8. [6 points] Suppose

$$
F(x)=\int_{3}^{2 x}\left(e^{5 t^{2}}-2\right) d t .
$$

Find all $x$-values where the graph of $y=F(x)$ has a horizontal tangent line, showing all of your work. You do not need to simplify your answer(s).
Solution: The graph has a horizontal tangent line where $F^{\prime}(x)=0$.
Using the Second Fundamental Theorem, we see $F^{\prime}(x)=2\left(e^{5(2 x)^{2}}-2\right)=2\left(e^{20 x^{2}}-2\right)$, and so $F^{\prime}(x)=0$ when $e^{20 x^{2}}=2$, i.e. $20 x^{2}=\ln 2$.
Therefore, $x= \pm \sqrt{\frac{\ln 2}{20}}$.
9. [9 points] For each part of this problem, write the CAPITAL LETTER corresponding to ALL answers that apply on your submission. You do not need to show your work.
a. [5 points] Suppose $f(x)$ is a continuous function defined for $x \geq 1$ satisfying:

- $f(x)>0$ for all $x \geq 1$.
- $f(x)$ is decreasing on its domain.
- $f(x) \leq \frac{1}{\sqrt{x}}$

Which of the following MUST be true about $f(x)$ ?
(A) $\int_{1}^{\infty} f(x) d x$ converges.
(B) $\int_{1}^{\infty}(f(x))^{2} d x$ converges.
(C) $\int_{1}^{\infty} \frac{f(x)}{x} d x$ converges.
(D) $\int_{1}^{\infty} f(x) d x$ diverges.
(E) None of the above.
b. [4 points] Which of the following pairs of polar coordinates are the same point in the $x y$-plane as the point $(x, y)=(-1,1)$ ?
(A) $(r, \theta)=\left(\frac{\sqrt{2}}{2}, \frac{\pi}{4}\right)$
(B) $(r, \theta)=\left(1, \frac{3 \pi}{4}\right)$
(C) $(r, \theta)=\left(-\sqrt{2},-\frac{\pi}{4}\right)$
(D) $(r, \theta)=\left(-\frac{\sqrt{2}}{2}, \frac{5 \pi}{4}\right)$
(E) None of the above.

