Quadratic Application – Projectile Motion

A soccer ball is kicked up in the air. Its height can be modelled by the equation

$$h = -5(t - 0)(t - 6)$$

a) What is the height of the soccer ball 2 seconds after it is kicked?

set $t=2$ $h=-5(2-0)(2-6)$

$=-5(2)(-4)$

$=40m$

b) What are the t-intercepts? 0 & 6

c) Expand the equation to represent it in standard form.

$h=-5(t-0)(t-6)$

$=-5(t^2-6t-0t+0)$

$=-5(t^2-6t+0)$

$h=-5t^2+30t+0$

d) What is the h-intercept? h-int = 0

e) Determine the vertex.

vertex

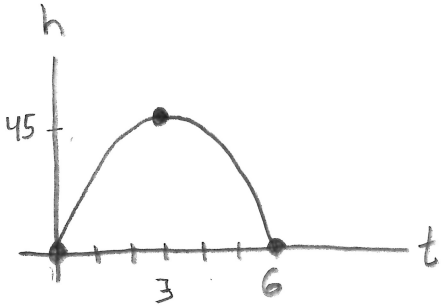
$t=\frac{(0)+(6)}{2}$ $h=-5(3-0)(3-6)$

$t=3$ $=-5(3)(-3)$

$h=45$

vertex → (3, 45)

f) Create a sketch to represent the relationship between the height of the soccer ball with respect to time.



g) What is the maximum height reached by the soccer ball and how long did it take to reach that height? Max height of 45m after 3 seconds.

h) For what length of time was the soccer ball airborne?

It was airborne for 6 seconds.

Projectile Question

A stone is thrown off a bridge. The height of the stone relative to the surface of the water down below is given by the equation:

$$h = -5t^2 + 10t + 40$$

h-int

a) What was the height of the stone 3 seconds after it was tossed?

set $t = 3$ $\quad h = -5(3)^2 + 10(3) + 40$

$= -5(9) + 30 + 40$

$= -45 + 30 + 40$

$= 25$m

b) What is the h-intercept? h-int = 40 m

c) Factor the equation to express it in factored form.

$h = -5t^2 + 10t + 40$

$= -5(t^2 - 2t - 8)$

$= -5(t-4)(t+2)$

d) What are the t-intercepts? 4 & -2

e) Determine the vertex.

vertex

$t = \frac{(4)+(-2)}{2}$

$t = 1$

$h = -5(1-4)(1+2)$

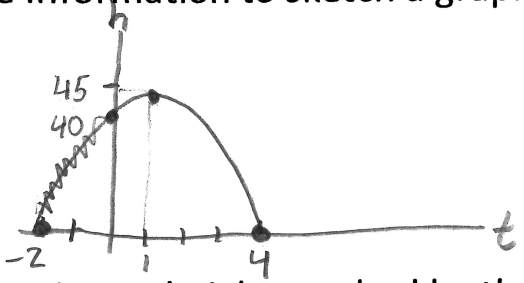
$= -5(-3)(3)$

$= 45$

vertex is (1, 45)

t h

f) Use the above information to sketch a graph of height vs. time.



g) What is the maximum height reached by the stone and how long did it take to reach that height? It reached a maximum height of 45m after 1 second.

h) What was the height of the bridge? 40m

i) How high was the stone thrown above the bridge?

height = 45 − 40

= 5m