

Solve each application problem. Show work to support your answers.

1. The number of board feet in a 16 foot long tree is approximated by the model $F(d) = 0.77d^2 - 1.32d - 9.31$ where F is the number of feet and d is the diameter of the log.
- How many board feet are in a log with diameter 12 inches?
 - What is the diameter that will produce the minimum number of board feet?

a) $F(12) = \boxed{85.73 \text{ ft}}$

b) vertex: $(.857, -9.876)$ $\boxed{.857 \text{ ft}}$

2. For the years of 1983 to 1990, the number of mountain bike owners m (in millions) in the US can be approximated by the model $m(t) = 0.377t^2 - 2.265t + 3.962$ for $3 \leq t \leq 10$ where $t = 3$ represents 1983.
- In which year did 2.5 million people own mountain bikes?
 - In what year was the number of mountain bike owners at a minimum?

a. $y = 0.377t^2 - 2.265t + 3.962 = 2.5$
 $t = 5.272$

$\boxed{1985}$

b. vertex: $(3.004, .560)$ $t = 3.004$ $\boxed{1983}$

3. While on an Audubon field trip, Jennifer sees a hawk grab a mouse on a cliff and then shortly drop its prey during flight. The height in feet of the prey is given by $h(t) = -16t^2 + 48t + 50$.

a. How long will it take the prey to strike the ground? $ht = 0$ when $t = \boxed{3.818 \text{ sec}}$

- b. What is the maximum height of the prey?

vertex: $(1.5, 86)$ $\boxed{86 \text{ ft}}$

4. A ball is thrown directly upward from an initial height of 200 feet with an initial velocity of 96 feet per second.

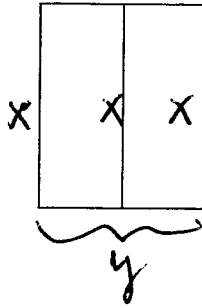
a. After how many seconds will the ball reach its maximum height? vertex $(3, 344)$

- b. What is the maximum height?

$\boxed{344 \text{ ft}}$

$\boxed{3 \text{ sec}}$

5. You have a 1200-foot roll of fencing and a large field. You want to make two enclosures by splitting a rectangular enclosure in half. What are the dimensions of the largest such enclosure?



dimensions : 200 ft by 300 ft.

6. A firm collects data on the amount it spends on advertising and the resulting revenue collected by the firm. Both pieces of data are in thousands of dollars.

x (advertising costs)	0	5	15	20	25	30
R (revenue)	6347	6524	7591	8251	7623	7478

- a. Calculate a quadratic regression equation. $y = -3.859x^2 + 161.982x + 6136.331$
 b. Use the regression equation to estimate the firm's revenue when the firm invested

\$10,000 in advertising. $R(10) = \text{7370.3 thousands of dollars}$

7. The average price of a gallon of gas at the beginning of each month for the period starting in November 2010 and ending in May 2011 are given below where t is the number of months that have passed since October of 2010.

- a. Find a cubic polynomial model to fit the data.
 b. Use the model to estimate the price of gas in February 2011.

Month	Price
Nov.	3.14
Dec.	3.21
Jan.	3.31
Mar.	3.87
Apr.	4.06
May	4.26

a) $y = -.008x^3 + .110x^2 - .239x + 3.284$

b) Feb 2011 $\Rightarrow x = 4$
 $y = \text{3.58}$

8. After the winter break, 3 students came to school sick with the flu. The following table shows the number of students infected with the flu depending on the number of days after the winter break.

time (days)	0	5	10	15	20	25	30
number of infected students	3	6	14	23	23	21	9

- a. Calculate the quartic regression. $y = 1.333 \times 10^{-4} x^4 - .012x^3 + .26x^2 - .393x + 2.952$
 b. Find the day at which the number of infected students will reach a maximum. vertex
 c. When will the number of infected students drop to zero?

x -intercept = 33.002

day 33

day 19 (19.546, 24.457)