MAT 142: College Mathematics
Lecture Notes: Chapter 7 (Part 2)

7.3: Modeling With Quadratic Equations

Graphing Quadratics

1. Quadratic Equation: $y = ax^2 + bx + c$

2. Characteristics of Parabolas:

3. Finding the Vertex: $y = 2x^2 + x - 3$

4. Finding the x and y intercepts:

5. Graph:

Quadratic Models:

In Physics, when an object is dropped or thrown, the height H an object is above the ground after time t can be modeled using the following equation:

$$H = -\frac{1}{2}gt^2 + v_0 t + h_0$$ where g=gravitational force (32 ft/sec/sec)

v=initial velocity h=initial height

Falling Objects: A baseball is thrown from the outfield upward at an initial speed of 32 ft per second at an initial height of 4ft. The height of the ball above the ground at time t is given by the equation:

a. Graph this equation:

b. What values of t make sense in the context of this situation?

c. Find the maximum height of the ball and the time it occurs.

d. Find how many seconds it will take for the ball to hit the ground.

7.4: Exponential Equations and Growth: (skip Logistic Growth on pgs. 330 – 333)

Paper Folding: Fold a piece of paper in half and record the number of "spaces" created in the piece of paper. Continue folding the paper and recording number of spaces four times: Record your results below:

Number of Folds	0	1	2	3	4	5
Number of "Spaces"						

Write an equation that models the situation:

Exponential Equation: $y = ab^x$

Graph:

Problem: If it were possible to fold the piece of paper 25 times, how tall do you think the paper would be? Note: *A ream of paper contains 500 sheets and is approximately 2.5 inches tall.*

Applications of Exponential Growth:

Population Growth: The 2000 census counted roughly 281 million people in the United States at a time when the yearly population growth rate was about 1.2 percent per year.

   If this rate of growth continues until 2045, what will the population of the United States be then?

Compound Interest: Suppose you deposit $1000 in an account that pays 8% interest per year.

    a.   How much money would be in the account after 5 years?

End of Year:	Amount in the Account
1	
2	
3	
4	
5	

Equation:

    b.   How long will it take the amount in the account to double?

Solving Exponential Equations Using Logarithms:

Definition of a Logarithm: $2^3 = 8$ **can be written:** $\log_2 8 = 3$

Property of Logarithms: $\log_b a^n = n\log_b a$

Solve:

    a. $2^x = 15$ b. $5^x = 35$

7.5: Proportions and Variation:

Ratio: A quotient of two numbers. Can be written as x to y, or x:y or $\dfrac{x}{y}$.

Proportion: A statement that two ratios are equal, such as $\dfrac{a}{b} = \dfrac{c}{d}$.

Solving Proportions:

Applications of Proportions:

Calculating drug dosages: The dosage of a particular drug is proportional to the patient's body weight. If the dosage for a 150-pound woman is 6 milligrams, what would the dosage be for her daughter who weighs 65 pounds?

Variation (direct, inverse and joint):

Applications of Variation:

Estimating water usage: Assume that the amount of water that is required for irrigation of a vineyard is inversely proportional to the amount of rainfall. If 30,000 gallons are used during a month in which there is 3 inches of rain, how much water would be used in a month that has 5 inches of rain?