MATH 1103 COMMON FINAL EXAM
SPRING 2016

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.

Final Exam for Math 1103, Spring 2016

1. Find the equation of the line that is parallel to $2x + 5y = 8$ and passes through the point $(-1,0)$
   a. $y = \frac{2}{5}x + \frac{2}{5}$
   b. $y = -\frac{5}{2}x + \frac{2}{5}$
   c. $y = \frac{5}{2}x + \frac{5}{2}$
   d. $y = -\frac{2}{5}x + \frac{2}{5}$
   e. $y = -\frac{2}{5}x - \frac{2}{5}$

2. Find the domain of the function $f(x) = \sqrt{4 - x}$
   a. $[4, \infty)$
   b. $(-\infty, 4)$
   c. $(4, \infty)$
   d. $(-\infty, 4]$
   e. $(-4,4)$

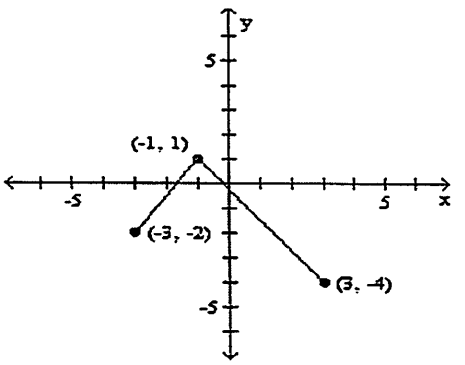
3. Given the function $f(x) = 2x^2 - 3x$, calculate $\frac{f(a+h)-f(a)}{h}$
   a. $4a - 3 + h$
   b. $4a - 3 - h$
   c. $4a - 3 - 3h$
   d. $4a - 3 - 2h$
   e. $4a - 3 + 2h$

4. Find $f(-1) + f(4)$ given the function

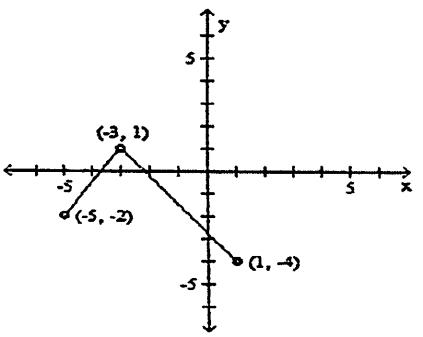
$$f(x) = \begin{cases} x^2 + 1 & if\ x < 1 \\ 3 & if\ x = 1 \\ 3x - 1 & if\ x > 1 \end{cases}$$

   a. 3
   b. 4
   c. 11
   d. 13
   e. 14

5. The graph of the function $y = f(x)$ is given below. Select the answer choice that represents the graph $y = f(x + 2) - 1$.



A)



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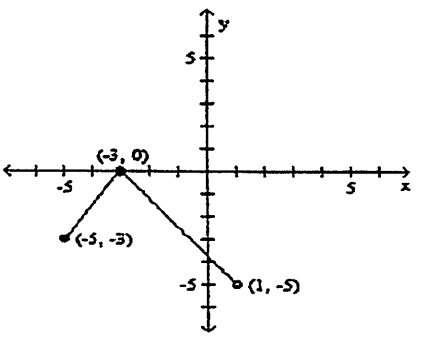
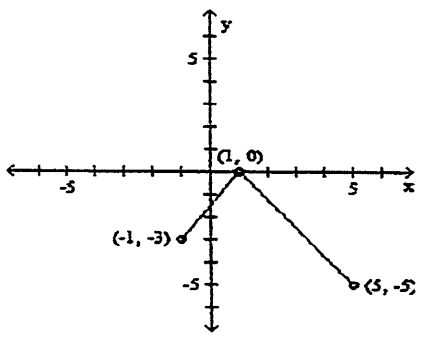
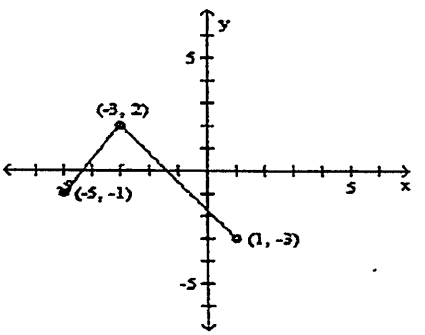


C)



D)



