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Prototype Quizbank  
for  
Physics & Astronomy  
  
(Python / LaTeX)

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<input type="checkbox"/> Attributes	Name
 D	<b>bank</b>
 D	input
 D	<b>output</b>
 D	utility
 A	makeExamPrt
 A	<b>makeTest</b>
 A	makeTestAux

Guy Vandegrift  
Wright State University, Ohio



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75 images  
102 quizzes  
1008 questions  
(as of 8/1/19)

images

- a02\_1Dkinem\_equations
- a03\_2Dkinem\_2dmotion
- a03\_2Dkinem\_smithtrain
- a04DynForce Newton\_forces
- a04DynForce Newton\_sled
- a04DynForce Newton\_tensions
- a05frictDragElast\_3rdLaw
- a06uniformCircMotGravitation\_frictio
- a06uniformCircMotGravitation\_proo
- a07\_energy\_cart

LaTeX (tex)  
document



```

\question
\includegraphics[width=0.25\textwidth]{images/Threetensions.png}
In the figure shown,  $\theta_1$  is 18 degrees, and
 $\theta_3$  is 34 degrees. The tension
 $T_3$  is 24 N. What is the tension,  $T_1$ ?
\ifkey\endnote{a04DynForce Newton_tensions_1 placed in Public
Domain by Guy Vandegrift: https://en.wikiversity.org/wiki/special:permalink/1863118}}\else{}
\begin{choices}
\choice 15.82 N.
\choice 18.19 N.
\CorrectChoice 20.92 N.
\choice 24.06 N.
\choice 27.67 N.
\end{choices}

```

This is LaTeX  
script

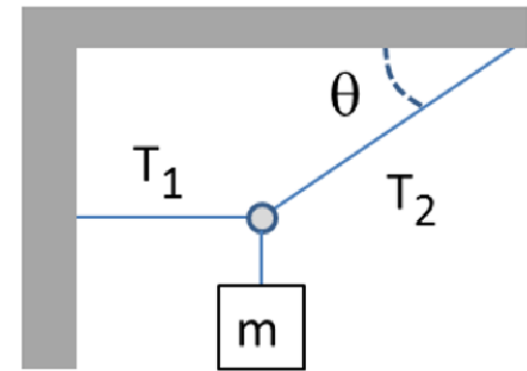


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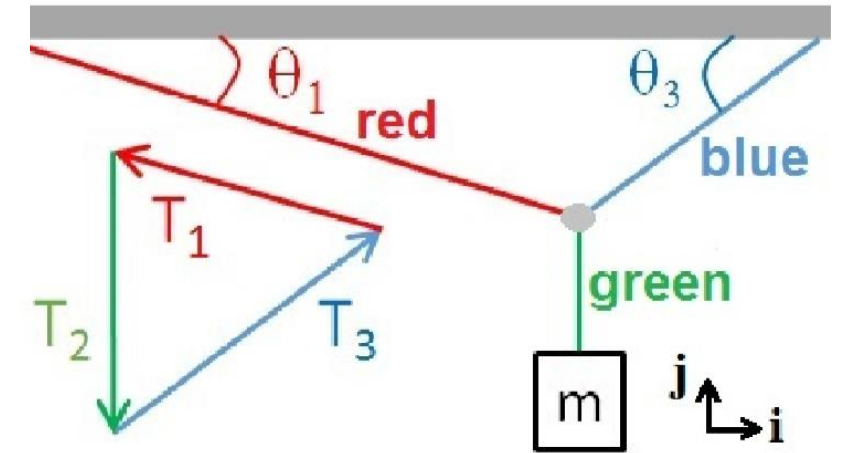
The 5-question quiz  
“Newton\_tensions”  
is numerical uses  
two figures.

In the figure shown,  $\theta$  is 21 degrees, and the mass is 3.1 kg. What is  $T_2$ ?

- A. 55.74 N.
- B. 64.1 N.
- C. 73.72 N.
- D. 84.77 N.**
- E. 97.49 N.



