Should We Raise The Minimum Wage

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Target Grade: Algebra 2

Time Required: 120 minutes

Standards

Common Core Mathematics

- HSS.ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

TN State Standards History

SSP.04 Construct and communicate arguments citing supporting evidence to:

- Demonstrate and defend an understanding of ideas
- Compare and contrast viewpoints
- Illustrate cause and effect
- Predict likely outcomes
- Devise new outcomes or solutions

Common Core English

- CCSS.ELA-LITERACY.W.9-10.1.A
  Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
- CCSS.ELA-LITERACY.W.9-10.1.B
  Develop claim(s) and counterclaims fairly, supplying evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level and concerns.

Lesson Objectives

Students will:

- Demonstrate understanding of patterns, relations, and functions
- Be able to compare and contrast different viewpoints
- Construct and communicate arguments using supporting evidence
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships
- Analyze change in various contexts

Central Focus

In this lesson, students will discover the minimum wage trend as time has passed. Students will use past and recent data of the minimum wage to create a scatter plot, so that they are able to predict the future. They will have the opportunity to write a letter to their senators to convince them to raise or not raise the minimum wage. They will use the data that they have retrieved from the activity in order to support their case. As students discover more about the minimum wage in their state, they will be able to learn to support their opinion through mathematical reasoning and statistical data.

Key Terms: coefficient of determination, regression equations, R^2 value, mathematical models, linear, cubic, quartic, quadratic, function

Background Information

Students should have some understanding of how to fit equations to real-world data in order to make predictions for the future. In addition, they should be able to read articles and analyze the situation. Prior to this lesson, students should have the basic knowledge of how to use a graphing calculator such as being able to graph a function or enter data in.

Prior to this lesson, teachers should be able to demonstrate how to use the graphing calculator in order to find the function that best fits the scatter plot. Teachers should have understanding of scatter plots specifically, how to find the line of best fit as well as coefficient of determination and regression equations.

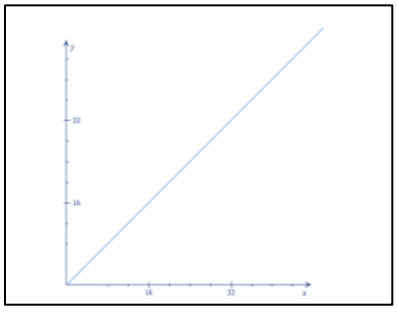
Key Terms:

Coefficient of Determination

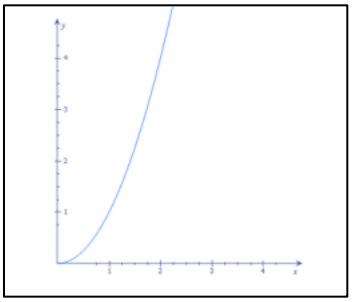
- The coefficient of determination is a statistical measurement that examines how differences in one variable can be explained by the difference in a second variable, when predicting the outcome of a given event.
  (Coefficient of Determination: Overview (investopedia.com))
- Here is a video with more information:
  R-squared or coefficient of determination | Regression | Probability and Statistics | Khan Academy - YouTube
- Note: The coefficient of determination is NOT the only factor to consider when determining the best fit equation for a set of data.

Regression Equations

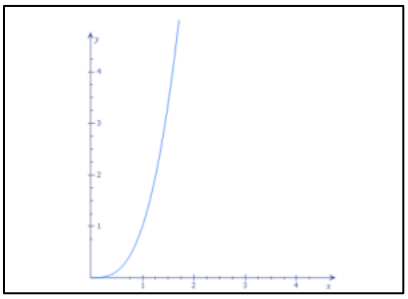
- A regression equation is used in statistics to find out what relationship, if any, exists between data sets.
  - Linear
    - $y = ax + b$
    - Constant rate of change.



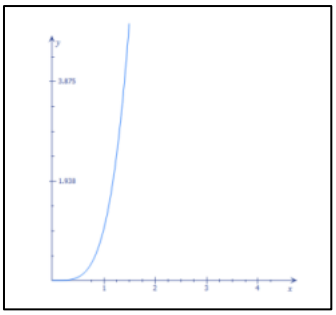
  - Quadratic
    - $y = ax^2 + bx + c$
    - Changing rate of change; not extremely steep rate of change.



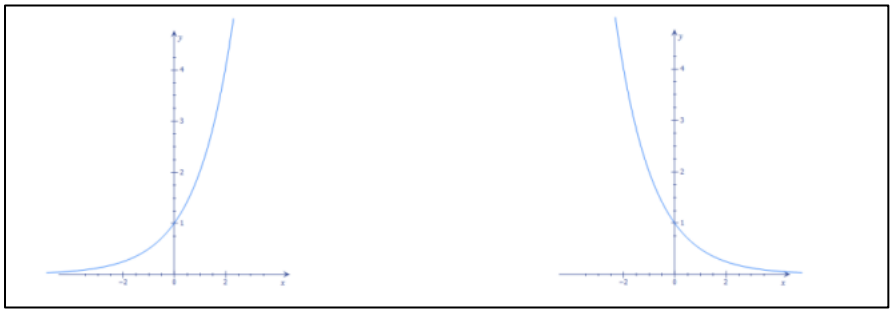
- Cubic
  - $y = ax^3 + bx^2 + cx + d$
  - Changing rate of change; steeper rate of change than quadratic.



