

Calculus I: Move the Curriculum

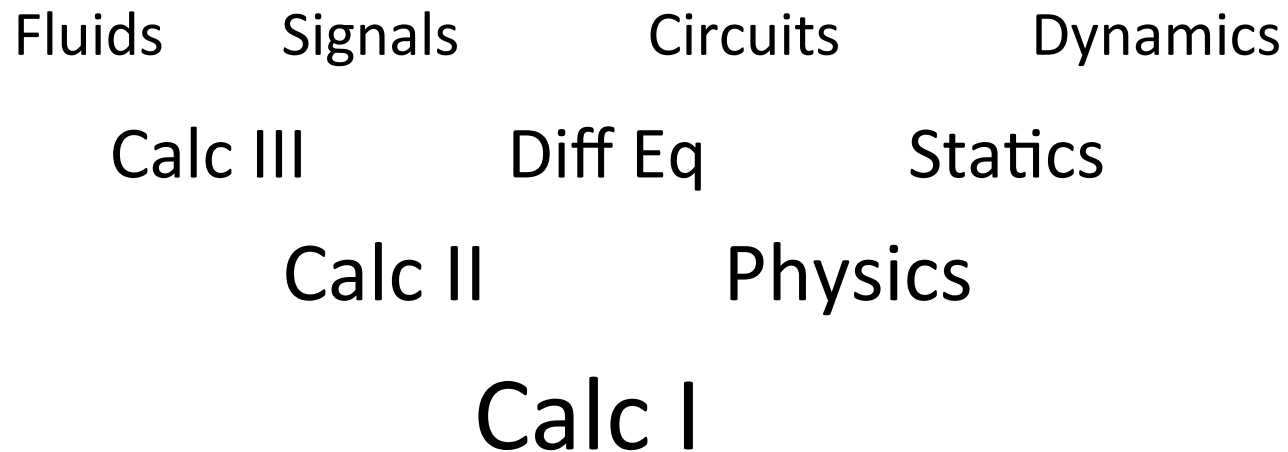
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Curriculum Tower



Calculus I is usually considered foundational

NEMC (the view from Idaho)

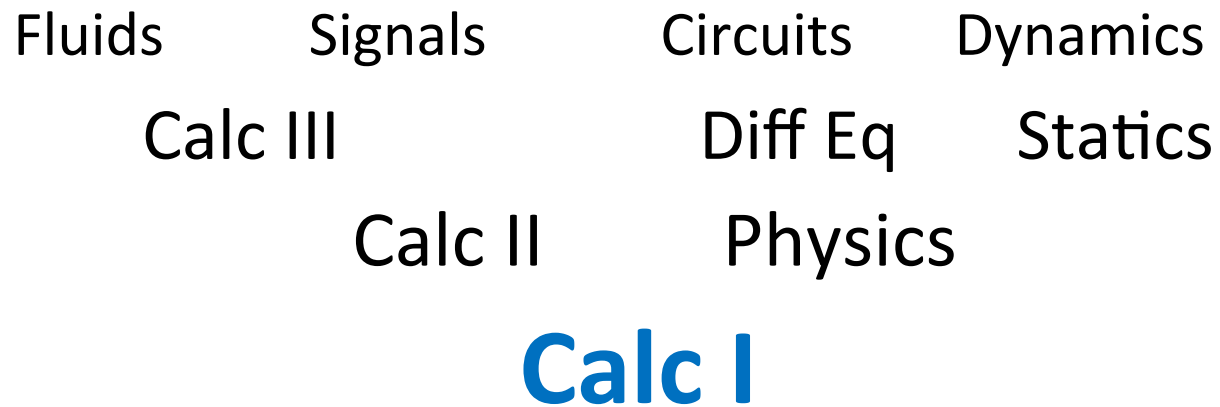
Wright State Engineering Mathematics becomes the/an entry point.

~~Fluids~~ ~~Signals~~ ~~Circuits~~ Dynamics
~~Calc III~~ ~~Diff Eq~~ Statics
~~Calc II~~ Physics
EGR 101

Delay Calc I. Large retention and grad. rate gains.

