University of San Diego

Rick Olson and Susan Lord



University of San Diego

Our Students

Typical of the rest of the University

- Fall 2009 USD SAT Avg Composite = 1190
- Fall 2009 Engineering SAT Composite = 1228
- Engineers Math scores higher
  - Min = 540 Avg = 645 Max = 750

First Math	# of Students	First Math Grade				
		A	B	C	D	F/W
College Algebra	1			1		
Calc I	32	10	9	10	2	1
Calc II	30	8	11	7	3	1
Calc III	14	6	6	1		1

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How We Fit Into CCLI

How can WSU's materials…

- Be used to supplement existing courses
- Complement tutoring performed by undergraduate students.

AY2008-09

- Establish an *Engineering Core Tutoring Center.*
- Tutors worked to identify the most common math difficulties

AY2009-10

- Offer two, one-unit, elective courses
- One in Fall, One in Spring

Track the usual measures

AY 2009-10 Activities

Two elective, one-unit, *Engineering Mathematics*

- Team taught by the PIs.
- No Labs.
- Based on the WSU materials, with less repetition.
- Emphasis on making the transition from a problem statement to the math equations.
- “Weekly” homework.
- In Class-Final.

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AY 2009-10 Activities

Fall semester

- Covered all of the general topics that were not calculus-based.
- 9 Students (3 Women, 1 Transfer)
- Students were placed in the class based on SAT math scores after the remaining part of their schedules were determined.

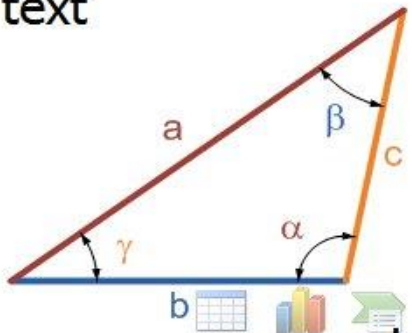
Spring semester

- Derivatives, integrals, and differential equations.
- Students self-selected the class. **All 3** were women.

Classes Use Active Learning

Law of Sines - Law of Cosines

- Click to add text



Law of Sines

$$\frac{\sin\alpha}{a} = \frac{\sin\beta}{b} = \frac{\sin\gamma}{c}$$

Law of Cosines

$$a^2 = b^2 + c^2 - 2bc\cos\alpha$$

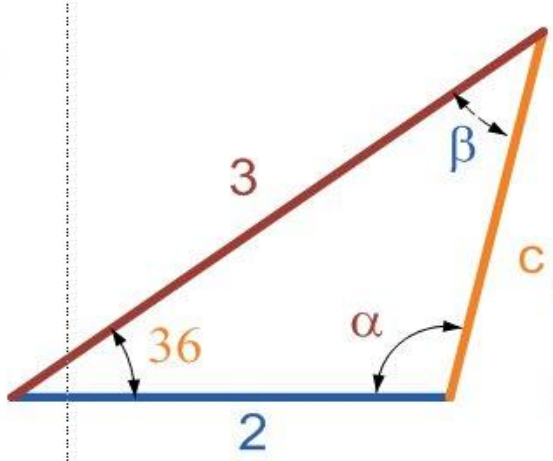
$$b^2 = a^2 + c^2 - 2ac\cos\beta$$

$$c^2 = a^2 + b^2 - 2ab\cos\gamma$$

Notice the relationships between the geometry and the terms in the formulas. Be able to fill in known terms and identify the unknown ones.

Classes Use Active Learning

When you have a triangle with some lengths or arcs known, you can use the Law of Cosines and Law of Sines to find missing information



1) Use Law of Cosines to find length of side c.
2) Then use Law of Sines to solve for angles.

