Grade 8 Mathematics Item Specificati

Response Type: Equation/Numeric

DOK Level 2

8.F.B.4

Construct a functio to model a linear relationship betwee two quantities. Determine the rate of change and initi value of the function from a description a relationship or from two (x, y)values, including reading these from table or from a graph. Interpret th 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.

Evidence Required:

1. The student constructs a function to model a linear relationship between two quantities.

Tools: Calculator

funct	pt Features: The student is prompted to construct a linear on given a linear relationship between two quantities.
Stim	ulus Guidelines:
•	Tables should be labeled
•	Granh scale should contain only integers
	Context should be familiar to students 13 to 15 years old
•	Item difficulty can be adjusted via these example methods:
-	 Slopes can be positive or negative
	• Axes scales can be varied including having different
	scales on each axis
	 Table values can be integers fractions or decimals
	• Grants can include intercents clearly plotted or any
	other points that are clearly marked \
	 Proportional relationship with positive rate of change
	aiven
	 Linear relationship with positive or negative rate of
	change given
	 Linear relationship where student must find the rate of
	change.
TM1	change.
Stim	ulus: The student is presented with a table of input and output
value	s, a graph, or a verbal statement that represents a linear
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funct	on.
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Exan x 2 3	on. Iple Stem 1: This table of values represents a linear function. <u>Y</u> <u>-6</u> <u>-6.5</u>
Exan x 2 3 8	on. aple Stem 1: This table of values represents a linear function. <u>Y</u> <u>-6</u> <u>-6.5</u> <u>-9</u>
Exan x 2 3 8	on. aple Stem 1: This table of values represents a linear function. <u>Y</u> <u>-6</u> <u>-6.5</u> <u>-9</u>
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Exan 2 3 8 Enter funct Exan	on. aple Stem 1: This table of values represents a linear function. by c -6 c -6.5 c -9 c -6.5 c -9 c -9 c -6 c -6.5 c -9 c -9 c -6.5 c -9 c -7.5 c -7.
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Exan x 2 3 Enter funct Exan	on. aple Stem 1: This table of values represents a linear function. $\frac{y}{-6}$ -6.5 -9 an equation in the form $y = mx + b$ that represents the on. aple Stem 2: This graph represents a linear function. y



Enter an equation in the form y = mx + b that represents the function.





Task Model 1 **Response Type: Example Stem 3:** A swimming pool with 1600 gallons of water is **Equation/Numeric** emptied at a constant rate of 300 gallons every 2 hours. DOK Level 2 Enter an equation in the form y = mx + b that represents the amount of water y, in gallons, remaining in the pool after x hours. 8.F.B.4 Construct a function Rubric: (1 point) Student enters the correct equation to model a linear (e.g., y = -0.5x - 5; y = -4x + 2; y = -150x + 1600). relationship between two quantities. **Response Type:** Equation/Numeric 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. Evidence **Required:** 1. The student constructs a function to model a linear relationship between two quantities. Tools: Calculator

Response Type: Equation/Numeric DOK Level 1 8.F.B.4 Construct a function to model a linear 0 relationship between two quantities. Determine the rate of change and initial 0 value of the function from a description of point. a relationship or from two (x, y)values, including reading these from a 0 table or from a 0 graph. Interpret the rate of change and initial value of a linear function in terms of the 0 situation it models, and in terms of its graph or a table of values.

Evidence **Required:**

Task Model 2

2. The student determines the rate of change and initial value of a function. either from a description of a relationship or from two (x, y) values, including reading the rate of change and/or the value of the function from a table or a graph.

Tools: Calculator

Prompt Features: The student is prompted to determine the rate of change or the initial value given a representation of a linear function as a table or graph.

Stimulus Guidelines:

- Tables and graphs must be labeled.
- Graph scale should contain only integers.
- Item difficulty can be adjusted via these example methods: Rate of change:
 - Input values increase by 1 unit on table or graph. Table values are whole numbers or integers.
 - Input values increase by multiples of 2, 3, or 5 on table or graph.
 - Table values are rational numbers. Values in decimal form should have only one digit after the decimal
 - Input values do not increase by the same number of units each time. Table values are integers.

