MATH 1103 COMMON FINAL EXAM
MULTIPLE CHOICE SECTION
FALL 2006

Please print the following information:

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<th>Name: ______________________</th>
<th>Instructor: ______________________</th>
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<td>Student ID: ________________</td>
<td>Section/Time: ____________________</td>
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The MATH 1103 Final Exam consists of two parts. These pages contain Part I which consists of 25 multiple choice questions. Part II consists of free response questions prepared by your instructor. You have three hours for the entire test.

This part of the exam consists of 25 multiple choice questions. They are printed on the front and the back of each page. Be sure that you answer 25 different questions. A special answer sheet is provided so that your answers can be machine graded.

- You must use a pencil with a soft black lead (#2 or HB) to enter your answers on the answer sheet.

- For each question choose the response which best fits the question.

- If you wish to change an answer, make sure that you completely erase your old answer and any other extraneous marks.

- There is no penalty for guessing. However if you mark more than one answer to a question, that question will be scored as incorrect.

- You may perform your calculations on the test itself or on scratch paper, but do not make any stray marks on the answer sheet.

- Make sure that your name appears on the answer sheet and that you fill in the circles corresponding to your name.

- The use of a TI-89 or a TI-92 calculator on this test is a violation of the Code of Student Conduct.

At the end of the examination you MUST hand in this booklet, your answer sheet and all scratch paper.
1. Find the domain of \( f(x) = \frac{\sqrt{x + 2}}{x - 2} \).

(a) \([-2, \infty)\)
(b) \([-2, 2)\)
(c) \((-2, 2) \cup (2, \infty)\)
(d) \((-\infty, 2) \cup (2, \infty)\)
(e) \([-2, 2) \cup (2, \infty)\)

2. Find the equation of a line that is perpendicular to \(7x - 4y = 12\) and passes through the point \((7, 3)\).

(a) \(4x + 7y = 61\)
(b) \(4x - 7y = -7\)
(c) \(4x - 7y = 7\)
(d) \(4x + 7y = 49\)
(e) \(4x + 7y = -12\)

3. Find \(f(-1) + f(-2)\) given the function \(f(x) = \begin{cases} |6x - 4| & \text{if } x < -1 \\ 2 & \text{if } x = -1 \\ \frac{2}{\sqrt{x^2 - 8}} & \text{if } x > -1 \end{cases}\).

(a) 22
(b) 30
(c) -14
(d) 18
(e) None of these.

4. Solve the quadratic equation \(x^2 - 4x - 2 = 0\).

(a) \(x = 2 \pm \sqrt{6}\)
(b) \(x = 2 \pm 2\sqrt{6}\)
(c) \(x = 2 \pm 2\sqrt{3}\)
(d) \(x = 2 \pm \sqrt{2}\)
(e) None of these.
5. Find the horizontal asymptotes (H.A.) and vertical asymptote(s) (V.A.) of
\[ f(x) = \frac{x^2 - 4}{(2 - 2)(14x - 2)}. \]

(a) \( H.A.: y = \frac{1}{7}; \ V.A.: x = \frac{1}{14} \)
(b) \( H.A.: y = \frac{1}{14}; \ V.A.: x = \frac{1}{7} \)
(c) \( H.A.: \text{None}; \ V.A.: x = \frac{1}{7} \) or \( x = 2 \)
(d) \( H.A.: y = \frac{1}{14}; \ V.A.: x = 2 \) or \( x = \frac{1}{7} \)
(e) \( H.A.: \text{None}; \ V.A.: x = \frac{1}{7} \)

6. Solve \( \frac{x + 3}{5 - x} + 2 \leq 0. \)

(a) \([5, 13]\)
(b) \((5, 13]\)
(c) \([5, 13)\)
(d) \((5, 13)\)
(e) None of these.

7. Which of the following properties are true of the function \( f(x) = -2(x + 4)^2 + 8 \)?

\[ \text{I. The vertex is } (-4, 8) \]
\[ \text{II. } f(x) \text{ has a relative Minimum Value} \]
\[ \text{III. } f(x) \text{ has been stretched by a factor of } 2. \]
\[ \text{IV. } f(x) \text{ has } x \text{-intercepts at } -6 \text{ and } 2. \]
\[ \text{V. } f(x) \text{ has } y \text{-intercept at } -24. \]

(a) Only I, III, IV, and V
(b) Only I and II
(c) Only I and III
(d) Only III and V
(e) Only I, III, and V
8. Find \( f^{-1}(x) \) if \( f(x) = \frac{5x - 3}{2 - x} \).

