

Algebra I

Exam #4-Linear Functions

Name:

Winter 2010, Mr. Burdick

Hour:

Date:

Total Score: (118 Points Possible).....

Extended Written Response Clear Purpose:

This formative task was developed to assess, to measure the knowledge and understanding of writing multiple responses toward the process of finding linear functions. The purpose of the assessment will provide detailed feedback for both students and teachers regarding the individuals and class progress toward the mastery of the learning goals. This assessment will assist the instructor to determine if the students understand the key concepts of linear functions by analytical, graphical and table interpretations at this point of the unit by assessing the short answer, and long extend responses. Another purpose of this formative assessment is to provide students a feedback on their knowledge/understanding of linear functions that they will need to know before they can effectively progress further in mathematics. The teacher will evaluate the students' work by providing specific feedback for the students after their evaluation of the work with this assessment. This will allow both the students and teacher see how the students are progressing toward mastering the learning goals of this unit.

Michigan Standards/Benchmarks:

StandardA3: Families of Functions

- **A3.1 Lines and Linear Functions**
 - A3.1.1: Write the symbolic forms of linear functions (standard, point-slope, and slope-intercept) given appropriate information and convert between forms.
 - A3.1.2: Graph lines (including those of the form $x = h$ and $y = k$) given appropriate information.
 - A3.1.3: Relate the coefficients in a linear function to the slope and x - and y -intercepts of its graph.
 - A3.1.4: Find an equation of the line parallel or perpendicular to given line, through a given point; understand and use the facts that non-vertical parallel lines have equal slopes, and that non-vertical perpendicular lines have slopes that multiply to give -1.

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Clear Targets:

Learning Targets	Knowledge Questions	Reasoning Questions
I can explain what each of the symbolic forms of linear functions (standard, point-slope, and slope intercept) represent and describe the process on how to switch between each one if one is already given.		7,12,14-15
I can demonstrate and describe the process on how to solve for the slope of a line if given two points.		6,8-15
I can define the terminology for this unit, like slope, parallel equation, perpendicular equation etc.	1-5	11-15
I can explain the process to solve for a linear function line by graphical and table interpretations		8,9,11-15
I can explain the process on how I can find the equation that is either parallel or perpendicular to the given line.		9,13

Directions:

- In the past month, we have been discussing the basics of linear functions by analytical, graphical and table interpretations. As similar to the Selected Response Assessment, we have found the process to find the equation of lines from tables and graphs by computing the slope and y-intercept and work with the different symbolic forms of linear functions. Also, we know how to compute the parallel and perpendicular line to a given equation. This exam is designed to assess your knowledge of this unit by answering short and long responses to explain and demonstrate the process; how to identify the different forms of linear functions, how one would compare/contrast one to the other format, how to compute the linear functions by using graphs and tables, and how to find the parallel and perpendicular equations to a given equation.
- There are 3 different sections on this test
 - **Section 1: Short answers sections, fill-in-the-blank are worth 2 points each**
 - **Section 2: Short answer response (Pick 3 of the 5 questions and will be worth 12 points per response)**
 - **Section 3: Longer response/essay section (Pick 3 of the 5 questions and will be worth 24 points per response).**

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- This test is worth 118 points. Write your name, hour and date in the upper left corner. Place your answers in the empty space provided. If you use up all the space, staple the extra sheet to the test. Make sure the extra sheet has your name, class and assignment on it as well as the problem number so I know this is a continuation in your response.
- After each question, you will be asked whether you were sure or unsure of your answer. Make an "X" or checkmark to identify your answer.
- Unless otherwise stated, you may use a graphing calculator to assist you on any question. However, using symbolic manipulating capabilities of calculators, such as the **TI-89 or TI-92 is not permitted.**
- The use of a **note sheet or external aid of any type** on this exam is **NOT permitted.**
- Once you are completed, review the test again and double-check your work. Quietly walk up to my desk and place the test in the basket for your class. Then, you can start working on the next investigation in your textbook or work on the practice problems that were just assigned. Please be quiet since every student deserves a quiet environment for this assessment.
- Take your time; you have the rest of the class period to complete this test. Don't rush and Good Luck! If you have any questions, raise your hand and I will assist/clear up any misunderstandings.
- After you turn in the assessment, you are encouraged to fill out the self-assessment portion of the assessment.

