Name: …………..……….......……

|  |  |  |
| --- | --- | --- |
| **Calculator Free** | **/16** | **%** |
| **Calculator Allowed** | **/44** | **%** |
| **Total** | **/60** | **%** |

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Mathematics Methods, Year 12, 2018

Test 3 – Further differentiation and applications, Integrals, Discrete Random Variables.

15 minutes working time.

Calculator Free Section (no notes, no calculators) SCSA Formula sheet allowed

**1. [2 marks]**

A probability distribution of a certain random variable *X* is given by:

P (*X* = *x*) =  ,where *x* = 1, 2, 3, 4.

Show that a probability distribution is formed.

**2. [2 marks]**

Give two reasons why the following cannot be a probability distribution.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *x* | 2 | 3 | 5 | 0 | 1 | 2 |
| P(X = *x*) | 0.0 | 0.1 | 0.2 | 0.3 | 0.1 | 0.4 |

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

A data scientist tracked how many cups of coffee she drank every day at work over the course of a year. She used the data to build a probability distribution where the random variable ***x*** represents the number of cups of coffee she drank on a given day. Here is the partially completed distribution:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***x*** | 1 | 2 | 3 | 4 | 5 |
| P(X = ***x***) | 0.2 | 0.25 | k | 0.15 | 0.1 |

a) Find k.

b) Find the expected value from the given table.

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

Each of the following represent discrete probability functions. Determine the value of

*k* for each.

(a) 

(b) 

**5. [4 marks: 3, 1]**

If , and A = 3 when t = 0, find

1. A in terms of t
2. the exact value of A, when t = 1.

Name: …………..……….......……

|  |  |  |
| --- | --- | --- |
| **Calculator Allowed** | **/44** | **%** |

Mathematics Methods, Year 12, 2018

Test 3 – Further differentiation and applications, Integrals, Discrete Random Variables.

45 minutes working time.Calculator Assumed Section (notes allowed), SCSA Formula sheet and calculators allowed

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

Nick takes a free throw for basketball *n* times. The probability , *p*, of Nick scoring is constant and all free throws are independent.

Let X be the number of times Nick scores a free throw in the *n* attempts.

The mean of X is 32 and the standard deviation is 4.

a) State the distribution of X.

b) Determine *n* and *p*.

**2. [10 marks - 1, 2, 2, 1, 1, 3]**

The probability that a new drug on the market will be effective against a particular disease is 0.8. Fifteen people suffering from this disease are given the drug.

Determine the probability that the drug is effective for:

a) 9 people

b) 8 or 10 people

c) More than 5 but less than 13 people

d) At least 8 people

e) At most 10 people

f) Less than 10 people given that it was effective for more than 7 people

**3. [8 marks: 3, 2, 3]**

In the following table, x is a score in a game and P(X) is the probability of getting that score. The expected mean of the discrete probability distribution is 2.8.

a) Find the values of m and n.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | 1 | 2 | 3 | 4 | 5 |
| P(X = x) | 0.2 | m | 0.3 | n | 0.1 |

b) Calculate the standard deviation of the scores.

c) Calculate:

(i) E(2X – 1)

(ii) Var(2 – 3X)

**4. [7 marks: 2, 2, 3]**

The probability distribution of x where random variable, X is the sum of the uppermost numbers when two fair die are rolled is tabulated below.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| P(X=*x*) |  |  |  |  |  |  |  |  |  |  |  |

Find:

a) P (X > 6)

b) P (X < 10)

c) P (X < 10 | X > 6)

**5. [3 marks]**

Given that y = 3t , t = e2p and p = 3x + 2, find .

**6. [12 marks: 1, 2, 2, 4, 3]**

In the testing being undertaken for Google’s driverless cars, there have been 0.6 minor accidents for every 160 000 km of travel.

a) If a typical testing journey is 50 km, what is the likelihood of an accident occurring?

b) In 5 successive typical testing journeys, what is the probability that the first three result in an accident the last two do not?

c) In 15 successive typical testing journeys, what is the probability that exactly 2 will result in an accident?

d) In 15 successive typical testing journeys:

(i) what is the expected number of accidents?

(ii) what is the standard deviation of the number of accidents?

e) If the typical testing journey was recorded in terms of miles, rather than kilometres, explain what effect, if any, would this have on the mean number of accidents recorded in 15 typical testing journeys? (1 mile = 1.6 km)