Grade 8 Mathematics Item Specification C1 TJ Claim 1: Concepts and Procedures



Claim 1: Concepts and Procedures Students can explain and apply mathematical concepts and carry out mathematical				
procedures with precision and fluency.				
Contont Domain: Stat	istics and Probability			
Target 1 [s]: Investig	nate patterns of association in bivariate data (DOK Levels 1, 2)			
Tasks for this target w	ill often be paired with 8.F Target F and ask students to determine the			
rate of change and init	ial value of a line suggested by examining bivariate data.			
Interpretations related	to clustering, outliers, positive or negative association, linear and			
nonlinear association w	vill primarily be presented in context by pairing this target with those			
from Claims 2 and 4.				
Standards:	8.SP.A Investigate patterns of association in bivariate data			
8.SP.A, 8.SP.1,				
8.SP.2, 8.SP.3,	8.SP.1 Construct and interpret scatter plots for bivariate			
8.5P.4	measurement data to investigate patterns of association between			
	two quantities. Describe patterns such as clustering, outliers,			
	association			
	8 SP 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.			
	8.SP.3 Use the equation of a linear model to solve problems in the			
	context of bivariate measurement data, interpreting the slope and			
	intercept. For example, in a linear model for a biology experiment,			
	interpret a slope of 1.5 cm/hr as meaning that an additional hour of			
	sunlight each day is associated with an additional 1.5 cm in mature			
	plant height.			
	8.SP.4 Understand that patterns of association can also be seen in			
	bivariate categorical data by displaying frequencies and relative			
	trequencies in a two-way table. Construct and interpret a two-way			
	the same subjects. Use relative frequencies calculated for rows or			
	columns to describe possible association between the two variables			
	For example, collect data from students in your class on whether or			
	not they have a curfew on school nights and whether or not they			
	have assigned chores at home. Is there evidence that those who			
	have a curfew also tend to have chores?			
Related Below-Grade	Related Grade 7 standards			
and Above-Grade				
Standards for	7.SP.A Use random sampling to draw inferences about a			
Purposes of Planning	population			
for Vertical Scaling:	7.SP.1 Understand that statistics can be used to gain information			
	about a population by examining a sample of the population;			
7.SP.A, 7.SP.1,	generalizations about a population from a sample are valid only if			
7.SP.2,	the sample is representative of that population. Understand that			
	random sampling tends to produce representative samples and			
	support valid inferences.			
F-LE.5,	1.5F.2 Use data from a random sample to draw inferences about a			
, כ זה ב	population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to sauge			
0.01-5	the variation in estimates or predictions			



	Related High School Standards
	F-IF.B Interpret functions that arise in application in terms of
	the context.
	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.
	F-LE.5 Interpret the parameters in a linear or exponential function
	in terms of a context.
	S-ID.B Summarize, represent, and interpret data on two
	categorical and quantitative variables
	S-ID.5 Summarize categorical data for two categories in
	two-way frequency tables. Interpret relative frequencies in the
	context of the data (including joint, marginal, and conditional
	relative frequencies). Recognize possible associations and trends in
	the data.
	S-ID.6 Represent data on two quantitative variables on a scatter
	plot, and describe how the variables are related.
DOK Levels:	1, 2
Achievement Level L	Jescriptors:
RANGE	Level 1 Students should be able to investigate a scatter plot for
Achievement Level	clustering between two quantities and construct a scatter plot from
	given data. They should be able to construct a two-way nequency
(Range ALD)	Lable of given categorical data.
nattorns of	Level 2 Students should be able to investigate a scatter plot for positive, pogetive, and linear association and informally fit a line to
	data for a given a scatter plot that suggests a linear association
bivariato data	They should be able to calculate frequencies from categorical data in
Divallace data.	a two-way frequency table
	a two-way frequency table.
	natterns such as outliers and nonlinear association. They should be
	able to write an equation for the trend line or line of best fit for a
	given scatter plot with a linear association. They should also be able
	to interpret and use relative frequencies from a two way table to
	describe possible association between two variables
	Level 4 Students should be able to use scatter plots trend lines
	and associations between variables in two-way frequency tables to
	make predictions in real-world situations.
Evidence Required:	1. The student interprets patterns of association between two
	quantities in a scatter plot (clustering in reference to the line of
	best fit, positive or negative association, linear association,
	nonlinear association, and the effect of outliers) and interprets
	the slope and y-intercept in terms of the context.
	2. The student identifies the slope (rate of change) and intercept
	(initial value) of a line suggested by examining bivariate
	measurement data in a scatter plot.
	3. The student constructs and interprets a two-way table
	summarizing data on two categorical variables collected from the
	same subjects.



