2008 Calculus Bee - April 8, 2008

<table>
<thead>
<tr>
<th>First Place</th>
<th>Darren Ong</th>
</tr>
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<tbody>
<tr>
<td>Second Place</td>
<td>John Lagrone</td>
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<tr>
<td>Third Place</td>
<td>Thanh Huynh</td>
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</tbody>
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- Evaluate and simplify \( \frac{d}{dx}(x^2 + x^0 + x^0 + x^8) \).
- Evaluate \( \int \frac{d\theta}{\cos^2 \theta} \).
- Evaluate and simplify \( \frac{d^{2008}}{dx^{2008}} \left( \frac{x^{2009}}{2008!} \right) \).
- Evaluate and simplify \( \int_3^\infty \sin(a^3) \, da \).
- Determine if the series \( \sum_{n=1}^{\infty} \frac{1}{n^{2008}} \) converges or diverges.
- For \( x > 0 \), find the minimum value of \( (x + \frac{1}{x})^{3.5} \).
- Find \( \int_{0}^{2008} g(x) \, dx \), if \( y = g(x) \) is graphed below.

![Graph of y = g(x)](image)

- Assume that \(-\frac{\pi}{2} < x < \frac{\pi}{2}\). Evaluate and simplify \( \int_{0}^{\tan x} \frac{2008}{1+e^t} \, dt \).
- Evaluate and simplify \( \int e^{x^3} \, dx \).
- Find the point \((x, y)\) on the graph of the function
  \[ f(x) = x^3 - 6x^2 + 5x + 2008 \]
  where the tangent line has least slope.
- Consider the graph of \( y = q'(x) \) below. Find
  - \( q''(-1) \)
  - \( q(3) - q(-1) \).

![Graph of y = q'(x)](image)

- Find \( \frac{d}{dx} \left( \int_{x}^{0} \sin(\theta - \theta^{2008}) \, d\theta \right) \).
- Find \( \int_{1}^{4} \sqrt{x^3 + 6x^2 + 9x} \, dx \).