UNIT TEST #016 | Australian Curriculum Mathematics | UTM8T4U8

ACACIA TUTORING

Probability, Tree Diagrams, and Venn diagrams

8 Unit Test

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Instructions: Read all questions carefully to ensure you understand what is being asked. When completing your official tests / exams, your grade will be based upon your: **understanding, fluency, reasoning, and problem solving,** so ensure you show all lines of working and draw accurate, labelled diagrams where necessary. (ACiQ|9.0 Mathematics standard elaborations found on final page (general assessment marking standards)). [Practise tests are marked out of a score of 10]. For multiple choice questions, tick or fill in the circle next to the corresponding letter under the question.

Check your work if you have time. *Remember:* you don't have to start at question one, it's always best to firstly look through the test, highlight the easy looking questions and complete them first, then secondly, go back through and work on the harder questions. Good luck! And remember to breathe!

$$\sum = \frac{\quad}{10} = \quad \%$$

Part 1: Multiple Choice (2 marks)

Question 1:

a) If you roll two dice, what is the probability of getting a sum of 7 ?

A. $\frac{1}{6}$ **B.** $\frac{1}{12}$ **C.** $\frac{1}{18}$ **D.** $\frac{1}{36}$

◯ **A** ◯ **B** ◯ **C** ◯ **D**

b) What does a probability of 1 represent ?

A. The outcome is impossible.
B. The outcome is unlikely.
C. The outcome is likely.
D. The outcome is certain.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Question 2:

a) If the probability that it will rain tomorrow is 0.95 , what is the probability that it will not rain?

A. 0.5 **B.** 0.95 **C.** 0.05 **D.** 0.095

◯ **A** ◯ **B** ◯ **C** ◯ **D**

b) In a Venn diagram where set A represents students who play football, and set B represents students who play basketball, what does the region outside both circles represent?

A. Students who play both football and basketball.
B. Students who play either football or basketball but not both.
C. Students who do not play either football or basketball.
D. Students who play only football.

◯ **A** ◯ **B** ◯ **C** ◯ **D**

Part 2: Short Answer (4 marks)

Question 3:

a) You roll two dice. One is a standard 6 sided die (cube) with the numbers one to six on it, and the other is a 4 sided die (triangular based pyramid) with the numbers one to four on it. What's the probability of getting a sum of 7 or 11 ?

b) Draw a Venn diagram for two sets, A and B, where:
Set A has 20 elements,
Set B has 15 elements,
10 **elements are in both A and B.**

Question 4:

a) If the probability of event A happening is $\frac{3}{5}$ and the probability of event B happening is $\frac{1}{3}$, what is the probability of both A and B happening if they are independent events?

b) If you draw two cards without replacement from a deck, what is the probability of getting two aces?

Part 3: Problem Solving (4 marks)

Question 5:

a) Using a two-way table, list the outcomes from rolling a standard 6 sided die along with a 4 sided die possible outcomes: $\{1, 2, 3, 4\}$. Then, using the combinations, write out another two-way table with the sum of each and calculate the probability of getting a sum of 7 .

b) In a class of 30 students, 18 like math, 12 like science, and 7 like both. How many students like neither subject? Use a Venn diagram to solve this.

Question 6:

a) A bag contains 5 red balls and 3 black balls. If you draw two balls without replacement, what is the probability that both are red?

b) Draw a tree diagram that shows the possible outcomes from rolling a standard die and flipping a coin.

Solutions

1a. (0.5 marks)

A. $\frac{1}{6}$

- There are 6 favorable outcomes: $(1+6, 2+5, 3+4, 4+3, 5+2, 6+1)$, out of 36 total outcomes,which simplifies to:

$$P(\Sigma = 7) = \frac{\text{Number of favourable outcomes}}{\text{number of outcomes}} = \frac{6}{36}$$
$$= \frac{6 \div 6}{36 \div 6}$$
$$= \frac{1}{6}.$$

b. (0.5 marks)

D. The outcome is certain.

2a. (0.5 marks)

C. 0.05

$$P(no\ rain) = 1 - P(rain)$$
$$= 1 - 0.95$$
$$= 0.05.$$

b. (0.5 marks)

C. Students who do not play either football or basketball.

- This region represents those who are not in set A or set B.

3a. (1 mark)

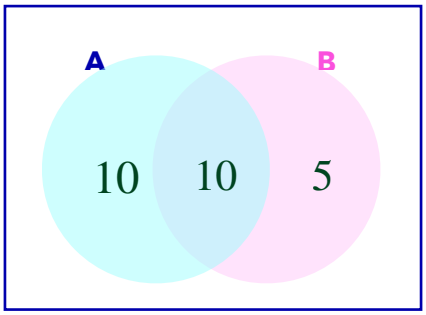
Sum of 7 can be $(3,\ 4), (4,\ 3), (5,\ 2), (6,\ 1) = 4$ combinations.

Sum of $11 = 0$ (No possible combinations.)

