**Course Specialist Test 4 Year 12**

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

**Task type: Response**

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

**Number of questions: \_\_\_\_\_7\_\_\_\_\_\_**

**Materials required:** Calculator with CAS capability (to be provided by the student)

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, and up to three calculators approved for use in the WACE examinations

**Marks available: \_44\_\_\_\_\_ 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 & 3 = 6 marks)

Solve the following.

1.  given that when .

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| --- |
| **Solution** |
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| **Specific behaviours** |
| P separates variables  P integrates all terms  P solves for constant |

1.  given that when .

|  |
| --- |
| **Solution** |
| (c=+2/225) |
| **Specific behaviours** |
| P separates variables  P integrates all terms  P solves for constant |

Q2 (4 marks)

An iron has a temperature of  is left in a room, of temperature , to cool such that the temperature  at time  minutes is given by . After 15 mins the temperature of the iron is . Determine the time taken for the iron’s temperature to drop to .

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| **Solution** |
| 51.57 minutes |
| **Specific behaviours** |
| P separates variables and integrates  Pderives an expression involving both variables  P solves for both constants (may be approx.)  P determines approx time and must give units |

Q3 (1, 5 & 2 = 8 marks)

The number  thousands, of bacteria cells living in a petri dish at time  hours is given by .

The initial number of cells was 2 thousand.

1. What is the limiting value of the number of cells as ?

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| **Solution** |
| 6 thousand |
| **Specific behaviours** |
| P states limiting value with units |

1. Using calculus and partial fractions, show every step to express  in terms of .

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| **Solution** |
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| **Specific behaviours** |
| P separates variables  P uses partial fractions and shows working for constants  P shows why absolute value not needed for log function  P rearranges to make N the subject with a constant  Psolves for constant |

1. Determine the number of cells after 15 hours.

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| **Solution** |
| Approximately 5870 cells |
| **Specific behaviours** |
| P subs t=15 into rule from part b  P determines quantity with units of thousands or 5870 cells  (Note –max –1 for units for entire question) |

Q4 (3, 2 & 2 = 7 marks)

Consider the slope field 

1. Sketch this field on the axes below.

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| **Solution** |
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| **Specific behaviours** |
| P shows horizontal grads at x=-2  P shows horizontal grads at x=3  P pattern at far left and right |

1. Draw the solution curve, axes above, that contains the point (1,1).

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| **Solution** |
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| **Specific behaviours** |
| P shape of solution curve  P shows pt A labelled on curve |

1. Determine the equation of the solution curve that contains (1,1).

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| **Solution** |
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| **Specific behaviours** |
| P integrates x terms  P solves for constant |

Q5 (2, 2 & 3 = 7 marks)

Consider an object that is moving with Simple Harmonic Motion such that  with  in metres and seconds respectively. At ,  metres and is a rest.

1. Determine a rule for  in terms of .

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| **Solution** |
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| **Specific behaviours** |
| P uses an appropriate trig function  P states all constants |

1. Determine the exact speed when  metres.

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| **Solution** |
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| **Specific behaviours** |
| P uses appropriate rule  P states exact speed, ignore units |

1. Determine the percentage of the time, to one decimal place, that the object is less than 3 metres from the mean position, .

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| **Solution** |
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| **Specific behaviours** |
| P solves for times at x=3 in a cycle or part cycle  P determines an interval time and then divides by total length of cycle or part cycle  P determines percentage |

Q6 (4 marks)

Consider an object that is initially at the origin and at rest such that its acceleration is given by  where  equals the speed in at seconds . Determine the exact speed when its displacement from the origin is  metres.

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| **Solution** |
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| **Specific behaviours** |
| P separates variables and uses appropriate form of acceleration  P integrates and uses a constant  P solves for constant  P determines exact speed |

Q7 (2, 3 & 3 = 8 marks)

A lolly company makes jelly beans where the mass of one jelly bean is normally distributed with a mean of 23.4 mg and a standard deviation of 3.2 mg. (Note: 1g=1000mg)

1. Determine the probability to two decimal places that the total mass of 85 jelly beans is more than two grams.

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| **Solution** |
| Prob=0.35 |
| **Specific behaviours** |
| P uses correct parameters  P determines prob to 2 dp |

1. Given that the probability that the mean mass of a jelly bean differs from the population mean by more than 0.35 mg is 5%, determine , the number of jelly beans that need to be sampled.

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| --- |
| **Solution** |
| Sample size = 322 |
| **Specific behaviours** |
| P states correct z score (must show)  P sets up equation for n  P rounds up |

1. On a particular day the operator of a machine that makes jelly beans is suspected of being faulty. A sample of 200 jelly beans had a sample standard deviation of 3.8 mg with a total mass of 5.4 grams. Present a mathematical argument to either support or to dismiss such a claim.

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| **Solution** |
| 23.4 does not lie in interval hence there is evidence that machine is faulty and a different population mean is likely.  OR  As not every confidence interval contains the true value of mean, no inference can be made on one confidence interval |
| **Specific behaviours** |
| P determines a confidence interval for population mean using sample given.  P looks to see if 23.4 lies in interval or discusses that not every interval contains  P states that fault is likely as 23.4 lies outside interval OR no inference possible |