Section I: Short Response, Fill-in-the-Blank (2 points each) for questions 1-5, on your answer sheet, fill in the missing word(s) that would complete the sentence. Also, make sure you check or mark if you are sure or unsure about the answer.

1. The equation that has the _____ slope as the given equation and has a different y- intercept is a called perpendicular equation.
Sure: _____ Unsure: _____
2. $y = mx + b$ is the generic formula for _____ equation.
Sure: _____ Unsure: _____
3. In order to _____ the slope, we use $\frac{\Delta y}{\Delta x}$ formula.
Sure: _____ Unsure: _____
4. In order to compute the Standard formula, the generic formula is _____.
Sure: _____ Unsure: _____
5. The other formula for linear function is _____, which the generic equation is $y - y_1 = m(x - x_1)$.
Sure: _____ Unsure: _____

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Section 2: Short Response (12 points each): for questions 6-10, please pick 3 out of the 5 short answers response questions by reading the given problems carefully. **SHOW YOUR WORK** on a separate piece of paper. Use your work as you describe the process in the short answers. Please elaborate on what your process is to solve each problem. This means I want you to discuss the steps you took in order to solve each step as well see your math on a separate piece of paper. Also, make sure you check or mark if you are sure or unsure about the answer.

6. (12 Points) With the given table,

# of Days	Amount of text message left
0	1000
1	920
2	840
3	760
4	680

Explain and demonstrate the process on how one would find the rate of change between $x=1$ and $x=2$? Please include the appropriate units in your answer.

Sure: _____ Unsure: _____

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7. **(12 Points)** Explain the process on how to switch between standard forms to point-slope form? Describe the steps that are involved to go through this problem. Provide at least one example in your response that demonstrates that you know how to do this process.

Sure: _____ Unsure: _____

Points received:

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8. (12 Points) Given this table,

# of Days	Miles ran in 1 workout
1	.5
2	1
4	1.5
4	2
5	2.5

Describe and demonstrate the process on how one would construct the slope point equation for this data. After constructing the equation, also explain what the function represents in terms with the two variables.

Sure: _____ Unsure: _____

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9. **(12 Points)** Given this table,

# of weeks	Amount of hours spent on a Online Social network website
0	0
2	6
4	12
6	18
8	24

Explain and demonstrate the process on how one would construct the perpendicular equation to the equation for this data. After constructing the equation, also explain what the function represents in terms with the two variables.

Sure: _____ Unsure: _____

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10. **(12 Points)** Explain what the slope is, and why is it important in linear functions?
Provide at least 3 examples in your response as well as using the appropriate units.

Sure: _____ Unsure: _____

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Section 3: Long Response (24 points each): for questions 11-15, Please pick 3 out of the 5 longer response questions by reading the given story problem carefully. You must choose one of the problem scenarios as one of your responses. After reading each question/problem, produce a written response that would demonstrate your knowledge on how to solve the problem algebraically and with a written explanation. Please elaborate on what your process is to solve each problem. This means I want you to discuss the steps you took in order to solve each step as well as see your math on a separate piece of paper. Also, make sure you check or mark if you are sure or unsure about the answer.

11. **(24 Points) Problem Scenario:** Sara just graduated from Beaver Creek High School and will be attending Grand Valley State University. She's considering playing colligate Volleyball for them, but didn't receive a full ride. Her parents are willing to help her pay for college but she needs to take a student loan out in order to cover all of the college expenses (\$20,000 for the 1st year). After the discussion with her family, they decided on two options. Her parents agreed to pay for half of the college fees if she decided not to play; however, she will need to work during the school year.

- Her 1st option is to take out a student loan of \$10,000 from her bank for the 1st semester and work part-time. This will help pay some of the debt while playing volleyball. She could become a tutor at the Tutoring Center with a wage of \$8.60 per hour, but limited to 15 hours per week. This will allow her to still have time to balance school with volleyball and a job. Also, her parents agreed to give her \$200 per month for spending purposes, since she can't work as much.
- Her second option is to not play volleyball at GVSU and have two jobs to pay off the \$10,000 she owes in loans. She could work part-time at Meijer's as a cashier with a wage of \$9.50 per hour, 30 hours per week. Also, her parents agreed to give her \$100 per month for spending purposes.

