



**Inclement Weather
Resources
Mathematics
Algebra II**

**The Department of Curriculum
&
Instruction**

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Hello MSCS Family,

This resource packet was designed to provide students with activities that can be completed at home independently or with the guidance and supervision of family members or other adults. The activities are aligned with the TN Academic Standards for Mathematics and will provide additional practice opportunities for students to develop and demonstrate their knowledge and understanding.

A suggested pacing guide is included; however, students can complete the activities in any order over the course of several days. Below is a table of contents which lists each activity.

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Day 1: Take Me Out to the Ball Game

Grade Level Standard(s)	<p>A2.F.IF.A.1 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.</p> <p>A2.N.Q.A.1 Use units as a way to understand real-world problems.</p> <p>A2.F.IF.B.4 Graph functions expressed algebraically and show key features of the graph by hand and using technology.</p> <p>A2.F.IF.B.6 Compare properties of functions represented algebraically, graphically, numerically in tables, or by verbal descriptions.</p> <p>A2.A.CED.A.2 Create equations and inequalities in two variables to represent relationships between quantities and use them to solve problems in a real-world context. Graph equations and inequalities with two variables on coordinate axes with labels and scales, and use the graphs to make predictions.</p> <p>A2.F.BF.B.3 identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive and negative); find the value of k given the graphs.</p> <p>A2.F.BF.B.4 Find the inverse of a function.</p>
Caregiver Support Option	For additional support, have the student access the page of video links below. After clicking the link and accessing the page, click “Expand All Here” to see the list of support videos by topic and skill. Linear Equations and Functions Videos
Materials Needed	Pencil and Paper
Question(s) to Explore	How can I determine if functions are one-to-one and onto? Can I determine the linearity, intercepts, and symmetry of functions? How do I analyze and compare graphs? Can I graph functions and inequalities in two variables? How can I identify and use transformation of functions?

Performance Task

Take Me Out to the Ball Game

Jasmine works at baseball games. She sells products including hot dogs, drinks, t-shirts, funny hats, pictures of the teams, and more. She can earn money by the hour, but her boss has also offered her a new opportunity. Jasmine needs to determine if the new opportunity is better than the pay she is already making.

Part A

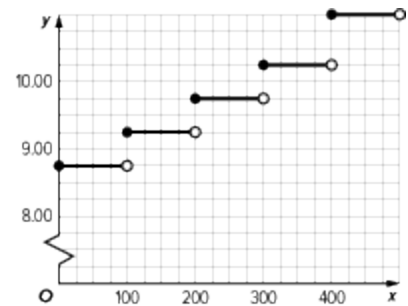
Jasmine currently earns \$9.25 per hour and gets an additional \$20 per week if she is on time each day. Since Jasmine is always on time, her current pay can be modeled by the function $f(x) = 9.25x + 20$, when $x \geq 0$.

Would the earnings function be *one-to-one*, *onto*, *neither*, *both*, *continuous*, *discontinuous*, and/or *discrete*? Explain. Assume that the codomain is $\{y | y \geq 0\}$. How much would she earn after working 30 hours (6 days of 5 hours of work each)?

Part B

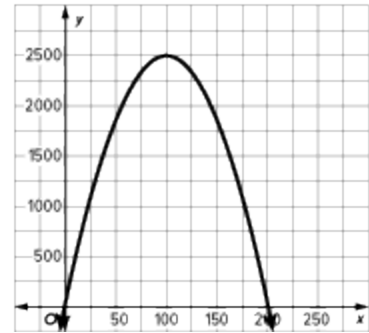
Jasmine’s boss has made a second offer. Her hourly wage would depend on how much she has sold that week in products.

Using the graph of the function, explain how the new pay structure works. Be sure to include the domain, range, and how much Jasmine would have to sell to make more money than she does now.



Part C

As Jasmine is walking up and down the stands selling hot dogs, she starts to think about her sales to determine if the offer is worth it. She decides to create this graph of hot dog sales over time of the game, in minutes.



