(1)
(A) $f'(x) = \frac{3}{x} + \sinh(x) - \frac{1}{1+x^2}$

(B) $f'(e) = \frac{3}{e} + \frac{e^e - e^{-e}}{2} - \frac{1}{1+e^2}$

(2) $\frac{1}{2}$

(3)
(A) 2

(B) Global min at $x = \frac{1}{2}$ Global max at $x = 1$

4

$$300 = 2x + y.$$

Hence

$$y = 300 - 2x.$$

$$A = xy.$$

$$A(x) = x(300 - 2x).$$

$$A'(x) = 300 - 4x.$$

Hence critical point: $x = 75$. Since

$$A''(x) = -4,$$

the graph of A is a parabola that opens downward. Hence $x = 75$ is a global max. Then

$$y = 300 - 2 \cdot 75 = 150.$$

$$\text{Largest area} = 75\text{feet} \cdot 150\text{feet} = 11250\,\text{square feet}.$$

(5)
$x = -4$ and $x = 5$

(6) critical points: $x = 6$ (local min) $x = 0$ (neither local min nor max)

(7) $\frac{3}{2}$

(8)

$$\frac{dy}{dx} = \frac{2x - \frac{y}{x}}{\ln x + 3y^2 \cosh(y^3) + 2y}$$

(9) $e^{(1-x)} \approx -x + 2$

(10) Let x be the number of chairs ordered above 300 chairs, so $0 \leq x \leq 100$.

$$\text{Revenue} = R = (90 - 0.25x)(300 + x).$$

$$\frac{dR}{dx} = 15 - 0.5x.$$

Critical point: $x = 30$. Since $\frac{d^2R}{dx^2} = -0.5$, the graph of R is a parabola that opens downward. Hence $x = 30$ is a global max.

$$\text{Max Revenue} = R(30) = \$27.225.$$

$$\text{Min Revenue} = \$0.$$

(11) By the Pythagorean Theorem,

$$w = \sqrt{400 - (\tfrac{l}{2})^2}.$$

Areal of the rectangle:

$$A = l \cdot w.$$

$$A(l) = l\sqrt{400 - (\tfrac{l}{2})^2}.$$

$$\frac{dA}{dl} = \frac{400 - \frac{l^2}{2}}{\sqrt{400 - (\frac{l}{2})^2}}.$$

Hence critical point: $l = \sqrt{800} = 2\sqrt{200} = 20\sqrt{2}$. Next, you must check that $l = 20\sqrt{2}$ is a global max. Then dimensions:

$$w = \sqrt{200} = 10\sqrt{2} \quad \text{feet}.$$

$$l = 20\sqrt{2} \quad \text{feet}.$$

$$\text{Max Area} = l \cdot w = 400 \quad \text{square feet}$$

(12) The line, pointing upward with slope -4, $x-$intercept: $(\frac{7}{2}, 0)$, $y-$intercept: $(0, 14)$