(Algebra 1 exemplar) FCPS Math *enVision* Topic Internalization

Topic Number: ___________

Pre-work

- Read the topic Focus, Coherence, and Rigor sections
- Read the highlighted math practices for the topic
- Read through the topic planner
- Complete the topic assessment(s) as if you were a student

Step 1: Identify the Content & Core Understandings

Reflect on essential standards for the unit

- What standards are taught in this unit? Star the essential standards for the unit.
- What are the key concepts of rigor for each standard? Indicate with an **A** (application), **C** (conceptual understanding), or **P** (procedural skill and fluency)

KY.HS.A.23

Standard: REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line)

Know	Do
Understand that a solution to an equation in two variables is an ordered pair. **- C** Understand that an equation in two variables has many possible solutions, all of which lie on the curve or line of the graph of that equation. **- C**	Graph linear, quadratic, and/or functions created by the expressions on the left side and the the right side of an equation as two curves (or lines). **- P** Understand the x-value from the intersection of the graph of the functions created by the left and right sides of the equation is the solution to the equation. exponential functions (with and without technology). **- P** Produce a table of values for linear, quadratic, and/or exponential functions (with and without technology). Identify the x-value of the intersection of the graph or table of the functions created from the left and right side of the equation. **- P**

KY.HS.F.1

Standard: F.IF.B.4.Linear (substandard of F.IF.B.4) 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. *Key features include intercepts, intervals where the function is increasing, decreasing, positive or negative, relative maximums and minimums, symmetries, end behavior~~, and periodicity.~~*

Know	Do
Understand that x-intercepts have a y-coordinate of zero. **- C** Understand that y-intercepts have a x-coordinate of zero. **- C** Understand an interval that increases is identified by y-values that increase as x-values increase. **- C**	Sketch a graph using key features. Identify x- and y-intercepts from a table and a graph. **- P** Identify intervals of increasing and decreasing behavior using interval notation. **- P** Identify maximums and minimums from a table and a graph. **- P**

Understand an interval that decreases is identified by y-values that decrease as x-values increase. **- C** Understand how to write interval notation. **- C** Understand the maximum value has the highest y-value. **- C**	Identify the axis of symmetry and write it as a linear equation (ex: x = 5). **– P** When given a graph, a table, and/or a verbal description, identify the meaning of the key features within a contextual situation. **- A** Identify a key feature to answer a question about a contextual situation. **- A**

KY.HS.SP.7

Standard: S.ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	
Know	**Do**
Understand the correlation coefficient is a measure of how well the model fits a set of data. **- C**	Identify the rate of change. **– P** Identify the y-intercept in a linear model. **– P** Explain the rate of change and the y-intercept in relation to the context of the situation. **- A**

Understand the topic and content of the unit and the way the unit will flow toward the central understanding / key ideas	• What are the essential questions of the unit? • Summarize the big idea of the unit in no more than three sentences. • How will the 3-Act Math Task connect to the learning goals?	**Big Idea #1:** The graph of an equation shows us all of the possible solutions to that equation. **Big Idea #2**: A situation with a constant rate of change can be represented by a line. The slope and initial value of that line can help us make sense of the situation. **Big Idea #3:** We can use a line of best fit to describe and make predictions based on real-world data.

Step 2: Dig Deeper into the Content

Review the learning objectives, intentions, and goals.	• Read through the lesson objectives. How does the learning of this unit move from simple to complex in order to meet the key concepts and skills outlined by the grade level standards?	In the first part of this unit, students work to express all of the (infinitely many) solutions to a given equation graphically. In order to reinforce this, it is necessary to constantly ask follow-up questions about graphs, such as, "What are the coordinates of this point here? What are those coordinates telling us about the equation in context?" Students build on this understanding and use the guiding questions to notice patterns and how it corresponds to the slope of graphs. They understand linear equations and graphs in context. Students will analyze scatter plots, will determine approximate and exact lines of best fit, will use the equations of these lines of best fit to make predictions, will describe (informally, then formally) their level of confidence based on attributes of the data set, and will ultimately describe whether or not they believe there is a causal relationship between the two variables being analyzed.
Complete the entire Topic Assessment for the unit using the	• What language/vocabulary is required to be successful on this assessment? In this unit?	**<u>Vocabulary</u>** linear inequality systems of linear inequalities strict inequality inclusive inequality

<table>
<tr>
<td>specific strategies, skills, and models outlined in the unit plan and lessons.</td>
<td>

What strategies/models are required for students to be successful on this assessment and in this unit?
Review the concepts of rigor you listed for each standard. Based on the assessment, are there any concepts you need to add to the chart?