Is this function linear? Does it have any types of symmetry? Where are the intercepts of the function, and what do they mean? Are there relative maximums or minimums? What do they mean in the situation? Using the hot dog sales, would it make sense for Jasmine to agree to her boss’s offer?

Part D

Jasmine has decided to create her own possible pay scale to discuss with her boss. For the first 10 hours per week, her pay will stay at \$9.25 with no bonus. For hours 11 through 20, she will earn \$11 per hour, and for hours 21 through 30, she will earn a flat rate of \$100.

Describe the sketch of a graph of the total amount earned over time for Jasmine if she typically works 30 hours per week. Does her new plan increase her pay?

Part E

Jasmine wasn’t impressed with her first idea for a new pay scale, so she decided to transform some functions and see which will increase her pay. She used the parent function $f(x) = x$ and transformed it to $g(x) = 10.5x + 50$.

Jasmine would like her boss to consider this function for determining her pay. Explain the transformations that were done on the parent function and how the function would be used to determine Jasmine’s pay. Then determine if this model is better for Jasmine.

Part F

During all of Jasmine’s calculations, one of her equations became quite a mess to solve.

$$2x^2 + 9x + 5 + 2x = x^2 + 32 + 3$$

Explain how Jasmine can create a related function and graph it to determine the solution.

Day 2: Optimizing Income	
Grade Level Standard(s)	<p>A2.N.Q.A.1 Use units as a way to understand real-world problems.</p> <p>A2.A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems in a real-world context.</p> <p>A2.A.CED.A.2 Create equations and inequalities in two variables to represent relationships between quantities and use them to solve problems in a real-world context. Graph equations and inequalities with two variables on coordinate axes with labels and scales, and use the graphs to make predictions.</p> <p>A2.A.REI.B.3 Write and solve a system of linear equations in a real-world context.</p>
Caregiver Support Option	<p>For additional support, have the student access the page of video links below. After clicking the link and accessing the page, click “Expand All Here” to see the list of support videos by topic and skill.</p> <p style="text-align: center;"><u>Equations and Inequalities & Linear Systems</u></p>
Materials Needed	Pencil and Paper
Question(s) to Explore	<p>Can I solve linear equations and inequalities in one variable?</p> <p>Can I solve systems of equations by graphing, substitution, or elimination?</p> <p>Can I solve equations and inequalities involving absolute value?</p>

Performance Task

Optimizing Income

Steven has a small business that provides computer application training and data entry support services. He earns \$25 per hour for training and \$15 per hour for data entry support. Steven can work no more than 40 hours a week. He wants to use linear programming techniques to optimize his income.

Part A

Construct a model to represent the amount of time Steven can spend on data entry and training. Be sure to define your variables. Sketch a graph of your model.

Part B

While Steven would like to spend most of his time training, the number of hours spent training cannot exceed twice the number of hours doing data entry support. Steven must spend at least 10 hours each week on data support. Construct a model to show the constraints. Sketch a graph of your model.

Part C

Find the vertices of the feasible region. Show your work, or explain how you found the coordinates.

Part D

What is the maximum possible amount of money Steven can earn in a week given the constraints? Round to the nearest dollar. Validate your solution to assess the reasonableness of your model.

Part E

The number of hours Steven worked one week resulted in a gross income of \$800. From this, a portion was withheld for benefits, retirement, and taxes. The total amount withheld from Steven's check was \$264.

The amount withheld for taxes was twice the amount withheld for retirement, and the amount withheld for benefits was \$24 less than the sum of retirement and taxes. Construct a system of equations that can be used to find the amount of benefits, retirement, and taxes. Be sure to define your variables.

Part F

Solve the system from **Part E**. Validate your solution to assess the reasonableness of your model.