Total outcomes for the two dice $= 6 \times 4$
$= 24$:

Probability $= \frac{4}{24} + \frac{0}{24}$
$= \frac{4}{24}$
$= \frac{4 \div 4}{24 \div 4}$
$= \frac{1}{6}.$

b. (1 mark)



[Description for drawing:Two overlapping circles, labeled A and B. Circle A contains 20 elements, Circle B contains 15 elements, with an overlap of 10 elements.]

Therefore, 10 elements are in the intersection of A and B = A ∩ B,

10 elements are only in A $(20-10)$, and

5 elements are only in B $(15-10)$.

4a. (1 mark)

For independent events, $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B)$:

$$P(A \cap B) = \frac{3}{5} \times \frac{1}{3}$$
$$= \frac{\cancel{3} \times 1}{5 \times \cancel{3}}$$
$$= \frac{1}{5}.$$

b. (1 mark)

First draw: $\frac{4}{52}$ (4 aces out of 52 cards).

Second draw: $\frac{3}{51}$ (3 aces left out of 51 cards).

Combined probability:

$P(\text{one event AND another event}) = P(1 \cap 2)$
$= P(\text{event one}) \times P(\text{event two})$

$$= \frac{4}{52} \times \frac{3}{51}$$
$$= \frac{4 \times 3}{52 \times 51}$$
$$= \frac{12 \div 12}{2652 \div 12}$$
$$= \frac{1}{221}.$$

5a. (1 mark)

Possible outcomes:

		Four sided die			
	Outcomes	**1**	**2**	**3**	**4**
Six sided die	**1**	(1, 1)	(2, 1)	(3, 1)	(4, 1)
	2	(1, 2)	(2, 2)	(3, 2)	(4, 2)
	3	(1, 3)	(2, 3)	(3, 3)	(4, 3)
	4	(1, 4)	(2, 4)	(3, 4)	(4, 4)
	5	(1, 5)	(2, 5)	(3, 5)	(4, 5)
	6	(1, 6)	(2, 6)	(3, 6)	(4, 6)

		Four sided die			
	Outcomes	**1**	**2**	**3**	**4**
Six sided die	**1**	2	3	4	5
	2	3	4	5	6
	3	4	5	6	7
	4	5	6	7	8
	5	6	7	8	9
	6	7	8	9	10

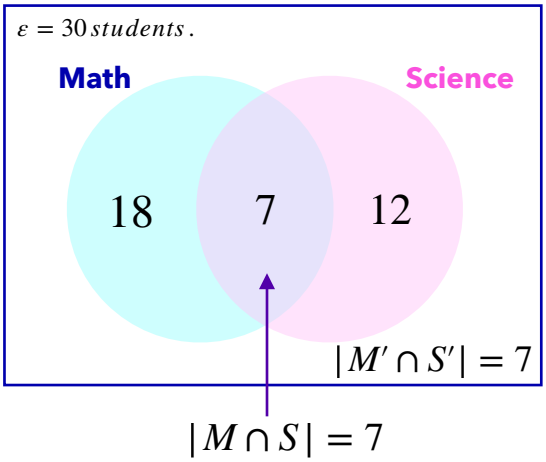
There are four possible outcomes where the sum is seven, out of a possible twenty four possible outcomes.
Therefore:

$$P(Sum\ of\ 7) = \frac{\text{Number of times the sum is seven}}{\text{Total Number of Outcomes}}$$

$$= \frac{4}{24}$$

$$= \frac{1}{6} \approx 0.167 \approx 16.7\,\%\,.$$

b. (1 mark)



Let M be the set of students who like math, S be the set of students who like science.

$$\begin{aligned}\text{Maths} &= |M| = 18,\\ \text{Science} &= |S| = 12,\\ \text{Maths and Science} &= |M \cap S| = 7.\end{aligned}$$

$$\begin{aligned}\text{Students who like at least one subject} &= \text{Maths or Science}\\ &= \text{Maths} + \text{Science} - \text{(Maths and Science)}\\ &= |M \cup S| = |M| + |S| - |M \cap S|\\ &= 18 + 12 - 7\\ &= 23\,.\end{aligned}$$

$$\begin{aligned}\text{Students who like neither} &= Total - |M \cup S|\\ |M' \cap S'| &= 30 - 23\\ &= 7\,.\end{aligned}$$

6a. (1 mark)

The probability of drawing a red ball first is $\frac{5}{8}$.

