Sebastian Bicen 5d

Due Tues 4th February

Conditional Probability
Ex 2A Q6-12
Ex 2C All questions

0

Add comment

Sebastian Bicen 7d

Due Tues 4th February

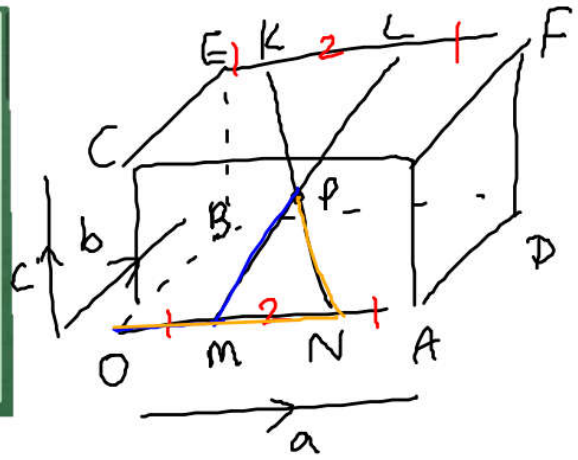
Pure Paper E - we can't yet do Q10, 11, 14

0

1 comment

Sebastian Bicen 1d
We also cannot do Q8

Add comment



$\overrightarrow{OP} = \overrightarrow{Om} + \overrightarrow{mP}$

$= \frac{1}{4}\underline{a} + \lambda\overrightarrow{mL}$

$= \frac{1}{4}\underline{a} + \lambda(\frac{1}{2}\underline{a} + \underline{b} + \underline{c})$

$\overrightarrow{mL} = -\frac{1}{4}\underline{a} + \underline{b} + \underline{c} + \frac{3}{4}\underline{a}$

$= \frac{1}{2}\underline{a} + \underline{b} + \underline{c}$

$\overrightarrow{OP} = \overrightarrow{ON} + \overrightarrow{NP}$

$= \frac{3}{4}\underline{a} + \mu\overrightarrow{NK}$

$= \frac{3}{4}\underline{a} + \mu(-\frac{1}{2}\underline{a} + \underline{b} + \underline{c})$

$\overrightarrow{NK} = -\frac{3}{4}\underline{a} + \underline{b} + \underline{c} + \frac{1}{4}\underline{a}$

