Quadratic Functions Word Problems

Ex. #1: The following function gives the height, h(t) metres, of a batted baseball as a function of the time, t seconds, since the ball was hit:

$$h(t) = -6(t - 2.5)^2 + 38.5$$

(a) What is the maximum height of the ball?

Vertex (2.5, 38.5)

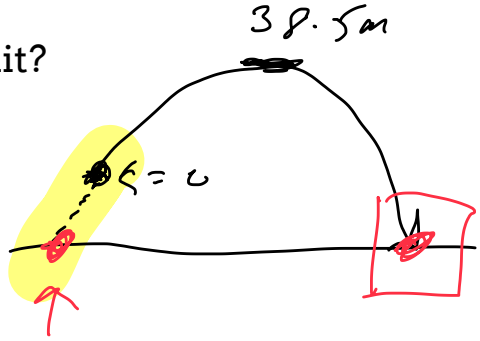
max @ $y = 38.5$ m

(b) What was the height of the ball when it was hit?

$t = 0$ $\quad h(0) = -6(0 - 2.5)^2 + 38.5$

$= -6(-2.5)^2 + 38.5$

$= 1$ m



(c) How many seconds after the ball was hit did the ball hit the ground, to the nearest second?

$0 = -6(t-2.5)^2 + 38.5$

$-38.5 = -6(t-2.5)^2$

$\pm\sqrt{\frac{38.5}{6}} = \sqrt{(t-2.5)^2}$

$\pm\sqrt{\frac{38.5}{6}} = t - 2.5$

$\pm\sqrt{\frac{38.5}{6}} + 2.5 = t$

$\sqrt{x^2} = \pm\sqrt{9}$

$5.0 = t$

OR

$t = -.3$ seconds

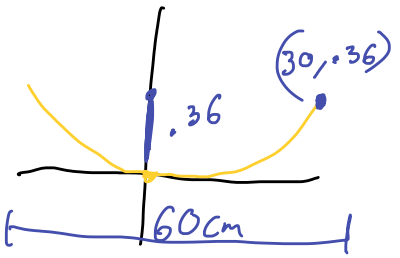
(d) Find the height of the ball 1s after it was hit?

$h = 25$ m $\quad t = 1 \quad h(1) = -6(1 - 2.5)^2 + 38.5$

$= -6(-1.5)^2 + 38.5$

$= 25$ m

Ex. #2: The mirror from a telescope has a diameter of 60cm and a maximum depth of about 0.36cm. Suppose a coordinate grid is placed at the vertex, write an equation for the curve.



Vertex $(0,0)$ $\rightarrow p, q = 0$

point $(30, .36)$

$y = a(x-p)^2 + q$

$y = ax^2$

$.36 = a(30)^2$

$\frac{.36}{30^2} = a$

$0.0004\text{cm} = a$

$y = .0004x^2$

Ex. #3: A theatre company has 300 season ticket subscribers. The theatre has decided to raise the price of a season ticket from its current price of $400. A survey of the subscribers has determined that for every $20 increase in price, 10 subscribers would not renew their seasons tickets.

(a) What is the maximum revenue the theatre will generate?

n = number of \$20 increments

Revenue = (Price)(# of tickets)

$400 + 20n$ $\qquad$ $300 - 10n$

$R(n) = (400 + 20n)(300 - 10n)$ ← multiply it out

$= 120{,}000 - 4000n + 6000n - 200n^2$ ← collect like terms

$= -200n^2 + 2000n + 120\,000$ ← standard form

$= -200(n^2 - 10n + 25 - 25) + 120\,000$ ← complete the square

$= -200(n-5)^2 + 5000 + 120\,000$

$= -200(n-5)^2 + 125\,000$ ← vertex form

(b) What ticket price will maximize revenue?

vertex $(5, 125000)$

n increments

\$500

max revenue of \$125 000 at a ticket price of \$500.

HW: one of 13-24
will be on the test.

Quiz tomorrow.
TEST Friday.