|--|

Allowable Response Types:	Matching Table; Equation/Numeric; Fill-in Table
Allowable Stimulus Materials:	Scatter plot, two-way relative frequency table, raw data
Construct-Relevant Vocabulary:	cluster, data, frequency, initial value, line of best fit, trend line, linear extrapolation, linear association, negative association, outlier, positive association, rate of change, relative frequency, scale, scatter plot, slope, two-way relative frequency table, variable, <i>x</i> - axis, <i>y</i> -axis, <i>x</i> -intercept, <i>y</i> -intercept
Allowable Tools:	Calculator
Target-Specific Attributes	
Non-Targeted Constructs:	
Accessibility Concerns:	Visual graphics and 3-D images may be difficult or not accessible for students who are blind or visually impaired. Reviewing tactile graphics may be time-consuming but not prohibitive. The simplest graphics with labels should be used to minimize this issue. Students with dyscalculia may have difficulty with the calculations. Students with visual perceptual disabilities may struggle with answer choices that contain complex number sentences. Students who are visually impaired or blind may need enlarged or brailled text. Students with reading disabilities may struggle with the reading load of word problems. All vocabulary should be at or below grade level to minimize this issue. Students with reading disabilities may need the text read aloud, or have access to trackers to follow along. Student with visual processing impairments may benefit from using a tracker or masker when reading. Consider replacing these response types with multiple choice items for Braille versions. The accommodations listed here are suggestions and could be altered depending on what accommodations will be allowable.
Development Notes:	Assessing the fit of a model (8.SP.2) will be assessed in Claim 4. Interpreting the slope and y -intercept in context (8.SP.3) will be assessed in Claims 2 and 4.



Response Type: Matching Table

Stimulus Guidelines:

- Context should be familiar to students 13–15 years old.
- Scatter plot will have an informative title relevant to the situation.
- Axes will have informative titles relevant to the situation and appropriate interval scales.
- The data set may include clustering.

statements about the data in a scatter plot are true.

- Item difficulty can be adjusted via these example methods:
 - The association may be positive, negative, linear, or 0 nonlinear.
 - There may be clustering, gaps, and outliers in the data. \circ

TM1a

Stimulus: The student is presented with a situation that involves a relationship between two quantities or continuous variables and a scatter plot of bivariate measurement data with sufficient points to demonstrate a linear or nonlinear relationship.

Example Stem: This scatter plot shows the relationship between the average weight and average heart rate for 11 different animals.



Select True or False for each statement based on the scatter plot.

Statement	True	False
There is a positive association between		
average weight and average heart rate for		
animals.		
Animals with higher body weights tend to		
have lower heart rates than animals with		
lower body weights.		
There is a linear association between		
average weight and average heart rate for		
animals.		

Rubric: (1 point) Student determines each statement as being either true or false (e.g., F, T, T) Each statement that interprets the

Task Model 1

DOK Level 1

8.SP.1

Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.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.

Evidence **Reauired:**

1. The student interprets patterns of association between two quantities in a scatter plot (clustering in reference to the line of best fit, positive or negative association, linear association, nonlinear



and the second the s	another plat and many involve elvetoring in reference to the line of
association, and the	scatter plot and may involve clustering in reference to the line of
effect of outliers)	best fit, positive or negative associations, linear associations,
and interprets the	poplinger associations, or the offect of outliers
and interprets the	noninear associations, or the effect of outliers.
slope and y-intercept	
in terms of the	Response Type: Matching Table
contoxt	
context.	
Tools: Calculator	



Response Type: Matching Table

Task Model 1

DOK Level 1

8.SP.1

Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.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.

