Probability of Events

AI HL Practice Problems

<table>
<tr><td colspan="2">Theoretical and Experimental Probability</td></tr>
<tr><td>1</td><td>A letter is picked at random from the word PROBABILITY. What is the probability that it is a letter from the word FACTS?</td></tr>
<tr><td>2</td><td>A bag contains 12 counters numbered from 1 to 12. If a counter is picked at random, find the probability that it is: a even b a cube number c prime and odd</td></tr>
<tr><td>3</td><td>A survey of the most common method of grocery shopping was carried out amongst a group of adults. The results are shown in the following table:
<table>
<tr><th>Method</th><th>Online</th><th>Instore</th></tr>
<tr><td>Age 20-39</td><td>64</td><td>31</td></tr>
<tr><td>Age 30-59</td><td>53</td><td>49</td></tr>
<tr><td>Age 60 and over</td><td>27</td><td>81</td></tr>
</table>
One adult is selected at random from the group.

a What is the probability that this adult shopped online?

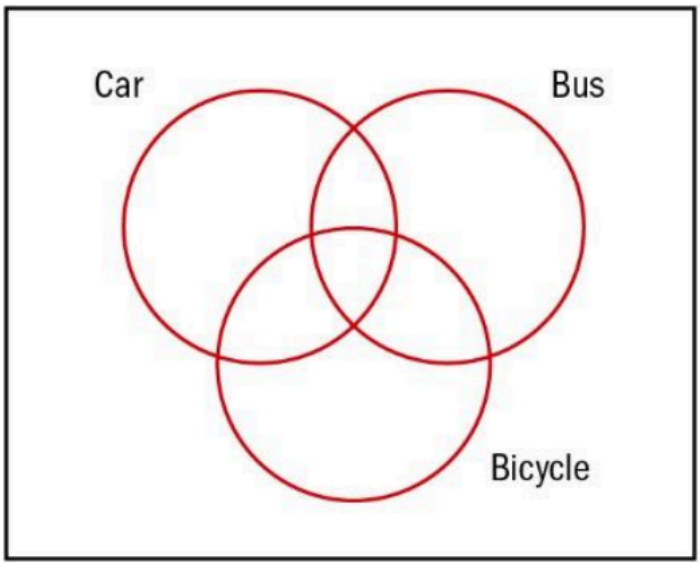
b If this sample is representative of the general population of adults aged 20 and over, how many people would you expect to shop instore in a town containing 80 000 adults aged 20 and over?</td></tr>
<tr><td>4</td><td>A fair icosahedral die (numbered 1 to 20) is rolled. What is the probability that it will show:

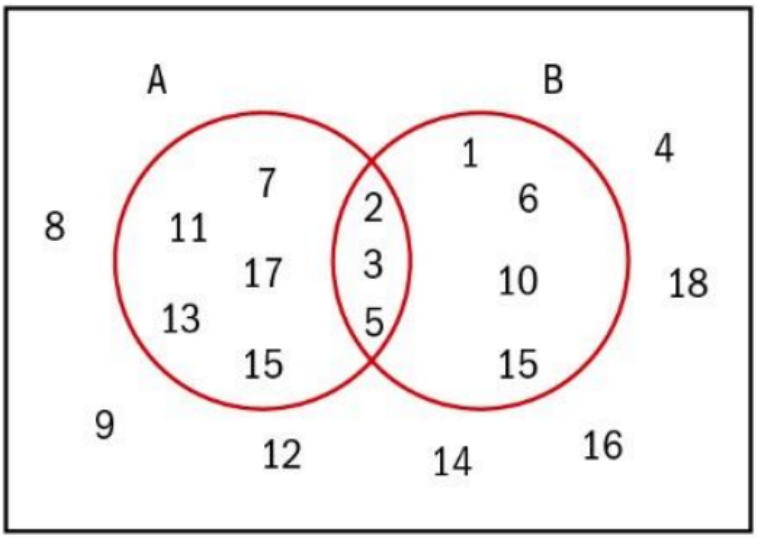
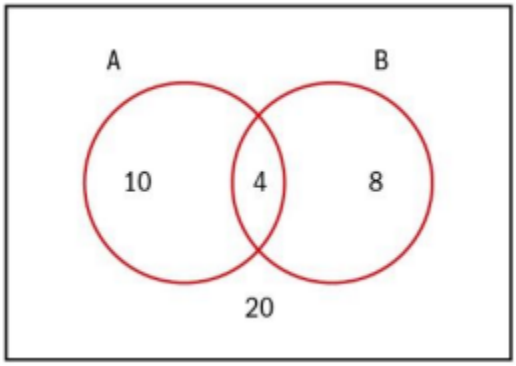
a a factor of 20?