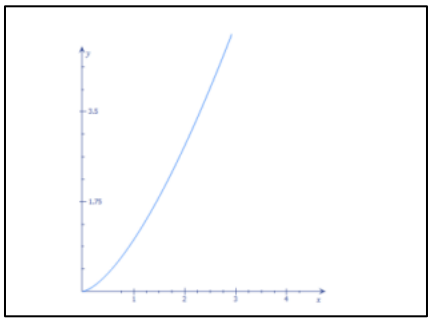
- Quartic
  - $y = ax^4 + bx^3 + cx^2 + dx + e$
  - Changing rate of change; steeper rate of change that is an option in this worksheet.



- Exponential
  - $y = ab^x$
  - Changing rate of change that starts small and quickly increases (growth) or starts large and quickly decreases without ever reaching zero (decay).



- Power
  - $y = ax^b$
  - The leading term ONLY from a polynomial equation; instead of sticking with a whole number power, the power function can give a decimal power (for example, $y = x^{1.5}$) and only includes the leading term of the polynomial function since the leading terms carries the "power" for the equation.



R^2 value

- R-squared (R^2) is a statistical measure that indicates the extent of variation in a dependent variable due to an independent variable. In investing, it acts as a helpful tool for technical analysis. It assesses the performance of a security or fund (dependent variable) with respect to a given benchmark index (independent variable).
  (R-Squared - Meaning, Regression, Examples, Interpretation, vs R (wallstreetmojo.com))

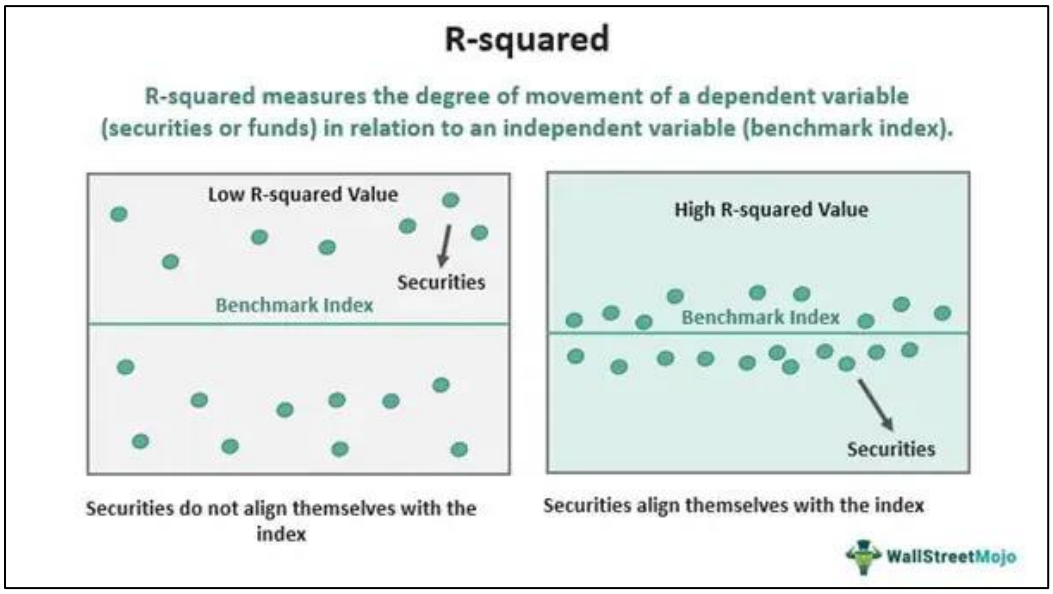


Figure 1: https://www.wallstreetmojo.com/r-squared/

Materials

- Function Toolbox
- Function Toolbox: Possible Regression Equations on a Graphing Calculator
- Fitting Regression Models to Real World Data
- Graphing Calculator (physical calculator or free online calculator at Desmos | Let's learn together.)
    - Using Desmos would be preferable, so that the students can insert the graph into the worksheet template easily.
- Canva: Home - Canva
- Computer
- Should We Raise the Minimum Wage Worksheet
- Should We Raise the Minimum Wage Worksheet Key

Instruction

Introduction (5 minutes)

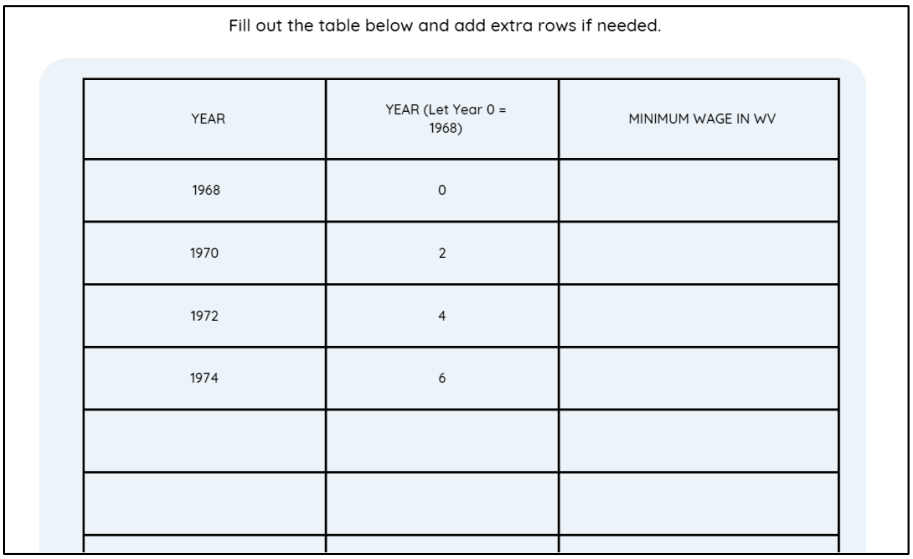
- As a whole class, have a discussion about minimum wage.
    - Ask the students: "In your own words, how would you describe/explain minimum wage?"

