**Sample Assessment Tasks**

Mathematics Methods

ATAR Year 12

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Sample assessment task

Mathematics Methods – ATAR Year 12

Test 3 – Unit 1

**Assessment type:** Response

**Conditions:**

Time for the task: Up to 50 minutes, in class, under test conditions

**Materials required:**

Section One: Calculator-free Standard writing equipment

Section Two: Calculator-assumed Calculator (to be provided by the student)

**Other materials allowed:** Drawing templates, one page of notes in Section Two

**Marks available: 44**

Section One: Calculator-free (23 marks)

Section Two: Calculator-assumed (21 marks)

**Task weighting: 8%**

**Section One: Calculator-free (23 marks)**

**Question 1 [3.2.16] [3.2.17] (6 marks)**

(a) Evaluate  given that: (2 marks)

(b)  (4 marks)

**Question 2 [3.2.22] (9 marks)**

A train is travelling on a straight track between two stations under the following conditions.

It starts from rest at station A and moves with acceleration 

It then maintains its speed for 60 seconds such that.

Finally, it slows to rest at a constant rate over 10 seconds such that and stops in station B.

1. Sketch the Velocity V’s Time graph (5 marks)
2. Calculate the total distance in metres between station A and station B. (4 marks)

**Question 3 [3.2.19] (3 marks)**

 .

**Question 4 [3.3.4] (5 marks)**

Below is the sample space for the tossing of two dice and recording the numbers on the upper face of each die.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | (1,1) | (1,2) | (1,3) | (1,4) | (1,5) | (1,6) |
| 2 | (2,1) | (2,2) | (2,3) | (2,4) | (2,5) | (2,6) |
| 3 | (3,1) | (3,2) | (3,3) | (3,4) | (3,5) | (3,6) |
| 4 | (4,1) | (4,2) | (4,3) | (4,4) | (4,5) | (4,6) |
| 5 | (5,1) | (5,2) | (5,3) | (5,4) | (5,5) | (5,6) |
| 6 | (6,1) | (6,2) | (6,3) | (6,4) | (6,5) | (6,6) |

One activity is to add the numbers in each pair and record how frequently these numbers came up. For example, (3,2) gives 3+2=5.

1. Set up a discrete probability table for the possible outcomes of this activity and give the theoretical probabilities. (2 marks)
2. Draw a relative frequency diagram from the table. (3 marks)

**End of Section One**

**Section Two: Calculator-assumed (21 marks)**

**Question 5 [3.2.18] (3 marks)**

A large container has developed a leak and is losing its liquid at a rate given by the equation, if the leak is stopped after three hours, calculate, to the nearest millilitre, how much liquid is lost in that time.

**Question 6 [3.2.20] (5 marks)**

1. (2 marks)
2. **** (3 marks)

**Question 7 [3.2.9; 3.2.21] (5 marks)**

An engineer is remotely monitoring the instruments from a test car travelling in a straight line on a track. At a given instant, she noticed that the acceleration of the car was a constant 4ms-2 and   
5 seconds later she recorded the car was travelling with a velocity of 50ms-1. Calculate the velocity equation of the car over this period and how far the car travelled in that time.

**Question 8 [3.3.5; 3.3.6] (3 marks)**

1. In Q4 Section One of this test, you were asked to set up a discrete probability table for the possible outcomes of the two–dice activity and give the theoretical probabilities.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | (1,1) | (1,2) | (1,3) | (1,4) | (1,5) | (1,6) |
| 2 | (2,1) | (2,2) | (2,3) | (2,4) | (2,5) | (2,6) |
| 3 | (3,1) | (3,2) | (3,3) | (3,4) | (3,5) | (3,6) |
| 4 | (4,1) | (4,2) | (4,3) | (4,4) | (4,5) | (4,6) |
| 5 | (5,1) | (5,2) | (5,3) | (5,4) | (5,5) | (5,6) |
| 6 | (6,1) | (6,2) | (6,3) | (6,4) | (6,5) | (6,6) |

Using the same table, calculate the Mean, and Standard deviation for the distribution:

(2 marks)

1. These terms in part (a) above are referred as parameters. Explain why. (1 mark)

**Question 9 [3.3.1] (5 marks)**

A carton contains 12 eggs, 5 of which are brown and 7 white. A chef selects 4 eggs at random, to use   
in an omelette.

1. Calculate the discrete probability distribution for *x* which represents the number of white eggs chosen, giving your answer in fraction form. (3 marks)
2. Calculate the mean and standard deviation of the probability distribution. (2 marks)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | 0 | 1 | 2 | 3 | 4 |
| Pr(X*=x*) |  |  |  |  |  |

**End of Section Two**

Solutions and marking key for Test 3 – Unit 1

**Section One: Calculator-free (23 marks)**

**Question 1 [3.2.16] [3.2.17] (6 marks)**

(a) Evaluate  given that: (2 marks)

|  |  |  |
| --- | --- | --- |
|  | | |
| **Specific behaviours** | **Mark allocation** | **Item classification** |
| Calculates the derivative of the integral correctly  Applies the chain rule correctly | 1  1 | complex  complex |

(b)  (4 marks)

|  |  |  |
| --- | --- | --- |
|  | | |
| **Specific behaviours** | **Mark allocation** | **Item**  **classification** |
| Partitions the algebraic fraction before integrating  Simplifies fractional indices when dividing  Simplifies fractions accurately when integrating  Shows adequate working with the substitution | 1  1  1  1 | simple  simple  simple  simple |

**Question 2 [3.2.21] (9 marks)**

A train is travelling on a straight track between two stations under the following conditions.