</td>
<td>
half-plane
maximum value
minimum value
interval notation
increasing interval
decreasing interval
vertex
axis of symmetry
domain

<u>Possible Strategies - finding and describing solutions:</u>
<table>
<tr><td>Level 1: Guess and Check (Decontextualized Student solutions)</td><td>Students may write an equation such as y = 12x + 8, then try substituting various values of x and y into the equation until they find a combination of values that “work”:

“This equation is true when x = 1 and y = 20.”</td></tr>
<tr><td>Level 2: Connect equation to graph</td><td>“This equation is true when x = 1 and y = 20, which connects to the fact that (1,20) is a point on the line that represents this equation.”</td></tr>
<tr><td>Level 3: Contextual descriptions</td><td>Once they have found a solution, students can explain the solution in the context of the problem

“The point (1,20) means that, if Jamiyah babysits for 1 hour, she will earn 20 dollars.”</td></tr>
<tr><td>Level 4: All possible solutions</td><td>Students can describe that the points on the graph each represent a unique situation that makes the equation true:

“The point (1,20) means that, if Jamiyah babysits for 1 hour, she will earn 20 dollars. The fact that (0,44) is not on the graph of the equation means that when Jamiyah babysits for 0 hours, she will not be paid 44 dollars. x=0 and y=44 does not satisfy the original equation.”</td></tr>
<tr><td>Level 5: Continuity</td><td>Same as level 4, but with an understanding that there are points represented “in-between” labeled points on a graph that also represent solutions to the equation:

“In fact, because these lines are connected, we see that Jamiyah is paid at the same rate even for parts of hours - the point (1.5,26) means that Jamiyah will be paid 26 dollars for working 1.5 hours.”</td></tr>
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</td>
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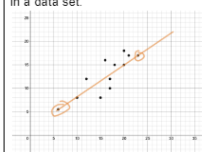
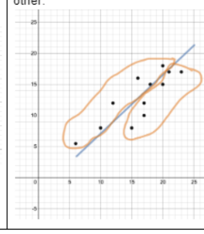
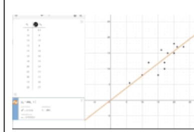
Possible Strategies for graphing linear equations:

<table>
<tr><th>Strategy # 1: Make a table</th><th>Strategy # 2: Use initial value and slope (“rise over run”) to plot 2-3 points</th><th>Strategy # 3: Use initial value but interpret fractional slope as a ratio</th></tr>
<tr><td>Students may make a table of values:
<table><tr><td>x</td><td>y</td></tr><tr><td>0</td><td>8</td></tr><tr><td>1</td><td>20</td></tr><tr><td>2</td><td>32</td></tr></table>
They would then graph these coordinate pairs and connect the dots.</td><td>Students plot the y-intercept (initial value) and use the slope to plot 1-2 additional points before connecting the dots.[3]

This looks like the .gif below (based on the equation y = 12x + 8), in which the student plots the y-intercept at (0,8), then moves over to the right one unit and up 12 units (because the slope is 12) and plots the next point, which is at (1,20). They then move over one to the right and up 12 again to plot the next point, which is at (2,32). Then they connect these dots.</td><td>Suppose students need to graph y = 5/4 x + 7. Using strategy #2, this would require students to plot the point (0,7) and then (1,8.25).

