WARM UP

HW tally

Pick it up.
Do both sides.

and pick up New Recording Sheet.

Handout

Arithmetic Sequences

$\boxed{1}$

A) 7, 17, 27, 37, ... Adding 10

-3

① ② ③ ④

$-3+10(4)$

$\cancel{10^n}$

zero term format $t(n) = -3 + 10n$

10^{n-1}

first term format $t(n) = 7 + 10(n-1)$

$7+10(4-1)$

$t(50) = -3+10(50)$

$t_{50} = 497$

B) 95 $90, 85, 80, 75, \ldots\ldots$ Subtracting 5

$t(n) = 95 - 5n$

or $t(n) = 90 - 5(n-1)$

$t(26) = 90 - 5(26-1)$

$= -35$

C)

n	$t(n)$
0	5.50
1	5.75
2	6.00
3	6.25
4	6.50
5	6.75

$t(n)$

zero term $t_n = 5.50 - 0.25n$

1^{st} term $t_n = 5.75 - .25(n-1)$

2 Consider the sequence *t(n) = -4, -1, 2, 5, ...*

A • Write the equation for the sequence, *t(n)*.

1st term $t(n) = -4 + 3(n-1)$

$t(n) =$

$t_n = 3n - 7$

B • Is it possible for *t(n)* to equal 42 ?

$42 = -4 + 3(n-1)$

$\frac{46}{3} = \frac{3(n-1)}{3}$

$16.\overline{3} = n-1$

$n = 17.\overline{3}$

C • For the function *f(x) = 3x -7*, is it possible for f(x) to equal 42 ?

$42 = 3x - 7$

$49 = 3x$

$x = \frac{49}{3} = 1\overline{7}.\overline{3}$ OK

$t(n) = -4, -1, 2, 5, \ldots\ldots$

Is it possible for $t(n) = 42$

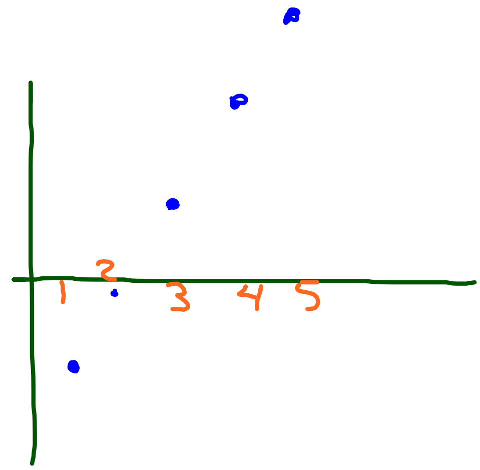
$t(n) = 3n - 7$

$42 = 3n - 7$

$+7 \qquad +7$

$49 = 3n$

$n = \frac{49}{3} \approx 16.3$



c) Is it possible for $t(n) = 42$

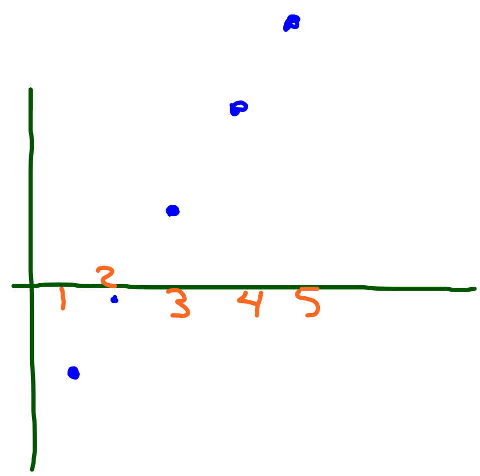
$t(n) = 3n - 7$

$42 = 3n - 7$

$+7 \qquad +7$

$49 = 3n$

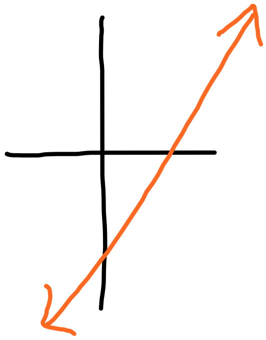
$n = \frac{49}{3} \approx 16.3$



So, NO, the domain of a sequence onlyincludes positive nubmers.