- Use the Laws to determine all angles, then make sure $\Sigma=180$.
- May need insight to realize an angle is > 90°.

$$c^2 = 3^2 + 2^2 - 2(3)(2)\cos 36 \quad \Rightarrow \quad c = 1.81$$

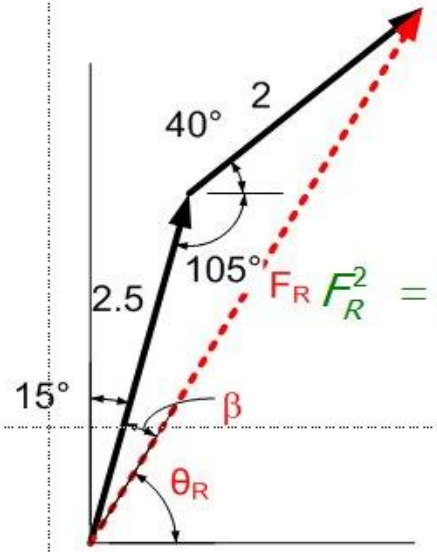
$$\frac{\sin 36}{1.81} = .325 = \frac{\sin\beta}{2} = \frac{\sin\alpha}{3}$$

$$\beta = \arcsin(2 * .325) = 40.5$$

$$\alpha = \arcsin(3 * .325) = 103 \text{ or } 77 \quad 103 \text{ since it's} > 90$$

Classes Use Active Learning

- Begin by drawing a complete sketch with all the known and unknown angles.
- Try to think about places you might use Law of Sines, Law of Cosines, or other relationships.



1) Find F_R using Law of Cosines:

a = FR b = 2 c = 2.5

α = 145

$F_R^2 = 2^2 + 2.5^2 - 2(2)(2.5)\cos(145) \Rightarrow F_R = 4.29N$

2) $\theta_R = 90 - 15 - \beta$

Use Law of Sines to find β:

$$\frac{\sin\beta}{b} = \frac{\sin\beta}{?2} = \frac{\sin\alpha}{a} = \frac{?\text{Sin } 145}{?4.295}$$

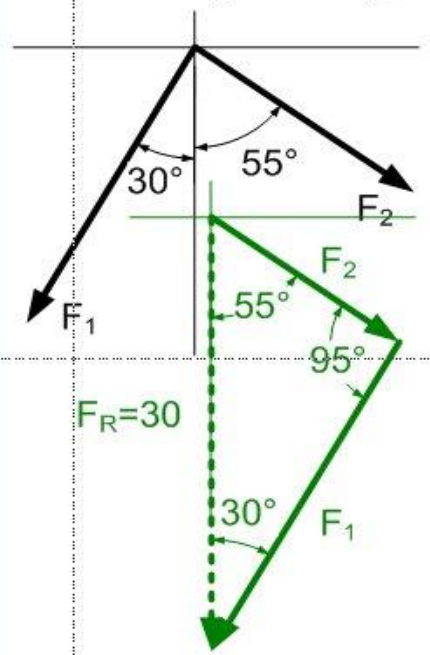
$$\beta = 15.5°$$

$$\theta_R = 90 - 15 - 15.5 = 59.5°$$

Classes Use Active Learning

Example 1

- You need the resultant of F_1 and F_2 to be a 30 lb force pointing straight down. What are magnitudes of F_1 and F_2?



- Draw the diagram, then identify the known and desired information.
- What are a, b, c, β, α, γ?
- Which Law(s) do you needed?

$$\frac{\sin 55}{F_1} = \frac{\sin 30}{F_2} = \frac{\sin 95}{30} = .0332$$

$$F_1 = \frac{\sin 55}{.0332} = 24.67lb$$

$$F_2 = \frac{\sin 30}{.0332} = 15.06lb$$

Did They Learn?

	Pre-Test	Post-Test
Fall Semester	47.6%	94.1%
Spring Semester	47.9%	95.0%

91% “increased my chances of success in engineering”.

