

SECURE MATERIAL - Reader Name: \_\_\_\_\_  
Tennessee Comprehensive Assessment Program

# TCAP/CRA

## 2014



# 8

## Phase II

### Carbon Dioxide Levels Task

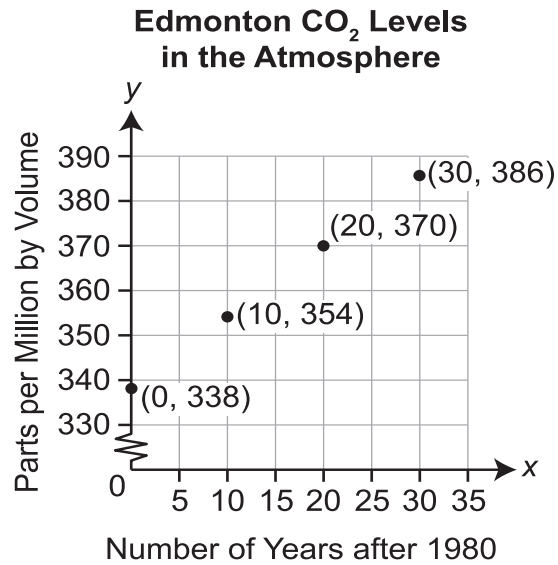
### Anchor Set

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## Constructed Response Assessment

### Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.



## Constructed Response Assessment

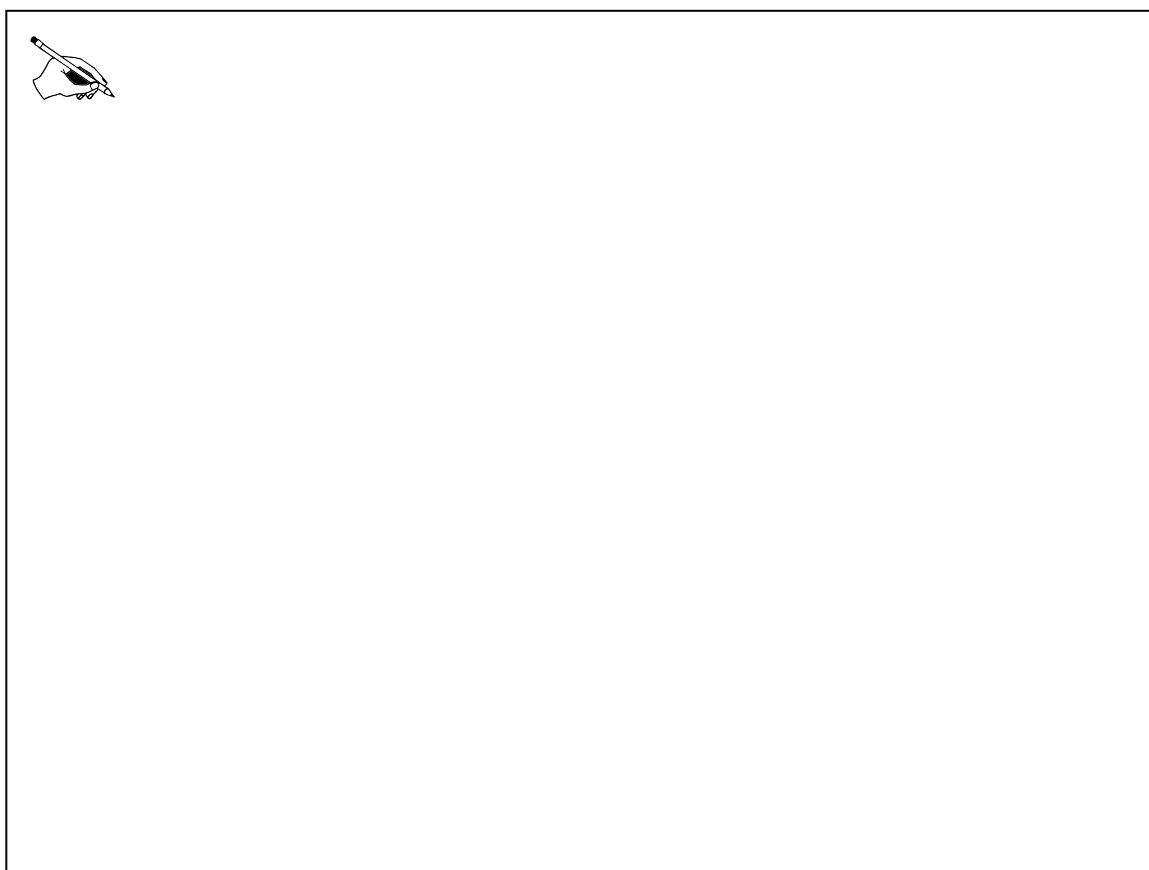
### Carbon Dioxide Levels Task

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

**Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere**

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372


- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.



## Constructed Response Assessment

### Carbon Dioxide Levels Task

- c. If the two CO<sub>2</sub> levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.



A large empty rectangular box for writing an answer, with a small icon of a hand holding a pen in the top-left corner.

## Scoring Guide

### The CCSS for Mathematical Content (2 points)

- 8.F.B.4 Writes an equation for the Edmonton data. Students may do this by: \_\_\_\_\_
- determining the slope and  $y$ -intercept from the graph;
  - determining the slope from the graph and using a point from the graph to write an equation in point-slope form; or
  - using guess and check to test various rules that input the given hours and output the given gallons.

**(1 Point)**

- 8.EE.C.8 Determines whether the two lines will intersect. The student may determine this in one of the following ways: \_\_\_\_\_
- using the rate of change of each function;
  - graphing the second set of data and analyzing the two graphs; or
  - writing and solving a system of linear equations for the two sets of data.

