

Homework Eight

Calculus I

College of the Atlantic

Due Friday, November 8, 2024

Part 1: WeBWorK. Do Homework 08A on WeBWorK. The WeBWorK page is here: <https://webwork-hosting.runestone.academy/webwork2/coa-feldman-es1024-fall12024> I recommend doing the WeBWorK part of the homework first. This will enable you to benefit WeBWorK's instant feedback before you do part two.

Part 2: Non-WeBWorK problems. Here are some instructions for how to submit this part of the assignment.

- Do the problems by hand using pencil (or pen) and paper. There is no need to type this assignment.
- Make a pdf scan of your work using genius scan or some similar scanning app. Please make the homework into a single pdf, not multiple pdfs.
- Submit the assignment on google classroom. Please don't email it to me.

Here are some non-WeBWorK problems.

1. Consider the function $g(x) = xe^x$.
 - (a) Find exact values for and classify all critical points. Determine any local maxima or minima (x and y values).
 - (b) Find exact values for all inflection points.
 - (c) Sketch the function.
2. Consider the function $h(x) = x + \sin(x)$.
 - (a) Find exact values for and classify all critical points. Determine any local maxima or minima (x and y values).
 - (b) Find exact values for all inflection points.
 - (c) Sketch the function.
 - (d) Explain in a few sentences why the function has the shape that it does.
3. Figure 1 shows how the rate $f(v)$ at which a bird uses energy to fly (measured in Joules/s) depends on the speed of the bird (measured in m/s). Let $a(v)$ be the amount of energy consumed by the same bird, measured in Joules/m.
 - (a) What is the relationship between $f(v)$ and $a(v)$?
 - (b) At what speed is $f(v)$ minimized? (Show the value on the graph.)
 - (c) At what speed is $a(v)$ minimized? (Show the value on the graph.)
 - (d) Under what circumstances might a bird want to fly so as to minimize $f(v)$?
 - (e) Under what circumstances might a bird want to fly so as to minimize $a(v)$?

energy (joules/sec)

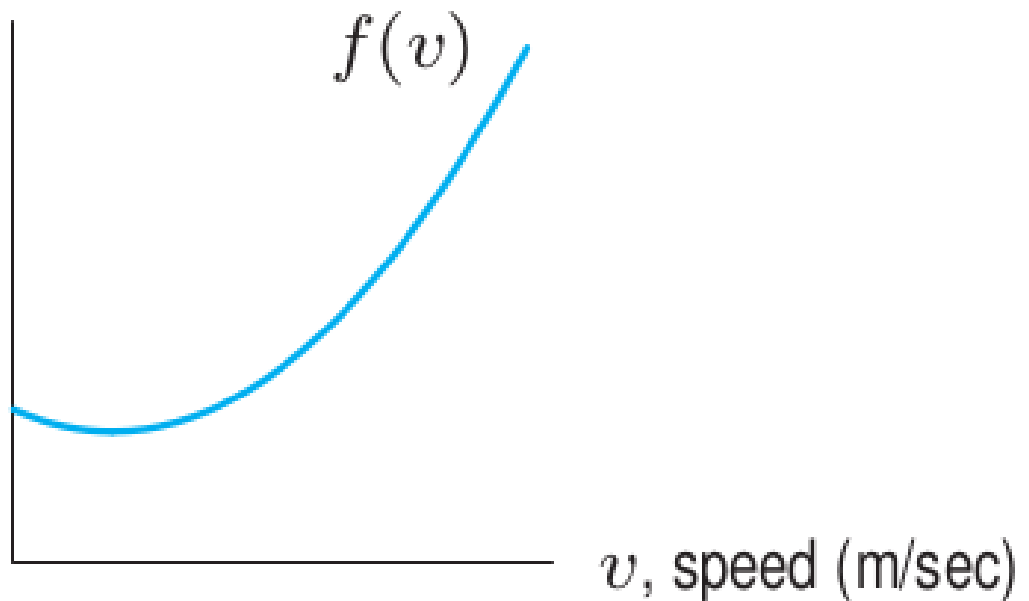


Figure 1: The amount of energy used by a flying bird.

4. A ball is thrown straight up from the top of a 30 meter building. The initial speed of the ball is v_0 . The height of the ball as a function of time is given by:

$$y = -10t^2 + v_0t + 30 . \quad (1)$$

- (a) At what time does the ball reach its highest point?
- (b) What is the maximum height reached by the ball?
- (c) How fast must the ball be thrown so that it makes it 100 meters above the ground?