

Name \_\_\_\_\_ Instructor \_\_\_\_\_ Section \_\_\_\_\_

Questions 16-18 are free response. Pages 6 and 7 should be turned in with your Answer Sheet. To receive credit please show all (correct) work.

16. (10 pts) A mathematics instructor has determined that there is a linear relationship between the number of hours a student spends studying for an exam and the grade the student earns. The instructor's data shows that a student who spent 7 hours studying earned a grade of 61 on the exam and a student who spent 12 hours studying earned a grade of 81.

- a. Find the linear equation that relates  $n$ , the number of hours of studying and  $P$ , the number of points earned on the exam.

$$\begin{array}{l} (7, 61) \\ (12, 81) \end{array} \quad m = \frac{81-61}{12-7} = \frac{20}{5} = 4$$

$$\left. \begin{array}{l} P = mn + b \\ 61 = 4(7) + b \\ 61 = 28 + b \\ 33 = b \end{array} \right\} P = 4n + 33$$

- b. If a student earned a 89 on an exam, how many hours did that student spend studying?

$$89 = 4n + 33$$

$$56 = 4n$$

$$14 = n$$

14 hours

- c. Interpret the slope in context of the problem.

The slope represents the change in the number of points with respect to the number of hours studying.

\* The student earns 4 points (beyond 33) for each hour spent studying.

17. (8 pts) Use the graphs to answer the questions.  
 (You do not need to show any work or to explain your answers for this problem.)

a. For what values of  $x$  is  $F(x) = 3$ ?

-9, -2, and 4

b. What is the relative minimum value of  $G(x)$ ?

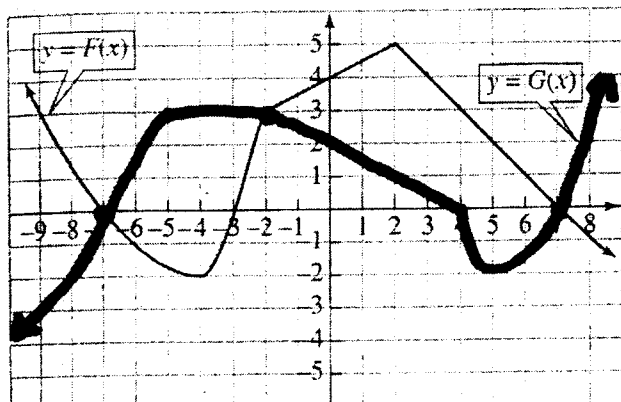
-2

c. On what intervals is  $F(x) > 0$ ?

$(-\infty, -7) \cup (-3, 7)$

d. On what intervals is  $F(x)$  decreasing?

$(-\infty, -4) \cup (2, \infty)$



18. (7 pts) Let  $f(x) = \frac{1}{x+2}$ . Determine and simplify the difference quotient:

$$\frac{f(x+h) - f(x)}{h}$$

$$f(x+h) = \frac{1}{(x+h)+2} = \frac{1}{x+h+2}$$

$$\frac{f(x+h) - f(x)}{h} = \frac{\frac{1}{x+h+2} - \frac{1}{x+2}}{h}$$

$$= \frac{\frac{x+2}{(x+h+2)(x+2)} - \frac{x+h+2}{(x+h+2)(x+2)}}{h}$$

$$= \frac{\frac{x+2 - x-h-2}{(x+h+2)(x+2)}}{h} = \frac{-h}{h(x+h+2)(x+2)} = \frac{-1}{(x+h+2)(x+2)}$$