4 Using Technology to Understand Quadratic Functions

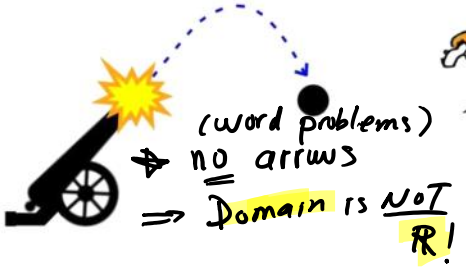
March 31, 2021 6:27 PM

FOM 11 Ch 7: Day 4 Using Technology to Understand Quadratic Functions (7.2)

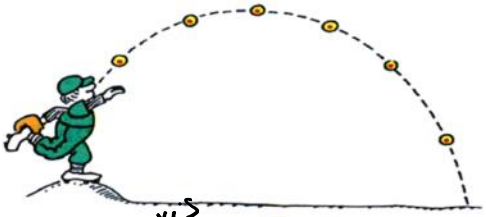
Projectile motion: *Any time you shoot a basket, throw a baseball, or launch fireworks – the path of the object in the air is modelled by a quadratic function!*

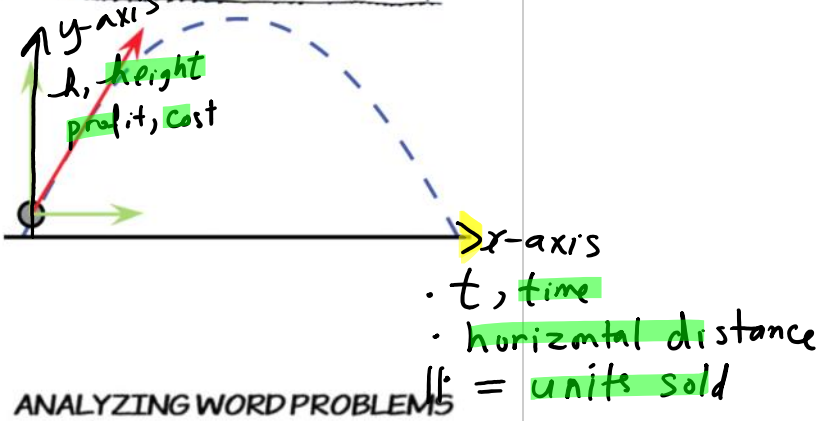
Goal: I can use technology (e.g., *desmos*) to analyze quadratic functions, e.g., identify the *vertex*, *domain*, *range*, *max* value (like maximum *height*), and *time spent in the air*.

Solving **P**rojectile **M**otion **P**roblems

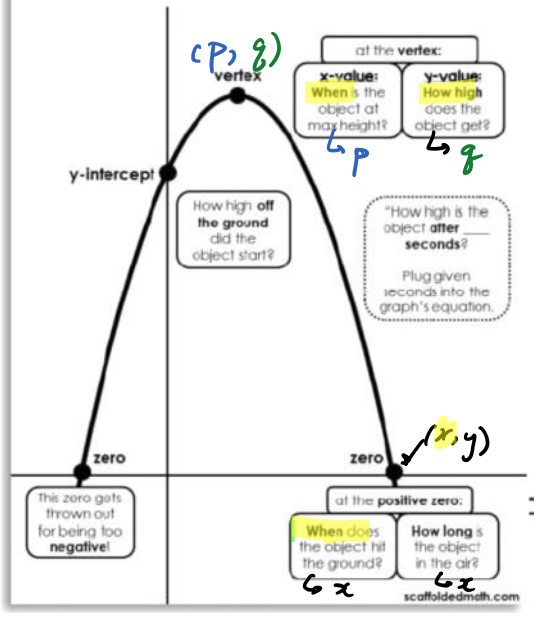


(word problems)
⇒ no arrows
⇒ Domain is NOT ℝ!

