**IB Math Studies – Chapter 14 – Probability – Review Questions**

**1.** Two identical dice have sides numbered one to six. **The dice are weighted**. All the numbers except the four have equal probability of appearing on top. The four is three times as likely as each of the other numbers to appear on top.

 The tree diagram below shows some of the probabilities.



(a) Find the values of *a* and *b* in the diagram.

(b) Both dice are thrown. Calculate the probability that two fours appear on top.

(c) One of the dice is thrown once. The result is not a two or a three. What is the probability that it is a six?

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

(Total 8 marks)

**2.** Claire and Kate both wish to go to the cinema but one of them has to stay at home to baby-sit.

The probability that Kate goes to the cinema is 0.2. If Kate does not go Claire goes.

If Kate goes to the cinema the probability that she is late home is 0.3.

If Claire goes to the cinema the probability that she is late home is 0.6.

(a) Copy and complete the probability tree diagram below.



(3)

(b) Calculate the probability that

(i) Kate goes to the cinema and is not late;

(2)

(ii) the person who goes to the cinema arrives home late.

(3)

(Total 8 marks)

**3.** Neil has three dogs. Two are brown and one is grey. When he feeds the dogs, Neil uses three bowls and gives them out randomly. There are two red bowls and one yellow bowl. This information is shown on the tree diagram below.



(a) One of the dogs is chosen at random.

(i) Find P (the dog is grey and has the yellow bowl).

(ii) Find P (the dog does not get the yellow bowl).

(3)

(b) Neil often takes the dogs to the park after they have eaten. He has noticed that the grey dog plays with a stick for a quarter of the time and both brown dogs play with sticks for half of the time. This information is shown on the tree diagram below.



(i) Copy the tree diagram and add the four missing probability values on the branches that refer to playing with a stick.

During a trip to the park, one of the dogs is chosen at random.

(ii) Find P (the dog is grey or is playing with a stick, but not both).

(iii) Find P (the dog is grey given that the dog is playing with a stick).

(iv) Find P (the dog is grey and was fed from the yellow bowl and is not
playing with a stick).

(9)

(Total 12 marks)

**4.** Today Philip intends to go walking. The probability of good weather (G) is . If the weather is good, the probability he will go walking (W) is . If the weather forecast is not good (NG) the probability he will go walking is .

(a) Complete the probability tree diagram to illustrate this information.



(b) What is the probability that Philip will go walking?

|  |  |
| --- | --- |
| *Working:* |  |
|  | *Answer*:(b) .................................................................. |

(Total 8 marks)

**5.** In a club with 60 members, everyone attends either on Tuesday for Drama (*D*) or on Thursday for Sports (*S*) or on both days for Drama and Sports.

 One week it is found that 48 members attend for Drama and 44 members attend for Sports and *x* members attend for both Drama and Sports.

(a) (i) Draw and **label fully** a Venn diagram to illustrate this information.

(3)

(ii) Find the number of members who attend for both Drama and Sports.

(2)

(iii) Describe, in words, the set represented by (*D*  *S*)'.

(2)

(iv) What is the probability that a member selected at random attends for Drama only or Sports only?

(3)

 The club has 28 female members, 8 of whom attend for both Drama and Sports.

(b) What is the probability that a member of the club selected at random

(i) is female and attends for Drama only or Sports only?

(2)

(ii) is male and attends for both Drama and Sports?

(2)

(Total 14 marks)

**6.** On a particular day 100 children are asked to make a note of what they drank that day.

 They are given three choices: water (W), coffee (C) or fruit juice (F)

 1 child drank only water.
6 children drank only coffee.
8 children drank only fruit juice.
5 children drank all three.
7 children drank water and coffee only.
53 children drank coffee and fruit juice only.
18 children drank water and fruit juice only.

(a) Represent the above information on a Venn Diagram.

(4)

(b) How many children drank none of the above?

(2)

(c) A child is chosen at random. Find the probability that the child drank

(i) coffee;

(ii) water or fruit juice but not coffee;

(iii) no fruit juice, given that the child did drink water.

(4)

(d) Two children are chosen at random. Find the probability that both children drank all three choices.

(3)

(Total 13 marks)

**7.** A group of 50 students completed a questionnaire for a Mathematical Studies project. The following data was collected.

18 students own a digital camera (D)

15 students own an ipod (I)

26 students own a cell phone (C)

1 student owns all three items

5 students own a digital camera and an ipod but not a cell phone

2 students own a cell phone and an ipod but not a digital camera

3 students own a cell phone and a digital camera but not an ipod

(a) Represent this information on a Venn diagram.

