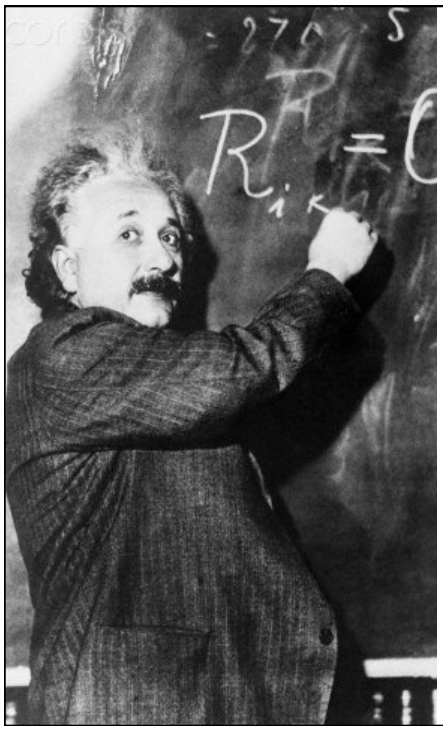
October 3, 2016 Physics 131 Prof. E. F. Redish

- **Theme Music:** ***Defying Gravity***
  Karen Chernowith & Idina Mentzel
- **Cartoon:** ***BC***
  Johnny Hart



The Equation of the Day

Weight and mass

$$\vec{F}_A^{grav} = \vec{W}_A = m_A \vec{g}$$

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Physics 131

Foothold Ideas: Gravity

- Every object (near the surface of the earth) feels a downward pull proportional to its mass:

$$\vec{W}_{E\to m} = m\vec{g}$$

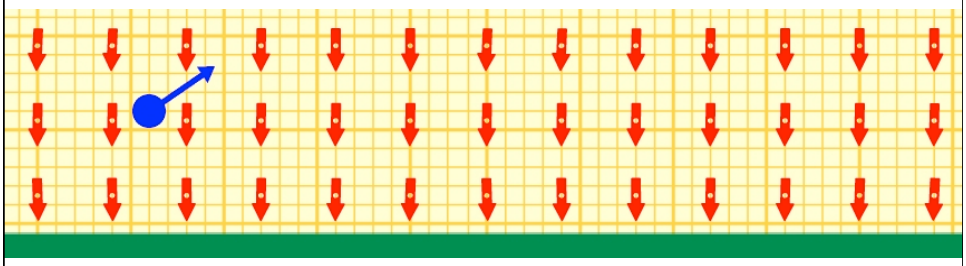
What object causes W?

where $\vec{g}$ is referred to as *the gravitational field.*

- This is a Force even though nothing touching the object is responsible for it.
- The gravitational field has the same magnitude for all objects irrespective of their motion and at all points.
- The gravitational field always points down.
- It is measured to be $g \approx 9.8$ N/kg

Why N/kg instead of m/s^2?

The gravitational field



Response to Gravity: Free Fall

- After an object has been released,
  - if it is dense enough so the forces from the air can be ignored
  - if nothing else is touching it

  the only force acting on it is gravity. (N0!)
- The **force** of gravity is proportional to the mass so **acceleration** is independent of mass,

$$\vec{a} = \vec{F}^{net}/m = \vec{W}_{E\to m}/m = m\vec{g}/m = \vec{g}$$