High School Mathematics Test 2015

Year 9 **Counting Techniques** Non Calculator

Skills and Knowledge Assessed:

- List all outcomes for two-step chance experiments, both with and without replacement using tree diagrams or arrays. Assign probabilities to outcomes and determine probabilities for events (ACMSP225)
- Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or' (ACMSP226)

Name_____

Section 1 Short Answer Section

Write all working and answers in the spaces provided on this test paper.

Questions 1 – 3 refer to the following:

When two coins are tossed, the possible outcomes are listed in the table below.

	Head	Tail
Head	HH	TH
Tail	HT	TT

1. What is the probability of tossing two heads?

……

2. What is the probability of both coins showing the same?

……....

……

3. The outcomes could also have been found using a tree diagram.
Draw a tree diagram in the space below to show how this could be done.

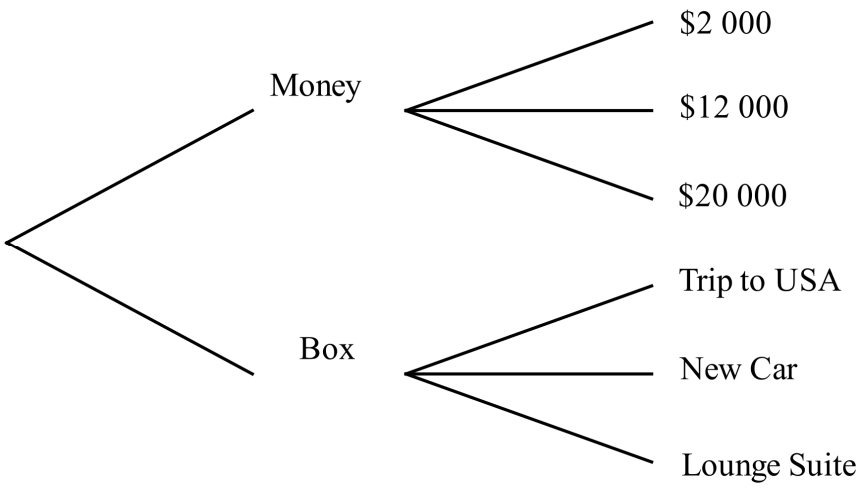
Questions 4 – 6 refer to the following:

In a game show the winner was given a choice of "The money or the box."

After making this choice, there were three possible money amounts and three possible prizes in the boxes; that were then chosen at random.

A particular winner decided to randomly choose between the money and the box.

The tree diagram shows their possible choices.



4. What is the probability that the winner received a lounge suite as a prize?

……....

……

5. What is the probability that the winner received a money prize greater than $2 000?

……....

……

6. What is the probability that the winner received either a money prize or a trip?

……....

……

Questions 7 – 9 refer to the following:

	Small Pot	Large Pot
Azalea	$12	$22
Camelia	$14	$24
Frangipani	$16	$26
Magnolia	$15	$25

Mason wants to buy a plant for his mum. He knows she likes magnolias, camellias, frangipanis and azaleas.

The Willows Plant Nursery has each of the plants above available in two sizes of pot, small or large.

The table show the cost of each of the possible combinations.

7. If Mason randomly chooses one of the options above, what is the probability that he will pay more than $15?

……....

……

8. If Mason randomly chooses a small pot from the options above, what is the probability that he will choose an azalea or a magnolia?

……....

……

9. If Mason randomly chooses one of the options above, what is the probability that he will not choose a frangipani?

……....

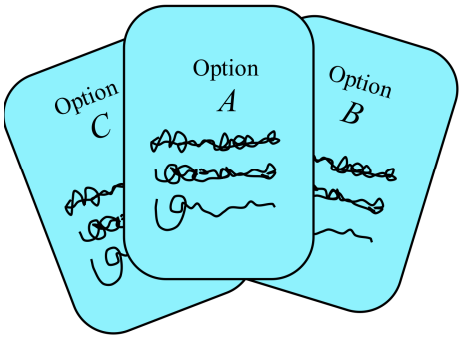
……

Questions 10 – 12 refer to the following:

Jack has three options for his upcoming two week holiday but as each option takes a week, he will only have the time to do two of them.

