SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Define, evaluate, and compare functions	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
None	8.F.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.	9-12.F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).ing to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).

Student Friendly Language:

I can identify a function.

I can understand that in a function every input value has exactly one output value.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• Function • Input is *x* • Output is *y* • Vertical line test	In a function, for every input value there is exactly one output value. The graph of a function is a set of ordered pairs.	Identify functions from equations, graphs, and tables/ordered pairs. Show that the input of a function has exactly one output value. Identify graphs as functions using the vertical line test.

Key Vocabulary:

Function y-value x-value Vertical line test Input Output Linear function Non-linear function

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Which of the following represent functions?

1. {(0, 2), (1, 3), (2, 5), (3, 6)}
2.

x	y
0	3
1	9
2	27

3.

x	y
16	4
16	-4
25	5
25	-5

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Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
None	8.F.2 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*	9-12.F.IF.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.* 9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

Student Friendly Language:

I can explain, compare and contrast properties and characteristics of functions given in different ways.

I can match the same function to different representations of that function..

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Properties of a function • Characteristics of a function • Graphs, tables, equations, and verbal descriptions of functions	Functions can be represented in multiple ways. Different representations can be used to compare functions to draw conclusions and make applications. A relationship between tables, graphs, and equations can be found by looking at similarities and differences.	Compare properties and draw conclusions from different representations of functions. Create equations and write functions for graphs, tables, and verbal descriptions of a function. Explain the purpose of representing a function in multiple ways.

Key Vocabulary:

Rate of change	Slope	Coordinate plane	x-coordinate	y-coordinate	x-axis
Function table	T-chart	Graph	Equation	Dependent variable	y-axis
Independent variable	Origin	Ordered pair	Equivalent		

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

1. Do test scores relate to the amount of time studying? How much studying do you need to do compared to the rest of the class in order to improve your test scores? How does the relationship between your study time and your friend’s study time compare? Who needs to study more to achieve an A?

2. You make $5 an hour at your part time job walking dogs. Your friend makes $6.50 washing cars. You have already saved $15, and your friend has saved nothing. How many hours will each of you have to work to save enough money for the ski trip that costs $150? Who has to work more hours?

3. Joe needs to hire a plumber to fix his toilet, but only has $300 saved. Pete’s Plumbing charges $75 initial fee plus $50 an hour. Young’s Plumbing charges $60 per hour. Which company would be best for Joe to hire?

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7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.* 7.RP.2. Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.* Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.* 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. 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. *r)* where *r* is the unit rate.	8.F.3 Interpret the equation *y = mx + b* as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function A = s^2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1),(2,4) and (3,9), which are not on a straight line.*	9-12.F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).*

Student Friendly Language:
I can recognize that a linear function forms a straight line. I can recognize that an equation in the form y=mx+b is a linear function. I can give examples of linear and non-linear equations. I can demonstrate through a graph that a function is not linear.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Linear function • Nonlinear function • y= mx + b • y-intercept • Slope	All equations that fit into the form y=mx + b are linear. All equations are either linear or nonlinear. Understand that linear functions have a constant rate of change between any two points.	Identify the slope and y-intercept of a linear equation in the form of y=mx+b. Explain the relationship between linear and nonlinear functions using tables, graphs, and equations in the form y=mx+b Use equations, graphs and tables to categorize functions as linear or nonlinear.

Key Vocabulary:

Rate of change	Slope	y-intercept	Unit rate	Coordinate plane	Linear function
Nonlinear function	Function table	Equation	Ordered pair	y=mx+b	

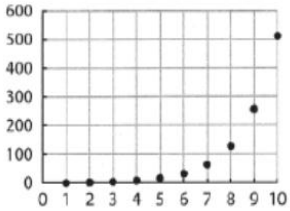
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Determine if the functions listed below are linear or nonlinear. Explain your reasoning.

1. $y = -2x^2 + 3$
2. $y = 0.25 + 0.5(x – 2)$
3.

X	Y
1	12
2	7
3	4
4	3
5	4
6	7

4.



