Exam 3 Calc 1 10/26/2018

Each problem is worth 10 points. For full credit provide complete justification for your answers.

1. What is $(\ln x)'$?

2. a) What is $\left(xe^x\right)'$?

   b) What is $\left(x\arcsin x\right)'$?

   c) What is $\left(x\cosh x\right)'$?

3. Evaluate $\lim_{x\to\infty}\frac{x}{e^x}$. Be sure to provide good justifications for your steps.

4. Differentiate $y = x\cos^{-1}x - \sqrt{1-x^2}$. [Hint: $\left(\cos^{-1}x\right)' = \frac{-1}{\sqrt{1-x^2}}$]

5. [Stewart] The table below gives estimates of the world population, in millions, from 1750 to 2000:

Year	Population	Year	Population
1750	790	1900	1650
1800	980	1950	2560
1850	1260	2000	6080

Use the exponential model and the population figures for 1800 and 1850 to predict the world population in 1900. Compare with the actual population.

6. Show why $\left(a^x\right)' = \left(\ln a\right) a^x$.

7. Biff is a calculus student at Enormous State University, and he's having some trouble. Biff says "Geez, calculus is hard! All this ticky-tack stuff is just literally killing me. Like, you know, sometimes they write 1 over sin, and sometimes they write $\sin^{-1}$, and sometimes they write arcsin, and sometimes they write csc, and I think maybe they're all the same, but who the heck knows? I bet literally nobody actually can tell which ones are different. "

   Explain clearly to Biff which of the functions he describes are actually the same, and which are different, and why.

8. Show that if $g(x) = \tan^{-1} x$ then $g'(x) = \frac{1}{1+x^2}$.

9. Why is $\frac{d}{dx}(\sinh^{-1} x) = \frac{1}{\sqrt{1+x^2}}$?

10. Evaluate $\lim_{x \to 0^+} x \ln x$. Be sure to provide good justifications for your steps.

Extra Credit (5 points possible): Evaluate $\lim_{x \to 0^+} x^x$. Be sure to provide good justifications for your steps.