He writes the three options on separate cards and labels them A, B and C.

He puts the cards into a bag and draws two out, to decide which options he will do, and in which order.



10. Draw a tree diagram or array to show the possible combinations of two options.

11. What is the probability that he does options A and C in any order?

……....

……

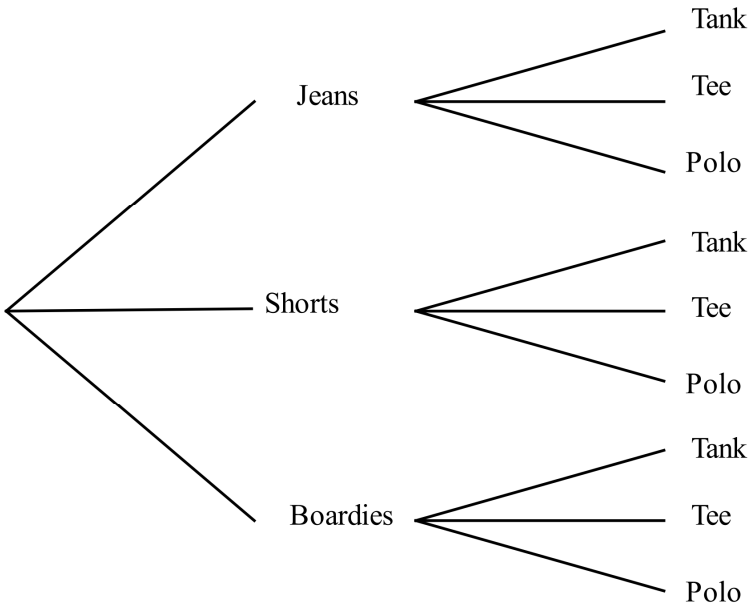
12. What is the probability that he does not do option A in the first week?

……....

……

Questions 13 – 15 refer to the following:

Evan has 3 clean tops and 3 clean pants to wear out on Friday night.
He puts the tops in one pile and the pants in another and randomly chooses one from each.
The tree diagram below shows the possible results.



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13. What is the probability that he doesn't wear a Tank with Boardies?

……....

……

14. What is the probability that he wears Shorts with either a Tee or Polo?

……....

……

15. What is the probability that he does not wear Shorts or a Tee?

……....

……

Questions 16 – 18 refer to the following:

The two way table shows the number of people who volunteered their time to a charity or community organisation, compared to their employment status.

	Volunteer	Don't Volunteer	Total
Employed	45	36	81
Unemployed	12	7	19
Total	57	43	

One of the people included in the data above is chosen at random.

16. What is the probability that the person is unemployed and volunteers their time?

……....

……

17. If a person is employed, what is the probability that they volunteer their time?

……....

……

18. What is the probability that the person is unemployed or volunteers or both?

……....

……

High School
Mathematics Test 2015

Year 9 *Counting Techniques*

Calculator Allowed

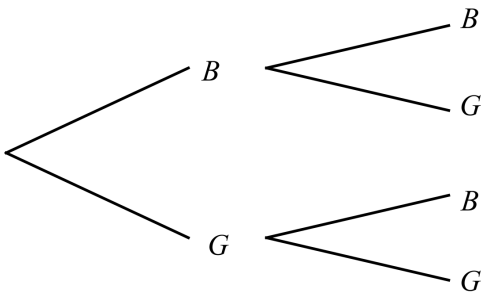
Name_____

Section 2 Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

Questions 1 and 2 refer to the following:

The possible gender combinations of a two child family are found using the tree diagram shown.



1. What is the probability that a two child family consists of 2 girls?

A. $\frac{1}{4}$ B. $\frac{1}{2}$ C. $\frac{3}{4}$ D. 1

2. What is the probability that a two child family consists of children of different genders.

A. 0 B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. $\frac{3}{4}$

Questions 3 – 6 refer to the following:

When a pair of dice are rolled and the sum of the result is taken, the possible outcomes are shown in the table below.

