APS Enhanced Scope and Sequence for Mathematics

3rd Quarter, 2007-2008

Grade 7

Content Overview

"Life is good for only two things, discovering mathematics and teaching mathematics"

~Siméon Poisson

Session Goals

- Provide a broad content overview of the major Georgia Performance Standards in Quarter 3 units
  - Staying in Shape unit
  - Values that Vary unit
- Discuss the rigor of knowledge and skills expected in each GPS unit
- Gather teacher perceptions of challenges they face in each unit

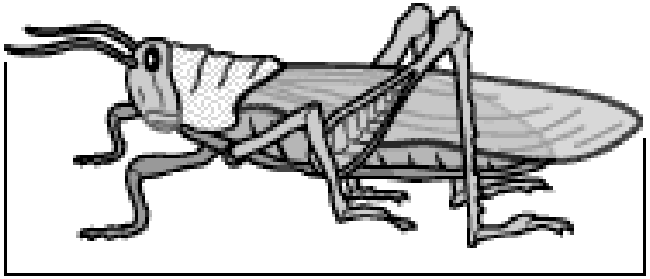
Concepts: Quarter 3 Grade 7

- Dilations and transformations in the coordinate plane
- Similarity and dilations
- Direct and indirect proportion

Session Essential Questions

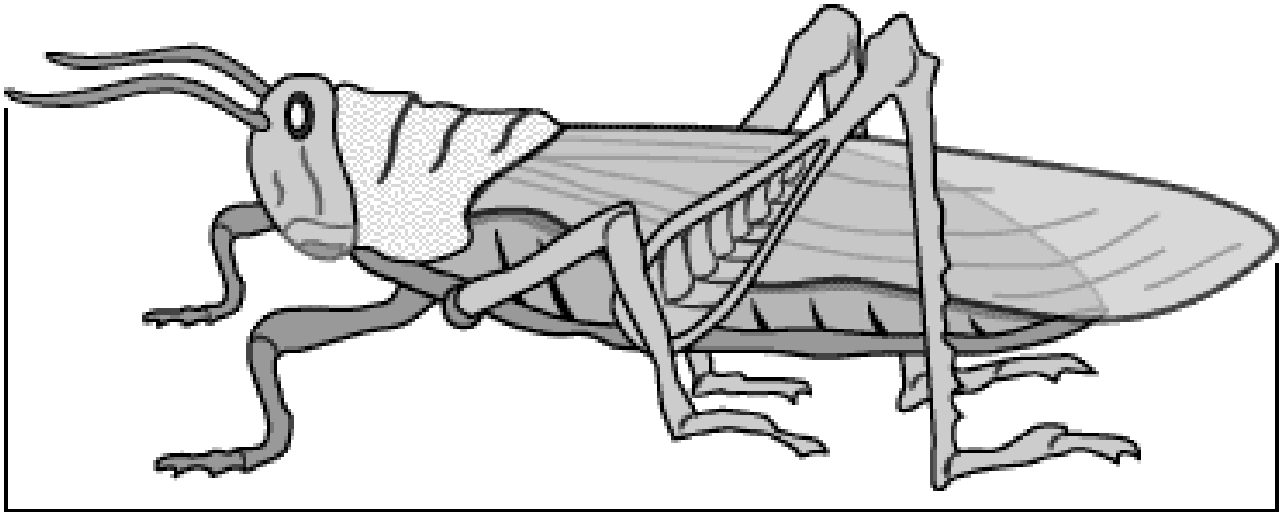
- How do I scale an object and when would I want to? What are the connections between similarity, scale factor, dilation, real size, scale size, and direct proportion? Where do I see examples of these math ideas in real life?
- Can I write mathematical rules for movements of and changes to figures in space? Who uses these rules and what are they good for?
- What is indirect proportion and what are examples of it in real life? How are equations and graphs of direct and indirect proportion helpful?

Engage: Staying in Shape Unit



Scale of 1:1

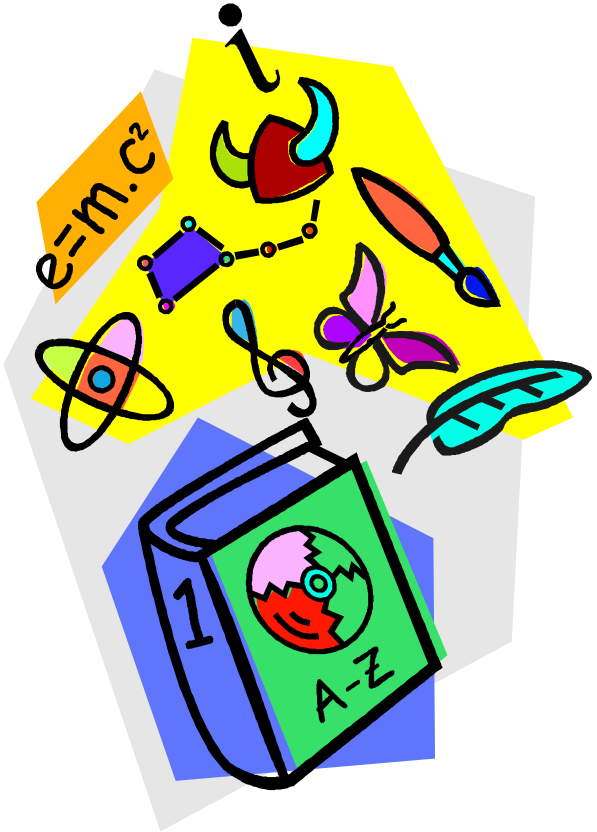
Scale of 1:2



Scale of 2:1

Vocabulary: Staying in Shape Unit

- Dilation
- Proportion
- Ratio
- Scale Factor
- Similar Figures
- Congruent Figures



Tasks: Staying in Shape Unit

- Playing with Dilations
- Dilations in the Coordinate Plane
- Changing Shapes
- Growing Logos
- Similar Triangles
- Making Copies
- Similar Pentagons
- Shadow Math
- Club Logo