***Part One**: Researching the Data* (30 minutes)

- Have the students individually read about the minimum wage at one of the following websites (the students may choose which one they would want to read):
    - Minimum wage in America: How many people are earning $7.25 an hour? (usafacts.org)
        - This article talks about the minimum wage across America. It breaks down what the minimum wage is in each state. In addition, this article explains and shows the data on the minimum wage across the United States.
    - Minimum Wage in America: A Timeline - HISTORY
        - This article talks about the history of the minimum wage in America. The article outlines in a timeline of how the minimum wage was established and where the minimum wage is "now" in 2019.
    - Optional Article for students who finish early: http://www.dol.gov/whd/minwage/coverage.htm.
        - This article talks about the history of the minimum wage in America. The article outlines how the minimum wage was established and where the minimum wage is "now" in 2007.

- Have a class discussion about what the article talked about. Ask the students what they learned from the article as well as what their opinions on minimum wage are based on reading the article.

- As a class, watch this video (6 minutes)
    - https://www.youtube.com/watch?v=EhreonsZU4c
        - Note that this video was published in 2016. This video talks about the history of the minimum wage beginning with the factory workers who began marching for higher wages in the early 1900s. The video ends with the current shift in minimum wage in 2016.
- As a class, look at the data produced by the United States Department of Labor showing the minimum wage in your state through the years at the website below. https://www.dol.gov/whd/state/stateMinWageHis.htm.
- Have the students make a table on a document showing the data for your state's minimum wage using the following format or use the template at this link (Note: the table says WV for West Virginia, but edit it according to your own state): https://www.canva.com/design/DAFE69NRy0k/yeICg63XNXSTGXTfupfk4g/view?utm_content=DAFE69NRy0k&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton



Fill out the table below and add extra rows if needed.

YEAR	YEAR (Let Year 0 = 1968)	MINIMUM WAGE IN WV
1968	0	
1970	2	
1972	4	
1974	6	

…and so on (continue using all of the years provided on the website).

***Part Two**: Calculating a Regression Equation to Fit the Data* (30 minutes)

- Place the students in groups of 3-4. Provide each student with the Function toolbox page and the chart. The students may choose to create their own as well.

- Have the students use the data from part one and insert it in the table in Desmos | Let's learn together. Students may also use their calculator.
- After the students put the data in the calculator, instruct the students to:
    - Consider each of the following regression equations from the Function Toolbox page: linear, quadratic, cubic, quartic, exponential (growth and decay), and power.
    - Fill in the chart below on a document (the document template is attached below) based on the observations of the scatterplot and/or the coefficient of determination and/or the equation.

	Insert the graph of:	Insert the:	Insert the:	Is the function a good fit based your observation of the...		
	SCATTERPLOT	COEFFICIENT OF DETERMINATION	EQUATION	SCATTERPLOT (YES/NO)	COEFFICIENT OF DETERMINATION (YES/NO)	EQUATION (YES/NO)
LINEAR						
QUADRATIC						
CUBIC						
QUARTIC						
EXPONENTIAL GROWTH						
EXPONENTIAL DECAY						
POWER						

- By following the instructions on the template, the students will complete the following steps:

1. Use a graphing calculator or the table feature on Desmos | Let's learn together. to make a scatter plot displaying the minimum wage data through the years.
    a. Based only on the scatterplot, if you were to fit an equation to the data, what type of equation might be a good fit (for example…linear, quadratic, etc.)?
    b. Think about what types of equations would not be a good fit for this type of data, and fill out the first column of the table as you think about it.
2. Use a graphing calculator to look at the coefficient of determination (r^2 value) for each regression equation that you were not able to eliminate by observing the scatterplot.
    a. Remember that any r^2 value less than 0.9500 is not strong enough of a fit for the data for the equation to be used to model that data.
    b. Recall what we have been talking about in class—the coefficient of determination is NOT the only factor to consider when determining the best fit equation for a set of data.
    c. A r^2 value of 0.9999 versus 0.9876 is not that different and should not be the only variable taken into consideration when determining the best fit equation for the data.
    d. Remember that the r^2 value is only ONE TOOL you should use when determining the best fit equation, and the data itself as it changes over time must be analyzed carefully using all available tools.
3. Use a graphing calculator to break down and analyze any equations that you were not able to eliminate based on the coefficient of determination.
    a. Pay close attention to the values that are given for the variables. Can you eliminate any other regression equations? Why?
4. Use a graphing calculator to graph any equations that you have not yet eliminated and therefore think might be a good fit on top of your scatter plot using an extended window to see what would happen to the minimum wage over time if you were to use that equation to model the data.
    a. Be sure to extend the window of both the x-axis and the y-axis so that you will have a better idea of how each function will fit the data over time. (A good window for this data might be $0 < x < 100$ since L1 is showing years since 1968, and $0 < y < 20$ since L2 is showing the value of the minimum wage in dollars.)
5. Use what you have observed to determine which regression equation you feel is the overall best fit equation to model the minimum wage data in your state.

    a. Write the equation that you selected to four decimal places for each numerical value (to be consistent).

    b. Justify the equation you selected.

