Curriculum Sample Template
Max. 8 Pages

Grade Level	8	**Content Area**	Mathematics
Course Title (grades 9-12 Only)			
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	Students will be familiar with the construction of scatter plots as well as graphing data to investigate patterns of association between two quantities. Students will understand concepts such as clustering, outliers, positive or negative association, linear association, and nonlinear association.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	Sierra Preparatory Academy will use the Connected Mathematics Program developed by Michigan State University and the National Science Foundation which employs a Socratic method of instruction that is mapped directly to the Common Core standards. *(The following lesson is adapted from a Common Core lesson from Thomasville Middle School developed by the National Council of Teachers of Mathematics.)*		
Standard Number and Description *List the Number* and the full description for the Required Standard or Science Performance Objective listed in section A.6.*	8.SP.2 Grade: 8 Domain: Statistics & Probability (SP) Cluster: Investigate patterns of association in bivariate data Standard: #2- Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.		
Materials/Resources Needed	Grid Paper (several sheets per student), Weights and Drug Doses worksheet, Bike Weights and Jump Heights Assessment, Overhead projector, class set of basic calculators.		

**** Standard Number**: For English Language Arts (Reading and Writing), use Grade, Strand, Standard (e.g., 3.RI.2). For K-8 Math, use Grade, Domain, Standard (e.g., 6.EE.7). For HS Math, use Conceptual Category-Domain, Standard (e.g., A-REI.6). For Science, use Grade, Strand, Concept, PO (e.g., 4.1.3.1).*

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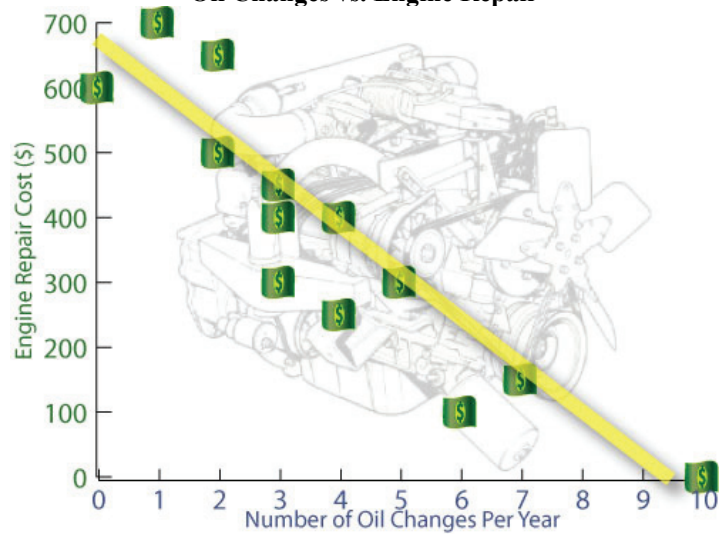
Lesson	Instructional Strategies	Student Activities
1	This is a three day curriculum sample. Day 1 The teacher will begin by briefly reviewing graphing techniques and related key terms including independent, or operating, variable and dependent, or response, variable — for example, time and distance. The teacher will lead students through a discussion demonstrating that the choice when fitting lines does not always depend on the physical relation between the operating and response variables. It is often more important to know which of the two is to be predicted. The teacher will then present data based upon a relationship between “Oil Changes” and “Engine Repairs.” The table below displays data that relate the number or oil changes per year and the cost of engine repairs. The activity which follows uses these data to introduce students to modeling with a linear function. **Oil Changes and Engine Repair** The teacher will project the graph onto the overhead projector after students have graphed the data using grid paper and pencil. Once the graph has been drawn, the teacher will ask students, "What is the significance of the line's downward (or negative) slope?" Students will say it means that the more oil changes made per year, the less money that needs to be spent on engine repairs. Note that the correct wording should be, "There appears to be a *relation* between the number of oil changes and the money spent on repairs."	Following a class discussion, students will predict the cost of repairs from the number of oil changes, using the number of oil changes as the *x* variable and engine-repair cost as the *y* variable. Students will graph the data being sure to properly label the axes. After further class discussion, it will be decided that the *x*-axis should be labeled "Number of Oil Changes per Year" (with a scale of 0–10), and the *y*-axis should be labeled "Engine Repair Cost (in dollars)" (with a scale of 0–700). The figure below displays the data from the table graphically. The students are asked to visualize a straight line as a representation of the data. Each student should draw a line that seems to "fit" the plotted points. A line that "fits" the points should have the same characteristics as the set of points; it should actually summarize the data. A line drawn this way is called an eyeball-fit line. **Oil Changes vs. Engine Repair** Students should examine the slope, which can be found by counting units. First they must define what a unit represents for each variable. In the graph above, one horizontal unit represents one oil change. One vertical unit represents $100