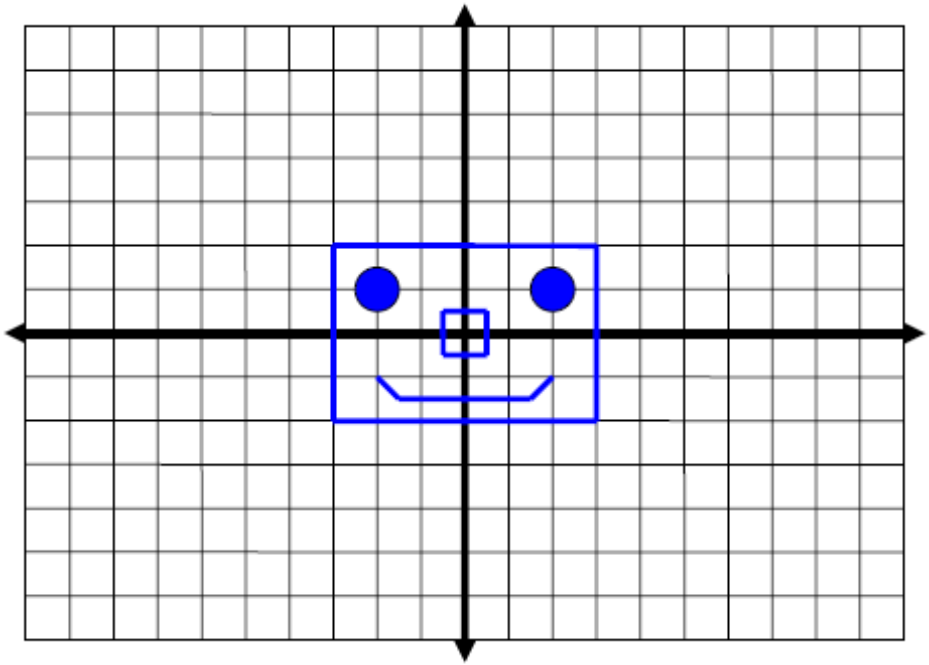
Engage: Staying in Shape Unit

- Mathematical rules to transform points in the coordinate plane are the basis for video and computer animation and special effects

Click the camera for a video example

Explore: Staying in Shape Unit

- Dilations in the Coordinate Plane task
- Think about:
  - Knowledge and skills
  - Making connections to previous concepts



Explain: Dilations & Measurements

	Perimeter	Area	Volume
Scale Factor **2**	2 times	4 times	8 times
Scale Factor **3**	3 times	9 times	27 times
Scale Factor **4**	4 times	16 times	64 times
Scale Factor **5**	5 times	25 times	125 times
Scale Factor **x**	?	?	?

Explain: Transformations & Similarity

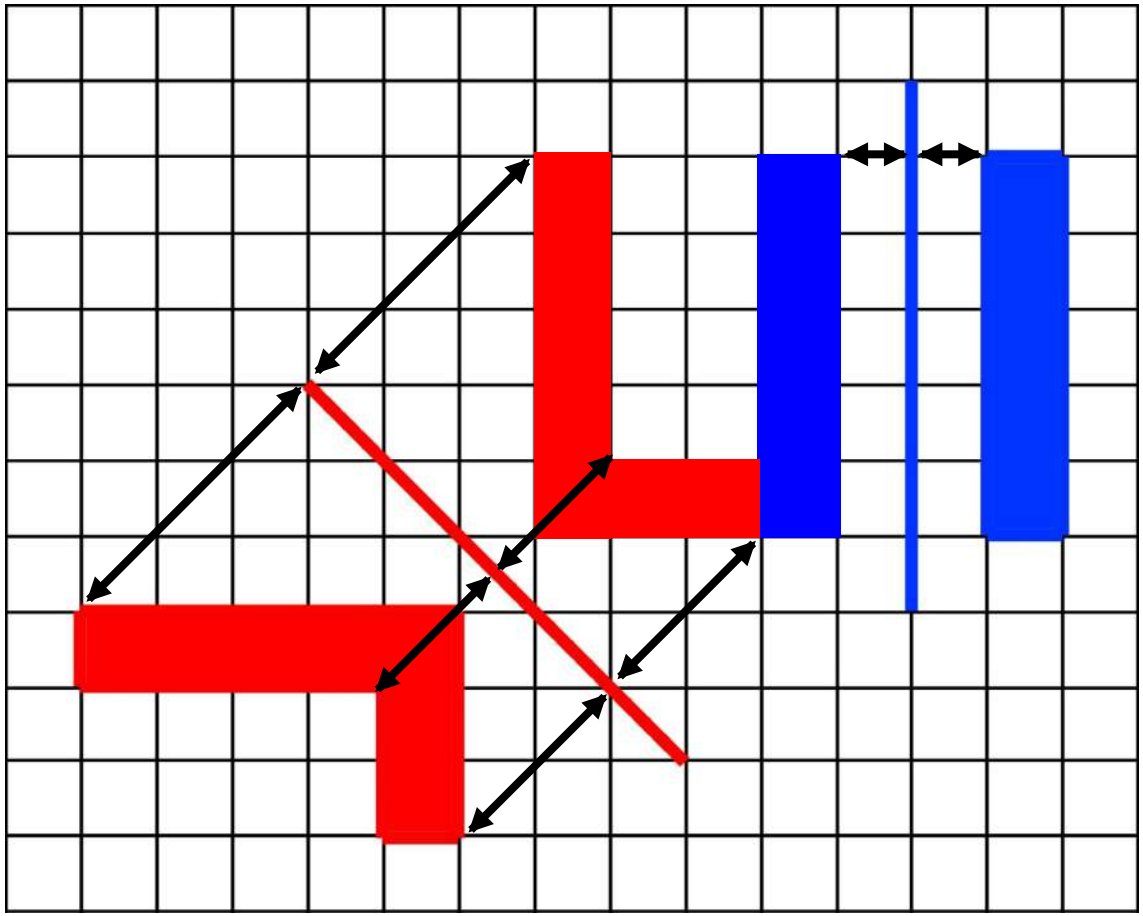
- There are four types of transformations:
  - **Rotations** - turns
  - **Translations** - slides
  - **Reflections** - flips
  - **Dilations** - reductions and enlargements
- Reflections, translations, and rotations can prove congruence
- Dilations can prove similarity
  - Scale factor **>1** will be an enlargement
  - Scale factor **<1** will be a reduction
  - Scale factor **= 1** will be congruent

Explain: Reflection

- **Reflection:** a transformation that flips a figure over a line

If the reflection line for the blue figure was the y-axis, what would be the (x, y) rule to reflect the figure?