Using this strategy (#3), students would instead recognize that a slope of 5/4 means that when the x-value increases by 4, the y-value increases by 5, so rather than move right 1 and up 1.25, they move right 4 and up</td></tr>
</table>

Possible Strategies for creating lines of best fit

<table>
<tr><th>Strategy #1: Use first and last points</th><th>Strategy #2: “Half on one side, half on the other”</th><th>Strategy #3: Try to minimize residuals</th><th>Strategy #4: Use technology to generate the line of best fit</th></tr>
<tr><td>This strategy is a starting point but does not take into account the trend - it simply draws a line through the first and last (left-most and right-most) points in a data set.
</td><td>Students will try to approximate the trend line and try to ensure that half of the points are on one side of the line and half on the other:
</td><td>Students will first do this informally, by trying to "make the line as close as possible to all of the points", then, when they have access to the tools that compute the residuals (such as in Lesson 12), they will do this more formally.</td><td>Students will learn to use Desmos to generate the line of best fit by typing $y_1 \sim mx_1 + b$.
</td></tr>
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Step 3: Plan for Learning Acceleration

<table>
<tr><td rowspan="3">Determine the root of possible unfinished learning</td><td rowspan="3">What prerequisite standards are necessary for students to access the content of the Topic? Use the Achieve the Core Coherence Map
What key concepts and skills do students need to know and do?
What representations might they utilize?</td><th>Prerequisite Standards</th><th>Key Concepts, Skills, & Representations</th></tr>
<tr><td>7.RP.A.2.D Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.</td><td>use variables to write expressions, equations, and inequalities
graph one variable inequalities on a number line
graph linear equations
graph systems of linear equations</td></tr>
<tr><td>8.EE.B.5 (taught at the end of 7th grade) Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving</td><td>will interpret the equation y = mx + b as a linear function and will use the equation to solve problems in context 2.
will interpret key features of linear equations in relation to a contextual situation.</td></tr>
</table>

		objects has greater speed. **8.EE.C.7 (taught at the end of 7th grade)** Solve linear equations in one variable: 8.EE.C.7.A: Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form *x* = *a*, *a* = *a*, or *a* = *b* results (where *a* and *b* are different numbers).	
		8.EE.B.5 (taught at the end of 7th grade) Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.	• plot points in a coordinate grid and construct an equation or a function to model the linear relationship • determine and interpret the slope and y-intercept • construct and interpret scatter plots • construct an equation or a function to model a linear relationship and determine/interpret the slope and y-intercept.
Anticipate student	Based on the assessment and standards, annotate the unit/module to illuminate the	**Potential Misconceptions:**	

misconceptions and plan a path to address them	following: ❑ What content is new or possibly challenging for students? ❑ What background knowledge do students have that they will build upon during this unit? ❑ What misconceptions might they have? ❑ How will you encourage productive struggle?	• A graph is the outcome of an equation (rather than an alternative representation):"We take the equation, we substitute values to get points, we connect the points, and we get the graph of the equation." • A graph is not complete until you have connected the dots: *Some students may believe that the process of connecting the dots of a graph, to make a line, is part of a process, rather than a declaration that each of the smaller points that make up the line represents a unique solution to the equation.* • Students make an error in finding the slope by mixing up x and y • Students may mix up the concept of slope in terms of positive and negative • Students may write coordinates in different orders, inconsistency in corresponding coordinates • Students misunderstand how the rate of change and initial value predictably affect eh outcome (y) and mix up initial value and rate of change • students assume that x is always the independent variable (graphed on the horizontal axis) and that y is always the independent variable (graphed on the vertical axis.) • students think that for every data set, there is a line of best fit that perfectly describes the data and makes perfect predictions. • Students confuse the correlation coefficient for the slope of the line of best fit. • Students conflate correlation and causation **Response to Misconceptions:** Small group instruction on the following topics: Resource — Purpose Resource A — Students use an equation to create a table and graph of a function. Resource B — Scholars interpret the meaning of slope and y-intercept in context. Resource C — Scholars write a linear equation from a given context by identifying the ROC and initial value. Resource D — Scholars write a linear equation when given either 2 coordinate pairs or 1 coordinate pair and the ROC. Resource E — Scholars use the equation from a line of best fit to make predictions. Resource F — Scholars interpret a correlation coefficient. **Considerations for Productive Struggle:** • Providing manipulatives / tools to support student learning • Partner work using Kagan structure • Visual anchors for students to reference • Celebrating showing grit and perserverence