It starts from rest at station A and moves with acceleration .

It then maintains its speed for 60 seconds such that

Finally it slows to rest at a constant rate over 10 seconds such thatand stops in station B.

1. Sketch the Velocity V’s Time graph (5 marks)

|  |  |  |
| --- | --- | --- |
|  | | |
| **Specific behaviours** | **Mark allocation** | **Item**  **classification** |
| Determines the first two velocity functions  Draws each section of the graph accurately | 2  3 | simple  simple |

1. Calculate the total distance in metres between station A and station B. (4 marks)

|  |  |  |
| --- | --- | --- |
|  | | |
| **Specific behaviours** | **Mark allocation** | **Item**  **classification** |
| Uses the velocity functions/graphs to calculate the distance travelled for each leg  States the correct distance travelled | 3  1 | simple  simple |

**Question 3 [3.2.19] (3 marks)**



|  |  |  |
| --- | --- | --- |
| The original graph has been translated two units to the left and the limits for the integral have also been translated two units to the left.  Hence, the area to be calculated in both cases is the same area enclosed by the function below  the *x* – axis. | | |
| **Specific behaviours** | **Mark allocation** | **Item**  **classification** |
| States the graph has been translated to the left  States the limits have also been translated two units left  States the area is the same in both cases | 1  1  1 | complex  complex  complex |

**Question 4 [3.3.4] (5 marks)**

1. Set up a discrete probability table for the possible outcomes of this activity and give the theoretical probabilities. (2 marks)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *x* | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | Pr(*x)* |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  |  |  |  |  |  |  | | | |
| **Specific behaviours** | **Mark allocation** | **Item**  **classification** |
| Defines the set of variables correctly  Completes the probability values | 1  1 | simple  simple |

1. Draw a relative frequency diagram from the table. (3 marks)

|  |  |  |
| --- | --- | --- |
|  | | |
| **Specific behaviours** | **Mark allocation** | **Item classification** |
| Centres each class on 2, 3 … etc.  Sets an appropriate horizontal scale  Draws a good representation of the histogram | 1  1  1 | simple  simple  simple |

Solutions and marking key for Test 3 – Unit 1

**Section Two: Calculator-assumed** **(21 marks)**

**Question 5 [3.2.18] (3 marks)**

A large container has developed a leak and is losing its liquid at a rate given by the equation, if the leak is stopped after three hours, calculate, to the nearest millilitre, how much liquid is lost in that time.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | | |
| **Specific behaviours** | | **Mark  allocation** | **Item classification** |
| Sets up the correct integral  Sets up the correct limits  States the correct volume to the nearest millilitre | | 1  1  1 | simple  simple  simple |

**Question 6 [3.2.20] (5 marks)**

1. (2 marks)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | | |
| **Specific behaviours** | | **Mark allocation** | **Item classification** |
| Uses symmetry to explain that the two areas are equal  States the areas are additive opposite in value | | 1  1 | simple  simple |

1. (3 marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  | | |
| **Specific behaviours** | | | **Mark allocation** | **Item classification** |
| Uses the points of intersection to define integral limits  Uses the correct integrand  Gives the correct area | | | 1  1  1 | simple  simple  simple |

**Question 7 [3.2.9; 3.2.21] (5 marks)**

An engineer is remotely monitoring the instruments from a test car travelling in a straight line on a track. At a given instant she noticed that the acceleration of the car was a constant 4 ms-2 and   
5 seconds later she recorded the car was travelling with a velocity of 50 ms-1. Calculate the velocity equation of the car over this period and how far the car travelled in that time.

|  |  |  |
| --- | --- | --- |
|  | | |
| **Specific behaviours** | **Mark allocation** | **Item classification** |
| Calculates the correct constant of integration  Gives the correct velocity equation  Uses the integral of the velocity equation to calculate the distance travelled  Uses the correct limits  Calculates the correct distance | 1  1  1  1  1 | simple  simple  simple  simple  simple |

**Question 8 [3.3.5; 3.3.6] (3 marks)**

1. In Q4 Section One, you were asked set up a discrete probability table for the possible outcomes   
   of the two-dice activity and give the theoretical probabilities.

Using the same table, calculate the Mean, and Standard deviation for the distribution:

(2 marks)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mean = 7  Standard deviation = 2.4152 | | |
| **Specific behaviours** | | **Mark allocation** | **Item classification** |
| Calculates the Mean correctly  Calculates the Standard deviation correctly | | 1  1 | simple  simple |

(b) These terms in part (a) above are referred to as parameters. Explain why. (1 mark)

|  |  |  |
| --- | --- | --- |
| Parameters refer to the measures of a population or a theoretical probability distribution. | | |
| **Specific behaviours** | **Mark allocation** | **Item classification** |
| Refers to parameters as a measure of population | 1 | simple |

**Question 9 [3.3.1] (5 marks)**

A carton contains 12 eggs, 5 of which are brown and 7 white. A chef selects 4 eggs at random, to use   
in an omelette.

(a) Calculate the discrete probability distribution for *x* which represents the number of white eggs chosen, giving your answer in fraction form. (3 marks)

(b) Calculate the mean and standard deviation of the probability distribution. (2 marks)

|  |  |
| --- | --- |
|  | Mean = 2.3333  Standard deviation = 0.8409 |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | 0 | 1 | 2 | 3 | 4 |
| Pr(X*=x*) |  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Specific behaviours** | **Mark allocation** | **Item classification** |
| Shows appropriate working for at least one value  Calculates the five values accurately  Gives the correct mean  Gives the correct standard deviation | 1  2  1  1 | simple  simple  simple  simple |

**End of solutions**