The following written homework problems are due at 6pm on Gradescope, the night before your class. You also have a WebWork assignment due at 11pm two days before your class.

(2.1) Use Part 1 of the Fundamental Theorem of Calculus to find the derivative of $f(x) = \displaystyle\int_{x^2}^{\cos x} \ln\left(1+v^4\right)\,dv$.

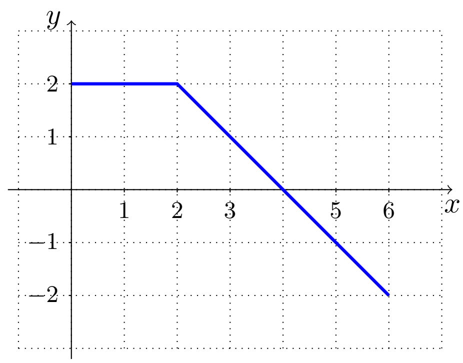
(2.2) Let $g(x) = \displaystyle\int_0^x f(t)\,dt$, where $f(x)$ is the function whose graph is shown below.

(a) Evaluate $g(x)$ for $x = 0, 1, 2, 3, 4, 5, 6$.

(b) On what interval is g increasing?
Your answer should be consistent with the values in (a), but make sure to justify your answer using Calculus.

(c) Sketch a graph of $y = g(x)$.

(d) Use the graph in (c) to sketch the graph of $g'(x)$. How does this sketch compare with the graph of f?



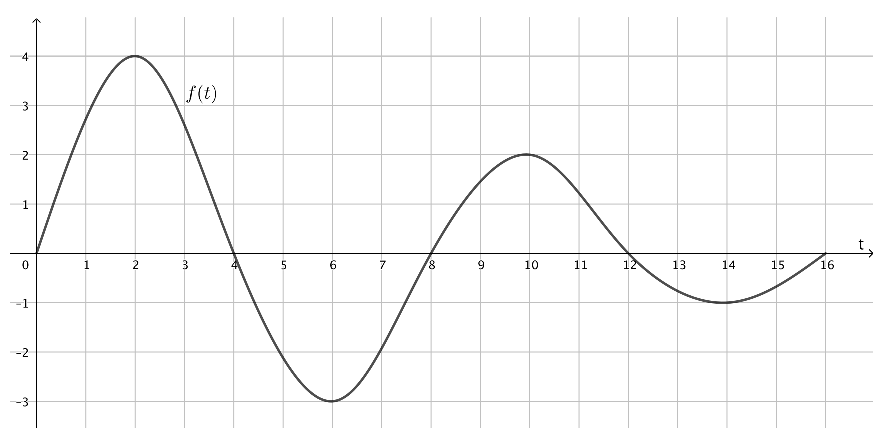
(2.3) Let $g(x) = \int_0^x f(t)\,dt$, where f is the function whose graph is shown. Answer the following questions, justifying your answers using the Fundamental Theorem of Calculus where appropriate. (You may assume the amplitude and area of each "hump" decreases from left to right in the graph.)

(a) At what values of x do local minimum and maximum values of g occur?

(b) Where does g attain its absolute maximum value?

(c) On what intervals is g concave downward?

(d) Sketch the graph of g.



(2.4) Professional Problem.

Let

$$f(x) = \begin{cases} 0 & \text{if } x < 0 \\ 2x & \text{if } 0 \leq x \leq 1 \\ 4 - 2x & \text{if } 1 < x \leq 2 \\ 0 & \text{if } x > 2 \end{cases}$$

and let $g(x) = \int_0^x f(t)\, dt$. Find an explicit formula for $g(x)$ (similar to the formula for $f(x)$) which does not involve integrals. Carefully draw the graphs of both f and g.

As always, refer to the "Professional Problem information" handout to create a *professionally written* solution. This week, you should especially focus on:

> **Figure:** This problem requires at least one figure. Put thought into how to present your figures clearly. Label the important parts. Draw with a reasonable scale, so that your graphs fill the space and do *not* have huge amounts of white space.
>
> **Mathematical Details:** This is a piecewise-defined function. Be careful to interpret the integral correctly. If it seems *too* easy, double-check your reasoning!

Hint: the groupwork called "Continually Thinking" provides a method for solving this problem!

You should have questions! When you do, here's what to do:

1. Post your question on Canvas: `http://canvas.umn.edu/`
   The answers you get will help everyone in the class!
2. Email *all* of the instructors with your question.
3. Write your solution (even if you're unsure about it) and bring it to the study session. Ask an instructor specific questions about it.

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