

Work in Progress – Enhancing On-Line Interaction with Graphical Tools

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Work in Progress - Enhancing On-Line Interaction with Graphical Tools

Abstract - A limitation in many on-line interaction systems (discussion boards, wikis, chat rooms, etc.) is the lack of graphical tools. When using these types of systems to provide asynchronous help for engineering classes, the lack of integrated graphical tools ignores the need to communicate with sketches and equations. Due to the nature of the material and the limitations of current technologies, students tend to work in a mixed- mode environment. That is, they will work out their solutions to problems on paper, and then they have to duplicate or describe their work in a text only mode when they go on-line for assistance. The requirements, design, and implementation of a prototype system for allowing students to seamlessly integrate images, sketches, and equations along with text in on-line discussion board environment is described.

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UT Engineering - Common First Year Curriculum



Fall Semester

- English 101 (3)
- Math 141 (4)
- Chemistry 120 (4)
- EF 151 Physics for Engineers I (4)
- EF 105 Computer Methods in Engineering Problem Solving (1)

Spring Semester

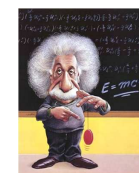
- English 102 (3)
- Math 142 (4)
- EF 152 Physics for Engineers II (4)
- Department Option

3

Courses Taught By Engineering Fundamentals

EF 151 Physics for Engineers I (4)

- Co-requisite is Calculus I
- Fall 2011 Enrollment: 413
 - 80 additional students in Honors
- Spring 2011 Enrollment: 136



EF 152 Physics for Engineers II (4)

- Fall 2011 Enrollment: 114
- Spring 2011 Enrollment: 324

EF 105 Computer Methods in Engineering Problem Solving (1)

- Co-requisite with EF 151

EF 230 Computer Solution of Engineering Problems (2)

- Taken by about half the departments
- Matlab



EF 402 Fundamentals of Engineering (1)

- Review of morning portion of FE exam
- Taken by most departments

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EF 151 and EF 152 Physics for Engineers I & II

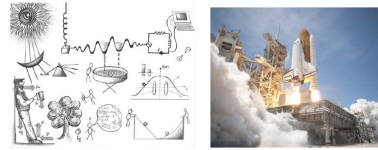
Physics

EF 151

- Vectors and 1D Motion
- 2D Motion; Forces
- Conservation of Energy and Momentum
- Rotational and Rigid Body Motion

EF 152

- Statics and Fluids
- Harmonic Motion, Sound, Waves
- Thermodynamics
- Electricity and Magnetism



Engineering

Communication

- Written reports
- Oral presentations
- Engineering calculations

Team Skills

- Numerous small projects
- Large end-of-semester project

Design

- Open-ended design problems

Introduction to Disciplines

- Overview of all Departments
- Departmental fair

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Lectures

- All students in one lecture hall
- Meet 3 times a week, MWF
- Team Taught
 - Two instructors
 - One talks, one writes/comments
 - Interaction and conversation
 - Streamlines use of technology
- Personnel Response System
 - Immediate Feedback
 - Part of grade
 - Encourage participation and thought
- Lectures are recorded
 - Available online
 - Includes video and screen contents
 - Indexed



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Recitations

- Meet twice a week, 75 minutes
- 24 - 28 students per section
 - Students sit at tables of 4
 - White boards at each table to facilitate collaborative learning
 - Teams assigned; 1 person from each quartile
 - New teams every 3 weeks
- Led by Graduate Teaching Assistants
 - Trained by faculty
 - Weekly planning meetings
 - Faculty drop into recitations
- Variety of activities
 - Problem solving
 - Labs
 - Demonstrations
 - Team projects



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Custom Course Management System

THE UNIVERSITY OF TENNESSEE **ENGINEERING FUNDAMENTALS**
KNOXVILLE

UT | A-Z | CDE | EF | Tmail | Voicemail | BlackBoard | MyUTK | Search | People | go

EF152 Fall, 2011

Physics for Engineers II

- Announcements
- Calendar
- Syllabus
- Instructors/GTAs

Resources

- General Info
- Procedures/Forms
- On-line Notes
- On-line HW
- Resources
- Team Projects
- Exam Information
- Discussion Board
- Help Sessions
- EF 151 - Spring, 2011

User: wachlele

- Control Panel
- Student Lists
- Grade Entry
- Grade Stats
- Edit page
- Browse
- Logout

