Raul Barrea
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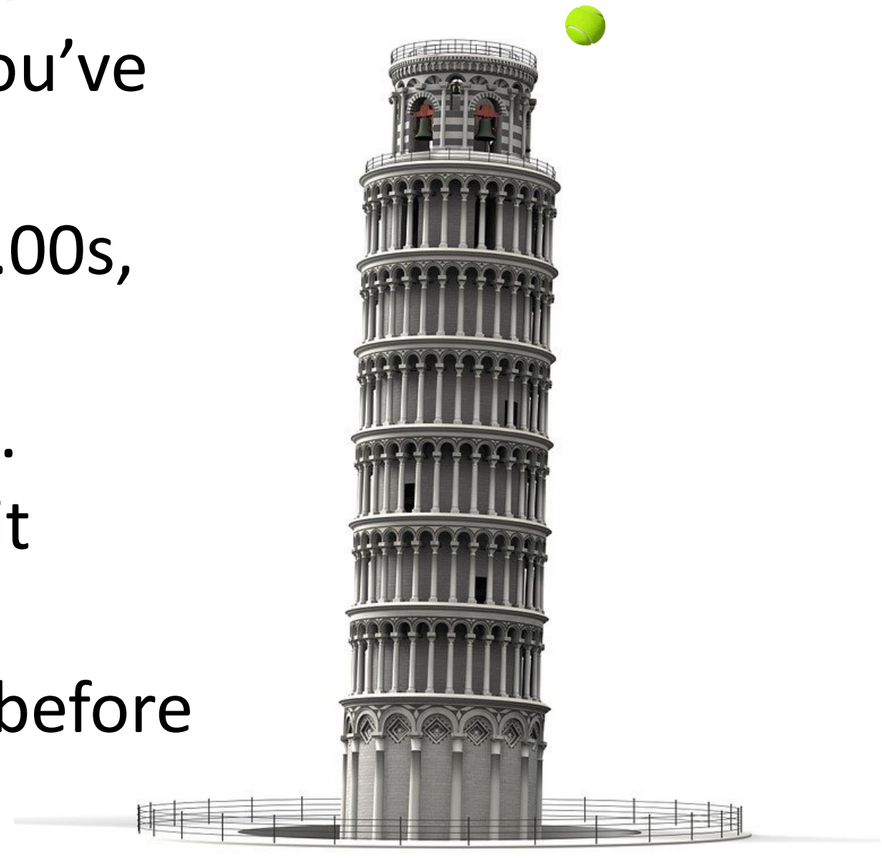
Object in Free Fall with no initial Velocity

Drop a tennis ball from the top of a tower

You climb to the top of a tower, 70 m above the ground. You drop a tennis ball from rest that you've brought with you, from the top of the tower.

1. Calculate how far the ball has fallen after 1.00s, 2.00 s, and 3.00 s,
2. Calculate its velocity at each of these times.
3. Calculate how long it takes for the ball to hit ground.
4. Calculate the final velocity of the ball right before hitting ground.



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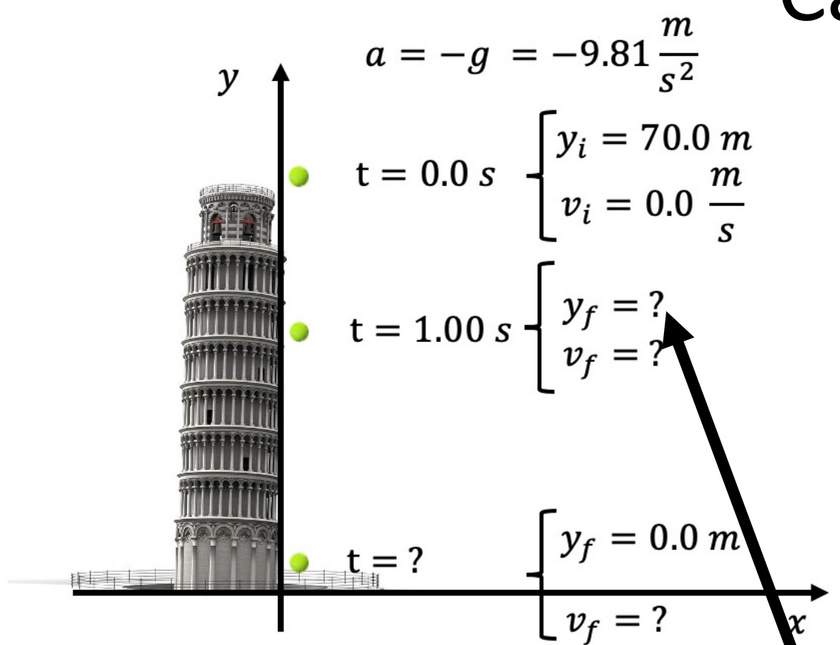

