

Rutgers University
Department of Physics & Astronomy

01:750:271 Honors Physics I

Lecture 1

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Course Instructor

Duiliu Emanuel Diaconescu

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Phone: 848 445 9054

E-mail: duiliu@physics.rutgers.edu

Office Hours: M 3-4pm or by appointment

Room & Time:

Physics Lecture Hall M 1:55-2:50pm,
W 1:55-2:50pm

Web page:

<http://www.physics.rutgers.edu/ugrad/271/>

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[Rutgers University Department of Physics and Astronomy](#)

Physics 271 -- Honors Physics I -- Fall 2014

Mondays and Wednesdays, 3:35-4:30 PM, Physics Lecture Hall, Busch Campus

Prerequisites: Enrollment in an honors program or permission of the department.

Corequisites: 01:640:CALC1. We will introduce the necessary mathematics (calculus) as we go along, but students should already be familiar with trigonometry, algebra and analytic geometry. It is expected that students will be taking calculus concurrently with this course, though some techniques and concepts from calculus will be introduced in the course as needed, perhaps before they are covered in any concurrent calculus class.

Catalog description of this course: Introduction to classical physics, covering mechanics, fluids, and thermodynamics.

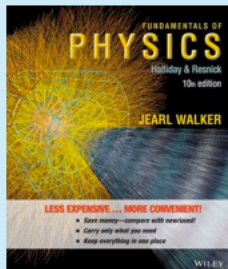
Primary Text book: ["Fundamental of Physics" by Holliday, Resnik and Walker, 10th Edition](#)

Additional material: You will also need a WebAssign Access Code Card and an iClicker transmitter.

Students with Disabilities: Please check this [webpage](#).

Course Links:

- [General Information](#)
- [Sections](#)
- [Syllabus](#)
- [Lecture notes](#)
- [Exam Copies](#)
- [Homework](#)
- [WebAssign Login Page](#)
- [Online Gradebook](#) (coming soon)
- [iClicker Instructions](#)
- [Registering your iClicker transmitter](#)



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Course Overview

Classical mechanics: the science of motion



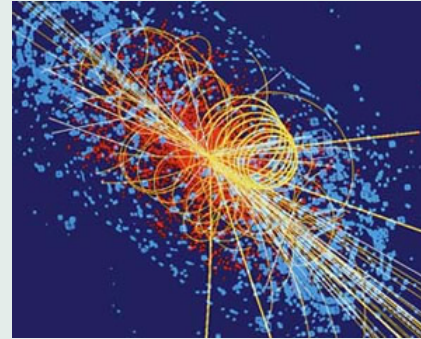
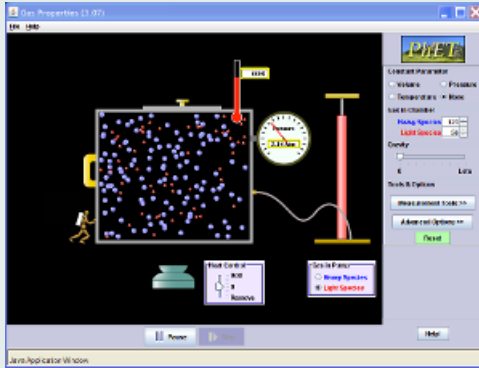
Motion in every day life

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Planetary and satellite motion (cosmic scale)

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Molecular and subatomic motion
(microscopic scale)

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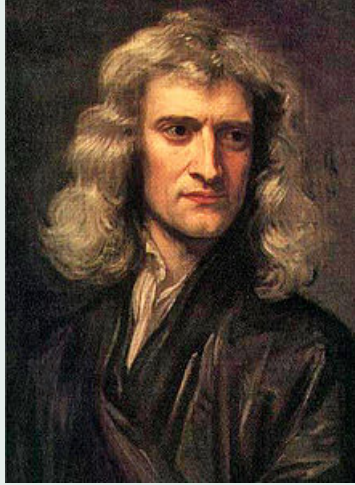
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Mathematical model for motion