Oil Changes Per Year	3	5	2	3	1	4	6	4	3	2	0	10	7
Cost of Repairs ($)	300	300	500	400	700	400	100	250	450	650	600	0	150



	The teacher will lead a discussion noting that although the line represents the data, there is no indication that the number of oil changes causes the need for engine repairs. There are many other variables that affect the cost of engine repairs. More oil changes may just mean those cars have more careful drivers.	in engine repairs. Since students have drawn different lines, the slopes will vary. Note that whereas a fraction or ratio is easily understood as the slope or rate of change, a decimal representation is more useful to compare slopes. After listing all the slopes reported by the class (perhaps in a stem-and-leaf plot), the class should determine a "consensus" slope. The number should be simple to use. For example, -70 is much more useful than -73.07 or -68.42 (the result obtained by choosing the two points (0,650) and (9.5,0) from the yellow line on the graph above). Since utility is more highly valued than precision in this instance, a slope of -70 seems to be a reasonable value.
2	Day 2 – Interpreting the graph in terms of slope. The teacher will ask "What is the change in the cost of repairs for each oil change?" A rate of change (or slope) of -70 indicates that for each additional oil change per year, the cost of engine repairs will tend to decrease by $70. (Students should note that a slope of -70 actually represents -70/1, which indicates a decrease of $70 per 1 oil change.) Associating measurement units with the slope is more important to give students a concrete basis for understanding. Next the teacher helps students examine the intercepts. The *y*-intercept is about 650. This means that if there are zero oil changes, engine repairs will cost about $750. From the graph, the *x*-intercept is about 9.5, which means that a car owner would expect to spend nothing on engine repairs if she changed the oil 9.5 times a year. The teacher will ask, "Is this a sensible number of oil changes per year?"	Students will begin by taking a brief quiz over the previous day's material (see assessment #1) Students will be able to interpret slope as rate of change. Students will discuss that changing the units on an axis will affect the slope. If the vertical axis were in cents rather than dollars, the slope would be -7,000. Students will use the slope and the *y*-intercept to write the equation of the line: Writing $y = mx + b$ for $m = -70$ and $b = 650$, students get $y = -70x + 650$. If the *y*-intercept is not accessible because of the scale, the equation of the line can be found by using any two points (not necessarily data points) on the line. Students can then use the equation to predict the cost of engine repairs expected for a specific number of oil changes. For example, if you change your oil four times a year, how much can you expect to pay in engine repairs? Let $x = 4$, then $y = -70(4) + 650 = \$370$. With four oil changes per year, you can expect to pay about $350 in engine repairs. Additional points on the graph will be discussed as needed. Homework: Weights and Drug Doses activity sheet (see assessment #2)
3	Day 3 – Summative Assessment – Unit Quiz After collecting the previous night's homework and reviewing the answers, the teacher distributes the "Bike Weights and Jump Heights" Unit Quiz.	Students will work individually to complete the assessment. Students will plot the graph by hand on the grid paper provided.

Summative Assessment Items: *Attach here.* For each summative assessment item, include an answer key or scoring rubric describing how points are to be awarded.

