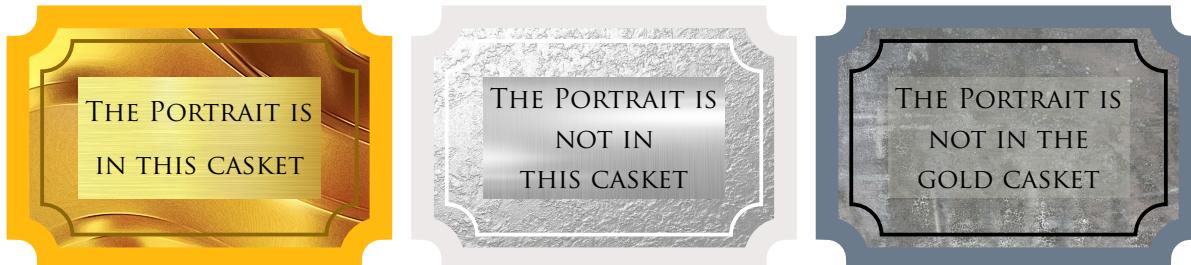


Here are the full, or partial solutions.

Year 8 and below

In Shakespeare's 'Merchant of Venice', Portia had three caskets - lead, silver and gold - inside one of which was Portia's portrait. Raymond Smullyan used this idea to write a series of logic puzzles, two of which you see here. To win the prize (one minute in the Total Perspective Vortex) you must say which casket holds the portrait. Portia tells you that, of the three statements on the caskets, at most one is true. Portia is truthful.



Solution

We start off with the assumption that the question is correct, Portia is truthful, and therefore, it is true that exactly one of the statements is true, or, they are all false.

We then proceed by cases: we look at each possibility in turn. We eliminate the possibilities that give rise to impossible situations.

Case 1: All statements are false

Gold: The statement on this casket is false: the portrait is not in the gold casket.

Silver: The statement is false: the portrait is in this casket.

Lead: The statement is false: the portrait is in the gold casket.

We have an inconsistency, this line of reasoning tells us the portrait is in two caskets at the same time, so we reject Case 1.

Case 2: The statement on the gold casket is true

Gold: The statement is true: the portrait is in the gold casket.

Silver: The statement is false: the portrait is in the silver casket.

Lead: The statement is false: the portrait is in gold casket.

Again we have an inconsistency, we have found the portrait is in the silver and gold caskets at the same time, so we reject Case 1.

Case 3: The statement on the silver casket is true

Gold: The statement is false: the portrait is not in the gold casket.

Silver: The statement is true: the portrait is not in the silver casket.

Lead: The statement is false: the portrait is in the gold casket.

Once again, our assumption has led to a contradiction, here the portrait is simultaneously in, and not in, the gold casket.

Case 4: The statement on the lead casket is true

Gold: The statement is false: the portrait is not in the gold casket.

Silver: The statement is false: the portrait is in the silver casket.

Lead: The statement is true: the portrait is not in the gold casket.

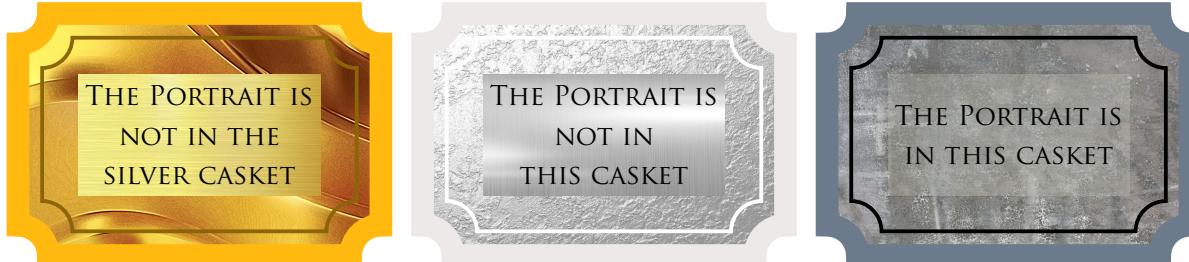
This time, we did not arrive at a logical impossibility, so, the portrait is in the silver casket.

We have looked at a methodical path to our solution. We could also have noticed that the statements on the gold casket and the lead casket say the opposite, so one of them must be true. Since at most, one of the statements is true, the statement on the silver casket must be false. Therefore the portrait is in the silver casket.

Year 9 and above

Please read the introduction above, and try the first puzzle.

This time Portia explains to you that at least one of the three statements is true and that at least one of the three statements is false. Portia is truthful. Which casket holds the portrait?



Solution

We could proceed by cases - taking each statement as true in turn - as in the solution to the first puzzle. To illustrate a different approach, we are going to proceed by cases but assume the portrait is in each casket in turn, and see what that leads to.

Case 1: The portrait is in the gold casket

The gold and silver statements are true. The lead statement is false. No inconsistencies, but let's check the other two cases anyway.

Case 2: The portrait is in the silver casket

The gold, silver and lead statements are all false, but this contradicts what Portia told you, that at least one statement must be true.

Case 3: The portrait is in the lead casket

The gold, silver and lead statements are all true, again, this contradicts what Portia told you.

So the first case is correct, the portrait is in the gold casket.