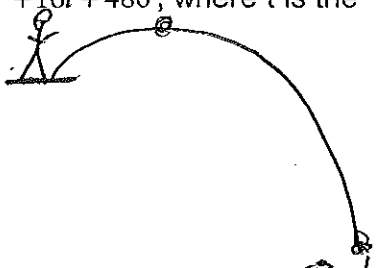
Name: _____
Date: _____ Period: ___

Quadratic Formula Word Problems

1. Jason jumped off of a cliff into the ocean in Acapulco while vacationing with some friends. His height as a function of time could be modeled by the function $h(t) = -16t^2 + 16t + 480$, where t is the time in seconds and h is the height in feet.



a. How long did it take for Jason to reach his maximum height?

$h = \frac{-16}{2(-16)} = \frac{1}{2}$ second

b. What was the highest point that Jason reached?

$-16(1/2)^2 + 16(1/2) + 480 = 484$ feet

Splash!

$\frac{-16+176}{-32} = -5$

$\frac{-16-176}{-32} = 6$

c. Jason hit the water after how many seconds?

$$\frac{-16 \pm \sqrt{16^2 - 4(-16)(480)}}{2(-16)} = \frac{-16 \pm \sqrt{30976}}{-32} = \frac{-16 \pm 176}{-32}$$

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

a. How long will it take for the rocket to return to the ground? QF

$$\frac{-128 \pm \sqrt{128^2 - 4(-16)(0)}}{2(-16)} = \frac{-128 \pm \sqrt{128^2}}{-32} = \frac{-128 \pm 128}{-32}$$

b. After how many seconds will the rocket be 112 feet above the ground?

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

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

QF

$$\frac{-128 \pm \sqrt{128^2 - 4(-16)(-112)}}{2(-16)}$$

$$\frac{-128 \pm \sqrt{9216}}{-32} = \frac{-128 \pm 96}{-32} = 1, 7$$

$\frac{-128+128}{-32} = 0$

$\frac{-128-128}{-32} = 8$

c. How long will it take the rocket to hit its maximum height?

$\frac{-128}{2(-16)} = 4$ sec

d. What is the maximum height?

$-16(4)^2 + 128(4) = 256$ feet

3. A rocket is launched from atop a 101 – foot cliff with an initial velocity of 116 ft/s.

a. Substitute the values into the vertical motion formula $h(t) = -16t^2 + vt + h_0$. Let h(t) = 0

b. Use the quadratic formula to find out how long the rocket will take to hit the ground after it is launched. Round to the nearest tenth of a second.

$h(t) = -16t^2 + 116t + 101$

$x = \frac{-116 \pm \sqrt{116^2 - 4(-16)(101)}}{2(-16)} = \frac{-116 \pm \sqrt{19170}}{-32} = \frac{-116 \pm 141.138}{-32}$

$\frac{25.14}{-32} = -.785$ OR $\frac{-257.14}{-32} = 8.04$

4. You and a friend are hiking in the mountains. You want to climb to a ledge that is 20 ft. above you. The height of the grappling hook you throw is given by the function $h(t) = -16t^2 - 32t + 5$. What is the maximum height of the grappling hook? Can you throw it high enough to reach the ledge?

$h = \frac{-(-32)}{2(-16)} = \frac{32}{-32} = -1$ second

But this is stupid. It means the max height was 1 second ago.

Plug in -1

$-16(-1)^2 - 32(-1) + 5$

$-16 + 32 + 5 = 21$ feet

5. You are trying to dunk a basketball. You need to jump 2.5 ft. in the air to dunk the ball. The height that your feet are above the ground is given by the function $h(t) = -16t^2 + 12t$. What is the maximum height your feet will be above the ground? Will you be able to dunk the basketball?

$h = \frac{-12}{2(-16)} = \frac{-12}{-32} = .375$ seconds

Plug in

$-16(.375)^2 + 12(.375) = 2.25$ feet

No. You need to do more squats.

6. A diver is standing on a platform 24 ft. above the pool. He jumps form the platform with an initi8al upward velocity of 8 ft/s. Use the formula $h(t) = -16t^2 + vt + s$, where h is his height above the water, t is the time, v is his starting upward velocity, and s is his starting height. How long will it take for him to hit the water?

$-16t^2 + 8t + 24$

$x = \frac{-(8) \pm \sqrt{(8)^2 - 4(-16)(24)}}{2(-16)} = \frac{-8 \pm \sqrt{1600}}{-32} = \frac{-8 \pm 40}{-32}$

$\frac{32}{-32} = -1$

$\frac{-48}{-32} = 1.5$ seconds