**(1 Point)**

### The CCSS for Mathematical Practice (2 points)

- MP2 Reasons abstractly to interpret the answer in part b within the context of the problem, stating that since the two lines will not intersect, there is no point in time when the recorded  $\text{CO}_2$  levels at the two laboratories will be the same. \_\_\_\_\_

**(1 Point)**

(MP2: Reason abstractly and quantitatively.)

- MP6 Uses mathematical terms correctly in all explanations. Algebraic expressions and all calculations are correct, and notation is precise. \_\_\_\_\_

**(1 Point)**

(MP6: Attend to precision.)

**TOTAL POINTS: 4**

## The CCSS for Mathematical Content Addressed In This Task

### Use functions to model relationships between quantities.

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.

### Analyze and solve linear equations and pairs of simultaneous linear equations.

8.EE.C.8 Analyze and solve systems of simultaneous linear equations.

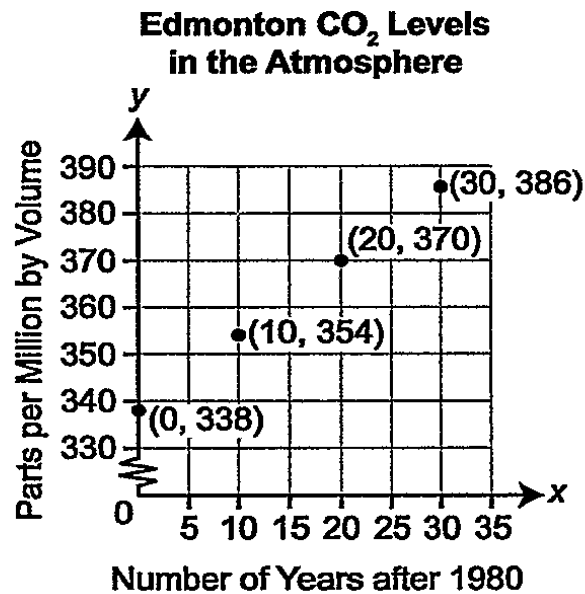
### The CCSS for Mathematical Practice\*

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.


\* Gray type indicates Mathematical Practices not addressed in this assessment.

**Carbon Dioxide Levels Task**

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.


$$y = \frac{8}{9}x + 338$$

Litho#: 00298200104


**Carbon Dioxide Levels Task**

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

**Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere**

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.



$$y = \frac{8}{15}x + 300$$

The <sup>starting</sup> CO<sub>2</sub> levels were different but the rate was the same.



## Carbon Dioxide Levels Task

- c. If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.



NO they won't because the y intercept, the starting amount of  $\text{CO}_2$ , isn't the same, but the rate of how much more is added is the same so they will never intersect



Anchor 1                                      Litho 00298200104

Total Content Points: 2                      (8.F.B.4, 8.EE.C.8)

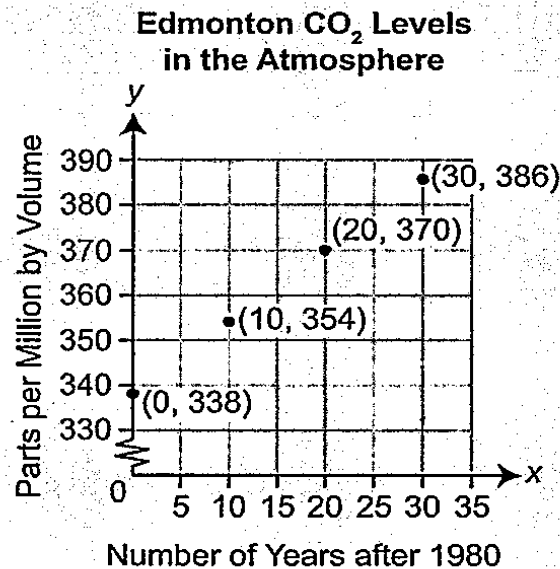
Total Practice Points: 2                      (MP2, MP6)

The student writes a correct equation for the Edmonton data ( $y = \frac{8}{5}x + 338$ ) (8.F.B.4). The student correctly states that the two lines will not intersect and explains why (“the y intercept, the starting amount of CO<sub>2</sub>, isn’t the same, But the rate of how much more is added is the same so they will never intersect”) (8.EE.C.8). The student correctly interprets the answer in Part C within the context of the problem (“the starting amount of CO<sub>2</sub>”; “how much more is added”) (MP2). The student uses mathematical terms correctly in explanations and uses precise notation (MP6).

Total Awarded Points: 4 out of 4

### Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.

$(0, 338)$   
 $(10, 354)$

$$\frac{354 - 338}{10 - 0} = \frac{16}{10} = 1.6$$

$$V = 1.6y + 338$$

$V = \text{Volume}$   
 $y = \text{years after 1980}$

Litho#: 00198200139


## Carbon Dioxide Levels Task

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.


 $(0, 300)$   
 $(15, 324)$


$$\frac{324-300}{15-0} = \frac{24}{15} = \frac{1.6}{1}$$

$$\begin{array}{l} \text{Mauna} \\ V=1.6y+300 \end{array} \quad \begin{array}{l} \text{Edmonton} \\ V=1.6y+338 \end{array}$$

There is no difference in the rates of change in the two since  $1.6-1.6=0$

## Carbon Dioxide Levels Task

- c. If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.

