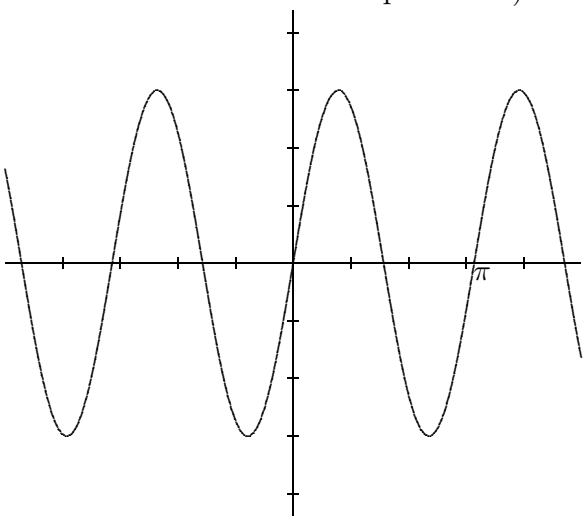
January 30, 1998 **Name** _____

The first 7 problems count 8 points each and the final 2 count 25 points each.

1. Fill in your three character code you received via email in the box ☐

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

2. 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) 2.5 **(B)** 3.5 **(C)** 4 **(D)** 5 **(E)** 5.5

3. What is the sum of the roots of

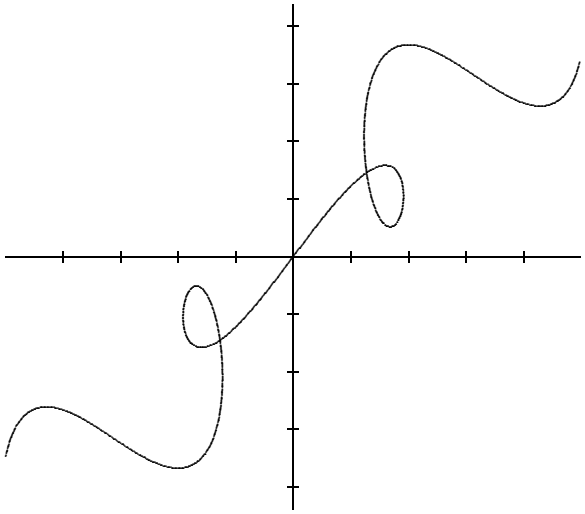
$$3|x| = x^2 + 2x - 6?$$

   (A) -4 **(B)** -3 **(C)** 0 **(D)** 8 **(E)** 12

4. Let $F(x) = \log(\sin x) + \sin(\sqrt{x})$. Which of the following belongs to the belongs to the domain of F?

   (A) -4 **(B)** -1 **(C)** 5 **(D)** 6 **(E)** 7

5. Match the curve below with one of the parametric representations given.



(A) $x = \sin(4t), y = \sin(3t)$ **(B)** $x = t + \sin(2t), y = t + \sin(3t)$

(C) $x = \cos t, y = \sin(t + \sin(5t))$ **(D)** $x = \sin(t + \sin t), y = \cos(t + \cos t)$

(E) $x = 1 + \sin(3t), y = -1 + \sin(4t)$

6. 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 $f^{-1}(g(4))$?

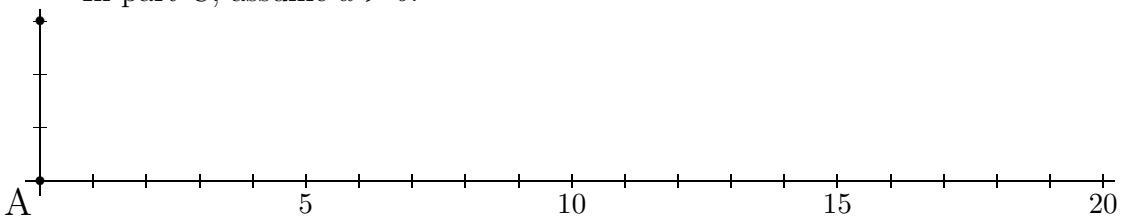
(A) 1 **(B)** 3 **(C)** 4 **(D)** 5 **(E)** 6

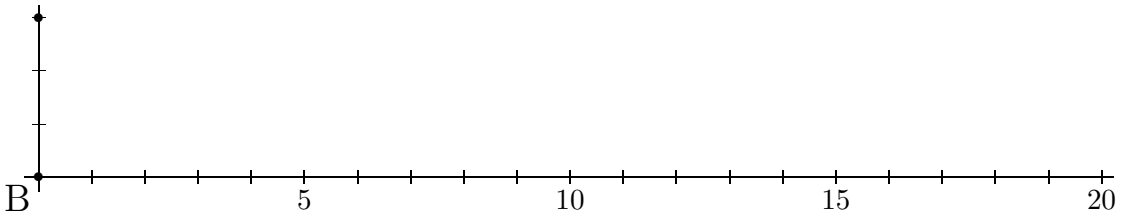
7. Referring again to the two functions in the previous question, solve the equation $f(g(f(g(x)))) = 4$ for x.

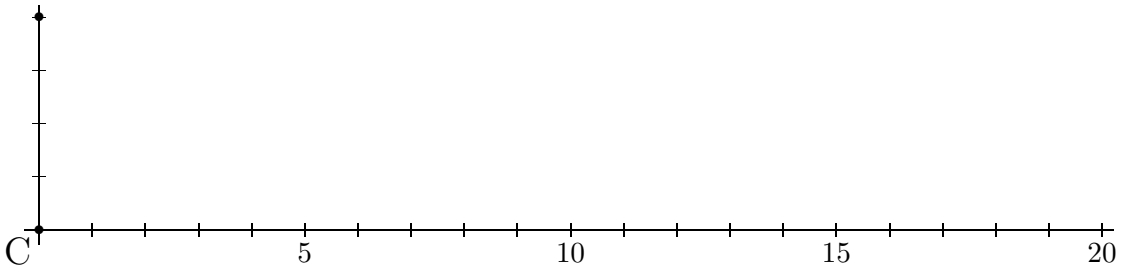
(A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

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

8. On the axes provided, sketch the three graphs of the function $H(t)$ whose value at time t is the height of the level of water in a tub, under the conditions given below. The water faucet, which pours water into the tub at the rate of a cubic units per minute, is turned on at time 0. Five minutes later, a plug is pulled which allows water to drain at b cubic units per minute. The capacity of the tub is $7a$ cubic units. The faucet is turned off after 10 minutes. That capacity is marked with a bullet on the vertical axis. The horizontal axis is measured in minutes.
In part A, assume $a < b$.
In part B, assume $a = b$.
In part C, assume $a > b$.







9. A. Does the function $f(x) = 3x - 5$ have an inverse. If it does, find it. If not, state why it does not.

B. Does the function $f(x) = e^{3x-5}$ have an inverse. If it does, find it. If not, state why it does not.