**Course Methods Test 2 Year 12**

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

**Task type: Response**

**Reading time for this test : 5 mins**

**Working time allowed for this task: 40 mins**

**Number of questions: \_\_\_\_\_4\_\_\_\_\_\_**

**Materials required:** Upto three calculators/classpads

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: 42 marks**

**Task weighting: 13%**

**Formula sheet provided: no but formulae listed on next page.**

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

Useful formulae

Q1 (2, 3, 3 & 2 = 10 marks)

Consider the functions  and the table of values below.

Determine the following showing full working.

1. 

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 uses product rule  🗸 determines derivative at x=3 |

1. 

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 uses quotient rule  🗸 subs correct values for numerator  🗸 obtains derivative at x=4 |

1. 

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 uses chain rule  🗸 determines derivative of f at x=5  🗸 states derivative at x=5  NOTE: max of 1 out of 3 if no chain rule used |

1. 

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 uses chain rule  🗸 states derivative  NOTE: zero marks if no factor of 3 (chain rule) used! |

Q2 (1, 2, 3, 2 & 3 = 11 marks)

Consider a group of kangaroos living in an isolated habitat such that the number of kangaroos,  at time  years ( at the start of 2012), is given by .

1. Determine the number of kangaroos at the start of 2012.

|  |
| --- |
| **c** |
| 64000 kangaroos |
| **Specific behaviours** |
| 🗸 states number |

1. Determine the increase in kangaroos over the first 5 years.

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 suns t=5  🗸 rounds up to nearest integer |

1. Determine to the nearest month when the population first exceeds 100000.

|  |
| --- |
| **c** |
| Three years and nine months. |
|  |
| **Specific behaviours** |
| 🗸 sets up equation  🗸 solves for time in years  🗸 rounds to nearest month (do not accept 8 months nor days) |

1. Determine the rate of growth at the start of 2024.

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 recognises that derivative is needed at time t=12  🗸 states rate, approx. or exact |

After 10 years the number of kangaroos starts to decline according the formula  where  are constants.

1. Determine if after 3 years after the decline of the kangaroos, the population is back to 64000.

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 determines A constant, accept decimal  🗸 sets up equation for r constant  🗸 solves for r |

Q3 (2, 2, 2, 2 & 4 = 12 marks)

An oscillating mass has a velocity,  given by  , .

The velocity is measured in metres/second with the time,  in seconds.

Find below a graph of the velocity.

1. Determine the first two exact times that the mass changes direction, .

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 first time, t>0  🗸 second time |

1. Shade on the diagram above the signed area that is represented by the integral

 .

|  |
| --- |
| **c** |
| Shades area between graph from  to |
| **Specific behaviours** |
| 🗸 shades positive signed area to intercept  🗸 shades negative signed area from intercept to . |

1. What does the integral represent for the mass?

|  |
| --- |
| **c** |
| Change in displacement from  to |
| **Specific behaviours** |
| 🗸 discusses change in displacement (Do not accept distance)  🗸 states start and finish times |

1. Determine the first time after  that the acceleration is zero . **(2 marks)**

|  |
| --- |
| **c** |
| Time= 5.83 seconds |
| **Specific behaviours** |
| 🗸 shows derivative of velocity  🗸 solves for first time after pi for zero acceleration WITH units  Note- full marks for answer only being a 2 mark question. |

1. The displacement of the mass is given by  metres, where  are constants. Determine the values of .

|  |
| --- |
| **c** |
|  |
| **Specific behaviours** |
| 🗸 diffs x to obtain expression of v in terms of A,B&C  🗸 sets up equations for constants  🗸 Solves for B & C  🗸 Solves for A |

Q4 (2, 3 & 4 = 9 marks)

1. Determine the values of  to two decimal places.

|  |
| --- |
| **c** |
| 5.53 & 8.85 Km |
| **Specific behaviours** |
| 🗸 equates D=-3  🗸 solves for x rounded to 2dp and gives units. |

1. Using calculus, determine the cross-sectional area of the trench to one decimal place.

|  |
| --- |
| **c** |
| Area = 7.3 square Km |
| **Specific behaviours** |
| 🗸 sets up definite integral with correct limits  🗸 states anti-derivative  🗸 states area ( no need to round nor units) |

1. Using calculus, determine the maximum distance of the trench below sea level.

|  |
| --- |
| **c** |
| Local min when x=6.494 & x=8.174 km      Max distance below sea level 6.69 km |
| **Specific behaviours** |
| 🗸 states derivative  🗸 equates derivative to zero and solves for three x values within domain in part a  🗸 states second derivative for all three stationary points  🗸 identifies correct stationary point and states depth as a positive number WITH units  (no need to calculate both y values)  Note: max of -1 for no units in this entire question. |

Working out space

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