Name: key Hr:___

Applications of Quadratics Day 2

1. A firework is shot upward so that its distance, in feet, above the ground after t seconds is $h(t) = -13t^2 + 312t$.

   a. Find the zeros of the function and explain the meaning in the context of the problem.

   x int $0 = -13t(t-24)$ $t = 0$ sec start time $t = 24$ sec end time

   b. Find the vertex of the function and explain the meaning in the context of the problem.

   vertex $h = \frac{-312}{(2(-13))} = 12$ $K = -13(12)^2 + 312(12) = 1872$

   12 sec. to reach a max height of 1,872 ft

2. From 1970-1990, the average cost of a new car *C* (in dollars) can be approximated by the model $C = 30.5t^2 + 4192$, where *t* is the number of years since 1970. During which year was the average cost of a new car $7,242?

   $y = 7242$ want x $7242 = 30.5t^2 + 4192$ $\sqrt{t^2} = \sqrt{100}$ $t = \pm 10$

   $3050 = 30.5t^2$ $1970 + 10 = 1980$

3. The height $h(x)$ (in feet) of a ball thrown by a child is $h(x) = -\frac{1}{12}x^2 + x + 2$ where x is the horizontal distance (in feet) from where the ball is thrown. (distance, height)

   a. How high is the ball when it is at its maximum height?

   vertex $h = \frac{-1}{(2(-.083))} = 6.024$ $k = -\frac{1}{12}(6.02)^2 + 6.02 + 2 = 5$ ft

   b. How high is the ball when it leaves the child's hand? time = 0

   y int. height $= -\frac{1}{12}(0)^2 + 0 + 2 = 2$ ft

   c. How far from the child does the ball strike the ground?

   x int. $\frac{-1 \pm \sqrt{(1)^2 - 4(-.083)(2)}}{2(-.083)} = -1.75, 13.5$ ft

   d. What is a realistic domain and range?

   D: $[0, 13.8]$ R: $[0, 5]$

   e. At a height of 4 feet how far has the ball gone?

   $y = 4$ find x $4 = -\frac{1}{12}x^2 + x + 2$ $-4 \quad -4$ $0 = -\frac{1}{12}x^2 + x - 2$

   $x = \frac{-1 \pm \sqrt{(1)^2 - 4(-1/12)(-2)}}{2(-1/12)}$ 2.54 ft and 9.46 ft

4. A bottle rocket is fired from the ground upwards at 64 feet per second. Using the quadratic model $h(t) = -16t^2 + 64t$ find the following:

a. What is the maximum height the bottle rocket reaches?

vertex
K

$h = \frac{-64}{(2(-16))} = 2$ $\quad K = -16(2)^2 + 64(2) =$ 64 ft

b. How long does it take for the bottle rocket to hit the ground?

x int.

$0 = -16t^2 + 64t$

$-16(t - 4)$

$t = 0$ & 4 sec.

6. Suppose the cost of producing x crates of pencils is given by $C(x) = \frac{1}{2}x^2 - 10x + 1000$. Find the following:

a. How much does it cost to produce 100 crates of pencils?

X = 100
find y

$y = \frac{1}{2}(100)^2 - 10(100) + 1000 =$ $5,000

b. How many crates of pencils will minimize the cost of production?

vertex
h

$h = \frac{-(-10)}{(2(\frac{1}{2}))} =$ 10 crates

7. A geyser sends a blast of boiling water high into the air. During the eruption, the height *h* (in feet) of the water *t* seconds after being forced out from the ground can be modeled by $h = -16t^2 + 70t$. How long is the boiling water in the air?

x int.

$0 = -2t(8t - 35)$ $\quad -2t = 0$ $\quad 8t - 35 = 0$

$t = 0$ $\quad t = 4.38$ sec.

8. A projectile is thrown upward so that its distance above the ground after t seconds is $h(t) = -12t^2 + 504t$. What is the maximum height of the projectile?

vertex
K

$h = \frac{-504}{2(-12)}$ $\quad K = -12(21)^2 + 504(12)$

5292 ft

9. When an object is dropped, its height in feet, *h*, can be determined after *t* seconds by using the falling object model $h = -16t^2 + s$, where *s* is the initial height in feet. Find the time it takes an object to hit the ground when it is dropped from a height of 196 feet.

h = 0
s = 196
find t

$0 = -16t^2 + 196$

$\sqrt{t^2} = \sqrt{12.25}$ sec $\quad t = 3.5$ sec

(10) find an expression to represent the length and width given area is $x^2 + 14x + 48$ $\quad L \cdot W = (x + 6)(x + 8)$