 No since they increase the same amount but have different starting points the graphs will never intersect

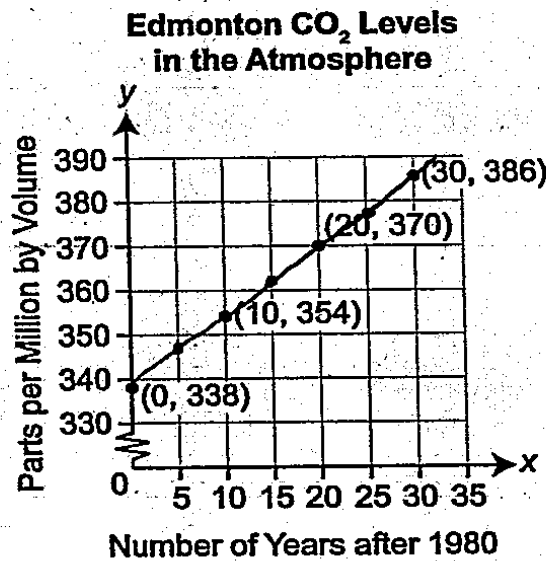


REVIEW YOUR  
WORK IF YOU  
HAVE TIME.



## Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.

	x	y	
	0	338	
+100	5	346	+8 every five years 15 354
	10	354	
	15	362	+1.6 every year
	20	370	
	25	378	
	30	386	

$1.6x + 338 = y$

## Carbon Dioxide Levels Task

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

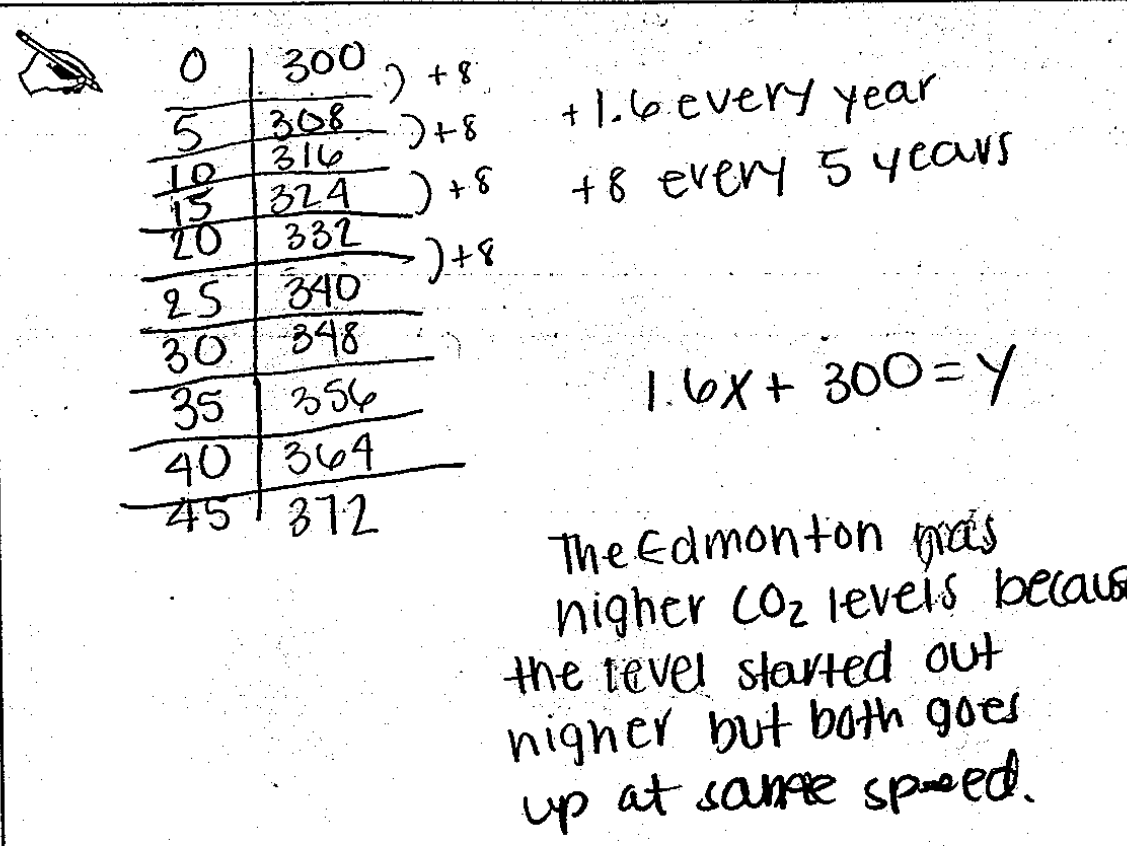
Mauna Loa CO<sub>2</sub> Levels in the Atmosphere

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

x2 ( 15 ( 30 (

) 24 )  
) 48 ) x2

- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.



Handwritten work showing a table of CO<sub>2</sub> levels and calculations:

0	300	) +8
5	308	) +8
10	316	) +8
15	324	) +8
20	332	) +8
25	340	) +8
30	348	)
35	356	)
40	364	)
45	372	)