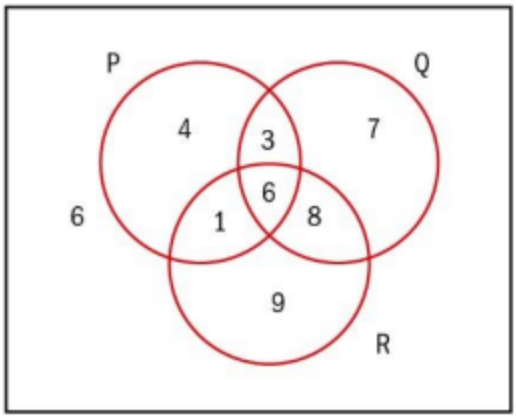
b a prime number?</td></tr>
<tr><td>5</td><td>A baseball team wins 60% of its home fixtures and 30% of its away fixtures. In a season where it plays 18 home matches and 15 away matches, how many matches would it be expected to win?</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Representing Combined Probabilities with Diagrams</td></tr>
<tr><td>6</td><td>In a school year group of 120 students, 53 study Spanish and 68 study French while 20 study neither French nor Spanish.

a How many study both French and Spanish?

b What is the probability that a student chosen at random studies Spanish but not French?</td></tr>
</table>

7	In a survey, 120 people were asked about their use of cars, buses and bicycles. It was found that 50 people used cars, 44 used buses and 46 used bicycles. Also 20 people used both cars and buses, 11 used both buses and bicycles,17 used bicycles only and 7 used all 3 modes of transport. **a** Copy this Venn diagram with numbers assigned in all regions.  **b** What is the probability that someone selected at random from this group does not use any of these three modes of transport?
8	Two fair spinners are designed. One is numbered from 1 to 5 while the other is numbered from 1 to 4. Each is spun and the product X of the two numbers obtained is calculated. Find: **a** P(X is even) **b** P(X is a square number) **c** P(X is a multiple of 3).
9	Five fair coins are tossed. What is the probability of getting three heads and two tails?
10	Two fair dice are rolled. What is the probability that the difference between the two numbers is greater than two?
Representing Combined Probabilities with Diagrams and Formulae	
11	A fair icosahedral (20-sided) die numbered 1,2,3, … 20 is rolled and the number noted. The events A ‘roll a prime number’ and B ‘roll a factor of 30’ are represented in the Venn diagram below.

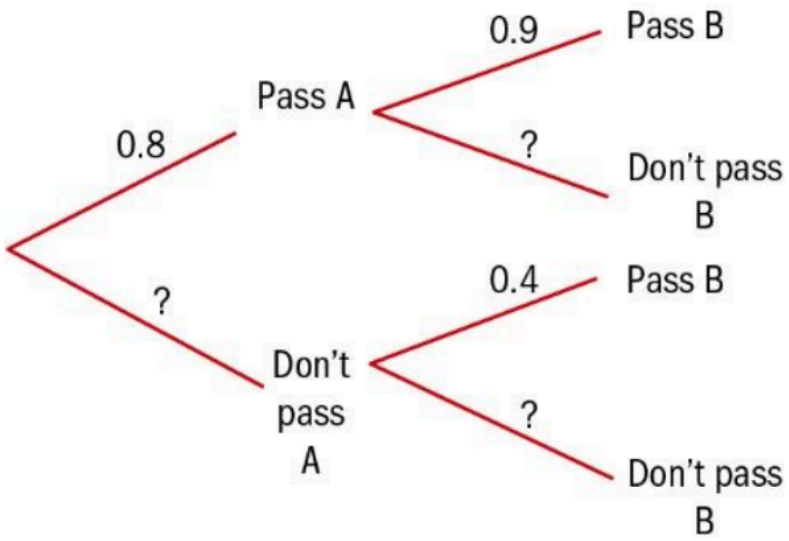
	 **a** Find P(A), P(B), P(A∩B) and P(A∪B) **b** Hence show that P(A∪B) = P(A) + P(B) - P(A∩B)
12	For these pairs of events, state whether they are mutually exclusive, independent or neither: **a** A - It will be cloudy today. B – It will be sunny tomorrow. **b** C – My baseball team will win their next game. D - My baseball team will lose their next game. **c** E – I will roll a six on a fair die. F – I will throw a tail on a fair coin.
13	In a group of 42 students in a school, A is the set of students studying art and B is the set of students studying biology. The numbers are shown in the Venn diagram below:  Show that A and B are independent.
14	The numbers of occurrences of the events P, Q and R are shown in the following Venn diagram.



Find:
a P(P|Q)

b P(Q|P)

Complete, Concise and Consistent Representations

15	Betty is about to take two mathematics tests: A and B. The probability that she passes test A is 0.8. If she passes this test then the probability that she will pass test B is 0.9 but, if she fails test A, her confidence drops and the probability that she passes test B is 0.4. **a** Copy and complete the tree diagram below  **b** Calculate the probability that she will pass test B.
16	A bag contains 10 red counters, 6 blue counters and 4 green counters. A counter is taken out at random and then replaced. This is repeated a second time. Find the probability that the two counters selected were the same colour.
17	A town has three districts: Alphaville, Betaville and Gammaville. 50% of the town live in Alphaville, 30% in

	Betaville and the remainder in Gammaville. A virus is spreading through the town so that, at present, 3% of Alphaville are infected, 2% of Betaville are infected and 1.5% of Gammaville are infected. **a** What percentage of the town are infected? **b** An inhabitant is selected at random and found to be infected. What is the probability that they come from Alphaville?
18	A bag contains 10 red counters and 10 blue counters. **a** If three counters are taken out at random with replacement, what is the probability that at least one counter is red? **b** Repeat part a without replacement.