§1.1: #1(d)
\[ \sum_{j=1}^{n} \frac{2}{j(j+2)} = \frac{2}{1 \cdot 3} + \frac{2}{2 \cdot 4} + \frac{2}{3 \cdot 5} + \ldots + \frac{2}{n(n+2)} \]

#3(b)
\[ 1 + 8 + 27 + 64 + 125 = \sum_{i=1}^{5} 2^3 \]

#12(c)
\[ \prod_{i=p}^{p+n} i = p \cdot (p+1) \cdot (p+2) \ldots (p+n) \]

§1.2: #1
(a) \[ L_{n} + L_{n+2} = 5 \cdot F_{n+1} \]  
(b) \[ F_{n} + L_{n} = 2F_{n+1} \]
(c) \[ F_{n+1} - F_{n} = F_{n-1} \cdot F_{n+2} \]  
(d) \[ F_{n} \cdot L_{n} = F_{2n} \]

#5
(a) \[ \sum_{i=1}^{n} F_{i} = F_{n+2} - 1 \]  
(b) \[ \sum_{i=1}^{n} F_{2i-1} = F_{2n} \]
(c) \[ \sum_{i=1}^{n} F_{2i} = F_{2n+1} - 1 \]  
(d) \[ \sum_{i=1}^{n} (-1)^{i-1} F_{2i-1} = (-1)^{n-1} F_{n} \]
8.1.4:

#5 Proof. When $n=1$, $1^3 = \left(\frac{1 \times 2}{2}\right)^2$; identity holds.

Assume it holds for $n = k$, then we are going to show it also holds for $n = k+1$. Namely:

$$\sum_{i=1}^{k+1} i^3 = \sum_{i=1}^{k} i^3 + (k+1)^3$$

Induction hypothesis:

$$= \left(\frac{k(k+1)}{2}\right)^2 + (k+1)^3.$$ 

$$= \frac{(k+1)^2 \cdot (k^2 + 4k + 4)}{2}$$

$$= \left[\frac{(k+1)(k+2)}{2}\right]^2.$$ 

So the identity holds for $n = k+1$. Hence by principle of induction, we know the identity holds for all positive integer $n$.

#6 Proof. When $n=1$, $3 \mid 2^2 - 1$.

Assume that $3 \mid 2^k - 1$. Then

$$2^{2(k+1)} - 1 = 4 \cdot 2^k - 1 = 3 \cdot 2^k + (2^k - 1)$$

is also divisible by 3. So by induction,

$$3 \mid 2^n - 1$$

for all positive integer $n$. 