

- 4 A letter is chosen at random from the 26-letter English alphabet. Find the probability that it is
- in the word **MATHEMATICS**
  - in the word **TRIGONOMETRY**
  - in the word **MATHEMATICS** and in the word **TRIGONOMETRY**
  - in the word **MATHEMATICS** or in the word **TRIGONOMETRY**.

$$U = \{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$$

$$M = \{M, A, T, H, E, I, C, S\} \quad n=8$$

$$T = \{T, R, I, G, O, N, M, E, Y\} \quad n=9$$

$$a) P(M) = \frac{8}{26} = \frac{4}{13}$$

$$b) P(T) = \frac{9}{26}$$

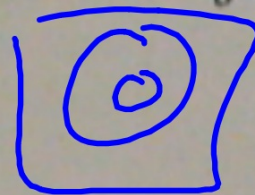
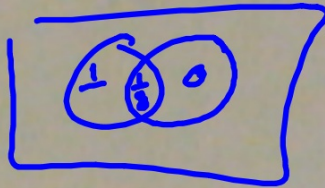
$$c) P(M \cap T) = \frac{4}{26} = \frac{2}{13}$$

$$d) P(M \cup T) = P(M) + P(T) - P(M \cap T) \\ = \frac{8}{26} + \frac{9}{26} - \frac{4}{26} = \frac{13}{26} = \frac{1}{2}$$

7 If  $X$  and  $Y$  are two events such that  $P(X) = \frac{1}{4}$  and  $P(Y) = \frac{1}{8}$  and  $P(X \cap Y) = \frac{1}{8}$ , find

a  $P(X \cup Y)$

b  $P(X \cup Y)'$



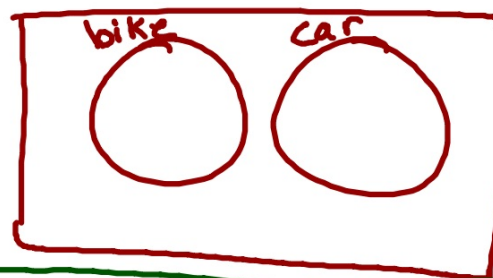
$$\begin{aligned} \text{a) } P(X \cup Y) &= P(X) + P(Y) - P(X \cap Y) \\ &= \frac{1}{4} + \frac{1}{8} - \frac{1}{8} = \frac{1}{4} \end{aligned}$$

$$\text{b) } P(X \cup Y)' = 1 - \frac{1}{4} = \frac{3}{4}$$

## Mutually Exclusive Events

Def: Two events are considered to be mutually exclusive if the outcomes cannot occur at the same time.

Ex | Fred rides his bike to school 3 days  
drives his car to school 1 day



$P(B)$  and  $P(A)$   
are mutually  
exclusive

$$\therefore P(A \cap B) = 0$$

If  $A$  and  $B$  are mutually exclusive  
then  $P(A \cap B) = 0$  and  $P(A \cup B) = P(A) + P(B)$

Ex Two events R and S have probabilities  
 $P(R) = \frac{3}{6}$  and  $P(S) = \frac{2}{12}$  and  $P(R \cup S) = \frac{3}{4}$ .  
Are S and R mutually exclusive?

does  $P(R) + P(S) = P(R \cup S)$ ?

$$\frac{3}{6} + \frac{2}{12} \stackrel{?}{=} \frac{3}{4}$$

$$\frac{4}{12} + \frac{2}{12}$$

$$\frac{6}{12}$$

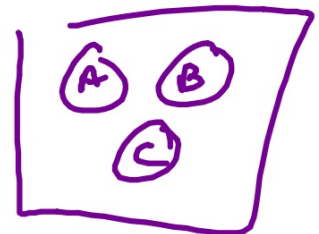
$$\frac{1}{2} \neq \frac{3}{4}$$

NO

Ex 2) In an inter-school quiz, Schools A, B, and C compete.  $P(A \text{ wins}) = \frac{1}{3}$ ,  $P(B \text{ wins}) = \frac{1}{4}$ ,  $P(C \text{ wins}) = \frac{1}{5}$

a)  $P(A \text{ or } B \text{ wins})?$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \\ = \frac{1}{3} + \frac{1}{4} - 0 = \frac{7}{12}$$



b)  $P(A \text{ or } B \text{ or } C \text{ wins})$

$$P(A \cup B \cup C) = \frac{1}{3} + \frac{1}{4} + \frac{1}{5} = \frac{47}{60}$$

$$c) P(\text{none of them win}) = 1 - \frac{47}{60} = \frac{13}{60}$$

HW p. 76 #1, 2, 3  
3D