8. [6 points] Suppose

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

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'(x) = 0. Using the Second Fundamental Theorem, we see $F'(x) = 2(e^{5(2x)^2} - 2) = 2(e^{20x^2} - 2)$, and so F'(x) = 0 when $e^{20x^2} = 2$, i.e. $20x^2 = \ln 2$. 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 $x \ge 1$ satisfying:
 - f(x) > 0 for all $x \ge 1$.
 - 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)
$$\int_{1}^{} f(x) dx$$
 converges.
(B) $\int_{1}^{\infty} (f(x))^{2} dx$ converges.
(C) $\int_{1}^{\infty} \frac{f(x)}{x} dx$ converges.
(D) $\int_{1}^{\infty} f(x) dx$ diverges.
(E) None of the above.

b. [4 points] Which of the following pairs of polar coordinates are the same point in the xy-plane as the point (x, y) = (-1, 1)?

$$(\mathbf{A}) (r, \theta) = \left(\frac{\sqrt{2}}{2}, \frac{\pi}{4}\right)$$
$$(\mathbf{B}) (r, \theta) = \left(1, \frac{3\pi}{4}\right)$$
$$(\mathbf{C}) (r, \theta) = \left(-\sqrt{2}, -\frac{\pi}{4}\right)$$
$$(\mathbf{D}) (r, \theta) = \left(-\frac{\sqrt{2}}{2}, \frac{5\pi}{4}\right)$$
$$(\mathbf{E}) \text{ None of the above.}$$