Unit 3: Probability Name:
13 December 2019

Exam: Probability, Venn diagrams, descriptive statistics, trigonometry

1. Given:
   $U = \{\text{the letters in the alphabet}\}$ $A = \{b, e, c, a\}$ $B = \{r, u, l, e, s\}$

   (a) What is $A \cap B$?

   (b) What is $A \cup B$?

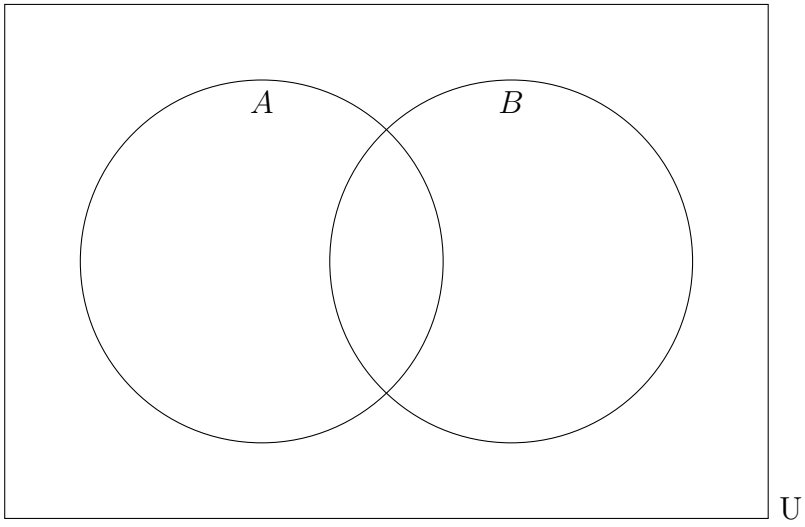
2. The universal set U is defined as the set of positive integers less than 10. The subsets A and B are defined as follows:

   $A = \{\text{the odd numbers}\}$ $B = \{\text{prime numbers}\}$

   (a) List the members of A'

   (b) List the members of $(A \cup B)'$

   (c) Place the elements of A and B in the appropriate regions in the Venn diagram below.

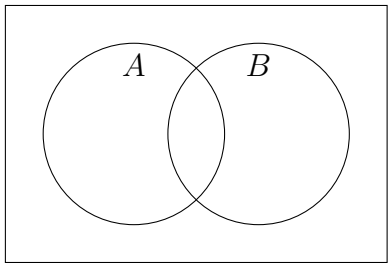


   (d) List the items in $A \cap B$.

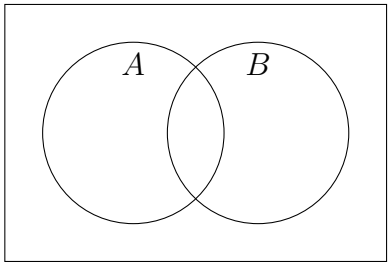
   (e) If an element is selected at random, what is the probability that it is a member of both sets, $(A \cap B)$?

3. For each Venn diagram, shade the area representing the expression.

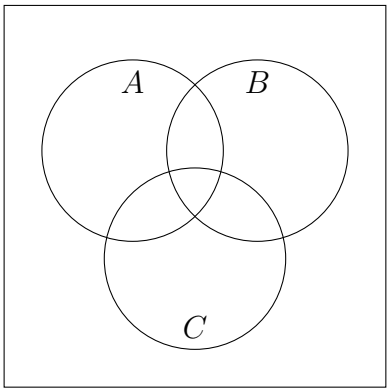
(a) $A \cup B$



(b) $A' \cap B$



(c) $(A \cap B) \cup C$



4. The events A and B are mutually exclusive with $\mathrm{P}(A) = 0.7$ and $\mathrm{P}(B) = 0.2$.

   (a) Write down $\mathrm{P}(A \cup B)$.

   (b) Find $\mathrm{P}(A' \cup B)$.

5. The events A and B are independent with $\mathrm{P}(A) = 0.5$ and $\mathrm{P}(B) = 0.8$.

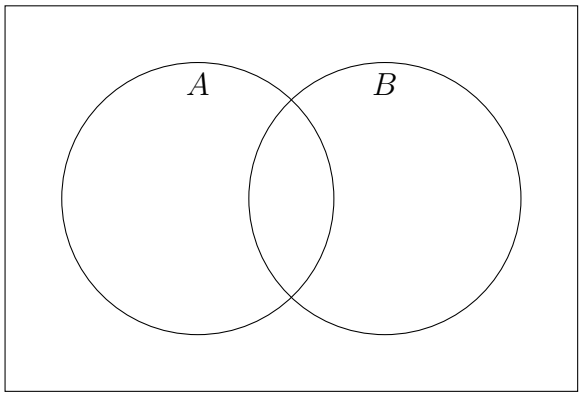
   (a) Find $\mathrm{P}(A \cap B)$.

