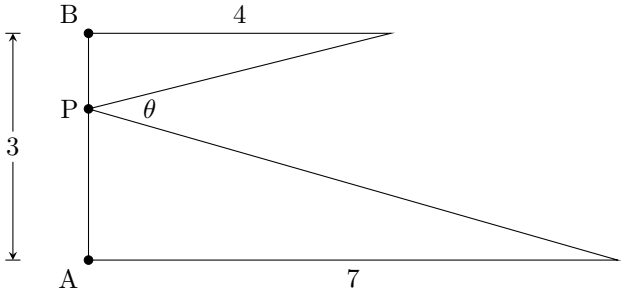
# Math 220 - Practice Exam 2

1. Determine the derivatives of the following functions:
   (a) $f(x) = \ln(x + e^{-x})$,
   (b) $f(x) = e^{\sin^{-1}(x)}$,
   (c) $f(x) = (x + \sin(x))^{\cos(x)}$,
   (d) $f(x) = x^{(2^x)}$,
   (e) $f(x) = \sinh(2x) + \cosh^{-1}(3x)$.
2. Evaluate so that your answer is a fraction.
   (a) $\tanh(\ln(2)) =$
   (b) $\sin(\tan^{-1}(\frac{3}{4}) + \cos^{-1}(\frac{5}{13})) =$
3. Determine each limit. Show your work.
   (a) $\lim_{x\to 0} \frac{\cos(2x)-1}{x^2+x^3}$
   (b) $\lim_{x\to 0} \left(x + e^{2x}\right)^{\cot(x)}$
4. Consider the following diagram, where the point $P$ is on the line segment $AB$.




   (a) Where should $P$ be placed on $AB$ in order to maximize the angle $\theta$?
   (b) Where should $P$ be placed on $AB$ in order to minimize the angle $\theta$?
5. Sketch a graph of the function $f(x) = \ln(\sin^2(x))$ on the interval $(-2\pi, 2\pi)$.
   (a) Show all vertical asymptotes, if they exist.
   (b) Show intercepts if they exist.
   (c) Show the coordinates of local minima or maxima if they exist. For each, explain why it is a minimum or a maximum.
6. Let $f(x) = xe^{-x^2/8}$.
   (a) Find the minimum and maximum values of $f(x)$ on the interval $[-5, 1]$.

(b) On what intervals is $f(x)$ concave up?

7. Suppose that $f(x) = e^{\sin(x)} + 2\cos(e^x - 1)$ and note that $f(0) = 3$. Find $(f^{-1})'(3)$.

8. Let $f(x) = x^3 + x$. Find a point $c$ in the interval $[2, 11]$ satisfying the conclusion of the Mean Value Theorem.