E. None of the above.

6. Which of the following functions has an inverse function on the domain $(-\infty, \infty)$

I. $f(t) = t^4$
II. $g(t) = 1 + 3t$
III. $h(t) = \sin(t)$

a. I only
b. II only
c. III only
d. II and III only
e. I and II only

7. If $(2, -5)$ is a point on the graph of $f(x)$, which of the following points MUST be on the graph of $y = \frac{1}{3}f(x-1)$

a. $(\frac{2}{3}, -4)$
b. $(1, -5)$
c. $(\frac{1}{3}, -5)$
d. $(1, -\frac{5}{3})$
e. $(3, -\frac{5}{3})$

8. Find $f^{-1}(x)$ if $f(x) = \frac{2}{3x+1}$

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

9. The vertex of the parabola, given by the equation $h(x) = kx^2 - x + 1$, where k is a positive constant, is

a. $(\frac{1}{2k}, -\frac{1}{4k})$
b. $(\frac{1}{2k}, \frac{1}{4k} + 1)$
c. $(\frac{1}{2k}, -\frac{1}{4k} + 1)$
d. $(-\frac{b}{2}, -\frac{1}{4k} + 1)$
e. None of the above

10. Given that $x = -1$ is a zero of the polynomial $f(x) = 16x^3 - 13x + 3$, what is the **sum** of the other zeros of $f(x)$?

a. 1
b. 2
c. 3
d. 4
e. 5

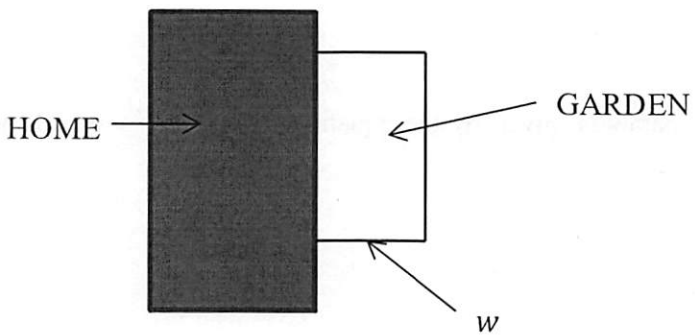
11. Find the inverse function of $f(x) = 2^{x+2}$

a. $f^{-1}(x) = \frac{1}{2^{x+2}}$
b. $f^{-1}(x) = -2^{x+2}$
c. $f^{-1}(x) = \log_2(x+2)$
d. $f^{-1}(x) = -2 + \log_2(x)$
e. None of the above

12. Find the range of the function $g(x) = -e^{x-a} + b$, where a and b are some positive integers.

a. $(-\infty, \infty)$
b. $(-\infty, 0)$
c. $(0, \infty)$
d. (b, ∞)
e. $(-\infty, b)$

13. Bob is making a rectangular garden next to his home. He has 100 feet of fencing and plans to use the side of the home as one side of the garden (see the figure). Assume that the width of the garden is w. Write the area of the garden A as a function of w.



a. $A = 10000 - 2w$
b. $A = 100w - w^2$
c. $A = w(100 - 2w)$
d. $A = 2w^2$
e. $A = 100 - 2w^2$

14. Find the domain of the function $f(x) = \ln(x-1) + 3$
    a. $(-\infty, \infty)$
    b. $(3, \infty)$
    c. $(-\infty, 1)$
    d. $(1, \infty)$
    e. $(1, 3)$

15. If $f(x) = 1 + \frac{1}{x}$ and $g(x) = x - 1$, find $(f \circ g)(x)$
    a. $\frac{x}{x-1}$
    b. x
    c. $x - 1$
    d. $\frac{1}{x}$
    e. $\frac{x+2}{x-1}$

16. The remainder R when $f(x) = 20x^{30} - 4x^3 + x^2 - 3x + 2$ is divided by $x + 1$ is
    a. $R = 30$
    b. $R = 20$
    c. $R = 12$
    d. $R = 16$
    e. $R = 22$

17. If $f(x) = 1 + \frac{1}{x}$ and $g(x) = x + 1$, find $(\frac{f}{g})(x)$
    a. $\frac{x}{x+1}$
    b. x
    c. $x + 1$
    d. $\frac{1}{x}$
    e. $\frac{x+2}{x+1}$

18. The value of $\log_3 27$ is
    a. 1
    b. 2
    c. 3
    d. 4
    e. None of the above

19. Find the horizontal asymptote (H.A.) and vertical asymptote(s) (V.A.) of $f(x) = \frac{x^2+x-2}{3x^2-4x-20}$
    a. V.A. $x = -2$; H.A. $y = 1$
    b. V.A. $x = -2$; H.A. $y = \frac{1}{3}$
    c. V.A. $x = -2$ and $x = \frac{10}{3}$; H.A. $y = 1$
    d. V.A. $x = \frac{10}{3}$; H.A. $y = \frac{1}{3}$
    e. V.A. $x = -2$ and $x = -\frac{10}{3}$; H.A. $y = 1$