Calculate how far the ball has fallen after 1.00s

$$y_f = y_i + v_i \cdot t + \frac{1}{2} \cdot a \cdot t^2$$

$$y_f = 70.0\,m + 0 \cdot t + \frac{1}{2} \cdot (-9.81\,\frac{m}{s^2}) \cdot (1.00s)^2$$

$$y_f = 70.0\,m - \ 4.905\,m$$

$$y_f = 65.1\,m$$

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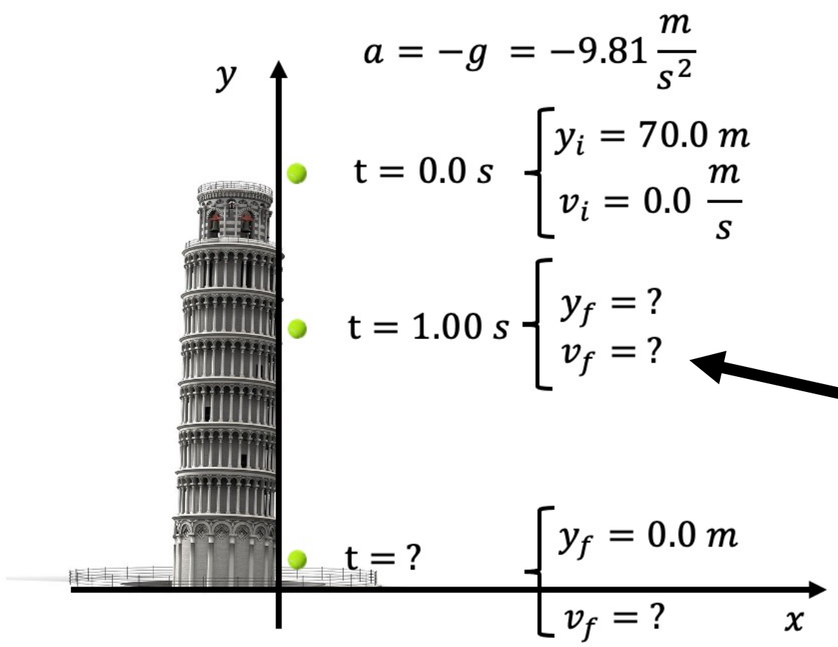

Calculate its velocity at 1.00 s

$$v_f = v_i + a \cdot t$$

$$v_f = 0 + (-9.81\,\frac{m}{s^2}) \cdot (1.00s)$$

$$v_f = -9.81\ \frac{m}{s}$$

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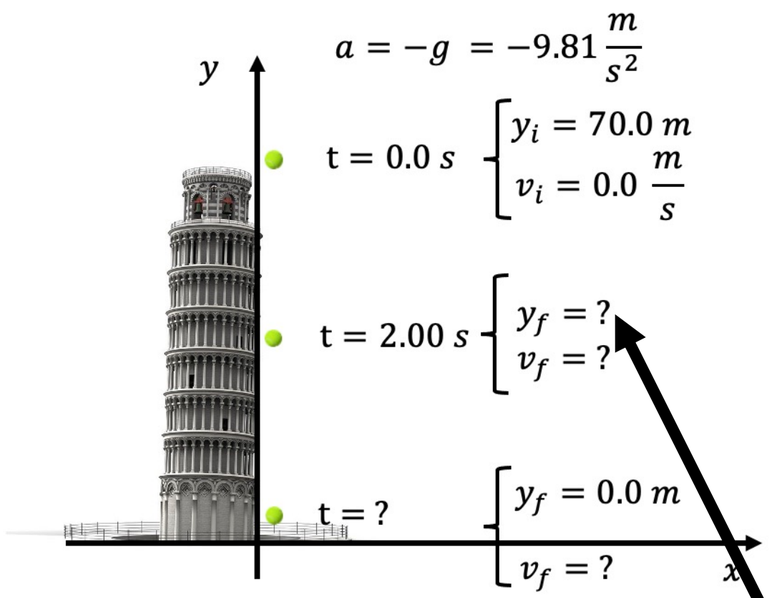
Calculate how far the ball has fallen after 2.00s



$$y_f = y_i + v_i \cdot t + \frac{1}{2} \cdot a \cdot t^2$$

$$y_f = 70.0\ m + 0 \cdot t + \frac{1}{2} \cdot (-9.81 \frac{m}{s^2}) \cdot (2.00s)^2$$

