Page 1

Accelerated Math Notes
(from Math 7 textbook
Section 1.7 and 1.8)
Constant Rate of Change and Slope

A **rate of change** is a rate that describes how one quantity changes in relation to another. When a relationship is linear (forms a straight line), it has a constant rate of change.

This change can be found by using a table or a graph. On a graph, this change is also known as the **slope** of a line.

Page 2

Vocabulary Start-Up

A **rate of change** is a rate that describes how one quantity changes in relation to another. In a linear relationship, the rate of change between any two quantities is the same. A linear relationship has a **constant rate of change**.
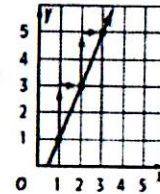
Another name for this is:

Key Concept Slope

Slope is the rate of change between any two points on a line.

$$slope = \frac{change\ in\ y}{change\ in\ x} \longleftarrow vertical\ change \\ \longleftarrow horizontal\ change$$

$$= \frac{2}{1}\ or\ 2$$

Page 3

The table below shows the amount of money a booster club earns washing cars for a fundraiser.

You can use a table to find the
Constant Rate of Change

Cars Washed	
Number	**Money ($)**
5	40
10	80
15	120
20	160

+5, +5, +5   +40, +40, +40

$$\frac{Change\ in\ money}{Change\ in\ cars} \qquad \frac{40}{5} = 8/car$$

Find ratios $\frac{\#}{\#\ cars}$ $\frac{40}{5}$ $\frac{80}{10}$ $\frac{120}{15}$ $\frac{160}{20}$

all equal $\frac{8}{1}$

Proportional since cost per car always the same

Page 4

You can use a graph and find the constant rate of change. This is also known as the slope.

Choose 2 points
$(20, 160)$ $(5, 40)$
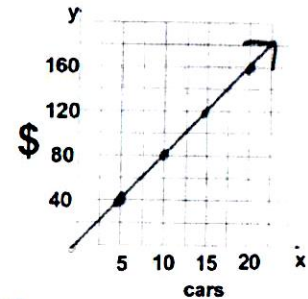
$$slope = \frac{\Delta y}{\Delta x} = \frac{160-40}{20-5}$$

$$= \frac{120}{15}$$

$$= 8$$

means Change in y, Change in x

160
120
$ 80
40

5 10 15 20   x
cars

We can find the slope of a line by choosing two points and using this formula.

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

$$\underset{x_1 \ y_1}{(0,5)} \quad \underset{x_2 \ y_2}{(2,1)} \qquad \text{OR} \qquad \underset{x_2 \ y_2}{(0,5)} \quad \underset{x_1 \ y_1}{(2,1)}$$

$$\text{slope} = \frac{1-5}{2-0} \qquad\qquad \text{slope} = \frac{5-1}{0-2}$$

$$= \frac{-4}{2} \qquad\qquad\qquad = \frac{4}{-2}$$

$$= \boxed{-2} \qquad\qquad\qquad = \boxed{-2}$$

Find slope of line through:

$$\underset{x_1 \ y_1}{(2,-1)} \text{ and } \underset{x_2 \ y_2}{(5,8)} \qquad \underset{x_1 \ y_1}{(-6,1)} \quad \underset{x_2 \ y_2}{(4,-8)}$$

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

$$= \frac{8 - -1}{5 - 2} \qquad\qquad = \frac{-8 - 1}{4 - -6}$$

$$= \frac{9}{3} \qquad\qquad\qquad = \boxed{\frac{-9}{10}}$$

$$= \boxed{3}$$

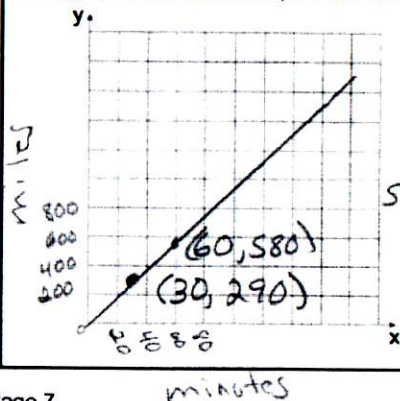**The table shows the number of miles a plane traveled while in flight. Use the information to find the approximate constant rate of change in miles per minute.**

x	Time (min)	30	60	90	120
y	Distance (ml)	290	580	870	1,160

$$\frac{\text{miles}}{\text{min}} \quad \frac{y}{x} \quad \frac{290}{30} \quad \frac{580}{60} \quad \frac{870}{90} \quad \frac{1160}{120}$$

$$9.\overline{6} \quad 9.\overline{6} \quad 9.\overline{6} \quad 9.\overline{6}$$

Since it is a proportional relationship, the constant ratio is the unit rate and constant rate of change

$$\boxed{9.\overline{6} \text{ miles/min}}$$

Now graph the relationship. Find the slope.