Dice	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

3. What is the probability of rolling a sum of 6?

A. $\frac{1}{36}$ B. $\frac{5}{36}$ C. $\frac{1}{6}$ D. $\frac{7}{36}$

4. What is the probability that the sum is a two digit number?

A. $\frac{1}{9}$ B. $\frac{5}{36}$ C. $\frac{1}{6}$ D. $\frac{7}{36}$

5. What is the probability that the sum is less than 7?

A. $\frac{5}{18}$ B. $\frac{5}{12}$ C. $\frac{7}{12}$ D. $\frac{3}{4}$

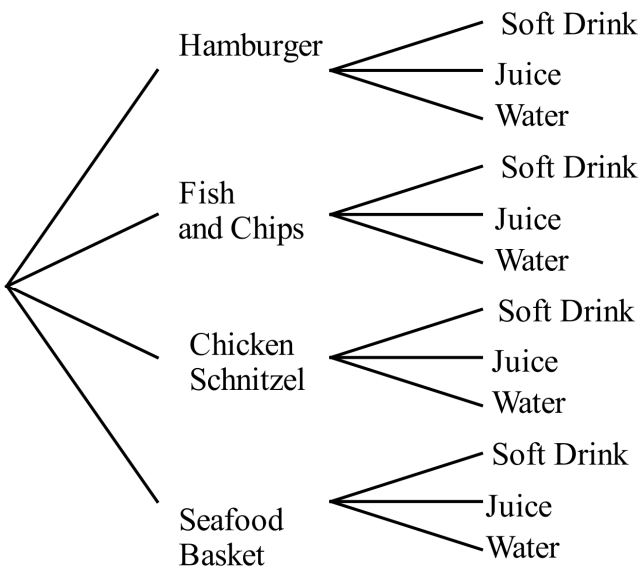
6. What is the probability that the sum is a multiple of 3?

A. $\frac{2}{9}$ B. $\frac{1}{4}$ C. $\frac{11}{36}$ D. $\frac{1}{3}$

Questions 7 and 8 refer to the following:

Pete has a choice of four snacks and three drinks at a café.

He asks his girlfriend to order for him. The choices are shown on the tree diagram.



7. What is the probability that she chooses fish and chips with either juice or water?

A. $\frac{1}{12}$ B. $\frac{1}{6}$ C. $\frac{1}{4}$ D. $\frac{1}{3}$

8. What is the probability that her choice does not include Fish, Seafood or Juice?

A. $\frac{1}{3}$ B. $\frac{5}{12}$ C. $\frac{1}{2}$ D. $\frac{2}{3}$

Questions 9 – 12 refer to the following:

Jason has to choose two songs to play during a video production.

He has narrowed the first song down to five choices and the second down to three choices.

The table shows the possible choices.

1st song / 2nd Song	Amazing	Angels	Rush	Urgent	Winter
Atomic	Amazing Atomic	Angels Atomic	Rush Atomic	Urgent Atomic	Winter Atomic
Avalon	Amazing Avalon	Angels Avalon	Rush Avalon	Urgent Avalon	Winter Avalon
Runaway	Amazing Runaway	Angels Runaway	Rush Runaway	Urgent Runaway	Winter Runaway

9. What is the probability that Runaway or Winter are included?

A. $\frac{1}{15}$ B. $\frac{2}{15}$ C. $\frac{2}{5}$ D. $\frac{7}{15}$

10. What is the probability that both songs start with the letter A?

A. $\frac{1}{15}$ B. $\frac{2}{15}$ C. $\frac{1}{5}$ D. $\frac{4}{15}$

11. What is the probability that both songs start with the same letter?

A. $\frac{1}{3}$ B. $\frac{2}{5}$ C. $\frac{7}{15}$ D. $\frac{3}{5}$

12. What is the probability that both songs start with a vowel?

A. $\frac{1}{15}$ B. $\frac{2}{15}$ C. $\frac{2}{5}$ D. $\frac{7}{15}$

Questions 13 - 15 refer to the following:

Adrian collects information on the number of supporters of footy teams at his work.

