

# Categorizing Functions

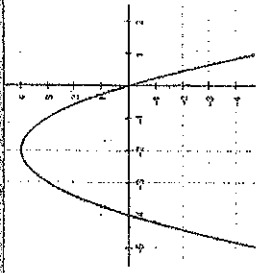
Name \_\_\_\_\_

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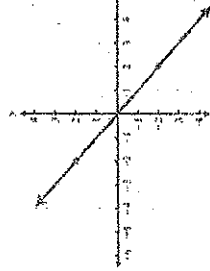
Directions: Use columns of the chart to categorize the items found in the Function Bank below. Write an explanation including justifications for each category.

## Function Bank

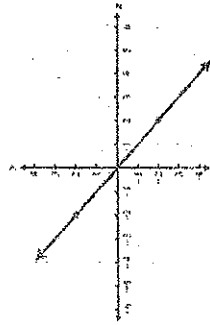
A.  $y = x^2 + 5$



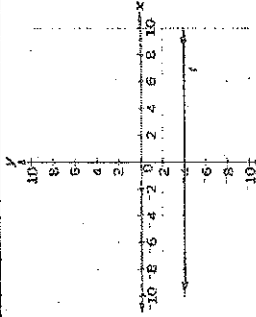
B.  $y = 2x^2 + 3x + 5$



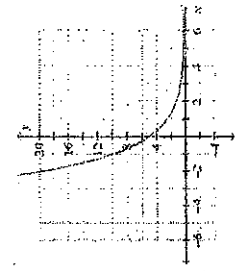
C.  $y = 3 - x$



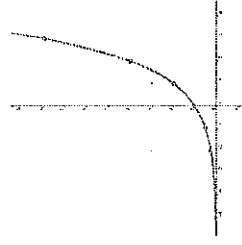
D.  $y = 3^x - 6$



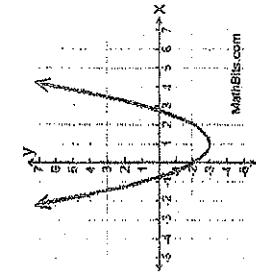
E.  $y = 4^x - 6$



F.  $y = x$



G.  $y = -x^2 - x - 1$



H.

J.

K.

L.

M.

N.

Linear Functions

Quadratics Functions

Exponential Functions

Justification:

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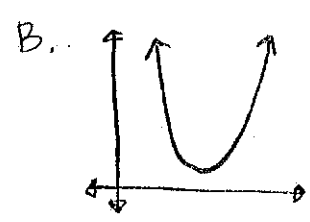
Justification:

Tell whether the following are linear, exponential, or neither.

A.

X	1	2	3	4	5
y	2	4	6	8	10

G. (10, 25) (11, 5) (12, 1)



H.

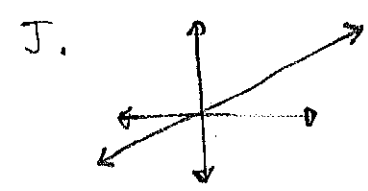
X	0	1	2	3
y	3	6	15	30

C. (1, 4) (2, 8) (3, 16)

I.  $y - 2x = 3$

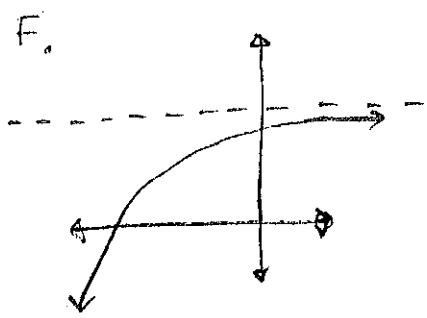
D.

X	2	4	6	8	10
y	81	27	9	3	1/3



E.  $y = 4x^2 + 6$

K. (-2, 20) (0, 16) (2, 12)



L.

X	y
-1	4
1	4
3	4
5	4
7	4

## Problems

Based on the difference in y-values, identify the graph as linear, quadratic, exponential, or neither.

