Statway™

A student success initiative supported by a Networked Improvement Community

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The Problem

- 60 – 90% of community college students place into developmental mathematics
- Only 30% of those students ever complete the sequence
- There is only one pathway through developmental mathematics, for both STEM and non-STEM students

One solution…new pathways

- Statway™
  - To-and-through college level statistics in one year
  - Developmental math in the service of statistics
- Quantway™
  - Quantitative literacy courses
  - A developmental math course followed by a college level course

What makes these pathways unique

- Curriculum: Designed by members of leading statistical and mathematics organizations, and supported by AMS, ASA, AMATYC, MAA
- Specific attention to:
  - Pedagogy
  - Professional Development
  - Productive Persistence
  - Language and Literacy
  - Articulation
- Networked Improvement Community

Networked Improvement Community

Collaboratory – "a center without walls"

- Collaboration of researchers and practitioners building and refining a solution
- Carnegie Foundation, Charles A. Dana Center, Researchers at leading universities
- 19 Statway™ community colleges in 5 states, 3 CSU campuses

Learning Philosophy Principles

- A “rich task” or overarching question motivates the development of concepts
- Mathematical tools are introduced as needed
- Lessons focus on fewer topics in greater depth
- Materials stress conceptual understanding over procedural fluency
- Technology is used for calculation

3 Key Learning Opportunities

- Productive Struggle
- Explicit Connections
- Deliberate Practice

3 Key Learning Opportunities

Productive Struggle:

- Students must be engaged in their own learning.
- Struggling with important ideas prepares students to benefit from direct instruction.

3 Key Learning Opportunities

Explicit Connections:

- Instruction must make explicit connections to earlier ideas, applications, and/or previous experience.
- Students' understanding grows by building connections.

3 Key Learning Opportunities

Deliberate Practice:

- Not repetitive practice!
- Tasks are sequenced and varied so that there is new effort for each.

Course Structure

- In-class Lessons: Activities demonstrate the new concepts and skills
- Students work in groups, instructor leads “wrap-up” and direct instruction
- Homework: Students work on MyStatway, a computer text and tutorial
- Grading is a combination of in-class written tests and “checkpoints” in MyStatway

MyStatway™

- An on-line statistics course, based on the Carnegie-Mellon OLI statistics course
- “Out of Class Experience” (homework)
- Students learn through reading text online and working through guided examples.
- Some tasks require students to “submit and compare” their own responses to answers provided.

Timeline

- 2010 – 2011
  - Establish and build the community
  - Co – development of materials and supports
  - Lesson study
- 2011 – 2012
  - Pilot the pathways
  - Strengthen the community
  - Continue to improve – curriculum, pedagogy, training, etc
- 2013 and beyond - Expand…

ASAP

- **A**lgebra **S**uccess **A**t **P**ierce – get through your Algebra ASAP!
- 14 unit learning community in 1 semester, for total immersion in Math
- 10 units of Algebra 1 and 2 blended together
- 3 unit College Success course
- 1 unit Directed Study – study skills

Who can take ASAP?

- Students who place at Algebra 1 level
- Students who passed Prealgebra
- Students who place at Algebra 2 level but want to review
- Students who passed Algebra 1 but want to refresh Algebra 1 (audit) and take Algebra 2

Support for ASAP

- Supplemental Instruction leader for each ASAP community (5 communities this semester)
- SI leaders funded by BSI funds for 13 hours per week – 5 hours in the classroom and 8 hours outside running study group sessions
- College success companion course taught by a counselor
- Counselor and Math instructor meet on a regular basis