When he has asked everyone, he records the results in the table below.

He has started to add a relative frequency column.

Team	Frequency	Relative Frequency
Tigers	16	0.2
Mariners	8	
Dragons	10	0.125
Bombers	12	0.15
Roar	18	
United	16	0.2

13. What numbers go in the relative frequency column for the Mariners and The Roar?

A. 0.1 and 0.2 B. 0.1 and 0.225 C. 0.2 and 0.225 D. 0.25 and 0.375

14. If a person from Adrian's work is chosen at random what is the probability that they support either the Tigers or the Dragons?

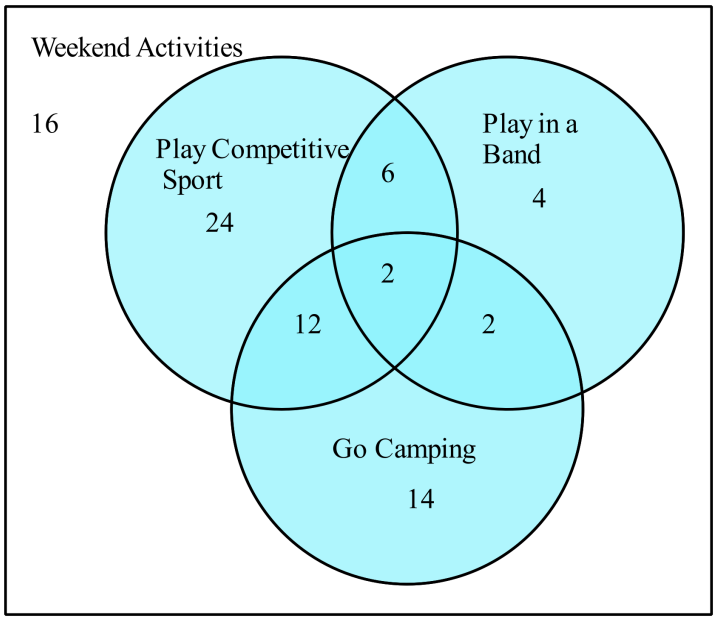
A. 0.125 B. 0.2 C. 0.225 D. 0.325

15. If a person from Adrian's work is chosen at random what is the probability that they don't support the Bombers or United?

A. 0.15 B. 0.35 C. 0.55 D. 0.65

Questions 16 – 18 refer to the following:

The Venn diagram shows how a group of students say that they spend time on a weekend.



One of the students is chosen at random.

16. What is the probability that the student plays competitive sport and is in a band?

A. 0.025 B. 0.075 C. 0.1 D. 0.125

17. What is the probability that the student plays competitive sport or plays in a band, but not both?

A. 0.525 B. 0.55 C. 0.625 D. 0.8

18. What is the probability that the student does not play in a band but does go camping?

A. 0.325 B. 0.35 C. 0.375 D. 0.55

High School
Mathematics Test 2015

Year 9 **Counting Techniques**

Calculator Allowed

Name_____

Section 3 Longer Answer Section

Write all working and answers in the spaces provided on this test paper.

Marks

1. A jar holds four marbles, two are red, one is blue and one is green.
Two marbles are drawn without replacement from the jar.

(a) Draw a tree diagram to show the possible combinations of two marbles. **2**

(b) What is the probability that the marbles are both red? **1**

……..

……..

(c) What is the probability that at least one of the marbles is green? **1**

……..

……..

(d) What is the probability that the marbles are not red and green or red and blue? **1**

……..

……..

High School
Mathematics Test 2015

Multiple Choice Answer Sheet

Counting Techniques

Name _____

Completely fill the response oval representing the most correct answer.