20. Find the oblique asymptote of the function $f(x) = \frac{x^3-1}{x^2-x+1}$
    a. $y = x$
    b. $y = x + 1$
    c. $y = x - 1$
    d. $y = x + 2$
    e. $y = 2x + 1$

21. Find the domain of the function $f(x) = \frac{x-3}{2x+8} - 5$
    a. $(-\infty, 4)$
    b. $(-\infty, -4)$
    c. $(-\infty, -4) \cup (-4, \infty)$
    d. $(3, \infty)$
    e. $(-\infty, \infty)$

22. Solve the following inequality
$$\frac{1-x}{x-2} + 1 > 0$$
    a. $(-\infty, 1) \cup (2, \infty)$
    b. $(-\infty, 2)$
    c. $(2, \infty)$
    d. $(-\infty, 1] \cup (2, \infty)$
    e. $[1,2)$

23. Solve the following inequality

$$x^2 + 2x - 8 < 0$$

a. $(-\infty, -4)$
b. $(-4,2)$
c. $(-\infty, -4) \cup (2, \infty)$
d. $(-\infty, -4) \cup [2, \infty)$
e. $(-\infty, -4] \cup (2, \infty)$

24. Solve the equation $3^{2x^2-5x} = 27$
a. $x = 3$
b. $x = 2$
c. $x = 3$ and $x = -0.5$
d. $x = -0.5$
e. $x = 5$ and $x = -0.5$

25. Convert the equation $2^3 = 8$ to logarithmic form
a. $\log_8 2 = 3$
b. $\log_8 3 = 2$
c. $\log_2 3 = 8$
d. $\log_2 8 = 3$
e. $\log_3 8 = 3$

26. If a certain amount of money is invested in a bank account at an interest rate of 8% per year, compounded continuously, how many years (t) will it take for the money to double? The value of t lies in
a. $0 < t \leq 5$
b. $5 < t \leq 7$
c. $7 < t \leq 9$
d. $9 < t \leq 11$
e. $11 < t \leq 13$

27. Solve $\log_2(3 - x) + \log_2(-x) = 2$
a. $x = -1, x = 4$
b. $x = -1$
c. $x = 4$
d. $x = 1, x = 4$
e. None of the above

28. Rewrite the expression as a single logarithm (a is a positive constant)

$$\log_a(2a) + \log_a(1) + \frac{1}{2}\log_a(16) - \log_a(a)$$

a. 1
b. $\log_a(2)$
c. $\log_a(8)$
d. $\log_a(4)$
e. $\log_a(10)$

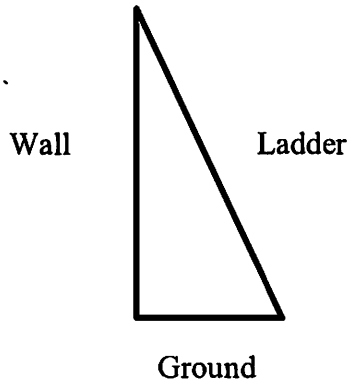
29. Convert 140° to radians
    a. $\frac{2\pi}{3}$
    b. $-\frac{5\pi}{6}$
    c. $\frac{6\pi}{7}$
    d. $\frac{7\pi}{9}$
    e. $\frac{7\pi}{6}$

30. Find the **exact** value of $\cos(-\frac{9\pi}{4})$
    a. $\frac{1}{2}$
    b. $-\frac{1}{\sqrt{2}}$
    c. $\frac{\sqrt{3}}{2}$
    d. $\frac{1}{\sqrt{2}}$
    e. $-\frac{\sqrt{3}}{2}$

31. Find the angle co-terminal with $\frac{17\pi}{3}$
    a. $\frac{\pi}{3}$
    b. $-\frac{\pi}{3}$
    c. $-\frac{17\pi}{3}$
    d. $-\frac{2\pi}{3}$
    e. $\frac{2\pi}{3}$

32. Find $\cos(2\theta)$ if $\sin(\theta) = -\frac{3}{5}$
    a. 1
    b. $\frac{7}{25}$
    c. $-\frac{7}{25}$
    d. $\frac{12}{25}$
    e. $\frac{6}{5}$

