



# HENDRIX

C O L L E G E

---

## Mathematical Models Notes

---

MATH 365

*Start*

JANUARY 20, 2026

*Author*

Paul Beggs  
BeggsPA@Hendrix.edu

*Instructor*

Prof. Christopher Camfield, Ph.D.

*End*

MAY 5, 2026

## TABLE OF CONTENTS

<b>1 One Variable Optimization</b>	<b>2</b>
1.1 The Five-Step Method . . . . .	2

## 1.1 The Five-Step Method

### Step 1: Ask the Question.

- Make a list of all the variables in the problem, including appropriate units.
- Be careful not to confuse variables and constants.
- State any assumptions you are making about these variables, including equations and inequalities.
- Check units to make sure that your assumptions make sense.
- State the objective of the problem in precise mathematical terms.

### Step 2: Select the modeling approach.

- Choose a general solution procedure to be followed in solving this problem.
- Generally speaking, success in this step requires experience, skill, and familiarity with the relevant literature.
- In this book we will usually specify the modeling approach to be used.

### Step 3. Formulate the model.

- Restate the question posed in step 1 in the terms of the modeling approach specified in step 2.
- You may need to relabel some variables specified in step 1 in order to agree with the notation used in step 2.
- Note any additional assumptions made in order to fit the problem described in step 1 into the mathematical structure specified in step 2.

### Step 4. Solve the model.

- Apply the general solution procedure specified in step 2 to the specific problem formulated in step 3.
- Be careful in your mathematics. Check your work for math errors. Does your answer make sense?

- Use appropriate technology. Computer algebra systems, graphics, and numerical software will increase the range of problems within your grasp, and they also help reduce math errors.

**Step 5. Answer the question.**

- Rephrase the results of step 4 in nontechnical terms.
- Avoid mathematical symbols and jargon.
- Anyone who can understand the statement of the question as it was presented to you should be able to understand your answer.

**Example 1.1: Pigs 1**

A pig weighing 200 pounds gains 5 pounds per day and costs 45 cents per day to keep. The market price for pigs is 65 cents per pound, but is falling at 1 cent per day. When should the pig be sold to maximize profits?

*Solution.* Begin by labeling parameters and **variables**, and relate them with **equations**:

$t$	<i>time (days),</i>
$m_0 = 0.65$	<i>initial market price (\$),</i>
$r_m = -0.01$	<i>rate of change of market price (\$),</i>
$w_0 = 200$	<i>initial weight (lbs),</i>
$r_w = 5$	<i>rate of change of weight (lbs),</i>
$d = 0.45$	<i>daily costs,</i>
$m(t) = m_0 + r_m t$	<i>market price after <math>t</math> days (\$),</i>
$w(t) = w_0 + r_0 t$	<i>pig's weight after <math>t</math> days (lbs),</i>
$c(t) = dt$	<i>total cost after <math>t</math> days (\$),</i>
$p(t) = r(t) - c(t)$	<i>profit after <math>t</math> days (\$).</i>

We take the derivative of  $p(t)$  and set it equal to 0 to get the critical points, which we can then evaluate.