Goal

Have both!



You will need a new Calculus I curriculum.

Why?

- No additional credit hours.
 - BSU has used NEMC.
 - Could not add credits, so replaced Intro to Eng.
 - Tensions and compromise.
- Strong Engr + Math partnership.
- First step towards revision of Calc II, etc.

How?

New Calculus Curriculum Principles:

- Use only data sets and continuous models selected from actual physical models.
- Every problem has units.
- All conceptual or theoretical content motivated by application to these models and data sets.
- Use notation, language and conventions of the disciplines from which the models are taken.
- Content will be relevant, recognizable, and applicable in subsequent STEM coursework.
- Content will be accessible from an intuitive or practical viewpoint.

A Classical Example

- Synthesis level Calculus question:

Differentiate $\sin(\cos(x \tan(x)))$

- Basic Knowledge
 - Derivatives of sine, cosine, tangent, x .
 - Product Rule. Chain Rule
- Synthesis features:
 - Basic knowledge elements are used in combination in a strategic order.
 - Cognitive load stresses retention and application of basic knowledge.

BSU Calculus I Exam Question

The height of a falling object is given by

$$h(t) = 1000 - 44.2t - 170e^{-.26t}$$

where h is in meters and t is in seconds. How high is the object at the instant its velocity is -35 m/s?

Question Elements

- Basic knowledge:
 - Basic derivative rules
 - Reading comprehension
 - Concept: derivative measures velocity
 - Extract output of a function (Plug-and-chug)
 - Given function output, solve for input.
- Synthesis: Use all of the above in a strategic order.

Results at BSU

- Voluntary buy-in has reached nearly 100%
 - Exceptions are honors and some extended campus offerings
 - Too much buy-in?
- Pass Rate gains; approx 8-10% bump.
- Instructors, students and clients all pleased.
- Shorter prereq chain (co-reg Trig).
- New Calc I is still a suitable prereq for Calc II.
(Lots of data to support this.)

Next Steps

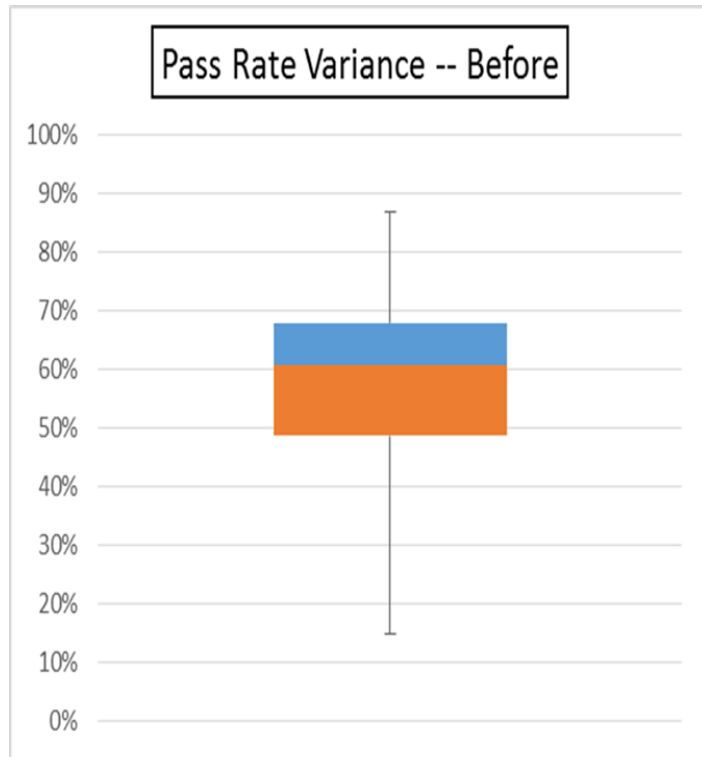
- Data analysis:
 - Retention effects
 - Demographic breakdown
 - Impacts on downstream courses other than Calc II
- Rewrite Calc II. (This is harder!)
 - Principles harder to apply.
 - Greater resistance from traditional viewpoint.
 - Calc II content intrinsically discordant.
 - No content model from Wright State

Thank You!

