Math 225 Final Examination Fall 2015

Name (print)____________________________

Name (sign)____________________________

Bing ID number _______________________
(Your ID may be checked during or after the test)

Section number____    Instructor________________________

No books, no notes, no electronic devices (calculators, cell phones, smart watches, etc.) Write all your work on the test – nothing else will be graded. **You must show all your work.** Your work must be legible, and the final answers must be reasonably simplified.

On some problems you may be asked to use a specific method to solve the problem (for instance, “Use the Fundamental Theorem of Calculus to find...”). On all other problems, you may use any method we have covered. **You may not use methods that we have not covered.**

**Wandering Eyes Policy**

You must keep your eyes on your own work at all times. If you are found looking around, you will be warned once, and only once. A second infraction may result in automatic zero on this test, and possibly a referral to the Harpur College Academic Honesty Committee.

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For instructor’s use only:

1. ___ (10)    4. ___ (10)    7. ___ (15)
2. ___ (15)    5. ___ (10)    8. ___ (15)
3. ___ (15)    6. ___ (10)    TOTAL: __________

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1
1. (10 points) Find the area of the region bounded by the curves $x = y^2$ and $x = 4$. 
2. (15 points) The region bounded by the curves $x = y^2$ and $x = 4$ is rotated about the line $x = -1$.

   a) Set up the integral that represents the volume of the resulting solid using the washers method. You must draw a typical washer or otherwise justify your formula. **Do not evaluate the integral.**

   b) Set up the integral that represents the volume of the resulting solid using the shells method. You must draw a typical shell or otherwise justify your formula. **Do not evaluate the integral.**
3. (15 points) The region bounded by the curves $x = y^2$ and $x = 4$ is rotated about the line $y = 5$.
   
   a) Set up the integral that represents the volume of the resulting solid using the **washers** method. You must draw a typical washer or otherwise justify your formula. **Do not evaluate the integral.**

   b) Set up the integral that represents the volume of the resulting solid using the **shells** method. You must draw a typical shell or otherwise justify your formula. **Do not evaluate the integral.**
4. (10 points) Evaluate the integral (definite or indefinite).

\[
a) \int_0^\pi x \cdot \sin(4x) \, dx \\
b) \int \sqrt{x} \cdot \ln x \, dx
\]
5. (10 points) Find the volume of the solid obtained by rotating the region bounded by \( y = x^3, \ y = 4x, \ x \geq 0 \) about the x-axis.
6. (10 points) A catapult shoots a ball straight up in the air with the initial velocity of $20 \text{ m/s}$. Find when the ball is $15 \text{ m}$ above the ground on the way down. (The time is measured in seconds, starting from the time the ball is shot).

**NOTE:** Assume that the acceleration of gravity is $10 \text{ m/s}^2$ and ignore the drag.
7. (15 points) What is the smallest possible total surface area (top, bottom and side) of the right circular cylinder of volume \((16\pi) \text{ m}^3\)? Justify.
8. (15 points)
a) Evaluate the integral
\[ \int_{0}^{\pi} x^2 \sin x \, dx \]

b) Find the average value on the segment \([0, \pi]\) of the function
\[ f(x) = x^2 \sin x \]