Answer Key

Performance Task

Take Me Out to the Ball Game

Sample Answers:

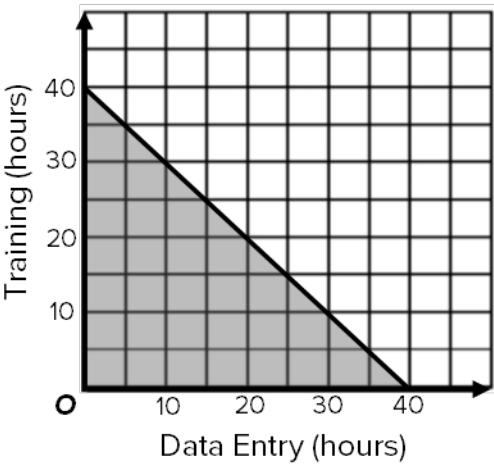
Part	Max Points	Scoring Rubric
A	1	<p>Full Credit:</p> <p>The function is continuous because you can draw the entire line without ever picking up your pencil. It is not onto because the range and the codomain are not equal. It is one-to-one because every value of the range corresponds to only one value of the domain. The data are not discrete.</p> <p>If Jasmine works a partial hour, she can still multiply this by 9.25 to determine the amount earned. She would earn \$297.50 for working 30 hours.</p>
B	1	<p>Full Credit:</p> <p>Jasmine’s boss is offering her a pay scale in the form of a step function. The domain of the function is $\{x \mid 0 < x < 500\}$, and the range is $r = \{y \mid y = 8.75, 9.25, 9.75, 10.25, 11\}$. Jasmine’s pay would increase each week if she reached a certain level of sales. If she doesn’t sell at least \$100 worth of merchandise in the week, her pay would drop below the \$9.25 she is currently earning. She has to sell \$200 or more to earn more than her current hourly rate. If Jasmine is able to sell quite a bit of merchandise, this pay scale could be beneficial to her.</p>
C	1	<p>Full Credit:</p> <p>This function is not linear, it is quadratic. It has linear symmetry. The intercepts at $(0, 0)$ and $(200, 0)$ show that at the beginning and end of the game (3 hours, 20 minutes), there are no hot dog sales. In fact, you can see that as the game progresses, the hot dog sales increase until about the middle of the game $(100, 2500)$ where they start to decrease again. The turning point, where the graph goes from increasing to decreasing, is an extrema or relative maximum. It is located at $(100, 2500)$ and shows that at about 100 minutes into the game there are 2500 hot dogs being sold throughout the game. With there being 6 games a week, and so many hot dog sales, among other things that can be sold, Jasmine would do well accepting her boss’s offer.</p>
D	1	<p>Full Credit:</p> <p>The sketch of the graph will be a piecewise-defined function, made of three linear pieces. The overall function is not linear, but will be continuous. A straight line will start at $(0, 0)$ and reach $(10, 92.50)$. At the end of 10 hours, Jasmine will have earned \$92.50. From the next 10 hours, she will earn another \$110, making her total at the second line segment \$202.50 after 20 hours, $(20, 202.50)$. Then, the third line segment will be a horizontal line showing the \$100 increase she earns for any hours worked between 21 and 30, capping out her total earnings at \$302.50. The graph will stop at</p>

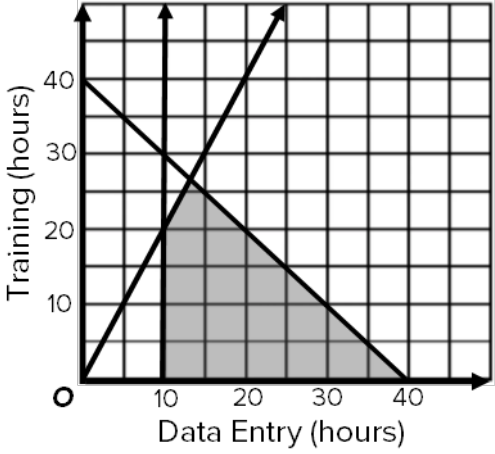
Part	Max Points	Scoring Rubric
		(30, 302.50). This plan will earn Jasmine more money than she originally earned, but only by \$5.
E	1	<p>Full Credit:</p> <p>Jasmine dilated the function by a factor of 10.5 and then translated the function up 50 units. If Jasmine were to work for 30 hours, the variable would be replaced with 30 and then solved. Or, you could graph the function and determine the value of $f(30)$. Her total pay would be $10.5(30) + 50 = 315 + 50 = 365$; she would earn \$365 for 30 hours of work. This is by far the best offer at this time. If Jasmine used her boss's scale, at most, she would earn \$11(30) hours for a total of \$330 for 30 hours of work and would have to reach the sales amount to earn that wage. Jasmine and her boss could discuss the "bonus" of \$50 that translated the formula to work out how she would earn that.</p>
F	1	<p>Full Credit:</p> <p>Jasmine should start by solving the equation for 0.</p> $2x^2 + 9x + 5 + 2x = x^2 + 32 + 3$ $2x^2 + 11x + 5 = x^2 + 35$ $x^2 + 11x - 30 = 0$ <p>Next, she can graph a related function and determine the zeros of that function. The zeros will be the x-intercepts of the function.</p> $f(x) = x^2 + 11x - 30$ <p>The x-intercepts are located at (5, 0) and (6, 0), making the solutions 5 and 6.</p>
Total	7	