On the other hand....

(c) Is it possible for the function $f(x) = 42$?



Yes, because the domain of $f(x) = 3n - 7$ is all real numbers

so $\frac{49}{3}$ can be an answer

3 **Complete the table for the geometric sequence. Then, write sequence formulas in both first term and zero term formats.**

0	$\frac{1}{7}$
1	1
2	7
3	49
4	343
5	2401
6	16807
7	117,649

$49 \cdot r \cdot r \cdot r = 16807$

$\frac{49r^3}{49} = \frac{1807}{49}$

$r^3 = 343$

$\sqrt[3]{\ } \quad \sqrt[3]{\ }$

$r = 7$

$t_n = \frac{1}{7}(7)^n$

$t_n = 1(7)^{n-1}$

4 **Benjamin is stuck on the problem shown below. Examine his work so far and help him by showing and explaining the remaining steps.**

Original problem: Simplify $(3a^{-2}b)^3$.

He knows that $(3a^{-2}b)^3 = (3a^{-2}b)(3a^{-2}b)(3a^{-2}b)$. Now what?

Original problem: Simplify $(3a^{-2}b)^3$.

He knows that $(3a^{-2}b)^3 = (3a^{-2}b)(3a^{-2}b)(3a^{-2}b)$. Now what?

$$\boxed{\frac{27b^3}{a^6}}$$

$$3 \cdot a^{-2} \cdot b \bullet 3 \cdot a^{-2} \cdot b \bullet 3 \bullet a^{-2} \cdot b$$

$$27\, b^3\, a^{-6}$$

$$a^{-2}\, a^{-2}\, a^{-2}$$

Pull out your HW

check your answers with the solutions

pens

After Test Assignment

Name __________ Date _____

this will count as the first assignment for the next Unit.

(1) Find the missing terms of the sequence and write a sequence formula in both *zero term* and *first term* format.

a) ____, ____, 125, ____, ____, ... (hint: the multiplier is 1.25)

first term format: $t_n =$ ________ zero term format: $t_n =$ ________

b) 4000, 1000, 250, ____, ____, ...

first term format: $t_n =$ ________ zero term format: $t_n =$ ________

After Test Assignment

Name Key Date _____

this will count as the first assignment for the next Unit.

(1) Find the missing terms of the sequence and write a sequence formula in both *zero term* and *first term* format.

a) 80, 100, 125, 156.25, 195.3125, ... (hint: the multiplier is 1.25)

first term format: $t_n = 80(1.25)^{n-1}$ zero term format: $t_n = 64(1.25)^n$

b) 4000, 1000, 250, 62.5, 15.625, ...

$\frac{1000}{4000} = \frac{1}{4}$ $\frac{250}{1000} = \frac{1}{4}$

first term format: $t_n = 4000\left(\frac{1}{4}\right)^{n-1}$ zero term format: $t_n = 16{,}000\left(\frac{1}{4}\right)^n$

or $4000(0.25)^{n-1}$

(2) Several customers at a fancy restaurant were reporting food poisening. A biologist named Tina was recording bacteria growth on the cooking surfaces. She is trying to predict the amount of bacteria after 20 hours. Unfortunately she lost the count after the first hour and forgot to record count at six hours.

a) Determine the missing counts.

b) Write a sequence formula, using the notation, "$t_n =$" that models the growth after n hours.

c) Use your formula to calculate the predicted bacteria counts after 20 hours.

hours	# bacteria
1	
2	10
3	25
4	62.5
5	156.25
6	

(2) Several customers at a fancy restaurant were reporting food poisening. A biologist named Tina wa recording bacteria growth on the cooking surfaces. She is trying to predict the amount of bacteria hours. Unfortunately she lost the count after the first hour and forgot to record count at six hours.

a) Determine the missing counts.

b) Write a sequence formula, using the notation, "$t_n =$" that models the growth after n hours.

$$t_n = 4(2.5)^{n-1}$$

c) Use your formula to calculate the predicted bacteria counts after 20 hours.

