1. (a) 7
   (b) $\frac{25}{3}$

2.

$$\sum_{k=7}^{1000} \frac{3^{2k+4}}{2^{3k+5}}$$
$$= \frac{3^4}{2^5} \sum_{k=7}^{1000} (\frac{9}{8})^k$$
$$= \frac{3^4}{2^5} \frac{(\frac{9}{8})^{1001} - (\frac{9}{8})^7}{\frac{9}{8} - 1}$$
$$= \frac{3^4}{2^5} \frac{(\frac{9}{8})^{1001} - (\frac{9}{8})^7}{\frac{1}{8}}$$
$$= \frac{3^4 * 8}{2^5}((\frac{9}{8})^{1001} - (\frac{9}{8})^7)$$
$$= \frac{3^4 * 8}{2^5} * (\frac{9}{8})^7((\frac{9}{8})^{994} - 1)$$

3. Given, $a_3 = 5$ and $a_{11} = 87$ Hence,

$$5 = a + 2d$$
$$87 = a + 10d$$
$$\therefore 87 - 5 = 10d - 2d$$
$$\therefore 82 = 8d$$
$$\therefore d = \frac{41}{4}$$
$$\therefore a = \frac{-31}{2}$$

Hence,

$$\sum_{k=3}^{200} a_k = \sum_{k=0}^{200} a_k - \sum_{k=0}^{2} a_k$$
$$= (\frac{200}{2}(2(\frac{-31}{2})) + (200-1)\frac{41}{4})) - (\frac{2}{2}(2(\frac{-31}{2})) + (2-1)\frac{41}{4}))$$

4. We know, for a geometric sequence, the n^{th} term is represented by $a_n = ar^{n-1}$ where a is the first term of the sequence.
Hence,

$$a_3 = ar^2 = 5$$
$$a_{11} = ar^{10} = 87$$
$$\frac{87}{5} = \frac{ar^{10}}{ar^2}$$
$$\frac{87}{5} = r^8$$
$$(\frac{87}{5})^{\frac{1}{8}} = r$$

Hence, common ratio $(r) = (\frac{87}{5})^{\frac{1}{8}}$

5.

$$\sum_{j=5}^{45}(j+1)(j-3) = \sum_{j=1}^{45}(j+1)(j-3) - \sum_{j=1}^{4}(j+1)(j-3)$$
$$\therefore \sum_{j=5}^{45}(j+1)(j-3) = \sum_{j=1}^{45}(j^2-2j-3) - \sum_{j=1}^{4}(j^2-2j-3)$$
$$= (\sum_{j=1}^{45} j^2 - 2\sum_{j=1}^{45} j - 3\sum_{j=5}^{45} 1) - (\sum_{j=1}^{4} j^2 - 2\sum_{j=1}^{4} j - 3\sum_{j=1}^{4} 1)$$
$$= (\frac{45*46*91}{6} - 2\frac{45*46}{2} - 3(45)) - (\frac{4*5*9}{6} - 2\frac{4*5}{2} - 12)$$
$$= \frac{(45*46*91) - (4*5*9)}{6} - 2\frac{(45*46) - (4*5)}{2} - (3(45) - 12)$$

6. (a) $a_n = -3 - 5n$
   $\therefore a_{n+1} = -3 - 5(n+1)$
   $\therefore a_{n+1} = -3 - 5n - 5$
   $\therefore a_{n+1} = -8 - 5n$
   $\therefore a_{n+1} = a_n - 5$
   Hence, the recursive relation for the given sequence is $a_{n+1} = a_n - 5$ with initial value $a_1 = -13$.

(b) $a_n = (-5) * 3^n$
$\therefore a_{n+1} = (-5) * 3^{n+1}$
$\therefore a_{n+1} = (-15) * 3^n$
$\therefore a_{n+1} = 3 * a_n$
Hence, the recursive relation for the given sequence is $a_{n+1} = 3 * a_n$ with initial value $a_1 = -5$.

(c) $a_n = n! * 2^n$
$\therefore a_{n+1} = (n+1)! * 2^{n+1}$
$\therefore a_{n+1} = 2 * (n+1) * n! * 2^n$
$\therefore a_{n+1} = 2 * (n+1)a_n$
Hence, the recursive relation for the given sequence is $a_{n+1} = 2 * (n+1)a_n$ with initial value $a_1 = 2$.