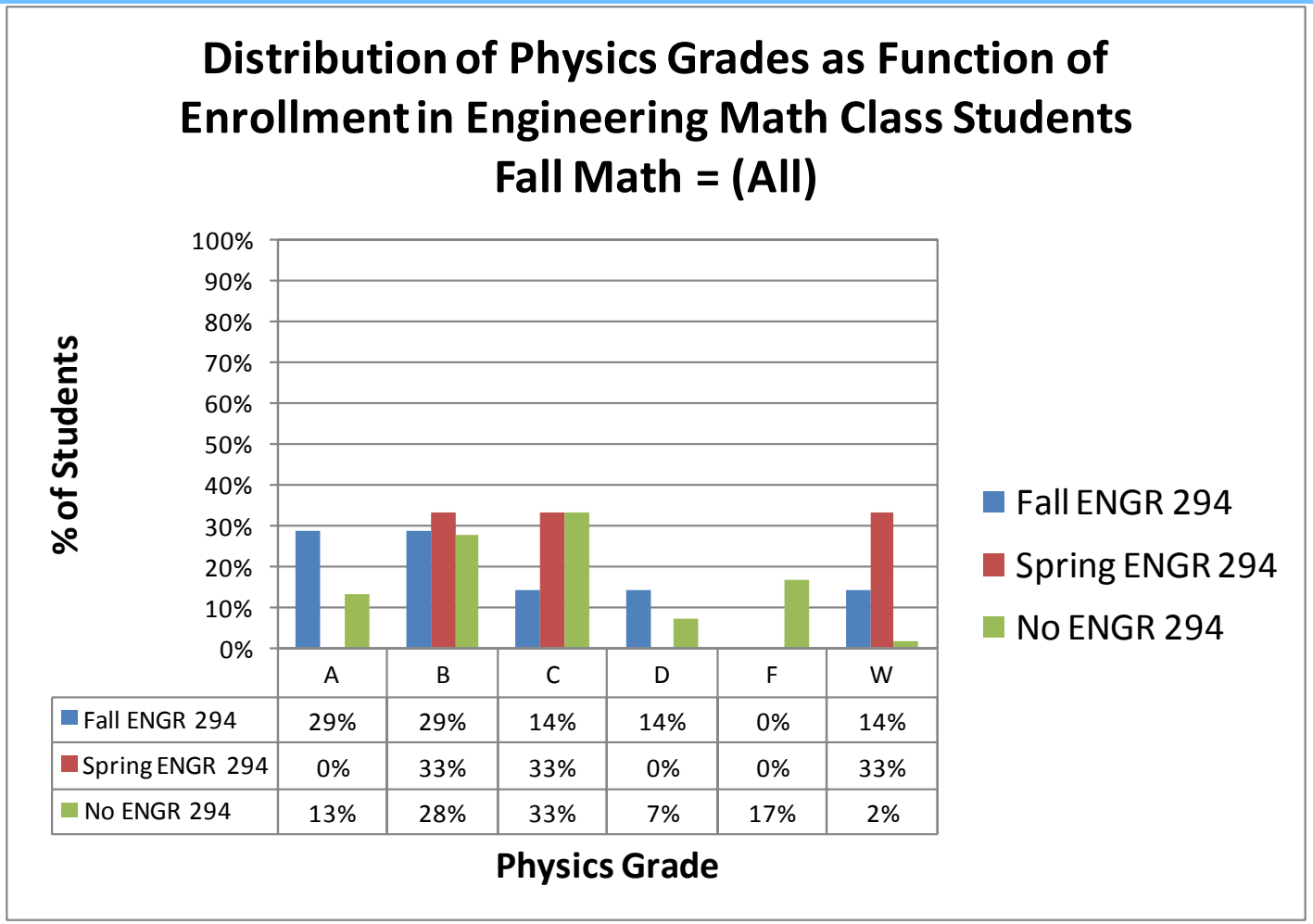
73% “increased my motivation to study engineering”

73% “increased my chances of success in future math courses.”

36% “increased my motivation to study math.”

Some students in the fall semester commented that a longer class, or two sessions/week might have been desirable.