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In a long response essay, what option should Sara decide to go with? Explain with supporting points and details. Also, having a visual, like a graph and table would be great visual support, and show your mathematical process on how to solve this problem. Write a persuasive letter to her parents as Sara, in order to convince why Sara picked either option 1 or 2. Please write in correct sentence structure, tense, grammar and spelling rules. Make this look professional letter that would convince Sara’s family on her decision choice.

Sure: _____ Unsure: _____

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12. (24 Points) After discussing many examples of real world applications of using linear functions, come up with 4 applications where someone can use linear functions and explain why/how you can use linear functions in the application. State what the variables, like m and b are in each situation with the appropriate units. Also write each of the 3 different forms of linear functions in your response as well.

Sure: _____ Unsure: _____

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13. (24 Points) Explain and demonstrate the process on how one would construct the parallel equation. In your response, include an example to demonstrate that you know this process and follow every step. I suggest making a table or a graph to use as support to your response. After constructing the equation, also explain what the function represents in terms with the two variables.

Sure: _____ Unsure: _____

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14. (24 Points) Of the 3 forms of linear functions that we learned so far in this class, pick two of the 3 forms and Compare/Contrast them in an essay format. Your response must include 3 similarities and 3 differences. You may at least use an example of each form in your response as support. Please indentify what the function and variables of the equation may represent in both cases.

Sure: _____ Unsure: _____

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15. (24 Points) Problem Scenario: A cellular phone company charges monthly rates according to the following plan:

- Option 1:
 - Monthly fee is \$39.99 for activation for a “Pay as You Go Phone”
 - This plan includes UNLIMITED text!
 - For calling, they charge \$.10 per minute for every call you make
- Option 2: Monthly fee is \$90.00 for UNLIMITED EVERYTHING-Call, text, and internet/data plan

Of the two plans, as time increase, which plan would you pick? Please come up with a persuasive essay convincing your parents on what plan they should pick for you. Please support your point with detail. Also, come up with an equation with all 3 forms of linear functions, and discuss what the function and variable represent in this case. After forming the equations, construct a graph for both options. Please label the axes and each function.

Sure:_____ Unsure:_____

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Post-Test Analysis

Student Self-Assessment: Congratulations on finishing the test. Now, I would like your feedback on this test. Please respond to each question honestly and thoughtfully. If you have questions, or need help, please raise your hand and I will re-clarify the instructions. If we need to discuss any differences in your grades, we will meet at a convenient time to discuss.

Please complete the following using complete sentences after reviewing the targets on the previous page:

1. MY STRENGTHS from this test: What was your best target, in which you felt you, did your best on? Explain why you think you did well. This response will tell me what I taught/got across to the students, in which they understand the concepts and process!

2. My "ACHLLIES TENDON(S)" from this test: Which were your poorest target(s)? Where do you feel you weren't as prepared for? Explain why you think you did poorly. Reasons might be: "I didn't study", "I didn't understand the material", and "I thought I understood the material", etc... This question will give me feedback on how I can improve my teaching and lessons.

3. WHAT I NEED TO REVIEW MORE after taking this test: Write down the target(s) that you made simple mistakes with or were unsure of the answers that you got right. Briefly described the mistake(s) you made or why you struggled. This is a question that will tell me where I may need to teach more effective next year and see where students need more time in!

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4. After taking this test, how would you improve your understanding of the material that were missed on the test, so you don't make the same mistakes again? Mark as many that apply.

_____ Come in to see Mr. Burdick before school. Day(s) _____

_____ Come in to see Mr. Burdick after school. Day(s) _____

_____ Complete the extra problems from the textbook. Which ones? _____

_____ Other ideas welcome. Please explain. _____

Thank you for putting your response to these self-assessment questions. If you answer the questions appropriately, you will receive valuable feedback on your study and work habits. Also, you will receive 10 EXTRA CREDIT points for doing this! Please turn in the assessment as well as all your work!

Thanks for taking the assessment!

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Answer Key

Section 1 Fill-in-the-Blank, The student should respond to the missing word in the sentence with the following:

1. Opposite reciprocal
2. Slope-intercept
3. Either compute, calculate or solve are correct possible answers
4. $Ax + By = C$.
5. Point-slope formula

Section 2 Short Response, Students should select 3 out of the 5 possible responses for this portion of the test.