Isaac Newton 1689, *Principia Mathematica*

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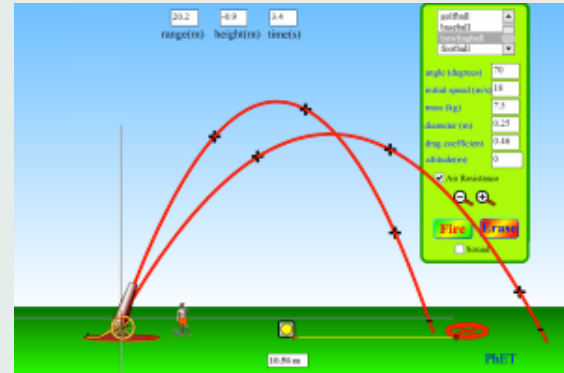
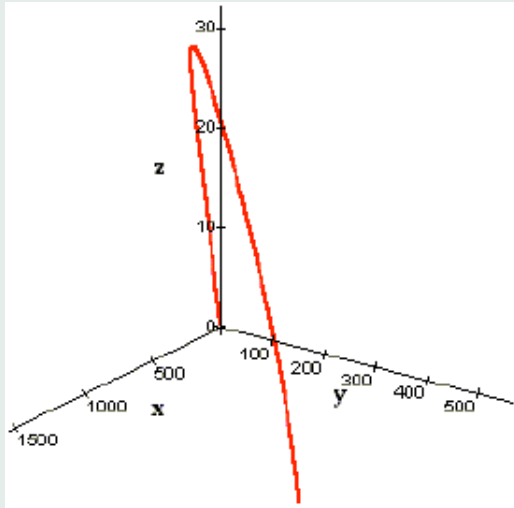
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Basic motion in 1, 2 and 3 dimensions

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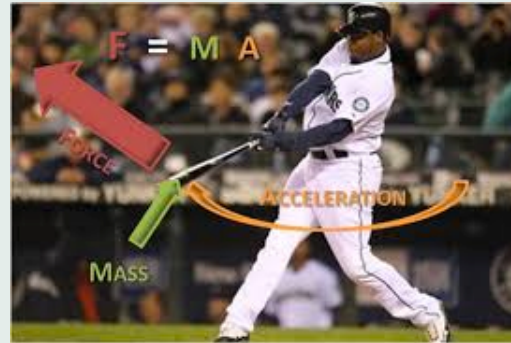
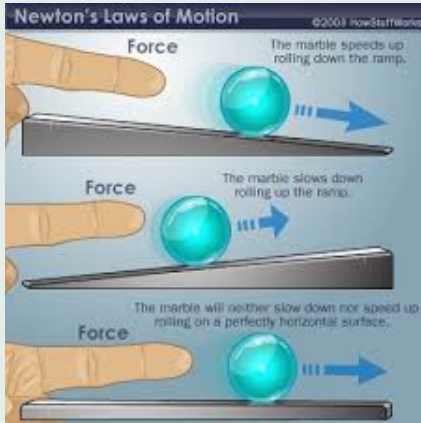
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What causes motion: **force**

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How hard is it to stop a moving object?

How hard is it to move a stationary object?

Quanta of motion: **momentum and energy**

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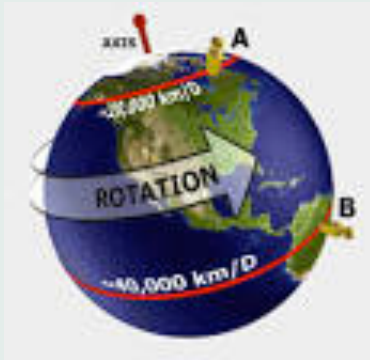
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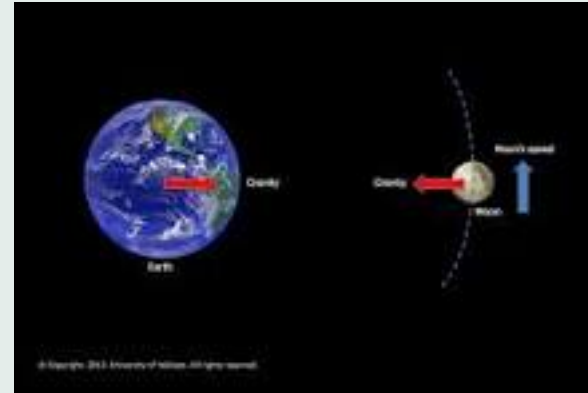
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Rotation.



Gravity.