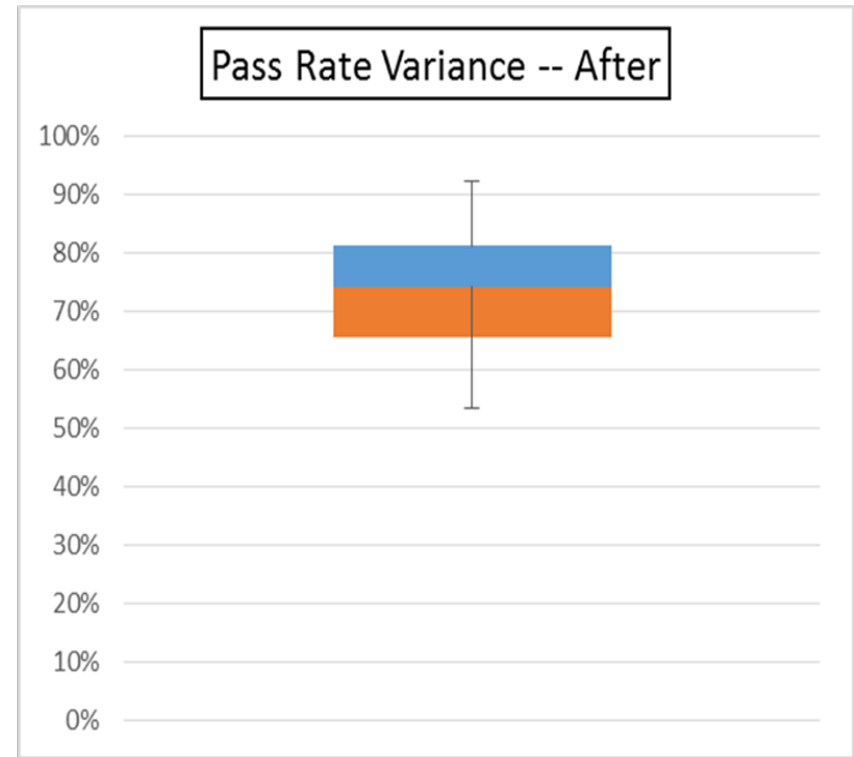
Questions?



Before: 60% Pass



After: 73% Pass



distributed load moment 6 (3236754)

Test / Preview

Code

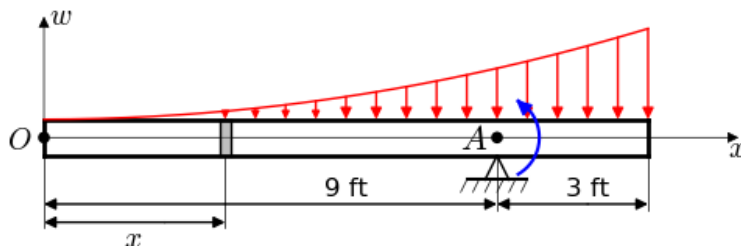
Previewer Tools

[Show New Randomization](#)[Open in Editor](#)[Print](#)Show: [All](#), [None](#) ☐ Key ☐ Solution ☐ Help/Hints ☐ Mark☐ Answer Format Tips

A 12 foot beam carries a distributed load of

$$w(x) = 2x^2 \text{ lbs/ft}$$

where x is the distance in feet from the left end of the beam.



On your own paper, write an integral for the total moment about A. Compute your integral.

$$M_A = \boxed{}$$

Which way will the beam tip?

- ☐ Clockwise
- ☐ Counter-clockwise
- ☐ Neither. The beam is perfectly balanced.

Question Details

Name (QID): distributed load moment 6 (3236754)

Usable/Draft: Usable

Locked: Yes

Mode: Numerical, Multiple-Choice

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Group: BSU Calculus

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