



<b>Skill:</b> Conditional Probability and Venn Diagrams
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**Questions**

Attempt these questions independently showing full and clear solutions. Check each answer as you go.

1. A group of 80 people were tested for having one of three attributes: blue eyes, blonde hair and wearing glasses. The results are as follows:
  - 30 people wore glasses
  - 33 people had blue eyes
  - 40 people had blonde hair
  - 15 had blue eyes and blonde hair
  - 10 people had blue eyes and wore glasses
  - 17 people wore glasses and had blonde hair
  - 7 people had all three attributes
  - a. Represent this information on a Venn diagram.
  - b. A person was selected at random from the group. Determine the probability that this person:
    - i. Had blue eyes, given that they wore glasses.
    - ii. Had blue eyes, given that they didn't have blonde hair.
    - iii. Didn't wear glasses, given that they didn't have blue eyes.
    - iv. Had none of the three attributes, given that they weren't blonde.
    - v. Had all three attributes given that they wore glasses and had blue eyes.
    - vi. Had exactly one of the three attributes given that they were blonde.

2. Given that  $P(A) = 0.3, P(B) = 0.45$  and  $P(A \cap B) = 0.24$ :
  - a. Construct a Venn diagram representing these probabilities.
  - b. Calculate the following probabilities:
 

i. $P(A B)$	ii. $P(A B')$
iii. $P(B' A)$	iv. $P(A' B')$
  - c. Determine whether the events  $A$  and  $B$  are independent.

3. It is given that, for two events  $A$  and  $B$ :

$$P(A|B) = 0.4 \quad P(B) = 0.25 \quad P(A) = \frac{1}{3}$$

Calculate the following probabilities (*you may find a Venn diagram useful*).

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|------------------|----------------------|
| i. $P(A \cap B)$ | ii. $P(B A)$         |
| iii. $P(B A')$   | iv. $P(A \cup B A')$ |

4.  $X$  and  $Y$  are two events such that  $P(X|Y) = \frac{1}{2}$  and  $P(Y|X) = \frac{2}{3}$  and  $P(X \cup Y) = 0.9$ .
  - a. Use this information to calculate the following probabilities:
 

i. $P(X \cap Y)$	ii. $P(Y)$
iii. $P(X' Y)$	iv. $P(X Y')$
  - b. Determine whether the events  $X$  and  $Y$  are independent.
  - c. State how you know the events  $X$  and  $Y$  are not mutually exclusive.