Chapter 5 WORD PROBLEMS!!!!

When an object is ***dropped***, its speed continually increases, and therefore its height above the ground decreases at a faster rate. The height *h* (in feet) of the object *t* seconds after it is dropped can be modeled by the function

$$\boxed{h = -16t^2 + h_0}$$ ← initial height

where h_0 is the object's initial height in feet, **t** is the time in seconds, and **h** is the height in feet.

Use the above information to solve the following:

Ex 1) A stunt man working on a set of a movie is to fall out of a window 200 feet above the ground.

a. What is the equation for this example? $y = -16t^2 + 200$

b. How high will the stunt man be after .5 seconds? 2 seconds?

$t = .5$
$y = -16(.5)^2 + 200$
$\boxed{y = 196 \text{ ft}}$

$t = 2$
$y = -16(2)^2 + 200$
$\boxed{y = 136 \text{ ft}}$

c. How much time will it take him to reach a height of 64 feet?

$y = 64$ → solve for t

$64 = -16t^2 + 200$
$-136 = -16t^2$
$\sqrt{8.5} = \sqrt{t^2}$

$\boxed{t = 2.92 \text{ seconds}}$

d. When will the man hit a rectangular cushion that is 10 feet above the ground?

$y = 10$ → solve for t

$10 = -16t^2 + 200$
$-190 = -16t^2$
$11.875 = t^2$

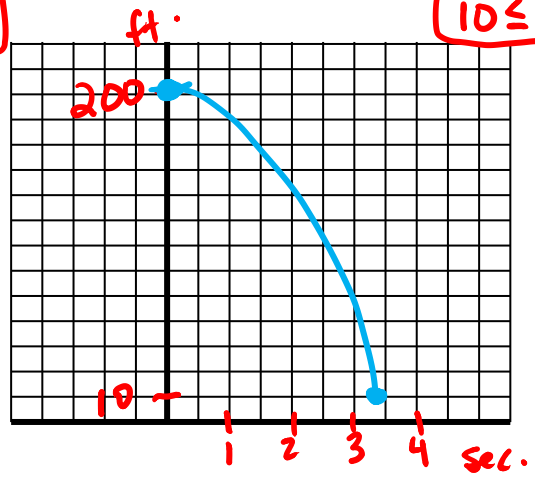
$\boxed{t = 3.45 \text{ seconds}}$

e. What is the proper domain for this function? The proper range?

time — domain $0 \to 3.45$ sec.
$\boxed{0 \le t \le 3.45}$

height — range $10 \to 200$ feet
$\boxed{10 \le y \le 200}$

f. Graph the function:



(.5, 196)
(2, 136)
(2.92, 64)
(3.45, 10)

Ex 2) At an engineering school, students are challenged to design a container that prevents an egg from breaking when dropped from a height of 50 feet. Write an equation giving a container's height *h* (in feet) above the ground after *t* seconds. Write an equation representing the situation and determine how long it will take for the container to hit the ground? h=0 ft.

$h=-16t^2+50$

$0=-16t^2+50$

$-50=-16t^2$

$3.125=t^2$

$\boxed{t=1.77 \text{ seconds}}$

For an object that is ***launched or thrown***, an extra term v_0t must be added to the model to account for the initial vertical velocity v_0.

$$\boxed{h = -16t^2 + v_0t + h_0}$$

Initial velocity can be …

positive - thrown upward negative - thrown downward zero – dropped

Ex 3) A baton twirler tosses a baton into the air. The baton leaves the twirler's hand 6 feet above the ground has an initial velocity of 45 feet per second.

a. What is the equation? $\boxed{h=-16t^2+45t+6}$

b. What is the highest point that the baton will go? maximum

(*could use $x=\frac{-b}{2a}$)

OR (1.41, 37.64)

$\boxed{37.64 \text{ ft}}$

*VERTEX - use $\boxed{\text{max}}$ on the calculator

* 2nd Trace - maximum left(ent), right (ent), guess (ent)

c. The twirler catches the baton when it falls back to a height of 5 feet. How long is the baton in the air?

$\underbrace{5}_{Y_2}=\underbrace{-16t^2+45t+6}_{Y_1}$

*use intersect