4 Keith, Yasmin and Suzie are friends who often go to a jazz club on a Friday night. The probability that Keith goes to the club on a particular Friday is 0.7 and is independent of whether or not Yasmin and Suzie go.

The probability that Yasmin goes to the club is 0.8 if Keith goes and 0.6 if Keith does not go.

The probability that Suzie goes to the club:
is 0.9 if both Keith and Yasmin go;
is 0.65 if Keith goes but Yasmin does not;
is 0.55 if Yasmin goes but Keith does not;
is 0.4 if neither Keith nor Yasmin go.

By drawing a tree diagram, or otherwise, find the probability that on a particular Friday:

(a) all three friends go to the club; *(3 marks)*

(b) Keith goes to the club but Yasmin and Suzie do not; *(2 marks)*

(c) Yasmin and Suzie go to the club but Keith does not; *(2 marks)*

(d) Suzie goes to the club. *(3 marks)*

Question Number and part	Solution	Marks	Total	Comments
4(a)	$0.7 \times 0.8 \times 0.9 = 0.504$	M1		Allow small slip
		m1		Completely correct method
		A1	3	0.504 cao, acf
(b)	$0.7 \times 0.2 \times 0.35 = 0.049$	M1		
		A1	2	0.049 cao, acf
(c)	$0.3 \times 0.6 \times 0.55 = 0.099$	M1		
		A1	2	0.099 cao, acf
(d)	$0.7 \times 0.8 \times 0.9 + 0.7 \times 0.2 \times 0.65 +$	M1		Sum of 4 probabilities, at least one correct
	$0.3 \times 0.6 \times 0.55 + 0.3 \times 0.4 \times 0.4 = 0.742$	m1		Completely correct method – allow one small slip
		A1	3	0.1742 cao, acf
	Total		**10**	

3 A rugby club has three categories of membership: adult, social and junior. The number of members in each category, classified by gender, is shown in the table below.

	Adult	**Social**	**Junior**
Female	25	35	40
Male	95	25	80

One member is chosen, at random, to cut the ribbon at the opening of the new clubhouse.

(a) Find the probability that:

(i) a female member is chosen;

(ii) a junior member is chosen;

(iii) a junior member is chosen, given that a female member is chosen. *(4 marks)*

(b) V denotes the event that a female member is chosen.
W denotes the event that an adult member is chosen.
X denotes the event that a junior member is chosen.

For the events V, W and X:

(i) write down two which are mutually exclusive; *(1 mark)*

(ii) find two which are neither mutually exclusive nor independent. Justify your answer. *(3 marks)*

3(a)(i)	$\frac{1}{3}$ (0.33 or better)	M1		Method
(ii)	0.4	M1		Method
(iii)	0.4	M1 A1	4	Clearly incorrect method M0 A1 all answers acf
(b)(i)	W,X	B1	1	W,X
(ii)	V,W Not mutually exclusive – same member may be female and adult Not independent $P(V \mid W) = \frac{5}{24}$ $\neq P(V)(\frac{1}{3})$	B1 E1 E1	3	V,W Reason not mutually exclusive – can be obtained for V, X $P(V \mid W) \neq P(V)$
	Total		**8**	

1 A random sample of 170 students aged between 16 and 21 years was asked their opinions regarding the level of the student loan available to students in higher education.

They were asked to comment on whether they felt the level of the loan was too low, about right or too high.

The following table summarises their replies.

Reply / Age of student	Too low	About right	Too high
16 – 17 years	45	17	8
18 – 21 years	40	35	25

A student is chosen at random.

B is the event "the student is aged 16 – 17 years".
C is the event "the student replied about right".
D is the event "the student replied too high".

(a) Find:

(i) $P(C)$; *(2 marks)*

(ii) $P(B \cap D)$; *(1 mark)*

(iii) $P(C \cup B)$; *(2 marks)*

(iv) $P(D \mid B)$. *(3 marks)*

(b) Define in words the event $B \cup D$. *(2 marks)*

Question Number and Part	Solution	Marks	Total Marks	Comments
1(a) (i)	$\frac{52}{170} = \frac{26}{85}$ (0.306 or 30.6%)	M1 A1	 2	For attempt to total for C
(ii)	$\frac{8}{170} = \frac{4}{85}$ (0.0471 or 4.71%)	B1	1	For attempt to sum relevant frequencies 45 + 17 + 8 + 35
(iii)	$\frac{105}{170} = \frac{21}{34}$ (0.618 or 61.8%)	M1 A1	 2	
(iv)	$\frac{8}{70} = \frac{4}{35}$ (0.114 or 11.4%)	M1 M1 A1	 3	For use of 70 For use of 8
(b)	The student is either aged 16 – 17 years or replied "too high" or both	B1 B1	 2	For 16 –17 years and "too high" For including "or both"
	Total		**10**	

