SOLUTIONS

Christ Church Grammar School

2018
UNIT TEST 4

MATHEMATICS METHODS Year 11

Section Two:
Calculator-assumed

Student name _____

Teacher name _____

Time and marks available for this section

Reading time before commencing work:	3 minutes
Working time for this section:	30 minutes
Marks available:	34 marks

Materials required/recommended for this section

To be provided by the supervisor
This Question/Answer Booklet
Formula Sheet (retained from Section One)

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, and up to three calculators approved for use in the WACE examinations

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Instructions to candidates

1. Write your answers in this Question/Answer Booklet.

2. Answer all questions.

3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specific to a particular question.

4. Supplementary pages for the use of planning/continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

5. **Show all your working clearly**. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat an answer to any question, ensure that you cancel the answer you do not wish to have marked.

6. It is recommended that **you do not use pencil**, except in diagrams.

See next page

Additional working space

Question number:_____

Additional working space

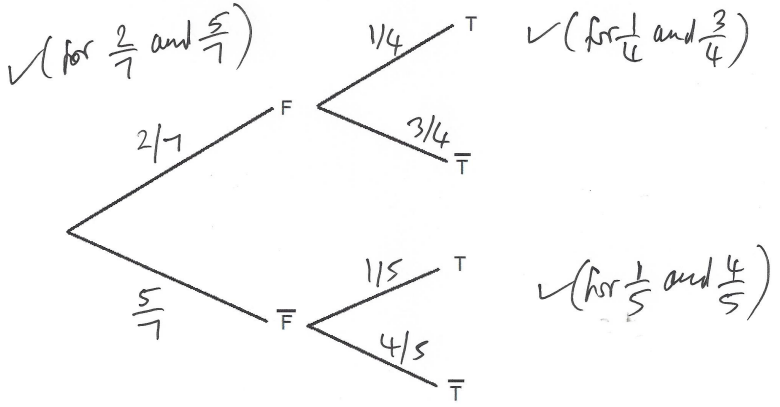
Question number:_____

Question 5 **(7 marks)**

Let F be the event that "a person enjoys playing football" and T be the event that "a person enjoys playing tennis", with:

$$P(F) = \frac{2}{7} \quad P(T|\overline{F}) = \frac{1}{5} \quad \text{and} \quad P(\overline{T}|F) = \frac{3}{4}$$

(a) Use this information to complete the probabilities on each branch of the tree diagram below: (3 marks)



(b) If a person is chosen at random find the probability that:

(i) The person enjoys playing tennis (2 marks)

$= P(\overline{F}T) + P(FT)$

$= \frac{5}{7} \times \frac{1}{5} + \frac{2}{7} \times \frac{1}{4} = \frac{3}{14}$ (or 0·214 to 3d.p.)

✓(correct combination of probabilities) ✓(correct final answer)

(ii) The person enjoys playing football given that they enjoy playing tennis. (2 marks)

✓(correct unsimplified fraction)

$$\frac{\frac{2}{7} \times \frac{1}{4}}{3/14} = \frac{2/28}{3/14} = \frac{2/28}{6/28} = \frac{1}{3}$$ ✓(correct final answer)

See next page

Question 6 **(8 marks)**

Asif selected 18 Australian Football League (AFL) players. He recorded their playing number, height and weight:

Player	*Playing number*	*Height (cm)*	*Weight (kg)*
Ben Keays	11	194	96
Luke Hodge	34	188	84
Allen Christensen	16	197	95
Ryan Bastinac	15	194	100
Mitch Robinson	11	179	82
Hugh McCluggage	30	210	119
Tom Bell	37	186	85
Rohan Bewick	24	193	93
Dayne Beams	16	188	100
Daniel Rich	27	172	75
Stefan Martin	35	179	74
Jarrod Berry	3	185	88
Josh Walker	17	182	77
Dayne Zorko	3	186	88
Cameron Rayner	44	202	104
Nick Robertson	32	181	79
Jacob Allinson	16	195	100
Cedric Cox	4	183	87

Let A be the event that a randomly selected footballer has a playing number less than 20.
Let B be the event that a randomly selected footballer is taller than $190\ cm$.
Let C be the event that a randomly selected footballer is heavier than $90\ kg$.

(a) Use the data to estimate the following:

(i) $P(A) = \frac{10}{18} = \frac{5}{9}$ ✓(final answer) (1 mark)

(ii) $P(A|B) = \frac{4}{7}$ ✓(correct numerator) ✓(correct denominator) (2 marks)

(iii) $P(B) = \frac{7}{18}$ ✓(final answer) (1 mark)

(iv) $P(\bar{B}|C) = \frac{7}{8}$ ✓(correct numerator) ✓(correct denominator) (2 marks)

See next page

Question 10 **(5 marks)**

A group of ten people consists of five pairs of twins. Each pair of twins consists of a male and a female. In how many ways can a committee of four be chosen from this group if:

(a) All individuals are eligible for selection. (1 mark)

$^{10}C_4 = 210$ ✓(for final answer)

