

Do your work on separate paper. Do *not* put final answers on this cover sheet. Just circle them. Follow homework formatting guidelines for your work: One-sided, staple at top left corner. MARGIN at the top left corner. The only difference is I don't want you to fold them.

- (10 pts) The function  $f(x) = x^2 - 6x - 11$  is 1-to-1 on the restricted domain  $[3, \infty)$ . Find the inverse function. State its domain and range.
- Find  $(f^{-1})'(5)$  for  $f(x) = x^2 - 6x - 11$  ( $x \geq 3$ ), in two ways:
  - (5 pts) Directly, using your answer from #1.
  - (5 pts) Using our theorem for derivative of the inverse..
- (5 pts each) Find the derivative with respect to  $x$ . Do not simplify.
 

a. $y = 2 \cdot 3^{2x^2-3x}$	c. $y = \log_3(x^2 - 2x)$
b. $y = \ln\left(\frac{(x^2 - 2x)^3}{(2x + 1)^5}\right)$ (Hint: Break it up into simpler logs!)	d. $y = (x^2 - 3x)^{2x^2+5x}$
	e. $y = x^2 \sin^{-1}(x^2 - 3x)$
	f. $y = x^2 \tanh^{-1}(x^2 - 3x)$
- (5 pts each) Evaluate the integral.
 

a. $\int x e^{x^2-3x} dx$	b. $\int \frac{dx}{x\sqrt{9-x^2}}$
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- (5 pts each) Simplify:
 

a. $\tan(\sec^{-1}(x))$	b. $\sin^{-1}\left(\sin\left(\frac{5\pi}{4}\right)\right)$
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- The half-life of Carbon-14 is about 5730 years. How old is a fire pit in which 30% of the original Carbon-14 remains?
- Evaluate  $\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x^2 - 3x}$  in two ways:
 

a. Factor, cancel, pass to the limit.	b. L'Hopital's rule
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- Evaluate the limits:
 

a. $\lim_{x \rightarrow 0} \left(\frac{\sinh(x) - x}{x^3}\right)$	b. $\lim_{x \rightarrow \infty} \left(x \sin\left(\frac{3}{x}\right)\right)$	c. $\lim_{x \rightarrow \infty} (4x + 1)^{\cot(x)}$
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