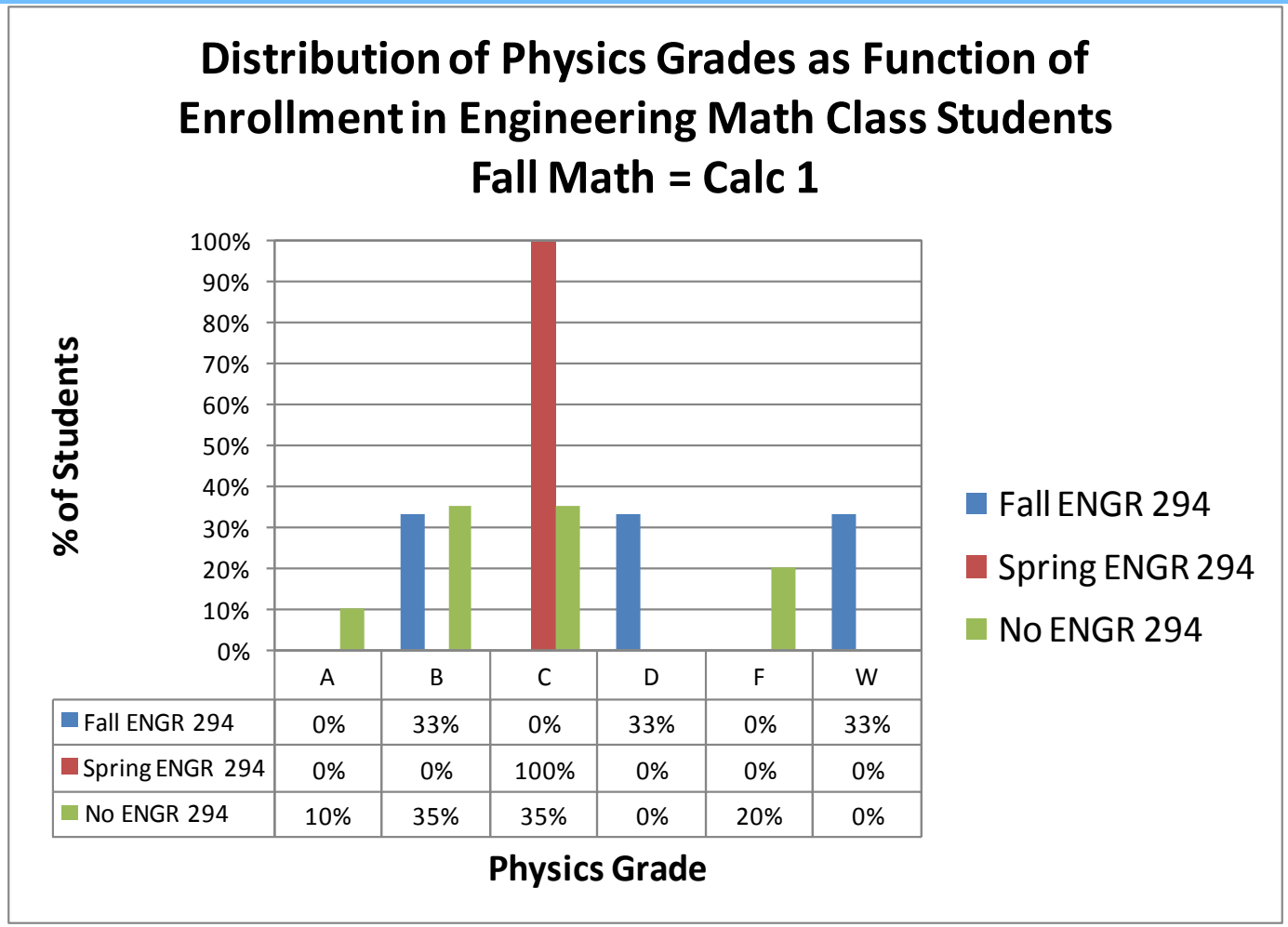
Did It Help with Physics?



	A	B	C	D	F	W
Fall ENGR 294	29%	29%	14%	14%	0%	14%
Spring ENGR 294	0%	33%	33%	0%	0%	33%
No ENGR 294	13%	28%	33%	7%	17%	2%