$$t_{20} = 4(2.5)^{20-1} = 145{,}519{,}152$$

hours	# bacteria
1	4
2	10
3	25
4	62.5
5	156.25
6	390,625

(3) Challenge:
Determine a formula for the geometric sequence:

n	t_n
1	
2	68
3	
4	~~768.08~~ 786.08
5	

$68 \cdot r \cdot r = 786.08$

$68r^2 = 786.08$

$r^2 =$

$r = 3.4$

GDC tidbit

battery usage

Four Day Unit

Transfer Skill Review from Alg/Geom

before starting Chapter 2

Today's AIM:

- Percent Growth
  (as related to sequences and exponential functions)
  requires geometric thinking

- Exponential "Boot Camp"

(A) Force 120 to grow by 15%

I think exponentially

$\times 1.15$

$\underset{0}{120}, \underset{1}{\underline{138}}, \underset{2}{\underline{158.7}}, \underline{182.5} \; \bullet \cdots \bullet$

$f(x) = 120(1.15)^{x-1}$

15% of 120 ?

$(.15)(120) =$

15% growth

100% + 15%

multiplier $1 + .15$

1.15

blue

handout

example

A

Force the following sequence to grow by 15 %

has a multiplier

$$\underset{1}{\underline{120}}, \underset{2}{\underline{\quad}}, \underset{3}{\underline{\quad}}, \ldots$$

120, ___, ___, ___, ...

How can we increase any number by 15% ?

We multiply by a growth factor

Start with 100% $100\% + 15\%$

Add 115%

convert to a decimal 1.15

120, ___, ___, ___, ___

$120 \times 1.15 = 138$

(B) Force 10,000 to decrease by 20%

think multiplier

20% decay

$100\% - 20\%$

$1 - .2$

multiple → $.8$

10,000, 8000, 6400, 5120 ....

0

$g(x) = 10000(.8)^x$

$$\frac{120}{1}, \frac{138}{2}, \frac{158.7}{3}, \frac{182.505}{4}, \ldots$$

$$t_n =$$

example B

10,000 zero term

3% decrease

10,000 , ___ , ___ , ___

$t(n) =$

example C

Start with 1000
at 6.5% growth

Write a formula.

How many weeks would it take
to reach 80,000

$$t(n) = 1000\,(1.065)^n$$

80 000

$$80\,000 = 1000\,(1.065)^n$$

(c) 1000 ants
+8% per day

a) $f(x) = \cancel{80000}\ 1000\,(1.08)^x$

b) How many days will it take to reach 80,000 ants?

$$1000(1.08)^x = 80000$$

divide by 1000

$$\underbrace{(1.08)^x}_{Y_1} = \underbrace{80}_{Y_2}$$

$$X = 56.9 \text{ days}$$

example D

GDC

option I 100, 11% growth

option II 2000, 4% growth

How many weeks before option I overtakes option II

B.B.

Notes

what if exponents are negative ????

What if there were negative exponents ?

$\left(\frac{3}{5}\right)^{-1} = \frac{5}{3}$

$5^{-1} = \left(\frac{5}{1}\right)^{-1} = \frac{1}{5}$

$\left(\frac{a}{de}\right)^{-1} = \frac{de}{a}$

$\left(\frac{1}{x}\right)^{-1} = x$

$\left(\frac{1}{4}\right)^{-2} = \left(\frac{4}{1}\right)^{2} = \boxed{16}$

$\left(\frac{1}{3}\right)^{-1}$

$\frac{1}{3^{-1}} = 3^{1} = 3$

$\left(\frac{x}{y}\right)^{-3} = \left(\frac{y}{x}\right)^{3} = \boxed{\frac{y^3}{x^3}}$

$\frac{1}{x^{-2}} = x^{2}$

$\left(\frac{3x}{y}\right)^{-2} = \left(\frac{y}{3x}\right)^{2} = \boxed{\frac{y^2}{9x^2}}$

$\frac{3^{1}}{e^{-2}} = 3e^{2}$ $\boxed{3e^2}$

$a^4 \cdot b^{-2} \cdot a^3 \bullet b^4 =$

$x^4 \cdot y^{-2} \cdot x^{-5} \cdot y^{2} =$

$\frac{n^8}{n^{-2}} =$

$\frac{5x^{-3}}{x^6} =$

Each pair should pick up and work on one handout.

