sing Factoring to Solve Problems

r each problem, define the variable, draw a diagram as licated, write an equation(s), and solve.

Projectiles, Finding Maximum Height

The **maximum height** will be at the **vertex** of the graph, where x = time and y = height. $x = \frac{-b}{2a}$

When height, h, is in feet: $h = -16t^2 + vt + c$

t is the time in motion (in seconds)

v is the initial upward velocity (in ft/sec or m/sec)

c is the initial height

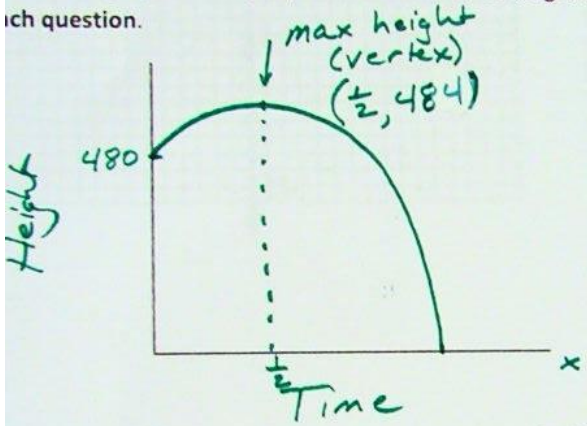
AMPLES:

Eli

Chris jumped off of a cliff with an initial velocity of 16 ft/s into the ocean in Acapulco while vacationing with some ends. The cliff was 480 ft above the ocean. $v = 16$

c

etch the graph of Eli's jump as a function of his height over time. Label all important information as you answer ch question.



Function h(t) = $-16t^2 + 16t + 480$

a = -16 b = 16 c = 480

) How long did it take for Eli to reach his maximum height? Variable: x = time Equation: $x = \frac{-b}{2a}$

$x = \frac{-16}{2 \cdot -16} = \frac{1}{2}$

olution: $\frac{1}{2}$ sec

) What was the highest point that Eli reached? Variable: h = height (at vertex) when $t = \frac{1}{2}$ Equation: $h = -16(\frac{1}{2})^2 + 16(\frac{1}{2}) + 480$

$h = -16 \cdot \frac{1}{4} + 8 + 480$

$h = -4 + 8 + 480$

$h = 484$

olution: ~~484~~ 484 ft

) Eli hit the water ($h = 0$) after how many seconds? Variable: t = time Equation: $0 = -16t^2 + 16t + 480$

$h = 0$

$0 = -16(t^2 - t - 30)$

$0 = -16(t + 5)(t - 6)$

-5 6

olution: 6 sec

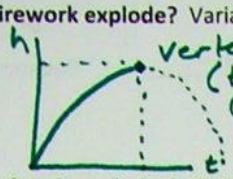
$v = 80$

me fireworks are fired vertically into the air from the ground at an initial velocity of 80 feet per second. When ighest point is reached by the firework –it explodes. Function h(t) = $-16t^2 + 80t + 0$

a= -16 b = 80 c = 0

ter how many seconds does the firework explode? Variable: t = time Equation: $t = \frac{-b}{2a}$

tion: $2\frac{1}{2}$ sec



$t = \frac{-80}{2 \cdot -16} = \frac{-80}{-32} = 2\frac{1}{2}$

hat is the height of the firework when it explodes? Variable: h = height Equation: $h = -16t^2 + 80t + 0$

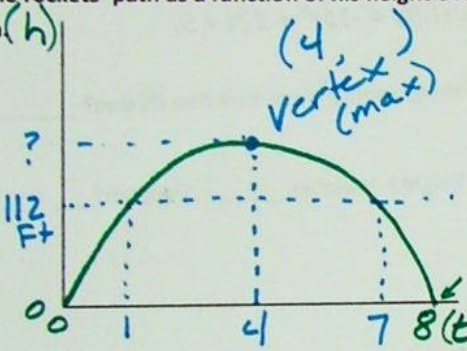
$h = -16(2.5)^2 + 80(2.5) + 0$

tion: 100 Ft

$h = 100$

a toy rocket is launched vertically upward from ground level with an initial velocity of 128 feet per second, then eight, h after t seconds is given by the equation $h(t) = -16t^2 + 128t$ (if air resistance is neglected.)

ch the graph of the rockets' path as a function of its height over time. Label all important information as you ver each question.



Function h(t) = $-16t^2 + 128t$

a= -16 b = 128 c = 0

ow long will it take for the rocket to return to the ground? Variable: t = time Equation: $h = -16t^2 + 128t$

$h = 0$

$0 = -16t^2 + 128t$

tion: 8 sec.

$0 = -16t(t - 8)$

0 and 8

r how many seconds will the rocket be 112 feet above the ground? Variable: t = time Equation: $112 = -16t^2 + 128t$

For $7 - 1 = 6$ $h = 112$

tion: 6 sec

$0 = -16t^2 + 128t - 112$

$0 = -16(t^2 - 8t + 7)$

$0 = -16(t - 1)(t - 7)$

1 & 7

(vertex)

w long will it take the rocket to reach its maximum height? Variable: t = time Equation: $t = \frac{-b}{2a}$

ion: 4 sec

$t = \frac{-128}{-32} = 4$

hat is the maximum height? Variable: h = height Equation: $h = -16t^2 + 128t$

$h = -16(4)^2 + 128(4)$

ion: 256 Ft

$h = 256$