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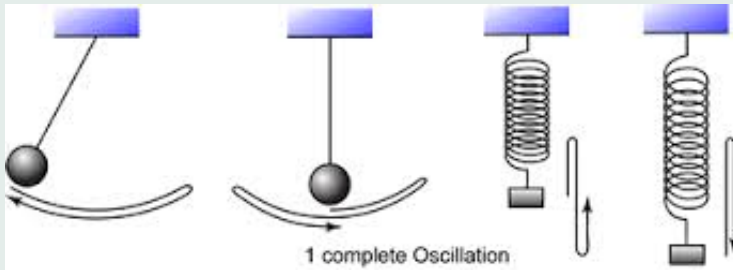
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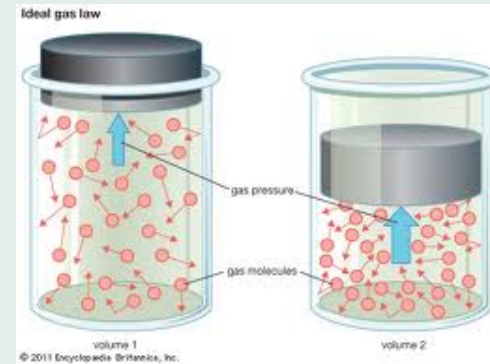
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Oscillations.



Kinetic theory of gases.

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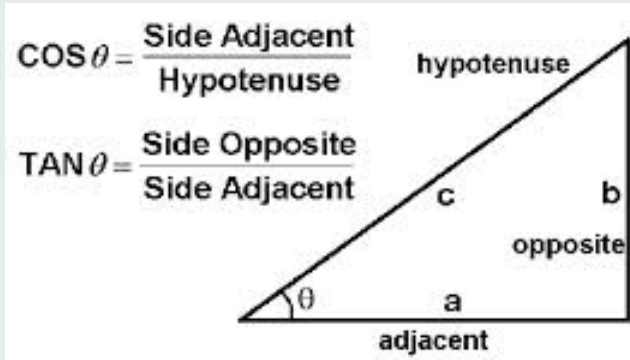
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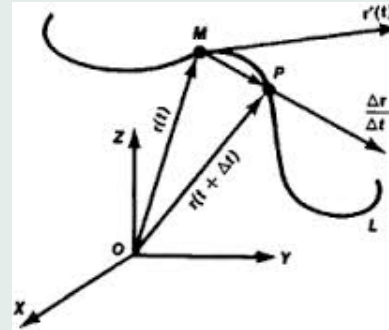
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Mathematical Background



Trigonometry.



Vector calculus.

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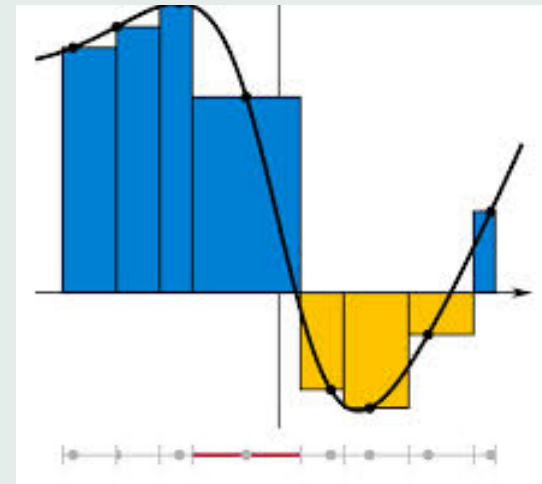
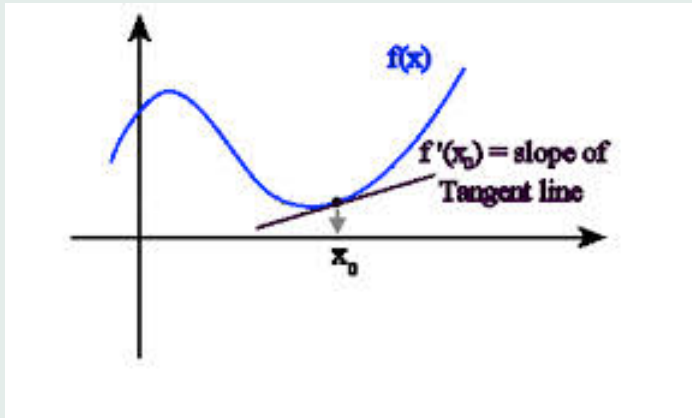
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Derivative: $\frac{df(x)}{dx}$

Integral: $\int f(x)dx$

Parallel math course: 01:640:CALC1.