8.SP.3

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

Evidence Required:

1. The student interprets patterns of

Prompt Features: The student is prompted to determine whether statements about the data in a scatter plot are true.

Stimulus Guidelines:

- Context should be familiar to students 13–15 years old.
- Scatter plot will have an informative title relevant to the situation.
- Axes will have informative titles relevant to the situation and appropriate interval scales.
- The data set may include clustering.
- Item difficulty can be adjusted via these example methods:
 - The association may be positive, negative, linear, or nonlinear.
 - The data set may reflect an explicit or implicit linear or explicit or implicit nonlinear relationship.
 - \circ $\;$ There may be clustering, gaps, and outliers in the data.

TM1b

Stimulus: The student is presented with a situation that involves a relationship between two quantities or continuous variables and a scatter plot of bivariate measurement data with sufficient points to demonstrate a linear or nonlinear relationship.

Example Stem: This scatter plot shows the relationship between the average weight and average heart rate for 11 different animals. The line of best fit is shown on the graph.



Select True or False for each statement based on the graph.

Statement	True	False
The line of best fit provides a good estimate of any animal's average heart rate based on its weight.		
The y-intercept is at approximately $(0, 185)$.		
Point D is one outlier because it is far away from the other data points.		

Rubric: (1 point) Student determines each statement as being



association between two quantities in a scatter plot (clustering in reference to the line of best fit, positive or	either true or false (e.g., F, T, F) Each statement interprets the scatter plot and may involve clustering in reference to the line of best fit, positive or negative associations, linear associations, nonlinear associations, the effect of outliers, the identification or the interpretation of the slope or <i>y</i> -intercept in terms of the context.
negative association, linear association, nonlinear association, and the effect of outliers) and interprets the slope and <i>y</i> -intercept in terms of the context.	Response Type: Matching Table
Tools: Calculator	



Response Type: Equation/Numeric

Stimulus Guidelines:

- Context should be familiar to students 13–15 years old. •
- Scatter plot will have an informative title relevant to the situation.
- Axes will have informative titles relevant to the situation and appropriate interval scales.
- The data set may include clustering. •

intercept of the line of best fit on a scatter plot.

- Item difficulty can be adjusted via these example methods: •
- The association may be positive, negative, linear, or 0 nonlinear.
- The data set may reflect an explicit or implicit linear 0 relationship or explicit or implicit nonlinear relationship.
- There may be clustering, gaps, and outliers in the data. 0

TM2

Stimulus: The student is presented with a situation that involves a relationship between two intervals or continuous variables and a scatter plot of bivariate measurement data with sufficient points to demonstrate a linear relationship. The graph will provide the line of best fit.

Example Stem: This scatter plot shows the relationship between animal weight and animal heart rate.



The y-intercept of the estimated line of best fit is at (0, b). Enter the approximate value of *b* in the first response box.

Enter the approximate slope of the estimated line of best fit in the second response box.

Rubric: (2 points) Student enters the correct value for the yintercept and the slope (e.g., 185 to 195; -2 to -3). (1 point) Student enters a value within the range for either the yintercept or the slope.

Response Type: Equation/Numeric (2 response boxes)

Task Model 2

DOK Level 2

8.SP.3

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

Evidence **Required:**

2. The student identifies the slope (rate of change) and intercept (initial value) of a line suggested by examining bivariate measurement data in a scatter plot.

Tools: Calculator



Response Type: Fill-in Table

Task Model 3

DOK Level 1

8.SP.4

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Evidence Required:

3. The student constructs and interprets a two-way table summarizing data on two categorical variables collected from the same subjects.

Tools: Calculator

Prompt Features: The student is prompted to complete a two-way table to summarize the data on two categorical variables for the same subjects.

