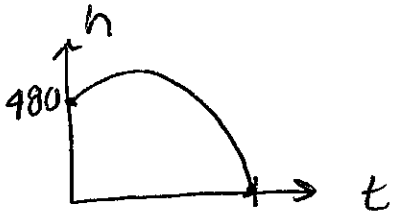
Name: Key
Date: _____ Period: ___

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?

vertex (0.5, 484)
0.5 seconds

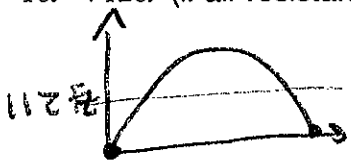
b. What was the highest point that Jason reached?

vertex (0.5, 484)
484 feet

c. Jason hit the water after how many seconds?

when $h = 0$, $t = 6$ seconds

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?

$h = 0$ $t = 8$ seconds

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

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

$t = 1$ $t = 7$
1 second

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

vertex (4, 256)
$t = 4$ sec

d. What is the maximum height?

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.

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

b) Roots $\{-0.856, 8.106\}$

So... 8.1 seconds

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 = 20 ft $\quad 20 = -16t^2 - 32t + 5 \rightarrow$

① Find where vertex is; rewrite equation to equal zero.

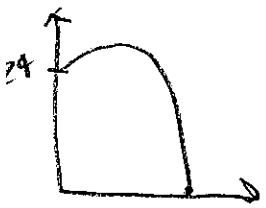
② Find max height (vertex) : 21 ft.

Yes

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?

Vertex $\left(\frac{3}{8}, 2.25\right)$

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?



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

Vertex (0.25, 25)

let $h = 0$

$t = 1.5$ seconds

7. A ball is thrown upward from a height of 15 ft. with an initial upward velocity of 5 ft/s. Use the formula $h(t) = -16t^2 + vt + s$ to find how long it will take for the ball to hit the ground.

$h = -16t^2 + 5t + 15$

$t = 1.1$ seconds

8. One of the games at a carnival involves trying to ring a bell with a ball by hitting a lever that propels the ball into the air. The height of the ball is modeled by the equation $h(t) = -16t^2 + 39t$. If the bell is 25 ft. above the ground, will it be hit by the ball?

Vertex (1.2, 23.76)

NO

9. A ship drops anchor in a harbor. The anchor is 49 ft. above the surface of the water when it is released. Use the vertical motion formula $h = -16t^2 + vt + s$ to answer the following questions.

a. What is the value of x, the starting height? 49 ft

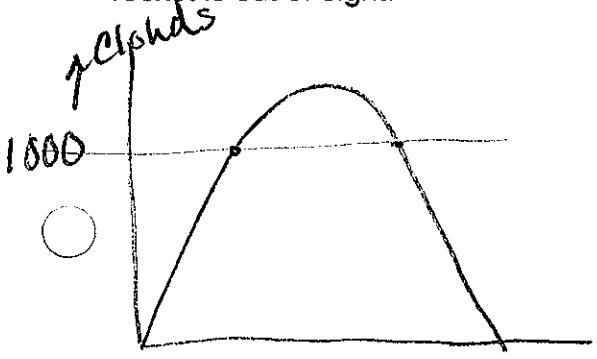
b. What is the value of h when the anchor hits the water? 0

c. The starting velocity is zero. After how many seconds will the anchor hit the water?

$h = -16t^2 + 49$

$t = 1.75$ seconds

10. An amateur rocketry club is holding a competition. There is cloud cover at 1000 ft. If a rocket is launched with a velocity of 315 ft/s, use the function $h(t) = -16t^2 + vt + h_0$ to determine how long the rocket is out of sight.



$h = -16t^2 + 315t$

$1000 = -16t^2 + 315t$

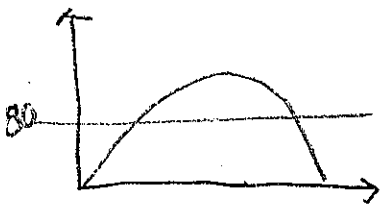
$0 = -16t^2 + 315t - 1000$

Roots $\{3.98, 15.71\}$

Time $= 15.71 - 3.98$

11.73 seconds

11. A trebuchet launches a projectile on a parabolic arc at a velocity of 35 ft/s. Using the function $h(t) = -16t + vt + h_0$, determine when the projectile will first reach a height of 80 ft., and how many seconds later will it again be 80 feet.

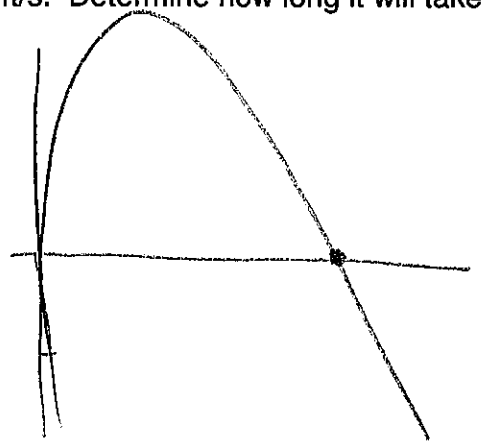


$80 = -16t^2 + 35t$

$0 = -16t^2 + 35t - 80$

Not given initial height, can't determine. If it starts at 0, then it only reaches ~19 ft

12. During World War I, mortars were fired from trenches 3 feet down. The mortars had a velocity of 150 ft/s. Determine how long it will take for the mortar shell to strike its target.



$h = 0$

$s = -3$ ft

$v = 150$ ft/s

Find x intercepts, roots

{0.02 9.355}

$t = 9.4$ seconds