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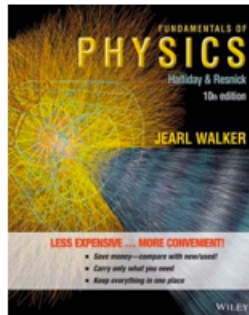
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Required Textbook

David Halliday, Robert Resnick, Jearle Walker,
Fundamentals of Physics, 10th edition
ISBN 9781118230640 (or the 9th edition.)



EDITION: 10TH 14
PUBLISHER: WILEY
ISBN: 9781118230640

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Grade Evaluation

Component	Weight	Date
Homework	25%	10 assignments
Exam 1	15%	Monday Oct 10
Exam 2	15%	Monday Nov 14
Final	25%	TBA
Quiz	15%	10-12 quizzes
Attendance	5%	iClicker answers

Final letter grade: based on grade distribution.

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Homework Assignments

- 10 assignments due at 1 or 2 week intervals
- 1st assignment due on Sept 26th 2015, 11:59pm.
- Internet based – [Webassign:](http://webassign.net/)
<http://webassign.net/>
- **No** late assignments accepted
- Lowest 2 homework assignments will be dropped.

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Institution: rutgers (**lowercase**)

Password: 9 digit Id number

Note: need to purchase access code from RU bookstore or Webassign website

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Exams

- All exams multiple choice
- Exams 1 and 2: 1 hour exams
- The Final: 3 hour exam in the exam period.
- Closed book, but you may bring one 8.5" x 11" sheet of paper (both sides) with formulas and notes to consult during the exam. You may also use a scientific calculator.
- Practice problems and sample tests posted on course webpage

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iClicker

- ~ 4-5 questions/lecture
- answer 75% to get full credit for attendance



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Behind Battery (newer models)

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i>clicker 2

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Recitations

Section	Day	Time	Room
H1	Thursday	10:35-11:30am	ARC-105
H2	Thursday	12:15-1:10pm	ARC-206
H3	Thursday	1:55-2:50pm	ARC-206
H4	Friday	1:55-2:50pm	SEC-202
H5	Friday	3:35-4:30pm	SEC-212
H7	Friday	10:35-11:30am	SEC-216
H8	Thursday	3:35-4:30pm	ARC-206
HA	Friday	8:55-9:50am	SEC-212
HB	Thursday	10:35-11:30am	ARC-205

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Note:

- short written quiz at the end of most recitations; 10-12 quizzes in total
- lowest 2 quizzes will be dropped
- no recitations the first week; will start the second week, Sept 12-16.

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1. Measurement

All physical quantities are measured in terms of specific **units**.

- length: miles, yards, feet ...
- time: hours, minutes, seconds ...
- temperature: degrees

Standard units should be **invariable**: independent of

- physical characteristics of a particular observer
- geographic location, weather, seasons, ...

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International System of Units (SI or metric system)

- 7 Base units :

Table 1. SI base units		
Base quantity	Name	Symbol
	SI base unit	
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

The first 3 relevant for
classical mechanics.

- **Second:**

The time taken by 9 192 631 770 oscillations of the light emitted by a cesium-133 atom.

- **Meter:**

The length of the path traveled by light in vacuum in a time interval of $1/299792458$ seconds.

- **Kilogram:**

The mass of a platinum-iridium cylinder 0.039 m in height and diameter.

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Prefixes

Prefixes for SI Units

Factor	Prefix ^a	Symbol	Factor	Prefix ^a	Symbol
10^{24}	yotta-	Y	10^{-1}	deci-	d
10^{21}	zetta-	Z	10^{-2}	centi-	c
10^{18}	exa-	E	10^{-3}	milli-	m
10^{15}	peta-	P	10^{-6}	micro-	μ
10^{12}	tera-	T	10^{-9}	nano-	n
10^9	giga-	G	10^{-12}	pico-	p
10^6	mega-	M	10^{-15}	femto-	f
10^3	kilo-	k	10^{-18}	atto-	a
10^2	hecto-	h	10^{-21}	zepto-	z
10^1	deka-	da	10^{-24}	yocto-	y

