



D & D Resources Ltd
Mathematics Exam Preparation Made Easy

External Achievement Standard - 91585

Practice External Assessments 3

PROBABILITY

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D & D Resources Ltd
P O Box 8
WAIHI BEACH 3642

Phone (07) 862 8599
Email admin@ddresources.co.nz
Web www.ddresources.co.nz
(orders, queries and feedback)

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NCEA 3 Statistics

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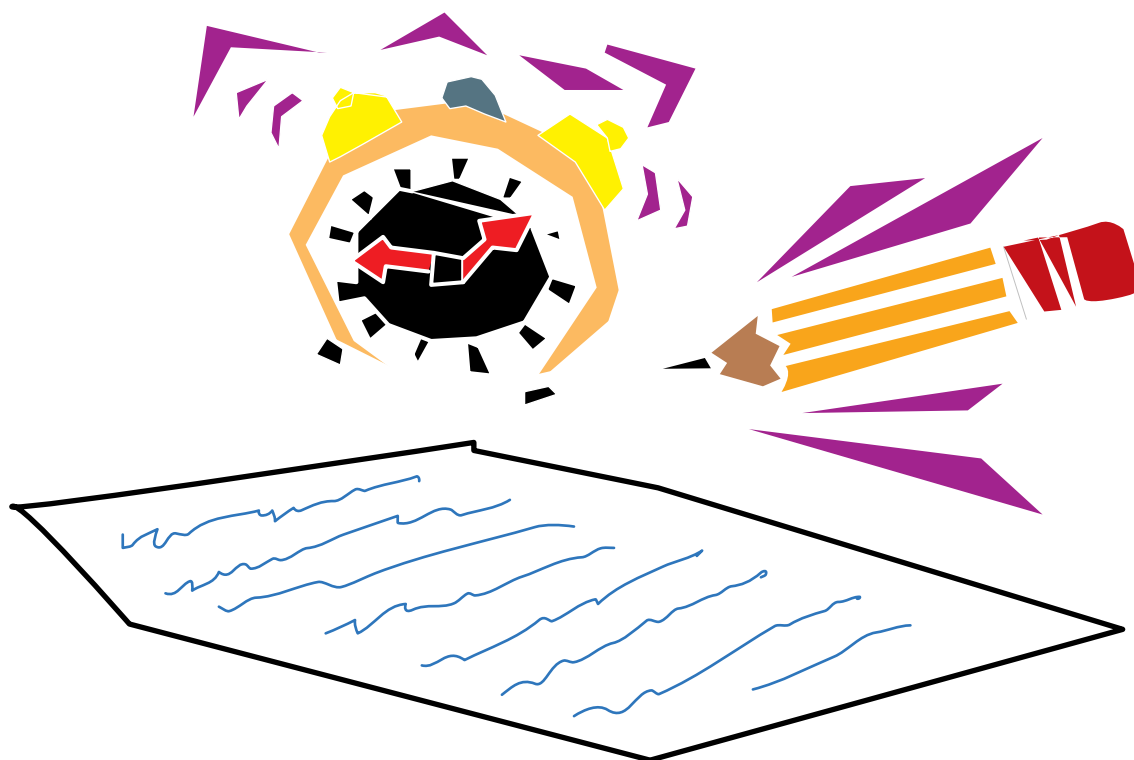
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The questions in the practice assessments are NOT in order of difficulty. Attempt all questions or you may not provide enough evidence to achieve the required standard.

Achievement Standard

91585

Apply Probability Concepts in Solving Problems

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none"> Apply probability concepts in solving problems. 	<ul style="list-style-type: none"> Apply probability concepts, using relational thinking, in solving problems. 	<ul style="list-style-type: none"> Apply probability concepts, using extended abstract thinking, in solving problems.

- ◆ This achievement standard is derived from Level 8 of The New Zealand Curriculum and is related to the achievement objectives
 - ❖ Investigate situations that involve elements of chance
 - calculating probabilities of independent, combined, and conditional events.
- ◆ Apply probability concepts in solving problems involves:
 - ❖ selecting and using methods
 - ❖ demonstrating knowledge of concepts and terms
 - ❖ communicating using appropriate representations.
- ◆ Relational thinking involves one or more of:
 - ❖ selecting and carrying out a logical sequence of steps
 - ❖ connecting different concepts or representations
 - ❖ demonstrating understanding of concepts;
 and also relating findings to a context, or communicating thinking using appropriate statements.
- ◆ Extended abstract thinking involves one or more of:
 - ❖ devising a strategy to investigate or solve a problem
 - ❖ identifying relevant concepts in context
 - ❖ developing a chain of logical reasoning
 - ❖ making a generalisation;
 and also, where appropriate, using contextual knowledge to reflect on the answer.
- ◆ Problems are situations that provide opportunities to apply knowledge or understanding of mathematical concepts and methods. Situations will be set in real-life or statistical contexts.
- ◆ Methods include a selection from those related to:
 - ❖ true probability versus model estimates versus experimental estimates
 - ❖ randomness
 - ❖ independence
 - ❖ mutually exclusive events
 - ❖ conditional probabilities
 - ❖ probability distribution tables and graphs
 - ❖ two way tables
 - ❖ probability trees
 - ❖ Venn diagrams.

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PEA 2

You are advised to spend 60 minutes answering this assessment.

You should show ALL working and answer ALL parts of ALL questions.