6. Components within the response:
 - The student must demonstrate and describe the correct process through analytical and explanation to calculate the slope from the given data.
 - The answer must be 80 texts per day between $x=1$ and $x=2$.
 - The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.
7. Components within the response:
 - The student must demonstrate and describe the correct process on switching between standard forms to point-slope form.
 - Also, the student must show at least one example in their response.
 - The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.
8. Components within the response:
 - The student must demonstrate and describe the correct process on how to find the slope-point equation from the given data. The students must describe as well as show their work analytically in each step in order to find the slope point equation.
 - These are the steps I'm looking for in the student's responses.
 - Calculate slope
 - Plug slope into slope point equations, $y = mx + b$, where m is the slope for this equation.
 - Plug a point from the table in order to find the y -intercept for the function.
 - Finally, the student will have the slope point equation for the given data.
 - Also, the student must explain what the function represents in terms with the two variables, with appropriate units for both variables.
 - The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.
9. Components within the response:
 - The student must demonstrate and describe the correct process on how to find the perpendicular equation from the given data. The students must describe as

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well as show their work analytical in each step in order to find the perpendicular equation.

- These are the steps I'm looking for in the student's responses.
 - Calculate slope
 - Plug slope into slope point equations, $y = mx + b$, where m is the slope for this equation.
 - Plug a point from the table in order to find the y -intercept for the function.
 - After finding the slope and y -intercept, they will have the slope point equation for the given data.
 - In order to find the perpendicular equation of the given data, they must take the opposite reciprocal of the slope. This process makes the new equation to be perpendicular to the original equation.
 - Then, the student must plug in a point and solve for the y -intercept.
 - Finally, the student will have the perpendicular equation to the given data.
- Also, the student must explain what the function represents in terms with the two variables, with appropriate units for both variables.
- The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.

10. Components within the response:

- The student must demonstrate and describe the correct process through analytical and explanation of the process to calculate the slope.
- Also, they must explain what the slope is important in linear functions.
- Also, the students must include at least 3 examples in their response as well as using the appropriate units.
- The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.

Section 3 Long Response, Students should select 3 out of the 5 possible responses for this portion of the test.

11. Components within the response:

- The students will write a persuasive essay/letter to her parents as Sara, in order to convince why Sara picked either option 1 or 2.
 - They must explain with supporting points and details.
 - Also, having a visual, like a graph or table would be great visual support, and show their mathematical process on how to solve this problem
 - The graph must include one linear functions from the given scenario,
 - The axes/title of the visual must be label correctly.
 - The students must use correct sentence structure, tense, grammar and spelling rules.

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- There is not a right or wrong answer to this question. They just need to be persuasive by deciding which option would be the best interest of Sara. It would help their argument by showing the analytical process within their essay to convince Sara's family why Sara picked either option 1 or 2.
- The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.

12. Components within the response:

- The students will write a long essay that discusses and demonstrates four real world applications of linear functions.
 - They must explain with supporting points and details on why/how they can use linear functions in each application.
 - For each application, they must use all 3 forms of linear functions.
 - The students must describe what the function and variables represents in each case with appropriate units.
 - The students must use correct sentence structure, tense, grammar and spelling rules.
- The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.

13. Components within the response:

- The student must demonstrate with an example as well as describe the correct process on how to find the parallel equation.
 - The student must include one example in this essay to demonstrate this process.
- The students must describe as well as show their work analytically in each step in order to find the parallel equation.
- These are the steps I'm looking for in the student's responses.
 - Calculate slope
 - Plug slope into slope point equations, $y = mx + b$, where m is the slope for this equation.
 - Plug a point from the table in order to find the y-intercept for the function.
 - After finding the slope and y-intercept, they will have the slope point equation for the given example.
 - In order to find the parallel equation of the given data, they must realize that the slope will be the same as the slope for the example. Thus, they will only need to change the y-intercept
 - They are infinity many ways to make the parallel equation but they must have the same slope.
 - Finally, the student will have the parallel equation to their example.
- Also, the student must explain what the function represents in terms with the two variables, with appropriate units for both variables.