$1\text{ cm} = 10^{-2}\text{ m} = 0.01\text{ m}$

$1\text{ km} = 10^3\text{ m} = 1000\text{ m}.$

Changing units

$$1 \text{ ft} = 0.3048 \text{ m} \qquad 1 \text{ lb} = 0.4536 \text{ kg}$$

$$1 \text{ m} = 3.281 \text{ ft} \qquad 1 \text{ kg} = 2.205 \text{ lb}$$

Examples:

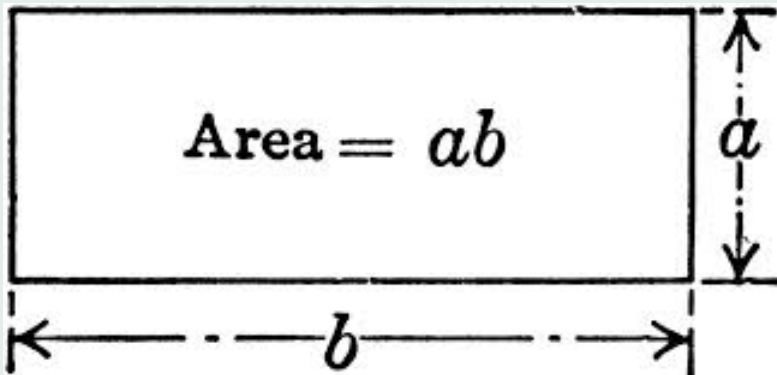
$$2.6 \text{ kg} = 2.6 \times 2.205 \text{ lb} = 5.733 \text{ lb}$$

$$0.7 \text{ cm} = 0.7 \times 10^{-2} \text{ m} = 0.7 \times 10^{-2} \times 3.281 \text{ ft} = 2.2967 \times 10^{-2} \text{ ft}$$

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Derived units

- Area



$$a = 2 \text{ m}, b = 3 \text{ m}$$

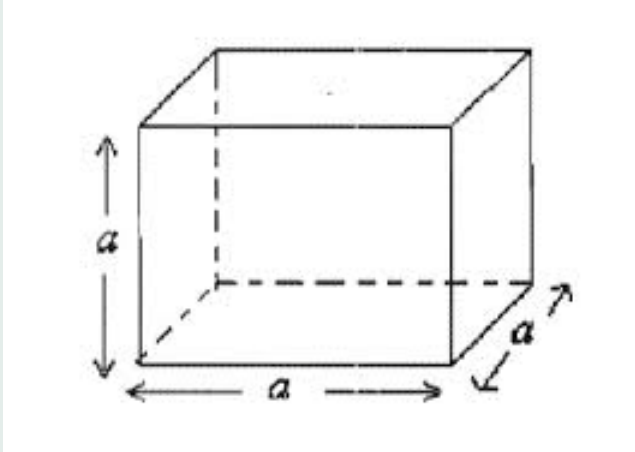
$$\text{Area} = 2 \text{ m} \times 3 \text{ m} = 6 \text{ m}^2$$

Square meter: area of a $1 \text{ m} \times 1 \text{ m}$ square.

$$1 \text{ m} \times 1 \text{ m} = 1 \text{ m}^2$$

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- Volume



$$a = 2 \text{ m}$$

$$\text{Volume} = 2\text{m} \times 2\text{m} \times 2\text{m} = 8 \text{ m}^3$$

Cubic meter: volume of a $1\text{m} \times 1\text{m} \times 1\text{m}$ cube.

$$1\text{m} \times 1\text{m} \times 1\text{m} = 1 \text{ m}^3$$

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- Density

$$\rho = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Density unit} = \frac{1 \text{ kg}}{1 \text{ m}^3} = 1 \frac{\text{kg}}{\text{m}^3}$$

$$= 1 \text{ kilogram per cubic meter}$$

Note: scientific notation

$$5000000 = 5 \times 10^6 = 5 \text{ E}6 \quad 0.00007 = 7 \times 10^{-5} = 7\text{E} - 5$$

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Next class: Monday September 12th,
PHL 1:55-2:50pm

Motion along a straight line

9th edition: Ch. 2.1-2.10

10th edition: Ch 2.1-2.6

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