***Part Three**: Extrapolating the Data* (20 minutes)

- Instruct students to use the best fit regression equation on Desmos | Let's learn together to mathematically estimate what the minimum wage should be this year in your state.
    - Be sure to have students show their work and remind them to subtract this year from 1968 to determine how many years have passed.)
- Have students look at a comparison of states in relation to what they pay their workers for a minimum wage at the website https://minimumwage.com/in-your-state/.
    - Ask the students: Were you surprised to learn how your states minimum wage compares to the federal minimum wage? How does the value that you got using your regression equation compare to what the minimum wage actually is in your state right now?

***Part Four**: Analyzing the Results of the Data to Make Educated Decisions* (20 minutes)

- Note that after researching the history of the minimum wage in Part One, the students know that Congress does not raise the minimum wage every year.
    - There have been periods of time in America's history when Congress only raised the federal minimum wage once in a ten-year period. While this may seem unfair and tough on employees who make minimum wage, there are nonetheless quite a few arguments about whether or not raising the minimum wage is actually helpful to Americans who work jobs that pay minimum wage.
- Have the students read about some pros and cons of raising the minimum wage on the following website: https://minimum-wage.procon.org.
- Have the students think about everything they have learned so far from this assignment. Ask the students to reflect on:
    - The data about the minimum wage throughout history in your state.
    - The mathematical model that you used to calculate what the minimum wage should be (mathematically speaking, only).
    - The pros and cons of raising the minimum wage.
    - How all of this affects you as a teenager living in your city and state who will likely be working a minimum wage job in the next few years.
- Instruct students to form an opinion about whether you think the minimum wage in your state should or should not be raised. Students can write their opinions on the worksheet provided in canva.
    - List at least three pros and three cons that you read about and expand upon them giving your opinion as to whether you agree or disagree with each one.

***Part Five**: Arguing an Opinion Using Data as Support* (20 minutes)

- Have students write a letter to their state Senators supporting/opposing raising the minimum wage using the following information:
    - You may address both senators in the same letter.
    - Explain your thoughts about whether raising the minimum wage in your state is appropriate and take a stand as to whether you believe the minimum wage should be raised again this year.
    - Justify your reasons for supporting/opposing the bill using the mathematical data you have collected, the articles you have read, and/or the video you watched.
    - Be sure to follow the proper etiquette for writing a formal letter, including the date, greeting, body, closing, and signature. You must sign your name using your official signature in ink.

Differentiation

- English Language Learners:
    - Allow students to work with an upper-level partner throughout the activity.
    - Allow students to use online translators.
    - Students are given the option of writing a letter to the Senators in Their Native Languages (a translation of the letters is sent to the senators)
- Students with disabilities:
    - Group students intentionally with others that can support them.
    - Give extra support during the group experiment.
    - Ask these students questions during the group work to make sure they understood the material from the presentation.
    - Give these students a structured template on which to complete the letter.
    - Students are permitted extended time for the assignment.
    - Students are permitted to write a modified letter, make video, or submit a voice recording to senators.
    - Students are encouraged to work with the math and special education teachers throughout the assignment to work through all parts and receive support.
- Advancement:
    - Have students read the optional article (Noted above as well.): http://www.dol.gov/whd/minwage/coverage.htm.
    - Have students complete further research into the history of the minimum wage.
    - Ask students to research the minimum wage of another state and how it would affect them if they lived in that state.

- Grouping:
    - Students could be grouped in ways that have varied levels in each group. This can help the students collaborate with each other. With different levels in a group, students can help and support each other, especially with the research and activity.
- Timing:
    - For the students who finish early, have them reflect back on the lesson and vocabulary in their own words.
    - For the students who are slower, since the students are in their groups for the majority of the time, the workload could be divided for timing purposes.

Assessment

Formative Assessment

- Throughout the lesson, the teacher will walk around the room as students are working on the activities. This will give the teacher the opportunity to assess how much the student knows and has learned throughout the lesson. This also allows the teacher to see what areas the students may be struggling in, so that the teacher can address the struggles in another lesson.

Summative Assessment

- The students will be working on an activity and worksheet. This will allow the teacher to see how much the class learned about regression equation to fit the data. Based on this assessment, the teacher may decide to review the next day.
- The letter to the senate activity will allow the teacher to see how much the student is able to explain the data that was observed in the activity. In addition, the writing assignment allows the teacher to see how students are able to predict the minimum wage in the future based on the given data. The students will be able to demonstrate their skill of reasoning based on mathematical data.

SHOULD WE RAISE THE MINIMUM WAGE?

NAME: _____ CLASS: _____

Take notes based on the article that you read and the video that you watched.

Notes on _____.

Notes on _____.

Notes on _____.

EXTRA NOTE SPACE

Instructions

1. Use a graphing calculator or the table feature on Desmos | Let's learn together. to make a scatter plot displaying the minimum wage data through the years.

a. Based only on the scatterplot, if you were to fit an equation to the data, what type of equation might be a good fit (for example…linear, quadratic, etc.)?

b. Think about what types of equations would not be a good fit for this type of data, and fill out the first column of the table as you think about it.

2. Use a graphing calculator to look at the coefficient of determination (value) for each regression equation that you were not able to eliminate by observing the scatterplot.

a. Remember that any value less than 0.9500 is not strong enough of a fit for the data for the equation to be used to model that data.

b. Recall what we have been talking about in class—the coefficient of determination is NOT the only factor to consider when determining the best fit equation for a set of data.

c. A value of 0.9999 versus 0.9876 is not that different and should not be the only variable taken into consideration when determining the best fit equation for the data.

d. Remember that the value is only ONE TOOL you should use when determining the best fit equation, and the data itself as it changes over time must be analyzed carefully using all available tools.