   (b) Find $\mathrm{P}(A \cup B)$.

   (c) Find $\mathrm{P}(B|A)$.

6. Given events A and B with $\mathrm{P}(A) = 0.4$, $\mathrm{P}(B) = 0.5$, $\mathrm{P}(A \cap B) = 0.25$.

   (a) Completely mark the Venn diagram with probabilities for each area.



   (b) Find $\mathrm{P}(A \cup B)$.

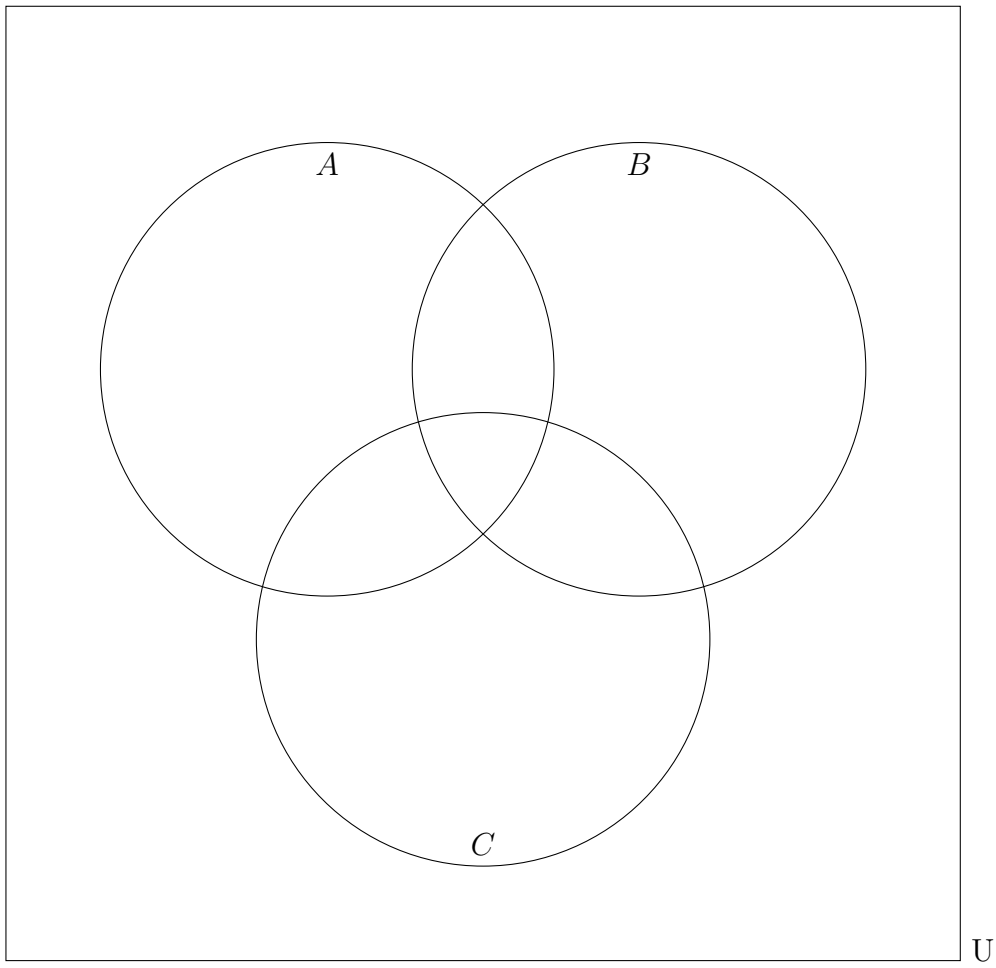
   (c) State whether events A and B are independent. Justify your answer.

   (d) Find $\mathrm{P}(A|B)$.

7. There are 80 athletes playing the following sports:

   - 35 play Archery
   - 44 play Badminton
   - 39 play Cricket
   - 16 play Archery and Badminton
   - 15 play Archery and Cricket
   - 10 play Badminton and Cricket
   - 3 play all three of these sports

   Complete the Venn diagram below with the number of students in each region to represent the situation.



8. Forty IB high school students range in age from 15 to 18 years old. The following table shows the frequencies of each age.

