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Redirect to download math vision project Module 4 Reply Key PDF after seconds Without text content! 1Sekusar One Mathematics: Integrated Approach Module 4 Function Functions of the Mathematical Vision Project: Scott Hendrickson, Jolie Med, Barbara Kuech, Travis Lemon, Janet Sustorius www.mathematicsvisionproject.org In Partnership with Utah State Education © 2012 Mathematics Vision Project | MV P In partnership with the State Of Utah Training State licensed under the Creative Commons Recognition---Ne-Commercial-ShareAlike 3.0 Reckless License. 2Module 4 – FeaturesClassical Task: Preparing for pool party- Developing understanding taskUsing history context of the schedule and describing the main features t (F.IF. 4)Ready, Set, Go Home: Features features 1Classical task: Floating down river - Solidify Understanding TaskUsing tables and graphics to interpret key functions (F.IF. 4, F.IF. 5) Ready , Set, Go home : Functions 2Classic task: Functions – Practical understanding of tasksFunctions of functions using different images (F.IF. 4, F.IF. 5)Ready, set, Go HomeWork: Features 3Classical Task: Water park – Solidify understanding of task understanding functionsIntervalization of notation functions (F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)Ready, Kit, Go Home : Functions of Functions 4Classic Task : Bringing it together – Strengthen understanding of task combination and context analysis functions using features (F.BF.1b, F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11, A.CED.3)Ready, Kit, Goes Home: Functions 5Classum Task: Interpretation Functions – Understanding TasksSl device graphics to solve problems given in the function (F.BF.1b, F.IF.2, F.IF.4, F.IF. 5 , F.IF.7, A.REI.11, Ready, Set, Go Home: Features 6Classic Tasks: A A Function – Solidify Understanding taskDefiniting function (F.IF.1)Ready, Set, Go home: Functions 7Class task: To function or not to function – Practice understanding TaskIdentifying whether a connection is a function given different representations (F.IF.1, F.IF.3)Ready, set, Work with homework go: Functions 8Class task: Matching this function – Practice understanding the functions of working and presenting a specific function (F.IF.2, F.IF.4, F.IF. 5, F.IF.7, A.REI.11,A.CED.3)Ready, set, go home: Features 9 V© 2012 Mathematical projects | M P In partnership with Utah State Office of Education licensed under Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unordered License.3Getting Pool-Ready Party © www.flickr.com/photos/jensmith826A Developing Understanding TaskSylvia has a small pool full of water that needs to be emptied and cleaned, then filled with pool part. During the process of preparing the pool, Sylvia did all of the following activities, each during a different time interval. Removed water with a bucket Filled the pool with a hose (the same speed as emptying pool)Drained water with a hose (the same speed as filling Cleaned empty pool) Sylvia and her two friends pulled out water with Took-break three buckets1. Sketch possible graphic showing the height of the water level in the pool over time. Be sure to include all the activities that Sylvia did to prepare the pool for the party. Remember that only one action happens. Think carefully about what each section of the chart will look like, indicating where activity is happening.2 Create a story connecting Sylvia's process of emptying, cleaning, and then fill the pool next to the schedule you created. Do your best to use the appropriate mathematical dictionary.3 Is graphics a function? Why or why not? Will all graphics created for this represent a function? V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Preparing for the pool party - Teacher NotesDevelop the understanding taskPurpose: This task is designed to develop the ideas of functions using a situation. Features of features such as zoom in/out and maximum/minimal can be difficult for people to feel, even in graphical representation, if not used to read graphics from left to right. A situation using the pool water level for a certain period of time can provide opportunities for students to make connections to these features. While some parts of the graph should come before others (emptying the pool before filling the pool), other situations can be thrown around (emptying the water with buckets and emptying the water with a hose). The key features of this task include: • The sketch of the graph when the water is emptied from the pool and graph graph when the pool is filled with water. • The sketch on the graph shows zero height for a period of time when the pool is empty and cleaned. • The sketch on the graph is continuous when using the hose (both filling and emptying) and that the change rate is the same for both filling and emptying. • The sketch on the graph is discreet (and looks like a step function) when using a bucket, with a water level drop three times faster when Sylvia has friends who help. • Students share their understanding of the graphs in part 2 • Students express that this situation is a function, pointing out that each incoming time stream has exactly one output representing the depth of the water. Basic standards Focus:F.IF.4 For a function that models a relationship between two quantities, interpret key characteristics of graphs and tables in terms of quantities and sketches showing key characteristics given an oral description of the relationship. Key features include: interceptions; intervals where the function increases, decreases, positively or negatively; relative maximums and minimums; symmetry; endevik; and periodicity.★Related standards: F.IF.1, A.REI.10, F.IF.5, F.IF.7UNIK (Whole class):Read the original situation and the first question. Make sure students understand that they are on the chart, where all the methods of emptying, cleaning, and then filling the pool are used in trouble. When they have completed their chart, they must write a story linking Sylvia's process of emptying, cleaning and then filling out the pool next to the chart they have created. V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Explore (Small Group): Your students may already be familiar with the strategies for creating graphs given in a situation. They are also familiar with the slope and speed of change, as well as graphics continuous and discreet. The context of this problem focuses on reducing and increasing the intervals of the graph,the rate of change, and the idea of a function is a continuous linear relationship against a situationWhich speed changes in discreet fashion. Because of their previous experience with sequences of linear features, look for students who show this difference between continuous scenarios in their graphs. Press students to explain in detail in their explanation of what happens at each time interval of the graph. This will help to bring out the features passages described in this tutorial (see the statement of purpose above). In addition to the features listed above, this task also shows the idea of domain features and step. If you do not have students to create a function presentation during the bucket situation, but they present discreetly, they plan to use this during the discussion part of the lesson to athow domain