In the figure shown,  $\theta_1$  is 15 degrees, and  $\theta_3$  is 37 degrees. The tension  $T_3$  is 22 N. What is the tension,  $T_1$ ?



In the figure shown,  $\theta_1$  is 17 degrees, and  $\theta_3$  is 30 degrees. The tension  $T_3$  is 46 N. What is the tension,  $T_1$ ?

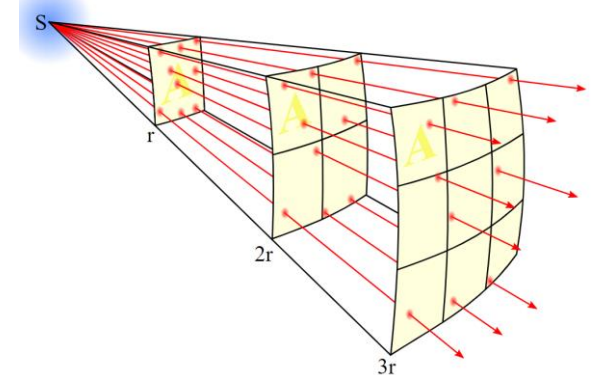
**Numerical questions use  
random input variables**



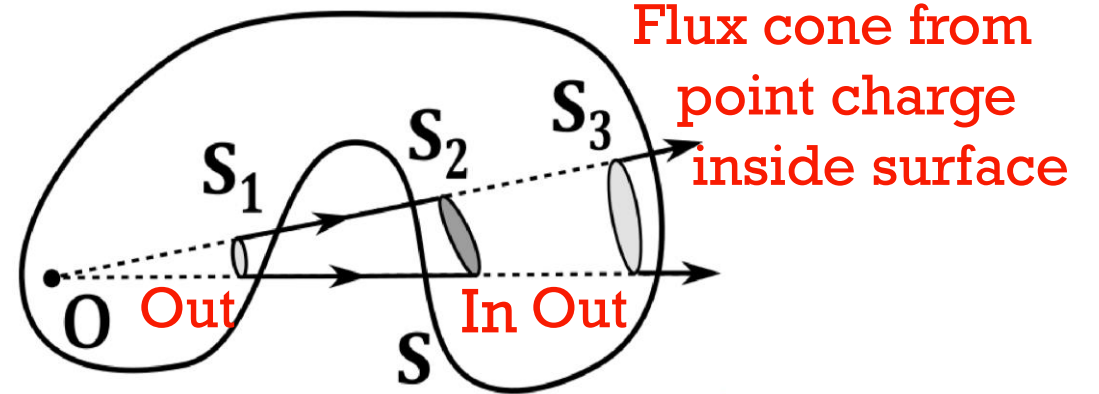
# True-False questions can be useful

In this description of the flux element,  $d\vec{S} = \hat{n}dA_j$  ( $j=1,2,3$ ) where  $\hat{n}$  is normal to the surface, and a positive charge is assumed to be inside the Gaussian surface shown. The field lines exit at  $S_1$  and  $S_3$  but enter at  $S_2$ .

**These are what I call cluster questions**



- In this figure,  $dA_1 = dA_3$
- In this figure,  $\vec{E}_1 \cdot d\vec{A}_1 = \vec{E}_3 \cdot d\vec{A}_3$
- In this figure,  $\vec{E}_1 \cdot d\vec{A}_1 + \vec{E}_2 \cdot d\vec{A}_2 = 0$
- In this figure,  $\vec{E}_1 \cdot d\vec{A}_1 + \vec{E}_3 \cdot d\vec{A}_3 = 0$
- In this figure,  $|\vec{E}_1| \cdot |d\vec{A}_1| = |\vec{E}_3| \cdot |d\vec{A}_3|$
- In this figure,  $|\vec{E}_1 \cdot d\vec{A}_1| = |\vec{E}_3 \cdot d\vec{A}_3|$



(Key: F, T, T, F, F, T)



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To make an exam:


Click *makeTest*

<input type="checkbox"/>	Attributes	Name
	D	bank
	D	input
	D	output
	D	utility
	A	makeExamPrt
	A	makeTest
	A	makeTestAux



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Command  
window

 C:\windows\py.exe

```
1 sample  
2 up2  
Enter integer for course:
```

A “course” is just a  
list of bank quizzes  
(sample has only 3)





tk

Print sample-testname 0 3: AstroChasingPluto

0 1: c19ElectricPotentialField\_SurfaceIntegral (3)

0 2: a04DynForce Newton\_tensions (5)

0 3: AstroChasingPluto (32)

3.1: The trip by "New Horizons" from Earth to Pluto took almost a

3.2: The "Chasing Pluto" video showed a stellar occultation that was observed in order to le

3.3: The "Chasing Pluto" video showed a stellar occultation that was observed

3.4: A stellar occultation occurs when a planet passes in front of a star

3.5: A stellar occultation occurs when the north or south pole of a planet is aligned with a st

3.6: Stellar occultation tells something about a planet because

3.7: Silicon carbide was used to construct the telescope "LORRI" because this material is

3.8: The darker portions of Pluto are believe to be from "snowflakes" of

3.9: "Pepssi", "Rex", "Swap", "Lorri", "Alice" and "Ralf" are

3.10: What was the concern about taking a telescope/camera to the cold environment near

3.11: As "New Horizon's" approaches Jupiter, it was essential that

3.12: The time to reach \ \ \ \ \ \ \ \ was shortened from 9 days to 3 hours due to the spe

3.13: While close to Jupiter, "New Horizons" the most spectacular image was of

3.14: The Kuiper belt has been described as a \ \ \ \ \ \ \ \ made of \ \ \ \ \ \ \ \

Select bank  
quiz and click

A question  
selection grid  
opens



tk

1	Print sample-testname	1	1: c19ElectricPotentialField_SurfaceIntegral
1	1: c19ElectricPotentialField_SurfaceIntegral (3)	<input checked="" type="checkbox"/>	1.1: A cylinder of radius, $r=3$ , and height, $h=4$ , is centered at the origin and oriented along the z axis. A vec
0	2: a04DynForce Newton_tensions (5)	<input type="checkbox"/> ON	1.2: A cylinder of radius, $r=3$ , and height, $h=4$ , is centered at the origin and oriented along the z axis. A vec
0	3: AstroChasingPluto (32)	<input checked="" type="checkbox"/>	1.3: A cylinder of radius, $r=3$ , and height, $h=4$ , is centered at the origin and oriented along the z axis. A vec

Toggle questions on/off test



Click to see question



tk

1 Print sample-testname

1 1: c19ElectricPotentialField\_SurfaceIntegral (3)

0 2: a04DynForce Newton\_tensions (5)

0 3: AstroChasingPluto (32)


1 c19ElectricPotentialField\_SurfaceIntegral: Question 2  
 \question A cylinder of radius,  $r=3$ , and height,  $h=4$ , is centered at the origin and oriented along the  $z$  axis. A vector field can be expressed in cylindrical coordinates as,  $\vec{F} = (2.35+2.57z)\hat{\rho} + 7.45z^3\hat{z}$ . Let  $\hat{n}$  be the outward unit normal to this cylinder and evaluate  $\left(\int_{\text{side}} \vec{F} \cdot \hat{n} dA\right)$  over the curved side surface of the cylinder.   
 \begin{choices} \choice 2.221E+03 \choice 2.690E+03 \choice 3.949E+03 \CorrectChoice 3.949E+03 \end{choices}

1 1: c19ElectricPotential

1.1: A cylinder of radius:

ON 1.2: A cylinder of radius:

1.3: A cylinder of radius:



