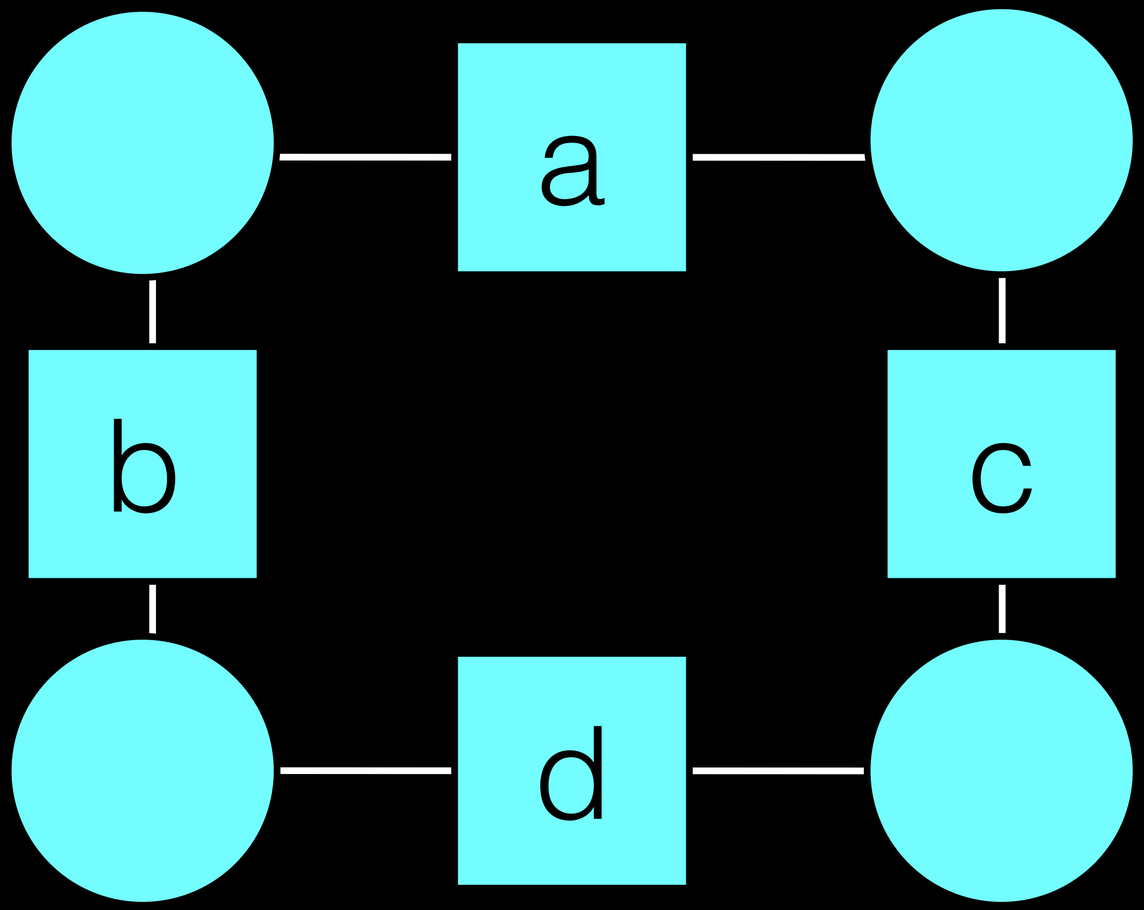