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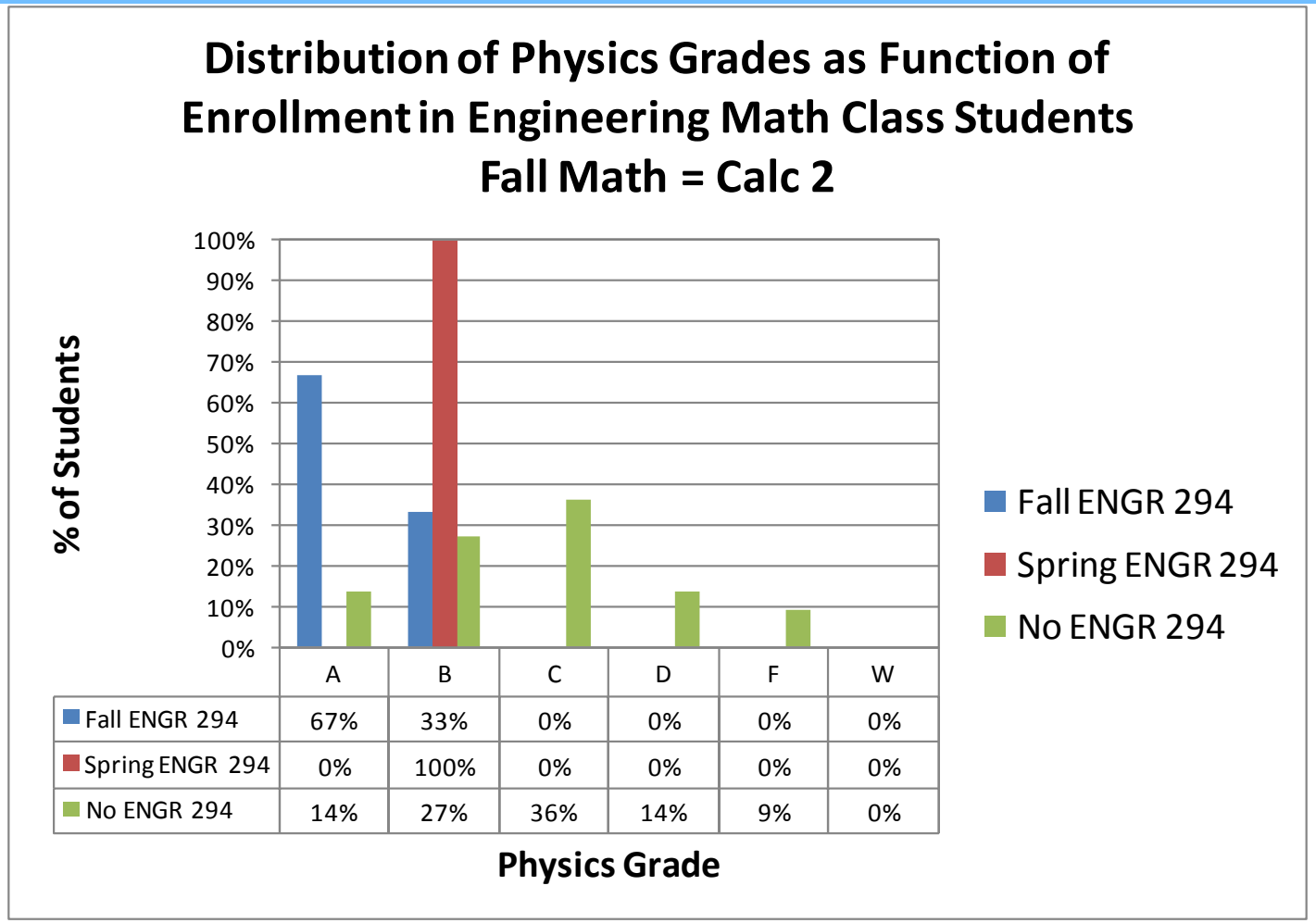
Did It Help with Physics?



	A	B	C	D	F	W
Fall ENGR 294	0%	33%	0%	33%	0%	33%
Spring ENGR 294	0%	0%	100%	0%	0%	0%
No ENGR 294	10%	35%	35%	0%	20%	0%