$(2.35+2.57z)\rho^3\hat{\rho}$   
 translates to:

$$(2.35 + 2.57z)\rho^3\hat{\rho}$$

The code imbeds  
 random variables  
 into the LaTeX



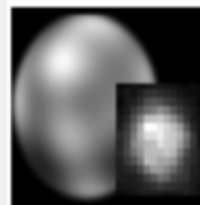


## Question 29

3 AstroChasingPluto: Question 29

\question

\includegraphics[width=0.3\textwidth]{images/Hst-pluto1-derivative.png}  
 These two images of Pluto represent: \begin{choices} \choice a land-based telescope and the "Hubble Space Telescope" \CorrectChoice raw and processed images \choice "New Horizon" near Earth and mid-way to Pluto \choice "New Horizon" mid-way to Pluto and near Pluto \choice "New Horizon" and the "Hubble Space Telescope" \end{choices}



- 3.18: The "blink compa
- 3.19: A typical average
- 3.20: Mike Brown's sea
- 3.21: Pluto ceased to b
- 3.22: The influence of .
- 3.23: When the discov
- 3.24: The influence of .
- 3.25: Which was NOT
- 3.26: As "New Horizon
- 3.27: \includegraphics[
- 3.28: \includegraphics[
- 3.29: \includegraphics[
- 3.30: The atmosphere



tk		
4	Print sample-testname	1 1: c19ElectricPotentialField_SurfaceIntegral
1	1: c19ElectricPotentialField_SurfaceIntegral (3)	<input checked="" type="checkbox"/> 1.1: A cylinder of radius, $r=3$ , and height, $h=4$ , is centered at the origin and oriented a
0	2: a04DynForce Newton_tensions (5)	<input type="checkbox"/> ON 1.2: A cylinder of radius, $r=3$ , and height, $h=4$ , is centered at the origin and oriented a
3	3: AstroChasingPluto (32)	<input checked="" type="checkbox"/> 1.3: A cylinder of radius, $r=3$ , and height, $h=4$ , is centered at the origin and oriented a

Test *testname* in course *sample* has 4 questions



```
%PREAMBLE
\newcommand{\quiztype}{mixed}
\newif\ifkey\documentclass[11pt,twoside]{exam}
\RequirePackage{amssymb, amsfonts, amsmath, latexsym, verbatim,
xspace, setspace,datetime,tikz, pgflibraryplotmarks, hyperref,
textcomp}
\usepackage[left=.4in, right=.4in, bottom=.9in, top=.7in]{geometry}
\usepackage{endnotes, multicol,textgreek,graphicx} \singlespacing
\parindent 0ex \hypersetup{ colorlinks=true, urlcolor=blue}
\pagestyle{headandfoot}
\runningheader{testname: Test}{\thepage\ of \numpages}
{156565750323}
\footer{}
{\LARGE{The next page might contain more answer choices for this
question}}{}
% BEGIN DOCUMENT
\begin{document}\title{testname: Test}
\author{\includegraphics[width=0.10\textwidth]
{images/666px-Wikiversity-logo-en.png}}\
The LaTeX code that creates this quiz is released to the Public Domain\

```

testname: Test



that creates this quiz is release  
for each question is documente  
[bucket.org/Guy\\_vandegrift/](https://en.wikiversity.org/wiki/bucket.org/Guy_vandegrift/)  
[s://en.wikiversity.org/wik  
mixed quiz 156565750323](https://en.wikiversity.org/wiki/mixed_quiz_156565750323)

Monday 12<sup>th</sup> August,

document was created with  
be possible for users to d  
rsions of this document.

**Timestamp  
on all pages**



testname: Test



The LaTeX code that creates this quiz is released to the Public Domain  
Attribution for each question is documented in the Appendix  
[https://bitbucket.org/Guy\\_vandegrift/qbwiki/wiki/Home](https://bitbucket.org/Guy_vandegrift/qbwiki/wiki/Home)  
<https://en.wikiversity.org/wiki/Quizbank>  
mixed quiz 156565874890

Monday 12<sup>th</sup> August, 2019

Though posted on Wikiversity, this document was created without wiktex using Python to write LaTeX markup. With a bit more development it will be possible for users to download and use software that will permit them to create, modify, and print their own versions of this document.