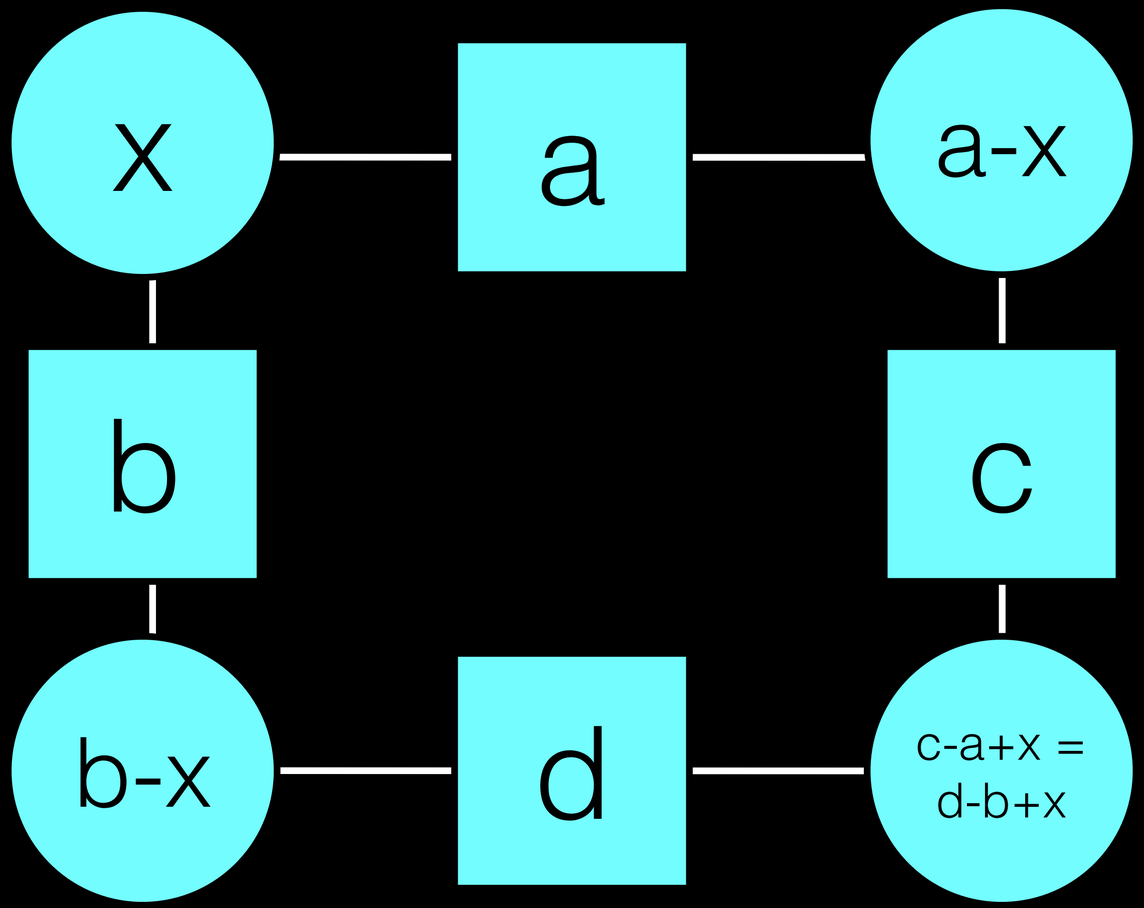
# Finite differences

