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| Name: | **SOLUTIONS** | | | | | Date: *\_\_\_\_\_\_\_\_\_\_\_* |
|  | **Year 11 Mathematics: Applications**  **Investigation 1, 2015**  **Topic – Forensic Science**  **In Class Component** | | | | | 55  = % |
| **Total Time:** | ***60*** *minutes* | |  | | | |
| **Reading Time:** | *5**minutes* | |
| **Working Time:** | *55**minutes* | |
| **Equipment:** | *SCSA Formula sheets, CAS calculator, Take Home Component* | | | | | |
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| **Date out:** | | *Week \_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_* | | **Date Due:** | *Week \_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_* | |
| **Take home component weighting:** | | *0% of the year* | | **In-class component weighting:** | *10% of the semester* | |
| **AIM:** *In this assessment, you will be investigating how mathematics is used in solving crimes, through Forensic Science. You will be using your TI-Nspire CAS for this investigation, in particular the spreadsheet function.* | | | | | | |

**MUDDY FOOTPRINTS**

A week after discovering the body of Py Thagoras at Lake Walyungup, Inspector Jack and Dr Math were called to a crime scene at a beach house in Safety Bay. On entry, Inspector Jack discovered the body of Correl Ation, a 28 year old female in the bedroom. The crime scene investigators processed the scene and discovered two sets of footprints in the bedroom and outside the bedroom window. One set of prints had a footprint length of 28 cm, and the other set of prints had a stride length of 70 cm.

Dr Math explained to Inspector Jack that the height of a person could be estimated using footprint length or stride length. According to Dr Math, a person’s height is approximately 6.6 times the length of their footprint, and their stride length is approximately 40% of their height.

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| **1.** | **[1 mark]** |
|  | Write the rule for determine the height of a person using their footprint length algebraically, with *h* representing the height of the person, and *f* representing the length of the footprint. |
|  | **h = 6.6 × f ✓** |

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| **2.** | **[2 marks: 1, 1]** | | |
|  | Determine the height of the following people, given their footprint length: | | |
| **a)** | **10 cm** | **b)** | **31.8 cm** |
|  | **h = 6.6 ×10 = 66 cm ✓** |  | **h = 6.6 × 38 = 209.88 cm ✓** |

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| **3.** | **[2 marks: 1, 1]** | | |
|  | Determine the length of a person’s footprint, given their height. Give your answer correct to the nearest mm. | | |
| **a)** | 189 cm | **b)** | 1.67 m |
|  | **✓** |  | **✓** |

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| **4.** | **[1 mark]** |
|  | Write the rule for determine the height of a person using their stride length algebraically, with *t* representing the height of the person, and *s* representing the stride length. |
|  | **✓** |

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| **5.** | **[2 marks: 1, 1]** | | |
|  | Determine the height of the following people, given their stride length: | | |
| **a)** | 55 cm | **b)** | 602 mm |
|  | **✓** |  | **✓** |

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| **6.** | **[2 marks: 1, 1]** | | |
|  | Determine the length of a person’s stride length, given their height: | | |
| **a)** | 199 cm | **b)** | 1.57 m |
|  | **✓** |  | **✓** |

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|  | Inspector Jack identified three suspects for the murder of Correl Ation. |
|  | * Matt Amatics – Correl’s co-worker. Matt missed out on a promotion overseas because of Correl’s mistakes. |
|  | * May Trix – Correl’s best friend. Correl stole May’s boyfriend last week. |
|  | * Perry Meter – Correl’s landlord. Correl hadn’t paid her rent for six weeks. |
|  | Inspector Jack used the Police Database to determine the height of each of the suspects. The information he discovered is compiled below. |
|  | |  |  | | --- | --- | | **Name** | **Height** | | Matt Amatics | 198 cm | | May Trix | 179 cm | | Perry Meter | 218 cm | |

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| **7.** | **[10 marks]** |
|  | Dr Math reasoned that one set of prints belonged to the victim. If Correl was 185 cm tall, who is the murderer? Show reasoning for your answer. |
|  | |  |  |  | | --- | --- | --- | | **Person** | **Foot Length** | **Stride Length** | | Matt | 198 ÷ 6.6 = 30 cm ✓ | 0.4 × 198 = 79.2 cm ✓ | | May | 179 ÷ 6.6 = 27.1 cm ✓ | 0.4 × 179 = 71.6 cm ✓ | | Perry | 218 ÷ 6.6 = 33.0 cm ✓ | 0.4 × 218 = 87.2 cm ✓ | | Correl | 185 ÷ 6.6 = 28.0 cm ✓ | 0.4 × 185 = 74 cm ✓ |   ∴ The murderer is May ✓  Her stride length is closes to the stride length found outside the window ✓ |
|  |  |

**CRASH SCENE INVESTIGATION**

Inspector Jack is a very busy detective. He has been called to investigate illegal drag racing on a stretch of sealed road in Rockingham. If he can prove that the cars were travelling in excess of 150 km/h, he can set up some cameras to catch the offending drivers and impound their cars.

