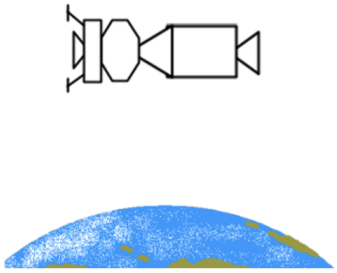
Free Fall

Motion under the influence of gravity ONLY! (Minimal Drag)



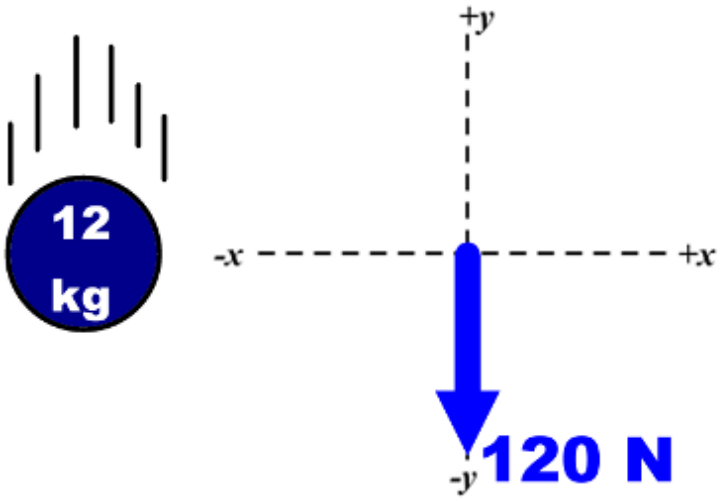
True Free Fall

Pretty close to Free Fall

Not even close

Free Fall Acceleration on Earth

g = 10 m/s/s
(DOWNWARDS)



CLOSE to FREE FALL

If an object…

- **Isn't moving too fast.**
- **Doesn't have large flat surface areas.**
- **Has an aerodynamic shape**

It won't be too far off from g = -10 m/s/s

"…assume drag is negligible…"

"…assume minimal drag…"

"…assume the object is in free fall…"

A kid falls from rest on a rooftop onto a trampoline. (Assume minimal drag) If she fell for 2.5 seconds…

a.) What was her final velocity?

b.) How far did she fall?

Solve this just like you would any other kinematics problem.

A kid falls from rest on a rooftop onto a trampoline. (Assume minimal drag) If she fell for 2.5 seconds…

a.) What was her final velocity?

b.) How far did she fall?

Known values:

$$v_i = 0\ m/s$$

Since there's minimal drag, she's experiencing true free fall → $a = -10\ m/s/s$

$$t = 2.5\ s$$

Choose the appropriate equation for answering the question…

- What was her final velocity?

Known values:

$$v_i = 0\ m/s$$

$$a = -10\ m/s/s$$

$$t = 2.5\ s$$

$$v_f = ??$$

"d" **NOT mentioned!**

$$v_f = v_i + at$$

$$v_f = -25\ m/s$$

Let's be careful here though!

These ARE known values!

$$v_i = 0\ m/s$$

$$a = -10\ m/s/s$$

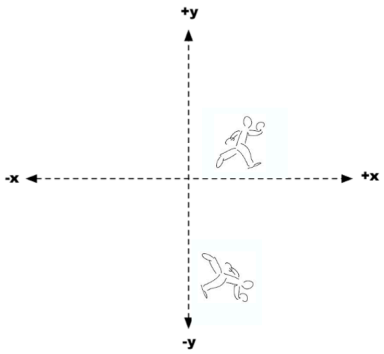
$$t = 2.5\ s$$

We DID use this equation!

$$v_f = v_i + at$$

We DID get $v_f = -25\ m/s$

When using kinematics in Free Fall, we need to be "direction-specific"



Example:

We can't just say "velocity", we must say "velocity in 'x'" or "velocity in 'y'".

Remember, we need to be **specific about direction**! Are we talking about **velocity, acceleration, displacement, in 'x' or 'y'?**

Known values BETTER!

$$v_{i,y} = 0\ m/s$$

$$a_y = -10\ m/s/s$$

$$t = 2.5\ s$$

Solving, we get…

$$v_{f,y} = -25\ m/s$$

Choose the appropriate equation for answering the question…

- How far did she fall?

Now that we know v_f we could use ANY of these three!

$$d = v_i t + \frac{1}{2} a t^2$$

$$d = \frac{1}{2}(v_f + v_i)t$$

$$v_f^2 = v_i^2 + 2ad$$

Again, be direction specific!

How far did she fall?