is Let students share their story with a partner, then hint at what they agree with others' graphs and possible mistakes in their thinking. Discuss (Whole Class): Select students to share who have the following as part of their chart. (Make sure that students who share can show their graphs to all students by explaining the characteristics of their graphs): • Student 1: they have a student share that has scored their axes and there are clear ideas about where the graph should be increased/decreased. This student does not share his or her story, but emphasizes the characteristics of his function. • Student 2: has a student share that has presented the part of the graph to be discreet in nature (not continuous decreasing linear graphics). Note the difference between a continuous constant rate of change versus a jump in the amount of water in the pool when using a bucket. At this stage, we are still focusing on increasing/reducing, comparing percentages and the idea that a feature may have different components within the function (i.e. continuously and discreetly). If the conversation naturally appears at this point about how the discrete part of the graph should look different (rather as a step function), then discuss this now. Otherwise, wait until the next student shares and then put it together. Again, this student does not share his or her story, but emphasizes the characteristics of his function. • Student 3: select a student to share their story while showing each part of the chart. Be sure to choose someone with an accurate history to highlight the features focused on this task. Make sure that the discussion includes the following characteristics: zoom in/out, y-intercept, axle labeling and interpretation of what it means, as well as the rate of change. At this point, if V© 2012 Mathematical Vision Project | M P In partnership with the State Of Utah Training State licensed under the Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unsupported license.the step function conversation has not occurred, use a graph that shows the bucket situation as separate, then ask students questions such as: • The graph tells a complete story? • Specify a time interval that is continuous, ask students to describe what happens at any given time. • Point to the discrete part of the graph and ask how much water is in the pool between the two separate points. While students do not need to know how to chart step features in Secondary I, the purpose of thisconversion is to contact students that each point of the schedule is a solution (A.REI.10) and that by time it is continuous, each input value (domain) exists from beginning to end of arts, cleaning, then filling the pool (F.IF.5). Aligned Ready, Set, Go: Features 1 V© 2012 Mathematical Vision Project | M P In partnership with the State Utah Licensed in Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unclaimed Features 1 Ready, Set, Go! Ready© www.flickr.com/photos/jensmith826 Theme: Graph of linear and exponential functions Graph each of the features. 1. f (x) = −2 x + 5 2. g(x) = 4 − 3 x 3. h(x) = 5(3 x) 5. v(t) = 2,5t − 4 6. f (x) = 8(3 x) 4. k(x) = 4(2 x) V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 5 Functions 1 Set theme: Describe attributes of a function based on graphical representation. 7. For each graph given, it shall correspond to the contextual description that is most appropriate. Then mark the independent and dependent axis with the correct variables. Graphs contextual descriptions i. The amount of money in a savings account, where regular deposits and withdrawals are made. A. ii. The oven temperature on a day when Mom bakes a few batches of biscuits. B. iii. The amount of gasoline gasoline before a truck-truck delivers more. 1999: The number of watermelons available for sale on the farmers' market on Thursday. v. The amount of kilometres recorded on the odometer of a delivery truck for a specified period of time. Project© Mathematical Vision for 2012.M P Partnership with the State Of Utah Training State licensed under the Creative Commons Recognition----Necommerce-ShareAlike 3.0 Unguarded License. 6 Function characteristics 1 8. Given the pair of graphs on each grid, create a list of similarities that the two graphs share and a list of differences. (Consider attributes such as continuous, discreet, growing, decreasing, straight, exponential, domain or range restrictions, etc.) a. Similarities: Similarities: Differences: b. Similarities: Similarity: Differences: V© 2012 Mathematical Vision Project| M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 7 Functions 1 Go to Subject: Solve Equations Find the x value in each equation. 9. 10x = 100 000 10. 3x + 7 = 5x − 21 11. −6 x -15 = 4x + 35 12. 5x − 8 = 37 13. 3x = 81 14. 3x -12 = −4x + 2315. 10 = 2x − 22 16. 243 = 8x + 3 17. 5x − 7 = 218 V© Project Mathematical Vision 2012 | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 8Subsing down the riverA Solidify Understanding TaskAlonzo, Maria, and Sierra drifted into the inner pipes down a river © www.flickr.com/photos/hamiltoncaenjoying their day. Alonzo noticed that sometimes the water level was washing in some places than in others. Maria noticed that there were times when they moved faster than in other times. Sierra laughed and said Math is everywhere!. To learn more about the river, Alonzo and Maria collect data during the trip. Alonzo creates a table of values by measuring the water depth of each minutes.1. minutes.1. data collected by Alonzo in order to interpret the main characteristics of this link. Maria created the graph by collecting data from a GPS device that told her about the distance she had traveled over a period of time.2 Using the graph created by Maria, describe the main features of this relationship. V© 2012 Mathematical Vision Project | M P In partnership with the State Of Utah Training State licensed under the Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unguarded License.93 Sierra looked at the data collected by her two friends and made several observations of her own. Explain why you agree or disagree with any observation made. • The depth of the water increases and decreases during the 120 minutes floating down the river. • The distance travelled always increases. • Distance travelled is a function of time. • The distance travelled is greater in the last ten minutes of the journey than in any other ten-minute time interval. • The distance/time graph area is all real numbers. • The interception of water depth over time is y (0,0). • The distance travelled increases and decreases over time. • Water level is a function of time. • The distance/time range graph is from [0, 15000]. • The water depth area in terms of time is from [0,120] • The water depth range over time is from [4,5]. • The distance/time graph does not have a maximum value. • The depth of the water reached a maximum of 30 minutes. V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Floating down the river - Teacher NotesA solidify Understanding TaskPurpose: The purpose of this task is to fix an additional function and solidify key features unlocking different representations. Features include: • domain and range • where function increases or decreases • x and y interception • change rates (informal) • discrete vs. continuousCorrestandards Focus:F.IF.4 For a function that models a relationship between two quantities, interprets key characteristics of graphs and tables in terms of quantities and sketch graphs showing key characteristics given the verbal description of the relationship. Key features include: interceptions; intervals where the function increases, decreases, positively or negatively; relative maximums and minimums; symmetry; endevik; and periodicity.