

# Unit 5: Comparing Linear, Quadratic, and Exponential Functions

The tables below each represent a different function. Use these functions to answer questions 1 – 6.

f(x)

x	-2	-1	0	1	2
f(x)	14	9	6	5	6

g(x)

x	-2	-1	0	1	2
f(x)	9	5	1	-3	-7

h(x)

x	-2	-1	0	1	2
f(x)	0.25	1	4	16	64

g(x)

1) What is the equation of the linear function?  $y = -4x + 1$ 

f(x)

2) What is the equation of the quadratic function?  $y = (x-1)^2 + 5$ 

h(x)

3) What is the equation of the exponential function?  $y = 4(4)^x$ 

g(x)

4) Which function has the smallest y intercept?

g(x)

5) Which function has a common difference?  $d = ?$  Arithmetic  $\rightarrow$  Linear

h(x)

6) Which function has a common ratio?  $r = ?$  Geometric  $\rightarrow$  Exponential

Linear

7) What type of function would represent the following situation: Jack has \$200 in the bank. He hopes to increase his savings by \$50 a month when he starts his new job.

$$y = 50x + 200$$

84

8) If  $k(x) = 4x^3 + 2$ , what is the average rate of change for the interval  $-2 \leq x \leq 1$ ?

$$\text{Slope: } \frac{y_2 - y_1}{x_2 - x_1}$$

$$\begin{matrix} (-2, 6) \\ (1, 258) \end{matrix}$$

$$\frac{258 - 6}{1 - (-2)} = \frac{252}{3} = 84$$

Exponential

9) Last August, McClure Middle school's temperature was 88 degrees inside. The air conditioner cooled the building at a rate of 5% per hour. What type of function is this?

$$y = 88(1 - 0.05)^x$$

4 years

10) 8<sup>th</sup> grade at MMS has seen an increase of students by 7 students each year. 8<sup>th</sup> grade at DMS has seen a decrease in the enrollment of students at a rate of 8% each year.

$$y = 7x + 400 \rightarrow 428$$

In how many years will both grades have approximately the same number of students enrolled if MMS had a initial enrollment of 400 8<sup>th</sup> graders, and DMS started with 600 8<sup>th</sup> graders?

$$y = 600(1 - 0.08)^x \rightarrow 429.84$$

h(x)

11) Given the parent functions  $f(x) = 4x$ ,  $g(x) = 5x^2$ , and  $h(x) = 12x$ , which function is greatest at  $x = 2$ ?

$$\begin{aligned} &= 4^2 \\ &= 16 \end{aligned}$$

$$\begin{aligned} &= 5(2)^2 \\ &= 5(4) \\ &= 20 \end{aligned}$$

$$\begin{aligned} &= 12(2) \\ &= 24 \end{aligned}$$

Quadratic

- 12) A baby bird flies up from his nest 6 feet the first second, 12 feet the next second, 22 feet the third second, and so on. What type of function is this?

1 6  
2 12  
3 22

Directions: Use the graph to the right to select the best answer for questions 16 - 18.

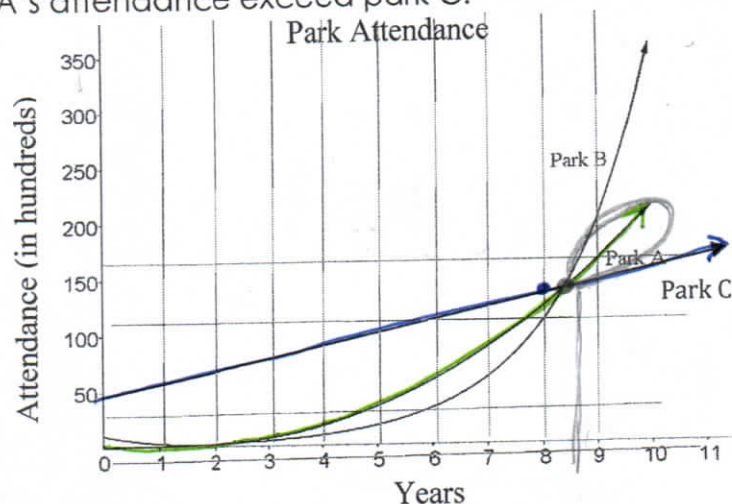
- Between 8-9 night 13) After how many years does Park A's attendance exceed park C.

C

- 14) Which park has the highest attendance the 8th year?

8.5

- 15) When do all 3 parks have the same attendance?



