Solution to 12.13.3.58

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Question: If $\Pr(A) = \frac{3}{10}, \Pr(B) = \frac{2}{5}$ and $\Pr(A + B) = \frac{3}{5}$, then $\Pr(B|A) + \Pr(A|B)$ equals

1) $\frac{1}{4}$
2) $\frac{1}{3}$
3) $\frac{5}{12}$
4) $\frac{7}{12}$

Solution:

$$\Pr(AB) = \Pr(A) + \Pr(B) - \Pr(A + B) \tag{1}$$
$$= \frac{3}{10} + \frac{2}{5} - \frac{3}{5} \tag{2}$$
$$= \frac{1}{10} \tag{3}$$

$$\Pr(B|A) = \frac{\Pr(AB)}{\Pr(A)} \tag{4}$$
$$= \frac{\frac{1}{10}}{\frac{3}{10}} \tag{5}$$
$$= \frac{1}{3} \tag{6}$$

$$\Pr(A|B) = \frac{\Pr(AB)}{\Pr(B)} \tag{7}$$
$$= \frac{\frac{1}{10}}{\frac{2}{5}} \tag{8}$$
$$= \frac{1}{4} \tag{9}$$

$$\Pr(B|A) + \Pr(A|B) = \frac{1}{3} + \frac{1}{4} \tag{10}$$
$$= \frac{7}{12} \tag{11}$$