KEY

Algebra I
Test Review – Unit 5: Comparing Functions

Name: _____
Date: _____ **Period:** ____

Determine the first five terms of the sequence.

1. $a_n = 2n + 38$ — 40, 42, 44, 46, 48
2. $a_n = 3(2)^{n-1}$ — 3, 6, 12, 24, 48
3. $a_1 = -24$; $a_n = a_{n-1} + 4$ — -24, -20, -16, -12, -8
4. $a_1 = 1/3$; $a_n = a_{n-1}(-3)$ — 1/3, -1, 3, -9, 27

Write a rule in explicit form for the nth term of each sequence.

5. -36, -38, -40, -42, ... $d = -2$ — $a_n = -36 + (n-1)(-2)$ — $a_n = -2n - 34$
6. -3, 12, -48, 192, ... $r = -4$ — $a_n = -3(-4)^{n-1}$
7. $a_{11} = 304$; $d = 30$ — plug into $a_n = a_1 + (n-1)d$; $304 = a_1 + (11-1)30$; $304 = a_1 + 300$; $a_1 = 4$; $a_n = 4 + (n-1)30$ — $a_n = 30n - 26$
8. $a_{52} = -228$; $a_{34} = -138$ — $d = \frac{-138 - (-228)}{34 - 52} = -5$; plug into $a_n = a_1 + (n-1)d$; $-138 = a_1 + (34-1)(-5)$; $-138 = a_1 - 165$; $a_1 = 27$; $a_n = 27 + (n-1)(-5)$ — $a_n = -5n + 32$

Write an explicit and recursive rule for the nth term of each sequence. Then find a_8.

9. 2000, 200, 20, 2, ...
   Explicit Rule: $a_n = 2000\left(\frac{1}{10}\right)^{n-1}$
   $a_8 =$ $\frac{1}{5000}$
   Recursive Rule: $a_1 = 2000$, $a_n = a_{n-1}\left(\frac{1}{10}\right)$

10. -4, 2, 8, 14, ... $a_n = -4 + (n-1)6$
    Explicit Rule: $a_n = 6n - 10$
    $a_8 =$ 38
    Recursive Rule: $a_1 = -4$, $a_n = a_{n-1} + 6$

State whether the sequence represents a linear function, exponential function, or neither.

11. 1, 3, 6, 10, 15, ... — NEITHER
12. 40, 43, 46, 49, 52, ... (+3 +3 +3 +3) — LINEAR FUNCTION
13. -4, 12, -36, 108, -324, ... (×-3 ×-3 ×-3 ×-3) — EXPONENTIAL FUNCTION

14. A first year teacher is paid $38,000. Each year she is paid an additional 5% over the previous year. Create a function that would represent the teacher's salary based on the number of years.

Initial Value: 38,000
Growth Factor: 1.05
Equation: $y = 38{,}000(1.05)^t$

RECALL: GROWTH $y = P(1+r)^t$ | DECAY $y = P(1-r)^t$

$1 + .05 = 1.05$
Growth Factor

KEY

15. A top level professional sports organization offers its athletes two different bonus retirement plans. Read each option, then fill in the tables.

Option 1: They will start an account with $20,000 and add $20,000 per year for each year the player plays successfully for the organization.

Years Played	0	1	2	3
Retirement Account	20,000	40,000	60,000	80,000

FORMULA $y = 20{,}000x + 20{,}000$

Option 2: They will start an account with $20,000 then add 50% to the value of the account for each year the athlete successfully plays for the team.

$y_1 = 20{,}000(1 + .50)^x$

Years Played	0	1	2	3
Retirement Account	20,000	30,000	45,000	67,500

FORMULA $y = 20{,}000(1.50)^x$

a.) Which option would be better for the athlete if he played for the team for 3 years? How much of a difference is there between the two plans?

Option 1, athletes would have $12,500 more in their account.

b.) Which option would be better for the athlete if he played for the team for 10 years? How much of a difference is there between the two plans?

Option 1: $y = 20{,}000(10) + 20{,}000$

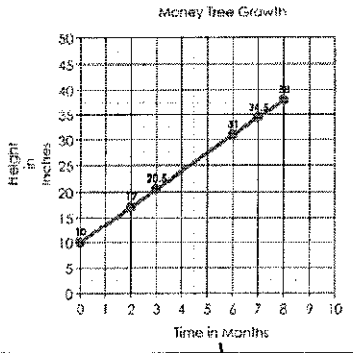
$y = \$220{,}000$

Option 2: $y = 20{,}000(1.50)^{10}$

$y = \$1{,}153{,}300.78$

Option 2 there is a difference of $933,300.78

16. Mr. Rich recently planted a crop of money trees in his garden. Each tree's growth is represented below.

TREE A	TREE B	TREE C
The first tree was five inches tall when planted. It has grown four inches every month since being planted. $y = 4x + 5$	Measurements were taken of the second tree and given below hint: find slope between the points	

Months	0	2	3	5
Height	3	12	16.5	25.5

$y = 4.5x + 3$

OR

$y = \frac{9}{2}x + 3$

use $(0, 10)$ and $(2, 17)$

NOTE: You can use any two points you want.

