

UNITED STATES MILITARY ACADEMY

MA 153 PROJECT #1
CATCHING THE ROADRUNNER AND BAKING SOUFFLÉ

MA 153 - ADVANCED MUTI-VARIABLE CALCULUS

SECTION - [REDACTED]

MAJOR BOWMAN

BY

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WEST POINT, NEW YORK

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____ MY DOCUMENTATION ATTRIBUTES ALL SOURCES USED AND ASSISTANCE
RECEIVED IN COMPLETING THIS ASSIGNMENT

____ NO SOURCES WERE USED OR ASSISTANCE RECEIVED IN COMPLETING THIS
ASSIGNMENT

SIGNATURES:

Abstract

After years of frustration and failed attempts of catching the ever elusive roadrunner, Wile E. Coyote is teaming up with members of Major Bowman's C Hour MA-153 class to successfully capture the roadrunner on 16 October 2008. Wile has devised a plan to hide behind a specific large boulder and launch a Exploding-Net Pod that will capture the annoying bird just as he zips down the road at 50 m/s. What we, as Wile's primary consultant's need to do in this report is determine the direction to launch the net and the speed to launch it at. Once we catch the Road Runner, the Road Runner's will make Road Runner Soufflé using the amount of eggs and crème considering a spending limit of \$35. The following analysis will show that an Exploding-Net Pod launched from point (50, 30, 391.5) at a horizontal angle .77 radians above the x axis and a vertical angle of 45° with an initial speed of 40.92 meters per second will be airborne for 7.78 seconds before hitting its target. It will also show that the Exploding-Net Pod should be launched when the Road Runner crosses the point (100, -54.4, 367.6). Furthermore, this analysis will show that 5 jars of crème sauce and 10 dozen eggs is the optimal amount of eggs and crème sauce purchase for the Road Runner Soufflé when given \$35 to spend, as it will make the most servings – 62.

Abstract

You have enlisted our help in capturing the Road Runner. Using the intelligence you provided, we came up with the necessities you needed in order to capture the Road Runner using your new ACME Exploding Net Pod Launcher. In addition, we found that you can make 62 servings of Road Runner Soufflé using 10 dozen eggs and 5 jars of cream sauce with your limited budget of \$35.

The following analysis of this projectile motion problem shows that when the Road Runner crosses point $(100, -54.4021, 367.601)$, you should fire your launcher from the hiding spot at point $(50, 30, 783/2)$. Through our calculations we discovered that in order to hit the road runner, you should fire the launcher with an initial velocity of 40.9168 meters per second. You will also need to fire in the direction of 44.5078° NE. The Net Pod will be in the air for a total of 7.78012 seconds at which it will land on the Road Runner at point $(150, 97, 320)$. If something goes wrong and you decide to fire the day before when the gravity is 2 m/s^2 to the south, and 1 m/s^2 to the west, you will need to fire at 34.3226 meters per second at a 43.05° direction and the projectile will be in motion for 7.02896 seconds. On the other hand, if you decide to capture the Road runner the day after the day you are planning on capturing the road runner when the gravity is 0 m/s^2 to the south, and 3 m/s^2 to the west, you will need to fire at 37.1454 meters per second at a 20.327° direction and the projectile will be in the air for 7.34657 seconds.

Abstract

Wiley Coyote wants to devise a plan to capture his arch nemesis the pesky Road Runner on a specific hill which has a road running along it. In this report we use the initial layout information given by ACME along with the equation modeling the hill and the graph modeling the road, in order to provide Wiley with the direction in which he should aim the launcher, the initial speed at which he should launch the pod, and how many seconds he should set the timer for so that the pod will open just as it reaches the Road Runner. We calculated these values not just according to the gravity on October 16th but also for the day before and day after in case things don't go according to Wiley's plan. Also, Wiley desires to know the point along the road where he should place a marker ahead of time in order to launch his net when Road Runner reaches this marker. The following analysis will show that on October 16th Wiley should: aim his launcher at $\theta = .776807$ (44.51 degrees in the x-y plane), launch the pod at an initial speed of 40.9168 m/s, set the timer for 7.78012 seconds, and set the marker at the point (100.017, -54.5566, 367.55). On the day before Wiley should: aim his launcher at $\theta = .751001$ (43.04 degrees in the x-y plane), launch the pod at an initial speed of 34.3226 m/s, and set the timer for 7.02896 seconds. On the day after Wiley should: aim his launcher at $\theta = .354601$ (20.32 degrees in the x-y plane), launch the pod at an initial speed of 37.1454 m/s, and set the timer for 7.34657 seconds. Finally, once Road Runner is captured Wiley wants to maximize Aunt Edna's famous Road Runner Soufflé made with Road Runner, eggs, and cream sauce while constraining himself to a budget of 35 dollars. The following analysis will show that Wiley will maximize Soufflé by buying 10 dozen eggs and 5 jars of cream sauce to make 62 servings of Aunt Edna's famous Road Runner Soufflé.

TABLE OF CONTENTS

Main Body

Background	1
Facts	2
Assumptions	2-3
Analysis	
Part I:	3-7
Part II:	7-9
Results	
Part I:	9-12
Part II:	12-13
Discussion	13
Conclusions and Recommendations	13-14

Appendices

A – Distance and Time (16 OCT 08)	A1
B – Gravity Vector $\langle 3, 0, 9.8 \rangle$	A2
C – Gravity Vector $\langle 1, 2, 9.8 \rangle$	A3
D – LaGrange Recipe	A4-A5