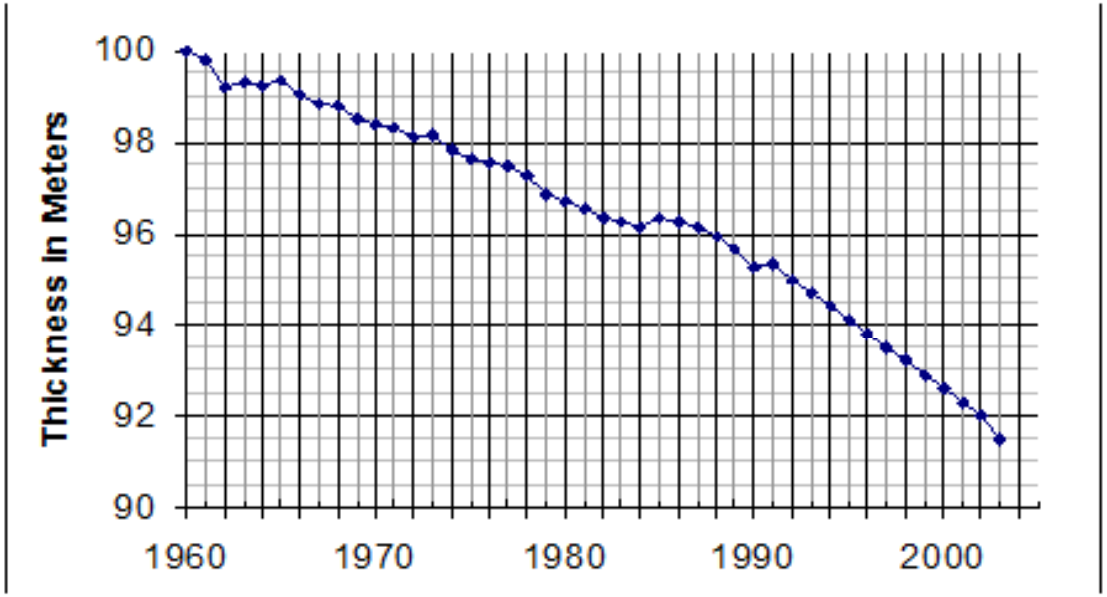
Materials for ASAP

- Custom book blends Algebra 1 and 2, minimizing repetition
- Directed learning activities stress critical thinking
- Homework includes skills practice problems and applications
- Clicker questions explore concepts
- Study Skills booklet

Lesson 4 Slope

Activity 1 Calculating Rate of Change

The graph shows how the thickness of a typical land-based glacier has changed over 43 years.



a. What was the **total change**, ΔH, in thickness from 1960 to 2003?

Year, t	Thickness, H
1960	
2003	

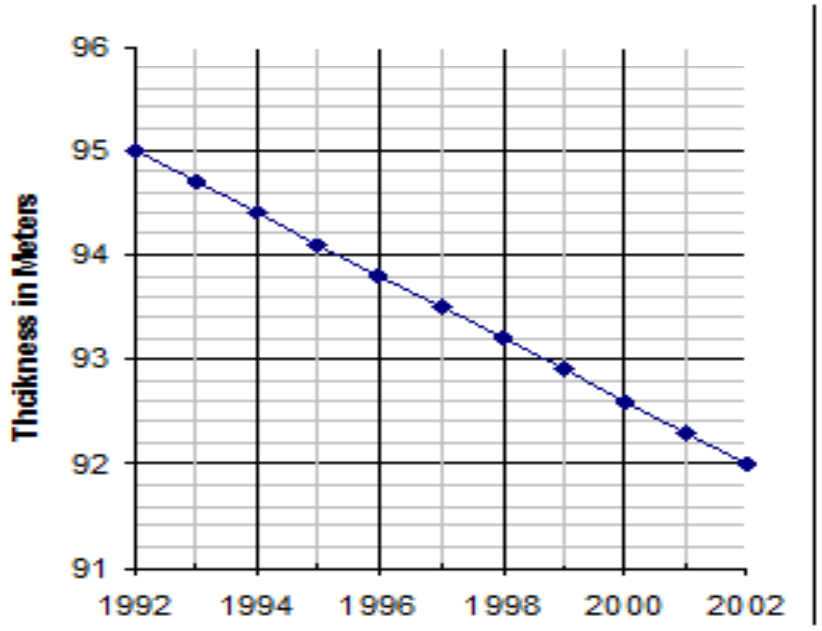
$\Delta H =$

Calculate the **average yearly change** in thickness, $\frac{\Delta H}{\Delta t}$, over that time interval. Give units with your answers.

b. The graph appears to be almost linear from 1992 to 2002. Read the graph to complete the table.

Year, t	Thickness, H
1992	
2002	

c. Calculate the slope of the graph from 1992 to 2002. Include units in your answer.



d. What does the slope tell us about glaciers?

ASAP Success Rate: Spring '08 – Spring '10

	Math 125 Success		
ASAP Status	Not Successful	Successful	Grand Total
ASAP	50	100	150
	33.33%	66.67%	100.00%
Non-ASAP (Alg 2)	2196	2502	4698
	46.74%	53.26%	100.00%
Total Count	2246	2602	4848
Total Proportion	46.33%	53.67%	100.00%

P-hat = 66.67% is significantly above P = 53.67% Z = 3.19 , alpha = .001

Note: The probability of a student making it through BOTH Algebra 1 and Algebra 2, regular format, is normally about 25 – 30%

Retention in ASAP: Spring '08 – Spring '10

ASAP Status	Math 125 Retention Not Retained	Retained	Grand Total
ASAP	22 14.67%	128 85.33%	150 100.00%
Non-ASAP	1015 21.60%	3683 78.40%	4698 100.00%
Total Count	1037	3811	4848
Total Proportion	21.39%	78.61%	100.00%

P-hat = 85.33% is significantly above the population
P = 78.61% Z = 2.01 alpha = .022