## Contents

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**Multiple versions  
with keys**

**Attribution for each question**









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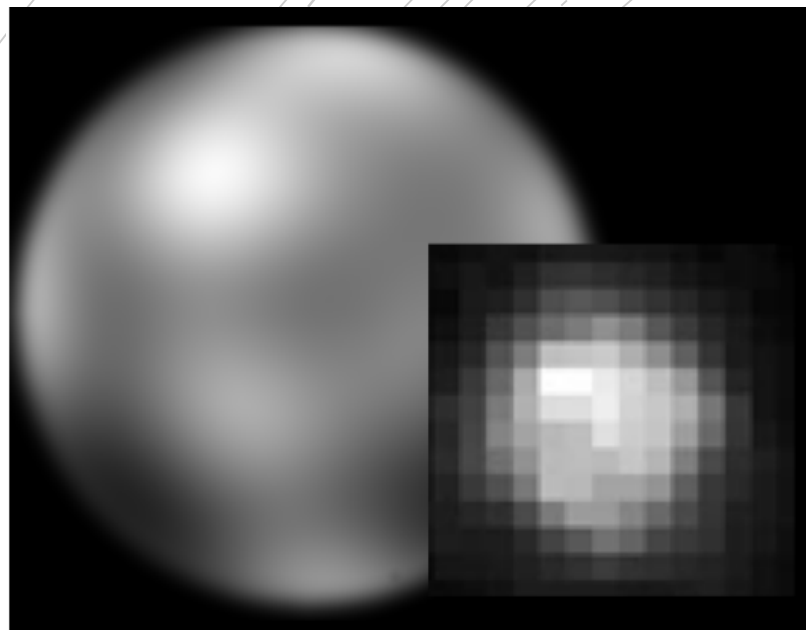
Output file after  
running MiKTeX

Archive with  
000\_cleanup.py

-  images
-  archive
-  156565874890-sample-testname
-  000\_cleanup

**All files with this  
timestamp  
moved here**





**This fact-based question is  
useless ...  
unless it immediately follows  
the learning experience**

These two images of Pluto represent:<sup>4</sup>

- 3. A. a land-based telescope and the "Hubble Space Telescope"
- B. raw and processed images**
- C. "New Horizon" near Earth and mid-way to Pluto
- D. "New Horizon" mid-way to Pluto and near Pluto
- E. "New Horizon" and the "Hubble Space Telescope"

**That experience  
could a classroom  
video or short  
passage on an exam**



	A	B	C	D	E	F	G
1	A mass of	<code>__m1</code>	kg is attached to a mass of	<code>__m2</code>	kg and experiences		
2	a force of	<code>__f</code>	N. What is the acceleration?				
3	<code>\$m/s^2\$</code>						
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14	1.15	1.8	2				
15	1.19	1.1	2				

