MATH 1103 Common Final Exam
Spring 2014

Please print the following information:

Name:	_____	Instructor:	_____
Student ID:	_____	Section/Time:	_____

The MATH 1103 Final Exam consists of 50 multiple choice questions. They are printed on the front and the back of each page. A special answer sheet is provided so that your answers can be machine graded. You have three hours for the entire test.

- 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.*

At the end of the examination you MUST hand in this booklet, your answer sheet and all scratch paper.

1. What is the value of $b + c$, if the exponential function $f(x) = c \cdot b^x$ satisfies $f(-1) = 4$ and $f(4) = 6$.

   (a) $2\sqrt[5]{\frac{3}{2}}$

   (b) $5\sqrt[5]{\frac{3}{2}}$

   (c) $5\sqrt[5]{\frac{2}{3}}$

   (d) $3\sqrt[5]{\frac{2}{3}}$

   (e) 0

2. Find the equation of the line parallel to $x = 3$ whose x-intercept is 2.

   (a) $x = 2$

   (b) $x = -2$

   (c) $y = 2$

   (d) $y = -x$

   (e) $y = x - 2$

3. Consider the piecewise defined function

$$f(x) = \begin{cases} x & \text{if } x < 0, \\ \sqrt{x+2} & \text{if } 0 \leq x < 1, \\ x + 2 & \text{if } x > 1. \end{cases}$$

   Evaluate $f(2) - f(0)$.

   (a) undefined

   (b) 2

   (c) $\sqrt{2}$

   (d) 4

   (e) $4 - \sqrt{2}$

4. Find the domain of the function $f(x) = \dfrac{1-x}{x-3}$.

   (a) $x < 1$

   (b) $x > 1$

   (c) $x < 3$

   (d) $x \neq 1$

   (e) $x \neq 3$

5. Find the domain of the function $f(x) = \dfrac{\sqrt{x-1}}{x^2-1}$.

   (a) $x < 1$

   (b) $x > 1$

   (c) $x \leq 1$

   (d) $x \geq 1$

   (e) $(-\infty, \infty)$

6. The function $f(x) = \dfrac{x}{x^2+1}$ is

   (a) odd

   (b) not defined for all real numbers

   (c) even

   (d) neither odd nor even

   (e) not a function (graph fails the vertical line test)

7. If the function $f(x)$ is even and $f(2) = 3$ then we also know that

   (a) $f(3) = 2$

   (b) $f(3) = -2$

   (c) $f(-2) = 3$

   (d) $f(-2) = -3$

   (e) $f(2) = -3$

8. If $f(x) = x - 2$ and $g(x) = x^2 + x$, what is $g \circ f(x)$?

   (a) $x^2 + x - 2$

   (b) $(x-2)^2 + x$

   (c) $(x-2)^2 + x - 2$

   (d) $x^2 + x + 2$

   (e) not defined for any real number

9. If the function $f(x) = \dfrac{2x+1}{3}$ is one-to-one, find its inverse.

   (a) $\dfrac{3x-1}{2}$

   (b) $\dfrac{3x+1}{2}$

   (c) $\dfrac{2x-1}{3}$

   (d) $\dfrac{2x+1}{3}$

   (e) The function is not one-to-one

10. Which of the following functions is **not** one-to-one?

    (a) $f(x) = |x|$ on $[0, \infty)$

    (b) $f(x) = x^2 + 3$ on $(\infty, -1)$

    (c) $f(x) = \sqrt{1 - x^2}$ on $(-1, 1)$

    (d) $f(x) = x$ on $(-\infty, \infty)$

    (e) $f(x) = x^3$ on $(-\infty, \infty)$

11. If $f(x) = 3^x + 1$ than $f^{-1}(10)$ equals

    (a) -1

    (b) 0

    (c) 1

    (d) 2

    (e) 3

12. If you shift the graph of $y = f(x)$ two units down and three units to the left, you get the graph of

    (a) $y = f(x-2)+3$
    (b) $y = f(x+3)-2$
    (c) $y = f(x+3)+2$
    (d) $y = f(x-3)+2$
    (e) $y = f(x-3)-2$

13. Find the difference quotient of the function $f(x) = x^2 - 1$ evaluated at $x = 3$. In other words, find $\dfrac{f(3+h)-f(3)}{h}$.

