**Course Specialist Test 2 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: \_41\_\_\_\_\_ marks**

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

**Formula sheet provided: Yes**

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

Q1 (2, 2 & 3 = 7 marks) (3.2.1-3.2.3)

Consider the functions  and  .

1. State the natural domain and range of .

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 states domain  🗸 states range |

1. Does  exist over the natural domain of ? Explain.

|  |
| --- |
| **Solution** |
| To exist  therefore does not exist over natural domain |
| **Specific behaviours** |
| 🗸 states does not exist with any reason  🗸 reason shows relevant domain and range |

1. State the rule and natural domain and range of .

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 states rule  🗸 states domain which excludes x=4  🗸 states range with correct endpoints inequalities of excluded interval |

Q2 (3, 3, 1 &2 = 9 marks) (3.2.4)

Consider the function  with domain  .

1. Sketch the inverse function on the axes below.

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 appears to be reflected in y=x  🗸 shows pts (-4,2) & (8,0) on iverse  🗸 correct domain and range |

1. Determine the inverse function  stating its domain. (Show all working)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 shows the interchange of y & x or shows how x is made the subject of rule  🗸 states inverse rule with correct sign  🗸 states domain |

1. Determine 

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 states x |

1. Determine when  exactly.

|  |
| --- |
| **Solution** |
| Meets on line y=x    Discard second answer as outside domain of f |
| **Specific behaviours** |
| 🗸 sets up an equation to solve for x  🗸 solves for one value of x exactly |

Q3 (3 marks) (3.2.6)

Consider the inequality  is **only true** for  with  a constant.

Determine the value of .

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 uses midpoint of solution interval  🗸 rearranges inequality to identify centre in terms of x  🗸 states correct value of constant |

Q4 (3 & 3 = 6 marks) (3.2.7)

Consider the following function .

1. Sketch  on the axes below.

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 appears to reflect left side  🗸 correct x intercepts  🗸 y intercept and drawn with correct domain |

1. Sketch  on the axes below.

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 both asymptotes shown  🗸 y intercept correct with y endpoints  🗸 shape in all 3 section |

Q5 (3 & 3 = 6 marks) (3.3.3-3.3.6)

Consider two rockets A&B, moving with constant velocities such that at time  hours their positions and velocities are as follows:



1. Determine the time and distance of their closest approach.

|  |
| --- |
| **Solution** |
| Distance=5 mins |
| **Specific behaviours** |
| 🗸 uses displacement vector with dot product OR calculus with separation vector  🗸 states time of closest approach (no need for units)  🗸 states distance approx. or exact (no need for units) |

1. Given that the rockets leave smoke trails that stays in the air for a long period of time, determine if the smoke trails cross at all and if they do, its position in space. Justify.

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| 🗸 uses lines with **different** parameters  🗸 shows solution to **stated** simultaneous equations(all 3) with values of parameters  🗸 states point of intersection of smoke trails |

Q6 (6 marks) (3.3.4, 3.3.6)

Consider the line  and the sphere  with  a constant.

Determine the value(s) of , to one decimal place, such that:

1. The line is a tangent to sphere.
2. The line meets the sphere in two places.
3. The line misses the sphere completely.

|  |
| --- |
| **Solution** |
|  |
| **Tangent**  **Two places**  **No intersection**  **Specific behaviours** |
| 🗸 subs line into sphere equation  🗸 sets up equation for  🗸 sets up a quadratic equation for  in terms of  🗸 determines expression for discriminant in terms of  and solves when  🗸 states values for one of the three scenarios with reasoning (no need for rounding)  🗸states values for all three scenarios with **reasoning for each** (no need for rounding)  NOTE: No follow through if mistake makes problem easier. |

Q7 (4 marks) (3.1.4)

The solutions to the complex equation  are plotted in the complex plane. ( is an integer &  is a complex constant). Exactly **four** of the solutions are plotted in the second quadrant,, and **no more**. Of these four solutions, the smallest argument is .

Determine all possible values of .

|  |
| --- |
| **Solution** |
| Consecutive roots arguments separated by  Four arguments are: |
| **Specific behaviours** |
| 🗸 uses additions of  🗸 sets up equation for lower boundary for  🗸 sets up equation for upper boundary for  🗸 states all allowed integer values for |