How would the rule be different if the transformation was a translation?

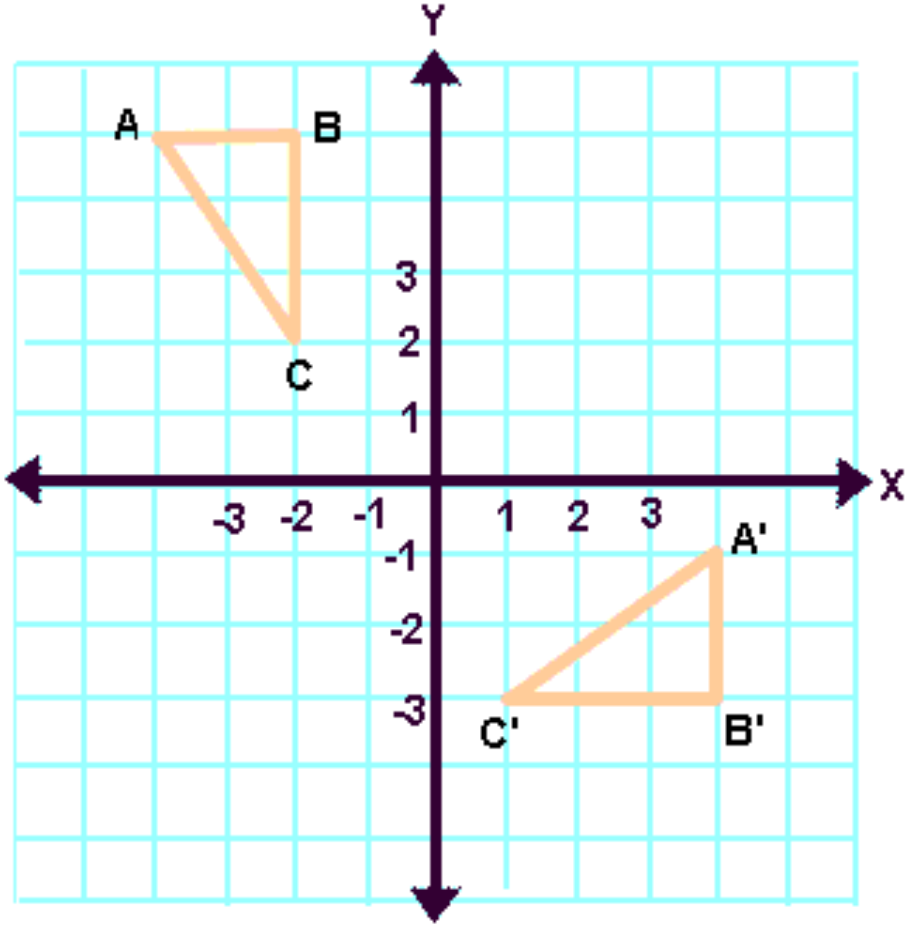


Explain: Rotation

- **Rotation**: a transformation that turns a figure about a fixed point at a given angle and a given direction

Triangle ABC has been rotated 90° clockwise to create triangle A′B′C′.

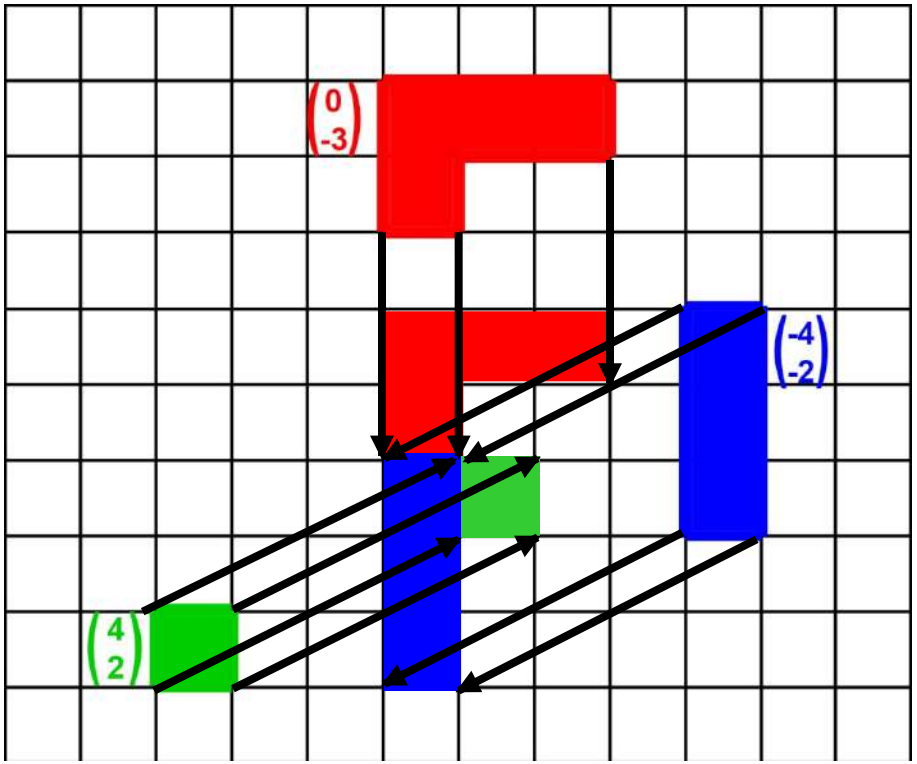
The center of rotation was (-3, -2).



Explain: Translation

- **Translation**: a transformation that slides a figure along a straight line

Translate the shapes by the given vector. What would be the rules for each translation in terms of (x, y)?



