Proof. 2.3.4e Prove $24|2(7^n)+3(5^n)-5$. Assume $n=0$.
We have $2(7^0)+3(5^0)-5=0$.
By Theorem 2.2a, $24|0$.
Assume $n=k$ holds.
We have

$$24|2(7^k)+3(5^k)-5 \tag{1}$$

Assume $n=k+1$. We have

$$\begin{aligned}
&2(7^{k+1})+3(5^{k+1})-5\\
=&14(7^k)+15(5^k)-5\\
=&15(7^k)+15(5^k)-5-7^k\\
=&15(2(7^k)+3(5^k)-5)-16(7^k)-30(5^k)+14(5)\\
=&25(2(7^k)+3(5^k)-5)-(36(7^k)+60(5^k)-24(5))\\
=&25(2(7^k)+3(5^k)-5)-12(3(7^k)+5(5^k)-10)
\end{aligned}$$

$(1) \implies 24|25(2(7^k)+3(5^k)-5)$.
$12|-12$ and $2|3(7^k)+5(5^k)-10 \implies 24|-12(3(7^k)+5(5^k)-10)$ by Theorem 2.2c. (2)
We can represent $3(7^k)$ as $2a+1$ for some $a \in \mathbb{Z}\,\forall k \geq -1$.
We can represent $5(5^k)$ as $2b+1$ for some $b \in \mathbb{Z}\,\forall k \geq -1$.
We now have

$$\begin{aligned}
&2a+1+2b+1-10\\
=&2a+2b-8\\
=&2(a+b-4)
\end{aligned}$$

It is clear that $2|2(a+b-4) \implies 2|3(7^k)+5(5^k)-10$.
Therefore by Theorem 2.2g and (2), we know $24|2(7^{k+1})+3(5^{k+1})-5$.
By FPMI we see $24|2(7^{k+1})+3(5^{k+1})-5 \implies 24|2(7^n)+3(5^n)-5\,\forall\, n \geq 0$. $\square$