**GREENWOOD COLLEGE**

**Mathematics Methods Units 3 & 4**

**Test 6 Continuous Random & Normal Distributions 2019**

Name Marking Key Mark **/21**

**All electronic devices must be switched off and in bags.**

**Access to Formulae Sheet allowed. No notes.**

**No calculators allowed in this section. Time limit 20 minutes.**

1. [ 2,1,3 = 6 marks]

The table below shows the waiting times for meals to arrive at a local restaurant at Hillarys.

|  |  |  |
| --- | --- | --- |
| Time | Cumulative Frequency | Relative Frequency |
|  | 2 | 0.04 |
|  | 7 | 0.1 |
|  | 18 | 0.22 |
|  | 35 | 0.34 |
|  | 44 | 0.18 |
|  | 50 | 0.12 |

**a)** Complete the third column of the table.

✓✓ (one mark if whole numbers given)

**b)** In which time interval is the next meal most likely to arrive?

✓

**c)** Estimate the probability that the next meal will take to arrive

1. Between 5 and 20 minutes 0.66 ✓
2. At least 4 minutes 1 – (4/5 0.04) ✓

= 0.968 ✓

2. [ 1,2,5 = 7 marks]

*k*

***x***

0 1 2 3 4 5

*f(x)*

The following graph is of a **continuous** random variable, *X*.

**a)** State the value of *k.*

5k = 1

k =  √

**b)** Complete the description of the probability

density function

*f* (*x*) = ✓✓

**c)** State:

1. *P*(*X* = 3) **ii)** P(*X* < 3)

0 ✓ 3/5 ✓

1. P(*X* < 3 | *X* > 1) **iv)** E(X)

½ ✓ 5/2 ✓

1. Var (X)

52/12 or 25/12 ✓

**3. [ 2,3 = 5 marks]**

a) Consider the function whose values p(x) are given below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | x | -1 | 0 | 1 |
|  | p(x) |  |  |  |

For what value(s) of m is this a probability function where x is an element of [-1, 0, 1] ?

+ + = 1 ✓

+ 2( + = 4

7 = 4

= 3 ✓

Taken out of test as m=3 gives negative probabilities when x = -1 and 1

**b)** The probability density function for a random variable, X, is given by the graph below



**i)** Determine the value of k.

3k +  ( 4 ) ( k ) = 1

5k = 1

k =  ✓

**ii)** Determine the probability that X is less than 5 given that X is greater than 1.

P( X < 5 | X > 1 ) = 

= ✓

= 0.875 or ✓

**4. [ 1,1,1 = 3 marks]**

Mr Matkowski travels to school each day by car. He normally sets out from home each

day at 7 a.m. exactly. The time taken for his journey can be considered to be normally distributed with a mean of 20 minutes and a standard deviation of 3 minutes.

Use your knowledge of the normal distribution to answer these questions:

**a)** State the probability that his journey takes:

1. more than 29 minutes 0.0015 ✓
2. less than 17 minutes 0.16 or 0.1585 ✓

**b)** State the time such that there is a 97.7% (sic) chance that he will arrive before this time.

2 std. deviations above = 0.954 plus 0.046/2 = 0.977

So 26 minutes therefore 7:26 am ✓

END OF SECTION

**GREENWOOD COLLEGE**

**Mathematics Methods Units 3 & 4**

**Test 4 Discrete Probability Distributions 2019**

Name Marking Key Mark **/36**

**All electronic devices must be switched off and in bags.**

**Access to Formulae Sheet and one sheet of A4 notes allowed. Use of approved calculators is assumed in this section.**

**Time limit 35 minutes.**

**5. [ 3,2,3,2 = 10 marks]**

The probability function of a random variable X is



**a)** Determine .

✓✓✓

**b)** Determine the probability that X is greater than , given that X is less than .

P( X >  | X <  ) = 

= ✓

= 0.8125 ✓

**c)** Determine and the standard deviation.

= ✓

Var(X) = E(X2)- [E(X)]2 OR

= – ✓

=

Std. deviation = ✓

**d)** Another probability function is such that .

State the expected value and variance of

E(y) = 3 x + 1 Variance = x

= 2.8 ✓ = ✓

**6. [ 4,3,3 = 10 marks]**

A continuous random variable X has a probability density function for

and = .

**a)** Determine the values of and .

= 1 and =

= 1 =

= 1 ✓ = ✓

Using simultaneous equations ✓✓

**b)** State such that = .

= ✓

= -1.3600 (not appropriate) ✓

Or = 2.6943 (4dp) ✓

**c)** Determine and .

= = = 2.25 ✓

= –

= 0.27083 ✓ or

**7. [3,2,5 = 10 marks]**

The number of fans accessing the Perth Glory official website each day is modelled

by a normal random variable with a mean of 350 and standard deviation of 18.

**a)** Determine the probability that tomorrow there will be:

**i)** fewer than 340 hits on the website

 **√**

**ii)** fewer than 370, given that there are more than 340.

✓ = 0.8125 (4d.p.) **√** (or 0.8126 if 4dp probailities used)

**b)** Determine the probability that over the next 5 days there will be between 340 and 370 on exactly 3 of those days. Show all distributions and relevant parameters that you use.

 **√**

 **√**

**c)** Using the normal approximation to the binomial distribution, determine the probability that over the next 365 days, there will be between 340 and 370 people on fewer than 200 occasions.

*μ* = 365 x 0.5575 = 210.7875 **√**

= 9.437039724 **√**

**√**

** √** =0.1158 **√**

**8. [ 6 marks]**

It is found that, in the manufacturing of a certain type of steel pin, 3% of the pins of steel pin are more than 6.59 cm in length, while 17% are less than 6.52 cm in length. Find correct to 3 decimal places, the mean and standard deviation of the distribution of lengths of the pins, if it is known that the distribution is normal.

P ( X > 6.59 ) = 0.03 P ( X < 6.52 ) = 0.17

Z score = 1.8807936 √ Z score = -0.954165 √

1.8808 + μ = 6.59 √ -0.9542 + μ = 6.52 √

Using Simultaneous equations

Standard deviation ( = 6.5436 ) √

and Mean ( μ = 0.0247 ) √

END OF PAPER