Agenda:

- Reminder: Writing Project due Monday
- Today: Wrap up sequences.
- Then: Start Sec. 15.1 (Graph Theory).

Homework:

1. Read the definitions of **walk**, **path**, and **circuit** on pp. 857-58, and read Example 7 that follows.

2. Read the definition of **complete graph** on p. 859, and read Example 9 that follows.

Sec. 15.1 HW #1, 3, 7, 9, 11-19 odd, 22, 33-37 odd, 40-41, 47, 48.

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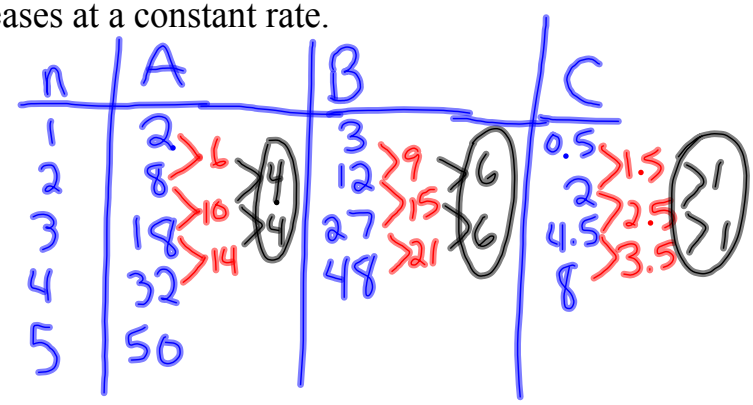
Describe the pattern of change in the *y*-value as the *x*-value increases or decreases at a constant rate.

A) $y = 2x^2$

B) $y = 3x^2$

C) $y = 0.5x^2$

D) $y = -2x^2$




Predict the pattern of change for:

$y = 5x^2$ $y = -4x^2$ $y = .25x^2$ $y = ax^2$

2nd differences should be 2a.

What type of function is shown here? Can you identify the formula?

| x | y |
|---|---|
| 0 | 0 |
| 1 | 0.5 |
| 2 | 2 |
| 3 | 4.5 |
| 4 | 8 |
| 5 | 12.5 |

$y = .5x^2$

| x | y |
|---|---|
| 0 | 2 |
| 1 | 0 |
| 2 | -2 |
| 3 | -4 |
| 4 | -6 |
| 5 | -8 |

$y = -2x + 2$

| x | y |
|---|---|
| 0 | 1 |
| 1 | 4 |
| 2 | 13 |
| 3 | 28 |
| 4 | 49 |
| 5 | 76 |

$y = 3x^2 + 1$

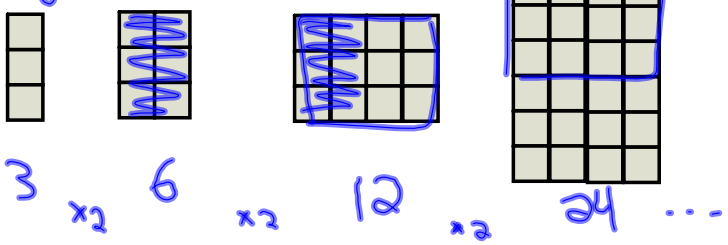
| x | y |
|---|---|
| 0 | 3 |
| 1 | 4 |
| 2 | 6 |
| 3 | 10 |
| 4 | 18 |
| 5 | 34 |

$y = 2^x + 2$

Deepening Understanding:

What kind of sequence is evident here?

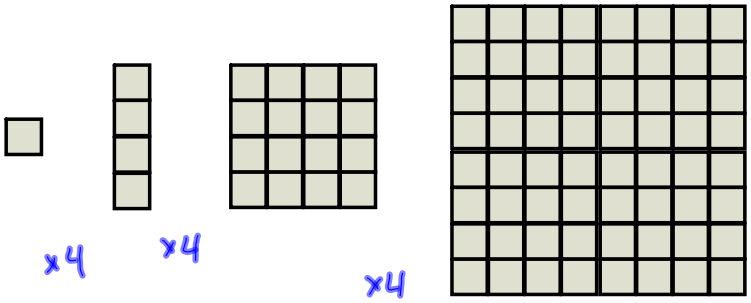
(geometric)




$y = \frac{3}{2^1}(2)^n$

$= 3(2^{n-1})$

What kind of sequence is evident here?




$y = (1)4^{n-1}$ ✓

Summary:

<u>Three (+) kinds of sequences:</u>

Linear (or Arithmetic)
- f(n) = an + b
- 1st differences constant

Quadratic
- $f(n) = an^2 + \textit{lower powers}$
- 2nd differences constant
- half of 2nd difference gives you *a*.

Higher powers (e.g. $f(n) = n^k + \textit{lower powers}$)
- *k*th differences constant

Exponential (Geometric is a special case)
- For Geometric only: Constant *ratio* between terms
- Exponential (& Geometric): *No* constant differences.

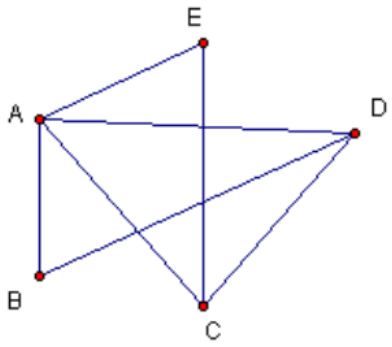
Sec. 15.1 - Basic concepts of graph theory

A **graph** is a collection of vertices (at least one) and edges. Each edge goes from a vertex to a vertex.