5. $A = \square r^2$

Solutions:

1. Nonlinear
2. Linear
3. Nonlinear
4. Nonlinear
5. Nonlinear

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Domain:	Functions	**Cluster:**	Use functions to model relationships between quantities.	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05.* 7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width	8.F.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values	9-12.F-IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. 9-12.F-BF.1 Write a function that describes a relationship between two quantities. a Determine an explicit expression, a recursive process, or steps for calculation from a context. b Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c (+) Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time. 9-12 F -LE. 1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Student Friendly Language:
I can write an equation to show a linear relationship between two quantities based on a graph or table. I can find rate of change and initial value of a linear function when given the description of a situation or two points. I can read a table or a graph and find an ordered pair that fits into the function. I can explain the meaning of the rate of change and the initial value of a linear function from a table or graph in the context of the situation. I can use tables or graphs to find the rate of change and initial values. I can model linear functions and explain the meaning using graphs, tables, and equations.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Linear relationship • Initial value • Interpretation of rate of change and initial value	Functions can be used to model linear relationships between quantities. Linear functions can be used to explain rate of change and initial value. There is a relationship between two quantities to be modeled. The slope is used to determine the rate of change. The y-intercept is used to determine the initial value.	Construct a function to model a linear relationship using different forms Determine the initial value of a linear function from a graph or a table. Calculate rate of change of a line given a description of a relationship or two ordered pairs Explain the meaning of the rate of change and initial value of a linear function based on the context, graph or table

Key Vocabulary:

Function	Table	Graph	Equation	Rate of change	Linear
Initial value	Ordered pair	Linear relationship	x-intercept	y-intercept	Slope-intercept form

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

1. A 6 ft. pool contains 1 foot of water at 10am. If the pool fills 6 inches every 15 minutes, what time will the pool be full?

2. Farmer Brad has a 500 gallon fuel tank. Cenex can fill the tank at 4 gallon every minute. If Farmer Brad has 20 gallons left in the tank, how long will it take to fill the tank?

3. You have been studying for a test. You have to get through 30 pages of notes. You have already read through 6 pages. If you study five pages an hour, how long will it take to finish your studying? How long will you have studied after studying 28 pages? If you finish studying at 9:15 pm, what time did you start studying?

4. You are saving some money for an iPhone. You need to save a total of $250. Your job at Dairy Queen earns you $7.50 per hour. You have worked for 10 hours, and you only need $100 more. How much money did you have when you started working?

5. Use the information in the following table of times and temperatures to find the rate of change of the function.

Time	6:00 a.m.	8:00 a.m.	10:00 a.m.	12:00 p.m.	2:00 p.m.
Temperature	45◦	50◦	55◦	60◦	65◦

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Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.RP.2 Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn. 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.	8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	9-12.F-IF.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. 9-12.F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. • 9-12.F.LE.1a- Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. • 9-12.F.LE.1b- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. • 9-12.F.LE.1c- Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Student Friendly Language:
I can describe how the two variables are related using a graph. I can distinguish when a graph is increasing or decreasing. I can sketch a graph when given a verbal description of it. I can identify and interpret the meaning of x- and y-intercepts of a graph.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• Increasing functions • Decreasing functions • x-intercept • Varying rates of change	A function is a relationship between two variables. A change in one variable will cause a change in the other variable. There is a relationship between the rate of change and the direction of the graph. Functional relationships between two quantities have meaning and can be represented by a graph and described verbally.. Functions may be increasing or decreasing.	Draw a graph based on a description of the relationship between two quantities. Analyze/investigate the intervals on a graph where changes (increase, decrease) are occurring and make conjectures about possible causes of the change Analyze the relationship between two quantities shown on a graph.

Key Vocabulary:			
Coordinate plane	Linear function	Non-linear function	Increasing
Decreasing	x-intercept	y-intercept	Constant

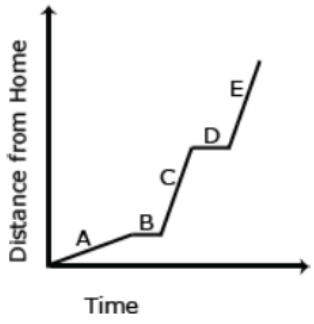
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

1. Based upon the graph of water in a tub, verbally describe what is happening between the two variables. On what segment is the water depth decreasing at the slowest rate/fastest rate? How can you tell?

2. Given this scenario, sketch a graph:

Mary started walking to school at a leisurely pace. She stopped to tie her shoe. Then she realized she was going to be late, so she started to run. After running for a minute she became tired and slowed to a fast walk. After 10 total minutes, she arrived at school.

3. The graph below shows a John's trip to school. He walks to his Sam's house and, together, they ride a bus to school. The bus stops once before arriving at school.
   Describe how each part A – E of the graph relates to the story.



Solution:
A John is walking to Sam's house at a constant rate.
B John gets to Sam's house and is waiting for the bus.
C John and Sam are riding the bus to school. The bus is moving at a constant rate, faster than John's walking rate.
D The bus stops.
E The bus resumes at the same rate as in part C.

3. Give the students a stop watch, have them walk a specified route and mark their time as specified locations. They will then graph their data and compare their graphs to others.

4. Follow and graph the grain, cattle, stock prices over a period of time. Analyze the graphs, make conjectures about the causes of changes in the graphs, compare the graphs of the different commodities.