Rules:

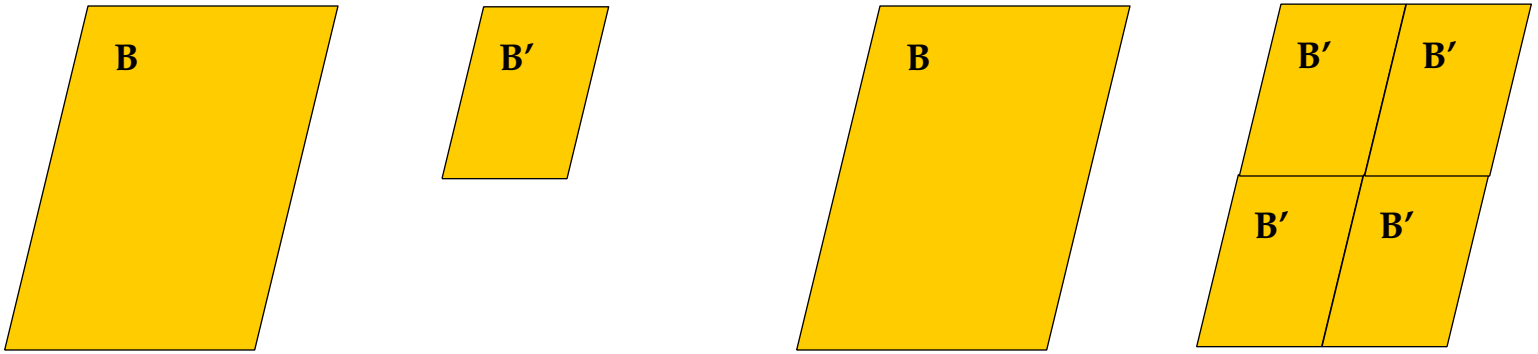
Red (x, y-3)

Blue (x-4, y-2)

Green (x+4, y+2)

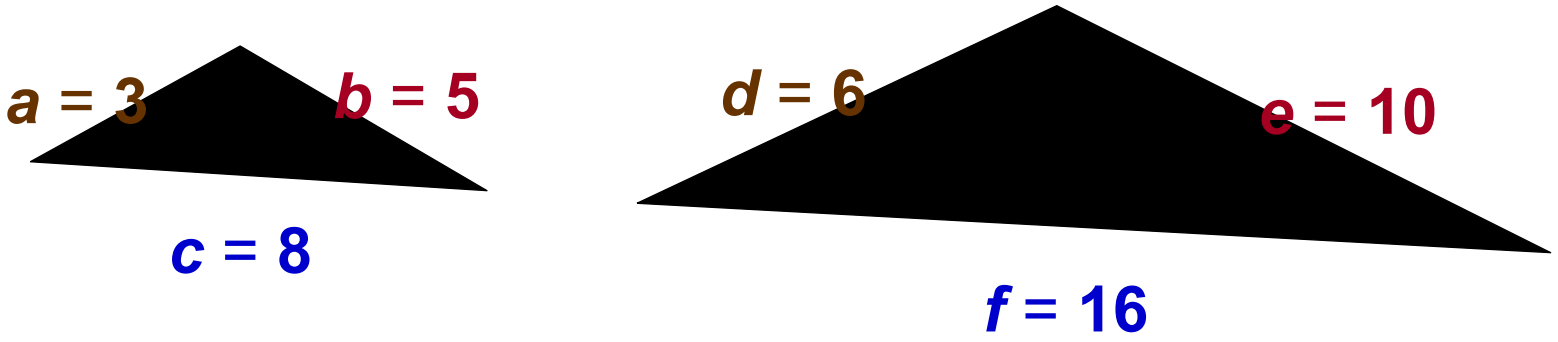
Explain: Dilations

- **Dilation**: a transformation that changes the size of a figure but not the shape. **Corresponding** angles are **congruent** and corresponding segments are in **proportion**. **Similar figures** are the result of a dilation.
- **Ratio**: the comparison of two quantities by division using the same unit of measure. Ratios may be written as r/s, r:s, or r to s.
- **Proportion**: an equation stating that two ratios are equal



Explain: Dilations & Scale Factor

- **Scale factor** is the ratio of corresponding lengths of the sides of two similar figures



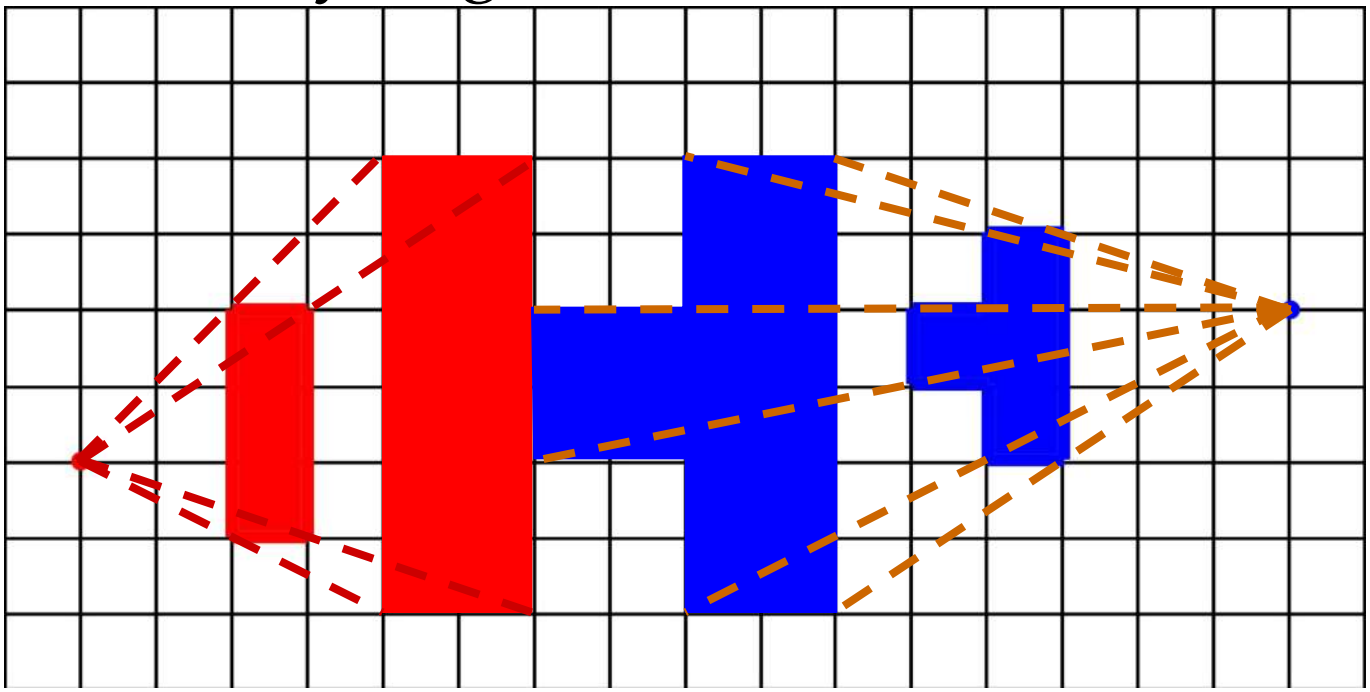
Side ***a*** corresponds to side ***d***, side ***b*** corresponds to side ***e***, and side ***c*** corresponds to side ***f***. The scale factor of the smaller triangle to the larger triangle is 1:2, 1 to 2, 1/2 or 0.5.