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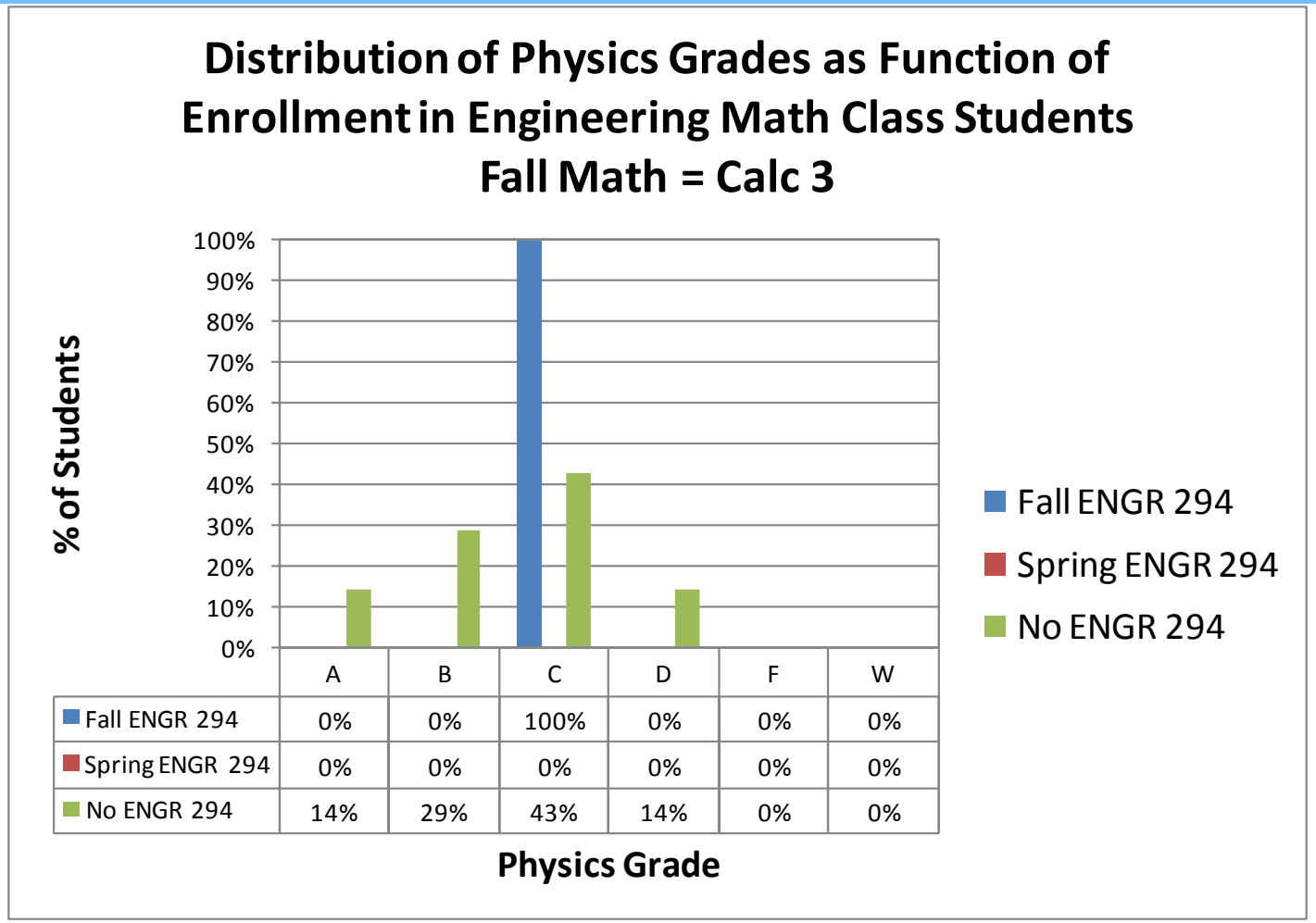
Did It Help with Physics?



	A	B	C	D	F	W
Fall ENGR 294	67%	33%	0%	0%	0%	0%
Spring ENGR 294	0%	100%	0%	0%	0%	0%
No ENGR 294	14%	27%	36%	14%	9%	0%

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Did It Help with Physics?



	A	B	C	D	F	W
Fall ENGR 294	0%	0%	100%	0%	0%	0%
Spring ENGR 294	0%	0%	0%	0%	0%	0%
No ENGR 294	14%	29%	43%	14%	0%	0%

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Did It Help With Retention?