Helpful Planning Resources

Resources from Louisiana Believes

- Companion docs are useful for breaking down standards
- Rigor docs are useful for determining levels of rigor aligned to standards and lessons

enVision Resources

- Topic Overview Videos
- Topic Introductions

Achieve the Core Coherence Map

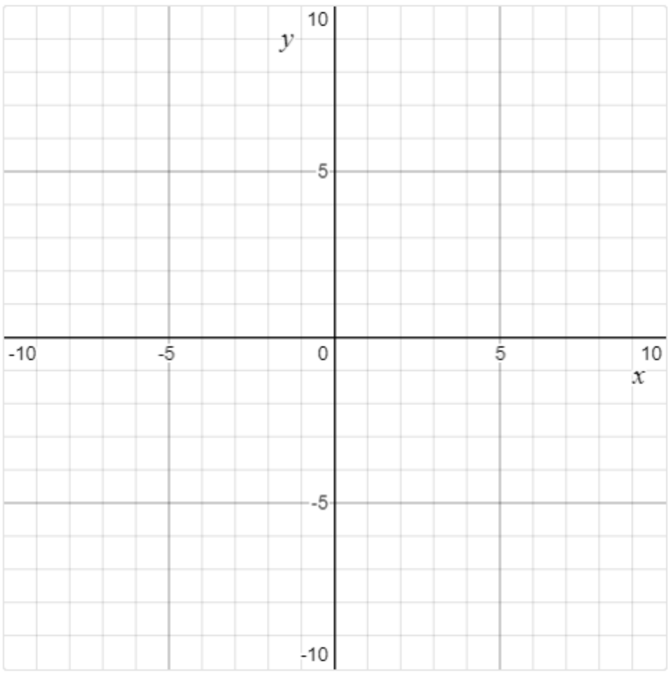
Small Group Planning Resources

Resource A:

1. Use the table to list at least three different solutions to this equation: $y = 5x - 7$

x	y

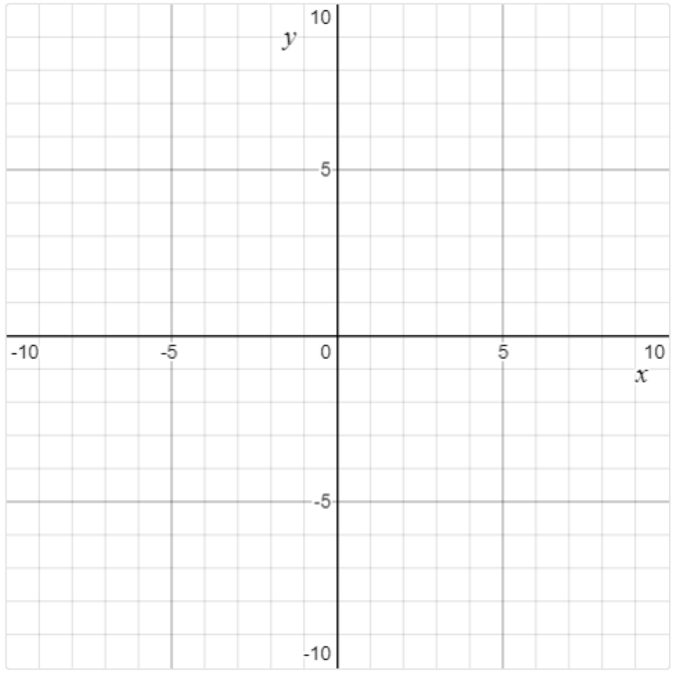
Then, plot these coordinates on the graph below.



2. Use the table to list at least three different solutions to this equation: $y = -x + 9$

x	y

Then, plot these coordinates on the graph below.



Resource B:

1. Justin is taking a cab from the airport back to his house. For every mile he drives, x, the amount of money he has, g(x), decreases.The equation below models how much money Justin has left for every mile the cab drives.

   $g(x) = -12x + 4$

   What does the rate of change and y-intercept represent in the context of this problem?

2. Michael is growing a rose bush in his backyard and records how fast it is growing. He writes the equation $y = 3 + 45x$ to model the height of the rose bush in feet, y, after x number of days since he started taking measurements.

   How tall was the rose bush when Michael started recording? How much does the rose bush grow each day?

Resource C:

1. James is 65 inches tall at the end of 7th grade. For the next year, James consistently grows 0.10 inches each month. Write an equation that represents H,James' total height t months after 7th grade.