Assessment #1 – Brief Review of Terms Quiz

1. What is an independent variable?
2. What is a dependent variable?
3. What is the difference between correlation and causation?
4. What is an "eyeball fit" line?
5. In general terms, what is the meaning of the slope of a line?

Answer Key

1. The independent variable is changed by the experimenter and is represented on the "x" axis. (2 points)
2. The dependent variable changes as a result of a change in the independent variable and is represented on the "y" axis. (2 points)
3. Correlation occurs when two variables show a tendency to change in the same way, but do not indicate that one variable *causes* a change in the other. (3 points)
4. An "eyeball fit" line is an approximation of a line graph that follows the general pattern of data on a scatter plot graph. (2 points)
5. The slope shows a rate of change based upon the relationship of the independent and dependent variables. (3 points)

Total Points Possible: 12
Mastery: 10 points (≈85%)

Assessment #2

Weights and Drug Doses

NAME _____

The dosage chart below was prepared by a drug company for doctors who prescribed Tobramycin, a drug that combats serious bacterial infections such as those in the central nervous system, for life-threatening situations.

Weight (pounds)	Usual Dosage (mg)	Maximum Dosage (mg)
88	40	66

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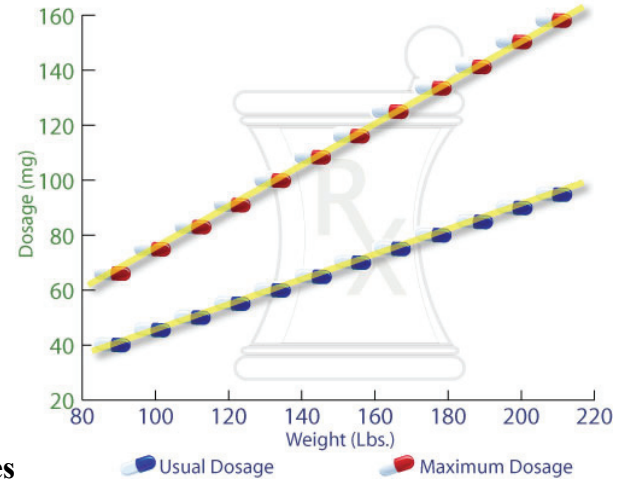
99	45	75
110	50	83
121	55	91
132	60	100
143	65	108
154	70	116
165	75	125
176	80	133
187	85	141
198	90	150
209	95	158

1. Use grid paper to plot the data (weight, usual dosage) and draw a best-fit line.
2. Plot (weight, maximum dosage) on the same axes. Draw a best-fit line.
3. Find the slope for each line. What do they mean, and how do they compare?
4. Write the equations of the two lines.
5. Are the two lines parallel? Why or why not?
6. Use a calculator to construct a regression line for this data set. How does this line compare to the two lines found in 1 and 2?



Homework Answer Key: Weights vs. Drug Doses

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3. The slope for usual dosage is about 0.45, and for maximum dosage is about 0.76. For every pound of increase in weight, you can increase the usually dosage by 45%, compared to a 76% increase per pound for maximum dosage.
4. The (weight, usual dosage) equation is approximately $y = 0.46x$. The (weight, maximum dosage) equations is approximately $y = 0.76x - 0.05$.
5. The lines are not parallel because they have different slopes.
6. $y = 1.67x - 0.46$. The ratio of the slopes, the change in maximum dosage to weight to the change in usual dosage to weight (0.76 / 0.46), is the slope of the new line. (Weight factors out of the ratio.)

Scoring Rubric:

1 & 2: Graph

Label of Graph	1 point
Correct Orientation of axes	1 point
Correct labels of axes	1 point
Correct plotting of data (usual dosage (ud))	3 points
Correct plotting of data (maximum dosage (md))	3 points

3. 2 points (ud); 2 points (md)
4. 2 points (ud); 2 points (md)
5. 2 points
6. 4 points

Total Possible Points: 23 points
Mastery: 20 points (≈85%)

Assessment #3

Bike Weights and Jump Heights – Unit Quiz

NAME _____

1. In BMX dirt-bike racing, jumping high or "getting air" depends on many factors: the rider's skill, the angle of the jump, and the weight of the bike. Here are data about the maximum height for various bike weights.