(4)

(b) Calculate the number of students who own none of the items mentioned above.

(2)

(c) If a student is chosen at random, write down the probability that the student owns a digital camera **only**.

(1)

(d) If two students are chosen at random, calculate the probability that they both own a cell phone **only**.

(3)

(e) If a student owns an ipod, write down the probability that the student also owns a digital camera.

(2)

(Total 12 marks)

**8.** Children in a class of 30 students are asked whether they can swim (S) or ride a bicycle (B).

There are 12 girls in the class. 8 girls can swim, 6 girls can ride a bicycle and 4 girls can do both.

16 boys can swim, 13 boys can ride a bicycle and 12 boys can do both. This information is represented in a Venn diagram.



(a) Find the values of *a* and *b*.

(2)

(b) Calculate the number of students who can do neither.

(2)

(c) Write down the probability that a student chosen at random can swim.

(2)

(d) Given that the student can ride a bicycle, write down the probability that the student is a girl.

(2)

(Total 8 marks)

**9.** In a group of fifteen students, three names begin with the letter B and four begin with a G. The remaining eight names begin with A, C, D, E, F, H, I and J respectively.

The 15 names are placed in a box. The box is shaken and two names are drawn out.

Find the probability that

(a) both names begin with any letter except G or B;

(b) both names begin with the same letter;

(c) both names begin with the letter H.



(Total 6 marks)

**10.** ***Note****: For this question, it is important that you show your working and explain your method clearly.*

 A box contains 10 coloured light bulbs, 5 green, 3 red and 2 yellow. One light bulb is selected at random and put into the light fitting of room A.

(a) What is the probability that the light bulb selected is

(i) green?

(1)

(ii) not green?

(1)

 A second light bulb is selected at random and put into the light fitting in room B.

(b) What is the probability that

(i) the second light bulb is green given the first light bulb was green?

(l)

(ii) both light bulbs are not green?

(2)

(iii) one room has a green light bulb and the other room does not have a green light bulb?

(3)

 A third light bulb is selected at random and put in the light fitting of room C.

(c) What is the probability that

(i) all three rooms have green light bulbs?

(2)

(ii) only one room has a green light bulb?

(3)

(iii) at least one room has a green light bulb?

(2)

(Total 15 marks)

**IB Math Studies – Chapter 14 – Probability – Mark Schemes**

**1.** (a) *a* = 1, *b* = 3  (A1)(A1) (C2)

(b) P (two fours) =  (M1)
=  (or 0.141 to 3 s.f.) (A1) (C2)

(c) P (not two or three) = ,  (A2)
so P (sixnot two or three) =  =  (or 0.167) (M1)(A1) (C4)

[8]

**2.** (a)



 (A1)(A1)(A1) 3

**Note:** (A1) for 0.8, (A1) for 0.7, (A1) for 0.6 and 0.4.

(b) (i) 0.2  0.7 = 0.14 (M1)(A1)(ft)

**Note:** (M1) for multiplying correct numbers. (G2) 2

(ii) 0.2  0.3 + 0.8  0.6 (M1)(M1)

= 0.54 (A1)(ft)(G2) 3

**Note:** (M1) for each correct product (use candidate’s
tree), (A1)(ft) for answer.

[8]

**3.** (a) (i) P (a dog is grey and has the yellow bowl)

 (M1)(A1)(G2)

**Note:** The (M1) is for multiplying two values along any branch of the tree.

(ii) P (dog does not get yellow bowl) =  (A1) 3

(b) (i) The tree diagram should show the values  for the brown branch (A1)
and  in the correct positions for the grey branch. (A1)(ft)

**Note:** Follow through if the branches are interchanged.

(ii) P (the dog is grey or is playing with a stick, but not both)

 (M1)

 (A1)(ft)(G1)

**Notes:** The (M1) is for showing two correct products (whether added or not).

Follow through from b(i).

Award (M1) for  (must be a sum).

(iii) P (dog is grey given that it is playing with stick)

 (M1)(A1)(ft)

**Note:** (M1) for substituted conditional probability formula, (A1) for correct substitutions.

 (A1)(ft)(G2)

(iv) P (grey and fed from yellow bowl and not playing with stick)
=   (M1)(A1)(ft)(G1)9

**Note:** (M1) is for product of 3 reasonable probability values.

[12]

**4.**

**Note:** In the Spanish papers B is used instead of G and P is used instead of W.

(a)

  (A4) (C4)

(b) P (*G*  *W*) =  (A1)
P(*NG*  *W*) =  (A1)
P(*W*) =  (M1)
=  (0.6875, 68.75% or 0.688 to 3 s.f.) (A1) (C4)

[8]

**5.** (a) (i)

  (A3) 3

**Note:** Award (A1) for a correct diagram (labelled), (A1) for x in the correct position, (A1) for either (48 – x) **or** (44 – x) correctly positioned.