2. Tara is filling up the swimming pool in her backyard. The pool already contains 5 liters of water and she is adding in 1.5 liters every hour starting at noon. Write an equation that represents P,the total amount of water in the pool x hours after noon.

Resource D:

1.

a. Write the equation of the line that passes through the points (-1, -4) and (-2, 0).

b. Write the equation of the line that passes through the points (-3, -8) and (2, 7).

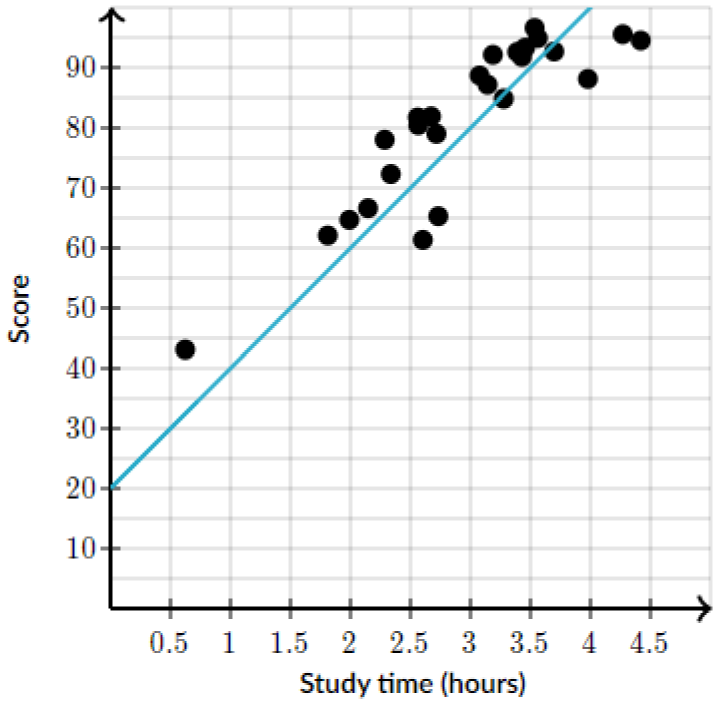
2.

a. Write the equation of the line that passes through (2, 4) with a slope of 3.

b. Write the equation of the line that passes through (-6, 8) with a slope of -12

Resource E:

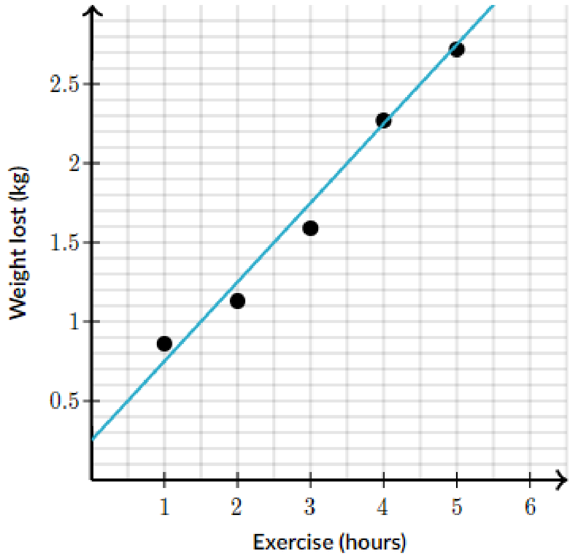
1. Liz's math test included a survey question asking how many hours students spent studying for the test. The scatter plot below shows the relationship between how many hours students spent studying and their score on the test. A line was fit to the data to model the relationship.



The equation of the line of best fit is y = 20x + 20 where yrepresents the total score and xrepresents the study time in hours.

What score would you predict for a scholar who spent 3.8 hours studying?

2. Arthur wanted to investigate how the amount he exercises impacts his weight loss. Each week he recorded the number of hours he exercised and the amount of weight he lost that week (in kilograms). A line was fit to the data to model the relationship.