ASAP MET (Math Exit Test) Results for Algebra 2: Spring '08 – Spring '10

ASAP	**Average**	**53.3**
	S.dev.	**18.8**
	n = 126	
Non-ASAP Algebra 2	**Average**	**52.8**
	S.dev.	**18.2**
	n = 3439	

ASAP students covered Algebra 1 & 2 in 1 semester and did as well as Algebra 2 students

ASAP Success at Transfer Level

	Algebra 1			Algebra 2				Transfer Level			
	Enrolled	Successful	%	Enrolled	%	Successful	%	Enrolled	%	Successful	%
ASAP	463	325	70%	323	70%	288	62%	105	23%	55	12%
Non-ASAP	5314	3046	57%	1689	32%	1153	22%	494	9%	374	7%

MAP – **M**odeling with **A**lgebra **P**roject

- Algebra 2
- Features Directed Learning Activities
- Instructors minimize lecturing and encourage group work – (*try to get the students to do more work than you do!*)
- In-class tutor (funded by BSI funds)
- Next semester we'll add a 1-unit lab under an NGLC grant with CSUN

MAP materials

- Directed learning activities – “struggling” is a good thing
- Critical thinking stressed with real world problems and data
- Videos for skills problems
- Skills Practice problems and Reading Questions scored in computer system
- Concept questions with clickers
- New: Lab booklet for prerequisite skills

Activity 2 Slope and Linear Models

The taxi fare in three different cities is described below. In each city, you pay an initial charge when you get into the taxi, and then your fare is based on the distance you travel. Each city uses a different distance unit to compute the fare.

City	Initial Charge	Distance Unit	Charge per Unit
Boston	1.45	$\frac{1}{8}$ mile	0.30
Honolulu	2.25	$\frac{1}{4}$ mile	0.75
New York	2.50	$\frac{1}{5}$ mile	0.40

a. Compute the charge per mile in each city. (Do not include the initial charge.) In which city do taxis charge the highest mileage rate?

b. Write a linear model for the taxi fare in each city, using miles as the input variable. (**Hint:** What is the initial value for each model?)

c. In which city do taxis charge the lowest fare for a 5 mile ride?

d. For what distance are the taxi fares in Boston and New York equal? (**Hint**: Use the appropriate models from part (b).)

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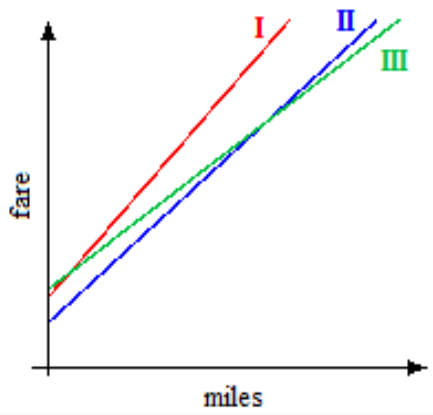
e. Choose the correct graph for each city.
Explain how you decided.

Boston:

Honolulu:

New York:



Lesson 24 Roots and Radicals

Activity 2 Heart Rate

An animal's heart rate is related to its size or mass, with smaller animals generally having faster heart rates. The heart rates of mammals are given approximately by the power function

$$H = f(m) = km^{-1/4}$$

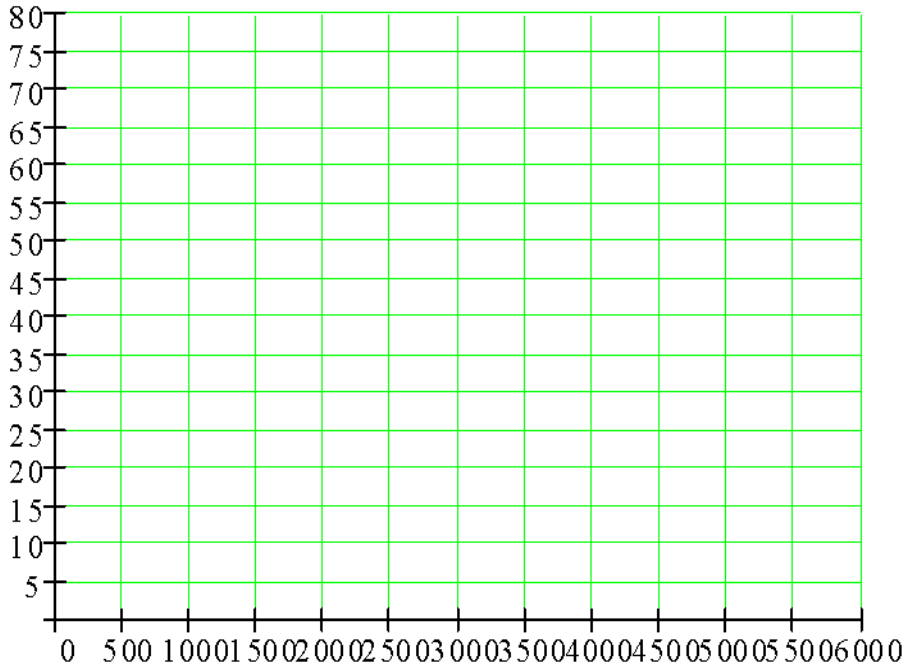
where m is the animal's mass and k is a constant.