$m = \frac{17 - 10}{2 - 0} = \frac{7}{2} = 3.5$

$y = 3.5x + 10$

OR

$y = \frac{7}{2}x + 10$

a.) Which tree is growing the fastest?

TREE B, growing 4.5 in. each month

b.) Which tree was the tallest when it was first planted?

TREE C, it was 10 in.

c.) Which Tree is the tallest after six months?

TREE A $y = 4(6) + 5$ 29 in.

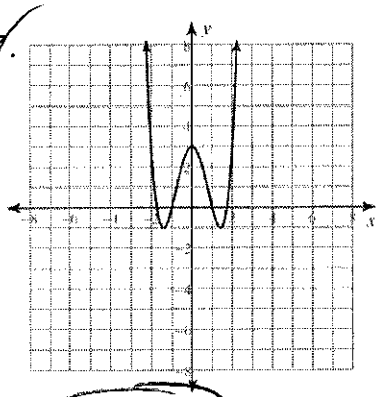
TREE B $y = 4.5(6) + 3$ 30 in.

TREE C $y = 3.5(6) + 3$ 31 in

TREE C it will be 31 in.

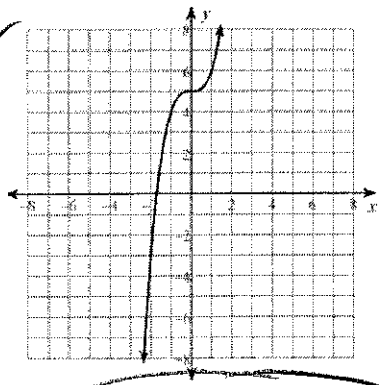
KEY

Determine if the functions are even, odd, or neither.

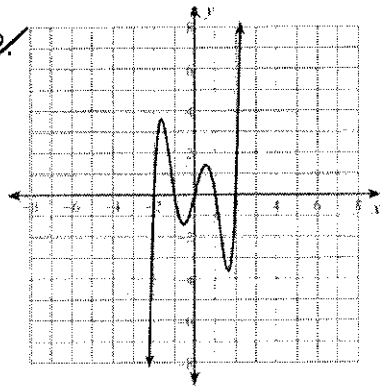
17. 

EVEN

symmetric about y-axis

18. 

NEITHER

19. 

ODD

symmetric about origin

20. $h(x) = 4x^4 - 3x^2 + 4x^0$

EVEN

ALL even exponents

21. $g(x) = (x+3)(x-2)$

$g(x) = x^2 - 2x + 3x - 6$

$g(x) = x^2 + x^1 - 6x^0$

NEITHER

odd and even exponents

22. $f(x) = -6x^5 + 3x^3 - x^1$

ODD

ALL odd exponents

23. Can you write the equation of a line that can be odd or even?

$y = 0$

Explain the transformations of the following functions compared to their respective parent graphs.

24. **$y = (3/4)^x$**

$y = 2(3/4)^x - 5$

- stretch by factor of 2
- shift down 5 units

25. **$y = 3^x$**

$y = (1/2)(3)^{x+3} + 4$

- compression by a factor of 1/2
- shift left 3 units
- shift up 4 units

26. **$y = x^2$**

$y = -2(x-1)^2 + 6$

- reflect over x-axis
- stretch by factor of 2
- shift right 1 unit
- shift up 6 units

27. Cindy is reading a summer book and made a plan to finish before school starts. She has already read 38 pages and plans to read 52 pages each day before school starts. She has 8 days before the start of school. Will she finish in time? Explain. → for a 500 page book

Equation: $y = 52x + 38$ $y = 52(8) + 38$ $y = 454$ pages

Conclusion: No, Cindy will have only read 454 pages before school starts. She will still need to read 46 more pages.

Determine the following characteristics about the graph of the function above.