$+1.6$  every year  
 $+8$  every 5 years

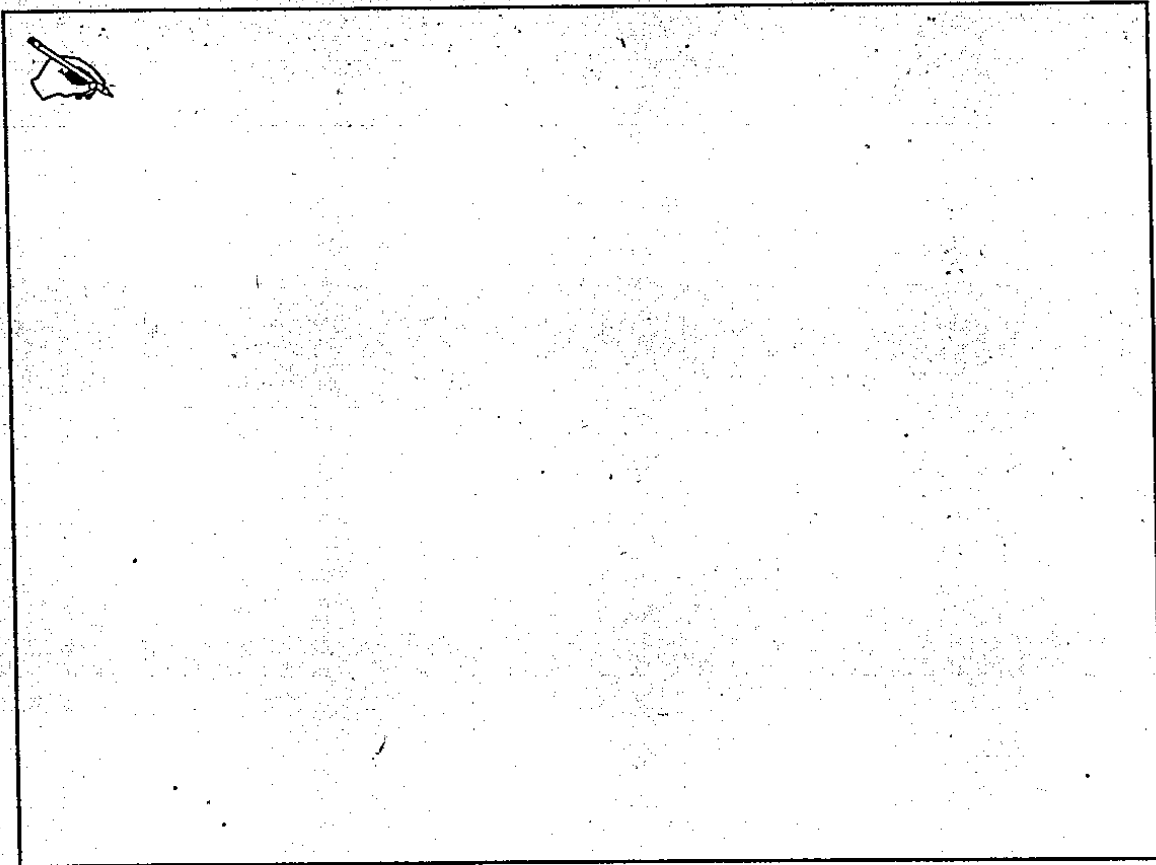
$1.6x + 300 = y$

The Edmonton has higher CO<sub>2</sub> levels because the level started out higher but both goes up at same speed.



## Carbon Dioxide Levels Task

- c. If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.

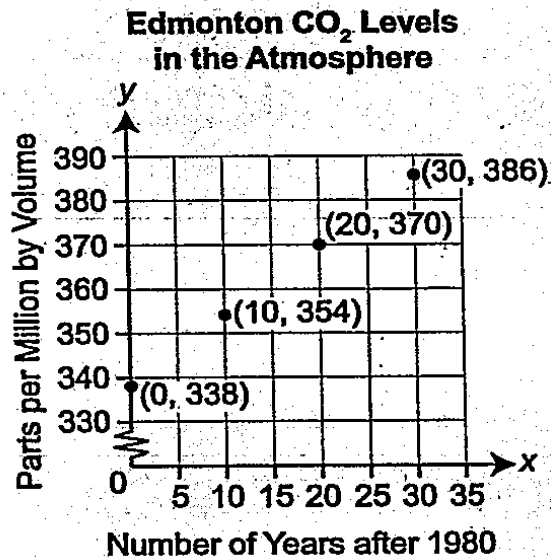


REVIEW YOUR  
WORK IF YOU  
HAVE TIME.




### Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.



$$\begin{array}{r}
 354 \\
 - 338 \\
 \hline
 16 = 10 = 1.6x + 338
 \end{array}$$

Litho#: 00018200152


### Carbon Dioxide Levels Task

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

**Mauna Loa CO<sub>2</sub> Levels in the Atmosphere**

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.


 Mauna Loa  
 $15 \times 300 \cdot 1.6 - 1.6 = 0$

$$\frac{324 - 300}{15 - 0} = \frac{24}{15} \cdot 1.6$$

The rates of change are not different, but the initial value for the CO<sub>2</sub> levels are different by 38 million parts by volume

## Carbon Dioxide Levels Task

- c. If the two CO<sub>2</sub> levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.



$$\begin{array}{r}
 1.6x + 338 = 1.6x + 300 \\
 \quad \quad \quad -300 \qquad \qquad \quad -300 \\
 \hline
 1.6x + 38 = 1.6x \\
 -1.6x \qquad \quad -1.6x \\
 \hline
 0x = 30
 \end{array}$$

These two graphs will never intersect because it comes down to  $0x$  making it 'unable to solve' which means that there is no solution to the system.



