

The Race Is On

START $x = vt$ FINISH

160 m

① 9 m/s $t = \frac{x}{v} = \frac{115 \text{ m}}{9 \text{ m/s}} = 12.8 \text{ s}$

② 8 m/s $t = \frac{x}{v} = \frac{100 \text{ m}}{8 \text{ m/s}} = 12.5 \text{ s}$

$\cos 30 = \frac{100}{d}$

$d = 115 \text{ m}$

100 m

9 m/s

$\cos 30 = \frac{v_x}{9}$

$v_x = 7.8 \text{ m/s}$

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?

$v_0 = 3.10 \text{ m/s}$

$\theta = 20.0^\circ$

$h = 19.5 \text{ m}$

$X = Vt$

$t = \frac{x}{v} = \frac{57 \text{ m}}{3.10 \text{ m/s}}$

$t = 18.4 \text{ s}$

$\sin 20 = \frac{19.5}{d}$

$d = 57 \text{ m}$

$d = \frac{19.5}{\sin 20}$

$x = 53 \text{ m}$

$t = \frac{y}{v_y} = \frac{19.5 \text{ m}}{1.06 \text{ m/s}}$

$t = 18.4 \text{ s}$

The Eagle Descends

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

$x = v_x t = (2.91 \text{ m/s})(18.4 \text{ s})$

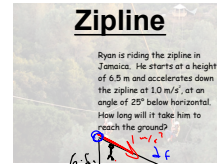
53 m

Constant-Acceleration Equations of Motion



TABLE 4-1 Constant-Acceleration Equations of Motion

Position as a function of time	Velocity as a function of time	Velocity as a function of position
$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$	$v_x = v_{0x} + a_x t$	$v_x^2 = v_{0x}^2 + 2a_x \Delta x$
$y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$	$v_y = v_{0y} + a_y t$	$v_y^2 = v_{0y}^2 + 2a_y \Delta y$



Handwritten notes for the zipline problem:

x y M_0
 $x_0 = 0$ $y_0 = 6.5$ $d_0 = 0$
 $x_f = -$ $y_f = 0$ $d_f = -$
 $a_x = -$ $a_y = -g$ $a = 1.0$
 $v_{0x} = 0$ $v_{0y} = 0$ $v_{0z} = 0$

Diagram showing acceleration components a_x and a_y relative to the zipline angle of 25° .

Equation: $x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$

HOMWORK

Unit 5 Problems (1-4)