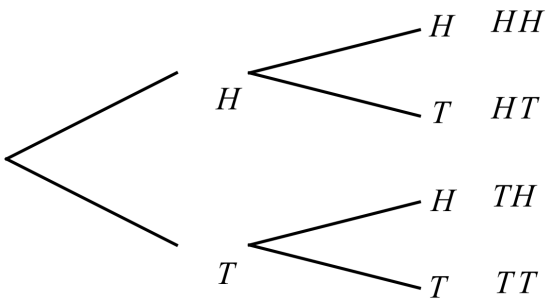
1.	A ⬭	B ⬭	C ⬭	D ⬭
2.	A ⬭	B ⬭	C ⬭	D ⬭
3.	A ⬭	B ⬭	C ⬭	D ⬭
4.	A ⬭	B ⬭	C ⬭	D ⬭
5.	A ⬭	B ⬭	C ⬭	D ⬭
6.	A ⬭	B ⬭	C ⬭	D ⬭
7.	A ⬭	B ⬭	C ⬭	D ⬭
8.	A ⬭	B ⬭	C ⬭	D ⬭
9.	A ⬭	B ⬭	C ⬭	D ⬭
10.	A ⬭	B ⬭	C ⬭	D ⬭
11.	A ⬭	B ⬭	C ⬭	D ⬭
12.	A ⬭	B ⬭	C ⬭	D ⬭
13.	A ⬭	B ⬭	C ⬭	D ⬭
14.	A ⬭	B ⬭	C ⬭	D ⬭
15.	A ⬭	B ⬭	C ⬭	D ⬭
16.	A ⬭	B ⬭	C ⬭	D ⬭
17.	A ⬭	B ⬭	C ⬭	D ⬭
18.	A ⬭	B ⬭	C ⬭	D ⬭
19.	A ⬭	B ⬭	C ⬭	D ⬭
20.	A ⬭	B ⬭	C ⬭	D ⬭
21.	A ⬭	B ⬭	C ⬭	D ⬭
22.	A ⬭	B ⬭	C ⬭	D ⬭
23.	A ⬭	B ⬭	C ⬭	D ⬭
24.	A ⬭	B ⬭	C ⬭	D ⬭
25.	A ⬭	B ⬭	C ⬭	D ⬭

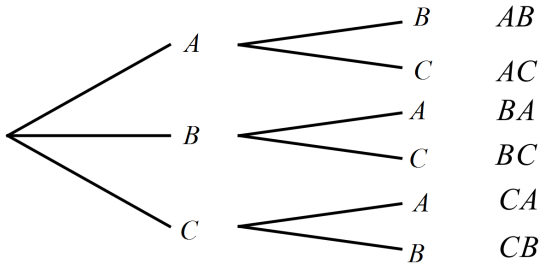
High School Mathematics Test 2015

Year 9 **Counting Techniques** Non Calculator

Section 1 Short Answer Section

ANSWERS

No.	WORKING	ANSWER
1.	$P(\text{H H}) = \frac{1}{4}$	$\frac{1}{4}$
2.	$P(\text{HH or TT}) = \frac{2}{4} = \frac{1}{2}$	$\frac{1}{2}$
3.		Tree diagram is answer
4.	$P(\text{Lounge suite}) = \frac{1}{6}$	$\frac{1}{6}$
5.	$P(\text{Money} > 2000) = \frac{2}{6} = \frac{1}{3}$	$\frac{1}{3}$
6.	$P(\text{Money or trip}) = \frac{4}{6} = \frac{2}{3}$	$\frac{2}{3}$
7.	There are 8 options. If more than \$15 then buys a frangipani in a small pot or any large pot, so 5 choices. $P(\text{Pay} > \$15) = \frac{5}{8}$	$\frac{5}{8}$
8.	There are 4 small pots. $P(\text{Azalea or a magnolia from small pots}) = \frac{2}{4} = \frac{1}{2}$	$\frac{1}{2}$

<table>
<tr><td>9.</td><td>There are 2 frangipanis so 6 are not.
$P(\text{Not frangipani}) = \frac{6}{8} = \frac{3}{4}$</td><td>$\frac{3}{4}$</td></tr>
<tr><td>10.</td><td> 