A^3: Assess, Analyze, Address

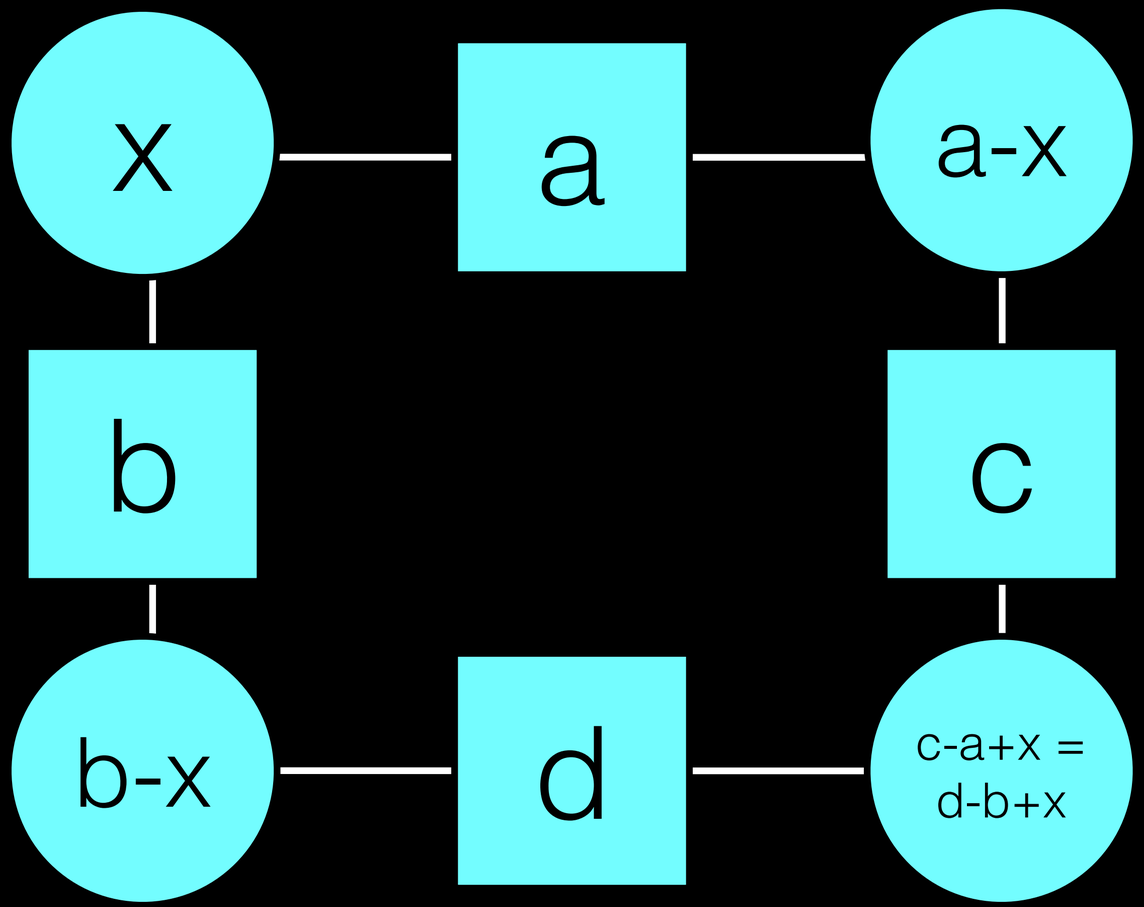
Summer 2017



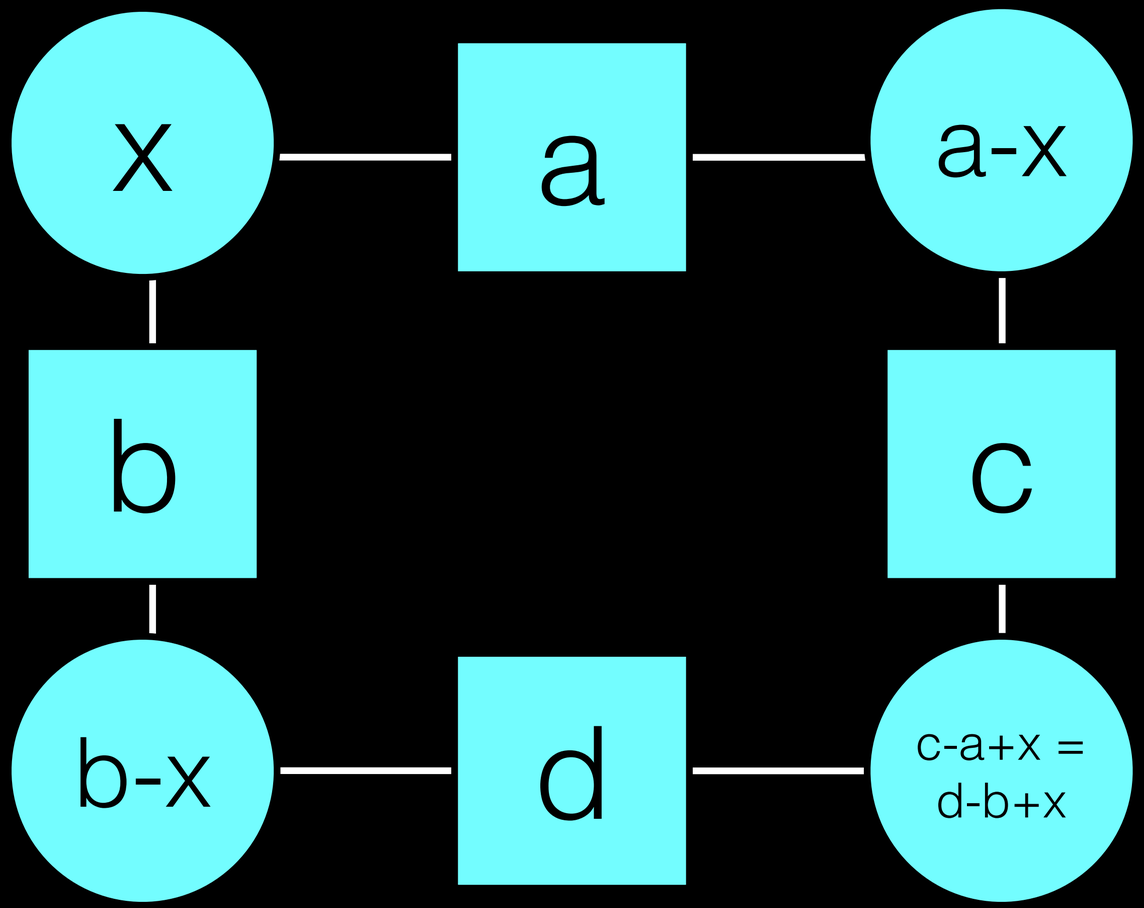

# Arithmagons




# Arithmagons



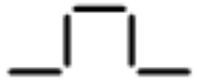

$$c - a = d - b$$




$$a + d = b + c$$

…some brilliant transition material…

# Create formula from table problem

| |  |  |  |
|---|---|---|---|
| figure number | 1 | 2 | 3 |
| number of toothpicks in figure | 5 | 10 | 15 |

- http://www.scimathmn.org/stemtc/frameworks/921a-functions-other-relations

- Can student "see" the pattern?
- Can student put pattern into math language?

# Create formula from table problem

| x | f(x) |
|---|---|
| 1 | 0 |
| 2 | 1 |
| 3 | 3 |
| 4 | 6 |
| 5 | |

# Create formula from table problem

| x | f(x) |
|---|---|
| 1 | 0 |
| 2 | 1 |
| 3 | 3 |
| 4 | 6 |
| 5 | 10 |
| 137 | |

# Create formula from table problem

| $ax^2 + bx + c$ | x | f(x) |
|---|---|---|
| | 1 | 0 |
| | 2 | 1 |
| | 3 | 3 |
| | 4 | 6 |
| | 5 | 10 |
| | 137 | |

# Create formula from table problem

| $ax^2 + bx + c$ | x | f(x) |
|---|---|---|
| $a \cdot 1 + b \cdot 1 + c$ | 1 | 0 |
| | 2 | 1 |
| | 3 | 3 |
| | 4 | 6 |
| | 5 | 10 |
