**IB Math SL Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Unit 5 Review Sheet (Probability and Distribution)**

**Part I – From Paper 1 – NO GDC**

**1.** The probability distribution of the discrete random variable *X* is given by the following table.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | 1 | 2 | 3 | 4 | 5 |
| P(*X* = *x*) | 0.4 | *p* | 0.2 | 0.07 | 0.02 |

(a) Find the value of *p*.

(b) Calculate the expected value of *X*.

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(Total 6 marks)

**2.** In a survey, 100 students were asked “do you prefer to watch television or play sport?” Of the 46 boys in the survey, 33 said they would choose sport, while 29 girls made this choice.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Boys | Girls | Total |
| Television |  |  |  |
| Sport | 33 | 29 |  |
| Total | 46 |  | 100 |

By completing this table or otherwise, find the probability that

(a) a student selected at random prefers to watch television;

(b) a student prefers to watch television, given that the student is a boy.

|  |  |
| --- | --- |
| *Working:* |  |
|  | *Answers*:  (a) ..................................................................  (b) .................................................................. |

(Total 4 marks)

**3.** Consider events *A*, *B* such that P (*A*)  0, P (*A*)  1, P (B)  0, and P (B)  1.

In each of the situations (a), (b), (c) below state whether *A* and *B* are

mutually exclusive (M);  
independent (I);  
neither (N).

(a) P(A|B) = P(A)

(b) P(A  B) = 0

(c) P(A  B) = P(A)

|  |  |
| --- | --- |
| *Working:* |  |
|  | *Answers*:  (a) ..................................................................  (b) ..................................................................  (c) .................................................................. |

(Total 6 marks)

4. Consider the events *A* and *B*, where P(*A*) = , P(*B*′) = and P(*A*  *B*) = .

(a) Write down P(*B*).

(b) Find P(*A*  *B*).

(c) Find P(*A*  *B*).

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(Total 6 marks)

**5.** The following diagram shows a circle divided into three sectors A, B and C. The angles at the centre of the circle are 90°, 120° and 150°. Sectors A and B are shaded as shown.



The arrow is spun. It cannot land on the lines between the sectors. Let *A*, *B*, *C* and *S* be the events defined by

*A*: Arrow lands in sector A

*B*: Arrow lands in sector B

*C*: Arrow lands in sector C

*S*: Arrow lands in a shaded region.

Find

(a) P(*B*);

(b) P(*S*);

(c) P(*A**S*).

|  |  |
| --- | --- |
| *Working:* |  |
|  | *Answers*:  (a) …………………………………………..  (b) …………………………………………..  (c) ………………………………………….. |

(Total 6 marks)

**6.** A discrete random variable X has a probability distribution as shown in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *x* | 0 | 1 | 2 | 3 |
| P(*X* = *x*) | 0.1 | *a* | 0.3 | *b* |

(a) Find the value of *a* + *b*.

(2)

(b) Given that E(*X*) =1.5, find the value of *a* and of *b*.

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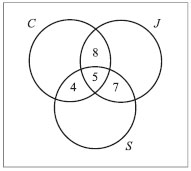
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(4)

(Total 6 marks)

**7.** The Venn diagram below shows information about 120 students in a school. Of these, 40 study Chinese (*C*), 35 study Japanese (*J*), and 30 study Spanish (*S*).



A student is chosen at random from the group. Find the probability that the student

(a) studies exactly two of these languages;

(1)

(b) studies only Japanese;

(2)

(c) does not study any of these languages.

(3)

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(Total 6 marks)

**Part II – From Paper 2 – GDC ok.**

**1.** A bag contains 10 red balls, 10 green balls and 6 white balls. Two balls are drawn at random from the bag without replacement. What is the probability that they are of different colours?

|  |  |
| --- | --- |
| *Working:* |  |
|  | *Answer:*  ....................................................................... |

(Total 4 marks)

**2.** The events *A* and *B* are independent such that P(*B*) = 3P(*A*) and P(*A**B*) = 0.68. Find P(*B*)



(Total 6 marks)

**3.** A box contains 35 red discs and 5 black discs. A disc is selected at random and its colour noted. The disc is then replaced in the box.

(a) In eight such selections, what is the probability that a black disc is selected

(i) exactly once?

(3)

(ii) at least once?

(3)

(b) The process of selecting and replacing is carried out 400 times.

What is the expected number of black discs that would be drawn?

(2)

(Total 8 marks)

**4.** A company manufactures television sets. They claim that the lifetime of a set is normally distributed with a mean of 80 months and standard deviation of 8 months.

(a) What proportion of television sets break down in less than 72 months?

(2)

(b) (i) Calculate the proportion of sets which have a lifetime between 72 months and 90 months.

