33°

52'

37''S

151°

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JE
MATHS

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ADV

- Set notation:

1. A couple has **two** children, each either a boy or a girl.
   (a) List all the outcomes.

   (b) List all the outcomes which have
   (i) at least one boy for set A.   (ii) **only** one boy for set B.

   (iii) no boy.

   (c) How many outcomes are in
   (i) set A.   (ii) set B.

2. A couple has **three** children, each either a boy or a girl.
   (a) List all the outcomes.

   (b) List all the outcomes which have
   (i) at least one boy for set A.   (ii) **only** one boy for set B.

   (iii) no boy.

   (c) How many outcomes are in
   (i) set A.   (ii) set B.

- Set proving:

3. Prove that $P(A) + P(\overline{A}) = 1$.

- Set theory (addition law): $P(A \text{ or } B) = P(A \cup B) = P(A) + P(B) - P(A \cap B)$

4. Two dice are thrown, what is the probability that
   (a) the sum is more than 8?   (b) the sum is equal to 8?

   (c) the sum is more than or equal to 8.

5. From 1 to 50 inclusively, one integer is chosen at random. Find the probability that this integer is
   (a) a multiple of 3.   (b) a multiple of 5.

   (c) a multiple of 3 or 5.

6. In a bag, $\dfrac{1}{2}$ are red balls, $\dfrac{1}{3}$ are black balls and the rest are green balls. If a ball is chosen at random, what is the probability that it is
   (a) a green ball?

   (b) a red ball or a black ball?

   (c) a red ball or a green ball?

7. Two dice are thrown, that is the probability of getting
   (a) a sum of 5 or a sum more than 9?

   (b) a sum of 5 or 2 odd numbers?

   (c) a sum more than 9 or 2 odd numbers?

   - Application of set theory (addition law) in probability:
8. From the following numbers from 1 to 20:
   1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20.
   The events A, B, C and D are:
      A: an even number is chosen:
      B: a number greater than 15 is chosen:
      C: a multiple of 3 is chosen:
      D: a one-digit number is chosen:
   (a) Find the probability of
      (i) an even number is chosen.   (ii) a number greater than 15 is chosen.

      (iii) a multiple of 3 is chosen.   (iv) a one-digit number is chosen.

   (b) Hence find:
      (i) an even number or a number greater than 15 is chosen.

      (ii) an even number or multiple of 3 is chosen.

      (iii) a number greater than 15 or a one-digit number is chosen.

- Application of set shading in probability:

9. A survey has been conducted by a group of 60 customers to try out three **freeze drinks in KFC**: **M**ountain Dew Freeze, **C**itrus Freeze and **P**epsi Freeze — 32 tried out for Mountain Dew Freeze, 29 tried out for Citrus Freeze, 15 tried out for Pepsi Freeze, 11 tried out for Mountain Dew Freeze and Citrus Freeze, 9 tried out for Citrus Freeze and Pepsi Freeze, 8 tried out for Mountain Dew Freeze and Pepsi Freeze, and 5 tried out for all three drinks.

(a) Draw a Venn diagram.
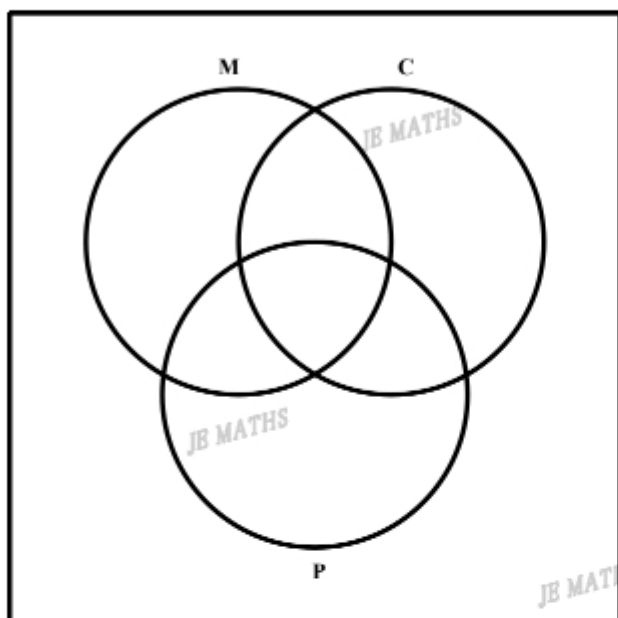
(b) Find the probability that a person is chosen at random that
(i) likes Mountain Dew or Pepsi Freeze.

