Grab a Week #4 Packet

Bell Ringer

Change equation to

$C = 500 - 5x + 0.1x^2$

Monday 12/9

A manufacturer of light bulbs has a daily production costs of $C = 500 - 5x + 16x^2$ where C is the total cost (in dollars) and x is the number of units produced.

1. How many light bulbs should be produced to yield a minimum cost?

2. What is the minimum cost?

$C = 0.1x^2 - 5x + 500$ (units, total prod., cost)

$\frac{-b}{2a} = \frac{-(-5)}{2(0.1)} = \frac{5}{0.2} = 25$ → 25 units

25

$0.1(25)^2 - 5(25) + 500$

$\$437.50$

(25, 437.5)

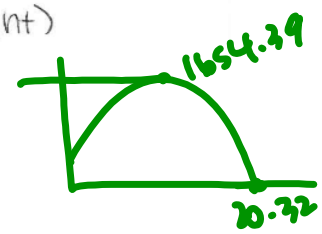
Correct Applications day 1 ws

Applications of Quadratics - Day 1 Key

1. If an M-16 is fired straight upward, then the height h(t) of the bullet in feet at time t in seconds is given by $h(t) = -16t^2 + 325t + 4$.

a) What is the starting height of the bullet? (time, height)

y-int 4 ft



b) How long does it take for the bullet to return to the earth?

x-int $x = \frac{-325 \pm \sqrt{(325)^2-4(-16)(4)}}{2(-16)} = -.012$ & 20.32 sec

c) What is the maximum height?

(h, k) $h = \frac{-(325)}{2(-16)} = 10.16$ $k = -16(10.16)^2 + 325(10.16) + 4 =$ 1,654.39 ft

d) What is a realistic domain and range?

D: [0, 20.32] seconds R: [0, 1,654.39] feet

y=500, find x e) At a height of 500 feet how much time has passed?

$500 = -16t^2 + 325t + 4$

$0 = -16t^2 + 325t - 496$

$t = \frac{-325 \pm \sqrt{(325)^2-4(-16)(-496)}}{2(-16)} \approx$ 1.66 sec, 18.65 sec

2. A contestant tosses a horseshoe from one pit to another with an initial vertical velocity of 50 feet per second. The horseshoe is released 3 feet above the ground. Use the model $h = -16t^2 + 50t + 3$, where h is the height (in feet) and t is the time (in seconds) to tell how long the horseshoe was in the air.

x-int $x = \frac{-50 \pm \sqrt{(50)^2-4(-16)(3)}}{2(-16)} = -.06$ and 3.18 sec

3. The number of mosquitoes $M(x)$, in millions, in a certain area depends on the June rainfall x, in inches, according to the equation $M(x) = 10x - 2x^2$. What rainfall produces the maximum number of mosquitoes?

Vertex, h (rainfall, mosquitos)

$M(x) = -2x^2 + 10x$ (a, b)

$\frac{-10}{2(-2)}$ $\frac{10}{4} =$ 2.5 inches

4. The polynomial function $I(t) = -0.1t^2 + 1.9t$ represents the yearly income (or loss) from a real estate investment, where t is time in years after 1970. During what year does the maximum income occur?

Vertex, h (time (yr), $)

$h = \frac{-(1.9)}{2(-0.1)} = 9.5$

1970 + 9.5 = year 1979

5. Your company uses the quadratic model $y = -7x^2 + 350x$ to represent how many units y of a new product will be sold x weeks after its release. How many units can you expect to sell in week 27?

x=27, find y $y = -7(27)^2 + 350(27) =$ 4,347 units

6. Your company uses the quadratic model $y = -4.5x^2 + 150x$ to represent the average number of new customers who will be signed on x weeks after the release of your new service. How many new customers can you expect to gain in week 8?

x=8, find y

$y = -4.5(8)^2 + 150(8) = 912$

$y = -4.5(7)^2 + 150(7) = 829.5$

$912 - 829.5 = 83$ customers

7. The profit for a company is given by $P(x) = -0.0002x^2 + 140x - 250000$, where x is the number of units produced. What production level will yield a maximum profit?

(# units, profit)

Vertex h

$\frac{-140}{2(-.0002)} =$ 350,000 units

8. A boy tosses a ball upward at 32 feet per second from a window that is 48 feet above the ground. The height of the ball above ground (in feet) at time t (in seconds) is given by $h(t) = -16t^2 + 32t + 48$.

x-int a) Find the time at which the ball strikes the ground.