★F.IF.5 Refers the area of a function to the graph and, where applicable, to the quantitative link described therein. For example, if the function h(n) gives the number of man-hours required to assemble n engines in a factory, the positive numbers will be an appropriate domain for functional.★Related standards: F.IF.1, F.IF.6Launch (whole class): Read the scenario aloud. Before students start, ask their to understand what it means to interpret the interpretation of of the main characteristics we are looking for when interpreting graphs (or tables)? After mentioning the main characteristics (domain,range, spaces where the function is increased/decreased and intercepted), you need students in small groups to work on the task. Explore (Small Group): As you observe, listen to students' explanations as they interpret the key capabilities of the table and chart. If students are struggling to write table-based features, you can ask them to tell the story presented by table values, or to invite them with questions like How deep is the water 0 minutes away? What do you know about the water level after this time? Another question is to ask students whether using another representation would help them V© 2012 Project Mathematical Vision | M P In partnership with utah state education licensed under Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unwary License.see features. Encouraging students to visually link the key characteristic described with mathematical performance will help throughout the group discussion. Note: If most students struggle to name the characteristics using the two representations, put the entire group together after all the groups have had time to work on the table presentation. Choose a tree that has correctly used interval notation to describe where the water level increases and decreases to share. Make sure that the connection is visually made between the table and the interval attitude. Then ask the entire group what other features can be interpreted from the table. I'm including so much, range and interception. At some point, we want to point out that while the table is discreet, the function is continuous. If a student brings it, turn around. Otherwise, wait until the entire group discusses the whole task. Discussion (entire class): The purpose of the whole group discussion is to highlight the links between a presentation and the main features of this feature. Be sure to use academic opinions throughout the group discussion. Before you start all the discussion of the group, publish the table and chart so that students can better share their observations about the fugue they describe. Start the entire discussion of the group by reviewing several of Sierra's misguided statements that will enable students to report feasible arguments. For example, within the range of water conversation willlook how important it is to look at the output values when discussing the scope, not the start and end point of the trip. After going to several observation notes,choose one student to share the main features of the graph (distance relative to time). Make sure that this student looks at every feature of the graph while writing the function interpreted next to the graph. Once the the entire group about other observations made by Sierra that are related to the graph. Then select another other share the main characteristics of the table. Then scroll through sierra's observation notes. If at this point the conversation is not to discuss how this value table is discreet, but it is a continuous feature asking for the domain. Make sure that at the end of this discussion students understand that only some of the points for solving a permanent function can be evaluated. Aligned Ready, Set, Go: Features 2 V© 2012 Mathematical Vision Project | M P In partnership with Utah State Office of Education Licensed in Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unwary License.10 Features of Features 2 Ready, Set, Go! Ready © www.flickr.com/photos/hamiltonca Theme: Solve systems using graphics Graphics Each system of linear equations and find where f(x) = g(x) f (x) = 2x − 7 f (x) = −5x − 2 f (x) 1 x − 21. 2. =− 3. 2 g(x) = −4 x + 5 g(x) = −2 x +1 g(x) = 2 x + 8 f (x) = 2 x (x) = 2 x (x) = 2 x + 4 f (x) = x4. 3 5. 3 6. g(x) = −x g(x) = − 1 x +1 3 g(x) = −x − 3 V© 2012 Project Mathematical Look | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 11 Features of Functions 2 Set Theme: Describe the characteristics of a function from the graphical representation. A description of the function shall be presented for each given graph. Be sure to take into account the following: reduction / increase, min /max, domain/ range, etc. 7. Description of the function: 8. Description of functions: V© 2012 Project Mathematical Vision | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 12 Features of Functions 2 9. Feature Description: Go topic: Create equations with explicit and recursive notation. Write equations for the given tables in both recursive and explicit form. Explicit: Explicit: Explicit: Recursive: recursive: recursive: Recursive: 10. 11. 12. n f(n) n) n) n) 1 5 1 6 0 -- 13 2 2 2 2 2 -5 3 -1 3 24 3 -- 1 Explicit: Explicit: Recursive: Recursive: Recursive: 13. 14. 15. n f(n) n) n) n) n) n) n) 1 5 2 5 0 -- 4 11 7 129 1 --16 5 13 9 513 2 -- 64 V© 2012 Draft mathematical views | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 13 © www.flickr.com/photos/intercontinentalhongkongFeatures functionsA Practice Understanding TaskFor each graph, determine whether the link is a function, and ifso, specify the main characteristics of the function (spaces where the function increases or decreases, the maximum or minimum value of the function, domain and range, x and y interceptions, etc.) 1. 2.3. 4.145.6. 7.15 Tbsp Determine domain, range, x, and y interceptions.02 9. Based on the table, determine the minimum value and -32032465 12620 Against below is a separate function defined at the interval of [1,5]. x f(x) 10. Determine domain, range, x, and y interceptions.14 11. Based on the table, determine the minimum value and where it is.2 10354853Vis the key characteristics for each situation. 12. The amount of daylight depends on the time of year. 13. The first term in the series is 36. Each consecutive mandate is exactly 1/2 of the previous mandate. 14. Marcus bought a couch for $900 for six months, with no interest. He pays $50 on the loan every week. 15. The first term in the series is 36. Each consecutive term of office is 1/2 less than the previous mandate. 