

**Kingsway Christian College**

**Maths Department5**

**Course**: Mathematics Methods Year 12

**Assessment Task**: Test 5 – Discreet Random Variables and The Binomial Distribution

**Student Name**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Date**: 10 & 11th August 2017

**Assessment Score**: \_\_\_\_\_\_\_\_\_\_\_\_ / 45

**Year Score**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Comments**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Teacher signature**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Parent/ Guardian signature**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**METHODS YEAR 12 Test 5 2017  
Discreet Random variables and Distributions**

**Calculator Allowed Time: 45 mins Marks: / 45**

**Calculators are allowed for this test, but no notes. Please show work out where needed.**

**Question 1 (3,4,3 = 10 marks)**

The discrete random variable  can only take the values 0, 1, 2, 3, 4, 5. The probability distribution of  is given by the following

 where  and  are constants.

1. Determine the values of  and .
2. Show that the expectation of  is  and determine the exact variance of .
3. Determine the exact probability that the sum of two independent observations from this distribution exceeds 7.

**Question 2 (3,2,2,3= 10 marks)**

On a long train journey, a statistician is invited by a gambler to play a dice game. The game uses two ordinary dice which the statistician is to throw.

If the total score is 12, the statistician is paid $6 by the gambler. If the total score is 8, the statistician is paid $3 by the gambler. However, if both or either dice show a 1, the statistician pays the gambler $2. Otherwise, no money changes hands.

Let $ be the amount paid to the statistician by the gambler.

1. Complete the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | 0 | 3 | 6 |
|  |  |  |  |  |

1. Explain why the table in part (a) describes a probability distribution for the discrete random variable .
2. Show that, if the statistician played the game 100 times, his expected loss would be $2.78, to the nearest cent.
3. Find the amount, $, that the $6 would have to be changed to in order to make the game unbiased.

**Question 3 (3 marks)**

Given that find the value of *p* such that

Show your working

**Question 4 (2,4 = 6 marks)**

In a school of 480 students, 25% said they barracked for the Dockers.

1. State why “ Supported the Dockers” is a Binomial random variable in this context.

1. Determine μ and σ.

**Question 5 (1,3,1,2 = 7 marks)**

A Study found that 80 per cent of people exhibiting common influenza symptoms recovered without taking any medication. A random sample of 30 people who had developed influenza symptoms was taken.

Let X denote the number of people in this sample who recovered without taking any medication.

1. State why X is classified as discrete and not continuous?
2. State the probability distribution of X and the mean and standard deviation of this distribution.
3. What is the probability, correct to three decimal places that
4. Exactly 25 people recovered without any medication?
5. At least 24 but no more than 28 recovered without any medication?

**Question 6 (3,2,2,2 = 9 marks)**

A manufacturer of chocolate produces 3 times as many soft centred chocolates as hard centred ones. The chocolates are randomly packed in boxes of 20.

*Let the Discreet Random Variable X = the number of hard centred chocolates per box.*

(a) Find the probability that in a box there are

(i) an equal number of soft centred and hard centred chocolates

(ii) at least one hard centred chocolate.

(iii) fewer than 5 hard centred chocolates.

(b) A random sample of 5 boxes is taken from the production line. Use your answer from question (iii), to find the probability that exactly 3 of the boxes contain fewer than 5 hard centred chocolates.

*Let the Discreet Random Variable Y= the number of boxes that contain fewer than 5 hard centred chocolates.*

**EXTRA WORKING**