BECA / Huson / 12.1 IB Math SL Name:
3 May 2019

Homework: Probability & Statistics

1. *[6 marks]*

Let $f'(x) = 3x^2 + 2$. Given that $f(2) = 5$, find $f(x)$.

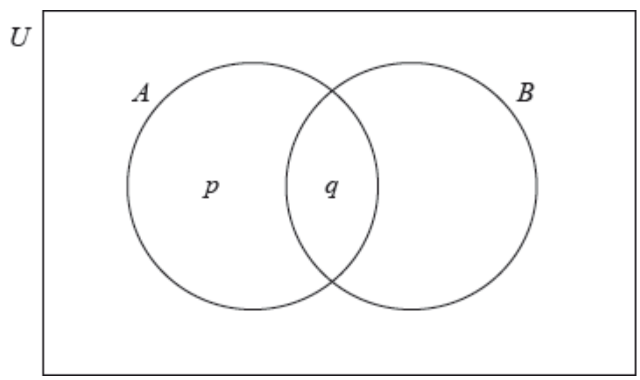
2. *[6 marks]*

The random variable X has the following probability distribution.

x	1	2	3
$\mathrm{P}(X = x)$	s	0.3	q

Given that $\mathrm{E}(X) = 1.7$, find q.

3a. The following Venn diagram shows the events A and B, where $\mathrm{P}(A) = 0.4,\ \mathrm{P}(A \cup B) = 0.8$ and $\mathrm{P}(A \cap B) = 0.1$. The values p and q are probabilities.



(i) Write down the value of q.

(ii) Find the value of p. *[3 marks]*

3b. Find $\mathrm{P}(B)$. *[3 marks]*

4a. There are 10 items in a data set. The sum of the items is 60.

Find the mean. *[2 marks]*

4b. The variance of this data set is 3. Each value in the set is multiplied by 4.

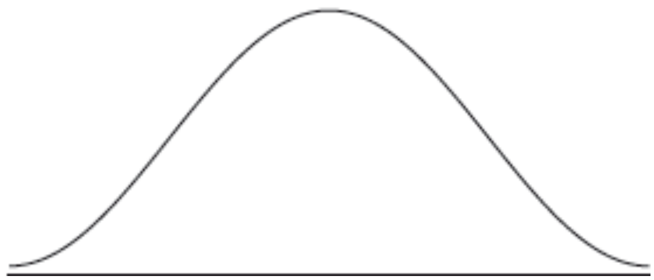
(i) Write down the value of the new mean.

(ii) Find the value of the new variance. *[3 marks]*

5a. *[2 marks]*

A random variable X is distributed normally with a mean of 20 and standard deviation of 4.

On the following diagram, shade the region representing $\mathrm{P}(X \leqslant 25)$.

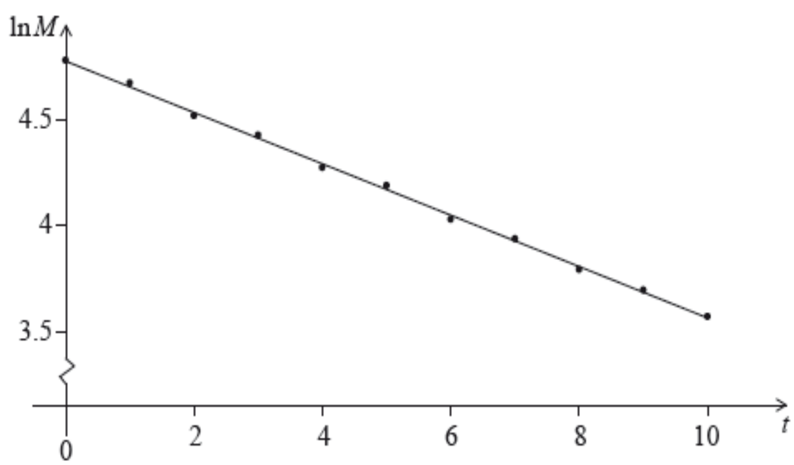


5b. Write down $\mathrm{P}(X \leqslant 25)$, correct to two decimal places. *[2 marks]*

5c. Let $\mathrm{P}(X \leqslant c) = 0.7$. Write down the value of c. *[2 marks]*

6a. *[2 marks]*

The mass M of a decaying substance is measured at one minute intervals. The points $(t,\ \ln M)$ are plotted for $0 \leqslant t \leqslant 10$, where t is in minutes. The line of best fit is drawn. This is shown in the following diagram.



The correlation coefficient for this linear model is $r = -0.998$.

State **two** words that describe the linear correlation between $\ln M$ and t.

