5.1 Motion in Two Dimensions

STANDARDS

5.1 I can define, interpret, and analyze objects moving in two dimensions.

The Race Is On

START \[ X = V_t \times t = 100 \text{ m} \]
FINISH

\[ t = \frac{X}{V_t} = \frac{100}{9} \approx 11.11 \text{ s} \]

The Eagle Descends

An eagle perched on a tree limb 19.5 m above the water spots a fish swimming near the surface. The eagle pushes off from the branch and descends toward the water. By adjusting its body in flight, the eagle maintains a constant speed of 3.10 m/s at an angle of 20.0° below horizontal.

The Eagle Descends

(a) How long does it take for the eagle to reach the water?

\[ t = \frac{X}{V} = \frac{19.5}{3.1} \approx 6.29 \text{ s} \]

(b) How far has the eagle traveled in the horizontal direction when it reaches the water?

\[ d = \frac{V_x \times t}{\cos \theta} = \frac{7.8 \times 6.29}{\cos 20°} \approx 53 \text{ m} \]
AP PHYSICS
October 22, 2018

5.1 TWO-DIMENSIONAL KINEMATICS AND PROJECTILE MOTION

**Constant-Acceleration Equations of Motion**

<table>
<thead>
<tr>
<th>Position as a function of time</th>
<th>Velocity as a function of time</th>
<th>Velocity as a function of position</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2 )</td>
<td>( v_{1y} = v_{0y} + a_y t )</td>
<td>( v_x^2 = v_{0x}^2 + 2a_x \Delta x )</td>
</tr>
<tr>
<td>( y = y_0 + v_{0y} t + \frac{1}{2} a_y t^2 )</td>
<td>( v_{1y} = v_{0y} + a_y t )</td>
<td>( v_y^2 = v_{0y}^2 + 2a_y \Delta y )</td>
</tr>
</tbody>
</table>

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**Zipline**

Ryan is riding the zipline in Jamaica. He starts at a height of 6.5 m and accelerates down the zipline at 1.0 m/s\(^2\), at an angle of 25° below horizontal. How long will it take him to reach the ground?

**HOMEWORK**

Unit 5 Problems

(1-4)