Épreuve de section européenne

The Powerball lottery

You work for the company that runs the Powerball lottery. Powerball is a lottery game in which you have two drums. The first one contains five white balls among a total of 53 balls and another one containing one red ball among 42 balls. Five balls are chosen from the first drum and one ball is chosen from the second drum, one ball after the other. To win the jackpot, a player must match all five white balls and the red ball. Other winners and their prizes are also shown in the table below. The overall probability of winning a prize in the Powerball lottery is nearly 1/36.

In answering the question, assume only one ticket is purchased.

Powerball Winners and Prizes

Match	Prize	Approximate Probability (2 Dp)
5 white, 1 red	Jackpot	8.3×10^{-9}
5 white	\$100,000	3.4×10^{-7}
4 white, 1 red	\$5,000	1.99×10^{-6}
4 white	\$100	8.16×10^{-5}
3 white, 1 red	\$100	9.36×10^{-5}
3 white	\$7	3.83×10^{-3}
2 white, 1 red	\$7	1.43×10^{-3}
1 white, 1 red	\$4	8.06×10^{-3}
1 red	\$3	1.43×10^{-2}
Other	\$0	?

adapted from Elementary Statistics picturing the world Larson and Farber

Questions

1) Find out all the possible events in this lottery. Which are the other events given in the table with price \$0 ?

2) a) Check that the overall probability of winning a prize in the Powerball lottery is near 1/36.
b) Deduce the missing value noted by "?" in the table

3) Working in the public relations department, you receive the following e-mail.

> *"You list the probability of matching only the red ball as* 1/70. *I know from my statistics class that the probability of winning is the ratio of the number of successful outcomes to the total number of outcomes. Could you please explain why the probability of matching only the red ball is 1/70 and not 1/42 ?"*

a) Explain the sentence *"the probability of winning … number of outcomes" ?*
b) Explain why the email tells that it might be 1/42 to find the red ball and the misdirection in this case.