3.Use a graphing calculator to break down and analyze any equations that you were not able to eliminate based on the coefficient of determination.

a. Pay close attention to the values that are given for the variables. Can you eliminate any other regression equations? Why?

4.Use a graphing calculator to graph any equations that you have not yet eliminated and therefore think might be a good fit on top of your scatter plot using an extended window to see what would happen to the minimum wage over time if you were to use that equation to model the data.

a. Be sure to extend the window of both the x-axis and the y-axis so that you will have a better idea of how each function will fit the data over time. (A good window for this data might be $0 < x < 100$ since L1 is showing years since 1968, and $0 < y < 20$ since L2 is showing the value of the minimum wage in dollars.)

5.Use what you have observed to determine which regression equation you feel is the overall best fit equation to model the minimum wage data in your state.

a. Write the equation that you selected to four decimal places for each numerical value (to be consistent).

b. Justify the equation you selected.

Fill out the table below and add extra rows if needed.

YEAR	YEAR (Let Year 0 = 1968)	MINIMUM WAGE IN WV
1968	0	
1970	2	
1972	4	
1974	6	

YEAR	YEAR (Let Year 0 = 1968)	MINIMUM WAGE IN WV

YEAR	YEAR (Let Year 0 = 1968)	MINIMUM WAGE IN WV

	Insert the graph of:	Insert the:	Insert the:	Is the function a good fit based your observation of the...		
	SCATTERPLOT	COEFFICIENT OF DETERMINATION	EQUATION	SCATTERPLOT (YES/NO)	COEFFICIENT OF DETERMINATION (YES/NO)	EQUATION (YES/NO)
LINEAR						
QUADRATIC						
CUBIC						
QUARTIC						
EXPONENTIAL GROWTH						
EXPONENTIAL DECAY						
POWER						

List at least three pros and three cons that you read about and expand upon them giving your opinion as to whether you agree or disagree with each one.

Pros

List at least three pros and three cons that you read about and expand upon them giving your opinion as to whether you agree or disagree with each one.

Cons

SHOULD WE RAISE THE MINIMUM WAGE?

NAME: KEY _____ CLASS: _____

Take notes based on the article that you read and the video that you watched.

Notes on _____.

Answers will vary.

Notes on _____.

Answers will vary.

Notes on _____.

Answers will vary.

EXTRA NOTE SPACE

Instructions

1. Use a graphing calculator or the table feature on Desmos | Let's learn together. to make a scatter plot displaying the minimum wage data through the years.

a. Based only on the scatterplot, if you were to fit an equation to the data, what type of equation might be a good fit (for example…linear, quadratic, etc.)?

b. Think about what types of equations would not be a good fit for this type of data, and fill out the first column of the table as you think about it.

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a. Remember that any value less than 0.9500 is not strong enough of a fit for the data for the equation to be used to model that data.

b. Recall what we have been talking about in class—the coefficient of determination is NOT the only factor to consider when determining the best fit equation for a set of data.

c. A value of 0.9999 versus 0.9876 is not that different and should not be the only variable taken into consideration when determining the best fit equation for the data.

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5.Use what you have observed to determine which regression equation you feel is the overall best fit equation to model the minimum wage data in your state.

a. Write the equation that you selected to four decimal places for each numerical value (to be consistent).

b. Justify the equation you selected.

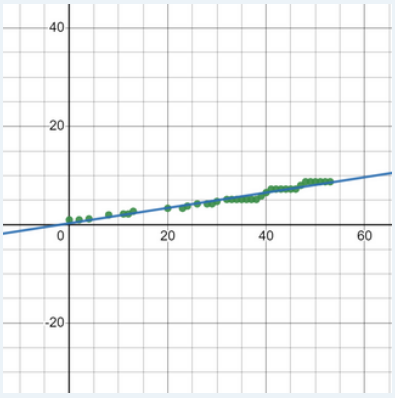
Fill out the table below and add extra rows if needed.

YEAR	YEAR (Let Year 0 = 1968)	MINIMUM WAGE IN WV
1968	0	$1.00
1970	2	$1.00
1972	4	$1.20
1976	8	$2.00
1979	11	$2.20
1980	12	$2.20
1981	13	$2.75
1988	20	$3.35
1991	23	$3.35
1992	24	$3.80
1994	26	$4.25
1996	28	$4.25
1997	29	$4.25
1998	30	$4.75
2000	32	$5.15

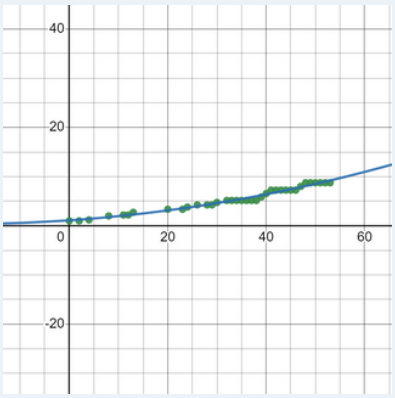
YEAR	YEAR (Let Year 0 = 1968)	MINIMUM WAGE IN WV
2001	33	$5.15
2002	34	$5.15
2003	35	$5.15
2004	36	$5.15
2005	37	$5.15
2006	38	$5.15
2007	39	$5.85
2008	40	$6.55
2009	41	$7.25
2010	42	$7.25
2011	43	$7.25
2012	44	$7.25
2013	45	$7.25
2014	46	$7.25
2015	47	$8.00
2016	48	$8.75