(b) The committee must consist of two males and two females. (1 mark)

$^5C_2 \times {}^5C_2 = 100$ ✓(for final answer)

(c) The committee cannot contain two people from the same pair of twins. (3 marks)

5 possibilities: ✓(for analysis)

4 males: $^5C_4$ = 5
3 males: $^5C_3 \times {}^2C_1$ = 20
2 males: $^5C_2 \times {}^3C_2$ = 30
1 male: $^5C_1 \times {}^4C_3$ = 20
0 males: $^5C_4$ = 5

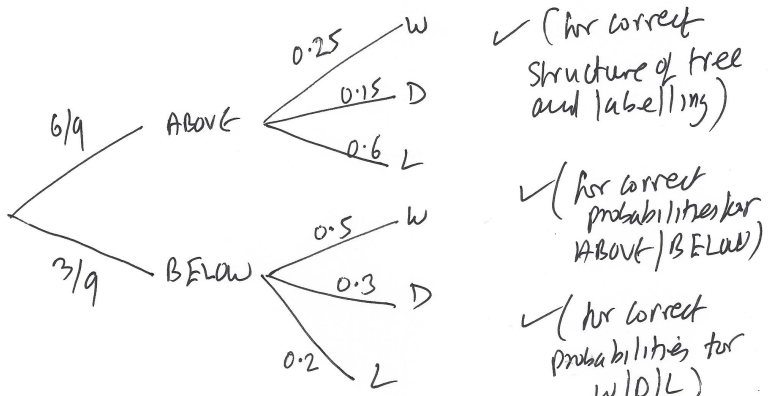
✓(for subtotals)

Pick 3 males from 5 and 1 female from the two who are not twins of the 3 picked males

answer = 5 + 20 + 30 + 20 + 5
= 80 ✓(final answer)

Question 9 **(5 marks)**

The Australian Soccer League consists of 10 teams. The Perth Glory team is currently in 7th place on the table. Perth Glory has a 25% chance of winning and a 60% chance of losing against any team placed above it. If a team is placed below it Perth Glory has a 50% chance of winning and a 20% chance of losing. **By drawing a suitable tree diagram and displaying the appropriate probabilities on each branch**, find the probability that Perth Glory will draw their next game.



✓ (for correct structure of tree and labelling)

✓ (for correct probabilities for ABOVE/BELOW)

✓ (for correct probabilities for W/D/L)

P(Draw next game)

$= \frac{6}{9} \times 0.15 + \frac{3}{9} \times 0.3$ ✓ (for correct expression)

$= 0.2$ ✓ (for final answer)

Question 6 (continued)

(b) Are events B and C independent? You must give a mathematical justification for your answer. (2 marks)

$P(B) = \frac{7}{18} = 0.39$

$P(B|C) = \frac{7}{8} = 0.875$

So $P(B) \neq P(B|C)$

So B and C are not independent

✓✓ (correct answer with valid justification)

(Note: zero marks if no valid justification given)

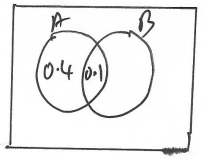
Question 7 **(3 marks)**

Suppose that:

$$P(A \cap B) = 0.1 \quad \text{and} \quad P(A \cap \overline{B}) = 0.4$$

Given that A and B are independent, calculate $P(A \cup \overline{B})$.

we are given:



So $P(A) = 0.5$

✓(for calculating $P(A)$)

A and B are independent

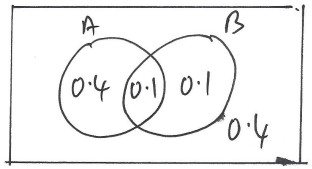
So $P(A \cap B) = P(A) \times P(B)$

$0.1 = 0.5 \times P(B)$

So $P(B) = 0.2$

✓(for calculating $P(B)$)

Sowe have:



So $P(A \cup \overline{B}) = 0.4 + 0.1 + 0.4$

$= 0.9$

✓(final answer)

Question 8 **(6 marks)**

The probabilities that students T, U and V can solve a particular problem are $0.6, 0.55$ and 0.2, respectively. If they try to solve the problem independently, then calculate the probability that:

(a) T and U solve the problem but V does not. (1 mark)

$= 0.6 \times 0.55 \times 0.8$

$= 0.264$ ✓(final answer)

(b) At least one of the three solves the problem. (2 marks)

P(none solve the problem)

$= 0.4 \times 0.45 \times 0.8 = 0.144$

✓(for probability that none solve the problem)

∴ P(at least one solves the problem)

$= 1 - 0.144 = 0.856$ ✓(final answer)

(c) Only one of the three solves the problem. (3 marks)

= P(T solves it, U and V do not)
+ P(U solves it, T and V do not)
+ P(V solves it, T and U do not)

✓(for correct analysis)

$= 0.6 \times 0.4 \times 0.8 + 0.4 \times 0.55 + 0.8$
$+ 0.4 \times 0.45 \times 0.2$

✓(for correct substitution of probabilities)

$= 0.428$ ✓(final answer)