IUPUI Department of Mathematical Sciences
Departmental Final Examination

PRACTICE FINAL EXAM VERSION #2

MATH 15900

Precalculus

Exam directions similar to those on the departmental final.

1. **DO NOT OPEN** this test booklet until you are told to do so.
2. This is NOT the exam for MATH 15300 or 15400.
3. There are 7 pages in this exam with problems 1 to 23 and a bonus problem.
4. You MUST get a new exam from the proctor if your exam is incomplete.
5. PRINT your name and student ID# below.
6. MARK your section below.
7. You will have two hours to complete this examination.
8. A TI-30Xa calculator is permitted, no other calculator is allowed.
9. No scrap paper, notes, books, or collaborators are allowed.
10. Exact answers may contain π or radicals or logarithms.
11. Simplify all answers completely.
12. Problems involving units must have the units represented on the answer to receive full credit.

Name  
(Print Clearly)

Student ID#

Practice Departmental Final Exam Recommendations to Students:
- Take this practice final exam like an actual examination (not like doing homework). That is, create an “exam like” atmosphere. This practice exam should be taken after completing a thorough review of the material.
- Set aside a two-hour block of time with no interruptions (no facebook, texting, phone calls, restroom breaks, etc.).
- Do not use any help aids, such as notes, textbook, internet, scrap paper, MAC staff, etc.
- Work through all problems noting which concepts you know well and which ones you need to spend more time on.
- Grade your exam using the answers in the back of your textbook (the textbook section and exercise number is noted at the top right of each problem).
- Rework any problem on the exam that you missed and then work similar problems from the textbook until you can perform the operations without error.
- Follow the same recommendations for taking the Practice Final Exam Version #1.
1. Simplify.  
\[
\left(\frac{4y^3}{x^4y^2}\right)^{1/2}
\]
1. ______________________ (4)

2. **Preparing a glucose solution**  In a certain medical test designed to measure carbohydrate tolerance, an adult drinks 7 ounces of a 30% glucose solution. When the test is administered to a child, the glucose concentration must be decreased to 20%. How much 30% glucose solution and how much water should be used to prepare 7 ounces of 20% glucose solution?  

2. ______________________ (4)

3. Solve for the specified variable.  
\[A = 2\pi(r + h) \text{ for } r\]  
3. ______________________ (4)

4. Solve the equation.  
\[2x^{-2/3} - 7x^{-1/3} - 15 = 0\]  
4. ______________________ (4)
5. Solve the inequality. Express the solution in **interval notation**.  
\[ x^3 + 2x^2 - 4x - 8 \geq 0 \]  

5. \( \quad \) (4)

6. Find an equation of the circle with center \( C(-4, 6) \) and passing through the point \( P(1, 2) \).  

6. \( \quad \) (4)

7. Given the points \( A(3, -1) \) and \( B(-2, 6) \). Find an equation (in slope-intercept form) for the perpendicular bisector of segment \( AB \).  

7. \( \quad \) (4)

8. Find the domain of \( f(x) = \frac{\sqrt{2x - 3}}{x^2 - 5x + 4} \).  

8. \( \quad \) (4)
9. Given \( f(x) = -2x^2 + 20x - 43 \).
   (3.6 #21)
   a) Use the quadratic formula to find the zeros of \( f(x) \).
      
      9a) \underline{__________________} \ (2)
   b) Find the maximum or minimum value of \( f(x) \).
      
      9b) \underline{__________________} \ (2)
   c) Sketch the graph of \( f(x) \).
      
      \begin{center}
      \includegraphics[width=0.7\textwidth]{graph}
      \end{center}

10. Find the quotient and the remainder if \( f(x) = 3x^3 + 2x - 4 \) is divided by \( p(x) = 2x^2 + 1 \). \ (4.2 #3)

   10. \underline{__________________} \ (4)
11. Given the one-to-one function \( f(x) = \sqrt[3]{x} + 1 \), find the inverse function, \( f^{-1}(x) \). \hspace{1cm} (5.1 \#37)

12. **Compound interest** If $1000 is invested at a rate of 7% per year compounded monthly, find the balance after 6 months. \hspace{1cm} (5.2 \#41)

13. If $1000 is deposited in a savings account that pays interest at a rate of 8.25% per year compounded continuously, find the balance after 5 years. \hspace{1cm} (5.3 \#5)

14. Find the **exact value** for the solution of the equation. \hspace{1cm} (5.6 \#19)

\[
\log(x^2 + 4) - \log(x + 2) = 2 + \log(x - 2)
\]
15. Find the foci of the hyperbola. Sketch its graph showing the center, vertices and foci.

\[ 4y^2 - x^2 + 40y - 4x + 60 = 0 \]

16. **Planning production**  A small furniture company manufactures sofas and recliners. Each sofa requires 8 hours of labor and $180 in materials, while a recliner can be built for $105 in 6 hours. The company has 340 hours of labor available each week and can afford to buy $6750 worth of materials. How many recliners and sofas can be produced if all labor hours and all materials must be used?

17. Find the **exact value** of \( \csc \theta \) if \( \theta \) is in standard position and \( P(-2,-5) \) is on the terminal side of \( \theta \).
18. Graph at least one complete period of $y = 1 + \tan x$.  

19. Verify the identity. **Show all work.** 

\[(\sec u - \tan u)(\csc u + 1) = \cot u\]  

20. Find the **exact values** for the solutions of the equation that are in the interval $[0, 2\pi)$. 

\[2\sin^2 u = 1 - \sin u\]
21. Given \( \sec \theta = -3; \ 90^\circ < \theta < 180^\circ \) find the \textbf{exact value} of \( \sin 2\theta, \cos 2\theta, \) and \( \tan 2\theta \) \hspace{1cm} (7.4 #3)

21a) \( \sin 2\theta : \) \hspace{2cm} (4)

21b) \( \cos 2\theta : \) \hspace{2cm} (4)

21c) \( \tan 2\theta : \) \hspace{2cm} (4)

22. In triangle \( ABC \) if \( \alpha = 42^\circ 10', \ \gamma = 61^\circ 20' \) and \( b = 19.7 \) find the value of \textbf{side} \( a. \) \hspace{1cm} (8.1 #5)

22. \hspace{2cm} (4)

23. Use \textbf{Heron's formula} to approximate the area of triangle \( ABC. \)

\( a = 25.0 \text{ ft}, \ b = 80.0 \text{ ft}, \ c = 60.0 \text{ ft} \) \hspace{1cm} (8.2 #39)

23. \hspace{2cm} (4)

\textbf{Bonus: Airplane takeoff} \hspace{0.5cm} An airplane takes off at a 10\(^\circ\) angle and travels at the rate of 250 \text{ ft/sec.} Approximately how long does it take the airplane to reach an altitude of 15,000 feet? \hspace{1cm} (6.7 #32)

\textbf{Bonus}: \hspace{0.5cm} (4)