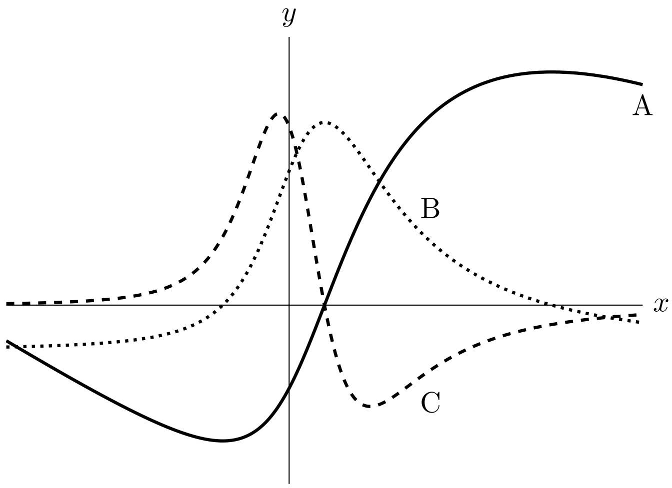
5. [4 points] Shown below is a portion of the graph of the function $y = f(x)$, along with portions of the graphs of an *antiderivative* $F(x)$ of $f(x)$, and the *derivative* $f'(x)$ of $f(x)$. Determine which graph is which, and then, on the answer lines below, indicate after each function the letter A, B, or C that corresponds to its graph. No work or justification is needed.



Answer: $F(x)$: A

$f(x)$: B

$f'(x)$: C

6. [3 points] Evaluate the following limits. For any limits that do not exist, including if they are limits that diverge to $\pm\infty$, write DNE. No work or justification is necessary.

$$\lim_{x\to\infty} \frac{x(4x^3+1)^2}{5x^7 - x^4 + 12} = \underline{16/5} \qquad \lim_{x\to\infty} \frac{\log(x)}{1-2^x} = \underline{0} \qquad \lim_{x\to\infty} \frac{e^{1/x}+e^{-x}}{2} = \underline{1/2}$$

7. [5 points] A company's maximum profit is earned when it produces $q = 6$ units of their product. If the company can produce as many units as it wants and its cost function in thousands of dollars is

$$C(q) = \frac{1}{3}(q-3)^3 + q + 20 \qquad \text{for } q \geq 0,$$

which of the statements i. – v. below could be true? *Circle all answers that could be true*, or else circle "vi." if none of them could be true.

$\boxed{\text{i.}}$ $MR(6) = MC(6)$, where MR and MC are the company's marginal revenue and marginal cost functions, respectively.

ii. The company's fixed cost is 20,000 dollars.

$\boxed{\text{iii.}}$ The company's marginal cost function is $MC(q) = (q-3)^2 + 1$.

iv. The company's marginal revenue function is $MR(q) = 26$.

$\boxed{\text{v.}}$ The company's revenue function is $R(q) = \begin{cases} 12q & 0 \leq q \leq 6; \\ 18 + 9q & q > 6. \end{cases}$

vi. NONE of the above.

Solution: Note that $MC(q) = C'(q) = (q-3)^2+1$, so iii. is true. Furthermore, when $q = 6$ we have $MC(q) = (6-3)^2 + 1 = 10$, which is enough to show that iv. cannot be true but v. could be true. Indeed, if $R(q)$ is as in v., then $MR(q) - MC(q) = 2 > 0$ for $q < 6$, while $MR(q) - MC(q) = -1 < 0$ for $q > 6$, showing that $R(q) - C(q)$ has a max at $q = 6$.