a. A typical human male weighs about 70 kilograms and has a resting heart rate of 70 beats per minute. Find the constant of proportionality, k, and write a formula for H as a function of m.

b. Complete the table with the heart rates of the mammals whose masses are given

Animal	Cat	Wolf	Horse	Polar Bear	Elephant
Mass (kg)	4	80	300	800	5400
Heart Rate					

c. Sketch a graph of H for masses up to 6000 kilograms.



d. What would be the mass of a mammal whose heart rate is 40 beats per minute?

e. Write the formula for H using a decimal fraction for the exponent.

Write the formula for H using a radical.

Examples of Reading Questions

RQ3 What sort of variables can be described by a linear model?

a. Increasing variables

b. Variables that change at a constant rate

c. Variables that describe time

d. Variables that can be graphed

RQ3 Describe the intercept method of graphing.

a. Make a table of values and plot the points.

b. Extend the line until it crosses both axes.

c. Solve for y in terms of x.

d. Plot the points $(x, 0)$ and $(0, y)$ and draw the line through them.

RQ4 True or False.

a. The notation $f(t)$ indicates the product of f and t.

b. If $y = f(x)$, then $f(x)$ gives the value of the input variable.

c. If Q is a function of M, we may write $M = f(Q)$.

d. In the equation $d = g(n)$, the letters d, g, and n are variables.

RQ2 True or False.

a. An exponential function $f(x) = b^x$ is always positive.

b. The function $f(x) = ab^x$ has a horizontal asymptote at $y = 0$.

c. The value of b determines how rapidly the graph of $f(x) = ab^x$ increases or decreases.

d. The graph of $f(x) = ab^x$ is decreasing if $b < 0$.

Examples of Concept Questions

Lesson 11

1. What are the x-intercepts of the graph of $y = 3(2x - 7)(x + 2)$?

a. $\frac{7}{2}$ and -2

b. $-\frac{7}{2}$ and 2

c. 3, $\frac{7}{2}$ and -2

d. 3, $-\frac{7}{2}$ and 2

2. What happens to the x-intercepts when you multiply the right side of $y = ax^2 + bx + c$ by 3?

a. The are tripled

b. They are divided by 3

c. They move 3 units to the right

d. They are unchanged

3. If the perimeter of a rectangle is 56 inches and its width is x inches, what is an expression for its length?

a. $56 - x$

b. $28 - x$

c. $56x$

d. $\frac{28}{x}$

4. Which statement is true?

a. All rectangles with the same perimeter have the same area.

b. The solutions of $x(18 - x) = 80$ are $x = 80$ and $x = 18$.

c. If the perimeter of a rectangle is 20 cm, the largest area it can have is 20 sq cm.

d. If you know the x-intercepts of the graph of $y = x^2 + bx + c$, you can write it in factored form.

MAP MET (Math Exit Test) Results: Fall '09 – Spring '10

MAP Intermediate Algebra

Average =	64.23
St.Dev. =	16.93
n = 108	

The MAP mean of 64 is significantly higher than the Population mean of 53

z = 6.35

alpha= 0.00003

All Intermediate Algebra

Average =	52.621
S.dev.	17.851
n = 1533	

MAP Success and Retention
Fall '09 – Spring '10

- **MAP** success: 47% compared to 53% overall (under but not statistically significant)
- **MAP** retention: 71% compared to 78% overall (under but not statistically significant)
- **MAP** success at transfer level: 75% compared to 62.5% overall

What Works: ASAP

- Repeated material in elementary and intermediate algebra is eliminated
- Students focus intensively and exclusively on math
- Community building through SI and counseling support
- Student attrition over two semesters is diminished

What Works: MAP

- Reading Questions encourage students to read before coming to class
- Activities and Concept Questions engage students
- Focus on applications increases writing ability and critical thinking without detracting from mastery of skills (but it takes time!)

Challenges

- In students' view, traditional courses are "easier"
- Instructors need to learn new teaching styles and collaborate with colleagues
- Active learning is difficult when students are not level-ready
- More class time is spent on critical thinking activities, less on skills
- Holes in very basic conceptual understanding hamper ALL students more than lack of skills

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