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| Name: | \_\_\_\_\_SOLUTIONS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | | Date: *\_\_\_\_\_\_* | |
| pact jpg1 | **Subject: METHODS MAT**  **Investigation 2, 2015**  **Topic: Applications of Differentiation** | | | | 34  = % | |
| **Weighting:** | *5% of the year.* | | | | |  |
| **Equipment:** | *Curriculum Council, Formula sheets, Calculators* | | | | | |
| **Important Information:**  *Although the take-home component is not worth any marks, it is essential in preparation for the in-class component. Knowledge and skills gained will be extended in the in-class validation component. This in-class validation will be completed under test conditions on the day in which this take-home component is due. The take-home component may be used when completing the in-class component. Contact will be made to parent(s) if the take-home component is not available for submission (at the start of the lesson).*  ***Answers should be rounded appropriately****. All working should be shown in the space provided. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks.*  *No pen, pencils, highlights etc. may be used during reading time. This time is to be used to read through the assessment and check that you understand what is being asked of you. You may speak with the teacher/supervisor during this time (by putting up your hand and waiting patiently for them to approach you) but you may only ask clarification questions and not how to solve the problems. After reading time has ended, you may not ask any more questions.* | | | | | | |
| **Take home component weighting:** | | *0% of the year* | **In-class component weighting:** | *5% of the year.* | | |

**Question 1**

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|  | Solution | Marking key/mathematical behaviours | Marks |
| (a) |  | * Identifies formula for volume | 1 |
| (b) |  | * Identifies expression with 3 dimensions * Substitutes another expression for length | 1  1 |
| (c) |  | * Identifies expression for volume | 1 |
| (d) |  | * Differentiates expression for volume * Applies linearity | 1  1 |
| (e) |  | * Equates derivative to zero * Solves resulting equation discarding zero result | 1  1 |
| (f) |  | * Substitutes w into expression for volume * Calculates volume and states units | 1  1 |
| (g) | Length is 70.22 cm  Height = 52.67 cm | * Determines length * Determines height | 1  1 |

**Question 2**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Solution | Marking key/mathematical behaviours | Marks |
| (a) |  | * Differentiates expression for volume * Applies linearity | 1  1 |
| (b) |  | * Equates derivative to zero * Solves resulting equation discarding zero result | 1  1 |
| (c) |  | * Calculates volume | 1 |
| (d) | Length is 70.22 cm  Height = 52.67 cm | * Determines length * Determines height | 1  1 |

**Question 3**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Solution | Marking key/mathematical behaviours | Marks |
| (a) |  | * Expresses relationship between radius or diameter and height * Determines *h* in terms of *r* * Substitutes expression for h in formula for volume of a cylinder | 1  1  1 |
| (b) |  | * Differentiates expression for volume * Applies linearity * Equates derivative to zero and determines value for radius | 1  1  1 |
| (c) | (i)  (ii)  Length = 158 – 2d = 52.67 cm | * Substitutes value for r into formula for volume * Calculates volume * Determines length | 1  1  1 |

**Part B**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Shape | Maximum volume  (cm3) | Dimensions for maximum volume  (cm) | | | |  |  | length | width | height | | Rectangular prism | 129 854 | 70.22 | 35.11 | 52.67 | | Triangular prism | 64 927 | 70.22 | 35.11 | 52.67 | | Cylinder | 114 735 | 52.67 | 52.67 | 52.67 | | |
| Marking key/mathematical behaviours | Marks |
| * Completes table with data obtained | 1 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Solution | Marking key/mathematical behaviours | Marks |
| (b) | Triangular prism  Cylinder  Rectangular prism  No pattern apparent in the listing – number of sides is increasing but for the rectangular prism | * Ranks and makes appropriate comment | 1 |
| (c) | Height is always 52.67 cm  Height is one third of total linear measurement  Where there were no restrictions on length and width, they were equal and the shapes almost “cubic” | * Describes two aspects of the dimensions | 1  1 |
| (d) | Rectangular prism with *l = w = h* = 52.67  Volume = 146 113 cm3 | * Identifies shape and dimensions satisfying condition * Gives volume greater than those calculated | 1  1 |