(a) \( f^{-1}(x) = \frac{2 - x}{5x - 3} \).
(b) \( f^{-1}(x) = \frac{2x + 3}{6} \).
(c) \( f^{-1}(x) = \frac{x - 2}{5x + 3} \).
(d) \( f^{-1}(x) = \frac{2x + 3}{x + 5} \).
(e) \( f^{-1}(x) = \frac{5x + 3}{2 + x} \).

9. Find \( g(f(1)) \) when \( f(x) = \frac{1}{\sqrt{x + 3}} \) and \( g(x) = 12x \).

(a) 6
(b) 3
(c) \( \frac{1}{\sqrt{15}} \)
(d) \( \frac{25}{2} \)
(e) None of these.

10. Find the quotient and remainder of \( \frac{x^4 - 3x^2 + 9}{x - 1} \).

(a) \( Q(x) = x^3 - 6x^2; R(x) = 3 \).
(b) \( Q(x) = x^4 + x^3 - 2x^2 - 2x + 7; R(x) = 0 \)
(c) \( Q(x) = x^3 - x^2 - 2x + 2; R(x) = 7 \)
(d) \( Q(x) = x^3 + x^2 - 2x - 2; R(x) = 7 \)
(e) None of these.
11. Which of the following numbers is not a potential rational root of 
\[ f(x) = 18x^3 - 9x^2 - 5x + 2. \]

(a) \( \frac{3}{2} \)
(b) \( \frac{2}{9} \)
(c) \( \frac{1}{6} \)
(d) \( -\frac{1}{2} \)
(e) 2

12. Find the sum of the roots of 
\[ f(x) = 2x^3 - 14x + 12. \]

(a) 0
(b) 1
(c) 4
(d) −4
(e) None of these.

13. The graph of \( f(x) = -\log_2 x + 5 \) can be obtained by applying transformations to 
\( g(x) = \log_2 x. \) Which of the following transformations could be used? Make sure your choice reflects the order in which the transformations are applied.

I. Move the function 5 units to the left.
II. Move the function 5 units up.
III. Move the function 5 units down.
IV. Reflect the function about the \( x \)-axis.
V. Reflect the function about the \( y \)-axis.

(a) V then II
(b) II then IV
(c) IV then II.
(d) IV then I.
(e) IV then III
14. Solve $3^{3x-3} = 3 \cdot 9^x$.
   (a) $x = 0$.
   (b) $x = \frac{3}{2}$.
   (c) $x = 4$.
   (d) No solution.
   (e) None of these.

15. Solve the equation $\log_2 (x + 2) + \log_2 (x - 2) = 5$.
   (a) $x = \frac{5}{2}$.
   (b) $x = -6$ and $x = 6$.
   (c) $x = -6$.
   (d) $x = 6$.
   (e) None of these.

16. Find the accumulated amount if $8000$ is invested into an account that pays $3\%$ interest compounded continuously for $5$ years.
   (a) $6,885.66$
   (b) $8,243.64$
   (c) $9,290.51$
   (d) $9,294.67$
   (e) None of these.

17. Find $\csc \theta$ if $\cos \theta = \frac{2}{5}$ and $\tan \theta < 0$.
   (a) $\frac{5\sqrt{21}}{21}$
   (b) $-\frac{5\sqrt{21}}{21}$
   (c) $-\frac{\sqrt{21}}{5}$
   (d) $-\sqrt{21}$
   (e) $1.10$
18. Simplify \( \sin 2k \cos k + \cos 2k \sin k \) using an appropriate trigonometric identity.

(a) \( \cos 3k \)

(b) \( \cos k \)

(c) \( \sin k \)

(d) \( \sin 3k \)

(e) None of these.

19. Use an appropriate sum or difference identify to find the exact value of \( \cos \left( \frac{5\pi}{12} \right) \).

(a) \( \frac{\sqrt{6} - \sqrt{2}}{2} \)

(b) \( \frac{\sqrt{6} + \sqrt{2}}{4} \)

(c) \( \frac{\sqrt{6} - \sqrt{2}}{4} \)

(d) \( \frac{\sqrt{6} + \sqrt{2}}{2} \)

(e) None of these.