$$y_f = 70.0\ m - 19.62\ m$$

$$y_f = 50.4\ m$$

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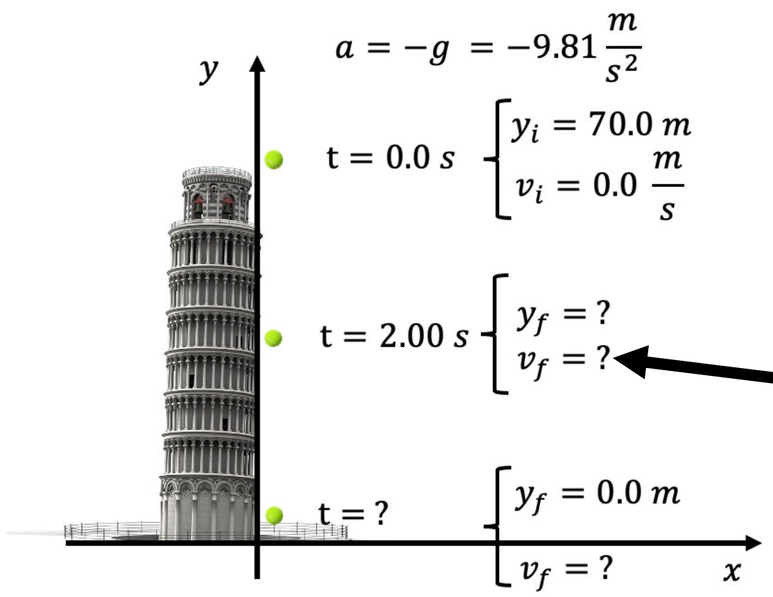

Calculate its velocity at 2.00 s

$$v_f = v_i + a \cdot t$$

$$v_f = 0 + (-9.81 \frac{m}{s^2}) \cdot (2.00s)$$

$$v_f = -19.6 \frac{m}{s}$$

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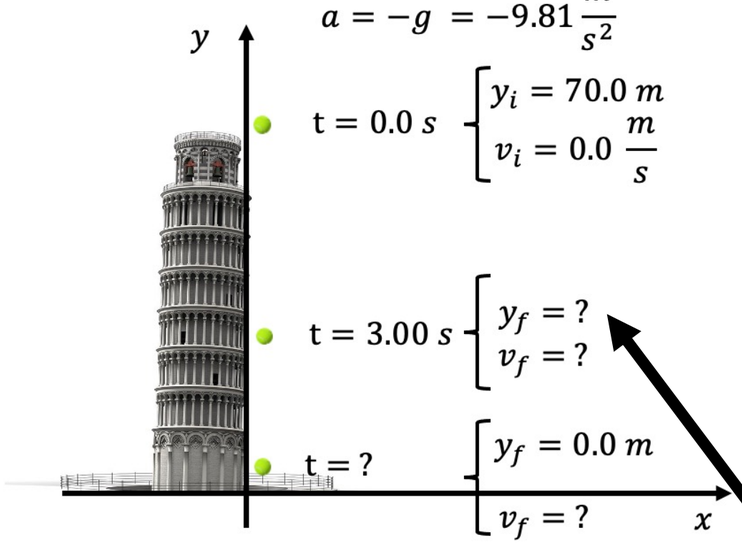
Drop a tennis ball from the top of a tower



Calculate how far the ball has fallen after 3.00s

$$y_f = y_i + v_i \cdot t + \frac{1}{2} \cdot a \cdot t^2$$

$$y_f = 70.0\ m + 0 \cdot t + \frac{1}{2} \cdot (-9.81 \frac{m}{s^2}) \cdot (3.00s)^2$$

$$y_f = 70.0\ m - 44.1\ m$$

$$y_f = 25.9\ m$$

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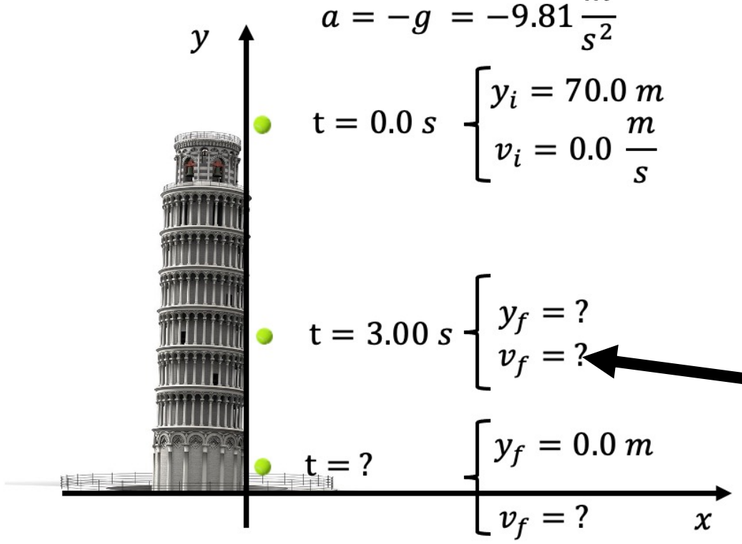
Drop a tennis ball from the top of a tower



