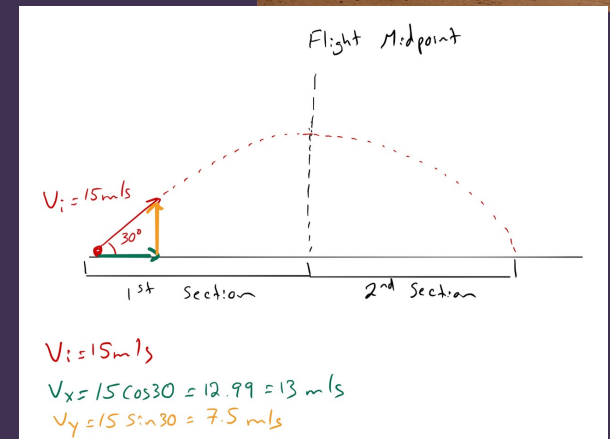


Projectile Motion

- Projectiles
- Gravity
- Tackling Projectile Motion Problems when $v_i = 0$
- Projectiles with v_i not equal to 0
- Answering more complex problems
- Practice



Preview File

Please enjoy this preview of your Student Version of the presentation. Please note within this sample file:

- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

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Google Classroom Ready**



A Projectile Is Simply...

The most common example of an object moving in two-dimensions where only the force of gravity and air resistance are acting on it.

Example: Baseball, cannonball, ski jumper



The Force of Gravity

- On Earth, the force of gravity causes ALL objects, no matter their size or mass, to accelerate downwards at 9.81 m/s^2
- However, different objects will fall at different rates due to air resistance – the force up on an object due to air acting on it
- If that air is removed ...



What Will Happen...

- You have two objects
- One is pushed horizontally off a desk while the other is dropped from the same height
- Which will hit the ground first assuming both have a $v_i = 0$

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BEEN REMOVED IN
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Tackling Projectile Motion Problems

1. READ THE QUESTION
2. Re-read the question and list your givens and unknown(s)
→ Ensure you divide your velocity into x and y components (i.e. v_{ix} , v_{iy} , v_{fx} , v_{fy})
3. Choose one of the 5 kinematic equations discussion previously
4. Draw a quick sketch, this gives you a better feel for the problem and helps avoid careless mistakes
5. Plug your numbers in and solve.

The 5 Kinematic Equations

$$a = \frac{v_f - v_i}{\Delta t}$$

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

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

$$v_f^2 = v_i^2 + 2a\Delta d$$

$$\Delta d = v_f \Delta t - \frac{1}{2} a (\Delta t)^2$$

Check Your Understanding

A ball is thrown from a window 10.0 m above the ground with an initial horizontal velocity of 3.0 m/s.

- a) How long will it take the ball to reach the ground?
- b) How far will the ball travel horizontally (i.e. its range)?

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Check Your Understanding

A child travels down a slide, leaving it with a velocity of 4.2 m/s horizontally. The child then experiences projectile motion, landing in a swimming pool 3.2 m below the slide.

a) For how long is the child airborne?

Check Your Understanding

A child travels down a slide, leaving it with a velocity of 4.2 m/s horizontally as shown below. The child then experiences projectile motion, landing in a swimming pool 3.2 m below the slide.

- a) For how long is the child airborne? **[answer: 0.81 s]**
- b) Determine the child's horizontal displacement while in the air.

Check Your Understanding

A child travels down a slide, leaving it with a velocity of 4.2 m/s horizontally as shown below. The child then experiences projectile motion, landing in a swimming pool 3.2 m below the slide.