$= -\frac{1}{2}\underline{a} + \underline{b} + \underline{c}$

b

$\mu = \lambda$

a

$\frac{1}{4} + \frac{1}{2}\lambda = \frac{3}{4} - \frac{1}{2}\mu$

$\frac{1}{4} + \frac{1}{2}\mu = \frac{3}{4} - \frac{1}{2}\mu$

$\mu = \frac{3}{4} - \frac{1}{4}$ $\mu = \frac{1}{2}$, $\lambda = \frac{1}{2}$

(Q4) $x = \sec 4y$

$\frac{dx}{dy} \frac{dy}{dx} = 4 \sec 4y \tan 4y$

$\frac{dy}{dx} = \frac{1}{4 \sec 4y \tan 4y}$

$= \frac{1}{4x \tan 4y}$

$x^2 = \sec^2 4y$

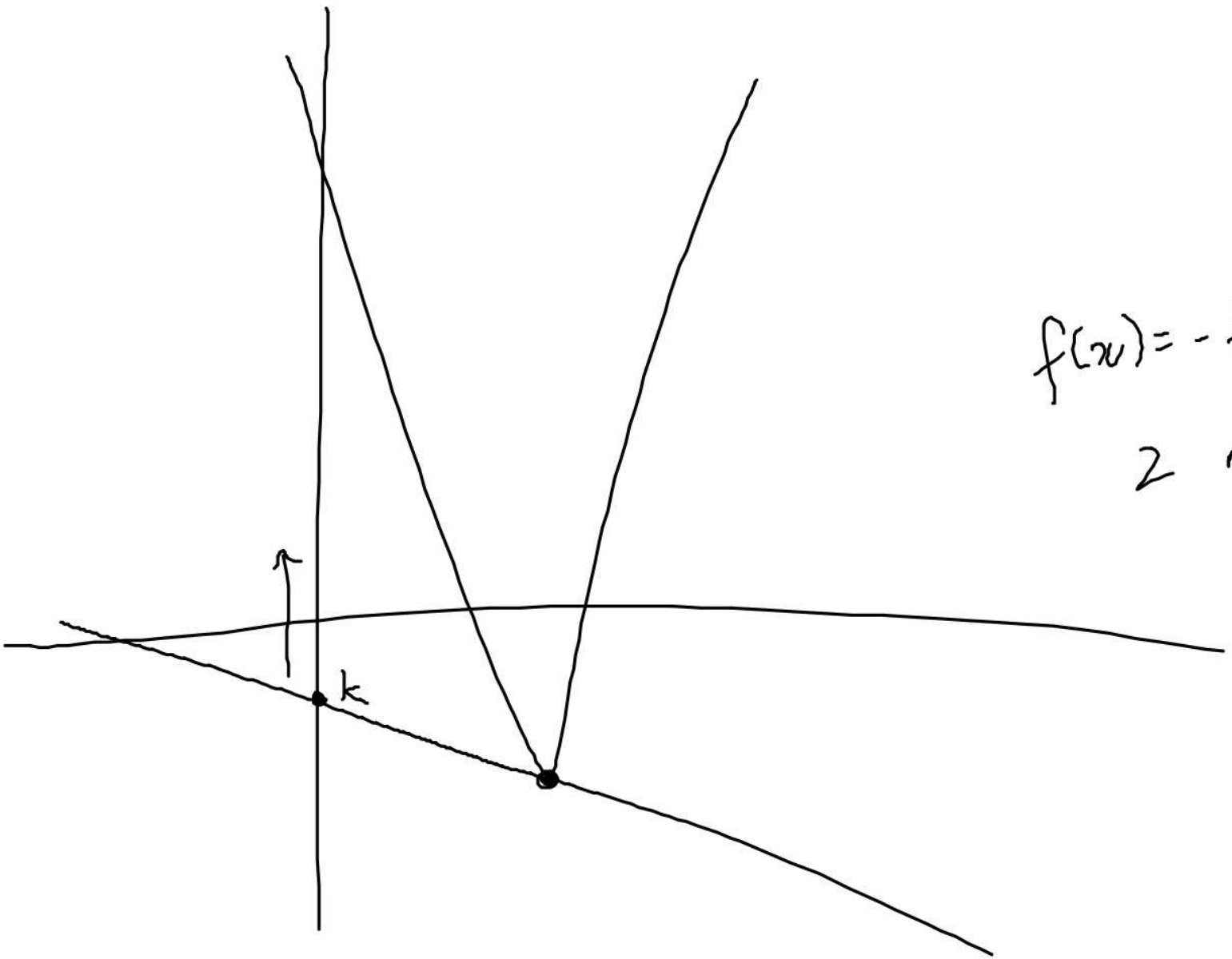
$x^2 = 1 + \tan^2 4y$

$\sqrt{x^2 - 1} = \tan 4y$

$\frac{dy}{dx} = \frac{k}{x\sqrt{x^2-1}}$

$\frac{dy}{dx} = \frac{1}{4x\sqrt{x^2-1}}$

$\frac{dy}{dx} = \frac{1/4}{x\sqrt{x^2-1}}$



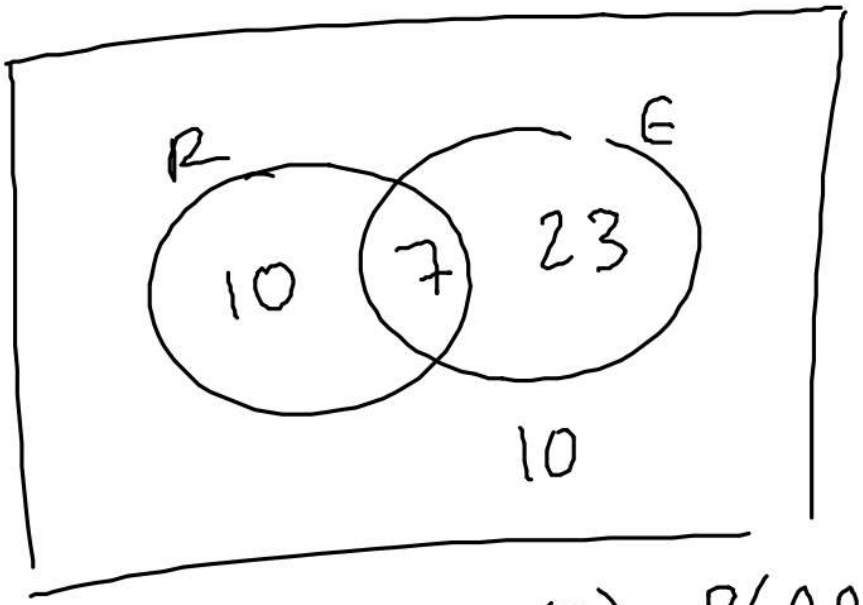
$f(x) = -\frac{1}{3}x + k$.