16. An empty tank of 15 gallons is filled with gasoline at the rate of 2 gallons per minute. For each equation, draw a graph and display the main characteristics of the graph.17) = −2 + 4, h ≥ 0 18. ( ) = 3 Functions – Teacher NotesA practice understanding tasksSpecial note of teachers: (only if necessary)Purpose: This task is designed for students to exercise interpretation of basic functions using graphs, table of values and situations. The main features of this task include students: • Applying their knowledge to interpret key function characteristics • Practicing writing an area of function • Comparing discreet and continuous situations • Graphs of linear and exponential equations and describing the main characteristics of graphCore Standards Focus:F.IF.4 For function, which models a relationship between two quantities, an interpretation of key characteristics of graphs and tables in terms of quantities, and diagrams of sketches showing key characteristics given an oral description of the link. Key features include: interceptions; intervals where the function increases, decreases, positively or negatively; relative maximums and minimums; symmetry; endevik; and periodicity.★F.IF.5 Refers the area of a function to the graph and, where applicable, to the quantitative link described therein. Related standards: F.IF.1, F.IF.3Launch (Entire class): Students should be able to start this task without additional support, as it is similar to the work they did on Preparing for a Pool Party and Floating Down river. It will be a good task to do in pairs. Review (Small Group): Monitor students to make sure they accurately answer questions about the functions of offunctions. If they only record one or two features, ask them what other features they've noticed. It's a good task to get students to justify their response to their partner as they go through the task. If students are wrong in their thinking, be sure to redirect your thinking. As a student, note the areas where students struggle to highlight these misconceptions throughout the group discussion. V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah, under the Creative Tokali program 3.0 Non-claimed license. Discussion (whole class): Since this is an exercise task, the discussion should involve overcoming problems that seem to be common problems, as well as problems that drive home standards. To start the entire group discussion, select one student to review all the features of one of the graphs to make sure that the change dictionary and corresponding features are displayed. Use this example to go through scrolls that are still confusing for students. The purpose of the whole group discussion is that ALL students can interpret key characteristics of graphs and tables and determine the area of a function. Aligned Ready, Set, Go: Features 3 V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Features 3 16 © ww.flickr.com/photos/intercontinentalhongkong Ready, Set, Go! Ready Topic: Create graphical representations and name the domain. Sketch a graphic to represent each function, and then specify the function domain. 1. y = 3x – 5 2. Sequence of terms so that f(0) = 1, f(n) = f (n -1) – 7 3. Sequence of terms so that f(1) = 8, f(n) = 1 (f (n - 1)) 4. f (x) = 3(4x) 2 Set Subject: Linear and exponential function attributes. Determine whether the claim is true or false, justify why. 5. All linear functions are increased. 6. Arithmetic sequences are an example of linear functions. 7. Exponential features have a domain that includes all real numbers. V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 17 Function characteristics 3 8. Geometric sequences have a domain that includes all numbers. 9. The exponential function range includes all real numbers. 10. All linear relationships are domain and range functions containing all real numbers. Go topic: Determine the domain of a feature from the graphical representation. For each graph, the area of the function is determined. 11. 12. 13. 14. V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. Amount of water (gallons) 18 ©www.flickr.com/photos/ableman/The Water ParkA Solidify understanding TaskAly and Dayne work in a water park and should drain the water at the end of each month for the trip they exercise. Everyone used a helper to remove water from the small pool at the bottom of their ride. The graph shows the amount of water in Aly's pool, a(x) and dayne basin, d(x), over time. Part I 1. Make as many observations as possible with the information given in the graph above. Part IIDayne understood that 1,000 gallons per minute and drained for 24 minutes. 2. Write the equation to draining the Dayne basin, d(x). What does each part of the equation mean? 3. Based on this new information, correctly label the graph above. V© 2012 Mathematical Vision Project | M P In partnership with Utah State Center of Education licensed under the Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unwary License.19 4. What values of x makes sense in this situation? Use a notation interval to save the domain of the situation. 5. Define a range or source values that are relevant in this situation. 6. Write the equation used to drain Alypool, a(x). Using the interval, specify the domain and range for the function, a(x), as well as the domain and scope of the situation. Compare the two domains by describing the limitations made by the situation. Part III Based on the graph and corresponding equations for each group, answer the following questions. 7. When is a(x) = d(x)? What does that mean? 8. Find (10). What does that mean? 9. If d(x) = 2000, x = ____ What does that mean? 10. When is a(x) > d(x)? What does that mean? V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Water Park - Teacher NotesIndive Understanding TaskPurpose: The purpose of this task is for students to interpret and emphasize functionsusing context. This task enables students to practice skills they have already learned and to strengthen their knowledge of functions. This task first requires students to make observations from the schedule. There are several observations that you need to make, and as studentsmake these observations, they have access to their knowledge as a way to prepare for the future task. In the following sections, students reinforce their understanding of the domain and distinguish between the sphere of function and the area of a situation. They also use a notation function to familiarize themselves with the meaning of the situation. In this task you should pay attention to the following mathematics: • Interpretation of x and y intercepts • Comparison of change speeds • Finding equivalent two functions • Connecting the equation to graphics and appropriate graphics labelling • Determining the area of function as well as restricted domains due to plot context • Interpretation of input and output functionsCorre Standards Focus :F.IF.2 Using function notation , assessing the input functions in their fields and interpreting data that use a notation function in terms of context. F.IF.4 For a function that models a relationship between two quantities, interpret key characteristics of graphs and tables in terms of quantities and sketch graphs showing key characteristics where an oral description of the relationship is given. Key features include: interceptions; intervals where the function increases, positive or negative; relative maximums and symmetry; endevik; and periodicity.