33. A ladder of length L leans against a vertical wall. The foot of the ladder makes an angle of 70° with the ground. How far is the foot of the ladder from the wall (X)?



a. $X = \frac{L}{\cos 70°}$
b. $X = L \sin 70°$
c. $X = L \tan 70°$
d. $X = L \cos 70°$
e. $X = \frac{L}{\sin 70°}$

34. Simplify $\frac{\sin(2x)}{1+\cos(2x)}$

a. $\frac{\pi}{2}$
b. x
c. 1
d. $\tan(2x)$
e. $\tan(x)$

35. Simplify $(1 + tan^2 x)(1 + \cos 2x)$

a. 1
b. 2
c. $\sin x + \cos x$
d. $\tan x$
e. None of the above

36. Find the exact value of $cot^{-1}(-\frac{1}{\sqrt{3}})$

a. $\frac{\pi}{6}$
b. $-\frac{\pi}{6}$
c. 0
d. $-\frac{\pi}{3}$
e. 1

37. Simplify $\frac{1}{1+\cos(-x)} + \frac{1}{1-\cos(x)}$

a. $2\csc^2(x)$
b. 2
c. $2\sin^2(x)$
d. $2\cos(x)$
e. 0

38. Simplify $\cos(-k)\sin(2k) - \sin(-k)\cos(2k)$ using an appropriate trigonometric identity.

a. $\cos 3k$
b. $\cos k$
c. $\sin k$
d. $\sin 3k$
e. None of the above

39. Use the appropriate sum or difference identity to find the exact value of $\cos(-\frac{7\pi}{12})$

a. $\frac{\sqrt{2}-\sqrt{6}}{4}$
b. $\frac{\sqrt{2}+\sqrt{6}}{4}$
c. $\frac{\sqrt{6}-\sqrt{2}}{4}$
d. $\frac{\sqrt{6}+\sqrt{2}}{2}$
e. None of the above

40. What is the **range** of the function $f(x) = \csc(2x)$

a. $(-\infty, \infty)$
b. $(-\infty, -1] \cup [1, \infty)$
c. $(-\infty, -2] \cup [2, \infty)$
d. $[1, \infty)$
e. $[2, \infty)$

41. Find the period and phase shift of $f(x) = 2\sin(3x + \pi)$

a. Period $= \frac{2\pi}{3}$, Phase shift $= -\pi$
b. Period $= 3$, Phase shift $= -\frac{\pi}{3}$
c. Period $= \frac{2\pi}{3}$, Phase shift $= -\frac{\pi}{3}$
d. Period $= 6\pi$, Phase shift $= \pi$
e. Period $= \frac{2\pi}{3}$, Phase shift $= \frac{\pi}{3}$

42. Find the general solution to the equation $2\cos(2\theta) + 1 = 0$ is

a. $\theta = \frac{\pi}{3};\ \theta = \frac{2\pi}{3}$

b. $\theta = \frac{\pi}{3} + 2k\pi;\ \theta = \frac{2\pi}{3} + 2k\pi$

c. $\theta = \frac{\pi}{3} + k\pi;\ \theta = \frac{2\pi}{3} + k\pi$

d. $\theta = 2k\pi$

e. $\theta = \frac{\pi}{2} + k\pi;\ \theta = \frac{2\pi}{3} + k\pi$

43. Find the exact value of $\tan(sin^{-1}\left(\frac{1}{\sqrt{2}}\right))$.

a. $\frac{\pi}{4}$

b. $-\frac{\pi}{4}$

c. 1

d. 0

e. -1

44. For what values of x in the interval $(-\pi, \pi)$ does the graph of $f(x) = \csc(2x + \frac{\pi}{2})$ have vertical asymptotes? (Angles are measured in radians)

a. $x = -\frac{3\pi}{2}, -\frac{\pi}{6}, \frac{\pi}{6}, \frac{3\pi}{2}$

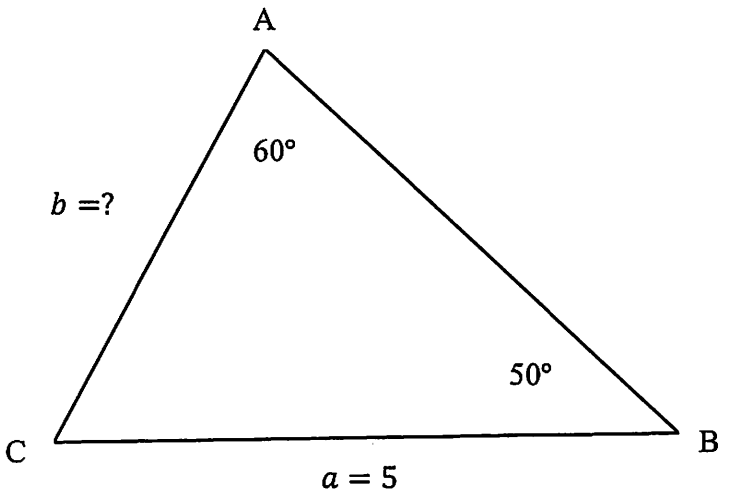
b. $x = -\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, \frac{3\pi}{2}$