    (a) h
    (b) $h+6$
    (c) h^2
    (d) h^2+6h
    (e) h^2+6h+9

14. If the parabola $y = x^2 + bx + c$ has its vertex at $(1,6)$, find b and c.

    (a) $b = -2$, $c = 7$
    (b) $b = -2$, $c = 5$
    (c) $b = 2$, $c = -5$
    (d) $b = 2$, $c = -7$
    (e) none of these

15. If the function $f(x) = \log_4(x+5) - 7$ is one-to-one, find $f^{-1}(x)$.

    (a) $f^{-1}(x) = 4^{x-7} + 5$
    (b) $f^{-1}(x) = 4^{x+7} - 5$
    (c) $f^{-1}(x) = 4^{x+7} + 5$
    (d) $f^{-1}(x) = 4^{x-7} - 5$
    (e) the function is not one-to-one

16. Find the equation of the axis of symmetry of the parabola $f(x) = 3x^2 - 30x - 10$.

(a) $x = -11$

(b) $x = -10$

(c) $x = -5$

(d) $x = 5$

(e) $x = 10$

17. If the function $f(x) = 4^x + 1$ is one-to-one, find its inverse.

(a) $4^{-x} + 1$

(b) $4^{-x} - 1$

(c) $\log_4(x) - 1$

(d) $\log_4(x - 1)$

(e) function is not one-to-one

18. What remainder do you get when you divide $3 \cdot x^{101} - x^{50}$ by $(x + 1)$?

(a) -4

(b) -3

(c) -2

(d) -1

(e) 0

19. Which of the following statements verifies the identity $\csc(\theta)\cos(\theta) = \cot(\theta)$?

(a) $\csc(\theta)\cos(\theta) = \cos(\theta)\sin(\theta) = \dfrac{\sin(\theta)}{\cos(\theta)} = \cot(\theta)$

(b) $\csc(\theta)\cos(\theta) = \dfrac{1}{\sin(\theta)}\sin(\theta) = \dfrac{\cos(\theta)}{\sin(\theta)} = \cot(\theta)$

(c) $\csc(\theta)\cos(\theta) = \sin(\theta)\dfrac{1}{\cos(\theta)} = \dfrac{\cos(\theta)}{\sin(\theta)} = \cot(\theta)$

(d) $\csc(\theta)\cos(\theta) = \dfrac{1}{\sin(\theta)}\cos(\theta) = \dfrac{\cos(\theta)}{\sin(\theta)} = \cot(\theta)$

(e) $\csc(\theta)\cos(\theta) = \dfrac{1}{\cos(\theta)}\cos(\theta) = \dfrac{\sin(\theta)}{\cos(\theta)} = \cot(\theta)$

20. Given that $x = 2$ is a zero of $f(x) = x^3 + 8x^2 - 31x + 22$, what is the sum of the other zeros of $f(x)$?

(a) -12

(b) -10

(c) -9

(d) 9

(e) 10

21. Solve the inequality $x^2 - 5x + 6 > 0$.

(a) $x < 2$

(b) $2 < x < 3$

(c) $x > 3$

(d) $x < 2$ or $x > 3$

(e) no solution

22. Solve the inequality $\frac{2x}{x-2} \geq 3$.

(a) $(2, 6]$

(b) $[2, 6)$

(c) $(-\infty, 2) \cup [6, \infty)$

(d) $(-\infty, 2] \cup (6, \infty)$

(e) $(-\infty, 2) \cup (6, \infty)$

23. Solve the inequality $x^2(x-1)(x+2) > 0$.

(a) $(-\infty, -2] \cup [1, \infty)$

(b) $(-\infty, -2) \cup (1, \infty)$

(c) $(-2, 0] \cup [1, \infty)$

(d) $(-\infty, -2] \cup [0, 1]$

(e) $(-\infty, -2) \cup (0, 1]$

24. Name *all* vertical and horizontal asymptotes of $f(x) = \frac{(5x+1)(x-3)}{x^2-9}$.

(a) $y = 5$, $x = 3$, $x = -3$

(b) $y = -\frac{1}{5}$, $x = 3$

(c) $y = 5$, $x = 3$, $x = -\frac{1}{5}$

(d) $y = 5$, $x = -3$

(e) $y = \frac{1}{5}$, $x = -3$

25. Use your calculator to find the value in radians of: $\operatorname{arcsec}(-2.68)$. Round your answer to two decimal digits.

    (a) 1.9

    (b) 1.95

    (c) 2

    (d) 2.015

    (e) 2.1

26. Find the range of the function $f(x) = 5 + 2 \cdot e^{-x}$.

    (a) $(5, \infty)$

    (b) $[5, \infty)$

    (c) $(-\infty, 5)$

    (d) $(-\infty, 2)$

    (e) $(2, \infty)$

27. How long will it take for 100 dollars to double, in an investment, when interest is compounded continuously at the rate of 5% per annum? Round your answer to the nearest year.