1.

x	-3	-2	-1	0	1	2	3
y	14	10	6	2	-2	-6	-10

2.

x	-3	-2	-1	0	1	2	3
y	$\frac{1}{2}$	1	2	4	8	16	32

3.

x	-3	-2	-1	0	1	2	3
y	21	12	5	0	-3	-4	-3

4.

x	-3	-2	-1	0	1	2	3
y	-16	-13	-10	-7	-4	-1	2

5.

x	-3	-2	-1	0	1	2	3
y	-14	-9	-4	1	6	11	16

6.

x	-3	-2	-1	0	1	2	3
y	-18	-6	-2	0	2	6	18

7.

x	-3	-2	-1	0	1	2	3
y	4	8	16	32	64	128	256

8.

x	-3	-2	-1	0	1	2	3
y	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27

9.

x	-3	-2	-1	0	1	2	3
y	30	20	12	6	2	0	0

10.

x	-3	-2	-1	0	1	2	3
y	11	9	7	5	3	1	-1

11.

x	-3	-2	-1	0	1	2	3
y	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27	81

12.

x	-3	-2	-1	0	1	2	3
y	-27	-9	-3	0	3	9	27

13.

x	-3	-2	-1	0	1	2	3
y	0	5	8	9	8	5	0

14.

x	-3	-2	-1	0	1	2	3
y	3	0	-1	0	3	8	15

15.

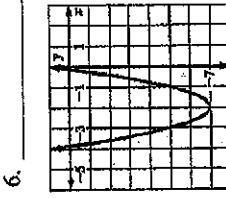
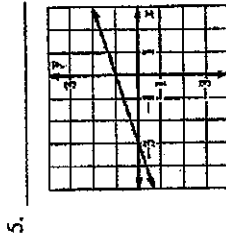
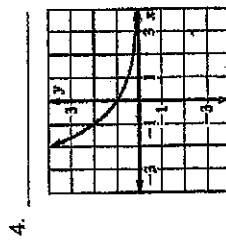
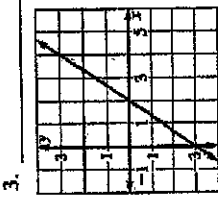
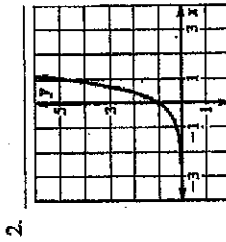
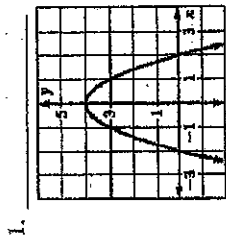
x	-3	-2	-1	0	1	2	3
y	1	0	-1	-2	-1	0	1

16.

x	-3	-2	-1	0	1	2	3
y	$\frac{9}{8}$	$\frac{9}{4}$	$\frac{9}{2}$	9	18	36	72

**Comparing Linear, Quadratic, and Exponential Worksheet**

Identify the following as Increasing Linear, Decreasing Linear, Positive Quadratic, Negative Quadratic, Exponential Growth, or Exponential Decay.



7. 

x	-2	-1	0	1	2
y	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$

8. 

x	-1	0	1	2	3
y	1	4	7	10	13

9. 

x	-1	0	1	2	3
y	22	17	12	7	2

10. 

x	-1	0	1	2	3
y	$\frac{1}{3}$	1	3	9	27

11.  $y = \left(\frac{5}{2}\right)^x$

13.  $y = -2x - 10$

15.  $y = 4x - 3$

17.  $y = 3 \cdot \left(\frac{1}{4}\right)^x$

19.  $y = (x+2)^2$

21.  $y = 2 \cdot 5^x$

23.  $y = -6x^2 - 5x + 4$

12.  $y = \frac{1}{4} \cdot 3^x$

14.  $y = 2x^2 + 5x - 7$

16.  $y = \frac{2}{5} \cdot 9^x$

18.  $y = 2(0.1)^x$

20.  $4x + y = 7$

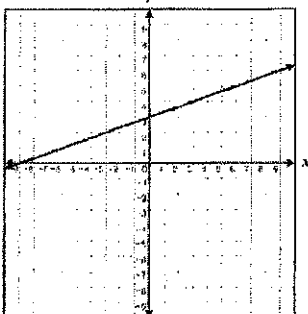
22.  $y = -(x-3)^2$

24.  $y = \frac{1}{7} \cdot \left(\frac{3}{8}\right)^x$

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

### Comparing Functions Homework

1. The functions  $f(x)$  and  $g(x)$  are described below. Compare the rate of change and intercepts of each. What do you notice about the two functions?