<table>
<tr><td></td><td>A</td><td>B</td><td>C</td></tr>
<tr><td>A</td><td>X</td><td>AB</td><td>AC</td></tr>
<tr><td>B</td><td>BA</td><td>X</td><td>BC</td></tr>
<tr><td>C</td><td>CA</td><td>CB</td><td>X</td></tr>
</table></td><td>Either of the diagrams or just a structured list would be okay.</td></tr>
<tr><td>11.</td><td>$P(\text{AC or CA}) = \frac{2}{6} = \frac{1}{3}$</td><td>$\frac{1}{3}$</td></tr>
<tr><td>12.</td><td>$P(\text{Not A first}) = \frac{4}{6} = \frac{2}{3}$</td><td>$\frac{2}{3}$</td></tr>
<tr><td>13.</td><td>There are 9 options.
$P(\text{Not tank and boardies}) = 1 - \frac{1}{9} = \frac{8}{9}$</td><td>$\frac{8}{9}$</td></tr>
<tr><td>14.</td><td>$P(\text{shorts with Tee or Polo}) = \frac{2}{9}$</td><td>$\frac{2}{9}$</td></tr>
<tr><td>15.</td><td>$P(\text{Not Shorts or Tee}) = \frac{4}{9}$</td><td>$\frac{4}{9}$</td></tr>
<tr><td>16.</td><td>$\text{Total} = 81 + 19 = 57 + 43 = 100$
$P(\text{Unemployed and volunteers}) = \frac{12}{100} = \frac{3}{25}$</td><td>$\frac{3}{25}$</td></tr>
<tr><td>17.</td><td>$\text{Total Unemployed} = 19$
$P(\text{Volunteer given Unemployed}) = \frac{12}{19}$</td><td>$\frac{12}{19}$</td></tr>
</table>

18.	$P(\text{Unemployed or Volunteer or both}) = \frac{12+45+7}{100} = \frac{64}{100} = \frac{16}{25}$	$\frac{16}{25}$

High School Mathematics Test 2015

Year 9 **Counting Techniques** Calculator Allowed

Section 2 Multiple Choice Section

ANSWERS

No.	WORKING	ANSWER
1.	$P(\text{Two girls}) = \frac{1}{4}$	A
2.	$P(\text{BG or GB}) = \frac{2}{4} = \frac{1}{2}$	C
3.	$P(\text{Sum} = 6) = \frac{5}{36}$	B
4.	There are 3 10's 2 11's and a 12 which are two digit numbers. $P(\text{Sum is 2 digits}) = \frac{6}{36} = \frac{1}{6}$	C
5.	There are 15 sums less than 7 $P(\text{Sum} < 7) = \frac{15}{36} = \frac{5}{12}$	B
6.	Multiples of three are 3, 3, 6, 6, 6, 6, 6, 9, 9, 9, 9, 12 $P(\text{Multiple of 3}) = \frac{12}{36} = \frac{1}{3}$	D
7.	$P(\text{Fish with J or W}) = \frac{2}{12} = \frac{1}{6}$	B
8.	There are 8 which include on or more of Fish, Seafood or Juice, so 4 are left. $P(\text{Not Fish or Seafood or J}) = \frac{4}{12} = \frac{1}{3}$	A

9. D

1st song / 2nd Song	Amazing	Angels	Rush	Urgent	Winter
Atomic	*Amazing* *Atomic*	*Angels* *Atomic*	Rush Atomic	*Urgent* *Atomic*	**Winter** **Atomic**
Avalon	*Amazing* *Avalon*	*Angels* *Avalon*	Rush Avalon	*Urgent* *Avalon*	**Winter** **Avalon**
Runaway	**Amazing** **Runaway**	**Angels** **Runaway**	**Rush** **Runaway**	**Urgent** **Runaway**	**Winter** **Runaway**

Those in **Bold**, 7 altogether.

$P(\text{Winter or Runaway}) = \frac{7}{15}$

10. D

There are 4 (shaded Yellow)

$P(\text{Both start A}) = \frac{4}{15}$

11. A

Those in Q 9 plus the one shaded green.