Initial value:

- Table starts with an input value of 0.
- Table does not show an input value of 0 Input values increase by 1 or by multiples of 2, 3, or 5 units on table or graph. Table values are rational numbers.
- Values in decimals form should have only one digit after the decimal place.
- Table does not show an input value of 0. Input values do not increase by the same number of units each time. Table values are integers.

TM2

Stimulus: The student is presented with a table of values or a graph and asked to determine the rate of change or initial value.

Example Stem 1: In this table, y is a linear function of x.

x	Y
0	50
2	40
4	30
6	20

Enter the rate of change of this function.

Rubric: (1 point) The student enters the correct rate of change (e.g., -5).

Response Type: Equation/Numeric





Task Model 2

Response Type: Equation/Numeric

DOK Level 1

8.F.B.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.

Evidence Required:

2. The student determines the rate of change and initial value of a function, either from a description of a relationship or from two (x, y) values, including reading the rate of change and/or the value of the function from a table or a graph.

Tools: Calculator

Example Stem 2: This table shows water level in a tank as a linear function of time.

Time (hr)	Water Level (ft)
0	50
2	40
4	30
6	20

Enter the rate of change of the water level, in feet per hour.

Rubric: (1 point) The student enters the correct rate of change (e.g., -5).

Response Type: Equation/Numeric

Example Stem 3: This graph shows water level in a tank as a linear function of time.



Enter the initial water level, in feet, of the water tank.

Rubric: (1 point) The student enters the correct initial value (e.g., 30).

Note: Without other information that points to a specific value on the graph, allow for a range of responses (e.g., 29.5-30.5).

Response Type: Equation/Numeric



Grade o Mathemat		ne consortium	
Task Model 3	Prompt Features: The student is prompted to determin statements regarding the rate of change and the initial v	e true alue from a	
Response Type: Matching Tables	representation of the function using a table, graph, or ve statement.	rbal	
DOK Level 2	 Stimulus Guidelines: Tables and graphs must be labeled 		
8 E R <i>1</i>	Granh scale should contain only integers		
Construct a function	• Them difficulty can be adjusted via these example	mothoday	
to model a linear	• Item uniculty can be aujusted via these example	methous.	
rolationship botwoon	The second secon	aranh	
	Table values are whole numbers or integer	graph.	
Determine the rote	Table values are whole numbers of integer	5. 	
Determine the rate	 Input values increase by multiples of 2, 3, table or graph 	01 2 011	
	Table values are rational numbers. Values	in decimal	
	• Table values are rational numbers. values		
rolationship or	norm should have only one digit after the c	lecimal	
from two (x, y)	point.	number of	
$x_{2} = x_{2} = x_{2$	units each time. Table values are integers		
reading these from a	Initial value:		
table or from a	\sim Table starts with an input value of 0		
graph Interpret the	\sim Table does not show an input value of 0 In	nut values	
rate of change and	increase by 1 or by multiples of 2 3 or 5	units on	
initial value of a	table or graph. Table values are rational n	imbers	
linear function in	\sim Values in decimals form should have only	one digit	
terms of the	after the decimal place.	and angle	
situation it models.	\circ Table does not show an input value of 0. It	nput values	
and in terms of its	do not increase by the same number of un	its each	
graph or a table of	time. Table values are integers.		
values.			
	ТМЗ		
Evidence	Stimulus: The student is presented with a graph, table,	or verbal	
Required:	description of a linear function.		
3. The student			
interprets the rate of	Example Stem: A swimming pool containing 1600 gallo	ns of water	
change and the	is emptied at a constant rate of 300 gallons every 2 hour	s.	
initial value of a			
linear function in	Determine whether each statement about the amount of	water in	
terms of the	the pool is true. Select True or False for each statement.		
situation it models,		T]	
its graph, or a table	Statement True	False	
of values.	The initial amount of water in the pool is		
— • • • • •	1600 gallons.		
Tools: Calculator	The amount of water in the pool decreases		
	by 150 gallons every 1 hour.		
	The amount of water in the pool at 3 hours		
	is 450 gallons.		
	Pubrice (1 point) Student determines each statement as	hoing	
	\mathbf{r} The second state of the second state 	being	
	Response Type: Matching Tables		

Rubric: (1 point) Student determines each statement as being either true or false (e.g., T, F, F). Each statement is a sentence describing the behavior of the function.