2 roots

Ex 2A
Q8)

"R" is Red
"E" is even

$n(R) = 17$
$n(E) = 30$
$n(R \cup E) = 40$



$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

9) $P(A) = 0.55$

$P(B) = 0.35$

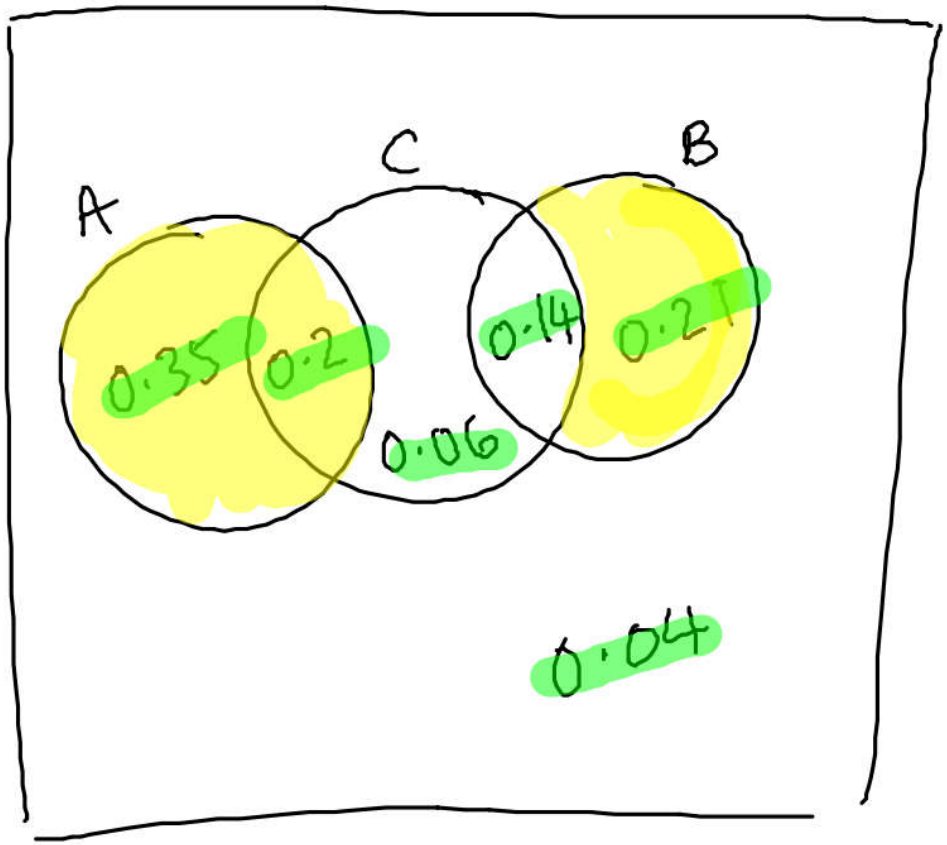
$P(C) = 0.4$

$P(A \cap C) = 0.2$

$P(A \cap B) = 0$

$P(B \cap C) = 0.35 \times 0.4$

$= 0.14$



$P(A' \cap B') = 0.1$

$= \phi = 0$

$P(A \cup (B \cap C')) = 0.76$

$P((A \cap C)' \cup B') = 1$

Your Turn

The events E and F are such that

$$P(E) = 0.28 \quad P(E \cup F) = 0.76 \qquad P(E \cap F') = 0.11$$

Find

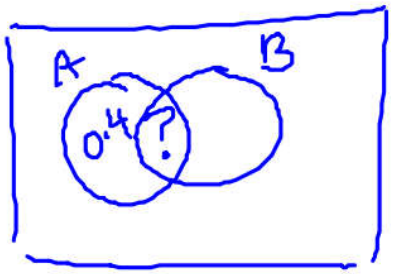
a) $P(E \cap F) =$

b) $P(F) =$

c) $P(E'|F') =$

(Drawing a Venn diagram is often helpful!)

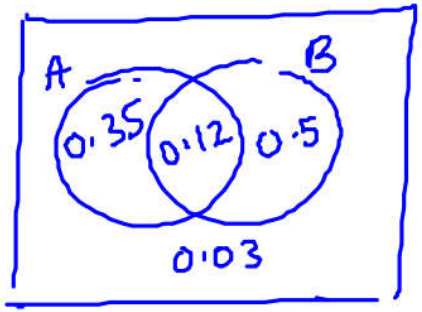
More Practice...



1 $P(A \cap B') = 0.4, P(A \cup B) = 0.75$

Then:

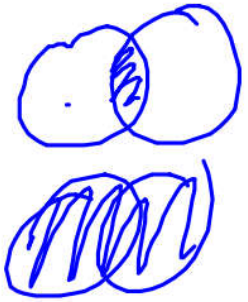
$$P(B) = \mathbf{0.35}$$