We're talking about displacement in 'y'!

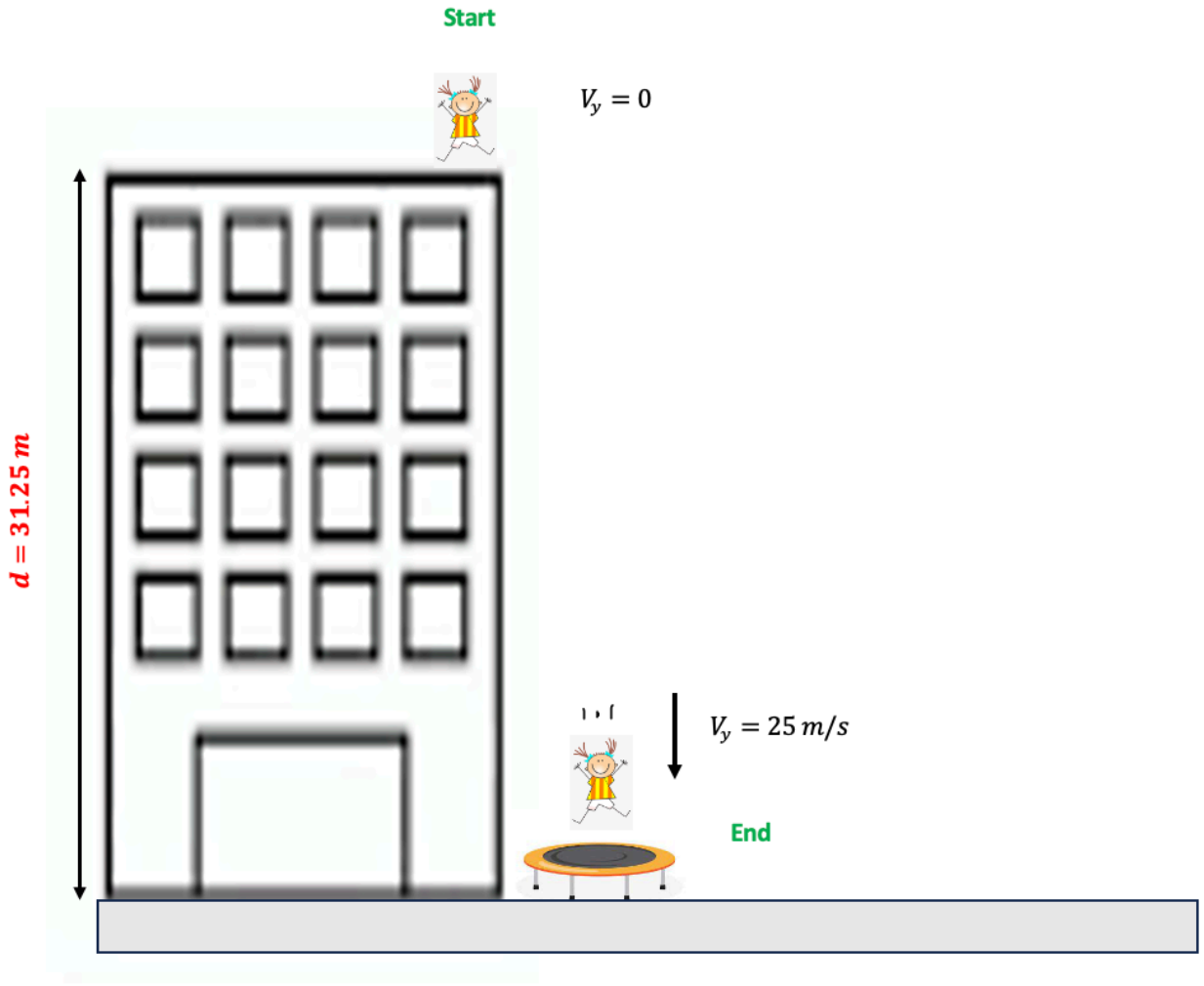
This means that when using the equations, we need velocity and acceleration in 'y'!

Solving for displacement we get…

$$d_y = -31.25\ meters$$

Getting a negative displacement for 'y' means that she ended at a LOWER height than she started at, which makes sense if she fell!

Here's a quick sketch of what happened.



Try this one on your own!

You're wondering how tall the Grand Canyon is, so you drop a rock from rest down into the canyon. After 9 seconds, you hear it hit the bottom. How tall must the canyon be?

Answer: 405 meters tall

***You can also assume free fall if the object you're dropping doesn't experience much drag. Objects likes rocks, bowling ball, etc.**