Name: Key Per: _____ Date: _____

Serafino • Algebra 2E

Sum of first n terms in infinite geometric series

$$S_n = \frac{a_1(1-r^n)}{1-r}$$

8D1 Finite Geometric Series

Homework

March Madness is upon us!
Round 1 has 32 games, round 2 has 16, round 3 has 8, etc.

a) Write the geometric sequence that represents how many games are taking place in each round.

32, 16, 8, 4, 2, 1

b) Express the sum of that series in Sigma Notation.

$\sum_{n=1}^{6} 32\left(\frac{1}{2}\right)^{n-1}$

c) Use the partial sum formula (given above) to assess how many TOTAL games occur in the entire March Madness tournament.

$S_6 = \frac{32\left(1-\left(\frac{1}{2}\right)^6\right)}{1-\left(\frac{1}{2}\right)} = \frac{31.5}{.5} = 63$

63 total games

Write in sigma notation and evaluate, using the finite sum formula:

1) 2, 12, 72, 432

$\sum_{n=1}^{4} 2(6)^{n-1}$

$S_4 = \frac{2(1-(6)^4)}{1-6} = \frac{-2590}{-5}$

= 518

2) −1, 5, −25, 125

$\sum_{n=1}^{4} -1(-5)^{n-1}$

$S_4 = \frac{-1(1-(-5)^4)}{1-(-5)}$

= 104

3) −2, 6, −18, 54, −162

$\sum_{n=1}^{5} -2(-3)^{n-1}$

$S_5 = \frac{-2(1-(-2)^5)}{1-(-2)}$

= −122

4) −2, −12, −72, −432, −2592

$\sum_{n=1}^{5} -2(6)^{n-1}$

$S_5 = \frac{-2(1-6^5)}{1-6}$

= −3110

Evaluate:

5) $\sum_{k=1}^{7} 4^{k-1}$

$S_7 = \frac{1(1-4^7)}{1-4} = 5461$

6) $\sum_{i=1}^{8} (-6)^{i-1}$

$S_8 = \frac{1(1-(-6)^8)}{1-(-6)}$

= −239,945

★ tricky!

7) $\sum_{i=1}^{9} 2^{i-1}$

$S_9 = \frac{1(1-(2)^9)}{1-2} = 511$

8) $\sum_{m=1}^{9} -2^{m-1}$

$S_9 = \frac{-1(1-(2)^9)}{1-(2)}$

= −511

Find the sum of the finite geometric series:

9) $\sum_{n=1}^{8} 2 \cdot (-2)^{n-1}$ $= -170$

10) $\sum_{n=1}^{9} 4 \cdot 3^{n-1}$ $= 39{,}364$

11) $\sum_{n=1}^{10} 4 \cdot (-3)^{n-1}$ $= -59048$

12) $\sum_{n=1}^{9} (-2)^{n-1}$ $= 171$

13) $1 + 2 + 4 + 8..., \; n = 6$

$S_6 = \frac{1(1-2^6)}{1-2} = 63$

14) $2 - 10 + 50 - 250..., \; n = 8$

$r = -5$

$S_8 = \frac{2(1-(-5)^8)}{1-(-5)}$ $= -130{,}208$

15) $1 - 4 + 16 - 64..., \; n = 9$

$= 52{,}429$

16) $-2 - 6 - 18 - 54..., \; n = 9$

$= -19{,}682$

17) $1 - 5 + 25 - 125..., \; n = 7$

$= 13{,}021$

18) $-3 - 6 - 12 - 24..., \; n = 9$

$= -1533$

$a_n = a_1(r)^{n-1}$

$1024 = 4(-2)^{n-1}$

$256 = (-2)^{n-1}$

$2^8 = 2^{n-1}$

$n = 9$

Not done!!!