- Public/private model – promotes sharing of resources
- Announcements, course materials, calendar
- Parameterized homework **with graphical notes**
- Discussion board with links to individual homeworks
- Student lists, background info, photos, notes
- Gradebook – flexible, one course – multiple sections
- Feedback / surveys / forms
- Exam archives
- Fully usable on tablets / phones
- Full archival and availability of previous semesters
- Team assignments – tracking
- On-line rubrics
- Searchable programming examples library

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Web-based Homework System

rbennet2 - On-Line HW 4.1-2

Current time: Fri Mar 6, 09:11:40
Deadlines:
Full credit: Tue Feb 24, 23:59
75% credit: Fri Mar 6, 23:59
50% credit: Mon Apr 27, 23:59

Clicking here takes students directly to our discussion board, and filters for only posts on this problem.

10% bonus: completed early
75% credit: if completed by module exam
50% credit: if completed by end of semester.

Students can type equations/notes here. EF staff view notes when providing help. Students can also upload images, e.g. pix text

Check out the vacuum tubes
http://dvice.com/archives/2008/04/top_ten_ways_to.php

Built-in calculator

2% penalty for each wrong answer to encourage students to think about answer.

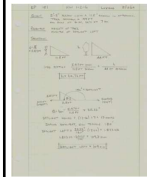
Try history can be reviewed to see errors (e.g. sign error).

Part Description Answer Chk History

A. What is the intensity of the sound from a speaker connected to Prof. Schlater's amp 3.5 m from the speaker? (W/m²) 6.25 pts. 0 hints 2% try again

B. What is the sound level in decibels at 3.5 m from a speaker connected to Prof. Schlater's amp? (10.2 db) 6.25 pts. 0 hints 2% try again

Portfolios
Students also have to write out problems on engineering paper; receive a grade based on format



Spring 2011: 161,539 tries 88,990 correct answers 274 punts

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Support for EF courses

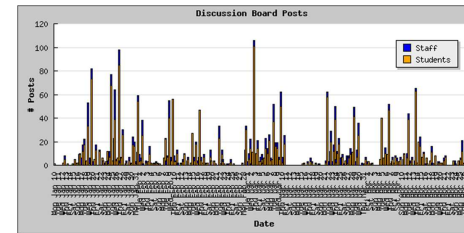
Help Sessions

Several evenings per week; answers to individual questions



Discussion Board

Available 24/7; monitored at specific times



EF 152, Spring 2011

657 questions
2418 answers
78,924 page views

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Discussion Board

Search for schw32-3 in the last 1 days with Category: All Pic Size: Pending: Go

Quick search: Recent Unanswered

SH H jbarry2 Wed 10/12 23:52 I D schw32-3: Part C. My starting equation is $(1/2)mv^2 = mgh + E(\text{loss})$, so when I plug it in I have $3,298,748.93$ (KE from part a) $= (22,000)(\sin(14)) = 3600$. Then I solve for h in my calc solver and get 416.338, then I divide by 5280 to get miles, what am I doing wrong??

H Anon Thu 10/13 0:04 do you have to use the solver?

H jbarry2 Thu 10/13 0:33 I don't think so, I just find it easier

H tsm1139 Thu 10/13 13:12 I used the same equation however your $E(\text{loss}) = 0$ and I used $mgh = 1/2mv^2$ and solved for h in terms of feet alone (making sure to divide by 32.2 to get a mass) then I converted it to miles, then you can relate the height to the distance up the ramp by using $\sin(\theta) = h$ and solve for d

H tsm1139 Thu 10/13 13:14 oh sorry I thought you were doing b haahh my bl

H rbennet2 Thu 10/13 15:19 jbarry? Not sure if it was a typo, but the friction force is 3600 pounds. Other than that, it is correct.

H jbarry2 Today 0:05 Oh my. I copied it wrong, go figure! thank you

Add a response... Mark as answered

SH H Anon Wed 10/12 19:02 I D schw32-3: when you use trig, do you the weight(sin/cos) ?

H Anon Wed 10/12 23:36 Nvm I figured it out

H amcintu1 Thu 10/13 23:39 what equation did you use anon?

Add a response... Mark as answered

SH H esander Wed 10/12 18:00 I D schw32-3: Getting it wrong on part A because you don't use the 10^{-n} function (e) doesn't seem fair. My answer was a little over 5 million, so I put it in as 5000000 (rounding a little, not my exact answer) and it counted it wrong, but then as 5e6 was right. There should be some sort of warning about the notation to answer that problem.

H rbennet2 Wed 10/12 18:05 You entered 50000000 not 5000000. So you tried a little over 50 million, not a little over 5 million. That is why it was counted wrong, not because of the format of the number.