$$P(A' \cap B') = \mathbf{0.25}$$



2 $P(A) = 0.47$ and $P(A \cap B) = 0.12$ and $P(A' \cap B') = 0.03$

Then:

$$P(A|B') = \frac{\boldsymbol{P(A \cap B')}}{\boldsymbol{P(B')}} = \frac{\mathbf{0.35}}{\mathbf{0.38}} = \frac{\mathbf{35}}{\mathbf{38}}$$



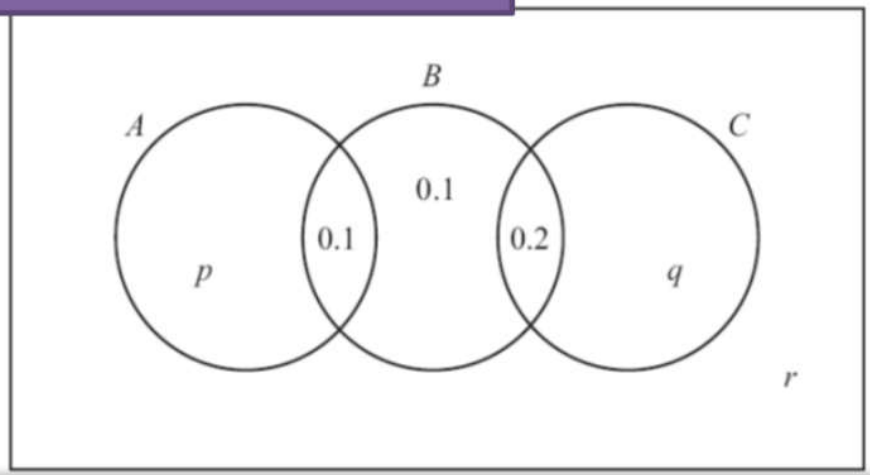
3 $P(A') = 0.7, P(B') = 0.2, P(A \cap B') = 0.1$

Then:

$$P(A \cup B') = \boldsymbol{P(A) + P(B') - P(A \cap B')}$$
$$= \mathbf{0.3 + 0.2 - 0.1}$$
$$= \mathbf{0.4}$$

$$P(B|A') = \frac{\boldsymbol{P(A' \cap B)}}{\boldsymbol{P(A')}} = \frac{\mathbf{0.6}}{\mathbf{0.7}} = \frac{\mathbf{6}}{\mathbf{7}}$$

May 2013 (R) Q6



The Venn diagram in Figure 1 shows three events A, B and C and the probabilities associated with each region of B. The constants p, q and r each represent probabilities associated with the three separate regions outside B.

