$\boxed{\text{5.1 Sequences}}$ p. 243 # 11-16 all, 19-32 all, 41-75 odd

(11) $a_n = n(-1)^{n-1}$ for $n \geq 0$

(12) $a_n = \frac{n}{(n+1)^2}$ for $n \geq 1$

(13) $a_n = \frac{1}{n} - \frac{1}{n+1}$ for $n \geq 1$

(14) $a_n = \frac{n^2}{3^n}$ for $n \geq 1$

(15) $a_n = (1-\frac{1}{n})(-1)^{n-1}$ for $n \geq 1$

(16) $a_n = 3 \cdot 2^n$ for $n \geq 0$

(19) $\sum_{k=1}^{5} (k+1) = 2+3+4+5+6 = \boxed{20}$

(20) $\prod_{k=2}^{4} k^2 = 4 \cdot 9 \cdot 16 = \boxed{576}$

(21) $\sum_{m=0}^{3} \frac{1}{2^m} = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \boxed{\frac{15}{8}}$

(22) $\prod_{j=0}^{4} (-1)^j = (1)(-1)(1)(-1)(1) = \boxed{1}$

(23) $\sum_{i=1}^{1} i(i+1) = 1(1+1) = \boxed{2}$

(24) $\sum_{j=0}^{0} (j+1) \cdot 2^j = (0+1) \cdot 2^0 = \boxed{1}$

(25) $\prod_{k=2}^{2} \left(1 - \frac{1}{k}\right) = \left(1 - \frac{1}{2}\right) = \boxed{\frac{1}{2}}$

(26) $\sum_{k=-1}^{1} (k^2+3) = 4+3+4 = \boxed{11}$

(27) $\sum_{n=1}^{10} \left(\frac{1}{n} - \frac{1}{n+1}\right) = 1 - \frac{1}{11} = \boxed{\frac{10}{11}}$

$\left(\frac{1}{1} - \cancel{\frac{1}{2}}\right) + \left(\cancel{\frac{1}{2}} - \cancel{\frac{1}{3}}\right) + \left(\cancel{\frac{1}{3}} - \cancel{\frac{1}{4}}\right) + \cdots + \left(\cancel{\frac{1}{10}} - \frac{1}{11}\right)$

(28) $\prod_{i=2}^{5} \frac{i(i+2)}{(i-1)(i+1)} = \frac{\cancel{2 \cdot 4}}{1 \cdot 3} \cdot \frac{\cancel{3 \cdot 5}}{\cancel{2 \cdot 4}} \cdot \frac{\cancel{4 \cdot 6}}{\cancel{3 \cdot 5}} \cdot \frac{5 \cdot 7}{\cancel{4 \cdot 6}} = \boxed{\frac{35}{3}}$

(29) $\sum_{i=1}^{n} (-2)^i = -2^1 + 2^2 - 2^3 + \cdots + (-2)^n$

(30) $\sum_{j=1}^{n} j(j+1) = 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \cdots + n \cdot (n+1)$

(31) $\sum_{k=0}^{n+1} \frac{1}{k!} = \frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \cdots + \frac{1}{(n+1)!}$

(32) $\sum_{i=1}^{k+1} i(i!) = 1 \cdot 1! + 2 \cdot 2! + 3 \cdot 3! + \cdots + (k+1)(k+1)!$

(41) $\sum_{k=1}^{m} \frac{k}{k+1} + \frac{m+1}{m+2} = \sum_{k=1}^{m+1} \frac{k}{k+1}$

(43) $\sum_{i=1}^{7} i^2(-1)^{i+1}$

(45) $\prod_{i=2}^{4} (i^2-1)$

(47) $\sum_{i=0}^{5} (-r)^i$

(49) $\sum_{k=1}^{n} k^3$

(51) $\sum_{k=0}^{n-1} (n-k)$

53 $i = k+1 \qquad k = i-1$

$$\sum_{k=0}^{5} k(k-1) \Rightarrow \sum_{i=1}^{6} (i-1)(i-2)$$

55 $j = i-1 \qquad i = j+1$

$$\sum_{i=1}^{n+1} \frac{(i-1)^2}{i \cdot n} \Rightarrow \sum_{j=0}^{n} \frac{j^2}{n(j+1)}$$

57 $j = i-1 \qquad i = j+1$

$$\sum_{i=1}^{n-1} \frac{i}{(n-i)^2} \Rightarrow \sum_{j=0}^{n-2} \frac{j+1}{(n-j-1)^2}$$

59 $$\sum_{k=1}^{n}(2k-3) + \sum_{k=1}^{n}(4-5k) = \sum_{k=1}^{n}(1-3k)$$

61 $$\left(\prod_{k=1}^{n} \frac{k}{k+1}\right)\left(\prod_{k=1}^{n} \frac{k+1}{k+2}\right) = \prod_{k=1}^{n} \frac{k}{k+2}$$

63 $$\frac{6!}{8!} = \frac{\cancel{6!}}{8 \cdot 7 \cdot \cancel{6!}} = \boxed{\frac{1}{56}}$$

65 $$\frac{n!}{(n-1)!} = \frac{n \cdot \cancel{(n-1)!}}{\cancel{(n-1)!}} = \boxed{n}$$

67 $$\frac{n!}{(n-2)!} = \frac{n \cdot (n-1) \cdot (n-2)!}{(n-2)!} = \boxed{n^2 - n}$$

69 $$\frac{n!}{(n-k)!} = \frac{n(n-1)(n-2)\cdots\cancel{(n-k)!}}{\cancel{(n-k)!}}$$

$$= n(n-1)(n-2)\cdots(n-k+1)$$

$$= \prod_{i=0}^{k-1}(n-i)$$

71 $$\binom{5}{3} = \frac{5!}{3!\,2!} = \frac{5 \cdot 4 \cdot \cancel{3!}}{\cancel{3!} \cdot 2} = \boxed{10}$$

73 $$\binom{3}{0} = \frac{\cancel{3!}}{0!\,\cancel{3!}} = \frac{1}{1} = \boxed{1}$$

75 $$\binom{n}{n-1} = \frac{n!}{(n-1)!(1!)} = \frac{n \cdot \cancel{(n-1)!}}{\cancel{(n-1)!}} = \boxed{n}$$