

Group Exam 1

Name: \_\_\_\_\_

Math 141, 1:50PM

Name of group member: \_\_\_\_\_

Professor Johnson

Name of group member: \_\_\_\_\_

Problem 1: (a) A United States President proposed the following plan to change the U.S. personal income tax system. According to his plan, the income tax would be 15% on the first \$19,300 earned, 25% on the next \$18,800 earned, and 35% on all income above and beyond that.

Find the amount of income tax owed for the following incomes. Show work by including the arithmetic that describes the origins of your numerical answers.

	income	taxed owed	show work!
Person 1	\$5,000		
Person 2	\$15,000		
Person 3	\$21,000		
Person 4	\$30,000		
Person 5	\$40,000		
Person 6	\$60,000		

(b) Consider the function  $T(x)$  that assigns to a given income amount,  $x$ , the tax owed,  $T(x)$ , according to the plan described above. The domain of  $T(x)$  is all positive income amounts, equivalently  $x \geq 0$ . The formula for the function  $T(x)$  is a piecewise linear function of the form below. Fill in the blanks.

$$T(x) = \begin{cases} \text{some formula goes here} & \text{if } \underline{\hspace{2cm}} \\ \text{a formula goes here} & \text{if } \underline{\hspace{2cm}} \\ \text{a formula goes here} & \text{if } \underline{\hspace{2cm}} \end{cases}$$

(c) Find the formulas describe the function  $T(x)$  on your specified intervals.

$$T(x) = \begin{cases} & \text{if } \underline{\hspace{2cm}} \\ & \text{if } \underline{\hspace{2cm}} \\ & \text{if } \underline{\hspace{2cm}} \end{cases}$$

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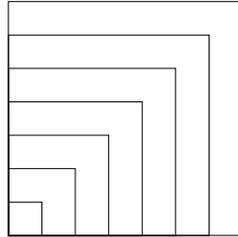
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**Calculator use is NOT permitted on this exam question.**

Problem 2:

The areas of the nested squares in the figure below are  $1^2$     $2^2$     $3^2$     $4^2$     $5^2$     $6^2$     $7^2$



What are the areas of the L-shaped bands (the differences between the squares)?

How does this figure show that  $1 + 3 + 5 + 7 + 9 + 11 + 13 = 7^2$ ?

In class we discussed  $f$  : a list of numbers,  $v$  : the corresponding differences between the numbers in the list, and then the sum of the differences. Explain why  $1 + 3 + 5 + 7 + 9 + 11 + 13 = 7^2$  is true using the ideas developed in class.

Using the observations above, find the sum below and explain how you know your answer is correct.

$$1 + 3 + 5 + 7 + 9 + \dots + 22,157 =$$

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Problem 3:

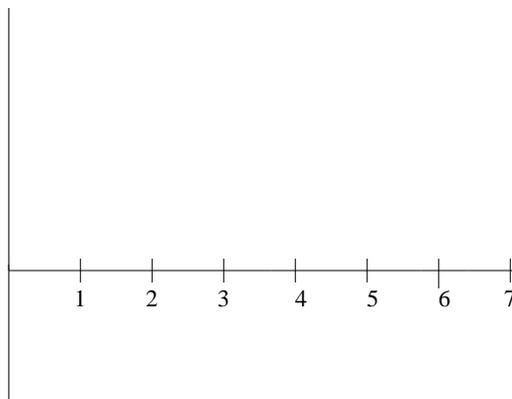
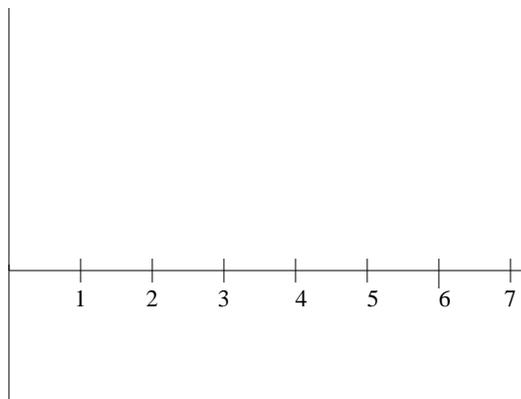
Let  $f$  denote the distance traveled by an object (in kilometers) at time  $t$  (in hours), and  $v$ , given below, represent the velocity of this object (in kilometers/hour) at time  $t$  (in hours).

$$v(t) = \begin{cases} 4 & \text{if } 0 < t < 1 \\ 1 & \text{if } 1 < t < 4 \\ 0 & \text{if } 4 < t < 6 \\ -2 & \text{if } 6 < t < 7 \end{cases}$$

Sketch the graph of the function  $v(t)$  in the space provided below

$f(t)$ , distance

$v(t)$ , velocity



Find the following values of the distance function  $f$ .

$$f(1) = \quad f(2) = \quad f(3) = \quad f(4) = \quad f(5) = \quad f(6) = \quad f(7) =$$

Sketch the function  $f(t)$  in the space provided above.

The equation for the function  $f(t)$  is a piecewise defined function. Find the equation describing the piece of this function that is defined over the interval  $1 \leq t \leq 4$ .

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