$P(\text{Both start same letter}) = \frac{5}{15} = \frac{1}{3}$

12. C

Those in italics, so 6 altogether.

$P(\text{Both start with vowel}) = \frac{6}{15} = \frac{2}{5}$

13. B

There are 80 altogether.

$\text{Relative frequency (Mariners)} = \frac{8}{80} = 0.1$

$\text{Relative frequency (Roar)} = \frac{18}{80} = 0.225$

14. D

$P(\text{Tigers or Dragons}) = 0.2 + 0.125 = 0.325$

15. D

$P(\text{Not Bombers or United}) = 1 - (0.2 + 0.15)$
$= 1 - 0.35 = 0.65$

16. C

Total number of students = 16+24+6+4+12+2+2+14 = 80

$P(\text{Sport and Band}) = \frac{8}{80} = 0.1$

17. A

$P(\text{Sport or Band but not both}) = \frac{24 + 12 + 4 + 2}{80} = \frac{42}{80} = 0.525$

18.	$P(\text{Not Band but camp}) = \frac{12 + 14}{80} = \frac{26}{80} = 0.325$	A

High School
Mathematics Test 2015

Multiple Choice Answer Sheet

Counting Techniques

Name _____ANSWERS_____

Completely fill the response oval representing the most correct answer.

1.	A ●	B ○	C ○	D ○
2.	A ○	B ○	C ●	D ○
3.	A ○	B ●	C ○	D ○
4.	A ○	B ○	C ●	D ○
5.	A ○	B ●	C ○	D ○
6.	A ○	B ○	C ○	D ●
7.	A ○	B ●	C ○	D ○
8.	A ●	B ○	C ○	D ○
9.	A ○	B ○	C ○	D ●
10.	A ○	B ○	C ○	D ●
11.	A ●	B ○	C ○	D ○
12.	A ○	B ○	C ●	D ○
13.	A ○	B ●	C ○	D ○
14.	A ○	B ○	C ○	D ●
15.	A ○	B ○	C ○	D ●
16.	A ○	B ○	C ●	D ○
17.	A ●	B ○	C ○	D ○
18.	A ●	B ○	C ○	D ○

High School Mathematics Test 2015

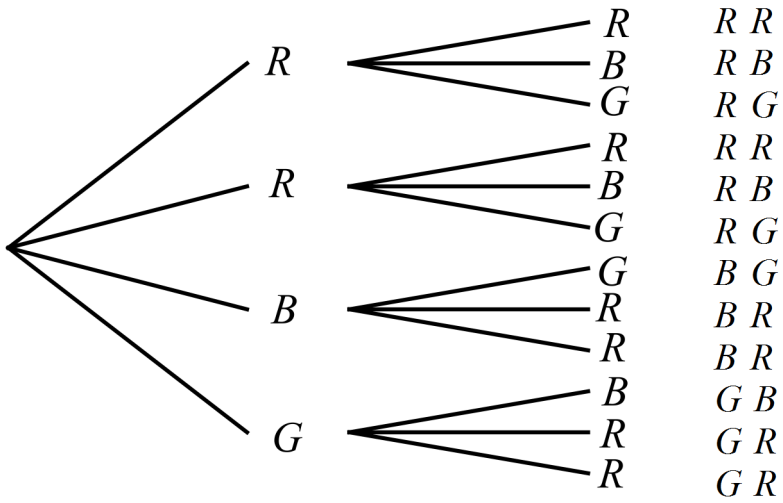
Year 9 **Counting Techniques** Calculator Allowed

Section 3 Longer Answer Section

ANSWERS

Marks

1. (a)



2

(b) $P(\text{R R}) = \frac{2}{12} = \frac{1}{6}$ **1**

(c) $P(\text{One is G}) = \frac{6}{12} = \frac{1}{2}$ **1**

(d) $P(\text{not RG or RB}) = P(\text{R R or GB or BG}) \frac{4}{12} = \frac{1}{3}$ **1**