H esander Wed 10/12 18:15 Huh. I guess I have happy keyboard fingers punching in extra zeroes. Nevermind.

Add a response... Mark as answered

SH H magdaboz2 Wed 10/12 16:22 I D schw32-3: I don't know what I am doing wrong in part a. I converted tons to pounds by multiplying by 2000. I then divided by 32.2 to convert to slugs. I converted the speed to feet per second and squared it. I plugged all that into $KE = (1/2)mv^2$ and I keep getting a rather large wrong answer! any suggestions?

H jmkcn1 Wed 10/12 16:53 If you actually squared your speed before you plug it into the KE equation then you will get a rather large answer. Convert your mph to fps and then use $KE = (1/2)mv^2$. (only square your speed once it is plugged into the equation.)

H jmkcn1 Wed 10/12 16:54 your answer will still be rather large though something on the power of 8 ex 1.31e8

H gassid Wed 10/12 16:59 for part c, do you just plug the given force opposite direction into your Eloss part of your equation?

H jmkcn1 Wed 10/12 17:03 for part b how do you use trig to find the elevation. I found the y-component of velocity using $\sin(\theta)$, but that doesn't tell me the final height the truck stops at, only the height per second. And then will I use the projectile motion equation?

H esander Wed 10/12 19:23 Part B is getting really frustrating. Someone tell me if I'm way off base here.

$(1/2)(22000/32.2)(123.2)^2 = (22000)(\sin(26))$

First one is initial kinetic energy, no potential energy since it's going up, no work $W_{fr} = 0$ no final kinetic energy, no energy loss and my (mg) is 11 tons and my height is $\sin(26)$, distance covered would be x. Right? Well apparently not.

H pccrum Wed 10/12 22:26 What worked for me was using the conservation of mechanical energy equation. A lot cancels out to zero and I got $5mv^2 = mgh$. I solved for final height. I kept everything in feet and converted afterwards.

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Sample On-Line Homework

Deadlines:
110% credit: Thu Oct 13, 2011 23:59
100% credit: Fri Oct 14, 2011 23:59
75% credit: Sun Oct 16, 2011 23:59
50% credit: Sat Oct 29, 2011 23:59
50% credit: Wed Nov 30, 2011 23:59

Show Solution Find Find Next Edit mode Clear View all Setup Utilities Reset Quiz Reset Quiz (test values) Reset Answers

Test/Question ID/Problem Set: 132/736/0

3. Notes/Calcs: Save Params $^{**}/$

A 32 ton truck loses its brakes and reaches the bottom of a hill with a speed of 60 mph. Fortunately, there is a runaway truck ramp which is inclined at angle of 10 degrees to the horizontal.

Calc: Calc All Calculator help JS solution: Get Save Manage Note Images

Part	Description	Answer	Chk	History
A.	Determine the kinetic energy of the truck just before it starts up the runaway truck ramp. (ft-lb)		8.33 pts. 100% 1 hint 2% try penalty punt	Clear tries and answer

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Getting the Pictures . . . Setup

EF Note Image Manager

Current Files associated with !hw 3-2-3 for wschlete

Selected image(s): Delete

Refresh the Page OR Return to the previous page OR Admin Browse

Loading Files

- Create a new sketch (svg file)
- Send a pix message or email with attachment to **EF151@ef.engr.utk.edu**. Include **!hw 3-2-3** in the subject or body of the message. [Getting set up to send images to the web site.](#)
- Webfolder - send a pix message or email with an image attachment to **EF151@ef.engr.utk.edu**

No webfolder files available.

From local file:

Browse...

Load from local file

From URL:

Load from URL

Device Registration

EF Mail Manager

This utility facilitates the texting and/or emailing of images to the EF web site. To make this work, you must register your account as follows.

- Use the desired source to send a message to the address **EF151@ef.engr.utk.edu** with the subject **!reg wschlete**. This tells the system that you want image attachments to messages from this source to be stored in your EF web folder.
- After sending the registration message, you should see an entry in the list below with the status of 'pending'.
- Use this page to enable the entry.
- After this is done attachments to messages from the source will be stored in your [EF web folder](#) where they will be accessible from the ef web site utilities.