| | 137 | |

# Create formula from table problem

| $ax^2 + bx + c$ | x | f(x) |
|---|---|---|
| a·1 + b·1 + c | 1 | 0 |
| a·4 + b·2 + c | 2 | 1 |
| a·9 + b·3 + c | 3 | 3 |
| a·16 + b·4 + c | 4 | 6 |
| a·25 + b·5 + c | 5 | 10 |
| | 137 | |

# Create formula from table problem

| $ax^2 + bx + c$ | f(x) |
|---|---|
| a·1 + b·1 + c | 0 |
| a·4 + b·2 + c | 1 |
| a·9 + b·3 + c | 3 |
| a·16 + b·4 + c | 6 |
| a·25 + b·5 + c | 10 |

# Systems of equations

- $a + b + c = 0$
- $4a + 2b + c = 1$
- $9a + 3b + c = 3$

… or can ask for handout

If you know why the trick works, is it still a trick?

# Why quadratic?

- $[\ f(x+1) - f(x)\ ] \quad - [\ f(x) - f(x-1)\ ]$
- $ax^2 + 2ax + a + bx + b + c - ax^2 - bx - c$
  $- [\ ax^2 + bx + c - ax^2 + 2ax - a - bx + b - c\ ]$

# Why quadratic?

- [ f(x+1) - f(x) ]  - [ f(x) - f(x-1) ]
- 2ax + a + bx + b + c - bx - c
  - [ bx + c + 2ax -a - bx + b - c ]

# Why quadratic?

- [ f(x+1) - f(x) ]  - [ f(x) - f(x-1) ]
- 2ax + a + b + c - c
  - [ c + 2ax -a + b - c ]

# Why quadratic?

- [ f(x+1) - f(x) ]  - [ f(x) - f(x-1) ]
- 2ax + a + b +  - [  2ax - a + b ]
- 2ax + a + b +  - 2ax + a - b
- 2a