Higher Check In - 11.02 Combined events and probability diagrams

1. Two normal, fair, six-sided dice are rolled. The score is found by adding the two values of the dice. Draw the sample space diagram for this and use it to work out the probability that the score is a prime number.

2. Jack estimates that the probability his football team will win their next game is 0.6 and the probability they will lose is 0.25. Calculate the probability that his team wins or draws their next game.

3. Q is the set of values between, but not including, -5 and 2. Use set notation to describe the set Q.

4. A lunch deal consists of a sandwich (ham, cheese, tuna or salad), a piece of fruit (banana, apple or pear) and a drink (orange juice, apple juice, water or lemonade). How many possible options are there for the lunch deal?

5. The probability of a student passing a health and safety exam is 0.45 and the probability they pass a first aid exam is 0.75. What is the probability the student fails both exams?

6. A dice is thrown twice and the results are recorded. Kerry says that the two throws are independent. Is she correct? Explain your answer.

7. A coin is tossed four times and the results are recorded. Joseph says that the probability of getting four heads is $\frac{1}{8}$. Is he correct? Explain your answer.

8. A fruit bowl contains only 5 apples and 3 pears. One fruit is taken at random from the bowl and not replaced. Another fruit is then taken at random from the bowl. Draw a tree diagram to show this and use it to calculate the probability that two apples are selected.

9. In a group of 50 students, 33 work part-time in a supermarket, 10 work part-time in a restaurant and 11 do not work part-time at all. If a student is chosen at random from this group, what is the probability this student works part-time in a supermarket and part-time in a restaurant?

10. 17 girls and 13 boys are in a class. This class took a geography test, in which 4 boys and 5 girls achieved 75% or above. If a pupil from this class is chosen at random, what is the probability that this pupil is either a girl or a pupil that achieved 75% or above?

Extension
How many different 3 letter combinations are there of the letters H, E and M?
How many different 4 letter combinations are there of the letters T, H, E and M?
How many different 5 letter combinations are there of the letters T, H, E, M and E?

Answers

1.

Dice 2

		1	2	3	4	5	6
	1	**2**	**3**	4	**5**	6	**7**
	2	**3**	4	**5**	6	**7**	8
Dice 1	3	4	**5**	6	**7**	8	9
	4	**5**	6	**7**	8	9	10
	5	6	**7**	8	9	10	**11**
	6	**7**	8	9	10	**11**	12

$$\text{Probability} = \frac{15}{36} = \frac{5}{12}$$

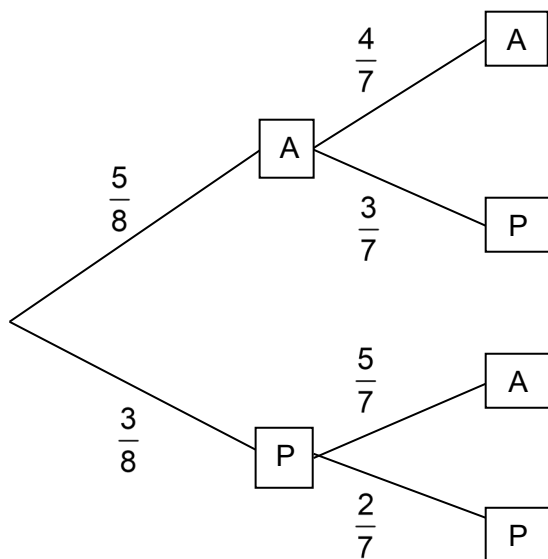2. 0.75

3. $Q = \{x : -5 < x < 2\}$

4. $4 \times 3 \times 4 = 48$ possible options.

5. $0.55 \times 0.25 = 0.1375$

6. Kerry is correct because the outcome of throwing the dice a second time is not affected by the outcome of the first throw.

7. Joseph is not correct as the probability is $\left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \right) \frac{1}{16}$.
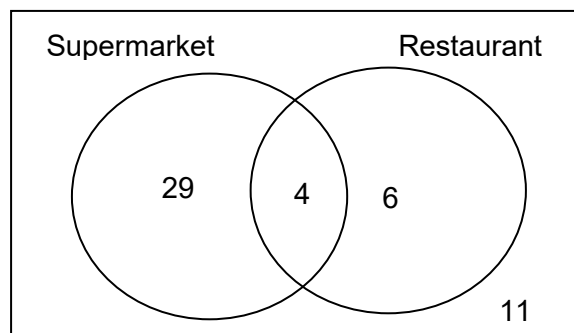
8.

$$\text{Probability} = \frac{5}{8} \times \frac{4}{7} = \frac{20}{56} = \frac{5}{14}$$

9.

$\mathscr{E}$

Supermarket   Restaurant

29   4   6

11

$$\text{Probability} = \frac{4}{50} = \frac{2}{25}$$

10. p(girl or 75% and above) = p(girl) + p(75% or above) − p(both)

$$= \frac{17}{30} + \frac{9}{30} - \frac{5}{30} = \frac{21}{30} = \frac{7}{10}$$

Extension

HEM = 6   (3 × 2 × 1)

HEM	EHM	MEH
HME	EMH	MHE

THEM = 24 (4 × 3 × 2 × 1)

THEM	HTEM	ETHM	METH
THME	HTME	ETMH	MEHT
TEHM	HETM	EHMT	MHTE
TEMH	HEMT	EHTM	MHET
TMEH	HMET	EMHT	MTEH
TMHE	HMTE	EMTH	MTHE

THEME has 5 letters so we might expect 120 (from 5 × 4 × 3 × 2 × 1). However, as two letters are the same, by doing 5 × 4 × 3 × 2 × 1 = 120 we will actually have counted double the number of available combinations (since we will have counted two instances of 'THEME' rather than just one, two of 'THEEM', etc). This means that the total number of different combinations is 60.

GCSE (9–1)
MATHEMATICS

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AO1	1	Draw a sample space diagram and calculate a probability			
AO1	2	Apply the addition law of probability			
AO1	3	Use set notation to describe a set of numbers			
AO1	4	Use the product rule			
AO1	5	Apply the multiplication law of probability			
AO2	6	Understand what is meant by independent events			
AO2	7	Apply the multiplication law of probability			
AO2	8	Construct a tree diagram and calculate a probability			
AO3	9	Solve a probability problem			
AO3	10	Apply the formula p(A *or* B) = p(A) + p(B) – p(A *and* B)			

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