60% of the students enrolled in ENGR 294 in fall 2009 will remain in engineering in fall 2010.

Typical first semester and first year retention rates at USD are approx. 80%, and 65%

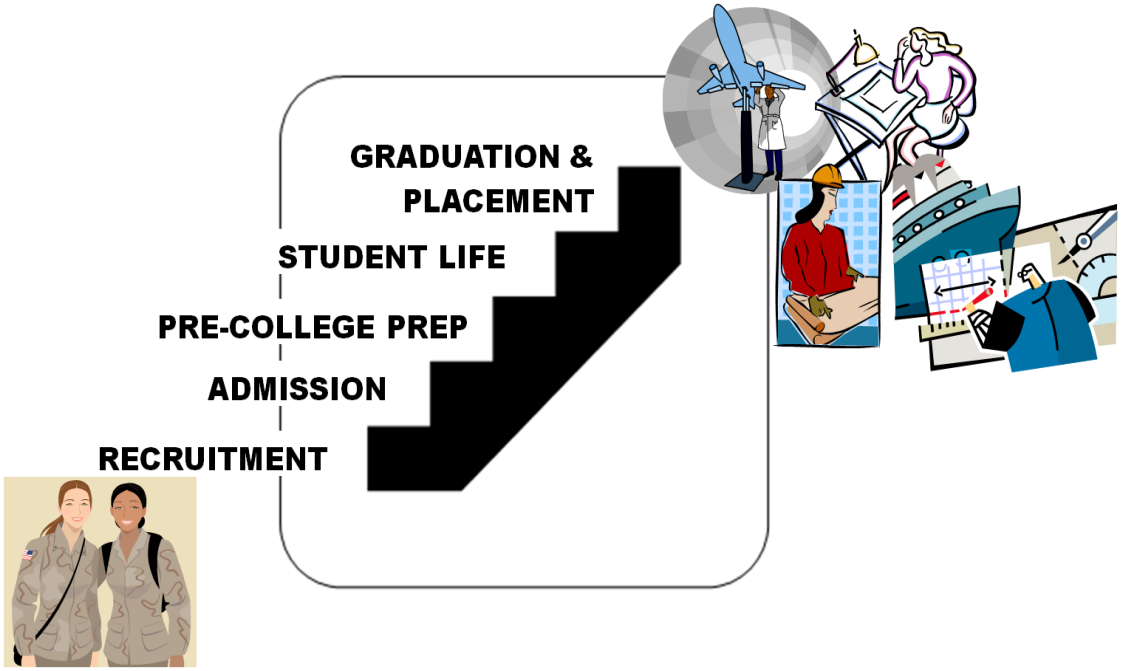
What's New For AY 2010-11?

1) Approximately 20 students will be in ENGR 294 in fall 2010.
2) Linear and quadratic equations and differential equations material will be removed from ENGR 294.
3) The remaining topics will be included in a one-semester course.

   This course may be offered in spring 2011 if the demand is sufficient.

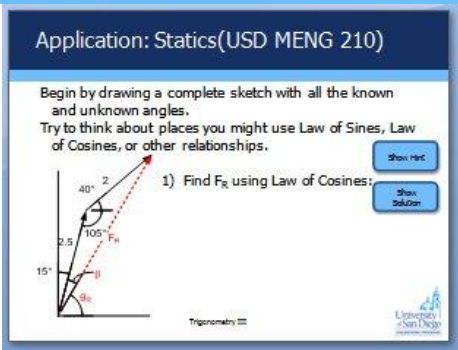
An Unexpected Outcome…

"Connecting Veterans to Customized Engineering Education at the University of San Diego" - NSF Grant 0948070

