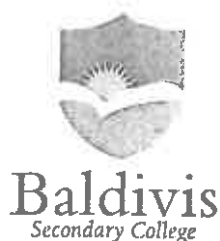


Name:

Mark Inkey

Date: _____



Year 11 Mathematics: Applications

Investigation 1, 2016

Topic – Forensic Science

In Class Component

$\frac{\quad}{\quad}$
50
$= \frac{\quad}{\quad} \%$

Total Time: **50 minutes**Reading Time: **5 minutes**Working Time: **45 minutes**Equipment: *SCSA Formula sheets, ClassPad calculator, Scientific Calculator, Take Home Component*

Date out: Week _____ Date _____ Date Due: Week _____ Date _____

Take home component weighting:	0% of the year	In-class component weighting:	10% of semester, 5% of the year
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AIM: In this assessment, you will be investigating how mathematics is used in solving crimes, through Forensic Science. You use your CAS ClassPad for this investigation, in particular the spreadsheet function.

MUDDY FOOTPRINTS

A week after discovering the body of Pythagoras at Lake Walyungup, Inspector Jack and Dr Math were called to a crime scene at a beach house in Warnbro. 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 prints outside the bedroom window. One set of prints had a footprint length of 27 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 6.2 times the length of their footprint, and their stride length is approximately 35% of their height.

1. [2 marks]

Determine the rule to find the height of a person given their footprint length:

Let h be the person's height.

Let f be the footprint length ✓

Rule: $h = 6.2f$ ✓

2. [2 marks: 1, 1]

Determine the height in centimetres of the following people, given their footprint length:

a) 12 cm

b) 31.5 cm

$$h = 6.2 \times 12$$

$$= 74.4 \text{ cm}$$

$$195.3 \text{ cm}$$

3. [2 marks: 1, 1]

By rearranging the formula determine the length of a person's footprint, given their height. Give your answer in centimetres correct to 1 decimal place.

a) 201 cm

b) 145 cm

$$f = \frac{h}{6.2}$$

$$= 32.4 \text{ cm}$$

$$23.4 \text{ cm}$$

4. [1 marks]

Write the rule for determining the height of a person using their stride length algebraically, with h representing the height of the person, and s representing the stride length.

$$h = \frac{s}{0.35}$$

5. [2 marks: 1, 1]

Determine the height of the following people in centimetres, given their stride length:

a) 67 cm

b) 54.6 cm

$$191.4 \text{ cm}$$

$$156 \text{ cm}$$

6. [2 marks: 1, 1]

By rearranging the formula determine the length of a person's stride length in centimetres, given their height:

a) 205 cm

b) 167 cm

$$s = 0.35h$$

$$71.75 \text{ cm}$$

$$58.45 \text{ cm}$$

Inspector Jack identified three suspects for the murder of Correl Ation.

- Anne Sirs – Correl's co-worker. Anne missed out on a promotion overseas because it was given to Correl.
- Sol Ootions – Correl's boyfriend. Correl dumped him last weekend when she got promoted.
- Mark Inkey – Correl's former boss. He was sacked after Correl discovered he was stealing from the company.

Inspector Jack used the Police Database to determine the height of each of the suspects. The information he discovered is compiled below.

Name	Height	Foot	Stride
Anne Sirs	198 cm	31.9cm	69.3cm
Sol Ootions	179 cm	28.9cm	62.65cm
Mark Inkey	186 cm	30cm	65.1cm
Correl Ation	172cm	27.7cm	60.2cm

7. [10 marks]

Dr Math reasoned that one set of prints belonged to the victim. If Correl was 172 cm tall, who is the murderer? To prosecute the murderer in court, all other suspects must be eliminated by proving they could not have been present according to the sets of muddy prints. Show full reasoning for your answer.

Correl Ation closest to footprint - victim.

Anne Sirs closest to stride. ✓

∴ Anne Sirs is the murderer ✓

SCHOOL ZONE INVESTIGATION

Inspector Jack is a very busy detective. He has been called to investigate speeding parents on a stretch of sealed road outside a school in Rockingham. If he can prove that the cars were travelling in excess of 40 km/h, he can set up some cameras to catch the offending drivers and fine them.

The total stopping distance for a car is based on the driver's reaction distance (the distance that is travelled during think time for the reaction to apply the brakes) and the actual braking distance for the car (*v is the speed the car is travelling at km/h*).

$$\text{Reaction distance (m)} = 0.208 \times v$$

$$\text{Braking distance} = 0.025 \times v^2$$

both Reaction distance and Braking distance are measured in metres and speed is measured in km/h

8. [3 marks: 1, 1, 1]

Determine the reaction distance in metres for cars driving at the speed below. Give your answer to the nearest whole metre.

a) 30 km/h

6m ✓

b) 45 km/h

9m . ✓

c) 53 km/h

11m ✓

9. [8 marks: 2, 2, 2, 2]

Determine the total stopping distance for cars travelling at the following speeds. Give your answer to the nearest whole metre.

a) 33 km/h

$6.864 + 27.225$ ✓
 $\approx 34\text{m}$ ✓

b) 51 km/h

$10.608 + 65.025$ ✓
 $\approx 76\text{m}$ ✓

c) 65 km/h

$13.52 + 105.625$ ✓
 $\approx 119\text{m}$ ✓

d) 70 km/h

$14.56 + 122.5$ ✓
 $\approx 137\text{m}$ ✓

10. [3 marks: 1, 1, 1]

Determine the speed of the driver, given the following information.

- a) Reaction distance of 7.696m.

37 km/hr ✓

- b) Reaction distance of 9.568m.

46 km/hr ✓

- c) Braking distance of 12.1m.

22 km/hr ✓



Speeding offences

Cars, motorcycles and other vehicles less than 22.5 tonnes Gross Combination Mass (GCM)

Please refer to the Road Safety Commission website for speeding offences for vehicles with a GCM of 22.5 tonnes or more.

Exceed the speed limit by	Fine	Demerit points
Not more than 9 km/h	2 penalty units	0
More than 9 but not more than 19 km/h	4 penalty units	2
More than 20 but not more than 29 km/h	8 penalty units	3
More than 30 but not more than 40 km/h	16 penalty units	6
More than 40 km/h	20 penalty units	7

* At certain holiday periods (e.g. Easter and Christmas) and on long weekends, demerit points are doubled for alcohol, speed and some other offences.

Periods when 'double demerit' points are in force are publicised through the Western Australian media, but you must obey BAC and speed limits at all times.

The value of a penalty unit is \$50.00. These penalties are reviewed from time to time. They are correct at date of publication.

You will need this information!

11. [15 marks]

Speeding fines and points are allocated on a sliding scale. Determine the speed and hence the fines and points allocated to the following drivers. Remember, the speed limit in a school zone is 40 km/h.

$$\text{Reaction time} = 0.208 \times v$$

$$\text{Braking distance} = 0.025 \times v^2$$

Parent	Reaction Distance (m)	Braking Distance (m)	Total Stopping Distance (m)	Speed (km/h)	Demerit points	Fine (\$)
Mr B. Racer	12.48	Not Required	102.48	60 ✓	3 ✓	\$400 ✓
Ms H. Oon	Not Required	72.9	84.132	54 ✓	2 ✓	\$200 ✓
Mr S. Gonzales	Not Required	129.6	144.576	72 ✓	6 ✓	\$800 ✓
Mr P. Plater	8.736	Not Required	52.836	42 ✓	0 ✓	\$100 ✓
Ms L. Driver	7.28	Not Required	37.905	35 ✓	0 ✓	0 ✓