After drawing one red ball, there are 4 red balls left out of 7 :

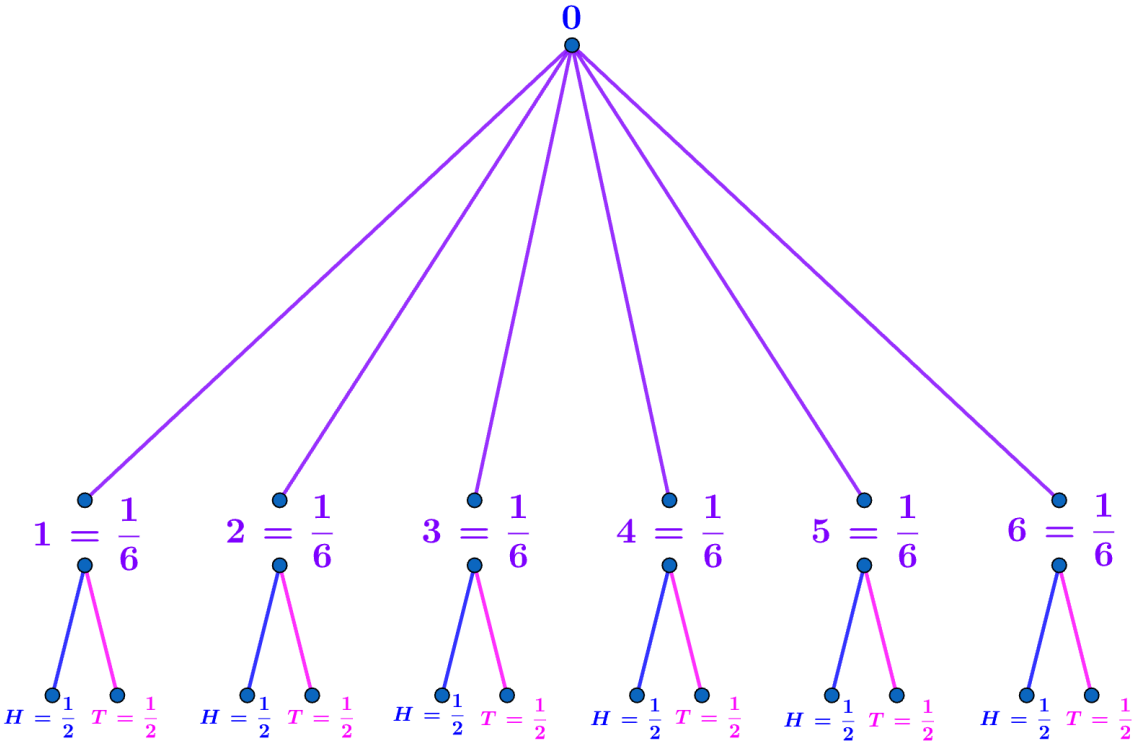
$$P(\text{second ball red} \mid \text{first ball red}) = \frac{4}{7}$$

Therefore, the probability of both being red is:

$$\begin{aligned}P(\text{Both Red}) = P(\text{Red Ball First}) \times P(\text{Second Ball Red I First Ball Red}) &= \frac{5}{8} \times \frac{4}{7}\\ &= \frac{5 \times 4}{8 \times 7}\\ &= \frac{20}{56}\\ &= \frac{5}{14}\,.\end{aligned}$$

b. (1 mark)

N.B. Only the outcomes are needed for full marks (not the probabilities).



$$\sum = \frac{\quad}{10} = \quad \%$$

General Assessment Marking Standards

Remember: When your official tests are marked, they won't be a score out of 10, they will be a grade (A,B,C,D,E) based on the following standards:

ACiQ | v9.0

Year 8 Mathematics standard elaborations

		A	B	C	D	E
		The folio of student work contains evidence of the following:				
Mathematical proficiencies	Understanding	accurate and consistent identification, representation, description and connection of mathematical concepts and relationships in complex unfamiliar, complex familiar, and simple familiar situations	accurate identification, representation, description and connection of mathematical concepts and relationships in complex familiar and simple familiar situations	identification, representation, description and connection of mathematical concepts and relationships in simple familiar situations	partial identification, representation and description of mathematical concepts and relationships in some simple familiar situations	fragmented identification, representation and description of mathematical concepts and relationships in isolated and obvious situations
	Fluency	choice, use and application of comprehensive facts, definitions, and procedures to find solutions in complex unfamiliar, complex familiar, and simple familiar situations	choice, use and application of effective facts, definitions, and procedures to find solutions in complex familiar and simple familiar situations	choice, use and application of facts, definitions, and procedures to find solutions in simple familiar situations	choice and use of partial facts, definitions, and procedures to find solutions in some simple familiar situations	choice and use of fragmented facts, definitions and procedures to find solutions in isolated and obvious situations
	Reasoning	comprehensive explanation of mathematical thinking, strategies used, and conclusions reached in complex unfamiliar, complex familiar, and simple familiar situations	detailed explanation of mathematical thinking, strategies used, and conclusions reached in complex familiar and simple familiar situations	explanation of mathematical thinking, strategies used, and conclusions reached in simple familiar situations	partial explanation of mathematical thinking, strategies used, and conclusions reached in some simple familiar situations	fragmented explanation of mathematical thinking, strategies used, and conclusions reached in isolated and obvious situations
	Problem-solving	purposeful use of problem-solving approaches to find solutions to problems.	effective use of problem-solving approaches to find solutions to problems.	use of problem-solving approaches to find solutions to problems.	partial use of problem-solving approaches to make progress towards finding solutions to problems.	fragmented use of problem-solving approaches to make progress towards finding solutions to problems.

Key shading emphasises the qualities that discriminate between the A–E descriptors

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