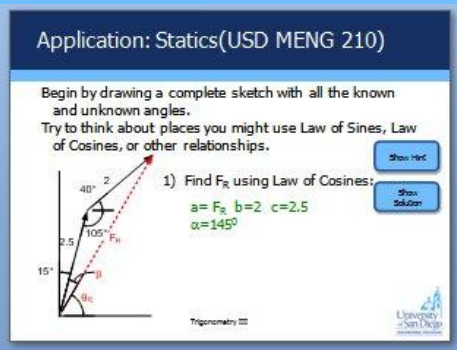


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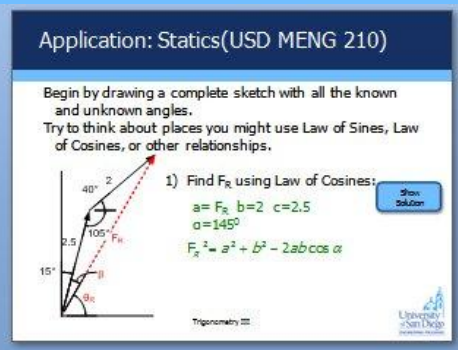
Self-Paced Materials for On-Line Use



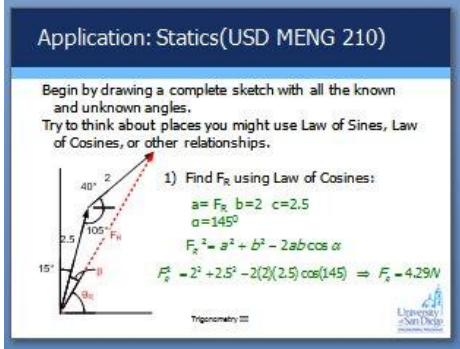
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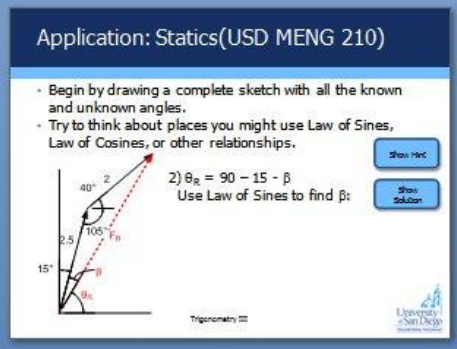
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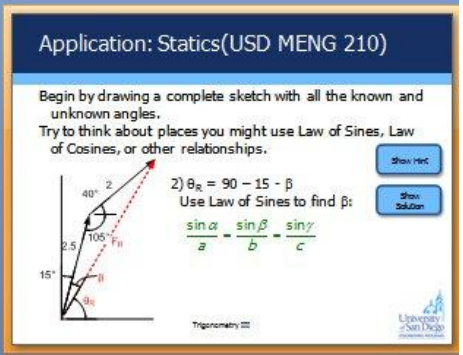
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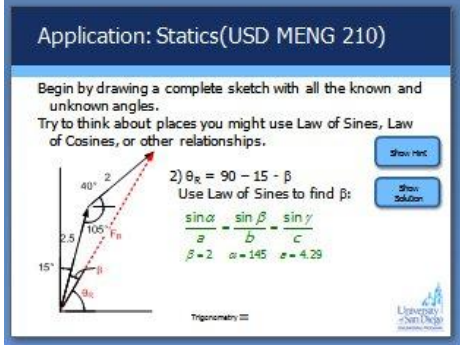
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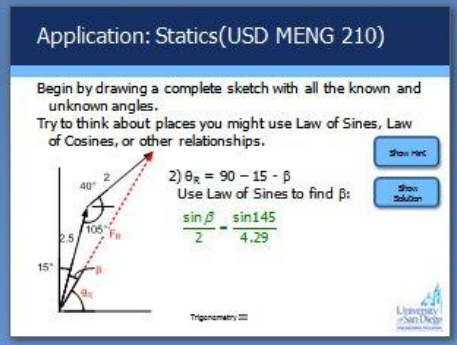


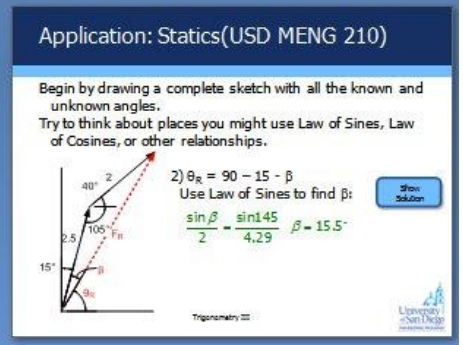
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18







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