YEAR	YEAR (Let Year 0 = 1968)	MINIMUM WAGE IN WV
2017	49	$8.75
2018	50	$8.75
2019	51	$8.75
2020	52	$8.75
2021	53	$8.75

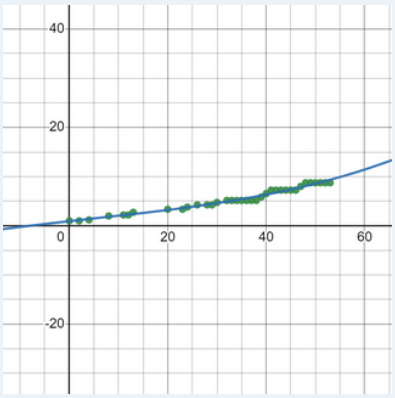
	Insert the graph of:	Insert the:	Insert the:	Is the function a good fit based your observation of the...		
	SCATTERPLOT	COEFFICIENT OF DETERMINATION	EQUATION	SCATTERPLOT (YES/NO)	COEFFICIENT OF DETERMINATION (YES/NO)	EQUATION (YES/NO)
LINEAR	BELOW	0.9787	y = 0.156123x+0.303233	YES	YES	YES
QUADRATIC	BELOW	0.9895	y = 0.00159x^2 + 0.068502x + 1.11343	YES	YES	YES
CUBIC	BELOW	0.9899	y = 0.000024x^3 - 0.000372x^2 + 0.111709x + 0.943029	YES	YES	YES
QUARTIC	BELOW	0.9747	y = 0.000002x^4 - 0.000318x^3 + 0.016112x^2 - 0.200568x	YES	YES	YES
EXPONENTIAL GROWTH	BELOW	0.9856	y = 1.62298*1.03412^x	YES	YES	YES
EXPONENTIAL DECAY	N/A	N/A	N/A	N/A	N/A	N/A
POWER	BELOW	0.9779	y = 0.127876*x^1.06667	YES	YES	YES



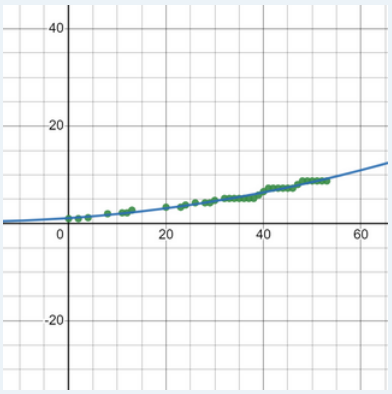
Linear



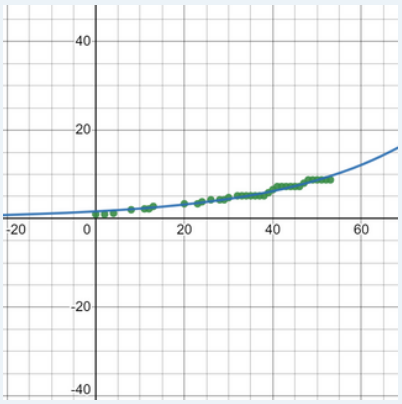
Quadratic



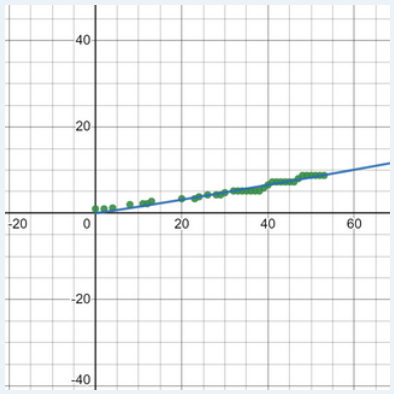
Cubic



Quartic



Exponential Growth



Power

List at least three pros and three cons that you read about and expand upon them giving your opinion as to whether you agree or disagree with each one.

Pros

Answers will vary.

List at least three pros and three cons that you read about and expand upon them giving your opinion as to whether you agree or disagree with each one.

Cons

Answers will vary.

Fitting Regression Models to Real-World Data

Calculating a Regression Equation

- Earlier, you learned how to estimate a line of best fit for a set of data using a graphing calculator. To do this, you took the following steps:
  - Insert the data into lists. To do so, press STAT and select "1:Edit." To clear out any data already in the lists, highlight "L1" and "L2" and press CLEAR.
  - To calculate the regression equation, press STAT a second time. Scroll over to "CALC."
- This process of finding a line of best fit is a good one; however, it's value is limited because many types of data fit better when placed on a curve instead of a line. For this reason, we can use other regression models in order to find the best fit equation for our data.
- REGRESSION EQUATION MODELS
  - Linear Regression Equation $(f(x)=ax+b)$ →"4:LinReg"
  - Quadratic Regression Equation $(f(x)=ax^2+bx+c)$ →"5:QuadReg"
  - Cubic Regression Equation $(f(x)=ax^3+bx^2+cx+d)$ →"6:CubicReg"
  - Quartic Regression Equation $(f(x)=ax^4+bx^3+cx^2+dx+e)$ →"7:QuartReg"
  - Exponential Regression Equation $(f(x)=ab^x)$ →"0:ExpReg"
  - Power Regression Equation $(f(x)=ax^b)$ →"A:PwrReg"

*NOTE: Don't forget, that *x* is a variable. It will stay a variable in the regression equation. All other letters (*a, b, c, d,* and *e*) will be replaced with numbers in the regression equation.