19) $a_1 = 4,\ a_n = 1024,\ r = -2$

$S_9 = \frac{4(1-(-2)^9)}{1-(-2)} = 684$

$a_n = a_1(r)^{n-1}$

$8748 = 4(3)^{n-1}$

$n = 8$

20) $a_1 = 4,\ a_n = 8748,\ r = 3$

$S_8 = \frac{4(1-(3)^8)}{1-(3)}$

$= 13{,}120$

Find the number of terms in each series: * You may need to ignore the negative

21) $a_1 = -2,\ r = 5,\ S_n = -62$

$S_n = \frac{a_1(1-r^n)}{1-r}$

$-62 = \frac{-2(1-(5)^n)}{1-5}$

$-62 = \frac{-2(1-(5)^n)}{-4}\ 2$

$-124 = 1-(5)^n$

$-125 = -(5)^n$

$n = 3$

22) $a_1 = 3,\ r = -3,\ S_n = -60$

$-60 = \frac{3(1-(-3)^n)}{1-(-3)} \rightarrow -60 = \frac{3(1-(-3)^n}{4}$

$-80 = 1-(-3)^n$

$-81 = -(-3)^n$

$81 = (-3)^n$

$n = 4$

23) $a_1 = -3,\ r = 4,\ S_n = -4095$

$-4095 = \frac{-3(1-(4)^n)}{1-4}$

$-4096 = -(4)^n$

$4096 = 4^n$

$\frac{\log 4096}{\log 4} = \frac{\log 4^n}{\log 4}$

$n = 6$

24) $a_1 = -3,\ r = -2,\ S_n = 63$

$63 = \frac{-3(1-(-2)^n)}{1-(-2)} \rightarrow 63 = -1(1-(-2)^n)$

$-63 = 1-(-2)^n$

$-64 = -(-2)^n$

$64 = (-2)^n$

$n = 6$

25) $-4 + 16 - 64 + 256\ldots,\ S_n = 52428$

$n = 8$

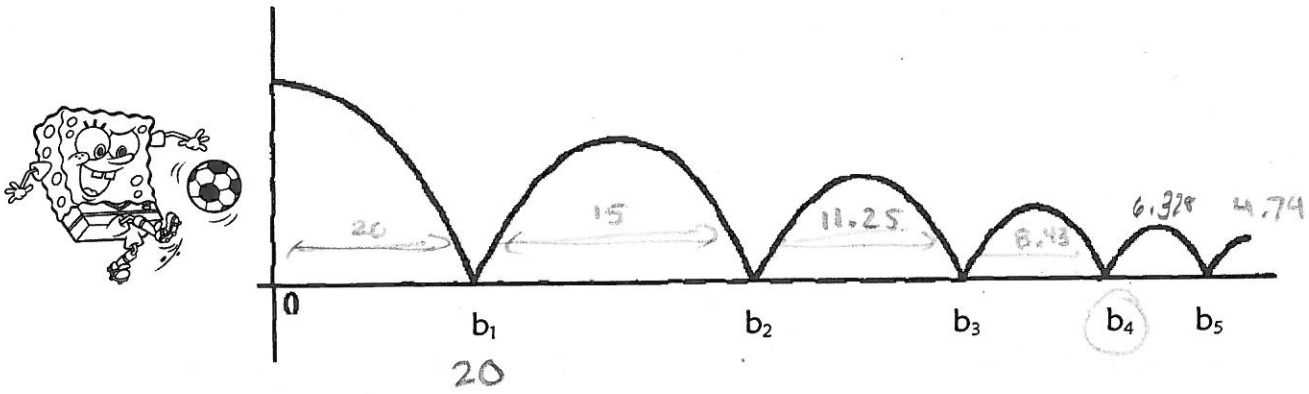
26) $\sum_{m=1}^{n} -2 \cdot 4^{m-1} = -42$

$n = 3$

$a_n = 20(.75)^{n-1}$

Spongebob kicks a soccer ball out of a gym window. It lands 20 feet from the building. Each bounce, it travels 75% of its previous bounce's distance.

Underneath each bounce, write the distance from the building each of the first 5 boucnes is.



a. What is the distance covered between the 1st and 2nd bounce? 15 ft What about between the 4th and 5th? 6.328 ft

b. How far is the ball from the building at the 4th bounce? $S_4 = \frac{20(1-.75^4)}{1-.75}$ = 54.68 ft

c. Between which two bounces is the ball 70 feet away from the building? Which bounce is it closer to?

$70 = \frac{20(1-(.75)^n)}{1-.75}$ $80 = 1-.75^n$ $\log 81 = n \cdot \log .75$ b/w 15th + 16th (closer to 15)

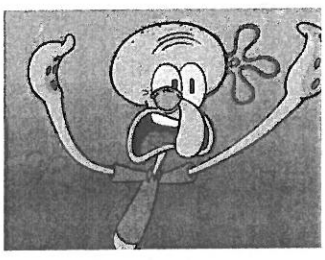
$-81 = -.75^n$

d. How far will it be in 20 bounces? $S_{20} = \frac{20(1-.75^{20})}{1-.75}$ = 79.746

e. 40 bounces? = 79.99

f. 500 bounces? $S_{500} = \frac{20(1-.75^{500})}{1-.75}$ = 80 ??

What is going on???



... Stay tuned to find out ☺