Anchor 4

Litho 00018200152

Total Content Points: 2 (8.F.B.4, 8.EE.C.8)

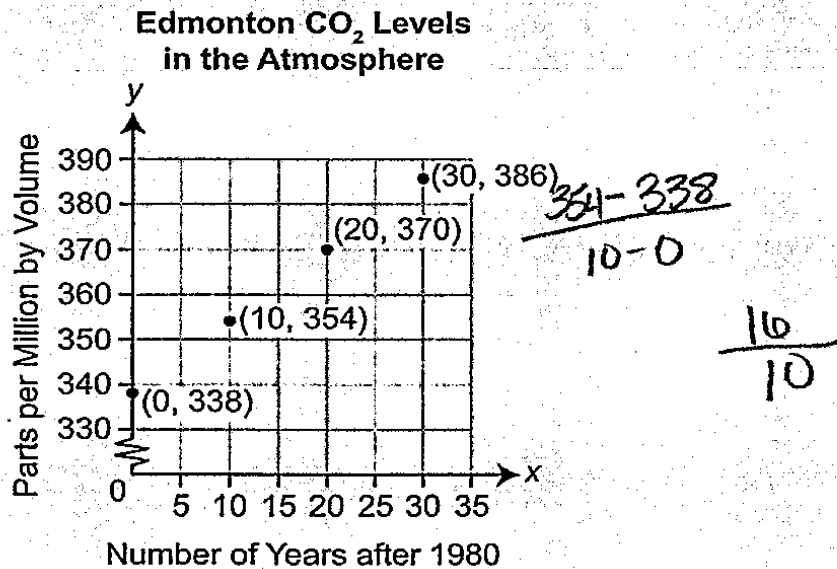
Total Practice Points: 0

The student writes a correct expression for the Edmonton data ( $1.6x + 338$ ), although the expression is not in the form of an equation (8.F.B.4). The student correctly states that the two lines will not intersect, and to demonstrate that there is no solution, shows a failed attempt to solve the system of equations (8.EE.C.8). The student does not interpret the answer in Part C within the context of the problem (no credit for MP2). The student uses mathematical terms correctly in explanations and performs correct calculations, but creates an incorrect equation in Part A ( $16 \div 10 = 1.6x + 338$ ) (no credit for MP6).

Total Awarded Points: 2 out of 4

## Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.

$y = 1.6x + 338$

## Carbon Dioxide Levels Task


Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

Mauna Loa CO<sub>2</sub> Levels in the Atmosphere

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

$$\begin{array}{r} 24 \\ \hline 15 \end{array}$$


- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.

 they are the same



**Carbon Dioxide Levels Task**

- c. If the two CO<sub>2</sub> levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.

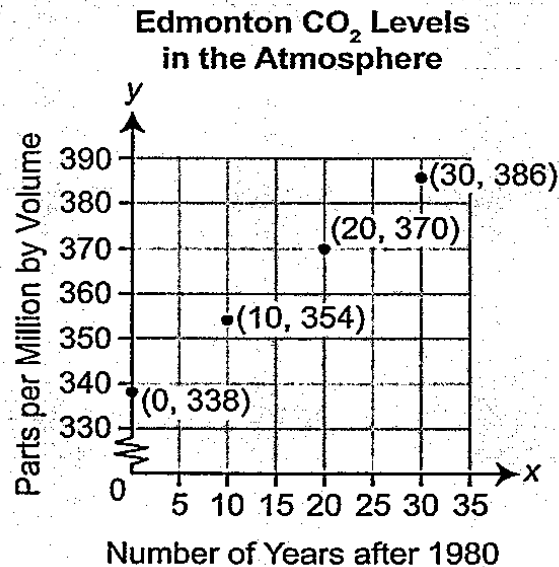
 No, they will be parallel because they have the same slope or rate of change.





**Carbon Dioxide Levels Task**

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.

$$y = 1.6x + 338$$


**Carbon Dioxide Levels Task**

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

**Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere**

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372


- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.

 the first formation started at 338 CO<sub>2</sub> and Mauna Loa started at 300 CO<sub>2</sub>

so there is a 38 CO<sub>2</sub> difference.  $338 - 300 = 38$

## Carbon Dioxide Levels Task

- c. If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.

 No, because they are both rising at the same rate.



Anchor 6

Litho 00068200139

Total Content Points: 2 (8.F.B.4, 8.EE.C.8)

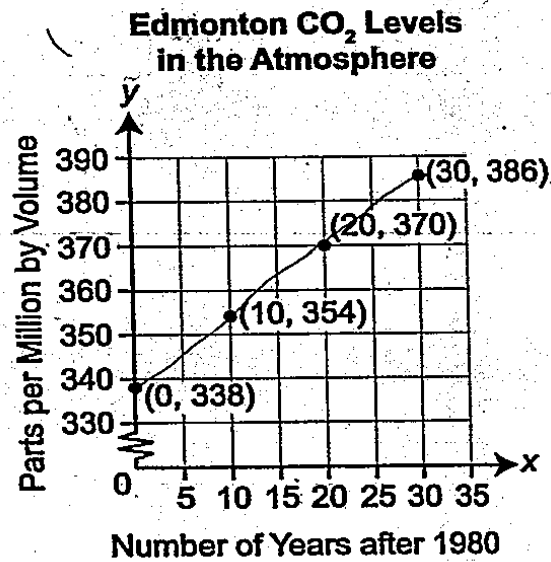
Total Practice Points: 0

The student writes a correct equation for the Edmonton data ( $y = 1.6T + 338$ ) (8.F.B.4). The student correctly states that the lines will not intersect; while the explanation given in Part C (“they are both rising at the same rate”) does not address the different starting points, the explanation in Part B does (“Edmonton started at 338 CO<sub>2</sub>, and Mauna Loa started at 300 CO<sub>2</sub>”) (8.EE.C.8). The student does not interpret the answer in Part C within the context of the problem (no credit for MP2). The student uses mathematical terms correctly in explanations and performs correct calculations, but does not answer the question in Part B, demonstrating a lack of precision in attending to the task (no credit for MP6).


Total Awarded Points: 2 out of 4

### Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.



$$y = 0.6x + 338$$

Litho#. 00038200152


**Carbon Dioxide Levels Task**

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

**Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere**

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.