Response Type: Matching Tables

Version 3.0

Grade 8 Mathematics Item Specification C1 TF

Response Type: Matching Tables

Task Model 4

Stimulus Guidelines:

- Tables and graphs must be labeled.
- Functions should have constant, decreasing, and/or increasing segments.
- Context should be familiar to students 13 to 15 years old.

TM4

Stimulus: The student is presented with a graph of a function which contains linear and/or nonlinear segments.

Example Stem: This graph shows the water temperature as a function of time.



Based on the graph, determine whether each statement is true. Select True or False for each statement.

Statement	True	False
The water temperature is increasing		
between hour 1 and hour 2.		
The water temperature is increasing		
between hour 3 and hour 4.		
The water temperature is constant between		
hour 0 and hour 1.		

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DOK Level 2

8.F.B.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.

Evidence **Required:**

4. The student qualitatively describes the functional relationship between two quantities by analyzing a graph (e.g., whether the function is increasing or decreasing, whether the graph is linear or nonlinear).

Tools: Calculator

Prompt Features: The student is prompted to determine true statements that gualitatively describe the functional relationship between two quantities.



Response Type: Multiple Choice, single correct response

Task Model 5

DOK Level 2

8.F.B.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.

Evidence Required:

5. The student draws a graph that exhibits the qualitative features of a function that has been described in writing.

Tools: Calculator

Prompt Features: The student is prompted to identify a graph or statements about a graph that match a given qualitative description.

Stimulus Guidelines:

- Graph can contain increasing, decreasing, and constant linear and nonlinear segments.
- Context should be familiar to students 13 to 15 years old.
- Item difficulty can be adjusted via these example methods:
 - Student verbally describes the qualitative features exhibited on a graph.
 - Student identifies a graph that exhibits the features of a function that has been described verbally with three or more qualitative statements.

TM5a

Stimulus: The student is presented with a description of a context or a graph of a function.

Example Stem: John is riding his bike.

- He increases his speed for 30 seconds.
- He stays approximately the same speed for the next 20 seconds.
- He slows down to a stop during the last 15 seconds.

Select the graph that best represents John's speed over time.





Task Model 5

Response Type: Multiple Choice, single correct response

DOK Level 2

8.F.B.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.

Evidence Required:

5. The student draws a graph that exhibits the qualitative features of a function that has been described in writing.

Tools: Calculator



Answer Choices: Each answer choice should be a graph that matches the verbal description. Distractors should be incorrect graphs that do not match the verbal description.

Rubric: (1 point) The student selects the correct graph that represents John's speed over time (e.g., A).

Response Type: Multiple Choice, single correct response

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	Smarter
Grade 8 Mathemat	cics Item Specification C1 TF Assessment Consortium
Task Model 5	Prompt Features: The student is prompted to create a graph that has given characteristics such as increasing, decreasing, or constant segments.
Graphing	Stimulus Guidelines:
DOK Level 1	 Context can contain increasing, decreasing, and constant linear and nonlinear segments and should be familiar to students 13 to 15 years old.
Describe qualitatively the functional	 Item difficulty can be adjusted via these example methods: Three or more qualitative statements Requires particular ordered pairs to be plotted.
two quantities by analyzing a graph (e.g., where the function is increasing	TM5b Stimulus: The student is presented with a blank grid with <i>x</i> - and <i>y</i> -axes labeled and the description of the context.
or decreasing, linear	Example Stem: John is riding his bike.
a graph that exhibits the qualitative features of a function	 He increases his speed for 30 seconds. He stays at the same speed for the next 20 seconds. He slows down to a stop during the last 15 seconds.
described verbally.	Use the Connect Line tool to draw a graph that represents John's speed over time.
Evidence	
5. The student draws a graph that exhibits the qualitative	Interaction: The student uses Add Point and Connect Line tools to plot points in the coordinate plane and connects the points with lines. Delete tool will also be provided.
that has been described in writing.	Rubric: (1 point) The student correctly draws a graph that represents the relationship (e.g., see below).
Tools: Calculator	
Accessibility Note: Graphing items are not currently able to be Brailled. Minimize the number of items developed to this TM.	John's Speed y Over Time (I) 15 15 10 10 10 10 10 10 10 10 10 10