Police use a formula to estimate the speed a car was travelling before an accident by measuring its skid marks. The formula is  , where *s* is the speed the car is travelling (in km/h), *d* is the distance the car skidded

(in metres), and *f* is the coefficient of friction, which depends on the road surface and road conditions.

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| **Condition** | **Coefficient** |
| Wet Sealed | 0.55 |
| Dry Sealed | 1.22 |
| Wet Gravel | 0.40 |
| Dry Gravel | 0.80 |

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| **8.** | **[4 marks: 1, 1, 1, 1]** | | |
|  | Determine the speed of the car based on the length of the skid marks below, given that the marks were made on wet sealed roads. Give your answer to the nearest whole number. | | |
| **a)** | 100 m | **b)** | 73 m |
|  | ✓ |  | ✓ |
| **c)** | 30 m | **d)** | 4.9 m |
|  | ✓ |  | ✓ |

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| **9.** | **[4 marks: 1, 1, 1, 1]** | | |
|  | Determine the speed of the car based on the length of the skid marks below, given that the marks were made on dry gravel roads. Give your answer to the nearest whole number. | | |
| **a)** | 6.5 m | **b)** | 24.5 m |
|  | ✓ |  | ✓ |
| **c)** | 15.8 m | **d)** | 98.1 m |
|  | ✓ |  | ✓ |

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| **10.** | **[6 marks: 2, 2, 2]** |
|  | Determine the distance the car would skid, given the following information. Give your answer to the nearest cm. |
|  |  |
| **a)** | Car travelling at 65 km/h on a dry sealed road. |
|  | ✓  ✓ |
| **b)** | Car traveling at 110 km/h on a wet gravel road. |
|  | ✓  ✓ |
| **c)** | Car travelling at 45 km/h pm on a wet sealed road. |
|  | ✓  ✓ |

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| **11.** | **[9 marks: 3, 3, 3]** |
|  | Determine the road conditions of the following accidents, given the following information: |
|  |  |
| **a)** | Car travelling at 136 km/h with a skid mark of 60 m. |
|  | ✓  ✓  ∴ Dry sealed road ✓ |
| **b)** | Car traveling at 46 km/h with a skid mark of 10.5 m. |
|  | ✓  ✓  ∴ Dry gravel road ✓ |
| **c)** | Car travelling at 56 km/h with a skid mark of 22.3 m. |
|  | ✓  ✓  ∴ Wet sealed road ✓ |

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| **12.** | **[6 marks]** |
|  | The CSI team at the suspected drag racing site discovered that there were 5 sets of skid marks. |
|  | * 82.6 m * 120.2 m * 129.1 m * 110.4 m * 32.3 m |
|  | Given that we have had a very dry summer, is Inspector Jack’s hunch about the site correct? Should he be given the go ahead to set up cameras to catch the racers? Justify your answer. |
|  | ✓  ✓  ✓  ✓  ✓  ∴ As the majority of the skid marks were produced by cars in excess of 150 km/h ✓  Jack should be able to set up the cameras |

**FRAUD**

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| **12.** | **[7 marks]** |
|  | Inspector Jack is a very busy detective. He has just been called into Rockingham Bank, as the manager suspects one his staff stole money and put it into an interest bearing account.  The manager knows the following information about the money:   * The money was stolen 15 years ago. * The money could be in one of three accounts:   + Supersaver with an interest rate of 3.95% p.a, compounded fortnightly   + Passbook Saver with an interest rate of 5.25% p.a, compounded monthly   + Megasaver with an interest rate of 6.25% p.a, compounded bi-annually. * The stolen money has been earning interest over the fifteen years and the account now holds over $1 000 000.   Using his favourite forensic accountant, Fin Ance, Inspector Jack tracks the money to one of three people:   * Prin Cipal has been working at the bank for 20 years and has a Passbook Saver account. * Pro Numeral has been working at the back for 25 years and has a Supersaver account * Sal Ary has been working at the bank for 16 years and has a Megasaver account.   Fin Ance discovered that the initial amount stolen to open the bank account was $450 000.  Who is the culprit? |
|  | Supersaver:  ✓  ✓ |
|  |  |
|  | Passbook:  ✓  ✓ |
|  |  |
|  | Megasaver:  ✓  ✓ |
|  |  |
|  | ∴ The culprit is Prin Cipal, as the money was deposited into Passbook Saver ✓ |