6. The following shows the results of a survey on the types of exercise taken by a group of 100 people.

65 run
48 swim
60 cycle
40 run and swim
30 swim and cycle
35 run and cycle
25 do all three

(a) Draw a Venn Diagram to represent these data. **(4)**

Find the probability that a randomly selected person from the survey

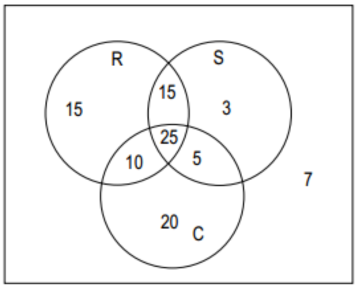
(b) takes none of these types of exercise, **(2)**

(c) swims but does not run, **(2)**

(d) takes at least two of these types of exercise. **(2)**

Jason is one of the above group.
Given that Jason runs,

(e) find the probability that he swims but does not cycle. **(3)**

Question Number	Scheme	Marks
6 (a)	 3 closed curves and 25 in correct place 15,10,5 15,3,20 Labels R, S, C and box	M1 A1 A1 B1
	All values/100 or equivalent fractions award accuracy marks.	(4)
(b)	7/100 or 0.07 — M1 for ('their 7' in diagram or here)/100	M1 A1 (2)
(c)	(3+5)/100 = 2/25 or 0.08	M1A1 (2)
(d)	(25+15+10+5)/100 = 11/20 or 0.55	M1 A1 (2)
(e)	$\mathrm{P}(S \cap C' \mid R) = \dfrac{P(S \cap C' \cap R)}{P(R)}$ Require denominator to be 'their 65' or 'their $\dfrac{65}{100}$'	M1
	$= \dfrac{15}{65}$ require 'their 15' and correct denominator of 65	A1
	$= \dfrac{3}{13}$ or exact equivalents.	A1 (3)
		Total 13

2 A factory has three machines A, B and C that wrap biscuits into multi-packs. Machine A wraps 40% of the multi-packs output, machine B wraps 25% and machine C wraps 35%.

It has been established that 5% of the multi-packs wrapped by machine A are faulty, 10% from machine B are faulty and 2% from machine C are faulty.

(a) Find the probability that a multi-pack, selected at random from all those wrapped,

(i) was wrapped by machine B and is faulty, *(1 mark)*

(ii) was wrapped by machine A and is not faulty, *(2 marks)*

(iii) is faulty. *(2 marks)*

(b) A multi-pack is selected at random from all those wrapped and is found to be faulty. Find the probability that it

(i) was wrapped by machine B, *(2 marks)*

(ii) was not wrapped by machine C. *(2 marks)*

(c) Given that a randomly selected multi-pack is not faulty, find the probability that it was wrapped by machine A. *(2 marks)*

Question	Solution	Marks	Total	Comments
2 (a)(i)	P(B and faulty) $= 0.25 \times 0.10$			
	$P(B) \times P(\text{faulty} \mid B)$ $= 0.025$ or $\frac{1}{40}$	B1	**(1)**	
(ii)	P(A and not faulty) $= 0.4 \times 0.95$	M1		
	$P(A) \times (1 - P(\text{faulty} \mid A)$ $= 0.38$ or $\frac{19}{50}$	A1	**(2)**	
(iii)	$P(A) \times P(\text{faulty} \mid A) + \text{ans (i)}$ $+ P(C) \times P(\text{faulty} \mid C)$	M1		for considering A, B, C faulty and adding
	$= (0.4 \times 0.05) + 0.025 + (1.35 \times 0.02)$			
	$= 0.052$ or $\frac{13}{250}$	A1	**(2)**	
(b)(i)	$P(B \mid \text{faulty}) = \frac{(0.025)}{(0.052)} = 0.481$ or $\frac{25}{52}$	M1 A1	**(2)**	
(b) (ii)	$P(A \text{ or } B \mid \text{faulty}) = \frac{(0.02 + 0.025)}{(0.052)}$	M1		
	$= 0.865$	A1	**(2)**	
(c)	$P(\text{not faulty}) = 1 - 0.052 = 0.948$	M1		for $\frac{a(ii)}{1 - a(iii)}$
	$P(A \mid \text{not faulty}) = \frac{(0.38)}{(0.948)} = 0.401$ or $\frac{95}{237}$	A1	**(2)**	
		TOTAL	**(11)**	