Stimulus Guidelines:

- Context should be familiar to students 13–15 years old.
 - Item difficulty can be adjusted via these example methods:
 - Student must determine sums of rows and columns.Student must determine sums of rows and/or
 - columns; and/or determines one non-sum cell.
 - Student must determine sums of rows and/or columns and/or determines two to three non-sum cells.

ТМЗа

Stimulus: The student is presented with a situation that involves a relationship between two categorical variables.

Example Stem: All 8th-grade students at a school answered Yes or No to the two survey questions shown.

- Do you have a cell phone? Yes No
- Do you have an MP3 player? Yes No

The same students responded to both questions. Complete the twoway frequency table to show the correct totals for the given data. You must complete **all** five cells of the table for a full credit response.

	MP3 Player	No MP3 Player	Total
Cell Phone	57	122	
No Cell Phone	30	65	
Total			

Rubric: (1 point) Student correctly fills in the table for all five cells with the correct totals (see below).

	MP3 Player	No MP3 Player	Total
Cell Phone	57	122	179
No Cell Phone	30	65	95
Total	87	187	274

Response Type: Fill-in Table

Grade 8 Mathematics Item Specification C1 TJ Task Model 3

TM3b

Stimulus: The student is presented with a situation that involves a relationship between two categorical variables.

Example Stem: All 8th-grade students at a school answered Yes or No to the two survey questions shown.

- Do you have a cell phone? Yes No
 - Do you have an MP3 player? Yes No

The same students responded to both questions. The results are shown in the table.

	Cell P	hone	MP3	Player
Totala	Yes	No	Yes	No
Totals	179	95	87	187

Of the 187 students with **no** MP3 Player, 65 have **no** cell phone.

Complete the two-way frequency table to represent the correct number of students in each cell. You must complete **all** nine cells of the table for a full credit response.

	MP3 Player	No MP3 Player	Total
Cell Phone			
No Cell Phone			
Total			

Rubric:

(2 points) Student correctly fills in the table for all nine cells with the correct totals (see below).

(1 point) Student correctly fills in the table for 6–8 cells with the correct totals (to allow for a minor calculation error).

	MP3 Player	No MP3 Player	Total
Cell Phone	57	122	179
No Cell Phone	30	65	95
Total	87	187	274

Response Type: Fill-in Table

Tools: Calculator



Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Response Type:

Fill-in Table

DOK Level 1

8.SP.4

Evidence **Required:**

3. The student constructs and interprets a two-way table summarizing data on two categorical variables collected from the same subjects.



Response Type: Fill-in Table

Task Model 3

DOK Level 1

8.SP.4

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Evidence Required:

3. The student constructs and interprets a two-way table summarizing data on two categorical variables collected from the same subjects.

Tools: Calculator

Prompt Features: The student is prompted to complete a two-way frequency table to summarize the data on two categorical variables for the same subjects.

Stimulus Guidelines:

- Context should be familiar to students 13–15 years old.
- Percentage values may go to the tenths or hundredths place. If so, give directions on rounding.

ТМ3с

Stimulus: The student is presented with a situation that involves a relationship between two categorical variables.

Example Stem: All 8th-grade students at a school answered Yes or No to the two survey questions shown.

- Do you have a cell phone? Yes No
- Do you have an MP3 player? Yes No

The same students responded to both questions. Complete the twoway relative frequency table to show the correct percentages in all cells. You must complete **all** five cells of the table for a full credit response.

	MP3 Player	No MP3 Player	Total
Cell Phone	20%	57%	
No Cell Phone	12%	11%	
Total			

Rubric: (1 point) Student correctly fills in the table for all five cells with the correct totals (see below). The percentage sign is not required for each cell in order for a student to get full credit. Correct answers may be given as decimal equivalents of the percentages (0.2 for 20%, etc.).

	MP3 Player	No MP3 Player	Total
Cell Phone	20%	57%	77%
No Cell Phone	12%	11%	23%
Total	32%	68%	100%

Response Type: Fill-in Table





Stimulus: The student is presented with a situation that involves a relationship between two categorical variables.

