</p>	<ul style="list-style-type: none"> Play Silent Board Games. 	<ul style="list-style-type: none"> Play Silent Board Games. The values for the independent variable are not in numerical order. Guide students in using the strategy of putting the values in numerical order to make finding patterns more logical. Ask students to look for the type of change between each dependent variables entry when the change in the independent variable is constant. 	<ul style="list-style-type: none"> Finding patterns take practice. Guide students in finding the change between entries of the dependent variable when the change between the independent variable is constant. Is there a constant difference between the values of the dependent variable entries? Is each multiplied by a constant? Help students with suggestions rather than telling students the rules.

Steps	Student Activity	Teacher Support	Comment/Evaluation
Explore 15-20 minutes	<ul style="list-style-type: none"> • Complete BC-19 through BC-22 with study team. 	<ul style="list-style-type: none"> • Move study teams into BC-19 through BC-22. • Remind students to use the example from their tool kit. • Guide students in labeling the axes, the scale, writing the equations, making the table, etc. 	
Summarize 10 minutes	<ul style="list-style-type: none"> • Read PZL-14. 	<ul style="list-style-type: none"> • Discuss PZL-14. 	
Homework	<ul style="list-style-type: none"> • BC-23 through BC-27. 		

Day 4
Writing rules for Input/Output Relationships

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Graph equations in two variables by making tables of ordered pairs. 	<ul style="list-style-type: none"> Determine rules for given relationships. 	<ul style="list-style-type: none"> Determine equations for specified conditions.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch</p> <p>8-10 minutes</p>	<ul style="list-style-type: none"> Complete BC-28 with teacher and study team. 	<ul style="list-style-type: none"> Complete BC-28 with students. Guide students in understanding why the points are connected. Restate the idea that the graph represents the partial solution to the equation. 	<ul style="list-style-type: none"> Beginning ideas of domain and range.
<p>Explore</p> <p>20-25 minutes</p>	<ul style="list-style-type: none"> Complete BC-29 through BC-31 with study team. 	<ul style="list-style-type: none"> Move study teams through BC-29. Guide students in arranging the values for the independent variable in order. Suggest the strategies for finding patterns that were used in previous lesson. Guide students in writing the rules in clear language. 	<ul style="list-style-type: none"> Do not insist that student write the relationships using equations.

Steps	Student Activity	Teacher Support	Comment/Evaluation
Summarize 10 minutes	<ul style="list-style-type: none"> • Present rules or descriptions of relationships in BC-29 and BC-30. • Give explanation for BC-31. 	<ul style="list-style-type: none"> • Select students or teams to present rules or descriptions of relationships in BC-29 and BC-30. • Discuss the mistake in BC-31. 	<ul style="list-style-type: none"> • BC-32 is good teacher directed extension.
Homework	<ul style="list-style-type: none"> • BC-33 through BC-36. 		

Day 5 Estimating Intercepts

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Graph equations in two variables by making tables of ordered pairs. Determine rules for given relationships. 	<ul style="list-style-type: none"> Graphs represent solution sets for given equations. Find x- and y-intercepts/ 	<ul style="list-style-type: none"> Determine slope for given lines.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 8-10 minutes	<ul style="list-style-type: none"> Complete BC-37 with teacher and study team. 	<ul style="list-style-type: none"> Complete BC-37 with students. Guide class in applying strategies involved in previous lessons. 	<ul style="list-style-type: none"> x-intercept is a value, not an ordered pair.
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete BC-38 and BC-39 with study team. 	<ul style="list-style-type: none"> BC-38 involves only an expression. No equations are being solved. The graph for BC-39 is discrete. Emphasize the reason why the points should not be connected. Guide student in expressing the rules in clear language. 	<ul style="list-style-type: none"> Students often confuse expressions with equations.
Summarize	<ul style="list-style-type: none"> Present rules for relationships in BC-38 and BC-39. 	<ul style="list-style-type: none"> Student should be able to state the rules for BC-38 and BC-39 with 	

Steps	Student Activity	Teacher Support	Comment/Evaluation
10 minutes		equations or written description. •	
Homework	<ul style="list-style-type: none"> • BC-40 through BC-46. 		