★F.IF.5 Refers the area of a function to the graph and, where applicable, to the quantitative link described therein. For example, if the function h(n) gives the number of man-hours required to assemble n engines in a factory, then the positive numbers will be an appropriate domain for operation. ★F.IF.7 Graphical features, expressed symbolically, show the key characteristics of the graph, hand-in-hand and the use of technologies for more complex cases.★a. Graph linear and square functions and display of interceptions, maximum and minimum.e. Graph exponential and logarithmic functions showing interceptions and extreme behavior, and trigonometric functions indicating period, middle line and amplitude. V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. A.REI.11 Explain why the x-coordinates of the points where the equation graphs y = f(x) and = g(x) intersect are the solutions of the equation f(x) = g(x); find solutions, for example, using technology to list features, make value tables, or find consistent approximations. These include cases where f(x) and/or g(x) are linear, polynomial, rational, reasonable, absolute, exponential and logarithmic functions.★A.CED.3 Constitute limitations by equations or inequalities, as well as through systems of equations and/or or ori qualifications, and interpret solutions as feasible or non-viable options in the context of modelling. Forexample, represent inequalities describing the nutritional and cost limitations of combinations of reflected foods. Related standards: F.IF.1, A.REI.10, A.REI.11, N.Q.1, A.CED.2Launch (Whole Class):P art 1 of this task has students to make observations of the context of history by interpreting two graphs on the same set of axes. The large-scale factor of the graph is not intentionally indicated (this will be part of what students do during the task). Students should share their observations about the context of history based on their previous experience with linear functions and without having to be accurate. Start the task with a copy of the displayed graphic. After reading the prompt, ask students to spend a few minutes recording their observations on their own. Then, in general, researchers offer their knowledge of the class using appropriate academic language (i.e. reduction, steady pace, etc.). Use this opportunity to get students to justify each observation. Reinforce with visual cues (i.e. point to the intersection of both graphs when someone says that at some point, both pools will have the same amount of water). Some of the other things to highlight include: • Each pool decreases • Each pool decreases at a steady rate, it's not the same speed as the other • Aly's pool drains faster than Dayne's • At some point both pools will have the same amount of water in them • Dayne's pool is at a higher rate than Dayne's. . initially • Aly's pool will be empty before Dayne's, but both will have 0 water in them at a time • At some point both pools will be emptyExploder (Small Group): After completing Part 1 as a whole, students will continue to fill in Parts II and III insmall groups. If students get stuck writing the Equation for dayne's pool, you might suggest they use a strategy they've used in the past to write the equation in order. (Creating two points based on the information provided, saving a table of values or using the graph may be ways for students V© 2012 Mathematics Vision Project | M P In partnership with the State Of Utah State For Training licensed under the Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Non-Public License.define the equation). The purpose of Part II is for students to communicate the meaning of the context and to use this information to link the area of function to the situation. For Part III, listen to the disciples to understand the notation. Students have knowledge of opening intersections and missing values and have knowledge of the use of notation function. The new twist for them here is to transfer this knowledge of the understanding of tens to answer the questions posed in this task. Encourage students to put it into words and by showing where this appears on the chart. Discussion (Whole class): Most of the group discussions should focus on features such as Part II domain and interception and part III assessment.For Part II, select two different students to explain their strategies for finding solutions for Dayne and Aly. During this time, make sure that other part II highlights (interceptions, area of function relative to area of the situation) come out during the discussion. Move the conversation to Part III. Select students to share who have made sense of questions. For questions 7, 8, and 9, have students explain the meaning of the question and then share their resolution strategy. Connections must be made between the graph and the equations. If some groups are struggling during this part of the task, let everyone work in the small group to their 10 problem, then go as a whole group. Aligned Ready, Set, Go: Features 4 V© 2012 Mathematical Vision Project | M P In partnership with Utah State Office of Education Licensed in Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unwary License.20 Features 4 Ready, Set, Go! Ready © www.flickr.com/photos/ableman Theme: Attributes of linear and exponential functions. 1. Write a well-developed point comparing and contrasting linear and exponential function. Be sure to include as many features of each feature as possible and be clear about the similarities and differences these features have. Set Theme: Identify feature attributes from the graphical representation. Based on the graph, each issue below identifies the attributes of the feature, such as domain, scope, and whether the function increases or decreases, etc. 3. V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 21 4. Features of functions 4 5. 7. 9. 6. V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 8. 22 Functions 4 Go to Subject: Find Equations and Function Rules. Find both explicit and recursive equations for each value table below. 10. 11. 12. Explicit: Explicit: n f(n) Explicit: n f(n) n) n) n f(n) 3 Recursive: 6 23 Recursive: 1 Recursive: 1 Recursive: 2 4 2 5 3 8 7 19 3 7 4 16 15 4 9 5 32 9 11 3. 14. n f(n) 15. n f(n) Explicit: 3 8 Explicit: 6 7 Explicit: n f(n) Recursive: recursive: 1 1 2 3 4 4 9 13 3 9 5 2 12 19 16. 17. n f(n) 18. n f(n) Explicit: 2 16 Explicit: 17 5 Explicit: n f(n) Recursive: Recursive: Recursive: 2 40 4 32 3 3 4 20 10 8 16 4 1 26 20 V© 2012 Project Mathematical Vision | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. Amount of water (in thousands of gallons) 23 © www.flickr.com/photos/neiltPooling It TogetherA Solidify Understanding TaskAly and Dayne work in a water park and you need to drain the water at the end of each month for the trip they oversee. Everyone used a water can to remove water from the small pool at the bottom of their ride. The graph below represents the amount of water in the Aly basin, a(x), and the Dayne Basin, d(x), over time. In this scenario, they decided to work together to drain their groups and created the equation g(x) = a(x) +d(x). Using the graph below showing a(x) and d(x), a new set of axes and graph g(x) is created. Identify g(x) and blind (scale, axes). 4 3 time (minutes)Answer the following