c. $x = -\frac{\pi}{4}, \frac{\pi}{4}$

d. $x = -\frac{3\pi}{4}, -\frac{\pi}{4}, \frac{\pi}{4}, \frac{3\pi}{4}$

e. $x = -\frac{3\pi}{4}, \frac{3\pi}{4}$

45. Use the Law of Sines to find the missing side b in the figure below. Round your answer to the nearest decimal digit.



a. 4.4
b. 4.2
c. 4.1
d. 5.7
e. 5.6

46. Suppose that $\sin\theta = -\frac{2}{5}$ and θ is in Quadrant 4. Evaluate $\sec\theta$

a. $\frac{-2}{\sqrt{29}}$

b. $\frac{5}{\sqrt{21}}$

c. $\frac{\sqrt{29}}{2}$

d. $\frac{\sqrt{21}}{5}$

e. $-\frac{5}{\sqrt{21}}$

47. Find the solutions to the equation $\tan(\theta) - \frac{1}{\sqrt{3}} = 0$ in the interval $(0,2\pi)$

a. $\theta = \frac{\pi}{6} + k\pi$

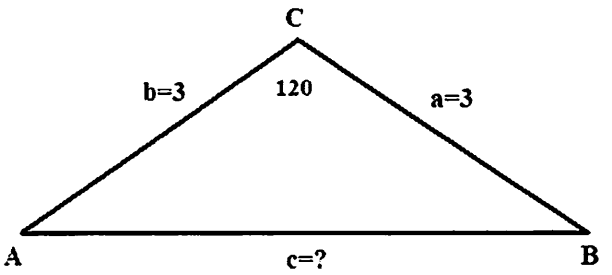
b. $\theta = \frac{\pi}{6}; \theta = \frac{7\pi}{6}$

c. $\theta = \frac{\pi}{6}; \theta = \frac{11\pi}{6}$

d. $\theta = \frac{\pi}{6}; \theta = -\frac{7\pi}{6}$

e. $\theta = \frac{\pi}{6}$

48. Use the Law of Cosines to find the length of the side c in the triangle ABC where $a = 3, b = 3$ and $\angle ACB = 120°$



a. $\sqrt{27}$

b. 27

c. $\sqrt{18 - 9\sqrt{3}}$

d. $\sqrt{18 + 9\sqrt{3}}$

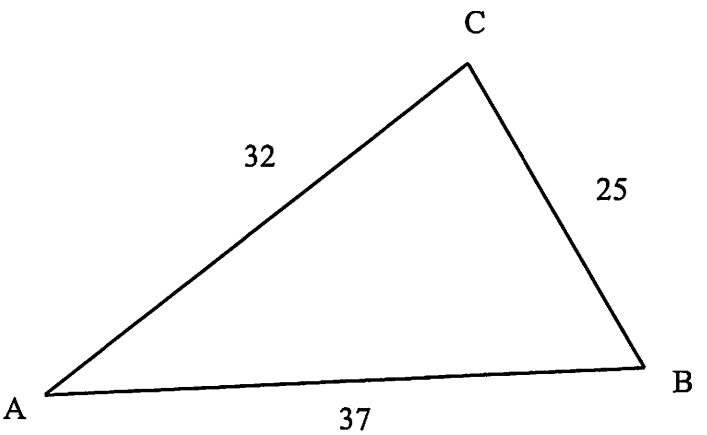
e. $\sqrt{10}$

49. If $(\sin x + \cos x) = \frac{1}{2}$, what is the value of $\sin x \,.\, \cos x$?

a. $\frac{1}{2}$
b. $\frac{1}{4}$
c. $\frac{3}{8}$
d. $-\frac{3}{8}$
e. $-\frac{1}{2}$

[Hint: Square both sides]

50. Use the Law of Cosines to find the measure of angle A (rounded to the nearest degree) in the figure below.



a. $A = 30°$
b. $A = 37°$
c. $A = 39°$
d. $A = 42°$
e. $A = 44°$