February 4, 2004   Name _____

The first nine problems count 6 points each and the final seven count as marked. There are 120 points available on this test.

   Multiple choice section. Circle the correct choice(s). You do not need to show your work on these problems.

1. Which of the following is a factor of $x^4 - x$? Circle all those that apply.

   (A) x **(B)** $x - 1$ **(C)** $x + 1$ **(D)** $x^2 + x + 1$ **(E)** $x^2 - x + 1$

2. How many roots does the equation below have?

$$x^2(x^2 - 3) - 4(x^2 - 3) = 0$$

   (A) 0   **(B)** 1   **(C)** 2   **(D)** 3   **(E)** 4

3.
$$\frac{1 + \frac{1}{x}}{1 - \frac{1}{x}} =$$

   (A) $\dfrac{x + 1}{x - 1}$ **(B)** $\dfrac{x - 1}{x + 1}$ **(C)** $x - 1$ **(D)** $1 - x$ **(E)** x

4. What is the radius of the circle whose equation is $x^2 - 8x + y^2 + 6y = 24$?

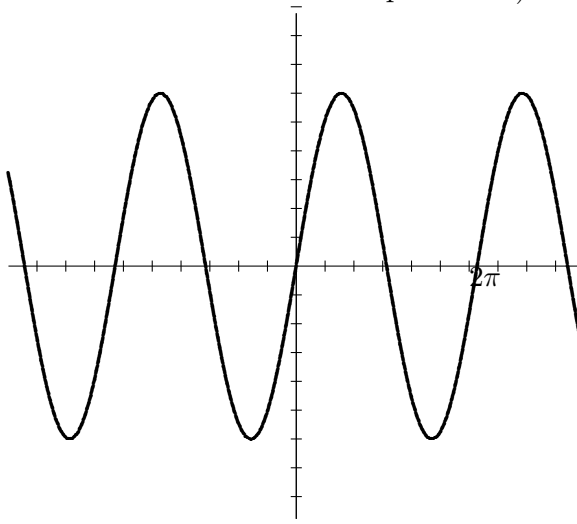   **(A)** 4   **(B)** $\sqrt{24}$ **(C)** 5   **(D)** 6   **(E)** 7

5. Which of the following is a solution to $2(5 - 3x) - 2 \cdot 5 - 3x = 108$? Circle all that apply.

   (A) -12 **(B)** -9 **(C)** -2 **(D)** 0   **(E)** none of these

6. Which of the following is a solution to $3(x-2)^3(x+1)^2 - 2(x-2)^2(x+1)^3 = 0$? Circle all that apply.

   (A) -2 **(B)** -1 **(C)** 0   **(D)** 2   **(E)** 8

7. Consider the function $y = a\sin(bx)$, where a and b are constants, shown below. What is $a + b$? (Tick marks are located at unit positions.)

(A) 2   (B) 4   (C) 5   (D) 6   (E) 7

8. Suppose the functions f and g are given completely by the table of values shown.

x	$f(x)$	x	$g(x)$
0	2	0	5
1	7	1	7
2	5	2	4
3	1	3	2
4	3	4	6
5	6	5	3
6	0	6	1
7	4	7	0

What is $g^{-1}(f(3))$?

(A) 1   (B) 3   (C) 4   (D) 5   (E) 6

9. Referring again to the two functions in the previous question, solve the equation $g(f(g(x))) = 5$ for x.

(A) 1   (B) 2   (C) 3   (D) 4   (E) 5

On all the following questions, **show your work.**

10. (7 points) Find the (implied) domain of the function $g(x) = \frac{\sqrt{x+1}}{x^2-9}$. Write your answer using interval notation.

11. (7 points) Let $f(x) = x^2 - x$. Compute in simplify $f(4), f(x+1), f(x+h)$, and $\frac{f(x+h)-f(x)}{h}$, where $h \neq 0$.

12. (7 points) The slope of the line tangent to the graph of $f(x) = 2x^2 - x$ at the point $(1,1)$ is 3. Find an equation for this tangent line.

13. (10 points) Sketch the curve below represented parametrically by
$x = t - \sin(2t), y = t + \cos(t)$ for $-2 \leq t \leq 2$ on the grid provided.

14. (7 points) This of the computation of $J(x) = \sqrt{(x-2)^2 + 3}$ as a sequence of four simple computations. Find four functions, f, g, h, and k such that $J(x) = f \circ g \circ h \circ k(x)$.

15. (15 points) A. Does the function $f(x) = 2x - 5$ have an inverse. If it does, find it. If not, state why it does not. B. Does the function $f(x) = \ln(2x-5)$ have an inverse. If it does, find it. If not, state why it does not.

Tear this page off your test booklet and take it home. Return it Friday at class time (or before) with a complete solution.

16. (20 points) A. First, complete the table below.

$$f(x) = \begin{cases} 2 & \text{if } x \leq -2 \\ |x| & \text{if } -2 < x \end{cases}$$

$$g(x) = \begin{cases} -x + 3 & \text{if } x \leq 1 \\ 2x & \text{if } x > 1 \end{cases}$$

x	$g(x)$	$f \circ g(x)$
-3		
-2		
-1		
0		
1		
2		
3		
π		

B. Find the composition $f \circ g$ of the two functions defined below. Remember that $f \circ g(x)$ is, by definition $f(g(x))$. Your final answer should not have the absolute value symbol in it.

Please sign the following pledge: On my honor I declare that I have neither given nor received any help from anyone else on this test.

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