questions about g(x). 1. What is g(x) ? 2. Specify the characteristics of g(x) and explain what each means means (each intercept, domain and range for this situation and for the equation, maxim and minimum, whether g(x) is a function, etc.) 3. Write the equation for g(x) using the intercepts in the chart. Compare this equation with the sum of equations created for a(x) and d(x) of the The Water Park task. Do they have to be the same? Why or why not? V© 2012 Mathematical Vision Project | M P In partnership with Utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unsupported License.24When combining features, many connections can be made. Make at least three links showing how equations a(x), d(x) and g(x) refer to the graphs of a(x), d(x), and g(x). (hint: consider the main features of the these functions). For a twist: If They and Dane Dane's Boss How will this affect the equation? Write the new equation, which represents how long it will take them to drain the two pools. V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Bringing it together: Teacher NotesSeding understanding TaskPurpose: The purpose of this task is for students to combine functions, make sense of function, and connect multiple representations (context, equations, and graphics). Students will also address the functions of the functions as they solve problems that arise from this context. Basic Standards Focus:F.BF.1 Write a function that describes the relationship between two quantities.★. Combine standard types of functions using arithmetic operations. For example, build a function that models the temperature of a cooling organ by adding the permanent function for decaying exponential, and to connect these functions to the model. F.IF.2 Using a notation function, evaluating input functions in their fields and interpreting data that use a notation function in terms of context. F.IF.4 For a function that models a relationship between two quantities, interpret key characteristics of graphs and tables in terms of quantities and sketch graphs showing key characteristics where an oral description of the relationship is given. Key features include: interceptions; intervals where the function increases, decreases, positively or negatively; relative maximums and minimums; symmetry; endevik; and periodicity.★F.IF.5 Refers the area of a function to the graph and, where applicable, to the quantitative link described therein. For example, if the function h(n) gives the number of man-hours required to assemble n engines in a factory, then the positive numbers will be an appropriate domain for operation. ★F.IF.7 Graphical features, expressed symbolically, show the key characteristics of the graph, hand-in-hand and the use of technologies for more complex cases.★a. Graph linear and square functions and display of interceptions, maximum and minimum.e. Graph exponential and logarithmic functions showing interceptions and extreme behavior, and trigonometric functions indicating period, middle line and amplitude. A.REI.11 Explain why the x-coordinates of the points where the equation graphs y = f(x) and = g(x) intersect are the solutions of the equation f(x) = g(x); find solutions, for example, using technology to list features, make value tables, or find consistent approximations. Include cases where f(x) and/or g(x) are linear, polio, rational, rational, absolute, exponential and logarithmic functions.★ V© 2012 Mathematics Vision Project | M P In partnership with Utah State Office of Education licensed under Creative Commons 3.0 Unguarded licence. 3. 3 3 equations or inequalities, as well as systems of equations and/or qualifications, and interpret decisions as feasible or non-viable options in the context of modelling. Forexample, represent inequalities describing the nutritional and cost limitations of combinations of reflected foods. Contact standards: F.IF.1, A.REI.10, A.REI.11, N.Q.1, A.CED.2Launch (Whole class): Read the introduction and remind students of the Task The Water Park, where Aly and Dayned were on the water from the pools over which they controlled in a water park. Ask the entire group What do a(x)+d(x)mean? Once you have completed this g(x) represents the combined effort to drain the two pools, proceed to the exploring part of the task, with students using any method to choose to create the graph of g(x) and then continue working on the task in small groups. Explore (small group): For stranded students, ask them questions like What information do you know about Aly and Dayne pools? and How can you present the information you know about a(x) and d(x) so that you can guess with g(x)? (Students can find solutions to solve g(x) by creating a table, agraph, or viewing equations.) Look for students who use different images to answer questions from the task. Make a note about this, as for the whole group discussion, you can choose students who use different methods to solve the first two questions. A common misconception would be that students who use intestinals will add X-intercepts to find the new X-intercept. This is a great opportunity to contagiously why it is appropriate to add y-intercepts to find the new y-intercept (these are the output values, therefore are the values of a(x) + d(x) and represent the amount of water in the pool), but why not add x-intercepts to find the new X-intercept (they are the input values and represent the amount of time it takes for each pool to drain separately). Discussion (Whole class): The purpose of this task is for students to have a deeper understanding of the basic functions and to be clearer about the function. The whole group discussion should cover what constitutes each part of a function and how this is performed when a notation of a function is used. It is most effective when students see this graphic,digital, and with equations and make connections to the characteristics of the function. There are many ways in which the whole group discussion can achieve these goals. Below is a suggestion on how to facilitate the entire group discussion using student error, which is also a common misconception. You can start the whole group discussion by having two students post their graphics on g(x), one is correct and the other is a common misconception (only if you feel your class V© 2012 Mathematics Vision Project | M P In partnership with the State of Education Utah licensed under the Creative Commons Program Recognition-Non-Commercial-ShareAlike 3.0 Unguarded License.There is a safe environment and student students part of the learning process is to learn from the classrooms). Start the conversation with how these are the two most common graphics in the whole room and that many people have either one or the other on their paper. Ask the entire group what is similar and what is different (both groups will have the same y-interception). Then select a student who has created a table showing the sum of the baseline values that agrees with the correct graph (select that student in advance). Also, students show how the equation of a(x) + d(x) shows in the correct graph. Make sure that the students they share are clearly expressed in the links showing how the equation a(x), d(x), g(x) refers to the graphs of a(x), d(x), and g(x). Once all students have the links between the right schedule and other presentations, ask what is the general discrepancy in the incorrect schedule. After all, students must leave how x is the input value and that g(x) is the value solution in x. Aligned Ready, Set, Go: Features 5 V© 2012 Mathematics Vision Project | M P In partnership with Utah State Office of Education Licensed in Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unwary License.25 Features 5 Ready, Set, Go! Ready Topic: Use graphical representation to find solutions. Use the graph of each provided function to find the specified values. © www.flickr.com/photos/neilt 1. 