# 3.3 Freely Falling Objects

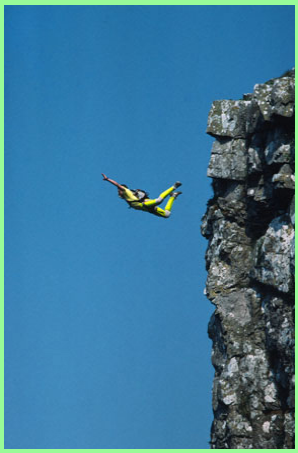
**STANDARDS**

**3.1** I can interpret and analyze the motion of an object in free fall.

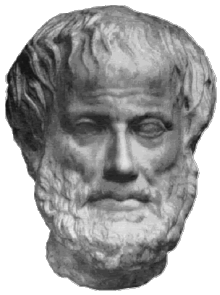
MECHANICS

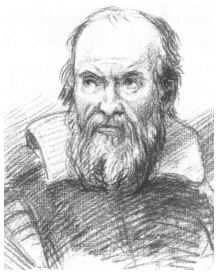
$v_x =$ $V_0 + at$ $a =$ acceleration
$x =$ $x_0 + V_0t + \frac{1}{2}at^2$ $A =$
$v_x^2 =$ $V_0^2 + 2a(x - x_0)$ $d =$
$E =$
$f =$
$F =$
$I =$
$\vec{a} =$ $K =$
$k =$
$|\vec{F}_f| \leq$ $L =$
$\ell =$
$m =$
$a_c =$ $P =$
$p =$
$\vec{p} =$ $r =$
$T =$
$\Delta\vec{p} =$ $t =$ time
$U =$
$K =$ $V =$
$v =$ speed/velocity
$\Delta E =$ $W =$
$x =$ position

**Free Fall** is the motion of an object falling freely under the influence of gravity.

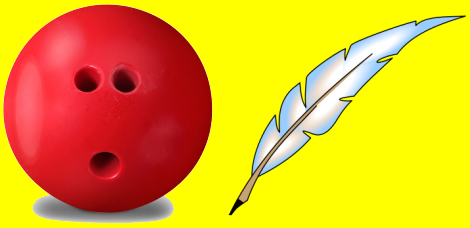


## Aristotle vs. Galileo





## Bowling Ball vs. Feather



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## What up "g"?

**g** ⟶ is the acceleration due to gravity

$$g = 9.80\ m/s^2$$

Is "g" a constant value everywhere on Earth?

**TABLE 2–5** Values of $g$ at Different Locations on Earth $(m/s^2)$

| Location | Latitude | $g$ |
|---|---|---|
| North Pole | 90° N | 9.832 |
| Oslo, Norway | 60° N | 9.819 |
| Hong Kong | 30° N | 9.793 |
| Quito, Ecuador | 0° | 9.780 |



# JOURNEY TO THE CENTER OF THE EARTH

**1** **2**


$x = x_0 + v_0 t + \frac{1}{2} a t^2$

$x = \frac{1}{2} g t^2$

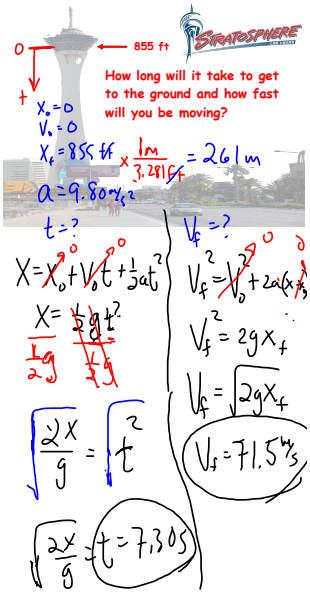
$x = 44\ m$

$1\ m = 3.281\ ft$

$44\ m \times \frac{3.281\ ft}{1\ m} = 150\ ft$

## Equations

| Equation |
|---|
| $v = v_i + g\,t$ |
| $x = x_i + v_i t + \frac{1}{2} g\,t^2$ |
| $v^2 = v_i^2 + 2\,g\,\Delta x$ |


# PRACTICE

Unit 3 Practice Problems

(6-9)