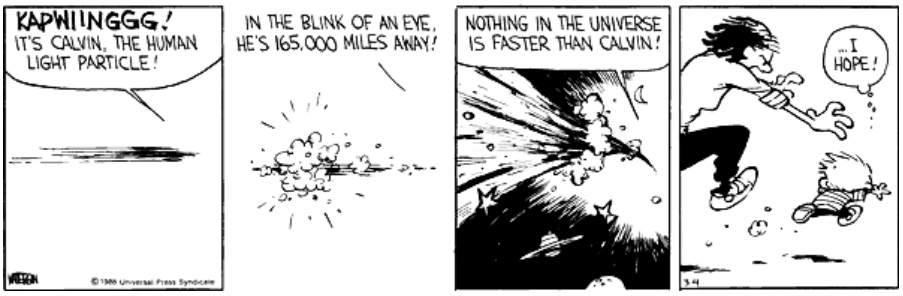
September 14, 2016 Physics 131 Prof. E. F. Redish

- **Theme Music: Johann Strauss II**
  Acceleration Waltz
- **Cartoon: Bill Waterson**
  Calvin & Hobbes



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Outline

- Go over Quiz 2
- Recap velocity
- "Thinking velocity" – Examples
- Acceleration
- Examples

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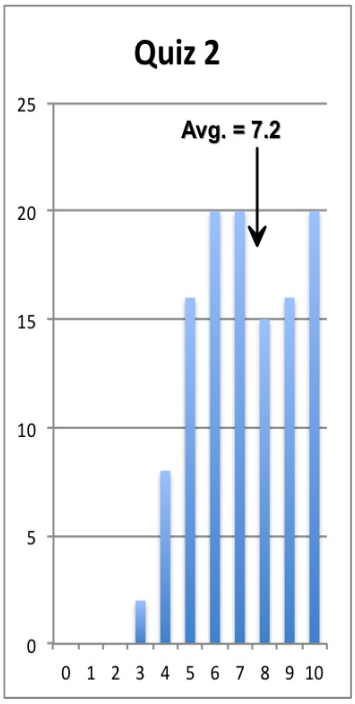
Quiz 2

	1		2	3	4
λν	91%	a	8%	0%	28%
[λν]	7%	b	3%	0%	9%
	0%	c	85%	3%	60%
	0%	d	1%	9%	2%
		e	2%	17%	1%
		f	2%	29%	
		g		16%	
		h		13%	
		i		7%	
		j		6%	



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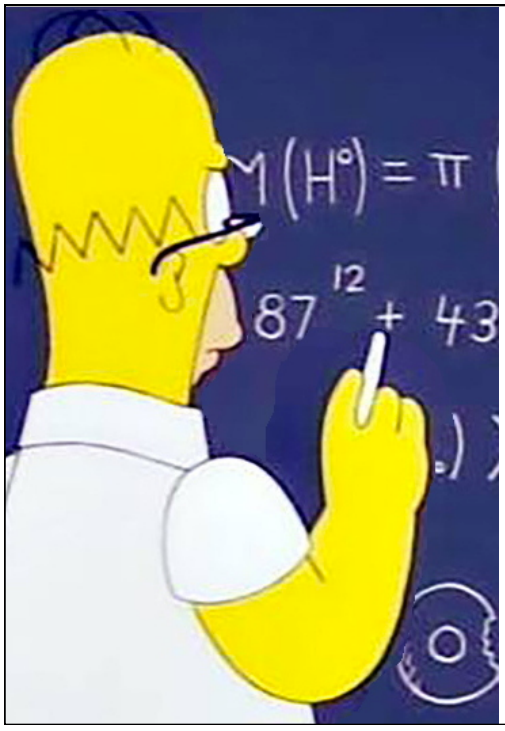

The Equation of the Day

Average and instantaneous acceleration

$$\langle a \rangle = \frac{\Delta v}{\Delta t}$$

$$a = \frac{dv}{dt}$$

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What have we learned? Representations and consistency

- Visualizing where an object is at different times → a position graph
- Visualizing how fast an object is moving at different times → a velocity graph
- Position graph → velocity graph
- Velocity graph → position graph

slopes $\langle v \rangle = \frac{\Delta x}{\Delta t}$ $v = \frac{dx}{dt}$

areas $\Delta x = v\,\Delta t$ $\Delta x = \int v\,dt$

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Graphing Velocity: Figuring it out from the motion

- An object in uniform motion has constant velocity.
- This means the instantaneous velocity does not change with time. Its graph is a horizontal line.
- You can make sense of this by putting your mind in "velocity mode" and running a mental movie.

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The sonic ranger (motion detector)

- The sonic ranger measures distance to the nearest object by echolocation.
  - A speaker clicks 30 times a second. A microphone detects the sound bouncing back from the nearest object in front of it.
  - The computer calculates the time delay between and using the speed of sound (about 343 m/s at room temperature) it can calculate the distance to the object.

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