The events A and B are independent.

we did (a) earlier

(a) Find the value of p. **(3)**

Given that $P(B|C) = \frac{5}{11}$,

(b) find the value of q and the value of r (4)

(c) Find $P(A \cup C|B)$ (2)

(a) **(From earlier)**

$$0.1 = (p + 0.1) \times 0.4$$
$$p + 0.1 = 0.25$$
$$p = 0.15$$

(b) $P(B|C) = \frac{P(B \cap C)}{P(C)}$

$$\frac{5}{11} = \frac{0.2}{0.2 + q}$$
$$q = 0.24$$
$$r = 1 - 0.15 - 0.1 - 0.1 - 0.2 - 0.24$$
$$= 0.21$$

(c) $P(A \cup C|B) = \frac{P((A \cup C) \cap B)}{P(B)}$

$$= \frac{0.1 + 0.2}{0.4} = 0.75$$

Ex 2C

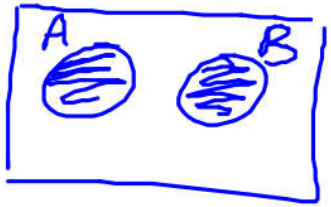
Full Laws of Probability

If events A and B are <u>independent</u>.

$$P(A \cap B) = P(A) \times P(B)$$
$$P(A|B) = P(A)$$

If events A and B are <u>mutually exclusive</u>:

$$P(A \cap B) = 0$$
$$P(A \cup B) = P(A) + P(B)$$



In general:

We first encountered this in the previous section.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

This is known as the **<u>Addition Law</u>.** **Informal Proof**: If we added the probabilities in the A and B sets in the Venn Diagram, we'd be double counting the intersection, so subtract so that it's only counted once.

IMPORTANT TIPS

If I were to identify two tips that will possibly help you the most in probability questions:

If you see the words '**given that**', Immediately write out the law for conditional probability.

Example: "Given Bob walks to school, find the probability that he's not late..."

First thing you should write: $P(L'|W) = \frac{P(L' \cap W)}{P(W)}$

If you see the words '**are independent**', Immediately write out the laws for independence.
(Even before you've finished reading the question!)

Example: "A is independent from B..."

First thing you should write: $P(A) \times P(B) = P(A \cap B)$

$P(A|B) = P(A)$ or $P(B|A) = P(B)$

If you're stuck on a question where you have to find a probability given others, it's probably because you've failed to take into account that two events are independent or mutually exclusive, or you need to use the conditional probability or additional law.

Edexcel S1

6. Explain what you understand by

(a) a sample space, **(1)**

(b) an event. **(1)**

Two events A and B are independent, such that $P(A) = \frac{1}{3}$ and $P(B) = \frac{1}{4}$

Find

(c) $P(A \cap B)$, **(1)**

(d) $P(A \mid B)$, **(2)**

(e) $P(A \cup B)$. **(2)**

eg.

	H	T
1	1H	1T
2	2H	2T
3	3H	3T
4	4H	4T

a) The set of **all** outcomes.

b) A set of one or more outcomes (that is a subset of the sample space).

c) $P(A \cap B) = P(A) \times P(B)$

$= \frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$

d) $P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{1/12}{1/4} = \frac{1}{3}$

$P(A|B) = P(A) = \frac{1}{3}$.

e) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{1}{3} + \frac{1}{4} - \frac{1}{12} = \frac{1}{2}$

C and D are two events such that $P(C) = 0.2$, $P(D) = 0.6$ and $P(C|D) = 0.3$. Find:

a. $P(C \cap D)$ b. $P(D|C)$ c. $P(C \cup D)$

$P(C \cap D)$ a) $P(C|D) = \frac{P(C \cap D)}{P(D)}$

$P(C|D) \times P(D) = P(C \cap D)$

$0.3 \times 0.6 = P(C \cap D)$

$0.18 = P(C \cap D)$.

b) $P(D|C) = \frac{P(C \cap D)}{0.2}$

$= \frac{0.18}{0.2}$

$= 0.9$.

c) $P(C \cup D) = P(C) + P(D) - P(C \cap D)$

$= 0.2 + 0.6 - 0.18$

$= 0.62$.