$1.6x + 338$  - More CO<sub>2</sub>  
 $1.6x + 300$  - Less CO<sub>2</sub>  
on the table



## Carbon Dioxide Levels Task

- c. If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.

 Yes, at 38  
same value (years)



REVIEW YOUR  
WORK IF YOU  
HAVE TIME.

Anchor 7

Litho 00038200152

Total Content Points: 1 (8.EE.C.8)

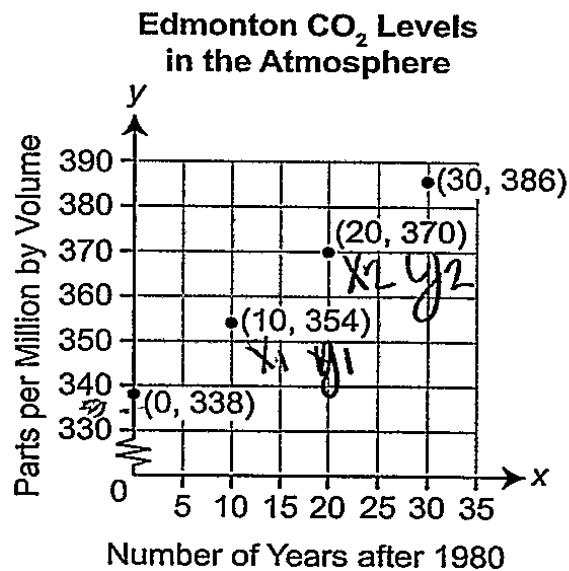
Total Practice Points: 0

The student writes an incorrect expression for the Edmonton data ( $.6x + 338$ ) (no credit for 8.F.B.4). The student states that the lines will intersect and provides the time at which they will do so (38 years), which is the correct explanation and point of intersection based on the incorrect answer in Part A (8.EE.C.8). The student does not interpret the answer in Part C within the context of the problem (no credit for MP2). The student uses mathematical terms correctly in explanations and performs correct calculations, but does not find the difference in the rates in Part B, demonstrating a lack of precision in responding to the task (no credit for MP6).

Total Awarded Points: 1 out of 4

## Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.

~~$y = 0.5x + 330$~~

$\frac{y_2 - y_1}{x_2 - x_1} = \text{slope}$

$\frac{370 - 354}{20 - 10} = \frac{16}{10} = \frac{8}{5}$

Litho#: 00218200115

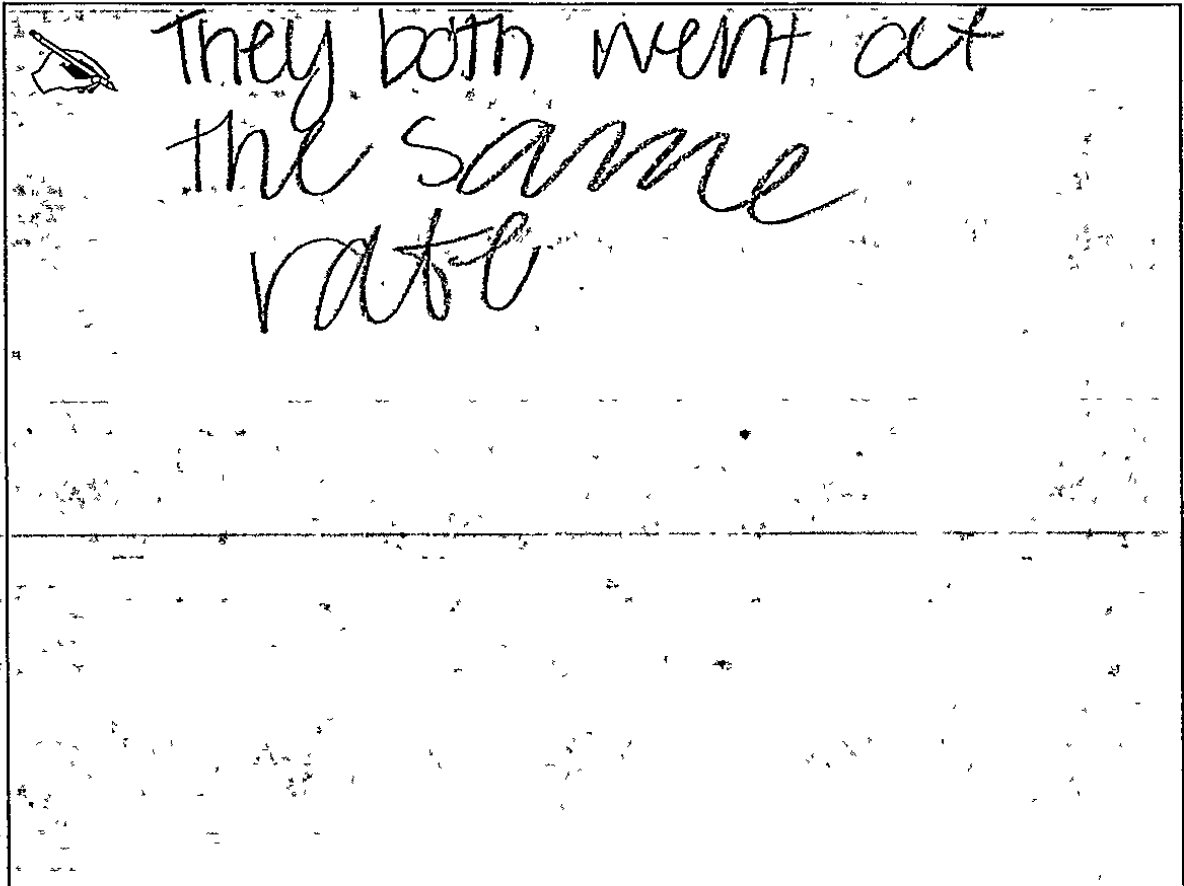
**Carbon Dioxide Levels Task**

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

**Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere**

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference

A rectangular box containing handwritten text. The text reads "They both went at the same rate." There is a small drawing of a hand pointing to the left at the top left of the box.