(ii) 48 – *x* + *x* + 44 – *x* = 60 (or equivalent), allow **ft** from (i) (M1)
 *x* = 32 (A1) 2

(iii) The set of members who **did not** attend for **both** (A2) 2
Drama and Sports (or equivalent)

(iv) P(*D* or *S*) =  (M1)(M1)

**Note:** Award (M1) for either  or , (M1) for adding.

 =  ***or***  ***or*** 0.467 (3 s.f.) ***or*** 46.7% (3s.f.) (A1) 3

(b) (i) P(Female and (*S* or *D*)) =  (M1)
=  ***or*** 0.333 (3 s.f.) ***or*** 33.3% (3s.f.) (A1) 2

(ii) P(Male and both *D* and *S*) =  (M1)
=  ***or*** 0.4 ***or*** 40% (A1) 2

[14]

**6.** (a)

  (A4) 4

**Note:** Award (A1) for the box and circles, (A3) for 7 correct entries, (A2) for 5 or 6 correct, (A1) for 3 or 4 correct.

(b) 100 – (1 + 7 + 6 + 18 + 5 + 53 + 8) = 2 (M1)(A1) 2

(c) (i) P(coffee) = (= 0.71) (A1)

(ii) P(W  F  C) =  (= 0.27) (A1)

(iii) P(FW) =  (= 0.258) (A1)(A1) 4

**Note:** Award (A1) for 8, (A1) for 31.

(d) P(both drank all 3) =  (A1)(A1)
= (= 0.00202) (A1) 3

[13]

**7.** (a)

|  |  |
| --- | --- |
|  | (A1)(A1)(A1) (A1)(ft) 4 |

**Note:** (A1) for rectangle with 3 intersecting circles,
(A1) for 1, (A1) for 5, 3, 2, (A1)(ft) for 9, 7, 20 if
subtraction is carried out, or 18, 15, 26 seen by
the letters D, I and C

(b) 50 – 47 (M1)

**Note:** (M1) for subtracting their value from 50.

= 3 (A1)(ft)(G2) 2

(c)  (A1)(ft) 1

(d)  (A1)(ft)(M1)

=  (A1)(ft)(G2) 3

**Notes:** (A1)(ft) for correct fractions from their
Venn diagram

(M1) for multiplying their fractions

(A1)(ft) for correct answer.

(e)  (A1)(ft)(A1)(ft) 2

**Note:** (A1)(ft) for numerator, (A1)(ft) denominator

[12]

**8.** (a) *a* = 4, *b* = 1 (A1)(A1) 2

(b) 30 – (4 + 12 + 1 + 2 + 4 + 4) = 3 (M1)(A1) (or (A2)) 2

(c)  (A1)(A1) 2

**Note:** Award(A1)for numerator,(A1)for denominator.

(d)  (A1)(A1)2

**Note:** Award(A1)for numerator,(A1)for denominator.

**9.** (a)  (M1)

=  (A1) (C2)

**Note:** (M1) is for a product including at least one correct fraction.

(b)  (M1)(M1)

**Note:** (M1) is for adding two products, the other (M1) is if both products attempt to deal with non-replacement and the numbers are not ridiculous.

=  (A1) (C3)

**Note:** If one correct product is doubled this receives (M1)(M0)(A0)

(c) The probability is 0. (Allow answer “impossible” or equivalent.) (A1) (C1)

[6]

**10.** (a) (i) *p*(green) =  (A1)

(ii) *p*(not green) =  (A1)

**Note:** Accept , 0.5 or 50% for either answer

(b) (i) *p*(GG) =  or 0.444 (3 s.f.) (A1)

(ii) *p*(not green then not green)
=  (M1)
=  or  or 0.222 (3 s.f.) (A1)

(iii) *p*(one green and one not green)
=  (M2)

**Note:** Award (M1) for , (M1) for (×2)

 =  or  or 0.556 (3 s.f.) (A1)

(c) (i) *p*(3 green) =  (M1)
 =  or  or 0.0833 (3 s.f.) (A1)

(ii) *p*(only one green) =  (M2)

**Note:** Award (M1) for , (M1) for (×3)

 =  or 0.417 (3 s.f.) or  or  (A1)

(iii) *p*(at least one green) = 1 – *p*(no green)
= 1 –  (M1)
= 1 – 
=  or  or 0.917 (3 s.f.) (A1)

[15]