Age (years)	15	16	17	18
Frequency	5	k	15	7

(a) Calculate the value of k. [1 mark]

(b) Write down the mode. [1 mark]

(c) Find the value of the range. [1 marks]

(d) Find the median. [1 marks]

(e) Find the mean. [2 marks]

(f) Find the standard deviation. [2 marks]

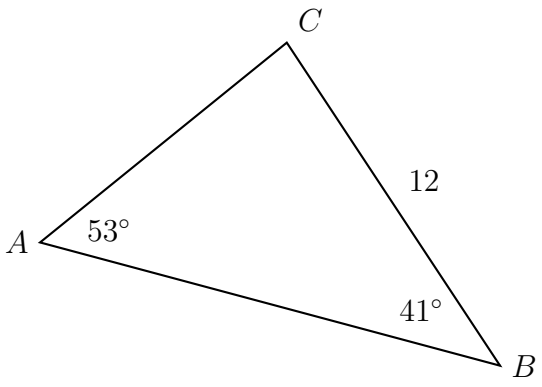
9. A runner records her pace in terms of distance run (d) in miles over time (t) in minutes during a 4.5 mile run. She models her pace with a linear regression equation $d = at + b$.

minutes (t)	0	8	15	22	30
miles (d)	0	1.8	2.7	3.7	4.5

(a) Find the values of a, b, and the correlation r. [3 marks]

(b) What does the value of a represent? [2 marks]

10. The following diagram shows triangle ABC (not drawn to scale).



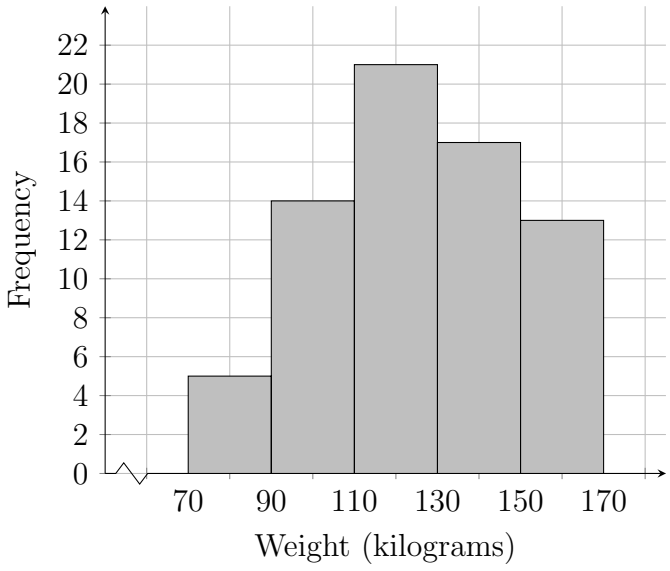
$BC = 12$, $C\hat{A}B = 53°$, and $A\hat{B}C = 41°$

(a) Find the measure of $A\hat{C}B$. [1 mark]

(b) Find AC. [3 marks]

(c) Find the area of triangle ABC. [3 marks]

11. The histogram below shows the weight w in kilograms for 70 professional football players.



The following is the frequency table for the distribution of w.

HR (x)	$70 \leq x < 90$	$90 \leq x < 110$	$110 \leq x < 130$	$130 \leq x < 150$	$150 \leq x < 170$
Freq	5	14	21	p	13

(a) Write down the value of p. [1 mark]

(b) Write down the modal class. [2 marks]

(c) A player is selected at random. Find the probability that the athlete weighs 110 kilograms or less. [2 marks]

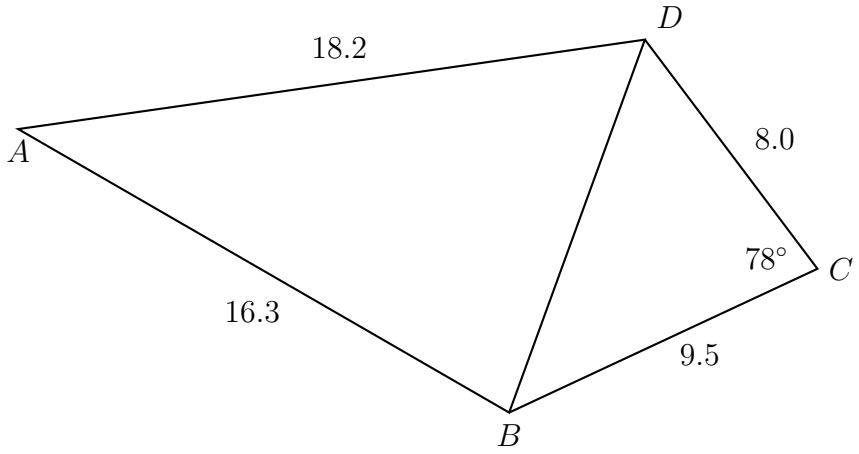
(d) Write down the mid-interval value for the class $110 \leq x < 130$. [1 mark]

(e) Hence find an estimate for the

i. mean; [2 marks]

ii. standard deviation. [2 marks]

12. The following diagram shows quadrilateral $ABCD$ (not drawn to scale).



$AB = 16.3$, $BC = 9.5$, $CD = 8.0$, $AD = 18.2$, and $B\hat{C}D = 78°$

(a) Find BD. [3 marks]

(b) Find $A\hat{B}D$. [3 marks]