20. Find the value of \( \cos 2\theta \) if \( \sin \theta = \frac{1}{3} \).

(a) \( \frac{1}{9} \)

(b) \( \frac{7}{9} \)

(c) \( \frac{1}{3} \)

(d) \( \frac{\sqrt{7}}{3} \)

(e) None of these.
21. The value of $c$ given as a length of the following triangle is closest to

![Triangle Diagram]

(a) 36
(b) 34
(c) 12
(d) 48
(e) 1264

22. Find the general solution to the equation $\sin 2x = \frac{1}{2}$.

(a) $x = \frac{\pi}{12} + \pi k$
(b) $x = \frac{5\pi}{4} + \pi k$
(c) $x = \frac{\pi}{12} + 2\pi k$, $x = \frac{5\pi}{4} + 2\pi k$
(d) $x = \frac{\pi}{6} + 2\pi k$, $x = \frac{5\pi}{4} + 2\pi k$
(e) $x = \frac{\pi}{12} + \pi k$, $x = \frac{5\pi}{12} + \pi k$

23. An algebraic expression for $\tan (\cos^{-1}(x))$ is

(a) $\frac{x}{\sqrt{1-x^2}}$
(b) $\frac{\sqrt{1+x^2}}{x}$
(c) $\frac{\sqrt{1-x^2}}{x}$
(d) $\sqrt{1-x^2}$
(e) $x$
24. If a person is looking at a tree from an angle of 70° and the tree casts a shadow that is 4 feet long, what is the height of the tree?

(a) $4 \sin 70°$
(b) $4 \cos 70°$
(c) $4 \tan 70°$
(d) $4 \csc 70°$
(e) $4 \sec 70°$

25. Simplify $\frac{\tan^2 x - \sec^2 x \tan x}{\cot (-x)}$.

(a) $\cot^2 x$
(b) $- \tan^2 x$
(c) $- \tan x$
(d) $\tan x$
(e) $\tan^2 x$
MATH 1103-007 Final Exam

Fri Dec 8, 2006 10:00-11:00am
Instructor: Ming (Catherine) Xiang

Part II. Free response problems. (Show each step to earn partial points)

First Name: Last Name:

1. Solve the following equation:

\[ 3x^2 - 1 = 8x \]

2. Solve the following inequality:

\[ \frac{x + 2}{x - 5} + 1 > 0 \]
3. Find \( f^{-1}(x) \): the inverse function of \( f(x) = 2\log(x-5)+3 \) and also find the domain and range of \( f^{-1}(x) \).

4. Find \( \sin(2\theta) \), if \( \cos \theta = -\frac{3}{5} \) and \( \frac{\pi}{2} \leq \theta \leq \pi \).
5. Solve the following triangle (find all the unknown angles and sides). Round your answer for both angles and sides to one decimal. Show all the laws and/or identities used.

\[ \alpha = \beta = 30^\circ \]
\[ b = 5 \]

\[ \alpha = 30^\circ \]
\[ \beta = 30^\circ \]

Identities and Laws you may need to use for this exam:

Law of sine: \[ \frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)} \]
Law of cosine: \[ c^2 = a^2 + b^2 - 2ab \cos C \]

Double angle identities: \[ \sin 2x = 2 \sin x \cos x \]
\[ \cos 2x = \cos^2 x - \sin^2 x = 1 - 2 \sin^2 x = 2 \cos^2 x - 1 \]
1. Find the slope-intercept form of the equation of the line joining the points: 
(0, -1) and (-1, -6)

2. Find the slope-intercept form of the equation of the line perpendicular to the line:
\[ y = -\frac{2}{3} x + 4 \]
and passing through (4, 5)
3. Find the vertex of the Parabola represented by the Quadratic equation:
   \[ y = -3x^2 + 6x - 3 \]

4. Rewrite the given expression as a single logarithm:
   \[ \log(10) + \log(1) + \frac{1}{2} \log(16) + 2 \log(3) - \log(5) \]
5. Solve the following rational inequality. State your solution set using interval notation.

\[ \frac{x + 1}{2x - 1} \geq 1 \]
6. Given \( \sin \theta = p \) fill in the table in terms of \( p \) using definitions of trigonometric functions and identities.

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<tr>
<th>Given ( \sin \theta )</th>
<th>( p )</th>
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<td>( \cos \theta )</td>
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<td>( \tan \theta )</td>
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<td>( \cot \theta )</td>
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<td>( \sec \theta )</td>
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<td>( \csc \theta )</td>
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