$-16t^2 + 32t + 48 = 0$ $(t-3)(t+1) = 0$

$t^2 - 2t - 3 = 0$ $t = 3, -1$ ✗

3 seconds

y=60, find x b) At a height of 60 feet how much time as passed?

$-16t^2 + 32t + 48 = 60$

$-16t^2 + 32t - 12 = 0$

$x = \frac{-32 \pm \sqrt{(32)^2 - 4(-16)(-12)}}{2(-16)} = \frac{1}{2}, \frac{3}{2}$

0.5 & 1.5 seconds

9. A rock is thrown upward so that its distance, in feet, above the ground after t seconds is $h(t) = -14t^2 + 336t$

x-int a. Find the zeros of the function and explain the meaning in the context of the problem. (sec, height)

$-14t(t-24) = 0$

$t = 0$ $t = 24$

Rock is on ground at start & again after 24 seconds

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

$\frac{-336}{2(-14)} = 12$

(12, 2016) At 12 seconds, it's 2,016 ft high

c. What is a realistic Domain and Range?

D: [0, 24] R: [0, 2016]

10. John owns a hotdog stand. He has found that his profit is represented by the equation $P(x) = -x^2 + 68x + 77$, with P being the profit in dollars, and x the number of hotdogs sold. How many hotdogs must he sell to earn the most profit?

(hotdogs, $)

Vertex h

$\frac{-68}{2(-1)} =$ 34 hot dogs!

11. The manufacturer of a CD player has found that the revenue R (in dollars) is $R(p) = -4p^2 + 1280p$, when the unit price is p dollars. If the manufacturer sets the price p to maximize revenue, what is the maximum revenue to the nearest whole dollar?

(price, revenue)

Vertex, K

$\frac{-1280}{2(-4)} = 160$ (160, 102,400) $102,400

$-4(160)^2 + 1280(160) = 102,400$

Applications Day 2 ws due tomorrow

Week #3 Packet due tomorrow

Standard 4C Opportunity 1 tomorrow

Standard 4A and 4B Retakes due Fri 12/20
(must do review in order to retake)

due tomorrow - Skip #9 - questions....?

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.

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

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?

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.

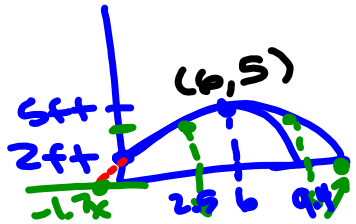
(horiz. ft, height)

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

$-\frac{b}{2(a)} = \frac{-(1)}{2(-1/12)} = \frac{-1}{-1/6} = (6, 5\text{ft})$ $-\frac{1}{12}(6)^2 + 6 + 2$

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

2 ft!



x-int

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

$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(-1/12)(2)}}{2(-1/12)} \approx 13.74\text{ft}$

d. What is a realistic domain and range?

D: [0, 13.74] R: [0, 5]

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

$4 = -\frac{1}{12}x^2 + x + 2$

$-4 \quad -4$

$0 = -\frac{1}{12}x^2 + x - 2$

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

$x = 9.4$

$x = 2.5$

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:

vertex
h, k

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

x-int

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

5. 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?

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

6. 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?

7. 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?

8. 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.

$0 = -16t^2 + 196$

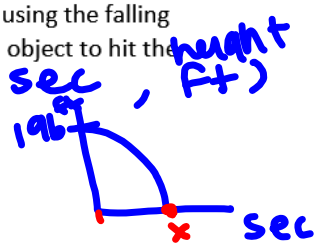
$-196 \quad -196$

$\frac{-196}{-16} = \frac{-16t^2}{-16}$

$\sqrt{12.25} = \sqrt{t^2}$

$t = 3.5$ seconds

(sec , ft)



9. Find an expression that could represent the length and the width of a billboard given the area of the billboard is $A = x^2 + 14x + 48$.

PRIORITIES:

*Finish Applications Day 1 and Day 2 Worksheets to be prepared for Standard 4C tomorrow

*Work on 4A or 4B Review to prepare to retake 4A or 4B

*Do Review 4C to prepare for quiz tomorrow

*Finish any other missing hw