(ii) likes Citrus or Pepsi Freeze but does not Mountain Dew freeze.

(iii) like Citrus Freeze but does not like Pepsi or Mountain Dew freeze.

- **Set theory (multiplication law):** $P(A \text{ and } B) = P(A \cap B) = P(A) \times P(B \mid A)$

10. There are 16 red and 14 black balls in a box.
    (a) If 2 balls are drawn one after another **with replacement**, find the probability that
       (i) all balls are red. (red and red)

    (ii) the first ball is red and the second ball is black. (red and black)

    (b) If 2 balls are drawn one after another **without replacement**, find the probability that
       (i) all balls are red. (red and red)

       (ii) the first ball is red and the second ball is black. (red and black)

- **Application of set theory (multiplication law) in probability:**
11. There are 6 gold, 3 silver and 3 bronze coins in a bag. If 3 coins are chosen at random with replacement, what is the probability that
    (a) all are gold?

    (b) all are of the same kind?

    (c) 2 gold and 1 silver?

    (d) none are gold?

12. A box contains 50 colour crayons of which 8 are yellow. If two are drawn in succession without replacement, find the probability that
    (a) both are yellow.

    (b) only one is yellow.

    (c) neither is yellow.

    - **Question involving multiple selections:**
13. A coin is tossed four times. Find the probability that:
    (a) every toss is a head.

    (b) no toss is a head.

    (c) there is at least one head.

    (d) the first three coins are heads.

    (e) the middle two are tails.

(f) Complete the table and show all working out.

No of heads	0	1	2	3	4
Probability	-	-	-	-	-

14. A bag contains six white marbles and four blue marbles. Three marbles are drawn in succession. At each draw, if the marble is white it is replaced, and if it is blue it is not replaced. Find the probabilities of drawing:

(a) no blue marbles.

(b) one blue marble.

(c) two blue marbles.

(d) three blue marbles.

15. (a) When a die is thrown **2** times, find the probability of obtaining

A gambler's dispute in 1654.

   (i) no six.

   (ii) at least one six. (3dps)

(b) When a die is thrown **4** times, find the probability of obtaining

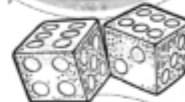   (i) no six.

   (ii) at least one six. (3dps)

(c) **A gambler's dispute problem in 1654:**

   When two dice are thrown **24** times, find the probability of obtaining

   (i) no double-six in one throw of two dice.

   (ii) at least one double-six in 24 throws. (3dps)

- **Set theory (condition probability formula):** $P(B \mid A) = \dfrac{P(A \cap B)}{P(A)} = \dfrac{|A \cap B|}{|A|}$

16. Rolling a die, given that only even numbers are considered, find the probability that the number is less than 3.

- Application of set theory (condition probability formula) in probability:

17. A die is rolled twice. Events A and B are defined as follows:

    A: The number obtained at the first time is greater than that at the second time.

    B: The sum of the two numbers is even.

    Find the probability that

    (a) the sum of the two numbers is even given that the number obtained at the first time is greater than that at the second time.

    (b) the number obtained at the first time is greater than that at the second time given that the sum of the two numbers is even.

18. In a certain population:

    30% of people have **blue eyes**

    20% have **black hair**

    10% have **black hair and blue eyes**

    A person is chosen from this population at random.

    (a) Find the probability that they have black hair, given that they have blue eyes.

    (b) Find the probability that they have blue eyes, given that they have black hair.

19. If $P(A \mid B) = P(A)$, prove that $P(B \mid A) = P(B)$.

- Application of condition probability formula in tree diagram cases:

20. A bag contains 5 white balls and 3 red balls. Two players, A and B, take turns drawing one ball from the bag at random, and balls drawn are **not replaced**.

    The player who <u>first gets two red balls is the **winner**</u>, and the game stops then.
    Player A draws first.

    (a) Find the probability that player A wins on his second draw.

    (b) Find the probability that player B wins on his second draw.

    (c) Find the probability that player A wins, given that the winning player wins on his second draw.

    (d) Neither player has won after two draws, given that A draws a red ball on his first draw.

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**JE
MATHS**

**Want to
learn?
We will
help u.**

••

**Don't
want to
learn?
We will
change u.**