NetID	Email	Status	Action				
wschlete	wschlete@utk.edu	Enabled,Confirm On	Disable	Enable	Block	Delete	Confirm Off
wschlete	wschlete@gmail.com	Enabled,Confirm On	Disable	Enable	Block	Delete	Confirm Off
wschlete	8653842813@mms.att.net	Enabled,Confirm On	Disable	Enable	Block	Delete	Confirm Off

Adjusting Pictures . . . More Open Source
JCrop and ImageMagick

Image Editor

convert -rotate -90 /www/c/ef151-2011-08/dropbox/webfolder/wschlete/hw/3-2-3-truck.jpg /www/c/ef151-2011-08/tmp/IE_AQ1ZQ1.1; chmod 755 /www/c/ef151-2011-08/tmp/IE_AQ1ZQ1.1;

Original Image: dropbox/webfolder/wschlete/hw/3-2-3-truck.jpg

Current Image: tmp/IE_AQ1ZQ1.1

Rotate

CCW 180 CW

Crop - specify crop area on the image

Crop Image

Size: 1296 x 968 pixels

49 %

Resize

Brightness,Saturation,Hue

0 0 0

Adjust

Convert to

jpg png

Other ImageMagick Operations

Other

Undo Redo

Save Save As New Cancel

15

Picture Associated with Homework

p75% credit: Sun Oct 16, 2011 23:59

75% credit: Sat Oct 29, 2011 23:59

50% credit: Wed Nov 30, 2011 23:59

Show Solution

Find Find Next

Edit mode Clear View all Setup Utilities Reset Quiz Reset Quiz (test values) Reset Answers

Test/Question ID/Problem Set: 132/736/0

A 32 ton truck loses it brakes and reaches the bottom of a hill with a speed of 60 mph. Fortunately, there is a [runaway truck ramp](#) which is inclined at angle of 10 degrees to the horizontal.

Notes/Calcs:

Save Params f * *

Calc

Calc All

Calculator help

IS solution: Get Save

edit annotate Manage Note Images

Part	Description	Answer	Chk	History
1	Determine the kinetic energy of the truck just before it starts up the runaway truck ramp.		8.33 pts. 100%	Clear trace and

16

Picture Associated with Homework

9/75% credit: Sun Oct 16, 2011 23:59
75% credit: Sat Oct 29, 2011 23:59
50% credit: Wed Nov 30, 2011 23:59


Show Solution

Find Find Next

Edit mode Clear View all Setup Utilities Reset Quiz

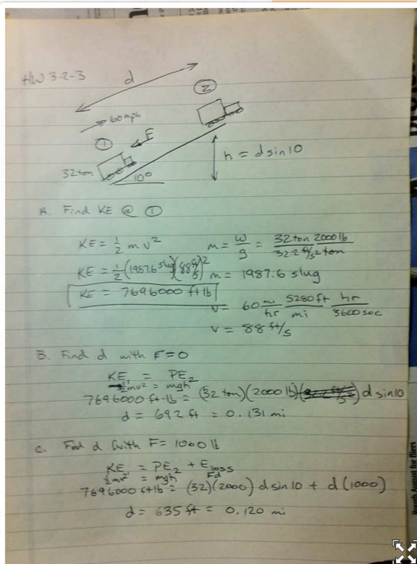
Test/Question ID/Problem Set: 132/736/0

3.



A 32 ton truck loses its brakes and reaches the bottom of a horizontal. Fortunately, there is a runaway truck ramp which is inclined horizontal.

Part	Description	Answer
	Determine the kinetic energy of the truck just	



Handwritten solution for problem 3:

A. Find KE @ ①

$$KE = \frac{1}{2}mv^2$$

$$m = \frac{W}{g} = \frac{32 \text{ ton} \cdot 2000 \text{ lb}}{32.2 \text{ ft/s}^2} = 1987.6 \text{ slug}$$

$$KE = \frac{1}{2}(1987.6 \text{ slug})v^2$$

$$KE = 7696000 \text{ ft} \cdot \text{lb}$$

$$v = 60 \frac{\text{mi}}{\text{hr}} = \frac{5280 \text{ ft}}{1.609 \text{ km}} \cdot \frac{1 \text{ hr}}{3600 \text{ sec}} = 26.8 \text{ m/s}$$

B. Find d with $F=0$

$$KE = PE$$

$$7696000 \text{ ft} \cdot \text{lb} = (32 \text{ ton}) \cdot (2000 \text{ lb}) \cdot d \sin 10^\circ$$

$$d = 692 \text{ ft} = 0.131 \text{ mi}$$

C. Find d with $F=1000 \text{ lb}$

$$KE = PE + E_{\text{spring}}$$

$$7696000 \text{ ft} \cdot \text{lb} = (32)(2000) d \sin 10^\circ + d(1000)$$

$$d = 635 \text{ ft} = 0.120 \text{ mi}$$

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Getting the Pictures . . . Sketching

EF Note Image Manager

Current Files associated with !hw 3-2-3 for wschlete

Selected image(s):

OR OR

Loading Files

- Create a [new sketch](#) (svg file)
- Send a pix message or email with attachment to EF151@ef.engr.utk.edu. Include **hw 3-2-3** in the subject or body of the message. [Getting set up to send images to the web site.](#)
- Webfolder - send a pix message or email with an image attachment to EF151@ef.engr.utk.edu

No webfolder files available.