2. A. f(4)= B. f(- 4) = C(f(x)= 4 D. f(x)= 7 A. g(- 1)= B. g(- 3)= C(- 3)= C(- 4 D. g(x)= -- -1 3. 4. A. h(x)= 1 h(x) B(x)= -2 C. h(0) = D. h(3)= A. d(-5)= B. d(x)= 4 C. d(4) = D(x)= D(x)= 0 V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 26 Functions 5 Set Subject: A function context finds solutions. For each situation, either create a function or use the given feature to find and interpret solutions. 5. Fran collects data on the number of feet she can walk every second and writes the following rule to model her walking frequency d(t)= 4t. A. What does Fran do if she writes d(12)=? B. In this situation what d(t) = 100 tell you? C. How can the function rule be used to show that an hour of 16 seconds has been walked? D. How can the function rule be used to indicate that a distance of 60 metres has been travelled? Ms Callaghan works a budget and forecasts her spending for each month. She is currently trying to determine how much her mobile phone company is likely to charge her for the month. It pays a flat fee of $80 a month for a plan that allows unlimited calling but costs 20 cents per text message. A. Write a feature, c(t), about Ms Callahan's current plan, which will calculate the price for the month based on the number of text messages she makes. B. Find c (20) C. Find c(45) D. Find c(t) = 100 E. Find c(t) = F. How many texts will $20 unlimited unlimited cheaper once its current plan? 7. Mr Multbank has developed a model for rodent population growth in the field of his house. He believes that starting each spring, the population can be modeled based on the number of weeks with the function p(t)= 8 (2t). A. Find p(t) = 128 B. Find p(4) C. Find p(10) D. Find the number of weeks it will take for the population to be over 20,000. E. After a year with 16 weeks of summer, if rodents can be modeled with Mr. Multbanks model, how many rodents would expect by the end of summer? What can stop or interrupt the actual number of populations? V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 27 Feature features 5 Go Topic: Discreet and continuous For each context or presentation determine whether it is discreet or continuous or can best be modeled in a discreet or continuous way and condition why. 8. Susan has a savings plan, where she puts $5 a week in her piggy bank. 9. 10. Marshall tracked the number of hits he received each baseball game and recorded his total hits for the season in the league. 11. The distance you have traveled since the beginning of the day. 12. 13. Number of gum balls price 5 1 10 2 15 3 20 4 V© 2012 Mathematics Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 28 © www.flickr.com/photos/alanenglishInterpreting FeaturesA Practice Understanding taskGiven graph of f(x), answer the following questions. Unless otherwise stated, limit the function area to what you see in the chart below. Approximate values are appropriate answers. 1. What is f(2)? 2. For which values, if any, f(x) = 3? 3. What is x-intercept? 4. What is the domain f(x)? 5. At what intervals is f(x) > 0? 6. At what intervals does f(x) increase? 7. At what intervals is f(x)reduced? 8. For which values, if any, is f(x) > 3? Take into account the linear graph of f(t) and the non-linear graph of g(t) in order to answer questions 9-14. 9. Where is f(t) = g(t)? 10. Where is > g(t) ? 11. What is f(0) + g(0) ? 12. What is f(-1) + g(-1) ? 13. What is greater: f(0) or g(-3)? 14. Graph: f(t) + d(t) of [-1, 3] V© 2012 Project Mathematical Vision | M P In partnership with the Utah State Department of EducationLicensed under the Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unordered License.29The same value table is two continuous functions, f(x) and g(x). Use the table to answer the following questions: x f(x) g(x) 15. What is g(-3)?-5 42 -13 16. For what value(s) is f(x) = 0?-4 30 -9 17. For which values is (x) increased?-3 20 -5 What interval is g(x) > f(x)-2 12 -1 19. Which function changes faster in the interval [-5, 0]? Why?-1 6 30271 0 112 0 153 2 194 6 235 12 12 20 31Use the following links to answer the questions below.h ( ) = 2 (= 3 − 2 = 5 = 4 = 5 + 120. Which of the above relationships are functions? Explain.21. Find f(2), g(2) and h(2).22. Write the equation for g(x) + h(x).23. Where is g(x)< h(x)?24. Where is f(x) ?25 increasing? V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Interpretation of features – Teacher notesPresta understanding TaskPurpose: Students use notation function in different forms and have become more comfortable with features. In this task, the goal is for students to practice their understanding of the following: • Distinguish input and output values when using notation • Evaluate input functions in their areas • Determine the solution where f(x) and g(x) graphs intersect based on value tables and by interpreting graphs • Combine types of standard functions using arithmetic operations (finding values of f(x)+ g(x)) Basic focus standards : F.IF.2 Using a notation function, evaluates the login functions in their areas, interpretative data that use the function, notations in terms of context. F.IF.4 For a function that models a relationship between two quantities, interpret key characteristics of graphs and tables in terms of quantities and sketch graphs showing key characteristics where an oral description of the relationship is given. Key features include: interceptions; intervals where the function increases, decreases, positively or negatively; relative maximums and minimums; symmetry; endevik; and periodicity.★F.IF.5 Refers the area of a function to the graph and, where applicable, to the quantitative link described therein. For example, if the function h(n) gives the number of man-hours required to assemble n engines in a factory, then the positive numbers will be an appropriate domain for operation. ★F.IF.7 Graphical features, expressed symbolically, show the key characteristics of the graph, hand-in-hand and the use of technologies for more complex cases.★a. Graph linear and square functions and display of interceptions, maximum and minimum.e. Graph exponential and logarithmic functions showing interceptions and extreme behavior, and trigonometric functions indicating period, middle line and amplitude. F.BF.1b Write a function that describes the relationship between two dimensions. Combine standardfeatures using arithmetic operations. A.REI.11 Explain why the x-coordinates of the points where the equation graphs y = f(x) and = g(x) intersect are the solutions of the equation f(x) = g(x); find solutions, for example, using technology to list features, make value tables, or find consistent approximations. V© 2012 Project vision | M R Partnership with State Office of Education licensed under Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unguarded License. These include cases where f(x) and/or g(x) are linear, polynomial, rational, reasonable, absolute, exponential and logarithmic functions.