**Course Methods Year 12 test one 2022**

Student name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Teacher name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Task type: Response**

**Time allowed for this task: \_\_\_\_\_40\_\_\_\_\_\_ mins**

**Number of questions: \_\_\_\_8\_\_\_\_\_\_\_**

**Materials required: No calculators nor classpads allowed**

Standard items: Pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: Drawing instruments, templates, notes on one unfolded sheet of
A4 paper.

**Marks available: \_\_\_40\_\_\_ marks**

**Task weighting: \_\_10\_\_%**

**Formula sheet provided: Yes**

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

Q1 (3, 4 & 3 = 10 marks)

Differentiate the following:

1. 

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| **Solution** |
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| **Specific behaviours** |
| P correct powerP uses factor of 5P uses factor of 3(no need to simplify)  |

1.  and simplify

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| **Solution** |
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| **Specific behaviours** |
| P uses product ruleP uses chain rule for bracket termP obtains a correct expressionP shows a fully simplified expression |

1.  (do not simplify)

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| **Solution** |
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| **Specific behaviours** |
| P uses quotient ruleP correct denominatorP correct numerator  |

Q2 (4 marks)

Determine the equation of the tangent to  at 

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| **Solution** |
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| **Specific behaviours** |
| P uses product ruleP determines gradientP sets up a constant and equation to solveP states tangent line |

Q3 (5 marks)

Determine the coordinates of the stationary points and their nature for . Justify.

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| **Solution** |
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| **Specific behaviours** |
| P determines first derivative P equates derivative to zeroP solves for x values of both stationary ptsP uses a derivative test and shows values to determine natureP determines y values of stationary pts |

Q4 (3 marks)

The displacement of a body from an origin O, at time  seconds, is  metres where



Determine the velocity and the displacement of the body when the acceleration is zero.

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| **Solution** |
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| **Specific behaviours** |
| P differentiates to determine velocity and accelerationP equates acceleration to zero and solves for tP states velocity and displacement for this time |

Q5 (4 marks)

Consider the function  which is graphed below.



On the **axes below**, sketch the gradient function  indicating on your sketch the location of any stationary points and any inflection points. (labelled)

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| **Solution** |
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| **Specific behaviours** |
| P correct shape being concave up with a min turning pt (location may differ)P labels local minimum (accept min)P labels inflection ptP labels local max (accept max)Note: No follow through if sketch is wrong as original function given & do not accept turning pt) |

Q6 (2 & 3 = 5 marks)

Consider the function  where .

1. Using the increments formula (small change) determine an approximate value for  and express this as an approximate percentage change again using the increments formula.

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| **Solution** |
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| **Specific behaviours** |
| P uses increments formulaP determines approx. g(2.1) |

1. The volume of a sphere of radius  metres is given by . Using the increments formula determine the approximate percentage change in volume for a 3% change in the radius.

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| **Solution** |
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| **Specific behaviours** |
| P sets up an expression for percentage change in volumeP simplifies expressionPsubs % change for r to give approx. % change in V |

Q7 (4 marks)

Let  equal the number of hectares that a farmer will use to grow corn one season. The amount of corn to be harvested per hectare is given by  kg for  . **Using calculus** determine the number of hectares that should be used to maximise the amount of corn produced.

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| **Solution** |
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| **Specific behaviours** |
| P determines expression for total amount of cornP differentiates and equates to zeroP solves for A (no units required)P shows using a derivative test that this is a local max |

Q8 (5 marks)

Let the cost, $, to make  items in a factory be given by  dollars. Using calculus show that the minimum **average cost** per item is equal to the marginal cost at this number of items.

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| **Solution** |
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| **Specific behaviours** |
| P determines exp for average and differentiatesP equates derivative to zero and solves for xP shows with derivative test that local minP shows marginal cost formulaPshows both equal at required x value |