MATH 141 – CALCULUS II
SECOND MIDTERM EXAM

Instructions. Answer each question on a separate answer sheet. Show all your work. Be sure your name, section number, and problem number are on each answer sheet, and that you have copied and signed the honor pledge on the first answer sheet. You may *not* use calculators, notes, or any other form of assistance on this exam.

(1) (a) (5 pts) Calculate $\cos(\tan^{-1}(\sqrt{2}))$.

   (b) (5 pts) Why does the function defined below have an inverse?
   $$f(x) = \frac{1}{x^3} - 3x \ , \ x > 0$$

   (c) (10 pts) Compute $(f^{-1})'(-2)$, where $f(x)$ is the function in part (b).

(2) (a) (10 pts) Calculate $\dfrac{d(3^{x^2})}{dx}$

   (b) (20 pts) Calculate $\displaystyle\int_0^{1/\sqrt{3}} \frac{dx}{\sqrt{4 - 9x^2}}$

(3) Calculate the following limits:

   (a) (15 pts) $\displaystyle\lim_{x\to\infty} \left(1 + \frac{1}{3x}\right)^{2x}$

   (b) (15 pts) $\displaystyle\lim_{x\to 1} \frac{\ln x - x + 1}{x^3 - 3x + 2}$

(4) (20 pts) Find a solution $y(x)$ of the differential equation:
$$xy' - 4y = x^2 \ , \ y(1) = 1$$