## Carbon Dioxide Levels Task

- c. If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.

yes... every point  
because they  
are the same  
line :)



REVIEW YOUR  
WORK IF YOU  
HAVE TIME.

Anchor 8

Litho 00218200115

Total Content Points: 1 (8.F.B.4)

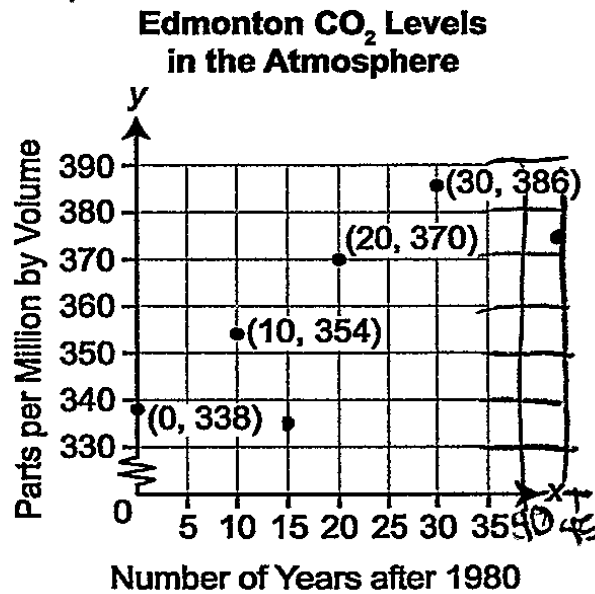
Total Practice Points: 0

The student writes a correct equation for the Edmonton data ( $y = \frac{8}{5}x + 338$ ) (8.F.B.4). The student incorrectly states that the lines will intersect and provides an incorrect explanation (“every point because they are the same line”) (no credit for 8.EE.C.8). The student does not interpret the answer in Part C within the context of the problem (no credit for MP2). The student uses mathematical terms correctly in the explanations, performs correct calculations, and uses precise notation, but provides neither work nor explanation for the correct answer in Part B (“They both went at the same rate”), demonstrating a lack of precision (no credit for MP6).

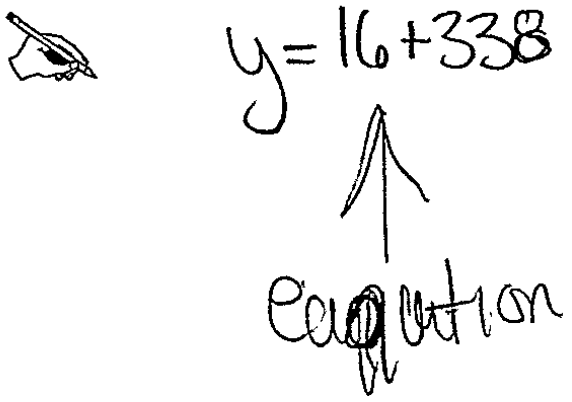
Total Awarded Points: 1 out of 4

## Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



- a. Write an equation that represents the data shown on the graph.



$y = 16 + 338$

↑  
Equation

Litho#: 00098200104

**Carbon Dioxide Levels Task**


Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

**Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere**

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

Handwritten annotations: A bracket on the left side of the table spans the three rows. On the right side, a bracket spans the first two rows with the number "24" written next to it, and another bracket spans the last two rows with the number "48" written next to it.


- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.

 The rate of change changes in the table



## Carbon Dioxide Levels Task

- c If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.

 no the lines will never intersect because they are parallel (#)  
parallel means they won't intersect



Anchor 9

Litho 00098200104

Total Content Points: 1 (8.EE.C.8)

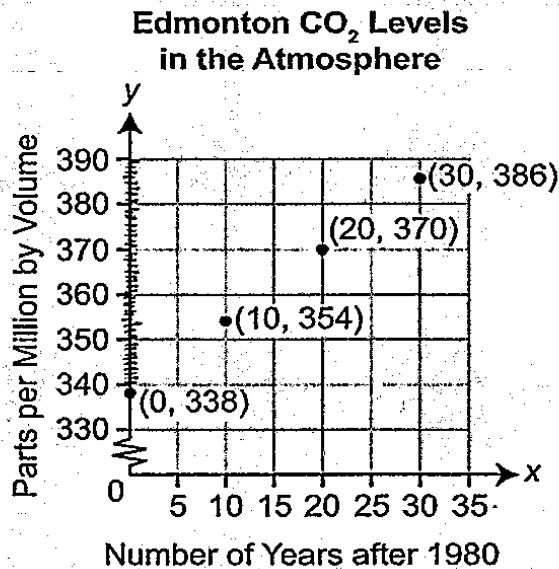
Total Practice Points: 0

The student writes an incorrect equation for the Edmonton data ( $y = 16 + 338$ ) (no credit for 8.F.B.4). The student correctly states that the lines will not intersect, and the explanation (“because they are parallel”) is acceptable because the student graphs the Mauna Loa data to show that they are parallel (8.EE.C.8). The student does not interpret the answer in Part C within the context of the problem (no credit for MP2). The student uses mathematical terms correctly in explanations but uses incorrect mathematical language in Part B (“The rate of change changes in the table”), demonstrating a lack of precision (no credit for MP6).