$$\frac{a}{d} = \frac{3}{6} = \frac{1}{2} \qquad \frac{b}{e} = \frac{5}{10} = \frac{1}{2} \qquad \frac{c}{f} = \frac{8}{16} = \frac{1}{2}$$

Elaborate: Dilations

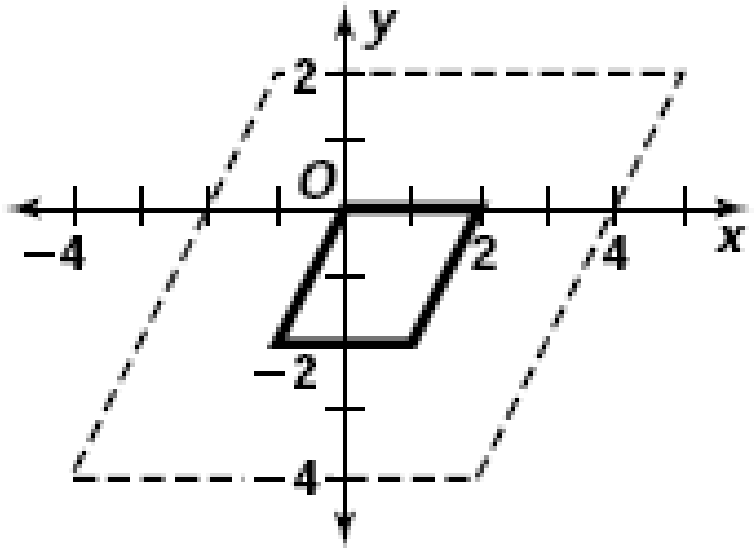
Enlarge these shapes from their corresponding centers of enlargement with a scale factor of 2.

What letter do you get?



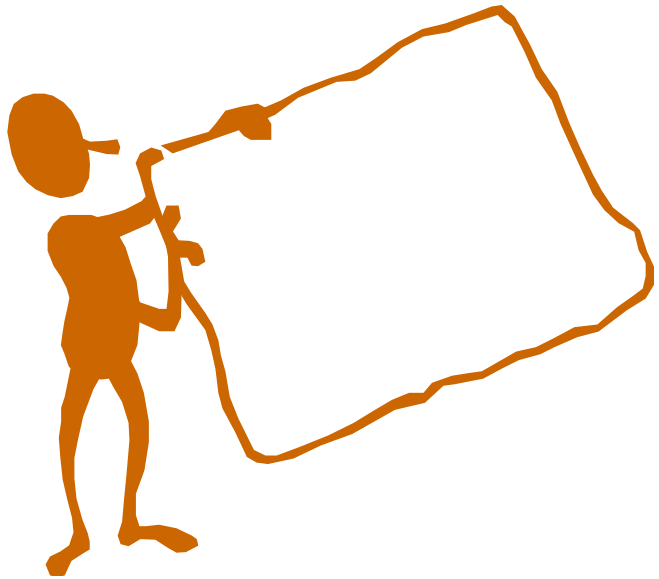
Evaluate: Staying in Shape Unit

- Changing Shapes task
- Think about:
  - Knowledge and skills
  - Making connections to previous concepts



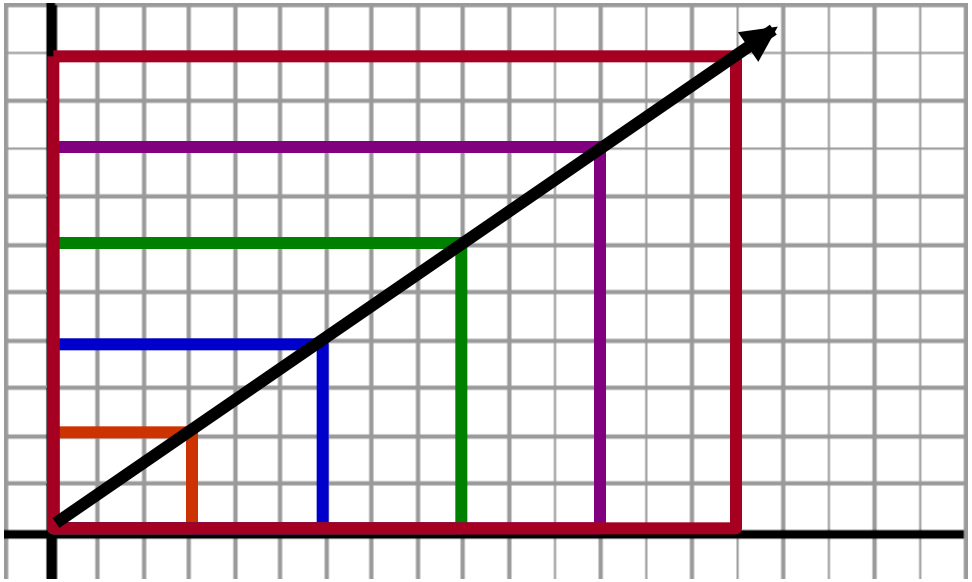
Evaluate: Staying in Shape Unit

- Read the introductory content for the Grade 7 Staying in Shape unit
- Pair and Share about those concepts you feel will be the most challenging for your students
- Record those challenges on post-it notes and post on the **Staying in Shape Parking Lot**



