ADVANCED PROGRAMME MATHEMATICS: PAPER II

MODULE 2   STATISTICS

QUESTION 1

1.1   A collection of antique toys containing six train sets, five model cars and three vintage toys are displayed at an auction. Three of these items are sold. Find the probability that all three items sold are of the same type.   (8)

1.2   The results of a random survey show that 70% of students listen to music while studying for an assessment.

(a)   A random sample of five students is selected. Find the probability that more than three students listen to music while studying for an assessment.   (8)

(b)   A second sample of 60 students is selected. The random variable X denotes the number of students who listen to music while studying for an assessment.

(i)   Using a suitable approximation, find the probability that at least 40 students of the sample selected listen to music while studying for an assessment.   (8)

(ii)   Justify the use of the approximation in (i) mathematically.   (2)

(iii)   Why does this justification in (ii) need to be provided to ensure
        that the approximation in (i) is suitable?   (2)
                                                                  [28]

QUESTION 2

2.1   The random variable X is normally distributed. The mean is twice the
       standard deviation. It is given that $P(X > 5,2) = 0,9$. Find the mean and the
       standard deviation, correct to two decimal places.   (8)

2.2   A six-sided dice is suspected of bias. The dice is thrown 100 times and it is
       found that it lands on a six 20 times. [Note that a dice is a cube with each
       side having a different number of dots on it, ranging from one to six].

       (a)   Calculate a 94% confidence interval for p, the probability of a dice
              landing on a six on any throw.   (6)

(b)   Use your answer to (a) to comment on whether the dice may be biased.   (2)

[16]

QUESTION 3

3.1   A player throws three darts. Let X represent the number of darts that hit the bull's eye. The probability distribution of X is shown in the table.

x	0	1	2	3
$P(X = x)$	0,5	0,35	p	q

(a)   Given that the expected value of X is 0,67, find the values of p and q.   (6)

(b)   Using the probabilities above and showing all working, find the standard deviation of X.   (5)

3.2   The diagrams below show the graphs of two functions, $g(x)$ and $h(x)$. For each of the functions g and h, give a reason why it cannot be a probability density function.
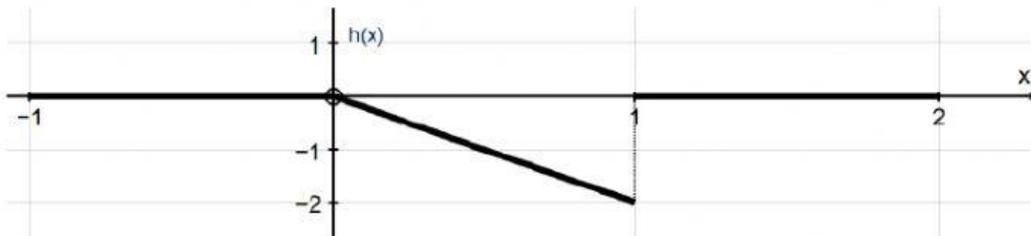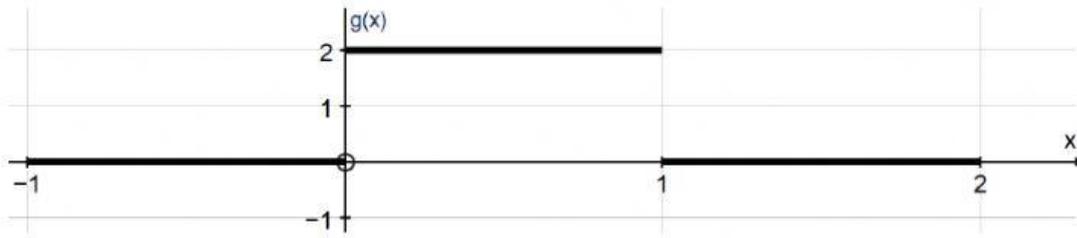
3.3 Each of the random variables *t*, *u*, *v*, *w*, *x* and *y* takes values between 0 and 2 only. Their probability density functions are shown in Figures 1 to 6 respectively.
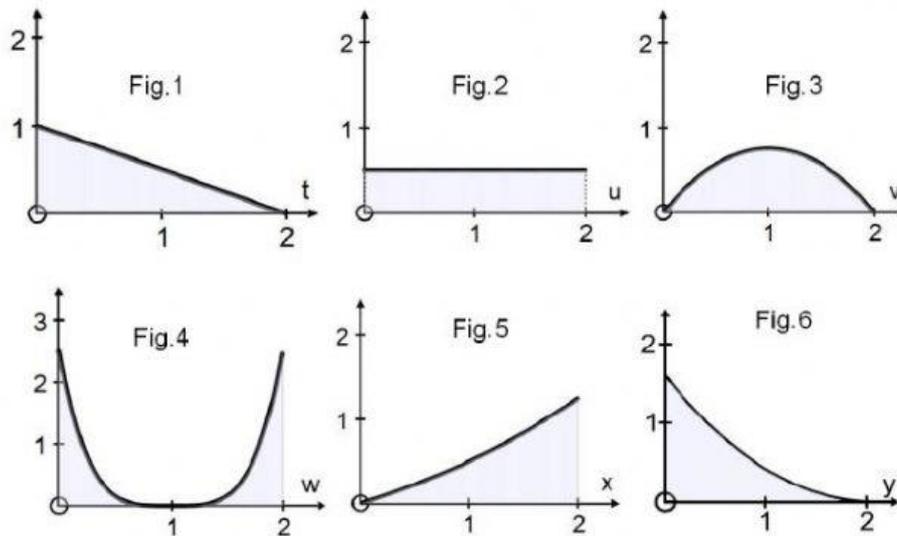
(a) Which of these variables has the largest median? Justify your answer. (3)

(b) Which of these variables has the largest standard deviation? Justify your answer. (2)

(c)   Use Fig. 1 to find $P(t < 0{,}5)$.

(6)

[26]