Exponent Review

Boot camp

Manipulating Powers

Exponent LAWS (add to your notes)

1) $(a^x)^y = a^{xy}$
2) $a^x \cdot a^y = a^{x+y}$
3) $\frac{a^x}{a^y} = a^{x-y}$
4) $(ab)^x = a^x b^x$
5) $\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
6) $a^{-x} = \frac{1}{a^x}$
7) $\frac{1}{a^{-x}} = a^x$

Handout

Manipulating Powers

Exponent LAWS (add to your notes)

1) $(a^x)^y = a^{xy}$
2) $a^x \cdot a^y = a^{x+y}$
3) ~~$\frac{a^x}{a^y} = a^{x-y}$~~
4) $(ab)^x = a^x b^x$
5) $\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
6) $a^{-x} = \frac{1}{a^x}$
7) $\frac{1}{a^{-x}} = a^x$

Simplify each expression.

Example: $(x^2)^4 = x^{2 \cdot 4} = x^8$

1. $x^4 \cdot x^2 = x^6$

use the 2nd law

2. $\frac{\cancel{x^8}\; x^2}{\cancel{x^6}\; 1} = \boxed{x^2}$

3. $(x^2 y)^3 = (x^2)^3 y^3 = \boxed{x^6 y^3}$

4. $\left(\frac{x}{y^3}\right)^5$ $\frac{x^5}{y^{15}}$

5. $y^{-15} = \frac{1}{y^{15}}$

6. $\frac{1}{x^{-15}}$ x^{15}

7. $\frac{\cancel{a^6}\;1}{a^3\;\cancel{a^9}}$ $\frac{1}{a^3}$

8. $(2c^2)^3$

$8c^6$

9. $\dfrac{n^4 \cdot n^6}{n^8 \cdot n^2}$

n^8

$\dfrac{\cancel{n^{10}}\ 1}{\cancel{n^{10}}\ 1}$

$\boxed{1}$

10. $4a^5 \cdot 3a^3$

$12a^8$

11. $\left(\dfrac{v}{3}\right)^4 \cdot \left(\dfrac{5}{v}\right)^2$

$\dfrac{v^2\cancel{v^4}}{81} \cdot \dfrac{25}{\cancel{v^2}\,1}$

$\boxed{\dfrac{25v^2}{81}}$

12. $(x^{-2})^2$

13. $\left(\dfrac{2}{x}\right)^{-1}$

Assignment:

is in Appendix A in the back Appendix

A.....10, 23, 88, 91, 92, 116, 119, 120

4

N $\frac{2K^5}{K}$	O $\frac{6K^9}{K^9}$
R $24A^2B = 8AB(\ ?\ )$	S $-56S^2A^8 = 14S^2A^4(?)$
T $A^2K^4 = (AK^2)(\ ?\ )$	U $A^3K^8 = (K^7)(\ ?\ )$
V $\frac{-18A^6K^2}{6A^3K}$	W $\frac{27A^2K^9}{-3AK^3}$

C $(-2A)^3$	D $(-4A)^2$
E $(A^4)^4$	G $(A^2)^3$
H $(-3A^2)^2$	I $3A(2A)^2$
L $(-4A^4)^3$	M $(5A^5)^2$

$-4A^4$	$9A^4$	6	A^3K	$-64A^{12}$	$16A^2$

$3A$	A^{16}	$25A^{10}$	6	$-3A^3K$	A^{16}

AK^2	$9A^4$	A^{16}

$-4A^4$	A^3K	$2K^4$

$-4A^4$	$-8A^3$	$3A$	A^{16}	A^{16}	$2K^4$

$-9AK^6$	$9A^4$	$12A^3$	$-64A^{12}$	A^{16}

$16A^2$	$3A$	$12A^3$	$-3A^3K$	$12A^3$	$2K^4$	A^6