

1. Consider the function $f(x) = x^2e^x + e^x$.
 - (a) $f(x)$ has one horizontal asymptote. Compute this asymptote.

 - (b) For what values of x is f increasing? *Justify with either a table or a sentence.*

 - (c) On what intervals is f concave down? *Justify with a table or a sentence.*

 - (d) State the points of inflection of f . *No justification necessary*

 - (e) Sketch f somewhere and show Matt.
2. Compute the following limits:
 - (a) $\lim_{x \rightarrow \infty} \frac{2^x}{x^2}$

 - (b) $\lim_{x \rightarrow 0} x(\ln x)^2$.

 - (c) $\lim_{x \rightarrow 0} x^x$ (*difficult*).
3. Using the **limit definition** of the derivative find $g'(0)$ if $g(x) = \begin{cases} x^3 \ln\left(\frac{1}{x^2}\right), & x > 0 \\ 0, & x = 0 \end{cases}$

4. (#16) Find the area of the largest rectangle that can be inscribed in a right triangle with legs of lengths 3 cm and 8 cm if two sides of the rectangle lie along the legs.
5. (#22) Find the equation of the line through the point $(2, 5)$ that cuts off the least area from the first quadrant.
6. (#21) A woman at a point A on the shore of a circular lake with radius 2 mi wants to arrive at the point C diametrically opposite A on the other side of the lake in the shortest possible time (see the figure). She can walk at the rate of 4 mi/h and row a boat at 2 mi/h. For what value of the angle θ shown in the figure will she minimize her travel time?

