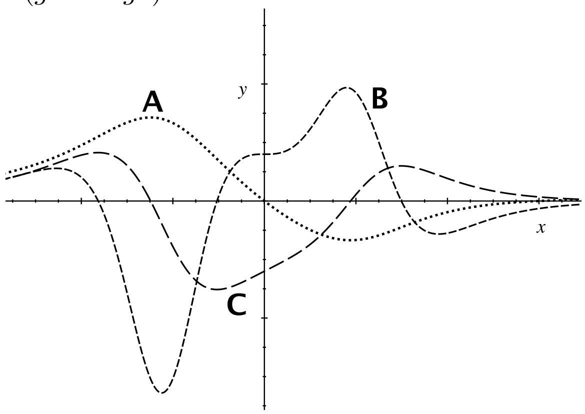
7. [6 points] Consider the function $W(t) = 3\ln\left(\sin(t)^2 + 2\right)$. Write down the limit definition of $W'(\pi)$. (You do not need to estimate or compute the derivative.)

Solution: Using the limit definition, we have

$$W'(\pi) = \lim_{h\to 0} \frac{3\ln(\sin(\pi+h)^2+2) - 3\ln(\sin(\pi^2)+2)}{h}.$$

8. [9 points] The three graphs labeled A, B, and C below depict a function g along with its first and second derivatives (g' and g''). Determine which is which.



Your answer to parts (a)–(c) should be a single legible capital letter (A, B, or C).

a. [2 points] The graph of g is labeled _______.

Solution: A

b. [2 points] The graph of g' is labeled _______.

Solution: C

c. [2 points] The graph of g'' is labeled _______.

Solution: B

d. [3 points] Briefly explain your reasoning.

Solution: Graph A cannot be the derivative of either B or C, because Graph A is positive for $x < 0$ and both Graphs B and C have intervals where the function is decreasing for $x < 0$. Thus, Graph A must be g. Graph C is positive where Graph A is increasing, negative where Graph A is decreasing and is crossing the $x-$axis at the peak and low point of Graph A. Note, also, Graph C cannot be the graph of the derivative of B, because, for example, C is negative to the left of $x = 0$ where Graph B is increasing. Graph B, however, can be the graph of the derivative of C—once again, by checking the sign of B when Graph C is increasing or decreasing, and looking for zeros of B when graph C has a peak or a valley. Thus, Graph A is g, Graph C is g', and Graph B is g''.