1) $a_n = \frac{1}{4n^2}$ $a_1 = \frac{1}{4(1)^2} = \boxed{\frac{1}{4}}$ $a_2 = \frac{1}{4(2)^2} = \boxed{\frac{1}{16}}$ $a_3 = \frac{1}{4(3)^2} = \boxed{\frac{1}{36}}$

$a_4 = \frac{1}{4(4)^2} = \boxed{\frac{1}{64}}$ $a_{1000} = \frac{1}{4(1000)^2} = \boxed{\frac{1}{4000000}}$

2) $a_n = \frac{a_{n-1}}{2}$ $a_1 = \boxed{-64}$ $a_2 = \frac{-64}{2} = \boxed{-32}$ $a_3 = \frac{-32}{2} = \boxed{-16}$

$a_4 = \frac{-16}{2} = \boxed{-8}$ $a_5 = \frac{-8}{2} = \boxed{-4}$

3) $3, -9, 27, -81, \ldots$ $\boxed{a_n = 3(-3)^{n-1}}$

$r = -3$

4) $a, a-3d, a-6d, a-9d, \ldots$ $a_n = a + (n-1)(-3d)$

$\boxed{a_n = a - 3dn + 3d}$

5) $\sum_{n=1}^{6} \frac{3}{2n} = \frac{3}{2(1)} + \frac{3}{2(2)} + \frac{3}{2(3)} + \frac{3}{2(4)} + \frac{3}{2(5)} + \frac{3}{2(6)}$

$\frac{3}{2} + \frac{3}{4} + \frac{1}{2} + \frac{3}{8} + \frac{3}{10} + \frac{1}{4}$

$\boxed{= \frac{147}{40} = 3.675}$

6) $\sum_{k=3}^{7} k(k+4) = 3(7)+4(8)+5(9)+6(10)+7(11)$

$= 235$

7) $a_n = 3+(n-1)(3)$

$a_n = 3+3n-3$

$a_n = 3n$

$\sum_{k=1}^{18} 3n$

8) $d = 3.4$

$a_n = 12.7+(n-1)(-3.4)$

$a_5 = -.9$

$a_{100} = -323.9$

9) $a_n = 80$

$a_5 = 56$

$80 = a+10d$

$56 = a+4d$

$24 = 6d$

$d = 4$

$80 = a+(11-1)d$

$56 = a+(5-1)d$

10) $S_8 = \frac{n}{2}(a+a_n)$

$S_8 = \frac{8}{2}(75+61)$

$S_8 = 544$

$n = 8 \quad a = 75 \quad d = -2$

$a_8 = 75+(8-1)(-2)$

$a_8 = 61$

11) ~~12~~ $S_n = n\left(\frac{a + a_n}{2}\right)$

$= 25\left(\frac{-7 + 29}{2}\right)$

$= 25\left(\frac{22}{2}\right)$

$= 25(11)$

$\boxed{= 275}$

$29 = -7 + (n-1)(1.5)$

$29 = -7 + 1.5n - 1.5$

$29 = -8.5 + 1.5n$

$37.5 = 1.5n$

$25 = n$

12) ~~13~~ $a_7 = -18$

$a_{17} = -68$

$-18 = a + 6d$

$-68 = a + 16d$

$50 = -10d$

$-5 = d$

$-18 = a + 6(-5)$

$-18 = a - 30$

$a = 12$

$a_n = 12 + (n-1)(-5)$

$a_n = -5n + 17$

$a_{24} = -5(24) + 17$

$\boxed{a_{24} = -103}$

13 ~~14~~ $38 = .5 + (n-1)(1.5)$

$38 = .5 + 1.5n - 1.5$

$38 = -1 + 1.5n$

$39 = 1.5n$

$\boxed{n = 26}$

14) ~~15~~ $a = 30$ $d = 5$ $a_n = 30 + (n-1)5$

$a_n = 25 + 5n$

$a_{35} = 25 + 35$ $\boxed{a_{35} = 200}$ $a_{40} = 25 + 5(40)$ $= 225$ $S_n = 40\left(\frac{30+225}{2}\right)$

$\boxed{S_n = 5100}$

15) ~~16~~ $r = \frac{2}{5}$ $\boxed{a_n = 7\left(\frac{2}{5}\right)^{n-1}}$ $a_5 = 7\left(\frac{2}{5}\right)^4$

$\boxed{= \frac{112}{625} = .1792}$

16) ~~17~~ neither

17) ~~18~~ $a = 27$ $r = 1/9$ $a_n = 27(1/9)^{n-1}$

$a_2 = 3$ $a_5 = 27(1/9)^4$

$\boxed{a_5 = 1/243}$

18) ~~20~~ $r = 3/4$ $a_5 = 2$ $2 = a\left(\frac{3}{4}\right)^4$ $a = \frac{512}{81}$ $a_n = \frac{512}{81}\left(\frac{3}{4}\right)^{n-1}$

$a_2 = \frac{128}{27}$

$a_3 = \frac{32}{9}$

19) ~~20)~~ ~~21)~~ $a = 3$

$a_n = 768,432$

$768432 = 3(4)^{n-1}$

$256144 = 4^{n-1}$

$\log_4 256144 = n - 1$

$9 = n - 1$

$10 = n$

20) ~~22)~~ $S = \frac{a}{1-r} = \frac{1/4}{1-(3/5)} = \frac{1/4}{2/5} = \frac{5}{8}$