BECA / Huson / 12.1 IB Math SL Name:
21 March 2019
7.4 Homework: Binomial distribution

1a. The following table shows the probability distribution of a discrete random variable X.

x	0	2	5	9
$\mathrm{P}(X=x)$	0.3	k	$2k$	0.1

Find the value of k. *[3 marks]*

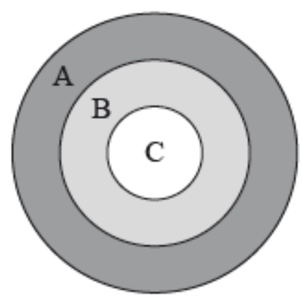
1b. Find $\mathrm{E}(X)$. *[3 marks]*

2. 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. *[6 marks]*

3a. The following diagram shows a board which is divided into three regions A, B and C.



A game consists of a contestant throwing one dart at the board. The probability of hitting each region is given in the following table.

Region	A	B	C
Probability	$\frac{5}{20}$	$\frac{4}{20}$	$\frac{1}{20}$

Find the probability that the dart does **not** hit the board. *[3 marks]*

3b. The contestant scores points as shown in the following table.

Region	A	B	C	Does not hit the board
Points	0	q	10	-3

Given that the game is fair, find the value of q. *[4 marks]*

4a. In a large university, the probability that a student is left handed is 0.08. A sample of 150 students is randomly selected from the university. Let k be the expected number of left-handed students in this sample.

Find k. *[2 marks]*

4b. Hence, find the probability that exactly k students are left handed; *[2 marks]*

4c. Hence, find the probability that fewer than k students are left handed. *[2 marks]*

5a. A box holds 240 eggs. The probability that an egg is brown is 0.05.

Find the expected number of brown eggs in the box. *[2 marks]*

5b. Find the probability that there are 15 brown eggs in the box. *[2 marks]*

5c. Find the probability that there are at least 10 brown eggs in the box. *[3 marks]*

6a. The probability of obtaining “tails” when a biased coin is tossed is 0.57. The coin is tossed ten times. Find the probability of obtaining **at least** four tails. *[4 marks]*

6b. The probability of obtaining “tails” when a biased coin is tossed is 0.57. The coin is tossed ten times. Find the probability of obtaining the fourth tail on the tenth toss. *[3 marks]*

7a. A factory makes lamps. The probability that a lamp is defective is 0.05. A random sample of 30 lamps is tested.

Find the probability that there is at least one defective lamp in the sample. *[4 marks]*

7b. A factory makes lamps. The probability that a lamp is defective is 0.05. A random sample of 30 lamps is tested.

Given that there is at least one defective lamp in the sample, find the probability that there are at most two defective lamps. *[4 marks]*

8. Two lines with equations $\boldsymbol{r}_1 = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix} + s\begin{pmatrix} 5 \\ -3 \\ 2 \end{pmatrix}$ and $\boldsymbol{r}_2 = \begin{pmatrix} 9 \\ 2 \\ 2 \end{pmatrix} + t\begin{pmatrix} -3 \\ 5 \\ -1 \end{pmatrix}$ intersect at the point P. Find the coordinates of P. *[6 marks]*

9a. Consider the points A (1 , 5 , 4) , B (3 , 1 , 2) and D (3 , k , 2) , with (AD) perpendicular to (AB) .

Find

(i) $\overrightarrow{\mathrm{AB}}$;

(ii) $\overrightarrow{\mathrm{AD}}$ giving your answer in terms of k . ***[3 marks]***

9b. Show that $k = 7$. *[3 marks]*

9c. The point O has coordinates (0 , 0 , 0) , point A has coordinates (1 , − 2 , 3) and point B has coordinates (− 3 , 4 , 2) .

The point C is such that $\overrightarrow{\mathrm{BC}} = \frac{1}{2}\overrightarrow{\mathrm{AD}}$.

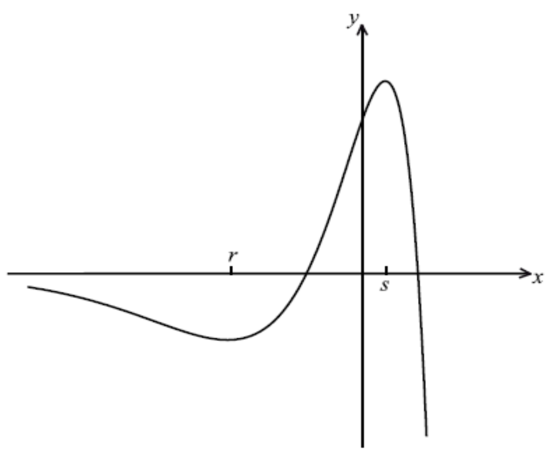
Find the position vector of C. *[4 marks]*

9d. Find $\cos \mathrm{A\hat{B}C}$. *[3 marks]*

10a. Let $f(x) = \mathrm{e}^{x}(1 - x^2)$.

Show that $f'(x) = \mathrm{e}^{x}(1 - 2x - x^2)$. *[3 marks]*

10b. Part of the graph of $y = f(x)$, for $-6 \leq x \leq 2$, is shown below. The *x*-coordinates of the local minimum and maximum points are *r* and *s* respectively. *[1 mark]*



Write down the **equation** of the horizontal asymptote.

10c. Write down the value of *r* and of *s*. *[4 marks]*

10d. Let *L* be the normal to the curve of *f* at $\mathrm{P}(0, 1)$. Show that *L* has equation $x + y = 1$. *[4 marks]*