Total Awarded Points: 1 out of 4

## Carbon Dioxide Levels Task

Measurements taken by scientists in Edmonton show that the levels of carbon dioxide in the atmosphere have been steadily increasing since 1980. The graph shows points from a model that represents a relationship between the level of carbon dioxide in the atmosphere and the number of years since 1980.



1/2

- a. Write an equation that represents the data shown on the graph.

✍  $y = 1\frac{1}{2}x + 338$

$y = mx + b$

Litho#: 00288200139


## Carbon Dioxide Levels Task

Another lab in Mauna Loa has also been collecting data on CO<sub>2</sub> levels.

Mauna Loa CO<sub>2</sub> Levels in  
the Atmosphere

Number of Years after 1980	CO <sub>2</sub> Levels
0	300
15	324
45	372

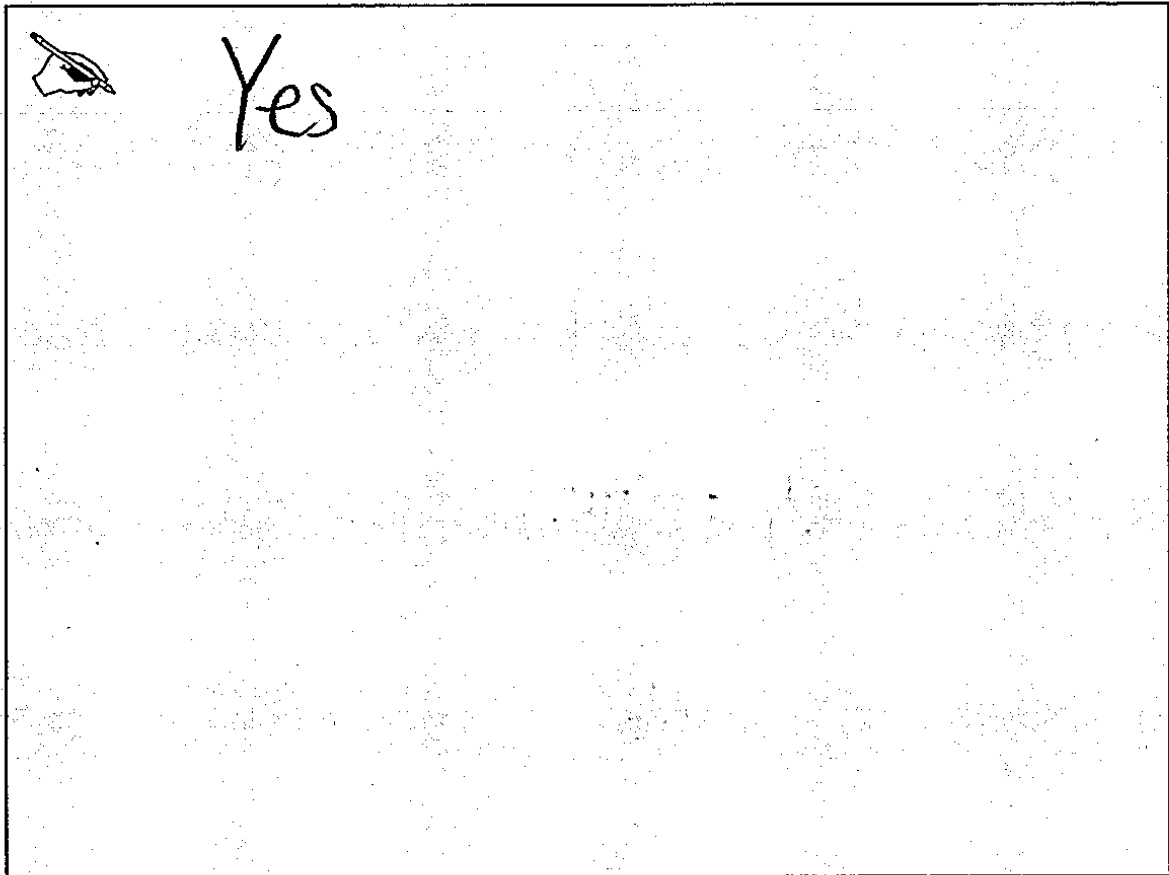
- b. What is the difference in the rates of change of CO<sub>2</sub> levels recorded at the two laboratories? Show your work or explain how you determined the difference.


$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{324 - 300}{15 - 0} = \frac{24}{15}$$

1.6 is the change the CO<sub>2</sub> levels

## Carbon Dioxide Levels Task

- c. If the two  $\text{CO}_2$  levels continue to increase at the rates shown, will the graphs of these two sets of data ever intersect? Why or why not? Interpret your answer in the context of the problem.



A large rectangular box containing a hand-drawn response. In the top left corner, there is a simple drawing of a hand holding a pen. To the right of this drawing, the word "Yes" is written in a cursive, handwritten style.



REVIEW YOUR  
WORK IF YOU  
HAVE TIME.

Anchor 10

Litho 00288200139

Total Content Points: 0

Total Practice Points: 0

The student writes an incorrect equation for the Edmonton data ( $y = 1\frac{1}{2}x + 338$ ) (no credit for 8.F.B.4). The student states that the lines will intersect, which would be correct based on the incorrect equation in Part A, but provides no explanation (no credit for 8.EE.C.8). The student does not interpret the answer in Part C within the context of the problem (no credit for MP6). The student performs calculations correctly but does not answer the question in Part B, demonstrating a lack of attention to precision in responding to the task (no credit for MP6).

Total Awarded Points: 0 out of 4