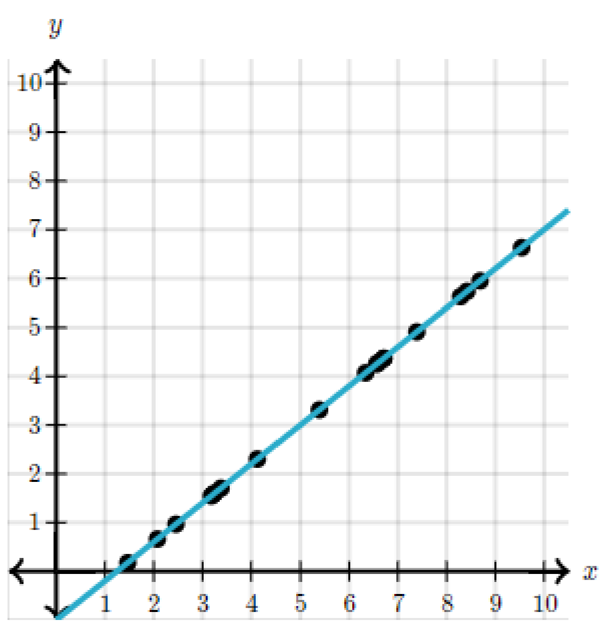


The equation of the line of best fit is W(h) = 0.5x + 0.25 where W(x) represents his weight loss in kilograms and x represents the number of hours he exercised.

Predict Arthur's weight loss in a week where he exercises for 6 hours.

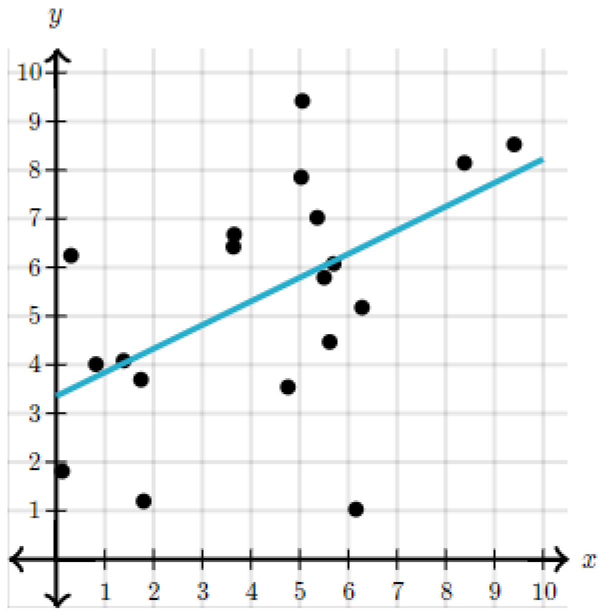
Resource F:

1. What is the correlation coefficient of the graph below?



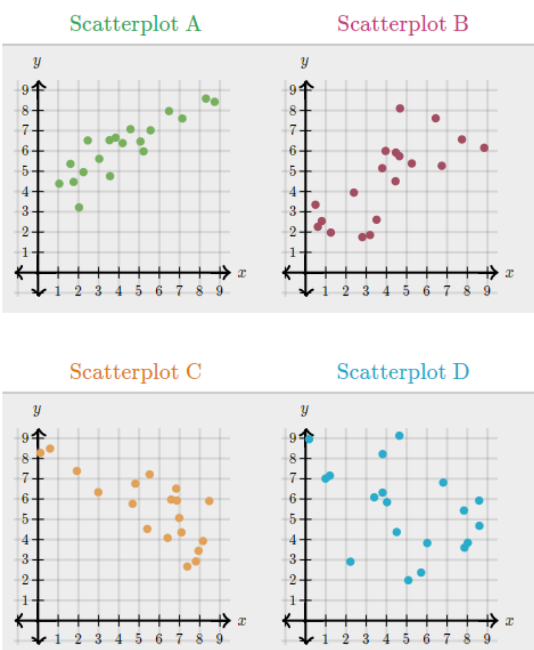
a. -1
b. 0
c. 0.5
d. 1

2. What is the correlation coefficient of the graph below?



a. -1
b. 0
c. 0.5
d. 1

3. Which scatterplot has a correlation coefficient of -0.77?



Resource G:

1. What is the relationship between ice cream sales and bathing suit sales?

a. Positive Correlation
b. Positive Causation
c. Negative Correlation
d. Positive Causation

2. What is the relationship between minutes spent exercising at the gym and calories burned?

a. Positive Correlation
b. Positive Causation
c. Negative Correlation
d. Positive Causation