Correlation Coefficients and Coefficients of Determination

- In the past, you have also learned about the correlation coefficient (the r value) for a linear function. When the calculator provides you with a linear regression equation, it also provides the correlation coefficient to help you to know if the equation is or is not a good fit. Recall that the closer that the value is to ± 1, the better the equation fits the real-world data.
- The coefficient of determination (the r^2 value) is used to determine if a non-linear equation is a good fit. Once again, the closer that the value is to ± 1, the better the equation fits the real-world data. If you coefficient of determination and/or correlation coefficient are not showing up on your calculator, press 2^{nd} 0 to turn the "Catalog" on. Then, scroll down to "Diagnostic On" and hit ENTER twice. When your calculator says "Done," the correlation coefficient will start appearing with each regression equation.

Scatter Plots

- If you want to see the scatter plot of the data on the calculator, press Y=. Use the arrow keys to scroll up to "Plot 1." To turn it on, highlight it by pressing ENTER. To set a good window for your data, press ZOOM 9 to activate the "ZoomStat" feature (which zooms in on the statistical data entered in the lists).
- If you want to save a regression equation so that the calculator will graph it without having to write the equation out and then entering it by hand, follow the steps for calculating a regression equation. However, instead of pressing ENTER, press VARS, scroll over to "Y-Vars," click on "1: Function," and then click on the equation you want to put it under for the graph (such as "Y_1").

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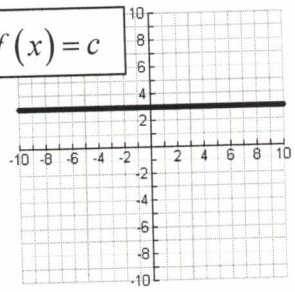
FUNCTION TOOLBOX

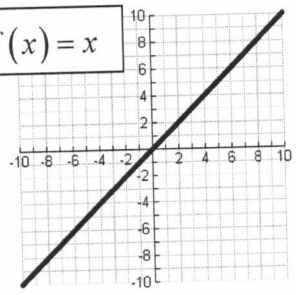
CONSTANT

$f(x) = c$

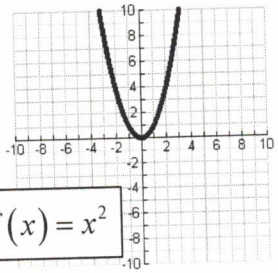


LINEAR

$f(x) = x$



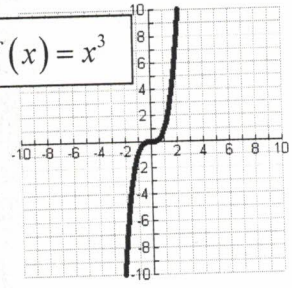
QUADRATIC



$f(x) = x^2$

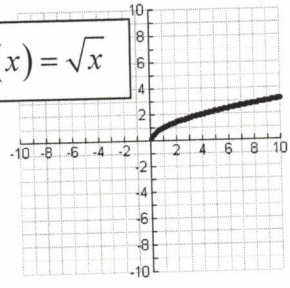
CUBIC

$f(x) = x^3$

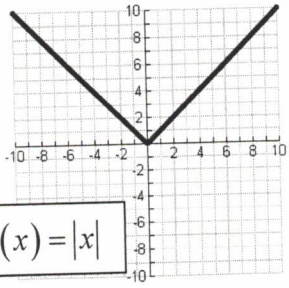


SQUARE ROOT

$f(x) = \sqrt{x}$



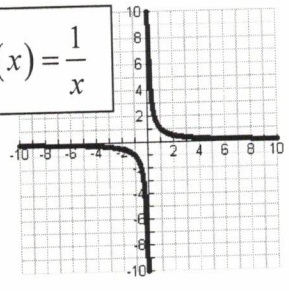
ABSOLUTE VALUE



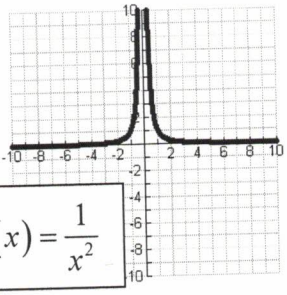
$f(x) = |x|$

INVERSE FUNCTION

$f(x) = \frac{1}{x}$

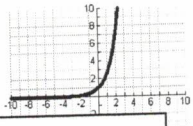


INVERSE SQUARE FUNCTION

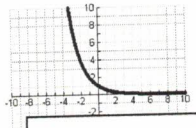


$f(x) = \frac{1}{x^2}$

EXPONENTIAL GROWTH/DECAY



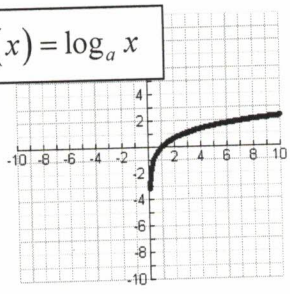
$f(x) = ab^x$,
where b>1.



$f(x) = ab^x$,
where b<1.