Example Stem: All 8th-grade students at a school answered Yes or No to the two survey questions shown.

- Do you have a cell phone? Yes No
 - Do you have an MP3 player? Yes No

The same students responded to both questions. The results are shown in the table.

	Cell Phone		MP3 Player	
Totals	Yes	No	Yes	No
	77%	23%	68%	32%

Of all the students surveyed, 20% have both a cell phone and a MP3 player.

Complete the two-way relative frequency table to show the correct percentages in all cells. You must complete **all** nine cells of the table for a full credit response.

	MP3 Player	No MP3 Player	Total
Cell Phone			
No Cell Phone			
Total			

Rubric:

(2 points) Student correctly fills in the table for all nine cells with the correct totals (see below).

(1 point) Student correctly fills in the table for 7-8 cells with the correct totals (to allow for a minor calculation error).

The percentage sign is not required for each cell in order for a student to get full credit. Correct answers may be given as decimal equivalents of the percentages (0.2 for 20%, etc.).

	MP3 Player	No MP3 Player	Total
Cell Phone	20%	57%	77%
No Cell Phone	12%	11%	23%
Total	32%	68%	100%

Response Type: Fill-in Table

Response Type: Fill-in Table

DOK Level 1

8.SP.4

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Evidence **Required:**

3. The student constructs and interprets a two-way table summarizing data on two categorical variables collected from the same subjects.

Tools: Calculator



Task Model 3	Prompt Features: The student is prompted to complete a two-way frequency table to summarize the data on two categorical variables						
Response Type:	for the same subjects.						
Fill-in Table							
	Stimulus Guideli	nes:					
DOK Level 1	 Context should be familiar to students 13–15 years old. Percentage values may go to the tenths or hundredths place. 						
8.SP.4	If so, give directions on rounding.						
Understand that	• Item difficulty can be adjusted via these example methods,						
	but are not limited to these methods:						
he seen in hivariate	0 1012	als are not giver	ii to the student.				
categorical data by	TM3e						
displaving	Stimulus: The stu	udent is present	ted with a situation	that involve	s a		
frequencies and	relationship betwe	en two categor	ical variables.				
relative frequencies		2					
in a two-way table.	Example Stem: A	All 8th-grade stu	udents at a school	answered Ye	s or		
Construct and	No to the two surv	vey questions sl	hown.				
interpret a two-way	 Do you hav 	ve a cell nhone?	Yes No				
table summarizing	 Do you hav Do you hav 	ve an MP3 plave	er? Yes No				
data on two	- ,						
callegorical variables	The same students	s responded to	both questions. Th	e results are			
same subjects llse	shown in the table						
relative frequencies		MD2 Diavor	No MD2 Disvor	Total			
calculated for rows	Cell Phone	40	114	154			
or columns to	No Cell Phone	24	22	46			
describe possible	Total	64	136	200			
association between			150	200			
the two variables.	Complete two-way	table to repres	sent the correct pe	rcentage of			
Evidonco	students in each c	ell. You must co	omplete all nine ce	lls of the tab	ole		
Required:	for a full credit res	sponse.					
3. The student			1				
constructs and MP3 Player No MP3 Player Total							
interprets a two-way	Cell Phone						
data on two	No Cell Phone						
categorical variables	Total						
collected from the				с и ·			
same subjects.	Rubric: (2 points)	Student correct	ctly fills in the table	e for all nine	cells		
Tooler Calculator	(1 point) Student correctly fills in the table for 6-8 cells with the						
	correct totals (to a	allow for a mino	r calculation error)	ens with the			
	The percentage sign is not required for each cell in order for a						
	student to get full credit. Correct answers may be given as decimal						
	equivalents of the percentages (0.2 for 20%, etc.).						
		-	•				
		MP3 Player	No MP3 Player	Total			
	Cell Phone	20%	57%	77%			
	No Cell Phone	12%	11%	23%			
	Total	32%	68%	100%			
	Beenenge Type, Fill in Table						
	Kesponse Type: Fill-in Table						