Domain: [0, 8]

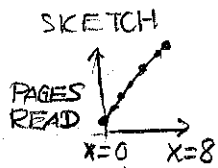
Range: [38, 454]

y-Intercepts: (0, 38)

Increasing/Decreasing: (0, 8)

Discrete or continuous. Why? Continuous, you can read part of a page

SKETCH



x = days

y = pages read

KEY

28. Jim is the class president at school and promoting acts of kindness. He started a chain reaction at school in which he gives three people a compliment. It is then their individual duty to give three additional compliments to three new people. Every day the number of compliments is tripling as more students get involved. There is a total of 2100 students at the school. The school's kindness campaign lasts for 7 days. Will all students be given a compliment at the end of the 7 days? Explain.

Use Explicit Model Equation: $a_n = 3(3)^{n-1}$ $a_7 = 3(3)^{7-1}$ $a_7 = 2,187$ students

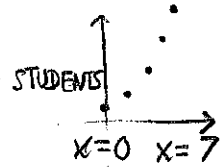
Conclusion: Yes, there are only 2,100 students in the school so the campaign will reach everyone in the student body.

Determine the following characteristics about the graph of the function above.

Domain: [1, 7] Range: [3, 2100]

y-Intercepts: (0, 1) Increasing/Decreasing: (1, 7)

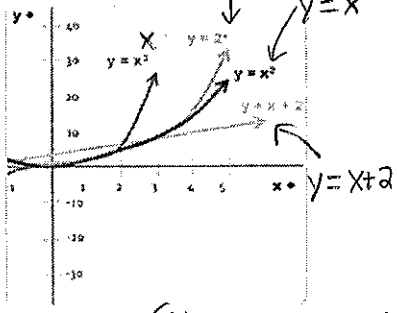
Discrete or continuous. Why? Discrete, can't have part of a person



x = days

y = # of students given a compliment

29.



a. Which function shows a constant rate of change?

$y = x + 2$ (LINEAR)

b. Which function shows the greatest rate of change for [2, 4]?

LINEAR: (2,4)(4,6) $m = 1$ | QUADRATIC: (2,4)(4,16) $m = 6$ | EXPONENTIAL: (2,4)(4,16) $m = 6$

c. Which function will increase the fastest as $x \to \infty$?

EXPONENTIAL

BOTH, the Exponential and Quadratic tie for the greatest R.O.C.

(You may use the y= table on Graphing Calculator)

Determine if the function represented by the table of values is linear, quadratic, exponential, or none of these.

30. $(-3, 8), (-2, 4), (-1, 2), (0, 1), (1, 0.5)$

$\times\frac{1}{2}$ $\times\frac{1}{2}$ $\times\frac{1}{2}$ $\times\frac{1}{2}$

Exponential

31.

x	−2	−1	0	1	2
y	4	1	−2	−5	−8

−3 −3 −3 −3

Linear

32.

x	2	3	4	5	6
y	2	4.5	8	12.5	18

+2.5 +3.5 +4.5 +5.5

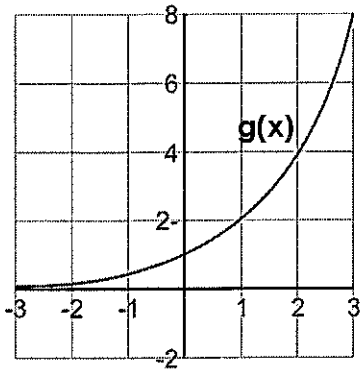
+1 +1 +1

Quadratic

KEY

33. The Drama Club has 250 protein bars to sell at the track meet. If it sells 45 bars per hour, write a function to represent the number of bars remaining after each hour.

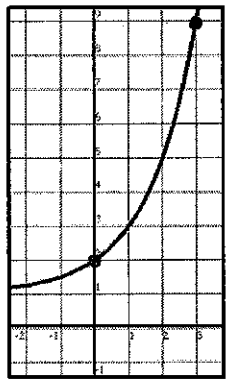
f(x): $-45x + 250$



	f(x)	g(x)	Greater?
Linear/Exponential:	Linear	Exponential	
y-intercept:	(0, 250)	(0, 1)	f(x)

34. **Use the functions below to answer the following.**

f(x)



Exponential

x	-2	-1	0	1	2	3
g(x)	-8	-13	-18	-23	-28	-33
		-5	-5	-5	-5	-5

Linear

h(x) = 3(¼)^x

Exponential

- Order the functions above in descending order according to their corresponding **y-intercepts.**

y-intercepts: h(x) > f(x) > g(x)

- Order the functions above in descending order according to their **average rates of change over the interval of [0, 3].**

Avg. ROC [0, 3]: f(x) > h(x) > g(x)

work

f(x) $m = \frac{7}{3}$

g(x) (0, -18) (3, -33) $m = -5$

h(x) (0, 3) $(3, \frac{3}{64})$ $m = -\frac{63}{64}$