Use the following situation to select the best answer to questions 19 - 20. Mr. Rat Trap is catching squirrels in attics. On the first day, he collects 3 squirrels. On the second day, he collects 9 squirrels. On the third day, he collects 27 squirrels. He continues to collect mice at this rate for a total of 6 days.

- 729 16) How many squirrels will he collect on the 6th day?

B

- 17) What type of sequence represents the situation described?

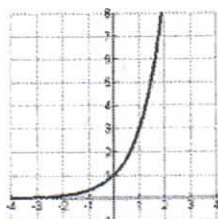
a) arithmetic b) geometric c) quadratic d) none of these

1 3  
2 9  
3 27  
4 81  
5 243  
6 729

For each of the following tables, graphs, and equations, tell whether the function is positive linear, negative linear, quadratic, exponential growth, exponential decay, or none of these.

EG

18)



Q

19)  $f(x) = x^2 + 10x - 2$

ED

20)  $y = 2(0.3)^x$

decay

NL

21)  $g(x) = -9x + 2$

Negative slope

$a_n = 60(3)^{n-1}$

$a_5 = 4860$

- 22) If there are 20 termites at the beginning of summer and they are tripling everyday, write an explicit rule representing this situation and state whether it is arithmetic or geometric. How many termites will there be after 5 days? (3 answers)

- 4, 12, 36, ... 23) Write the first 3 terms of the sequence represented recursively by  $a_1 = 4$  and  $a_n = a_{n-1}(3)$ . State whether it is arithmetic or geometric.

$a_n = a_{n-1} \cdot r$   $a_n = a_{n-1} + d$

yint

0 20  
1 60  
2 180



## Comparing Functions

Use the tables below to answer questions 1-7.

$x$	$f(x)$
1	5
2	2
3	1
4	2
5	5

Handwritten notes:  $0 \rightarrow 10$ ,  $-5 \rightarrow +2$ ,  $-3 \rightarrow +2$ ,  $-1 \rightarrow +2$ ,  $+1 \rightarrow +2$ ,  $+3 \rightarrow +2$ ,  $10 \rightarrow +5$

$x$	$g(x)$
1	-12
2	-9
3	-6
4	-3
5	0

Handwritten notes:  $0 \rightarrow -15$ ,  $-3$ ,  $+3$

$x$	$h(x)$
1	1
2	2
3	4
4	8
5	16

Handwritten notes:  $0 \rightarrow 1/2$ ,  $x^2$

1. Which function is quadratic?  $(x-3)^2 + 1$   
☒ A.  $f(x)$       B.  $g(x)$       C.  $h(x)$       D. none of these
2. What is the equation of the linear function? Assume  $y$  will represent  $f(x)$ ,  $g(x)$ , or  $h(x)$ .  
 A.  $y = 3x + 7$       ~~B.  $y = -3x + 7$~~       ~~C.  $y = -3x + 15$~~       ☒ D.  $y = 3x - 15$
3. Which function has the greatest y-intercept?  
☒ A.  $f(x)$       B.  $g(x)$       C.  $h(x)$       D. they are all equal
4. Which function has a common ratio?  
 A.  $f(x)$       B.  $g(x)$       ☒ C.  $h(x)$       D. none of these  
*exponential*
5. Which function has the greatest average rate of change over the interval  $4 \leq x \leq 5$ ?  
 A.  $f(x)$       B.  $g(x)$       ☒ C.  $h(x)$       D. they are all equal  
 $\frac{5-2}{5-4} = \frac{3}{1}$        $\frac{0-(-3)}{5-4} = \frac{3}{1} = \frac{3}{1}$        $\frac{16-8}{5-4} = \frac{8}{1}$
6. Which function increases over the entire function?  
 A.  $f(x)$       B.  $g(x)$       ☒ C.  $h(x)$       D. none of these  
*exponential always wins*
7. Which function has both an interval of increase and an interval of decrease?



What type of function could represent each situation?

7. Paul rides in a taxi. He pays \$8 to start and then \$1.50 for each mile.

- ☒ A. linear      B. quadratic      C. exponential      d. none of these

8. Suzi starts out running 100 yards. Each day she doubles the distance she runs.

- A. linear      B. quadratic      ☒ C. exponential      d. none of these

9. Jane's pay has a starting salary of \$28,000. In addition, she earns 4.5% commission on the items she sells.

- A. linear      B. quadratic      ☒ C. exponential      d. none of these

10. Bradley gets a job where his starting salary is \$30,000 and gets a 12% pay raise each year.

- A. linear      B. quadratic      ☒ C. exponential      d. none of these

11. Given the function  $f(x) = x^2 + 3$ , what is the average rate of change over the interval  $1 \leq x \leq 2$ .

A. 4

☒ B. 3

C. 2

D. 1

$$\begin{array}{l} (1, 4) \\ (2, 7) \end{array} \quad \frac{7-4}{2-1} = 3$$

12. The population of Tiny Town is increasing by 5 people each year, with a beginning population of 75. The population of Center City had a decay factor of .95 with an initial population of 300.