$x$	$g(x)$
-3	-4
0	-3
3	-2
6	-1

2. The gym offers 3 membership plans.

**Pay As You Go:** \$6 each time you work out

**Regular Deal:** \$50 per month plus \$2 each time you work out

**Unlimited Deal:** \$100 per month for unlimited use.

What does the y-intercept of each function represent?

Pay as you go is the cheapest plan until what number of visits is reached?

3. Supply is modeled by the linear function  $f(x) = 0.3x + 100$ , where  $f(x)$  represents the price per tablet in dollars and  $x$  represents the number of tablets. Demand is modeled in the table below, where  $g(x)$  represents the price per tablet in dollars and  $x$  represents the number of tablets.

$x$	$g(x)$
100	490
300	370
500	250
600	190

Find the rate of change of each function. Which of the two lines is the steepest?

Find the equation for  $g(x)$ , and find the intersection of the two lines. What does this point represent?

What happens if the supply exceeds the demand?

4. Compare the y-intercept and rate of change for each function. Based on this information, which function would you choose?

**Function A:** A rental store charges \$40 to rent a steam cleaner and \$4 for each additional hour.

**Function B:**

Hours ( $x$ )	Total cost ( $g(x)$ )
3	46
4	53
5	60
6	67

5. Ryan has invested \$50,000 in the bank at 1.5% simple interest. The function to represent his money in the bank is  $R(x) = 50,000(1.015)^x$ .  
Jamie has invested \$20,000 in the bank at 3% simple interest. The function to represent his money in the bank is  $J(x) = 20,000(1.03)^x$ .

Compare the rate of change and y-intercepts for the first 20 years in the bank.

Ryan and Jamie are both 50 years old. Do you think Jamie's savings will ever catch Ryan if neither one of them touches the money that is in their accounts?

6. Compare the rate of change and y-intercepts of each exponential function over the interval  $[0, 4]$ .

**Function A:** The value of a car in dollars,  $f(x)$ , depreciates after each year,  $x$ . The following table shows the value of a car for each of the first 4 years after it was purchased.

$x$	$f(x)$
0	22,450
1	19,307
2	16,604.02
3	14,279.46
4	12,280.33

**Function B:** The value of a second car is modeled by the equation  $g(x) = 19,375(0.84)^x$ , where  $g(x)$  represents the value of the car  $x$  years after the date it was purchased.

Find the common ratio for both functions. Which one is smaller? How does it compare to the rate of change for that function?

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

### Comparing Linear and Exponential Functions Homework

1. Consider the following:

- **Option 1:** You can be paid \$20 an hour for 20 hours of work.
- **Option 2:** You can get \$1 the first hour, \$2 the second hour, \$4 the third hour, and \$8 the fourth hour. Your hourly rate would continue to double every hour. You are working 20 hours.

a. Write an **explicit** and **recursive** formula for each option.

b. Which option would you choose, and why?

c. If you only worked 10 hours would your answer be the same? Why?

2. **Question:** Which function **increases faster**,  $f(x) = 4x - 5$  or  $g(x) = 4^x - 5$ ?

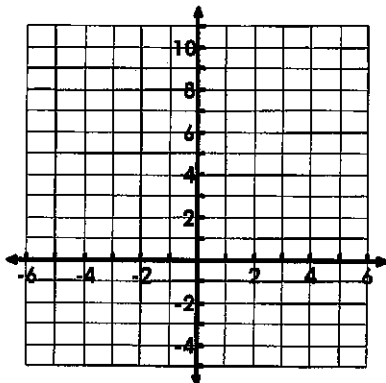
a. Make a table of values to help you decide the answer.

Find the rate of change of different intervals to help you decide.

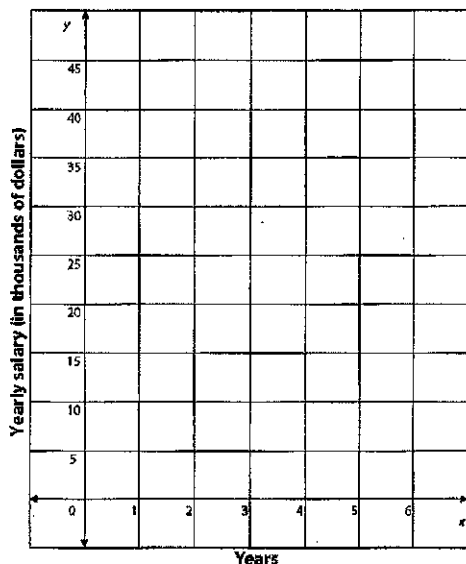
x	$f(x) = 4x - 5$
-3	
-2	
-1	
0	
1	
2	
3	

x	$g(x) = 4^x - 5$
-3	
-2	
-1	
0	
1	
2	
3	

b. Make a graph to confirm your answer that you put in 2a.