(60, 580)
(30, 290)

minutes

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{580 - 290}{60 - 30}$$

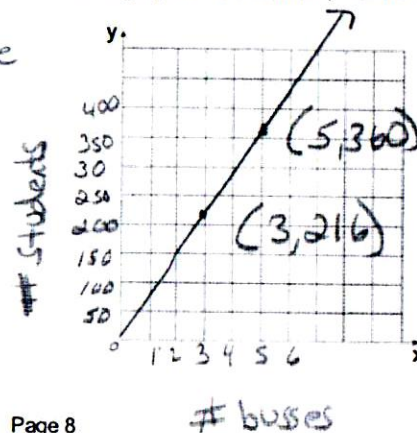$$= \frac{290}{30}$$

$$= 9.\overline{6} \text{ or } \frac{29}{3}$$

The table shows the number of students that buses can transport. Use the table to find the constant rate of change in students per school bus.

x	Number of Buses	2	3	4	5
y	Number of Students	144	216	288	360

+72

$$\frac{\Delta y}{\Delta x} \quad \frac{72}{1} = \boxed{72 \text{ students/bus}}$$
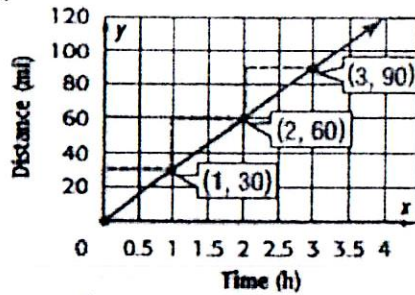
Now graph the relationship. Find the slope.

students

buses

(5, 360)
(3, 216)

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

$$= \frac{360 - 216}{5 - 3}$$

$$= \frac{144}{2}$$

$$= \boxed{72}$$

Page 9

Use the graph to find the constant rate of change in miles per hour while driving through the city.

30 miles/hour

(1, 30)
unit rate

If its proportional then unit rate is constant rate of change.

Explain what the point (1, 30) represents on the graph.

In 1 hour you go 30 miles.

Graph:
- Distance (mi) on y-axis: 20, 40, 60, 80, 100, 120
- Time (h) on x-axis: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4
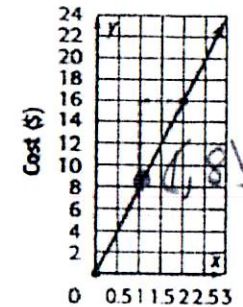- Points: (1, 30), (2, 60), (3, 90)

Page 10

The table and graph both show the hourly charge to rent a bicycle at two different stores. Which store charges more per bicycle? Explain by finding each constant rate of change.

Pedals Rentals

Time (hour)	Cost ($)
2	24
3	36
4	48

12, 12

$\frac{24}{2} = 12/hour$

$(0,0)$ $(2,16)$

$slope = \frac{16-0}{2-0} = 8$

Super Cycles
- Cost ($) on y-axis: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24
- x-axis: 0, 0.5, 1, 1.5, 2, 2.5, 3
- point (1, 8)

$8/hour.
Look at point (1,8) to get unit rate
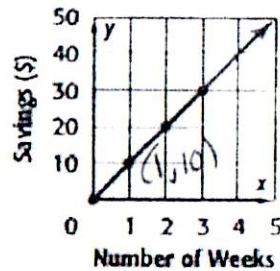

Page 11

The table and graph both show the amount of money that Mi-Ling and Daniel save each week. Who saves more per week? Explain by finding each constant rate of change.

Mi-Ling's Savings

Time (weeks)	Savings ($)
2	$30
3	$45
4	$60

Choose 2 points
(2,30) (4,60)
$x_1 y_1$ $x_2 y_2$

$slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{60-30}{4-2}$

$= \frac{30}{2}$

$= $15/week

Daniel's Savings
- Savings ($) on y-axis: 10, 20, 30, 40, 50
- Number of Weeks on x-axis: 0, 1, 2, 3, 4, 5
- point (1, 10)

Proportional so look at point (1,0)
$10/week

Mi Ling

Page 12

The table shows the relationship between the number of seconds y it takes to hear thunder after a lightning strike and the miles x you are from lightning. Graph the data and find the slope.

Miles (x)	0	1	2	3	4	5
Seconds (y)	0	5	10	15	20	25

$\frac{x | y}{0 | 0}$
$1 | 5$

Graph:
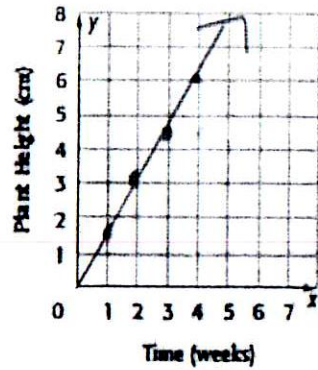- seconds on y-axis: 5, 10, 15, 20
- miles on x-axis: 1, 2, 3, 4, 5
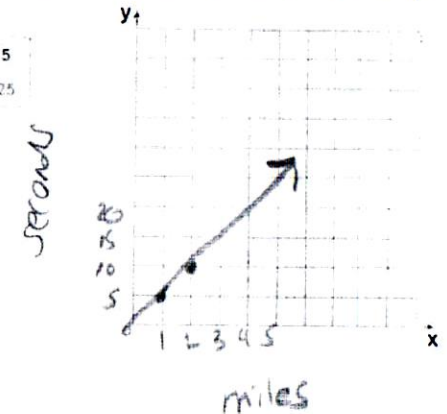
What does this slope represent? 5

It takes 5 seconds to hear thunder 1 mile away.

Graph the data about plant height for a science fair project. Then find the slope of the line.

Week	Plant Height (cm)
1	1.5
2	3
3	4.5
4	6

Plant Height (cm) vs Time (weeks)

Slope = 1.5
use unit rate point (1, 1.5)

What does this slope represent?

Plant grows 1.5cm each week