

Do all your work and put all your answers WITH your work, CIRCLED, on the white paper provided. All I want on this sheet is your NAME! Spend no more than 2 minutes on any single problem on your first pass through the test. If you don't finish a problem in 2 or 3 minutes, start a fresh sheet of paper for the next problem, and so on.

Formatting should be the same as homework, only you don't need to re-state the question, because the question's attached to your test!

1. The function  $f(x) = x^2 - 7x - 15$  is 1-to-1 on the restricted domain  $D = \left[\frac{7}{2}, \infty\right)$ .
  - a. (10 pts) Find the inverse function  $f^{-1}(x)$ . State its domain and range.
  - b. (5 pts) Find  $(f^{-1})'(5)$ , directly, by differentiating your answer for part a.
  - c. (5 pts) Find  $(f^{-1})'(5)$  by applying a theorem regarding derivatives of inverse functions.
  
2. (5 pts each) Find the derivative with respect to  $x$ . All "-1" powers refer to function inverses, not reciprocals.
 

<ol style="list-style-type: none"> <li>a. <math>y = 3 \cdot 2^{\sin(x)}</math></li> <li>b. <math>y = \ln\left(\frac{\sqrt[5]{x^2 - 3x}}{\sin^3(x)}\right)</math></li> <li>c. <math>y = \log_5(\tan(x^2))</math></li> </ol>	<ol style="list-style-type: none"> <li>d. <math>y = [7x^3 - 5x]^{\cos(x)}</math></li> <li>e. <math>y = \cos(x) \cdot \sin^{-1}(5x^3 - 7x)</math> or <math>\cos(x) \cdot \arcsin(5x^3 - 7x)</math></li> <li>f. <math>y = \sin(x) \cdot \cosh^{-1}(5x^3 - 7x)</math></li> </ol>
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3. (5 pts each) Evaluate the integrals
 

<ol style="list-style-type: none"> <li>a. <math>\int \sec^2(x) \cdot e^{\tan(x)} dx</math></li> </ol>	<ol style="list-style-type: none"> <li>b. <math>\int \frac{dx}{5x\sqrt{x^2 - 36}}</math></li> </ol>
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4. (5 pts each) Simplify the following.
  - a.  $\sec\left(\tan^{-1}\left(\sqrt{9x^2 - 100}\right)\right)$
  - b.  $\sin^{-1}\left(\sin\left(\frac{5\pi}{4}\right)\right)$ . *I think you're OK on the domains, after class talk.*
  
5. (10 pts) The doubling time of an investment is 10 years. Assuming interest compounds continuously, what is the rate of interest?
  
6. (5 pts each) Evaluate the following limits:
 

<ol style="list-style-type: none"> <li>a. <math>\lim_{x \rightarrow \infty} \left(1 + \frac{3}{x}\right)^{5x}</math></li> </ol>	<ol style="list-style-type: none"> <li>b. <math>\lim_{x \rightarrow 0} \left(\frac{e^{2x} - 1}{\sin(x)}\right)</math></li> </ol>	<ol style="list-style-type: none"> <li>c. <math>\lim_{x \rightarrow \frac{\pi}{2}^-} (\sec(x) - \tan(x))</math></li> </ol>
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## Bonus:

1. Find the volume of the solid of revolution obtained by revolving the function  $y = \sqrt{x}$  about the  $y$ -axis in 2 ways:
  - a. (10 pts) Shell Method
  - b. (10 pts) Disk Method