(ii) Illustrate this proportion by appropriate shading in a sketch of a normal distribution curve.

(5)

(c) If a set breaks down in less than *x* months, the company replace it free of charge. They replace 4% of the sets. Find the value of *x*. **(3)**

(Total 10 marks)

**5.** Intelligence Quotient (IQ) in a certain population is normally distributed with a mean of 100 and a standard deviation of 15.

(a) What percentage of the population has an IQ between 90 and 125?

(2)

(b) If two persons are chosen at random from the population, what is the probability that both have an IQ greater than 125?

(3)

(c) The mean IQ of a random group of 25 persons suffering from a certain brain disorder was found to be 95.2. Is this sufﬁcient evidence, at the 0.05 level of signiﬁcance, that people suffering from the disorder have, on average, a lower IQ than the entire population? State your null hypothesis and your alternative hypothesis, and explain your reasoning.

(4)

(Total 9 marks)

**6.** A fair coin is tossed eight times. Calculate

(a) the probability of obtaining exactly 4 heads;

(2)

(b) the probability of obtaining exactly 3 heads;

(1)

(c) the probability of obtaining 3, 4 or 5 heads.

(3)

(Total 6 marks)

**7.** In a school of 88 boys, 32 study economics (E), 28 study history (H) and 39 do not study either subject. This information is represented in the following Venn diagram.



(a) Calculate the values *a*, *b*, *c*.

(4)

(b) A student is selected at random.

(i) Calculate the probability that he studies **both** economics and history.

(ii) Given that he studies economics, calculate the probability that he does **not** study history.

(3)

(c) A group of three students is selected at random from the school.

(i) Calculate the probability that none of these students studies economics.

(ii) Calculate the probability that at least one of these students studies economics.

(5)

(Total 12 marks)

**8.** Dumisani is a student at IB World College.  
The probability that he will be woken by his alarm clock is   
If he is woken by his alarm clock the probability he will be late for school is   
If he is not woken by his alarm clock the probability he will be late for school is 

Let *W* be the event “Dumisani is woken by his alarm clock”.  
Let *L* be the event “Dumisani is late for school”.

(a) Copy and complete the tree diagram below.



(4)

(b) Calculate the probability that Dumisani will be late for school.

(3)

(c) Given that Dumisani is late for school what is the probability that he was woken by his alarm clock?

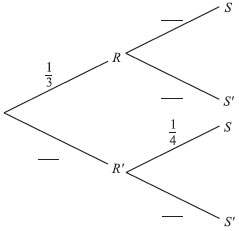
(4)

(Total 11 marks)

**9.** The following probabilities were found for two events *R* and *S*.

P(*R*) = , P(*S*  *R*) = , P(*S*  *R′*) = .

(a) **Copy** and **complete** the tree diagram.



(3)

(b) Find the following probabilities.

(i) P(*R*  *S*).

(ii) P(*S*).

(iii) P(*R*  *S*).

(7)

(Total 10 marks)

**10.** Two restaurants, *Center* and *New*, sell fish rolls and salads.

Let *F* be the event a customer chooses a fish roll.

Let *S* be the event a customer chooses a salad.

Let *N* be the event a customer chooses neither a fish roll nor a salad.

In the *Center* restaurant P(*F*) = 0.31, P(*S*) = 0.62, P(*N*) = 0.14.

(a) Show that P(*F*  *S*) = 0.07.

(3)

(b) Given that a customer chooses a salad, find the probability the customer also chooses a fish roll.

(3)

(c) Are *F* and *S* independent events? Justify your answer.

(3)

At *New* restaurant, P(*N*) = 0.14. Twice as many customers choose a salad as choose a fish roll. Choosing a fish roll is **independent** of choosing a salad.

(d) Find the probability that a fish roll is chosen.

(7)

(Total 16 marks)

**11.** Three students, Kim, Ching Li and Jonathan each have a pack of cards, from which they select a card at random. Each card has a 0, 3, 4, or 9 printed on it.

(a) Kim states that the probability distribution for her pack of cards is as follows.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *x* | 0 | 3 | 4 | 9 |
| P(*X* = *x*) | 0.3 | 0.45 | 0.2 | 0.35 |

Explain why Kim is incorrect.

(2)

(b) Ching Li correctly states that the probability distribution for her pack of cards is as follows.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *x* | 0 | 3 | 4 | 9 |
| P(*X* = *x*) | 0.4 | *k* | 2*k* | 0.3 |

Find the value of *k*.

(2)

(c) Jonathan correctly states that the probability distribution for his pack of cards is given by P(*X* = *x*) = . One card is drawn at random from his pack.

(i) Calculate the probability that the number on the card drawn is 0.

(ii) Calculate the probability that the number on the card drawn is greater than 0.

(4)

(Total 8 marks)