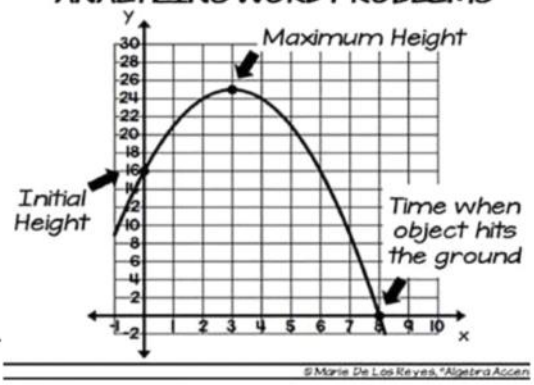




Quadratic Keywords



ANALYZING WORD PROBLEMS



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Example 1: A water arch at a splash pad is defined by the quadratic function $f(x) = -0.15x^2 + 3x$.

a) Use *desmos* to graph the function using the grid provided.

b) What is the maximum height that the water reaches? 15 m

c) At what time is the water at maximum height? p

d) How long does it take the water to hit the ground? 10 sec

e) What is the domain? $[0, 20]$ $0 \le x \le 20$

f) What is the range? $[0, 15]$ $0 \le y \le 15$

Example 2: A cliff diver dives from a cliff that is about 30 m above the water. The diver's height, h, in meters after t seconds is modelled by $h = -5t^2 + 5t + 30$. → desmos: use "x", not "t"

a) Use *desmos* to graph the function using the grid provided.

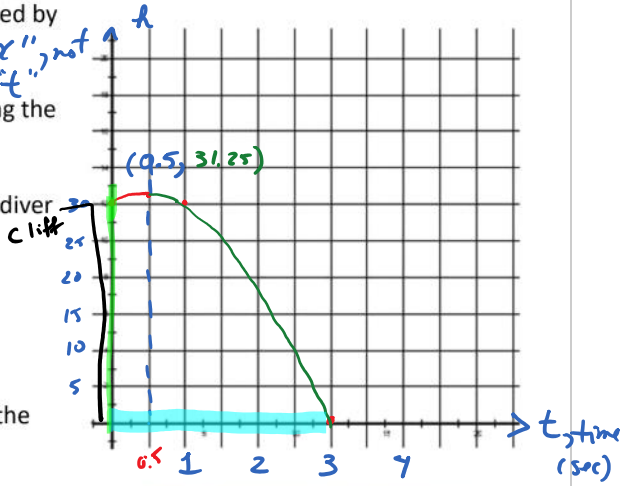
b) What is the maximum height that the diver reaches? 31.25 m

c) At what time is the diver at maximum height? 0.5 sec

d) How long does it take the diver to hit the water's surface? 3 sec

e) What is the domain? $[0, 3]$

f) What is the range? $[0, 31.25]$

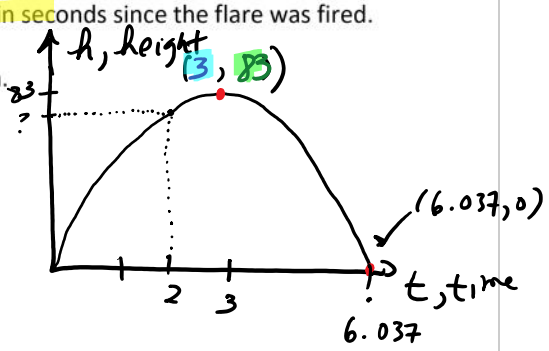


Example 3: Some boaters use red aerial mini flares in an emergency. The path of one brand of flare, when fired at an angle of 70 degrees to the horizontal, is modelled by the function

$$h(t) = -9(t-3)^2 + 83$$

where *h(t)* is the height in metres and *t* is the time in seconds since the flare was fired.

a) Use *desmos* to sketch a graph of the function.



b) What is the maximum height of the flare?

83 m

c) How many seconds does it take to reach the maximum height?

3 sec

d) How many second until the flare hits the water? (Same as asking "How long was it in the air?")

6.037 sec

e) If the flare burns red for 2 seconds, how high is it when it burns out?

$t = 2$ Plug in $t=2$ into equation:

$$h(t) = -9(t-3)^2 + 83$$
$$= -9(2-3)^2 + 83$$
$$= -9(-1)^2 + 83$$
$$= -9(1) + 83$$
$$= 74 \text{ m}$$

It is 74 m high.

f) Domain: $[0, 6.037]$

g) Range: $[0, 83]$