

# Summation & Sigma Notation Practice

Name Master  
Date \_\_\_\_\_ Block \_\_\_\_\_

Sigma Notation:  $\sum_{\text{beginning}}^{\text{end}} \text{expression}$

Example:  
 $\sum_{n=1}^6 2n = 2 + 4 + 6 + 8 + 10 + 12 = 42$

Write in expanded form and find the sum.

1.  $\sum_{k=2}^6 3k - 5$

$3(2) - 5 + (3)(3) - 5 + 3(4) - 5$   
 $+ 3(5) - 5 + 3(6) - 5$

1. Expanded Form: 1 + 4 + 7 + 10 + 13

Sum: 35

2.  $\sum_{k=4}^7 2k + 7$

$2(4) + 7 + 2(5) + 7 + 2(6) + 7$   
 $+ 2(7) + 7$

2. Expanded Form: 15 + 17 + 19 + 21

Sum: 72

3.  $\sum_{k=1}^8 (-3)^{k-1}$

$(-3)^0 + (-3)^1 + (-3)^2 + (-3)^3 + (-3)^4$   
 $+ (-3)^5 + (-3)^6 + (-3)^7$

3. Expanded Form: 1 + 3 + 9 + 27 + 81 + 243

Sum: -1640  
 $+ 729$   
 $+ 2187$

4.  $\sum_{b=1}^5 4\left(\frac{1}{2}\right)^{b-1}$

$4\left(\frac{1}{2}\right)^0 + 4\left(\frac{1}{2}\right)^1 + 4\left(\frac{1}{2}\right)^2 + 4\left(\frac{1}{2}\right)^3 + 4\left(\frac{1}{2}\right)^4$

4. Expanded Form: 4 + 2 + 1 +  $\frac{1}{2}$  +  $\frac{1}{4}$

Sum: 7 $\frac{3}{4}$  or 7.75

Find the sum of each series described using the summation formula. (i.e., DO NOT EXPAND.)

5.  $\sum_{k=4}^{20} 5k$   $\frac{n}{2}(a_1 + a_n)$   $a_1 = 5(4) = 20$   
 $S_{17} = \frac{17}{2}(20 + 100)$   $a_n = 5(20) = 100$

5. Sum: 1020

6.  $\sum_{p=11}^{35} 4p - 3$   $S_n = \frac{n}{2}(a_1 + a_n)$

$a_1 = 4(11) - 3$   
 $a_4 = 41$   
 $a_n = 4(35) - 3$   
 $a_n = 137$

6. Sum: 2225

Use sigma notation to express each series.

7.  $-2, 2, 6, 10, 14, 18$   $d=4$

$a_0 = 2 - 4$   
 $a_0 = -2$   $\sum_{n=1}^5 4n - 2$

8.  $54 + 18 + 6 + 2 + \frac{2}{3} + \frac{2}{9}$   $r = \frac{1}{3}$

$\sum_{n=1}^6 54\left(\frac{1}{3}\right)^{n-1}$

Write each series in expanded form, and find its sum.

9.  $\sum_{x=0}^6 -3x + 2$

10.  $\sum_{x=3}^8 \frac{1}{2}x - 6$

9. Expanded Form:  $2 + -1 + -4 + -7 + -10$   
 $+ -13 + -16$   
 Sum: 49

10. Expanded Form:  $-4.5 + -4 + -3.5 + -3 + -2.5 +$   
 $-2$   
 Sum: -19.5

Find  $S_n$  for each series described.

11.  $\sum_{k=1}^{20} (2k+1)$   
 $S_{20} = \frac{20}{2}(3+41)$  440

12.  $\sum_{k=3}^{10} 2^k$   
 $S_8 = \frac{8(1-(2)^9)}{(1-2)}$  2040

13.  $\sum_{m=5}^{25} m-1$   
 $S_{21} = \frac{21}{2}(4+24)$  294

14.  $\sum_{n=0}^8 -2\left(\frac{-1}{2}\right)^{n-1}$   
 $S_9 = \frac{4(1-(\frac{-1}{2})^9)}{(1-(\frac{-1}{2}))}$   $\frac{171}{64}$

Use sigma notation to express each series.

15.  $6 + 12 + 24 + 48$   
 $\sum_{n=1}^4 6(2)^{n-1}$

16.  $16 - 24 + 36 - 54 + 81 - 121.5 + 182.25$   
 $\sum_{n=1}^7 16(-1.5)^{n-1}$

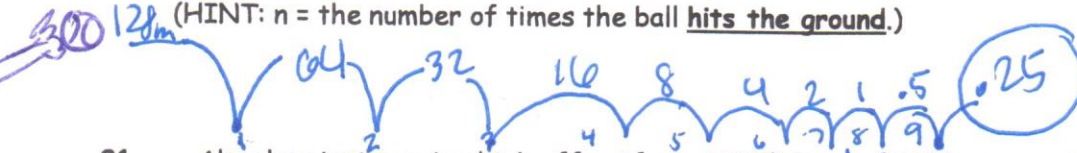
17.  $3 - 9 + 27 - 81 + 243$   
 $\sum_{n=1}^5 3(-3)^{n-1}$

18.  $4 + 1 - 2 - 5 - 8$   
 $\sum_{n=1}^5 -3n + 7$

19. A pile driver drives a post 9 feet into the ground on its first hit. Each additional hit drives the post  $\frac{2}{3}$  the distance of the prior hit. Find the total distance the post has been driven after 4 hits.

$a_1 = 9$   $r = \frac{2}{3}$   
 $\frac{9}{1} + \frac{6}{2} + \frac{4}{3} + \frac{8}{4}$  21.67 feet  $r = .5$

20. Parth drops a ball from a height of 128 meters. Each time it hits the ground, it bounces 50% of its previous height. How high does the ball bounce after the ninth time it hits the ground?  
 (HINT:  $n$  = the number of times the ball hits the ground.)



21. Alma has just received job offers from ACME, Inc. and Widget.com. Both companies have offered her a salary of \$35,000 for the first year. ACME, Inc. tells Alma they will increase her salary by 5% each year. Widget.com says they will increase her salary by \$2,000 each year. Use the  $n$ th term formulas to calculate her salary in year 9 with each company.

$a_1 = 35,000$   
 $n$ th term geometric

ACME: \$ 51,710.94

Widget: \$ 51,000

$a_9 = 35000(1.05)^8$

$n$ th term arithmetic  
 $a_9 = 35000 + 8(2000)$