Day 6
Comparing Graphs of Lines and Parabolas

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Graph linear equations. 	<ul style="list-style-type: none"> Compare equations whose graphs are straight lines to those equations whose graphs are parabolas. 	<ul style="list-style-type: none"> Graphing first and second degree equations in two variables.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch 8-10 minutes</p>	<ul style="list-style-type: none"> Complete BC-45 with teacher and study team. 	<ul style="list-style-type: none"> Complete BC-45 with students. Give student examples of parabolic shapes that appear around them. Satellite dish, path of water from a water fountain, etc. 	<ul style="list-style-type: none"> Not an in depth study of graphing parabolas. Students should understand that not all equations produce graphs that are straight lines.
<p>Explore 20 minutes</p>	<ul style="list-style-type: none"> Complete BC-46 through BC-49 with study group. 	<ul style="list-style-type: none"> Guide students in writing BC-47 in clear language. Graphs of parabolas should be smooth curves, not segmented from point to point. 	
<p>Summarize</p>	<ul style="list-style-type: none"> Present BC-38 to class. 	<ul style="list-style-type: none"> Select students of study teams to present BC-38 to class. 	

Steps	Student Activity	Teacher Support	Comment/Evaluation
15-20 minutes			
Homework	<ul style="list-style-type: none">• BC-50, BC-51, BC-53, BC-54.		

Day 7 Exploring Parabolas

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Graphing equations which represent lines or parabolas. 	<ul style="list-style-type: none"> Review of inequality symbols. Definition and use of domain. 	<ul style="list-style-type: none"> Relations and functions.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 8-10 minutes	<ul style="list-style-type: none"> Follow teacher discussion on BC-55 Complete summary and examples relating to inequality, ellipses, and domain for tool kit. 	<ul style="list-style-type: none"> Lead discussion on $-x^2$ and $(-x)^2$. Review inequality symbols. Explain the word 'ellipses' as ... Give explanation and examples of 'domain.' 	<ul style="list-style-type: none"> Many facts and definitions that are important lead to future work contained in this section.
Explore 15-20 minutes	<ul style="list-style-type: none"> Complete BC-56 through BC-58 with study team. 	<ul style="list-style-type: none"> Start BC-56 with students. Detailed graphing and identification of the various characteristics associated with the parabola will be discussed later in detail. 	<ul style="list-style-type: none"> Student should be aware that the graph of many equations are not straight lines.
Summarize 10-15 minutes	<ul style="list-style-type: none"> Share graphs for BC-56 and BC-37 with class. Complete BC-61 with teacher and 	<ul style="list-style-type: none"> Select students to share graphs of BC-56 and BC-57 with class. Discuss BC-61 with class. 	<ul style="list-style-type: none"> Stress the identification of the independent and dependent variable.

Steps	Student Activity	Teacher Support	Comment/Evaluation
	study team.		
Homework	<ul style="list-style-type: none">• BC-59 through BC-60, BC-62.		

Day 8
Unit Summary and Review

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Graphing equations for lines and parabolas. 	<ul style="list-style-type: none"> Review of main ideas from Unit 3. 	<ul style="list-style-type: none"> Determine equations for specified conditions. Understanding relations and functions.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch</p> <p>8-10 minutes</p>	<ul style="list-style-type: none"> With study team, list mathematical ideas and topics encountered in this unit. Complete BC-79. 	<ul style="list-style-type: none"> Compile list of mathematical ideas and topics encountered in this unit. Remind students that there are specific places identified in the text to find the main ideas. Guide students in completing BC-79. 	<ul style="list-style-type: none"> Graphs of Non-Linear Functions may be optional. The Burning Candle Investigation may also be optional. Guide students in a systematic review of main ideas and topics encountered during this unit.
<p>Explore</p> <p>20-30 minutes</p>	<ul style="list-style-type: none"> Complete BC-80 and VC-81 with teacher and study team. Complete BC-82 through BC-88 with study team. 	<ul style="list-style-type: none"> Complete BC-81 together with students. Guide students in developing study habit of using previous work to help with new assignments. 	<ul style="list-style-type: none"> Good place for embedded assessment while guiding and monitoring student progress.

Steps	Student Activity	Teacher Support	Comment/Evaluation
Summarize 15 minutes	<ul style="list-style-type: none"> • Read PZL-15. • Complete tool kit clean-up. 	<ul style="list-style-type: none"> • Guide students in tool kit clean-up. 	
Homework	<ul style="list-style-type: none"> • Complete tool kit clean-up. • Review 	<ul style="list-style-type: none"> • Assign questions from Skill Builders if necessary. 	