Performance Task

Optimizing Income

Sample Answers:

Part	Max Points	Scoring Rubric
A	2	<p>Full Credit:</p> <p>Let x represent the time in hours that Steven spends on data entry support and let y represent the time in hours spent in training.</p> $x + y \leq 40$ 
B	2	<p>Full Credit:</p> $x + y \leq 40$ $y \leq 2x$ $x \geq 10$

Part	Max Points	Scoring Rubric
		
C	1	<p>Full Credit:</p> <p>There are four vertices.</p> <p>(10, 0) is the intersection of $x = 10$ and $y = 0$.</p> <p>(10, 20) is the intersection of $x = 10$ and $y = 2x$.</p> <p>(40, 0) is the intersection of $y = 0$ and $x + y = 40$.</p> <p>To find the last vertex, I solved the system $x + y = 40$ and $y = 2x$ by substitution.</p> $x + 2x = 40$ $3x = 40$ $x = \frac{40}{3}$ <p>So the vertex is at $\left(\frac{40}{3}, \frac{80}{3}\right)$.</p>
D	1	<p>Full Credit:</p> <p>The maximum must occur at one of the vertices. The amount he can earn is given by the function $f(x, y) = 15x + 25y$.</p> <p>(10, 0): $15(10) + 25(0) = 150$</p> <p>(10, 20): $15(10) + 25(20) = 650$</p> <p>(40, 0): $15(40) + 25(0) = 600$</p> <p>$\left(\frac{40}{3}, \frac{80}{3}\right)$: $15\left(\frac{40}{3}\right) + 25\left(\frac{80}{3}\right) \approx 867$</p> <p>The maximum amount Steven can earn in one week is \$867.</p> <p>Validate the conclusion by checking the earnings for another point inside of the feasible region. Choose (20, 10).</p> <p>(20, 10): $15(20) + 25(10) = 550$</p> <p>Because the value is less than the maximum found, the model appears to be correct.</p>

Part	Max Points	Scoring Rubric
E	1	<p>Full Credit:</p> <p>Let r represent the amount for retirement, t represent the amount for taxes, and b represent the amount for benefits.</p> $r + t + b = 264$ $t = 2r$ $r + t - 24 = b$
F	1	<p>Full Credit:</p> <p>The second and third equations can be used to substitute into the first equation.</p> $r + 2r + r + 2r - 24 = 264$ $6r - 24 = 264$ $6r = 288$ $r = 48$ <p>Substituting back: $t = 2(48) = 96$ and $b = 48 + 96 - 24$ or 120.</p> <p>To summarize: $r = 48$, $t = 96$, and $b = 120$.</p> <p>Validate by checking the solution as compared to the given information.</p> <p>Given: The total is \$264. $r + t + b = 264 \rightarrow 48 + 96 + 120 = 264 \checkmark$</p> <p>Given: The amount withheld for taxes was twice the amount withheld for retirement. $t = 2r \rightarrow 96 = 2(48) \checkmark$</p> <p>Given: The amount withheld for benefits was \$24 less than the sum of retirement and taxes. $r + t - 24 = b \rightarrow 48 + 96 - 24 = 120 \checkmark$</p> <p>The solution is validated.</p>
Total	8	