Engage: Values that Vary Unit

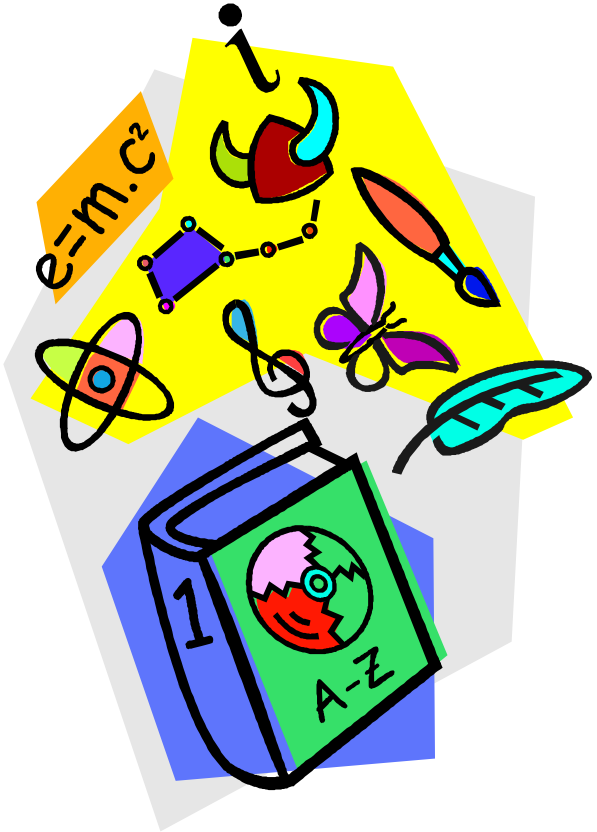
- How is the work we just did with scale factor and dilation connected to direct proportion?



- What are some "pitfalls" in using cross multiplication as the only way to solve proportions?

Vocabulary: Values that Vary Unit

- Variation and proportion
- Constant of proportionality
- Direct Proportion
- Indirect Proportion
- Equation
- Ratio



Tasks: Values that Vary Unit

- How Fast Can You Go?
- Seesaw Nickels
- Surprise Birthday Party
- Decorating for the Dance
- Name that Graph!
- How Long Does it Take?
- Bathtub

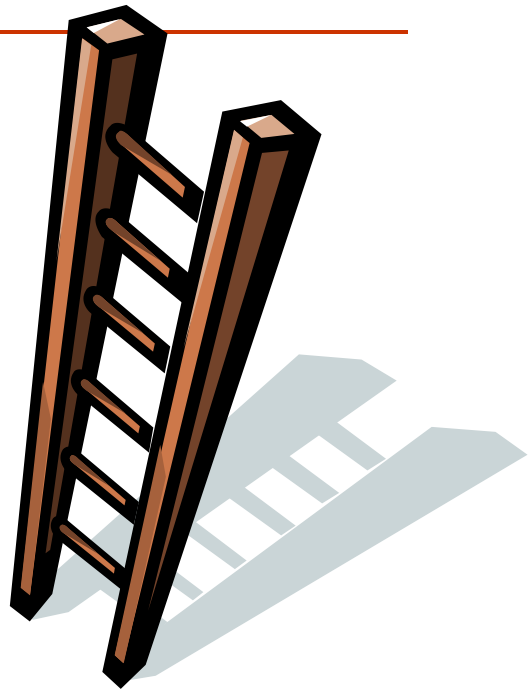
Explore: Values that Vary Unit

- Decorating for the Dance task
- Chart your answers on the poster paper

Explain: Direct Proportion

Consider the following direct proportion situation:

It takes 2 hours for a company to manufacture each ladder that it makes



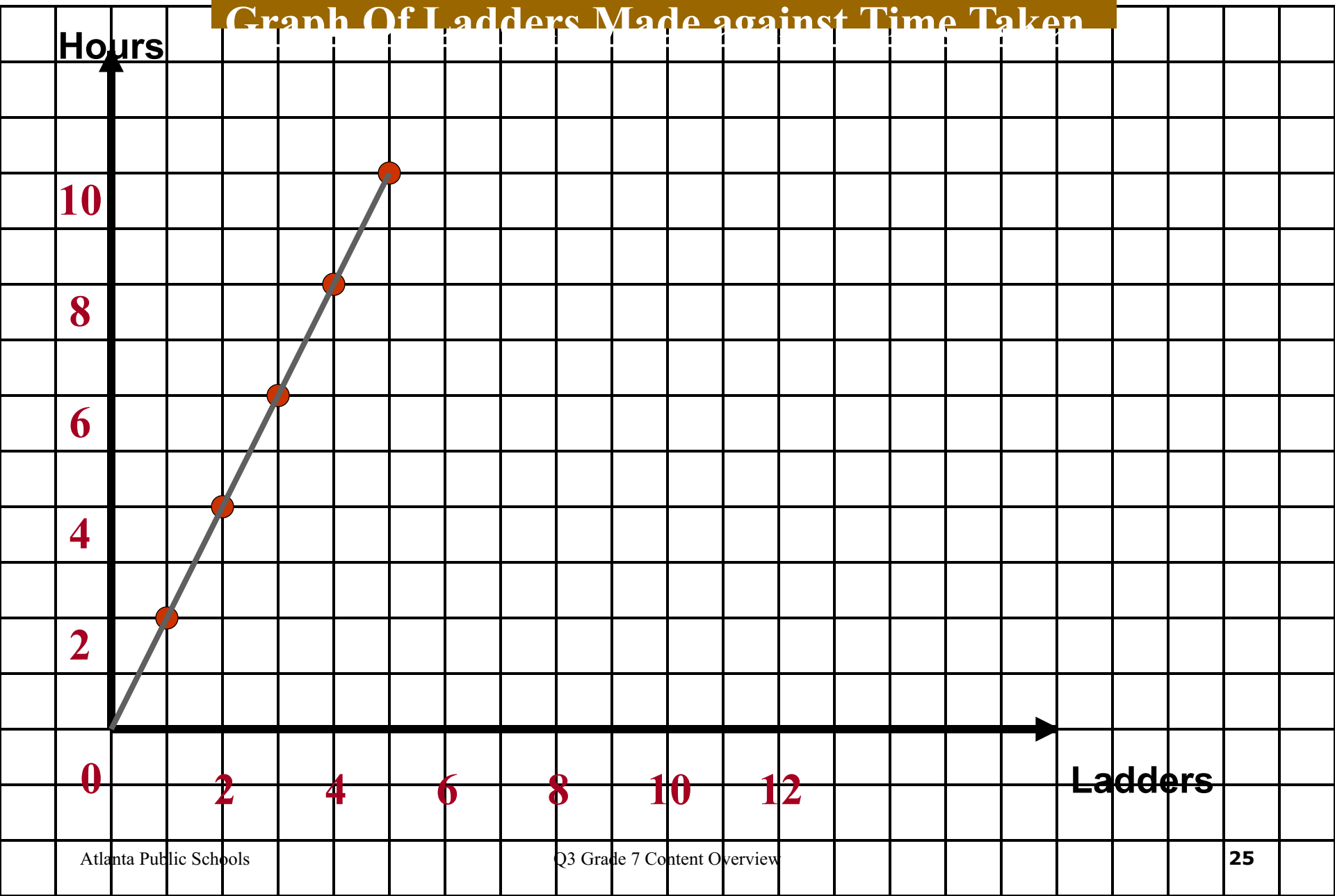
Examine the table below:

