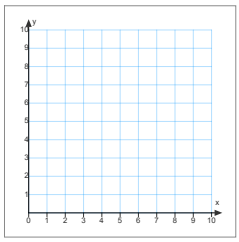
5.2 Rate of Change

Rate of change can be found using a table or a graph (slope)

Table:

Independent Variable	Dependent Variable

Graph



The average rate of change between two points is the slope of the line segment joining the points.

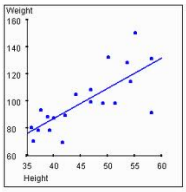
Average Rate of Change = or

Explain what rate of change represents in each situation.

Bicycle Trip

Time (h)	Distance (km)
0	5
2	10

Height and weight



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Example: Comparing Rates of Change

The distance required to stop a car depends on the speed at which the car is travelling.
The following table shows the reaction distance and the breaking distance needed to stop a car on dry pavement for given speeds.

Speed (km/h)	0	10	20	30	40	50
Reaction distance (m)	0	1.5	3	4.5	6	7.5

Speed (km/h)	0	10	20	30	40	50
Breaking Distance (m)	0	0.5	2	4.5	8	12.5

a) Calculate the average rate of change between consecutive points in each table. Describe the rates of change revealed in each table.
b) Graph the data in the tables. Describe how the graph reflects the rates of change across the data.

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Solution:

Speed km/h	ReactionDistance (m)	$\frac{\text{Change in distance}}{\text{Change in speed}}$

Speed km/h	BreakingDistance (m)	Change in distance / Change in speed

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Graph both tables from above using your on graph paper.

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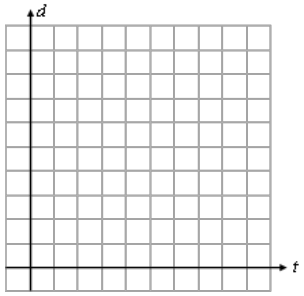
Example: Use a table and graph to describe rates of change in the following situation.

This table shows the change in height of a tomato plant from germination until the tomatoes ripens.

Time (weeks)	0	2	4	6	8	10	12	14	16	18
Height (cm)	0	5	10	20	40	58	75	86	90	90

a) Determine when the rate of change in the height is:
i) Zero ii) Constant iii) Changing
b) When is the rate of change in height the greatest?
c) Describe the growth of the plant.



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Create a table of first differences

Time (weeks)	Height (cm)	First Differences

PATTERNS OF CHANGE IN A GRAPH OR TABLE SUMMARY:

Identifying Rates of Change

Rate of Change	First differences on Table	Example of graph
Zero		
Constant		
Changing		

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Complete each of the following on lined paper.

1. For each table, name the variables.

a)

Hours worked	Earnings ($)
4	32
20	160

$/h

b)

Pages printed	Cost ($)
1000	56
5000	145

$/page

c)

Distance driven (km)	Fuel used (L)
45	3
60	12

L/Km

2. State the units of the rate of change for each table in question 1. What does the rate of change represent?

a) wage b) price of printing c) Fuel mileage

3. Refer to the tables in question 1. Determine the average rate of change between each pair of points in the table.

a) $\frac{(160-32)}{(20-4)} = \frac{128}{16} = \$8/h$

b) $\frac{145-56}{5000-1000} = \frac{89}{4000} = \$0.02225/page$

c) $\frac{12-3}{60-45} = \frac{9}{15} = 0.6\ L/Km$

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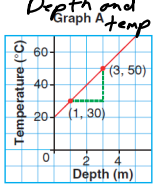
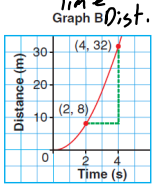
4. For each graph, name the variables.

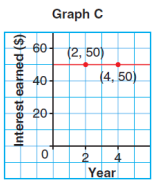
a) Graph A: Depth and temp



b) Graph B: Time Dist.



c) Graph C: Year Interest



5. State the units of the rate of change for each graph. What does the rate of change represent in each situation?

a) °C/m b) m/s c) $/year

6. Determine the average rate of change between the indicated points on the graph.

a) $\frac{50-30}{3-1} = \frac{20}{2} = 10\ °C/m$

b) $\frac{32-8}{4-2} = \frac{24}{2} = 12\ m/s$

c) $\frac{50-50}{4-2} = \$0/year$.

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9. Bipin is a financial advisor. He uses these tables to help his clients understand the difference between simple interest and compound interest.

Simple Interest				
Year	0	5	10	15
Amount ($)	500	700	900	1100

200 200 200

Compound Interest				
Year	0	5	10	15
Amount ($)	500	735	1079	1586

$101.4/yr.

a. Calculate the average annual rate of change for consecutive pairs of data in each table.

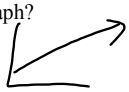
a) $\frac{200}{5} = \$40/\text{year}$

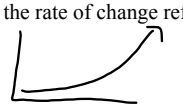
b) $\frac{735-500}{5-0} = \frac{235}{5} = \$47/\text{year}$ $\frac{1079-735}{5} = \$68.8/\text{year}$

b. Describe the rates of change in each table. What do these values indicate about each type of interest?

a) constant (straight) b) Increasing → curve up.

c. Graph the data in the tables. How is the rate of change reflected in the graph?





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Homework: p.274 #7, 8. If you did all the work in class today. If not, please complete all homework listed.

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