10. [Jan 2012 Q2] (a) State in words the relationship between two events R and S when $P(R \cap S) = 0$. **(1)**

R and S are mutually exclusive.

The events A and B are independent with $P(A) = \frac{1}{4}$ and $P(A \cup B) = \frac{2}{3}$. Find

(b) $P(B)$, **(4)**

(c) $P(A' \cap B)$, **(2)**

(d) $P(B' | A)$. **(2)**

$P(A \cap B) = P(A) \times P(B)$

$P(A|B) = P(A)$

$P(B) = x$

$P(A) \times P(B)$

b) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

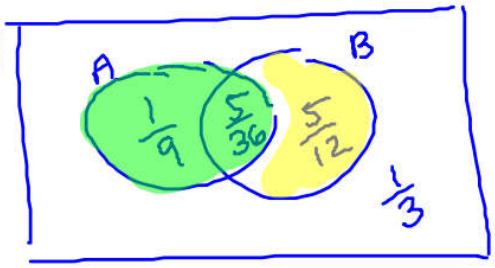
$\frac{2}{3} = \frac{1}{4} + x - \frac{1}{4}x$

$\frac{2}{3} - \frac{1}{4} = \frac{3}{4}x$

$\frac{5}{12} = \frac{3}{4}x$

$x = \frac{5}{9}$ $P(B) = \frac{5}{9}$

c)



$P(A \cap B) = \frac{1}{4} \times \frac{5}{9} = \frac{5}{36}$

$P(A' \cap B) = \frac{5}{12}$

$P(A' \cap B) = P(A') \times P(B) = \frac{3}{4} \times \frac{5}{9} = \frac{5}{12}$

d) $P(B'|A) = \frac{1/9}{1/4} = \frac{4}{9}$

$P(B'|A) = P(B') = \frac{4}{9}$

$P(B'|A) = \frac{P(B' \cap A)}{P(A)} = \frac{1/9}{1/4} = \frac{4}{9}$

Edexcel S1

Your Turn

9. Three events A, B and C are defined in the sample space S. The events A and B are mutually exclusive and A and C are independent.

(a) Draw a Venn diagram to illustrate the relationships between the 3 events and the sample space. **(3)**

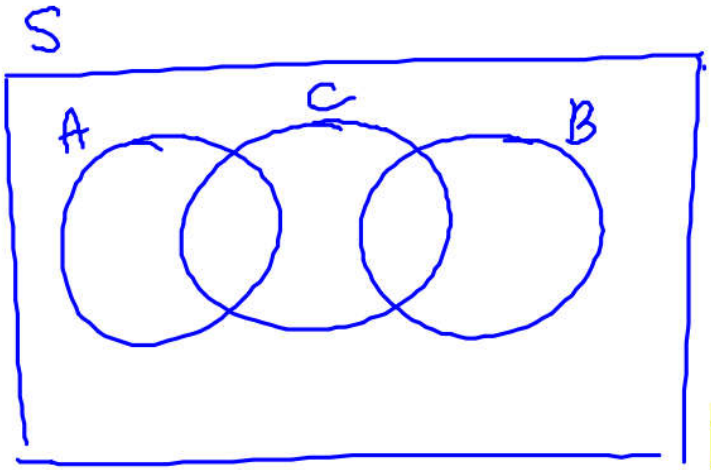
Given that $P(A) = 0.2$, $P(B) = 0.4$ and $P(A \cup C) = 0.7$, find

(b) $P(A \mid C)$, **(2)**

(c) $P(A \cup B)$, **(2)**

(d) $P(C)$. **(4)**

a)



Ex 2D
All questions

b) A and C are independent.

$P(A \cap C) = P(A) \times P(C)$

$P(A \mid C) = P(A)$

$P(A \mid C) = 0.2$.

c) $P(A \cup B) = P(A) + P(B)$

$= 0.2 + 0.4 = 0.6$

d) $P(A \cup C) = P(A) + P(C) - P(A \cap C)$

$0.7 = 0.2 + x - 0.2x$

$0.5 = 0.8x$

$x = \frac{5}{8} = P(C)$.