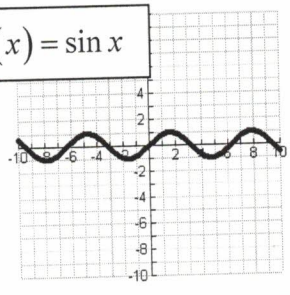
LOGARITHMIC FUNCTION

$f(x) = \log_a x$



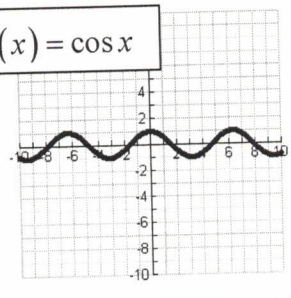
SINE FUNCTION

$f(x) = \sin x$



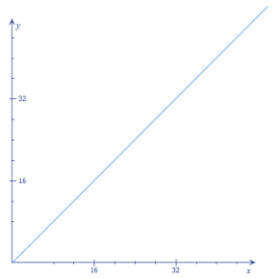
COSINE FUNCTION

$f(x) = \cos x$

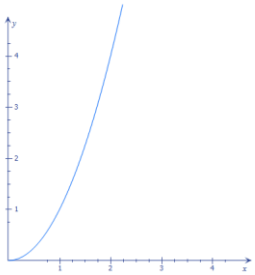


FUNCTION TOOLBOX:
POSSIBLE REGRESSION EQUATIONS ON A GRAPHING CALCULATOR

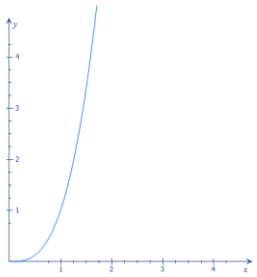
1.) Linear ($y = ax + b$)—constant rate of change



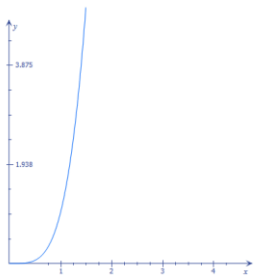
2.) Quadratic ($y = ax^2 + bx + c$)—changing rate of change; not extremely steep rate of change



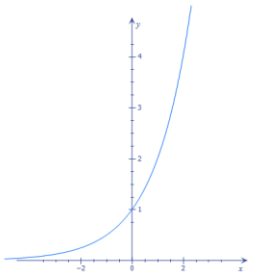
3.) Cubic ($y = ax^3 + bx^2 + cx + d$)—changing rate of change; steeper rate of change than quadratic

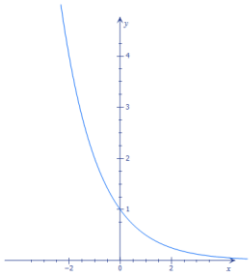


4.) Quartic ($y = ax^4 + bx^3 + cx^2 + dx + e$)—changing rate of change; steepest rate of change that is an option

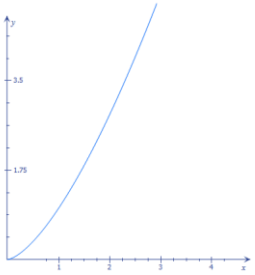


5.) Exponential ($y = ab^x$)—changing rate of change that starts small and quickly increases (growth) or starts large and quickly decreases without ever reaching zero (decay)





6.) Power ($y = ax^b$)—the leading term ONLY from a polynomial equation; instead of sticking with a whole number power, the power function can give a decimal power (for example, $y = x^{1.5}$) and only includes the leading term of the polynomial function since the leading terms carries the "power" for the equation



***<u>NOTE</u>: There are a few other options for regression equations on a graphing calculator. However, these are the most common equations used to model real world data and the only ones we will use for this course.**

SHOULD WE RAISE THE MINIMUM WAGE?

Scoring Rubric

SELF-EVALUATION

GRADING RUBRIC

PART ONE: Researching the Data **_____/5**

- Table Correctly Displays the Minimum Wage Data (5 POINTS)

PART TWO: Calculating a Regression Equation to Fit the Data **_____/20**

- Chart Showing if a Function is a Good Fit or Not a Good Fit Based on the Scatterplot, Coefficient of Determination, and Graph is Correct Based on the Data (10 POINTS)
- Justification of Which Equation is the Best Fit Regression Equation Based on Mathematical Tools and Analysis of the Data is Correct to Four Decimal Places (10 POINTS)

PART THREE: Extrapolating the Data **_____/7**

- Estimation of the Mathematical Minimum Wage for Our State for the Current Year is Correct and Work is Shown for the Calculations (5 POINTS)
- Comparison of Our State to Other States in Terms of the Minimum Wage (2 POINTS)

PART FOUR: Analyzing the Results of the Data to Make Educated Decisions **_____/5**

- List of Three or More Pros and Three or More Cons of Raising the Minimum Wage and Student's Opinion about Agreeing/Disagreeing with Each Point (5 POINTS)

PART FIVE: Arguing an Opinion Using Data as Support **_____/30**

- Letter to State Senators Includes Mathematical and Additional Supports to Justify Student's Opinion for Supporting or Opposing the Bill by Referencing the Mathematical Model, Articles, and/or Other Information Learned (20 POINTS)
- Format for a Formal Letter is Followed (5 POINTS)
- Grammar, Spelling, Mechanics, and Punctuation (5 POINTS)

TOTAL _____/67

COMMENTS/FEEDBACK:

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SHOULD WE RAISE THE MINIMUM WAGE?

Scoring Rubric

PEER EVALUATION

GRADING RUBRIC

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TOTAL _____/67

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SHOULD WE RAISE THE MINIMUM WAGE?

Scoring Rubric

TEACHER EVALUATION

GRADING RUBRIC

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