    (a) 14 years

    (b) 13 years

    (c) 12 years

    (d) 11 years

    (e) 10 years

28. Find the amount in 10 years if a principal $P = \$3,000$ is invested at the rate of $r = 6\%$, compounded quarterly. Round your answer to the nearest dollar.

    (a) $\$5,428$

    (b) $\$5,439$

    (c) $\$5,442$

    (d) $\$5,458$

    (e) $\$6,002$

29. Use the base-change formula to find $\log_3(34)$. Round your answer to the nearest decimal digit.

    (a) 2.9

    (b) 3.0

    (c) 3.1

    (d) 3.2

    (e) 3.3

30. Solve the equation $9^{x-1} = 3^x$.

    (a) $x = 0$

    (b) $x = 2$

    (c) $x = -2$

    (d) $x = 4$

    (e) $x = -4$

31. Find the domain of $f(x) = \ln(2 + 3x)$.

(a) all real numbers

(b) $x > -\frac{2}{3}$

(c) $x \geq -\frac{2}{3}$

(d) $x > -\frac{3}{2}$

(e) $x \geq \frac{3}{2}$

32. Assume a and b are positive numbers. Write $\log\left(\frac{\sqrt[3]{a}}{3b}\right)$ as a sum and/or difference of logarithms. Do not use exponents.

(a) $\log(a) - \log(b)$

(b) $\frac{\log(a)}{3} - 3\log(b)$

(c) $\frac{\log(a)}{\log(b)}$

(d) $\frac{\log(a)/3}{\log(3) + \log(b)}$

(e) $\frac{\log(a)}{3} - \log(3) - \log(b)$

33. Find all real solutions of $\log(x + 3) + \log(x) = 1$.

(a) $x = 2$

(b) $x = -5$

(c) $x = 2$ or $x = -5$

(d) $x = -\frac{3}{2} + \frac{\sqrt{13}}{2}$

(e) $x = -\frac{3}{2} \pm \frac{\sqrt{13}}{2}$

34. Convert 80^o into radians.

(a) $\frac{\pi}{9}$

(b) $\frac{2\pi}{9}$

(c) $\frac{\pi}{3}$

(d) $\frac{4\pi}{9}$

(e) $\frac{5\pi}{9}$

35. What is the reference angle for $\theta = -\frac{7\pi}{6}$, measured in radians?

(a) $-\frac{\pi}{6}$

(b) $\frac{\pi}{6}$

(c) $-\frac{5\pi}{6}$

(d) $\frac{5\pi}{6}$

(e) $-\frac{7\pi}{6}$

36. Determine the amplitude and period of $f(x) = -5 \cdot \sin\left(\frac{x}{3}\right)$. (Angles are measured in radians.)

(a) Amplitude: 5 Period: 6π

(b) Amplitude: 5 Period: 3π

(c) Amplitude: 5 Period: 8π

(d) Amplitude: $\frac{1}{5}$ Period: $\frac{4\pi}{3}$

(e) Amplitude: $\frac{1}{5}$ Period: 6π

37. Find the vertical asymptotes of $f(x) = \tan\left(x + \frac{\pi}{4}\right)$ in the interval $(0, 2\pi)$.

(a) $x = \frac{\pi}{4}$

(b) $x = \frac{3\pi}{4}$

(c) $x = \frac{\pi}{4}$ and $x = \frac{5\pi}{4}$

(d) $x = \frac{3\pi}{4}$ and $x = \frac{7\pi}{4}$

(e) $x = \frac{\pi}{2}$ and $x = \frac{3\pi}{2}$

38. Simplify $\cos(x) - \sin(x) \cdot \cot(x)$.

(a) $\sin(x)$

(b) $\cos(x)$

(c) 0

(d) $\csc(x)$

(e) $\tan(x)$

39. $\sin\left(\theta - \frac{\pi}{2}\right)$ is equal to:

(a) $\cos(\theta)$

(b) $-\cos(\theta)$

(c) $\sin(\theta)$

(d) $-\sin(\theta)$

(e) $\cos(\theta) - \sin(\theta)$

40. Find the value of $\cos(\theta)$ if $\sin(\theta) = \frac{5}{13}$ and $0 < \theta < \pi/2$.

(a) 0

(b) $-\frac{12}{13}$

(c) $\frac{8}{13}$

(d) $\frac{144}{169}$

(e) $\frac{12}{13}$

41. If $\cot(\theta) > 0$, the terminal side of θ must lie in one of which two quadrants?

(a) Q1 or Q2

(b) Q2 or Q3

(c) Q1 or Q4

(d) Q1 or Q3

(e) Q3 or Q4

42. Use trigonometric identities to find $\sin(\alpha)\cos(60^o - \alpha) + \cos(\alpha)\sin(60^o - \alpha)$.

(a) $\frac{1}{2}$

(b) $\frac{\sqrt{3}}{2}$

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

(d) $\frac{\sqrt{2}}{2}$

(e) $-\frac{1}{2}$

43. Which of the following equations is **NOT** an identity?

(a) $\sin(2\theta) = 2\sin^2(\theta) - 1$

(b) $\cos(\theta)\sec(\theta) = 1$

(c) $\cos(2\theta) = 2\cos^2(\theta) - 1$

(d) $\sin(2\theta) = 2\sin(\theta)\cos(\theta)$

(e) $\csc(\theta) = \dfrac{1}{\sin(\theta)}$

44. Solve the equation $\tan(3x) = 1$ on the interval $[0, \pi]$. (Angles are measured in radians.)

(a) $x = \dfrac{\pi}{12}$

(b) $x = \dfrac{\pi}{12}, \dfrac{5\pi}{12}$

(c) $x = \dfrac{\pi}{12}, \dfrac{5\pi}{12}, \dfrac{3\pi}{4}$

(d) $x = \dfrac{3\pi}{4}$

(e) there is no solution

45. What is the value of α if $\cos^2(\alpha) - \sin^2(\alpha) = -\dfrac{1}{2}$ and $0 < \alpha \leq \pi/2$? (Angles are measured in radians.)

(a) $\alpha = \dfrac{\pi}{3}$

(b) $\alpha = \dfrac{\pi}{4}$

(c) $\alpha = \dfrac{\pi}{10}$

(d) $\alpha = \dfrac{5\pi}{12}$

(e) there is no solution

46. You are at 3,000 feet from the entrance of a building. The angle of elevation to the top is 30^o. How tall is the building? Round your answer to the nearest feet.

(a) 1,000

(b) 1,500

(c) 1,732

(d) 1,808

(e) 1,902

47. If $-2 \leq x \leq 2$ then which of the following expressions equals $\sin\left(\cos^{-1}\left(\frac{x}{2}\right)\right)$? Here $\cos^{-1}(x)$ stands for the compositional inverse of $\cos(x)$.

(a) $\frac{\sqrt{4+x^2}}{2}$

(b) $-\frac{\sqrt{4+x^2}}{2}$

(c) $\frac{\sqrt{2-x^2}}{2}$

(d) $\frac{\sqrt{4-x^2}}{2}$

(e) $-\frac{\sqrt{4-x^2}}{2}$

48. Find $\sin(\alpha)$ if $\cos\left(\frac{\alpha}{2}\right) = \frac{1}{2}$ and α is in the second quadrant.

(a) $-\frac{\sqrt{3}}{2}$

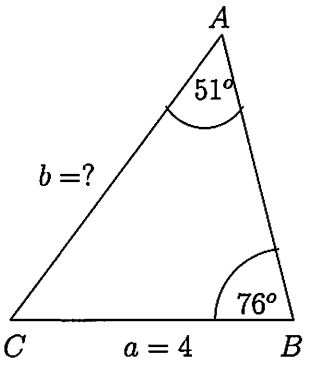
(b) $\frac{\sqrt{3}}{2}$

(c) $-\frac{1}{2}$

(d) $\frac{1}{2}$

(e) $-\frac{\sqrt{2}}{2}$

49. Use the law of sines to find the missing side b in the picture. Round your answer to the nearest decimal digit.



(a) 4.8

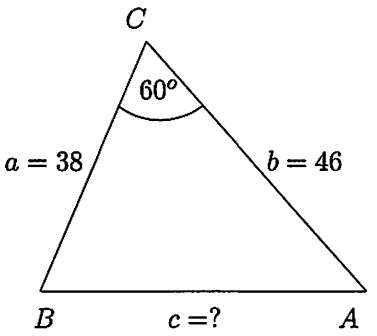
(b) 5.0

(c) 5.2

(d) 5.3

(e) 5.4

50. Use the law of cosines to find the missing side c in the picture.



(a) 906

(b) 1812

(c) $2\sqrt{890 - 437\sqrt{3}}$

(d) $2\sqrt{453}$

(e) $\sqrt{453}$