WEIGHT (pounds)	HEIGHT (inches)
19	10.35
19.5	10.3
20	10.25

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20.5	10.2
21	10.1
22	9.85
22.5	9.8
23	9.79
23.5	9.7
24	9.6

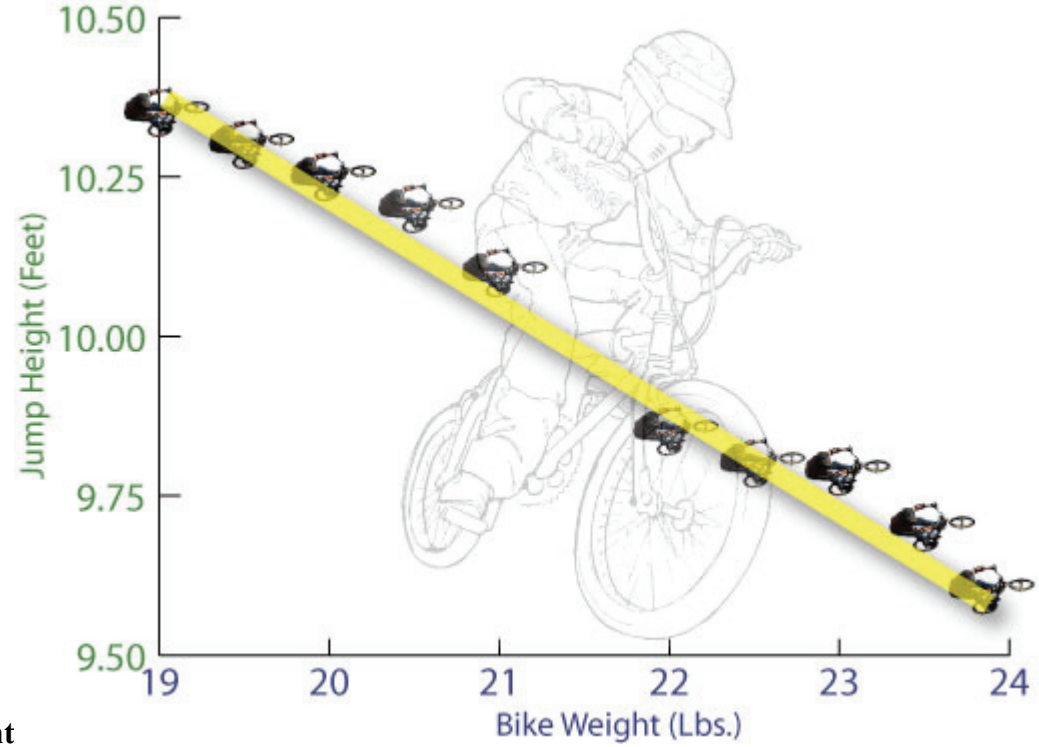
Use grid paper to plot the data (weight, height). If the data are linear, draw a trend or best-fit line.

2. Is there a positive, negative, or no relationship between bike weight and jump height?
Explain your answer.

3. As the weight increases, the height _____.

4. Find the slope or rate of change. What does this mean in words?

5. Predict the maximum height for a bike that weighs 21.5 pounds if all other factors are held constant.



Answer Key: **Bike Weight vs. Jump Height**

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1. Negative
2. Decreases
3. -0.150; for every 1-pound increase in weight, the height decreases slightly less than 2/10 of an inch.
4. A 21.5-pound bike would be able to jump about 10 inches.

Scoring Rubric:

1. Graph

Label of Graph	1 point
Correct Orientation of axes	1 point
Correct labels of axes	1 point
Correct plotting of data	5 points

2. 2 points
3. 2 points
4. Correct Slope 2 points
   Correct description 2 points
5. 2 points

Total Points Possible: 18
Mastery: 15 points (≈85%)