6b. The equation of the line of best fit is $\ln M = -0.12t + 4.67$. Given that $M = a \times b^t$, find the value of b. *[4 marks]*

7a. A competition consists of two independent events, shooting at 100 targets and running for one hour.

The number of targets a contestant hits is the S score. The S scores are normally distributed with mean 65 and standard deviation 10.

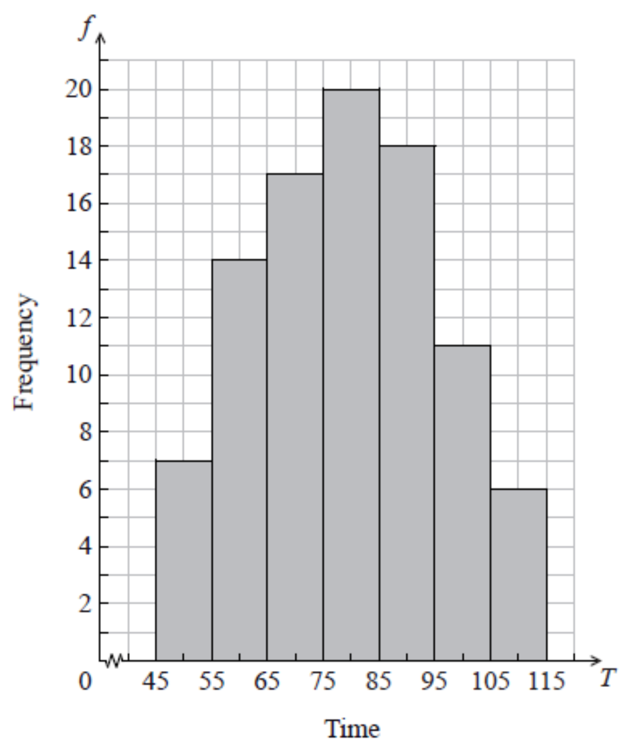
A contestant is chosen at random. Find the probability that their S score is less than 50. *[2 marks]*

7b. The distance in km that a contestant runs in one hour is the R score. The R scores are normally distributed with mean 12 and standard deviation 2.5. The R score is independent of the S score.

Contestants are disqualified if their S score is less than 50 **and** their R score is less than x km.

Given that 1% of the contestants are disqualified, find the value of x. *[4 marks]*

8a. The histogram below shows the time *T* seconds taken by 93 children to solve a puzzle.



The following is the frequency distribution for T.

Time	$45 \le T < 55$	$55 \le T < 65$	$65 \le T < 75$	$75 \le T < 85$	$85 \le T < 95$	$95 \le T < 105$	$105 \le T < 115$
Frequency	7	14	p	20	18	q	6

(i) Write down the value of p and of q.

(ii) Write down the median class. *[3 marks]*

8b. A child is selected at random. Find the probability that the child takes less than 95 seconds to solve the puzzle. *[2 marks]*

8c. Consider the class interval $45 \leq T < 55$.

(i) Write down the interval width.

(ii) Write down the mid-interval value. *[2 marks]*

8d. Hence find an estimate for the

(i) mean;

(ii) standard deviation. *[4 marks]*

8e. John assumes that *T* is normally distributed and uses this to estimate the probability that a child takes less than 95 seconds to solve the puzzle.

Find John's estimate. *[2 marks]*

9a. The weights of players in a sports league are normally distributed with a mean of 76.6 kg, (correct to three significant figures). It is known that 80% of the players have weights between 68 kg and 82 kg. The probability that a player weighs less than 68 kg is 0.05.

Find the probability that a player weighs more than 82 kg. *[2 marks]*

9b. (i) Write down the standardized value, *z*, for 68 kg.

(ii) Hence, find the standard deviation of weights. *[4 marks]*

9c. *[5 marks]*

To take part in a tournament, a player's weight must be within 1.5 standard deviations of the mean.

(i) Find the set of all possible weights of players that take part in the tournament.

(ii) A player is selected at random. Find the probability that the player takes part in the tournament.

9d. *[4 marks]*

Of the players in the league, 25% are women. Of the women, 70% take part in the tournament.

Given that a player selected at random takes part in the tournament, find the probability that the selected player is a woman.

10a. Two boxes contain numbered cards as shown below.

Two cards are drawn at random, one from each box.

Copy and complete the table below to show all nine equally likely outcomes. *[2 marks]*

3 , 9		
3 , 10		
3 , 10		

10b. Let *S* be the sum of the numbers on the two cards.

Find the probability of each value of *S*. *[2 marks]*

10c. Find the expected value of *S*. *[3 marks]*

10d. Anna plays a game where she wins $\$50$ if *S* is even and loses $\$30$ if *S* is odd.

Anna plays the game 36 times. Find the amount she expects to have at the end of the 36 games.

[3 marks]