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| linear IPS | Year 12 Methods  TEST 4 2019  Friday 23 August  TIME: 45 minutes working  One page of notes is allowed.  **Calculator Assumed**  46 Marks 6 Questions |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Note: All part questions worth more than 2 marks require working to obtain full marks.**

**Question 1 (8 marks)**

Consider the function .

1. Sketch the function on the axes below showing all major features. (3 marks)

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| **Solution** |
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| **Specific behaviours** |
| 🗸 asymptote at x=-3  🗸 shape  🗸 positive y intercept |

1. Determine the value of  given that . (2 marks)

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| **Specific behaviours** |
| 🗸 converts to a power statement  🗸 expresses p in terms of a |

1. Consider the new function , determine the x coordinate where  on this new function. (Note;  is the same constant as above.)

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| **Specific behaviours** |
| 🗸 obtains correct equation for x  🗸 uses a power statement  🗸 final expression for x in terms of a |

(3 marks)

**Question 2 (15 marks)**

A company makes circuit boards to be used to make computers. The length of the circuit boards is estimated to be Normally distributed with a mean of 35 cm and a standard deviation of 16.7 cm.

A customer will only buy circuit boards that are between 22.5 and 41 cm.

1. Determine the probability that a circuit board will meet the customer’s requirements.

(2 marks)

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| **Solution** |
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| **Specific behaviours** |
| 🗸 uses correct parameters  🗸 states probability (at least 2 dp) |

1. If the company made 20 circuit boards, determine the probability that at least 12 boards would be suitable for the customer. (3 marks)

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| **Solution** |
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| **Specific behaviours** |
| 🗸 states binomial distribution  🗸 uses correct parameters  🗸 states probability  Note: Answer only- 2 marks out of 3 |

The government will tax the circuit boards made by the company according to its length. Complete the table below by determining the probabilities to 4dp.

1. (4 marks)

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| **Solution** |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Length of circuit board |  |  |  |  | | Tax $ | $5 | $7.50 | $9 | $11.50 | | Probability | 0.0975  Or  0.1156 | 0.2668 | 0.5021 | 0.1155  Or  0.1336 | |
| **Specific behaviours** |
| 🗸 at least two correct probs  🗸 at least 3 correct probs  🗸 all four correct  🗸 all rounded to 4 dp |

1. Determine the expected tax bill for a circuit board. (2 marks)

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| E(Tax)=$8.49 or $8.43 or $8.54 |
| **Specific behaviours** |
| 🗸 states to at least 2 dp  🗸 states units |

1. Determine the standard deviation for the tax of a circuit board. (2 marks)

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| Standard deviation =$ 1.635 or 1.686 or 1.669 |
| **Specific behaviours** |
| 🗸 states to at least 2 dp  🗸 shows calculation  Note: full marks for answer only, no need for units |

1. **Show** one reason why the Normal probability model is not appropriate for the lengths.

(2 marks)

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| **Solution** |
| 0.018 which cannot be as length cannot be negative. |
| **Specific behaviours** |
| 🗸 states that lengths cannot be negative  🗸 states prob that length is less than zero |

**Question 3 (4 marks)**

The exam data for a cohort of Year 12 Methods students at a school has a mean of 72% and a standard deviation of 22%. The Head of Department needs to scale the results so that the mean is 60% and a standard deviation of 15%. This will be done by multiplying the original scores by a constant  and adding a constant (any order). Determine two possible pairs values of  and the order they should be applied.

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| **Solution** |
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| **Specific behaviours** |
| 🗸 shows an equation for value of a  🗸 shows an equation for value of b  🗸 solves for one pair of a&b values stating order  🗸 states two possible pairs of a&b values and stating order |

**Question 4 (3 marks)**

A pharmaceutical company wishes to gather information on a new form of headache tablets.

Comment on whether there is any bias in the following sampling methods, give reasons.

1. People were surveyed outside a dental clinic. (1 marks)

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| Bias as dental patients more likely to have headaches due to dental pain than average. |
| **Specific behaviours** |
| 🗸 States bias with a reason |

1. People waiting at a central bus station in the city. (1 marks)

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|  |
| No bias as not connection between headaches and mode of travel in general |
| **Specific behaviours** |
| 🗸 states no bias with a reason  Accept a reasonable argument of bias with reason for this part ONLY |

1. People were contacted using random mobile numbers. (1 marks)

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| Bias as only people with mobiles contacted-those with landlines only are ignored |
| **Specific behaviours** |
| 🗸 Bias stated with reason |

**Question 5 (10 marks)**

A probability density function is defined as the following.

 where  is a constant.

Determine the following.

1. the exact value of . (2 marks)

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| **Specific behaviours** |
| 🗸 integrates function above  🗸 states exact value of a |

1.  (2 marks)

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| **Specific behaviours** |
| 🗸 integrates over correct domain  🗸 states prob to at least 2 dp or exact |

1. the mean of . (3 marks)

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| **Specific behaviours** |
| 🗸 uses correct integral  🗸 limits correct  🗸 states mean (Note: 2 marks for answer only) |

1. the standard deviation of . (3 marks)

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| **Solution** |
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| **Specific behaviours** |
| 🗸 uses correct integral for variance  🗸 uses correct limits  🗸 states the standard deviation (i.e. square root of variance) |

**Question 6 (6 marks)**

It is believed that a toy company produces defective toys at a proportion of .

1. A consultant wishes to determine the true proportion  of defective toys within 5% and with a confidence of 90%. Determine how many toys should be taken for sampling.

(3 marks)

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| **Solution** |
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| **Specific behaviours** |
| 🗸 uses appropriate z score  🗸 sets up an equation for n  🗸 states a rounded up value for n |

1. A year later another sample is taken and a 95% confidence interval for the proportion of defective toys is calculated as . Determine the sample size. (3 marks)

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| n=114 |
| **Specific behaviours** |
| 🗸 uses correct p value  🗸 sets up an equation for n with correct z score  🗸 states a rounded up n value |