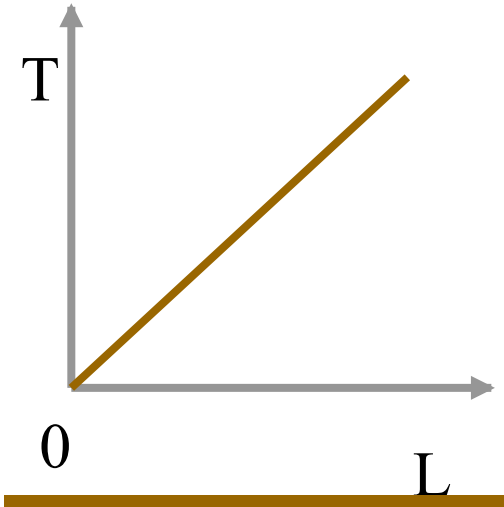
Ladders	0	1	2	3	4	5 Hours
	0	2	4	6	8	10

©Microsoft Word clipart

Now look at the graph of the data

Graph Of Ladders Made against Time Taken





Key Facts about Direct Proportion

All direct proportion graphs are straight line graphs passing through the origin

Look at the table of values again:

Ladders	0	1	2	3	4	5
Hours	0	2	4	6	8	10

If you divide the number of hours by the given number of ladders, what do you find each time?

The answer is **2** every time. As x increases, y increases at a constant rate of 2x. This is a **linear** equation in the form **y = kx** where 2 is the **constant of proportionality** (**k**). Note also that the ratio of Ladders to Hours remains constant at x:2x

Explain: Indirect Proportion

A farmer has enough cattle feed to feed 64 cows for 2 days.

Examine the table below. As the number of cows increases the number of days of feed decreases.