Write an explicit rule to model the population of each and determine the number of years at which the two will have approximately the same population.

A. 10 years

B. 14 years

C. 18 years

D. 22 years

13. Given the functions  $f(x) = 6x - 5$  and  $g(x) = x^2 + 2x - 2$ , which function is greater when  $x = 3$ ?

$$\begin{aligned} &= 6(3) - 5 \\ &= 18 - 5 = 13 \end{aligned}$$

$$\begin{aligned} &= (3)^2 + 2(3) - 2 \\ &= 9 + 6 - 2 \\ &= 13 \end{aligned}$$

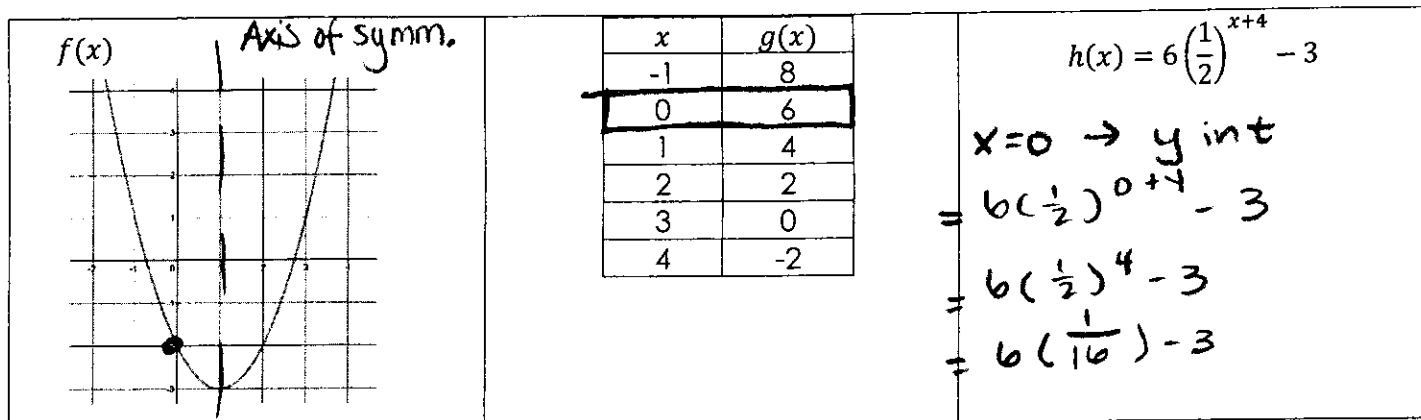
A.  $f(x)$

B.  $g(x)$

☒ C. they are equal

D. cannot be determined

Use the functions represented in the graph, table and equation to answer #14-18.



14. Which function has a ~~maximum~~ value?  
~~Minimum~~

☒ A.  $f(x)$

B.  $g(x)$

C.  $h(x)$

D. none of these

15. Which function has the greatest y-intercept?

A.  $f(x)$

☒ B.  $g(x)$

C.  $h(x)$

D. both  $g(x)$  and  $h(x)$

16. Which function has an asymptote at  $y = -3$ ?

A.  $f(x)$

B.  $g(x)$

☒ C.  $h(x)$

D. none of these

17. Which function has an axis of symmetry at  $x = 1$ ?

☒ A.  $f(x)$

B.  $g(x)$

C.  $h(x)$

D. none of these

18. Which function has a common difference?

A.  $f(x)$

☒ B.  $g(x)$

C.  $h(x)$

D. none of these

Determine which type of sequence could be used to model this situation and write an explicit rule.

19. Your match box car has traveled 5 feet after one second, 10 feet after two seconds, and 15 feet after three seconds.

☒ A. Arithmetic;  $a_n = 5n$

B. Arithmetic;  $a_n = 5 + 5n$

C. Geometric;  $a_n = 5(5)^{n-1}$

D. Geometric;  $a_n = 5(2)^{n-1}$

1	5
2	10
3	15

20. A beetle population triples each week. After the first week there are 27 beetles.

A. Arithmetic;  $a_n = 3n$

B. Arithmetic;  $a_n = 3n + 9$

☒ C. Geometric;  $a_n = 27(3)^{n-1}$

D. Geometric;  $a_n = 3(9)^{n-1}$