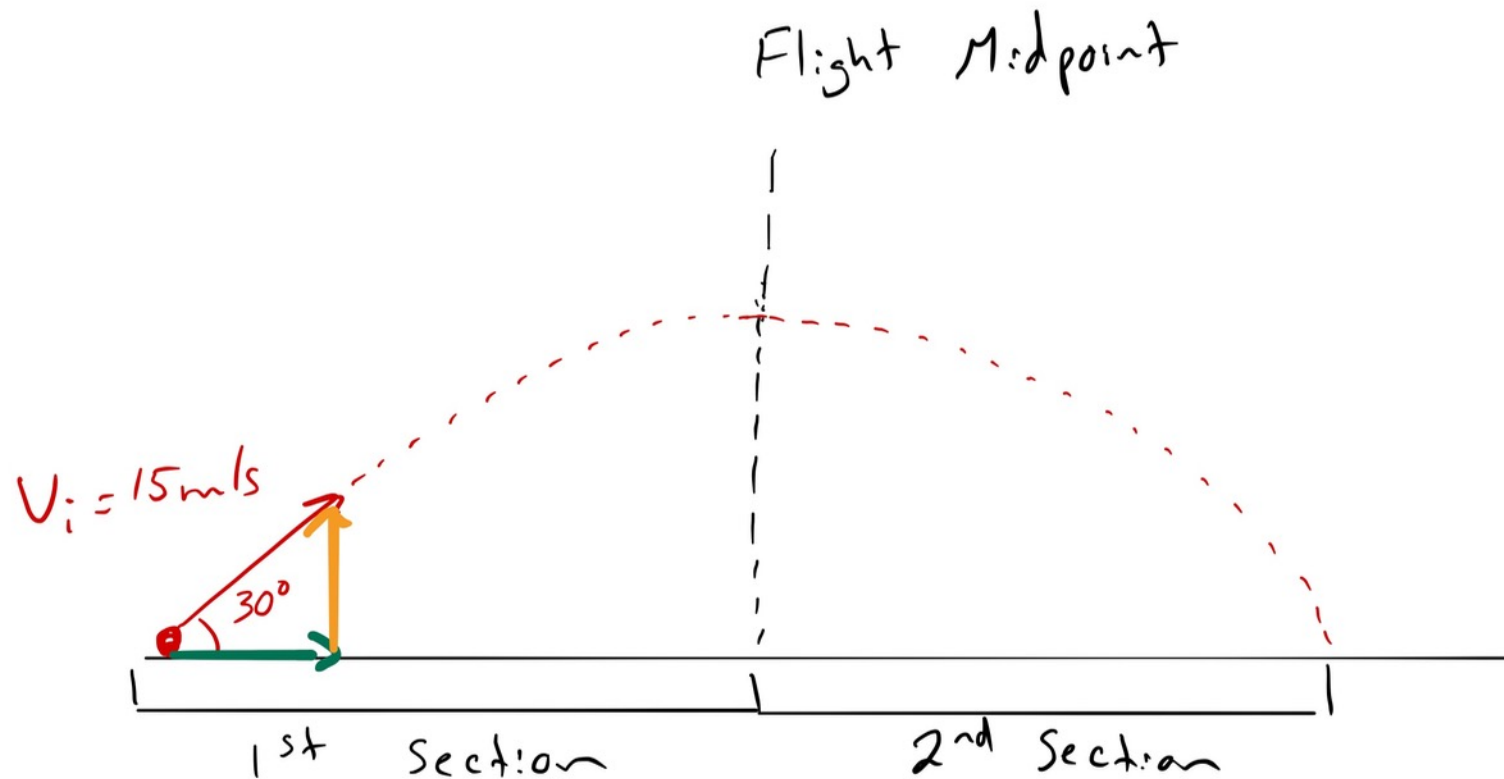
- a) For how long is the child airborne? **[answer: 0.81 s]**
- b) Determine the child's horizontal displacement while in the air.
[answer: 3.4 m [fwd]]
- c) Determine the child's velocity upon entering the water.

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Analyzing More Complex Projectile Motion

- The same kinematics equations can be used to analyze problems where the initial velocity is at some angle to the horizontal, $v_{iy} \neq 0$
- Often, you
- You will also need to use vectors components to find the velocity values in the x and y directions

Example



$$V_i = 15 \text{ m/s}$$

$$V_x = 15 \cos 30 = 12.99 = 13 \text{ m/s}$$

$$V_y = 15 \sin 30 = 7.5 \text{ m/s}$$

Check Your Understanding

A soccer player running on a level playing field kicks a soccer ball with a velocity of 9.4 m/s [fwd] at an angle of 40° above the horizontal. Determine the soccer balls

- a) time of flight.
- b) range.
- c) maximum height.

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Check Your Understanding

A golfer is trying to improve the range of her shot. To do so she drives a golf ball from the top of a steep cliff, 30.0 m above the ground where the ball will land. If the ball has an initial velocity of 25 m/s and is launched at an angle of 50° above the horizontal, determine the balls

- a) time of flight. **[answer: 5.1 s]**
- b) its range.

Check Your Understanding

A golfer is trying to improve the range of her shot. To do so she drives a golf ball from the top of a steep cliff, 30.0 m above the ground where the ball will land. If the ball has an initial velocity of 25 m/s and is launched at an angle of 50° above the horizontal, determine the balls

- a) time of flight. **[answer: 5.1 s]**
- b) its range. **[answer: 82 m [fwd]]**
- c) its final velocity just before it hits the ground.

Check Your Understanding

A princess, trapped in a castle wraps a message around a rock and throws it from the top of the castle wall with an initial velocity of 12 m/s [42° above the horizontal]. The rock lands just on the far side of the castle's moat, at a level 9.5 m below the initial level. Determine the

a) time of flight.

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Check Your Understanding

A princess, trapped in a castle wraps a message around a rock and throws it from the top of the castle wall with an initial velocity of 12 m/s [42° above the horizontal]. The rock lands just on the far side of the castle's moat, at a level 9.5 m below the initial level. Determine the

- a) time of flight. **[answer: 2.4 s]**
- b) width of the moat. **[answer: 22 m]**
- c) velocity at impact.

Check Your Understanding

A superhero launches himself from the top of a building with a velocity of 7.3 m/s at an angle of 25° above the horizontal. If the building is 17 m high

- a) how far will he travel horizontally before reaching the ground?
- b) what is his final velocity?