From local file:

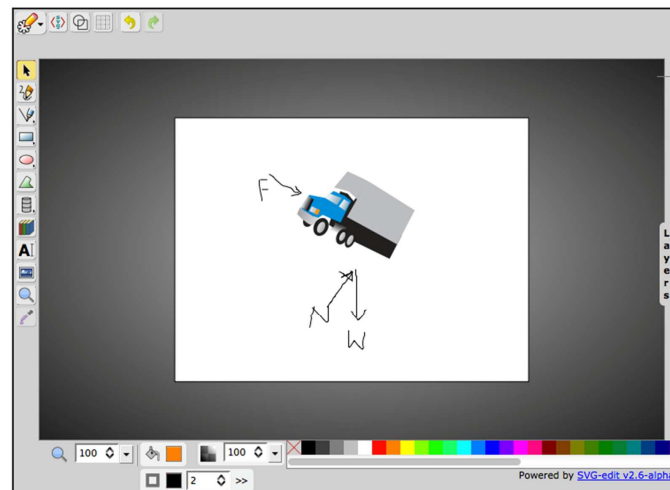
From URL:

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SVG-Edit – More Open Source Coolness

EF Sketcher

dropbox/webfolder/wschlete/hw/3-2-3-sketch.svg



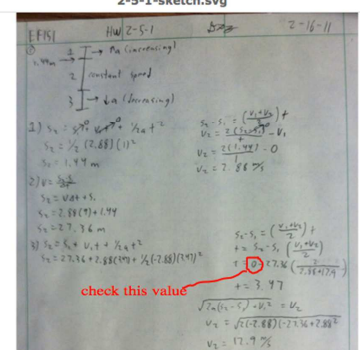
19

SVG-Edit – Annotation

1.

Notes/Calcs:

2-5-1-sketch.svg

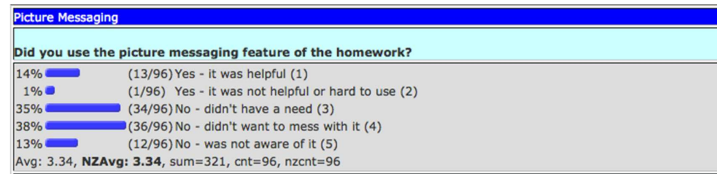


Ex-Gov. Phil B. Bryant, the Neyland State physics degree makes some elevator. He stands on a scale. The mass of the elevator is 1000 kg.

Part	Description	Answer	# tries:	Clear tries and answer
A.	As the elevator starts down, standing on reads 492 N. Determine the magnitude of the acceleration of the elevator. (m/s^2)	A: 2.88 C: 2.88042	1 hint	<input type="button" value="Clear tries and answer"/>
B.	Determine the tension in the cable supporting the elevator as the elevator starts down. (N)	A: 6380 C: 6382.14	2 hints	<input type="button" value="Clear tries and answer"/>

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The Survey Says . . .



- It is a good feature I should have taken more advantage of.
- that was the best thing about the homework. it really helped being able to have the professors instruct us on where we went wrong.
- cool feature
- Never got around to it
- good idea!
- Didn't know we had one
- I never figured it out.
- Good feature.
- I didn't use it but I will say I think it is a fantastic idea and should be kept in the course and improved upon.
- I'm sure it will be very helpful to next falls EF 151 class.
- That seemed like more trouble than it is worth.
- I never knew how to do the picture feature and didn't really have the urge to try and figure it out.
- I used my wacom drawing tablet with it. It was awesome.
- Technology is crazy.
- I found it was easier to just go to help session if you needed to show your work
- I figured out about it by the end of the year.
- the pictures and videos really help to bring some explanation to questions being asked.

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Summary and the Future

- Greatly reduces time to provide help
- Student adoption has been slow
- Can expand the concept
 - Discussion Board (too much sharing?)
 - Other file types (Matlab, Word, Excel, One Note)
- Facebook link?
- E-portfolio

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