3. Lena has been offered a job with two salary options. The first option is modeled by the function  $f(x) = 500x + 31,000$ , where  $f(x)$  is her salary in dollars after  $x$  years. The second option is represented by the function  $g(x) = 29,000(1.04)^x$ , where  $g(x)$  is her salary in dollars after  $x$  years. If Lena is hoping to keep this position for at least 5 years, **which salary option should she choose? Support your answer with a graph and by finding the rate of change over the first 5 years.**



4. The function  $f(x)$  represents the amount of air remaining in an exercise ball that originally had 4,500 cubic inches of air and is losing 6% of its air every minute,  $x$ . So, the function  $f(x) = 4,500(0.94)^x$  represents the remaining air in this ball. The function  $g(x) = 4500(0.97)^x$  represents the amount of air remaining in a second exercise ball.

**Which of the following statements is true about the functions  $f(x)$  and  $g(x)$ ?**

- The function  $f(x)$  has a greater rate of change than the function  $g(x)$  over the interval  $[2, 5]$ .
- The function  $g(x)$  has a greater rate of change than the function  $f(x)$  over the interval  $[2, 5]$ .
- The rates of change for both  $f(x)$  and  $g(x)$  are equal over the interval  $[2, 5]$ .
- The rates of change cannot be determined.



**HOMEWORK Task: Talk is Cheap!**

To encourage communication between parents and their children and to prevent children from having extremely large monthly bills due to additional minute charges, two cell phone companies are offering special service plans for students.

Talk Fast cellular phone service charges \$0.10 for each minute the phone is used.  
 Talk Easy cellular phone service charges a basic monthly fee of \$18 plus \$0.04 for each minute the phone is used.

Your parents are willing to purchase for you one of the cellular phone service plans listed above. However, to help you become fiscally responsible they ask you to use the following questions to analyze the plans before choosing one.

1. How much would each company charge per month if you talked on the phone for 100 minutes in a month? How much if you talked for 200 minutes in a month?
2. Build a table, make a graph, and write a function rule,  $f(x)$  or  $g(x)$ , to represent the cost of each cellular service in terms of the number of minutes,  $x$ .

**Tables:**

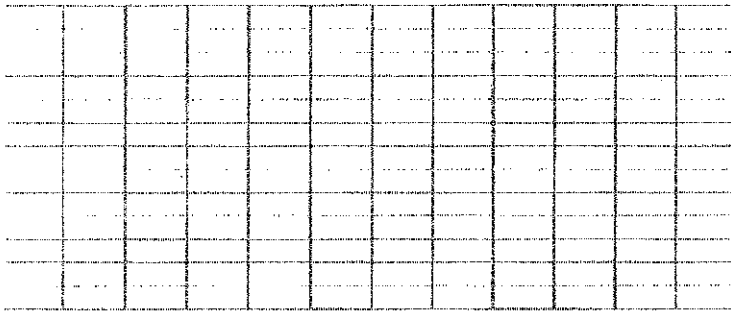
**Talk Fast:**  $f(x) =$

(number of minutes) $x$									
total cost in dollars) $f(x)$									

**Talk Easy:**  $g(x) =$

(number of minutes) $x$									
total cost in dollars) $g(x)$									

**Graph:**



**Rule:**

**Use the table, graph, and/or rule to help answer the following questions:**

3. Which company would be a better financial deal if you plan to use the phone for 200 minutes a month? Explain your reasoning.

4. Which company would be a better financial deal if you plan to use the phone for 500 minutes a month? Explain your reasoning.

5. Depending on the number of minutes you talk on the phone each month, explain to your parents which cellular phone plan is more economical. Include in your explanation the point at which both cellular phone plans cost the same amount of money.

6. If you know the cost of each plan for 300 minutes, can you double this cost to find the cost for 600 minutes? Explain your answer.