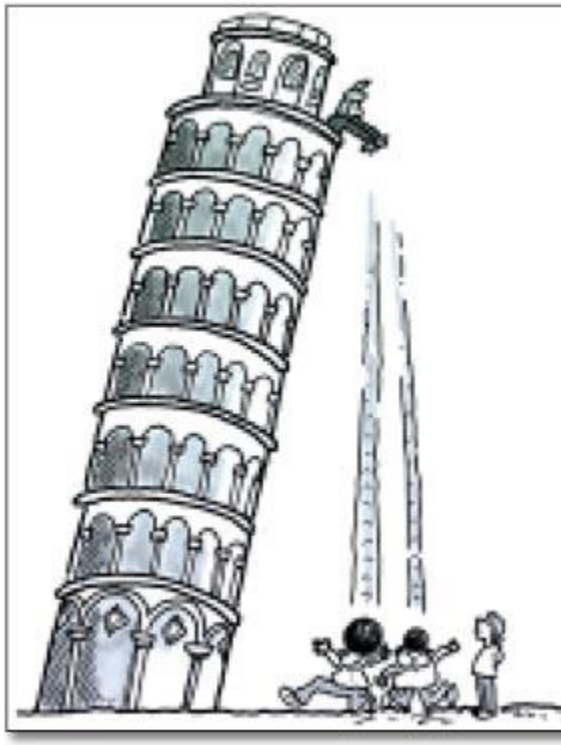
Acceleration

- Acceleration: $$a = \frac{\text{change in velocit y}}{\text{change in time}} = \frac{\Delta v}{\Delta t}$$

Standard units of acceleration : m/s^2



Galileo Galilei's experiment in Pisa (possibly, a legend)

- If there were no air resistance, all objects in Earth gravity would fall with the same acceleration,

$g=9.81\ m/s^2$ (directed downward)

- For motion at constant acceleration *a* , with no initial speed, the displacement after time *t* is:

$$\Delta x = v_{average} t = \left(\frac{0 + at}{2} \right) \times t = \frac{at^2}{2}$$

Equations of Motion

- **Equation of Motion** gives position of a particle as a function of time.
- Motion with constant velocity is called ***uniform.*** **Equations of Uniform Motion in 1D**:

$$a(t) = 0$$
$$v(t) = v_0$$
$$x(t) = x_0 + v_0 t$$

Here $x_0 = x(0)$ and $v_0 = \mathrm{v}(0)$ are coordinate x and velocity v at time $t = 0$.

- Equations of **Constant-Acceleration Motion in 1D**:

$$a(t) = a$$
$$v(t) = v_0 + at$$
$$x(t) = x_0 + v_0 t + \frac{at^2}{2}$$

Homework

Problem 1.

Suppose that you are trying to reproduce an experiment of Galileo by dropping a rock from certain tower. The time of its free fall turns out to be *t=5.0* seconds.

a) How tall is the tower?

b) What will be the time of the rock's fall if it is dropped from half the tower's height?

Problem 2.

The largest passenger airplane, Airbus A380, has acceleration a=2 m/s^2 during its take-off.

a) How much time it needs to reach the take off speed v= 280 km/hr?

b) How long the runway should be?