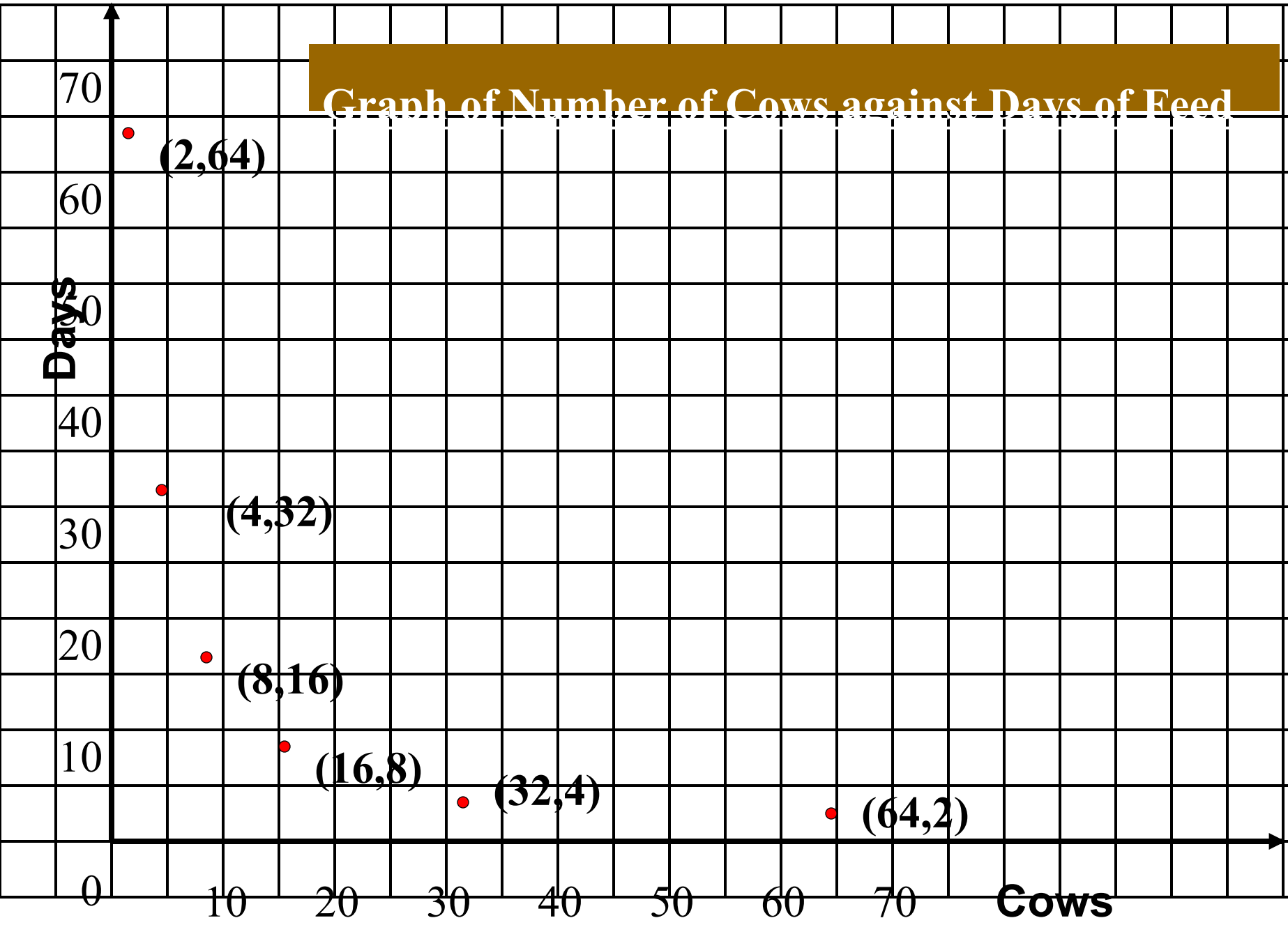
Cows	2	4	8	16	32	64
Days	64	32	16	8		

We are going to draw a graph of the table.

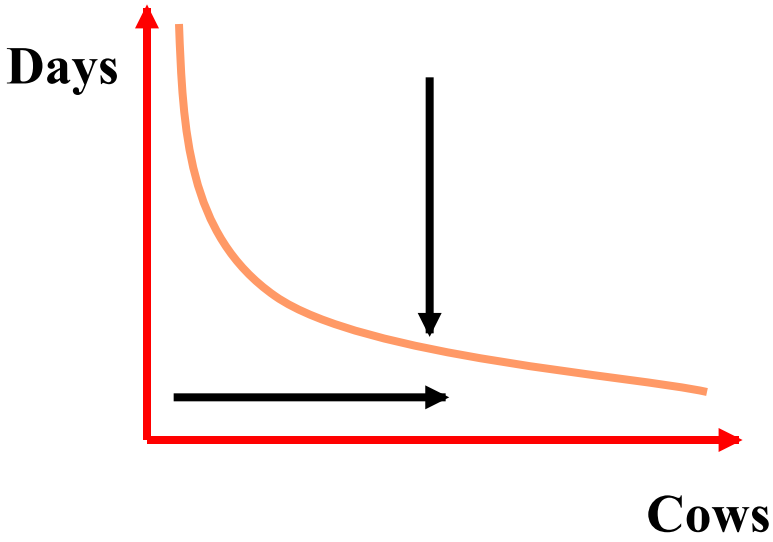
The scale allows each axis to go at least up to 65.

We estimate the position of the points (2,64) (4,32) etc. as accurately as possible.

Graph of Number of Cows against Days of Feed



The graph is a typical inverse or indirect proportion graph



It shows us that as the number of cows increases, the number of days left of feed decreases. The reverse is also true. If we decrease the number of cows, we will increase the number of days of feed.

Cows	2	4	8	16	32	64
Days	64	32	16	8	4	2

This is a non-linear equation in the form $y = \frac{k}{x}$

where **k** is still the constant of proportionality. However, y varies inversely to x. In this situation, what is **k**?

Evaluate: Values that Vary Unit

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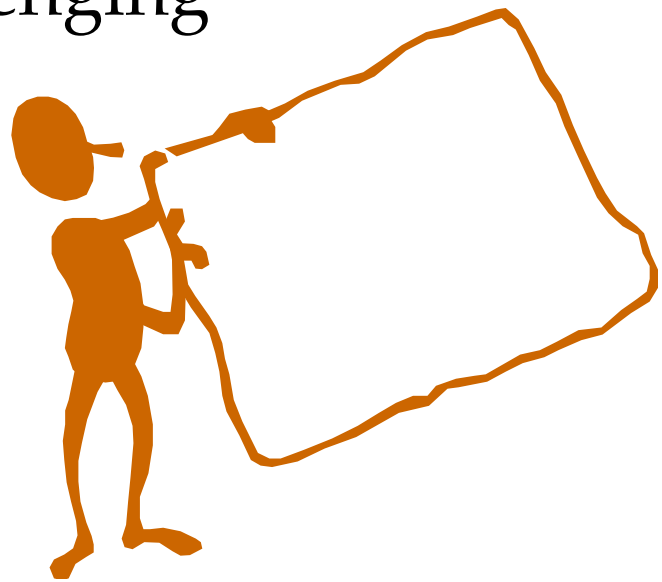

Resources and References

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- Burns, M. (2000). *About teaching of mathematics: A K-8 resource* (2nd ed.). Sausalito, CA: Math Solutions Publications.
- Chapin, S. (2003). Crossing the bridge to proportional reasoning. *Mathematics Teaching in the Middle School, 8,* 420-425.
- NetTrekker http://school.nettrekker.com/frontdoor/

Resources and References (cont'd.)

- Stanley, D., McGowan, D., and Hull, S. (2003). Pitfalls of over-reliance on cross multiplication as a method to find missing values.
- United Streaming http://streaming.discoveryeducation.com/search/assetDetail.cfm?guidAssetID=a39e2ac4-e031-4e6a-8115-fc59ef04bf76
- Van de Walle, J.A., (2007). *Elementary and Middle School Mathematics: Teaching Developmentally*. Boston: Allyn and Bacon.
- www.georgiastandards.org/mathframework.aspx site has webcasts for teachers on:
  - Constructions, Transformations & 3D Figures
  - Similarity & Dilations
  - TI-83 Plus Transformations with Cabri Jr.

Session Reflection

- Can I write mathematical rules for movements of and changes to figures in space? Who uses these rules and what are they good for?
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Contact Information

Diamond M. Jack

SRT-4 Model Teacher Leader

(404) 802-6537 (office)

djack@atlanta.k12.ga.us (email)