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- The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.

14. Components within the response:

- The student will write a long essay that compares/contrast 2 out of the three forms of linear functions
 - They must include 3 similarities and 3 differences in their response.
 - For their response, they must use an example of each form in their response as support.
 - The students must describe what the function and variables represents in each case with appropriate units.
 - The students must use correct sentence structure, tense, grammar and spelling rules.
- The scoring for this question will be based on the Mathematics Scoring Rubric for Extended-Response.

15. Components within the response:

- A well written persuasive essay/letter to their parents in order to convince why they picked either option 1 or 2.
 - Students must explain with supporting points and details and show their mathematical process on how to solve this problem.
 - Also, they must include the 3 different forms of linear functions, point-slope, slope-intercept, and standard forms.
 - They must describe what the function and variables represents in each case with appropriate units.
 - The essay must include a graph for their option, which has the 3 different equations and axes label correctly.
 - The students must use correct sentence structure, tense, grammar and spelling rules.

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Mathematics Scoring Rubric for Extended-Response (Short and Long Response)

Score Level:	MATHEMATICAL KNOWLEDGE: Knowledge of mathematical principles and concepts which result in a correct solution to a problem.	STRATEGIC KNOWLEDGE: Identification and use of important elements of the problem that represent and integrate concepts which yield the solution (e.g., models, diagrams, symbols, computations).	EXPLANATION: Written explanation of the rationales and steps of the solution process. A justification of each step is provided. Though important, the length of the response, grammar, and syntax are not the critical elements of this dimension.
4	<ul style="list-style-type: none"> ◆ shows complete understanding of the problem's mathematical concepts and principles ◆ uses appropriate mathematical terminology and notations including labeling answer if appropriate ◆ executes algorithms and computations completely and correctly 	<ul style="list-style-type: none"> ◆ identifies all important elements of the problem and shows complete understanding of the relationships among elements ◆ shows complete evidence of an appropriate strategy that would correctly solve the problem 	<ul style="list-style-type: none"> ◆ gives a complete written explanation of the solution process; clearly explains what was done and why it was done ◆ may include a diagram with a complete explanation of all its elements
3	<ul style="list-style-type: none"> ◆ shows nearly complete understanding of the problem's mathematical concepts and principles ◆ uses mostly correct mathematical terminology and notations ◆ executes algorithms and computations, however, the computations are generally correct but may contain minor errors 	<ul style="list-style-type: none"> ◆ identifies most of the important elements of the problem and shows a general understanding of the relationships among them ◆ shows nearly complete evidence of an appropriate strategy for solving the problem 	<ul style="list-style-type: none"> ◆ gives a nearly complete written explanation of the solution process; clearly explains what was done and begins to address why it was done ◆ may include a diagram with most of its elements explained
2	<ul style="list-style-type: none"> ◆ shows some understanding of the problem's mathematical concepts and principles ◆ uses some correct mathematical terminology and notations ◆ may contain major algorithmic or computational errors 	<ul style="list-style-type: none"> ◆ identifies some important elements of the problem but shows only limited understanding of the relationships among them ◆ shows some evidence of a strategy for solving the problem 	<ul style="list-style-type: none"> ◆ gives some written explanation of the solution process; either explains what was done or addresses why it was done ◆ explanation is vague, difficult to interpret, or does not completely match the solution process ◆ may include a diagram with some of its elements explained
1	<ul style="list-style-type: none"> ◆ shows limited to no understanding of the problem's mathematical concepts and principles ◆ may misuse or fail to use mathematical terminology and notations ◆ attempts an answer 	<ul style="list-style-type: none"> ◆ fails to identify important elements or places too much emphasis on unrelated elements ◆ reflects an inappropriate strategy for solving the problem; strategy may be difficult to identify 	<ul style="list-style-type: none"> ◆ gives minimal written explanation of the solution process; may fail to explain what was done and why it was done ◆ explanation does not match presented solution process ◆ may include minimal discussion of the elements in a diagram; explanation of significant elements is unclear
0	<ul style="list-style-type: none"> ◆ no answer attempted 	<ul style="list-style-type: none"> ◆ no apparent strategy 	<ul style="list-style-type: none"> ◆ no written explanation of the solution process is provided

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