QUESTION ONE

- (a) Study the table below of fatal motor vehicle crashes involving speeding by time of day and day of week in New Zealand (2009 – 2011). *Source Ministry of Transport.*

	Day	Day (0600 – 1759)	Evening (1800 – 2159)	Night (2200 – 0559)	TOTAL
Week	Monday	16	7	5	28
	Tuesday	17	9	7	33
	Wednesday	11	2	15	28
	Thursday	16	11	10	37
	Friday	14	17	22	53
Weekend	Saturday	24	11	30	65
	Sunday	25	13	10	48
	TOTAL	123	70	99	292

- (i) If a random fatal crash involving speed is selected from this period, what is the probability that it occurred in the weekend?

- (ii) If two of the fatal crashes are randomly selected from this period, calculate the probability that only one of the two fatal crashes occurred during the week.

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- (b) Consider the events “a fatal crash involving speed during the evening” and “a fatal crash involving speed in the weekend”. Explain whether these events are independent. Justify your answer.

QUESTION TWO

- (a) USA breast cancer research shows that 30% of women biopsied for breast cancer actually have the disease and if fine needle aspiration cytology is used for testing, it results in a false positive rate of 3% and a false negative rate of 13%.

Study the partially completed table below of 100 000 women who were biopsied.

	Have breast cancer	Do not have breast cancer	TOTAL
Test result was positive			
Test results was negative	3900		
TOTAL	30 000	70 000	100 000

- (i) Explain the terms 'false positive' and false negative' in the context of this question.

- (ii) Complete the table and calculate the probability that a women with a negative result actually had breast cancer.

- (iii) Comment on the reliability of the fine needle aspiration cytology biopsy test based on these results. Justify your answer.

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- (b) The company's 100 employees get a free heart check each year. Their blood pressure is tested as well as whether they have an irregularity in their heartbeat.

The results of the screening show that:

- 18% of employees have high blood pressure
- 22% have low blood pressure
- 16% have an irregular heartbeat
- of those employees with an irregular heartbeat, one-quarter have high blood pressure
- of those employees with normal blood pressure, one-tenth have an irregular heartbeat.

- (i) What is the probability that a random employee from the company has a regular heartbeat and low blood pressure?

- (ii) Are the company employees, who do NOT have normal blood pressure more likely to have an irregularity in their heartbeat?

Support your answer with appropriate statistical statements.

- (iii) After a blood test one of the employees indicates the presence of a blood disorder which appears in only 1% of the population. The test for the disease indicates a positive result for the disease 97% of the time when the person has the disease and 2% of the time when the disease is not present.

What is the probability that the employee actually has the blood disorder given the test is positive?

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PEA 2

Quest.	Evidence	Achievement	Merit	Excellence																				
		Apply probability concepts in solving problems.	Apply probability concepts, using relational thinking, in solving problems.	Apply probability concepts, using extended abstract thinking, in solving problems.																				
ONE		TWO of:	TWO of:	ONE of:																				
(a) (i)	<table border="1"> <tr> <td></td><td>D</td><td>E</td><td>N</td><td>Total</td></tr> <tr> <td>Week</td><td>74</td><td>46</td><td>59</td><td>179</td></tr> <tr> <td>Wk'end</td><td>49</td><td>24</td><td>40</td><td>113</td></tr> <tr> <td>Total</td><td>123</td><td>70</td><td>99</td><td>292</td></tr> </table> <p>P(fatal crash in weekend)</p> $= \frac{113}{292} = 0.3870$		D	E	N	Total	Week	74	46	59	179	Wk'end	49	24	40	113	Total	123	70	99	292	<ul style="list-style-type: none"> identifies required figures from table and gets correct probability. 		
	D	E	N	Total																				
Week	74	46	59	179																				
Wk'end	49	24	40	113																				
Total	123	70	99	292																				
(a) (ii)	<p>P(one of two occur during week)</p> $= \left(\frac{179}{292} \times \frac{113}{291} \right) + \left(\frac{113}{292} \times \frac{179}{291} \right)$ $= 0.4761$	<ul style="list-style-type: none"> identifies required figures from table and gets one correct probability. 	<ul style="list-style-type: none"> identifies required figures from table and gets correct probability. 																					
(b)	<p>P(fatal crash evening) = $\frac{70}{292}$</p> <p>P(fatal crash weekend) = $\frac{113}{292}$</p> <p>P(fatal crash evening \cap weekend) = $\frac{70}{292} \times \frac{113}{292}$</p> $= 0.0928 \neq \frac{24}{292} \text{ (0.0822)}$ <p>Not independent.</p>	<ul style="list-style-type: none"> correct probabilities and states assumption that not independent. 																						
(c) (i)	<p>Probabilities:</p> $P(\text{fatal evening} \mid \text{week}) = \frac{46}{179} = 0.2570$ $P(\text{fatal evening} \mid \text{wknd}) = \frac{24}{113} = 0.2124$ <p>A fatal crash involving speed in the evening is 1.2 times ($0.2570 \div 0.2124$) more likely to occur during the week than the weekend.</p>	<ul style="list-style-type: none"> one conditional probability calculated. 	<ul style="list-style-type: none"> both conditional probabilities calculated and undertakes comparison by relative ratio (i.e. a fatal crash involving speed is 1.2 times more likely to occur in the evening during the week than the weekend). 																					