<u>Example:</u>

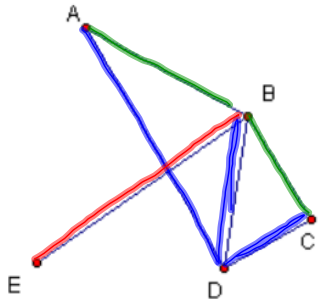
The following graph shows how five people are connected as friends on Facebook. Who is friends with whom? How many friendships are there altogether?

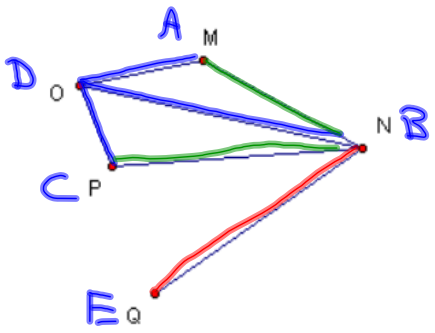
AB AC AD AE CE BD CD



Only the relation between the vertices has significance (indicated by the presence or absence of an edge.)

Example: Two sets of five friends have Facebook accounts. The friendships are indicated below. Are the relationships identical between the two circles of friends?

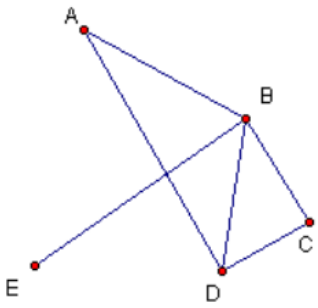


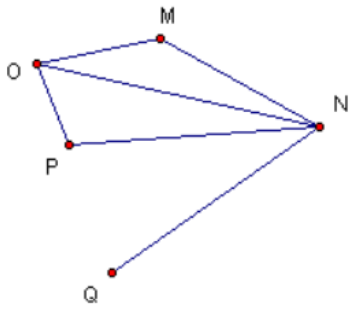




Same Example: The following graphs are *isomorphic*.

That is, there is a one-to-one correspondence between the vertices that preserves the connections between corresponding vertices?

Illustrate this one-to-one correspondence to prove they are isomorphic graphs. (Tip: Relabel the second graph's vertices, and color code corresponding edges).




12.04 - Graphs.gsp

Definition: A graph is **connected** if one can move from each vertex to every other vertex along edges of the graph.

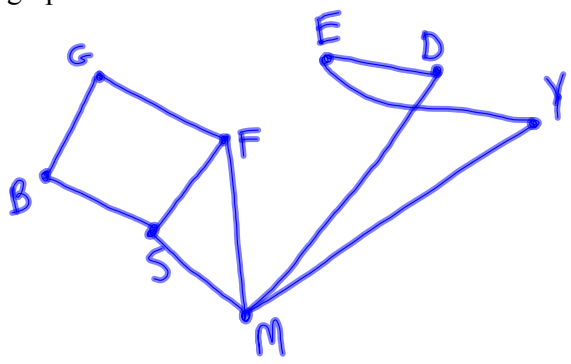
(If not, the graph is **disconnected** and will have more than one **component**.)

Example:

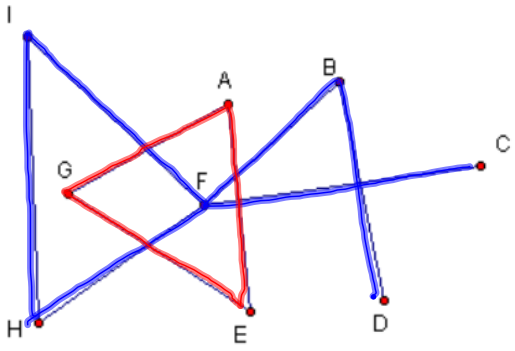
You plan a bus trip. Greyhound has the following connections:

| | |
|---|---|
| **G**rand Forks | --> Bimidji, Fargo |
| **F**argo | --> Grand Forks, St. Cloud, Minneapolis |
| **B**emidji | --> Grand Forks, St. Cloud |
| **S**t. Cloud | --> Bemidji, Fargo, Minneapolis |
| **D**uluth | --> Escanaba, Minneapolis |
| **M**inneapolis | --> Fargo, St. Cloud, Duluth, Green Bay |
| **E**scanaba | --> Duluth, Green Bay |
| Green Ba**Y** | --> Escanaba, Minneapolis |

Is this a connected graph? What does this mean in the context of this problem?



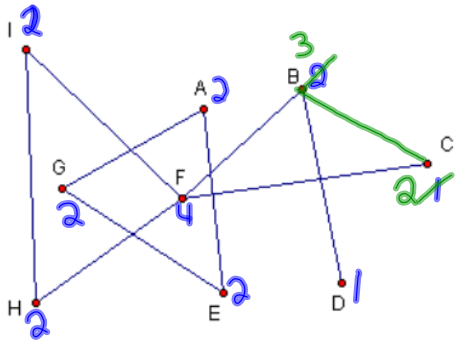

Is this a connected graph? Color the distinct components.




12.04 - Graphs.gsp

Definition: The **degree** of a vertex is the number of edges joined to that vertex.

Label each vertex with its degree.




What is the sum of the degrees? How is this related to the number of edges? 18 = deg(graph), 9 = # of edges.

* Try adding edges to the graph above. Does the relationship between edges and vertices still hold? # of

* Create your own graph and see if this relationship holds.

Theorem: (# of edges) × 2 = (sum of degrees)

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## Attachments

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