Python converts to number strings: `__m1`, `__m2`, `__f`

**Students don't need to know Python/LaTeX to create exam questions. They can use: Excel, MatLab, C, ...**

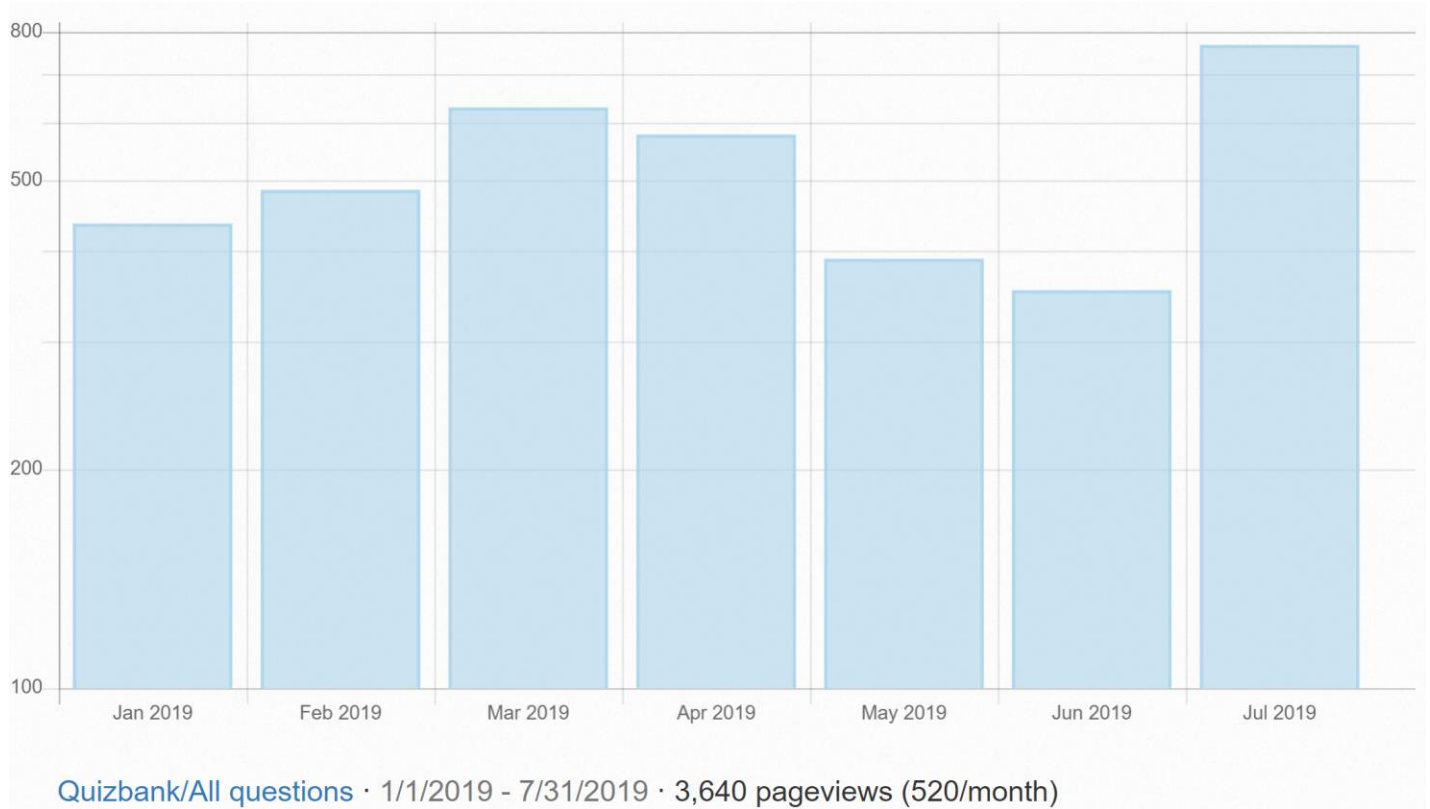
Excel uses one or more columns to calculate a, e.g.:  
`=B12 / (B12+C12)`

Random input:  
`=ROUND(1.01+0.9*RAND(),1)`



[https://tools.wmflabs.org/pageviews/?project=en.wikiversity.org&platform=all-access&agent=user&range=latest-20&pages=Quizbank/All\\_questions](https://tools.wmflabs.org/pageviews/?project=en.wikiversity.org&platform=all-access&agent=user&range=latest-20&pages=Quizbank/All_questions)

The bank has been viewed 3,640 times in the last six months



Quizbank/All questions · 1/1/2019 - 7/31/2019 · 3,640 pageviews (520/month)



	A	B	C
1	3.20E+08	32 million:	US population
2	4.00E+06	divided by 80	freshman age
3	1.33E+06	divided by 3	in college
4	1.33E+04	divided by 100	1% professor participation
5	1.33E+04	13 thousand/year	at one question per student

Order-of-magnitude  
estimate

13 thousand bank  
questions per year!



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In physics education, a ... **Fermi question** is an  
**estimation** problem designed to teach ... **approximation**.