Calculate its velocity at 3.00 s

$$v_f = v_i + a \cdot t$$

$$v_f = 0 + (-9.81 \frac{m}{s^2}) \cdot (3.00s)$$

$$v_f = -29.4\ \frac{m}{s}$$

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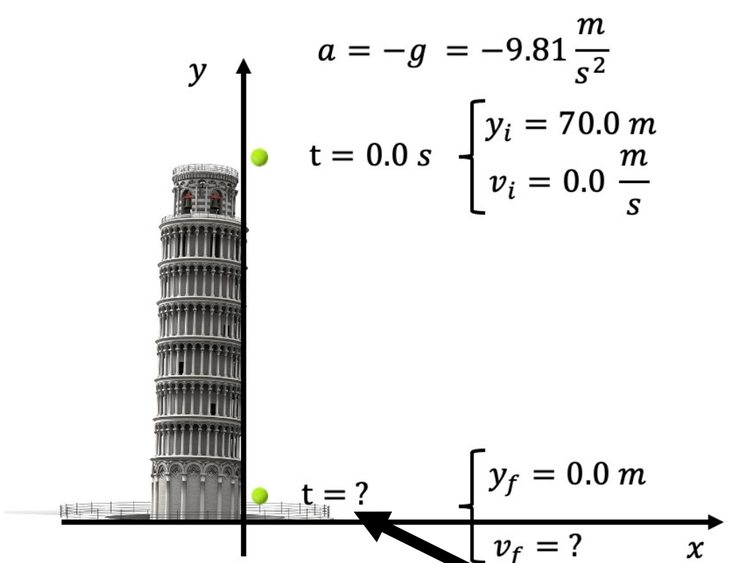
Calculate how long it takes for the ball to hit ground



$$y_f = y_i + v_i \cdot t + \frac{1}{2} \cdot a \cdot t^2$$

$$0 = 70.0\,m + 0 \cdot t + \frac{1}{2} \cdot (-9.81\,\frac{m}{s^2}) \cdot t^2$$

$$0 = 70.0\,m - 4.905\,\frac{m}{s^2} \cdot t^2$$

$$t = \sqrt{\frac{70.0\,m}{4.905\,\frac{m}{s^2}}}$$

$$t = 3.78\,s$$

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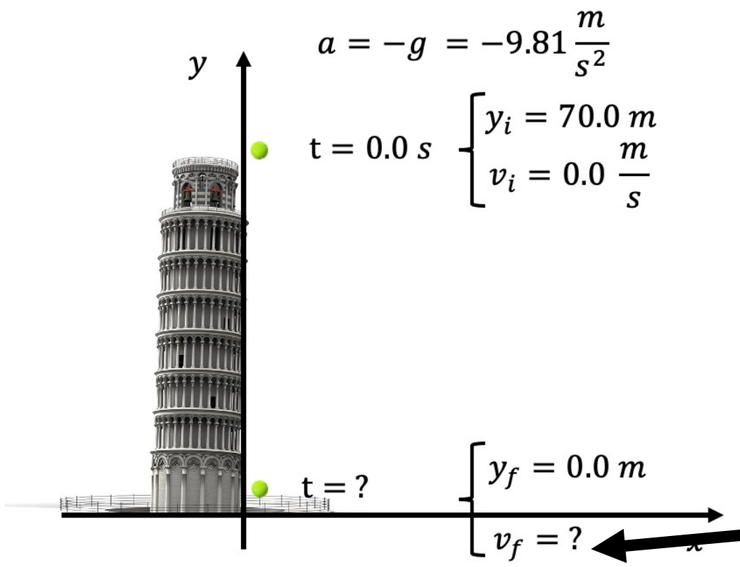
Calculate the final velocity of the ball right before hitting ground



$$v_f = v_i + a \cdot t$$

$$v_f = 0 + (-9.81 \frac{m}{s^2}) \cdot (3.78s)$$

$$v_f = -37.1\ \frac{m}{s}$$

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