★A.CED.3 Constitute limitations by equations or inequalities, as well as through systems of equations and/or or ori qualifications, and interpret solutions as feasible or non-viable options in the context of modelling. Forexample, represent inequalities describing the nutritional and cost limitations of combinations of reflected foods. Related standards: F.IF.1, A.REI.10, A.REI.11, N.Q.1, A.CED.2Launch (Whole Class): Students should be able to start this task without additional support, as it is similar in nature to the work they did at Water Park and Pooling To together. If you prefer, you can make a graph on the board and ask students a few questions using a notation function before getting them to start the task. It would be a good task to get students to start themselves, and then to sequence them after most have completed the first set of questions. Review (small group): Watch for students who confuse I/O values. Without context, keeping track of this isa general error. Encourage students to explain their arguments as they work through solutions to problems. If students are wrong in their thinking, be sure to redirect your thinking. As you observe, pay attention to the areas where students are struggling. Discuss (the entire class): Go to the problems that seem to be common questions that students are still struggling with. Then select students to share their method of graphic number 14. Compare students who used point by point with those who added from one chart to the next. The purpose of this whole group discussion is that ALL students can evaluate functions using notation, can interpret function functions using a graph or value table, and combine two functions to make another function. Aligned Ready, Set, Go: Features 6 V© 2012 Mathematical Vision Project | M P In partnership with Utah State Office of Education Licensed in Creative Commons Recognition-Non-Commercial-ShareAlike 3.0 Unwary License.30 Features 6 Ready, Set, Go! Ready topic: Solve systems by graphically graphical graphical calculation of each system of linear equations and find where f(x) = g(x) © www.flickr.com/photos/alanenglish f (x) = 3x + 4 f (x) = -5x +12 1. 2. f (x) = 1 x + 2 3. 2 g(x) = 4 x +1 g(x) = −2x − 3 g(x) = 2x − 7 f (x) = 2 x + 5 f (x) = x + 5 f (x) = x − 64. 3 5. 6. g(x) = -x + 7 g(x) = −x − 3 g(x) = −x − 6 V© 2012 Project Mathematical Vision | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 31 Functions of the 6 Set Theme: Link context to graphicimages For each graphic, create a context, provide independent and dependent variables that will match the context you select. Then create a 2014, which describes what happens on the chart. 7. Зависима променлива: _____² независима променлива: _____2222 Независими променливи: _____Описание на контекста и историята за графиката: зависима променлива:_____² независима променлива:___©_____000000000 M P Партньорство с щата Щата за обучение в Юта лицензирана по програмата Криейтив Комънс Признание----Некомерсиално-ShareAlike 3.0 Непредпазен лиценз. 32 Features of 6 Go Topic features: Describe the characteristics of a function from the graphical representation. A description of the function shall be presented for each given graph. Be sure to take into account the following: reduction / increase, min /max, domain/ range, etc. 7. Description of the function: 8. Description of functions: V© 2012 Project Mathematical Vision | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 33 Features of Functions 6 9. Function description: 10. Description of the function: V© 2012 Mathematical Vision Project | M P Partnership with the State of Utah Training State licensed under the Creative Commons Recognition----Ne-Commercial-ShareAlike 3.0 Unguarded License. 34A Water FunctionA Understanding Development TaskAndrew walked around a water park taking pictures of his family with his phone. Later, he found his phone missing. To help him search for his lost phone, he drew a picture card that took his footsteps, showing where he was going. If we want to determine Andrew's location in the park in terms of weather, his location will be a function of the weather? Why or why not? Explain. © 1. Situation A: Sketch a graph of the total distance Andrew has walked if he walks the course all the time. 2. Situation B: Outline the graph of Andrew's distance from the input (his starting point) as a function of the time. 3. How will the chart of each situation change if Andrew stopped on the slide for a certain period of time? Will this change change, is this situation a function? V© 2012 Mathematical Vision Project | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. Water function – The Teacher notesSeuble the understanding of the task: The purpose of this task is to solidify the definition of function. Students explore the relationship between area elements and how each item within a domain has exactly one matching element in the range. Students need to realise that the domain can be restricted and can be a function. Students should also realize that the relationship is a function, although two different entrances produce the same output as when Andrew is in the same place on two different occasions in his walk. Basic standards Focus: F.IF.1 F.IF.1 That function from one set (called a domain) to another set (called a range) assigns each domain item exactly one element of the range. If f is a function and x is an analyment of its area, f(x) means the output of f corresponding to input x. Fis graph of the equation y = f(x). Startup (The whole class): Have students think about the context of the task and make sure they are clear about the path Andrew is taking around the park. Let them read a prompt to the right of the park photo and guess whether Andrew's location is a function of the time before they work on the task. Ask students to write their conjectures and explanations, and then have students to share their conjectures and explanations. Link their arguments to the definition of function. This means that the discussion focuses on the issue that at any time Andrews in one place, which means that for each element of the domain there is exactly one element of the range. Study (Small Group):D students will explore many functional relationships that arise from the same context. In this case, the total distance travelled as a function of time walking; and distance from a point as a function of time walking. Although the graphics of these two features will bedifferent, look for students who show the horizontal lines as a common feature in each of their graphs for the time interval when Andrew is still standing next to the slide. While you're a self-working student, ask how they make decisions about the characteristics of their features, such as where graphs increase or decrease, where graphs have maximum and minimes, what the domain and range are, and what limitations are created by the situation, and what graph offsets are in context. Discussion (entire class): V© 2012 Draft Mathematical Perspectives | M P In partnership with utah State Office of Education licensed under Creative Commons Recognition-NonCommercial-ShareAlike 3.0 Unwary License. License.