We are given that

$$f(x) = \begin{cases} \frac{xh}{p} & \text{for } 0 \le x \le p \\ \frac{h(\pi - x)}{\pi - p} & \text{for } p \le x \le \pi \end{cases}$$

From the formula for the Fourier sine coefficients, we have

$$\begin{aligned} A_m &= \frac{2}{\pi} \int_0^\pi f(x) \sin mx \; dx \\ &= \frac{2}{\pi} \int_0^p \frac{xh}{p} \sin mx \; dx + \frac{2}{\pi} \int_p^\pi \frac{h(\pi - x)}{\pi - p} \sin mx \; dx, \end{aligned}$$

where we use the fact that $f(x)$ is piecewise. By algebra,

$$A_m = \frac{2h}{\pi p} \int_0^p x \sin mx \; dx + \frac{2h}{(\pi - p)} \int_p^\pi \sin mx \; dx - \frac{2h}{\pi(\pi - p)} \int_p^\pi x \sin mx \; dx \tag{1}$$

Integrating,

$$\begin{aligned} \int_p^\pi \sin mx \; dx &= -\frac{1}{m} \left[\cos mx\right]_p^\pi \\ &= \frac{1}{m} \cos mp - \frac{1}{m} \cos \pi m. \end{aligned}$$

Letting $a, b \in \mathbb{R}$ and integrating by parts,

$$\begin{aligned} \int_a^b x \sin mx \; dx &= \left[x \int \sin mx \; dx\right]_a^b - \int_a^b \frac{dx}{dx} \int \sin mx \; dx \; dx \\ &= -\frac{1}{m} \left[x \cos mx\right]_a^b + \frac{1}{m} \int_a^b \cos mx \; dx \\ &= -\frac{1}{m} \left[x \cos mx\right]_a^b + \frac{1}{m^2} \left[x \sin mx\right]_a^b \\ &= \frac{1}{m} \left(a \cos ma - b \cos mb\right) + \frac{1}{m^2} \left(\sin mb - \sin ma\right). \end{aligned}$$

Substituting for a and b,

$$\begin{aligned} \int_0^p x \sin mx \; dx &= -\frac{p}{m} \cos mp + \frac{1}{m^2} \sin mp \\ \int_p^\pi x \sin mx \; dx &= \frac{p}{m} \cos mp - \frac{\pi}{m} \cos m\pi - \frac{1}{m^2} \sin mp. \end{aligned}$$

Substituting into (1),

$$\frac{m}{2h} A_m = -\frac{1}{\pi} \cos mp + \frac{1}{\pi mp} \sin mp$$

$$
\begin{aligned}
&+\frac{1}{(\pi-p)}\cos mp-\frac{1}{(\pi-p)}\cos \pi m\\
&-\frac{p}{\pi(\pi-p)}\cos mp+\frac{1}{(\pi-p)}\cos m\pi+\frac{1}{\pi m(\pi-p)}\sin mp\\
=&-\frac{1}{\pi}\cos mp+\frac{1}{(\pi-p)}\cos mp-\frac{p}{\pi(\pi-p)}\cos mp\\
&+\frac{1}{\pi mp}\sin mp+\frac{1}{\pi m(\pi-p)}\sin mp\\
=&\left(\frac{1}{\pi-p}-\frac{1}{\pi}-\frac{p}{\pi(\pi-p)}\right)\cos mp+\left(\frac{1}{\pi mp}+\frac{1}{\pi m(\pi-p)}\right)\sin mp.
\end{aligned}
$$

Observe that

$$\frac{1}{\pi-p}-\frac{1}{\pi}-\frac{p}{\pi(\pi-p)}=\frac{\pi-\pi+p-p}{\pi(\pi-p)}=0$$

and

$$\frac{1}{\pi mp}+\frac{1}{\pi m(\pi-p)}=\frac{\pi-p+p}{\pi mp(\pi-p)}=\frac{1}{mp(\pi-p)},$$

so

$$A_m=\frac{2h}{m^2}\frac{\sin mp}{p(\pi-p)}$$

as desired.

For $0<h$, $0<p<\pi$, we have $A_m=0$ iff $\sin mp=0$. When $p=\pi/2$, $\sin m\pi/2=0$ for $m=2,4,\ldots$, so the second, fourth, and so on, harmonics are missing. Similarly, when $p=\pi/3$, $\sin m\pi/3=0$ for $m=3,6,\ldots$, so the third, sixth, and so on, harmonics are missing.