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**MATHEMATICS**

**SPECIALIST**

**UNIT 3**

**Semester One**

**2019**

**SOLUTIONS**

***Calculator−free Solutions***

1.

 ✓✓

 units ✓

 and only solution ✓ [4]

2. (a) (i)

 ✓✓

 (ii) is another factor ✓

 (iii)

 ✓

 Leading term: ✓

 Constant: ✓

 ✓

 Solutions

 (b)

 ✓

 ✓

 ✓

 ✓



✓ magnitude = 0.5

✓ radians apart

 [13]

3. (a)

 ✓

 ✓

 ✓

 (b) Entering equation into a matrix gives:

 Using row-reduction in one step gives:

 ✓

 From the last row: ✓

 and . ✓

 (c) (i)

 the normal to the plane is parallel to direction vector of the line,

 ✓

 hence, accept values that are multiples of as follows:

 ✓

 (ii) Using , the line becomes

 ✓

 ✓

 Coordinates of POI are ✓ [11]

4. (a) Roots: or ✓✓

 Poles: or ✓✓

 y-intercept: ✓



 (b)

✓ poles at x = -1,3

✓discontinuities at roots x = 1,6

✓ y-intercept (0,1)

✓ correct curvature around x = 1

✓ correct curvature for x > 3 and x < -1

 (c) from symmetry over the y-axis ✓ [11]

5. (a) From the graphs:

 for , hence need ✓

 but only

 and for , and hence ✓

 (b) and ✓

 ✓

 (c) Need and ✓

 Hence, and

 Domain ✓✓

 Range stays the same ✓ [8]

6. (a) Centre is midpoint between P and Q = ✓

 Radius ✓

 ✓

 (b) is normal to the plane, hence ✓

 ✓

 (simplified) ✓ [6]

***Calculator−Assumed Solutions***

7. Let with

 ✓

 ✓

 ✓

 ✓ [4]

8. (a) (i)

 since the z-coordinate is already of magnitude 1, then

 the x ad y coordinates must be zero. Hence,

 and ✓✓

 (ii) ✓

 ✓

 and ✓✓

 (b) ✓

 and ✓

 If ΔABC equilateral, then

 ✓

 ✓ [10]

9. (a) ✓✓✓

 (b) ✓✓✓

 (c)

 ✓

 two lines through the origin. ✓



 ✓✓

 [10]

10. (a) ✓✓

 (b)

 cm ✓

 cm/s ✓

 cm ✓

 cm/s ✓



✓(b)

✓(f)

✓(b)

 (c) sec ✓

 (d) ✓

 ✓

10. (e)

 ✓✓

 (f) CAS cm/s at s ✓✓

 cm ✓ [17]

11. (a) OR ✓✓

 (b) ✓✓

 (c) ✓✓

 ✓✓ [8]

12. (a) and

 (i) ✓✓

 (ii)

 ✓✓

 (iii) ✓✓



12. (b) (i) and occur along the line connecting the

 centre of the circle with the origin.

 and ✓✓

 (ii) and

 ✓✓

 ✓✓ [12]

13. (a) Speed m/s ✓

 ✓

 ✓

 (b)

 ✓

 ✓

 Distance m ✓

 (c) ✓

 ✓

 m/s ✓

 at m above level ground. ✓

 (d) distance , ✓✓ [12]

14. (a) ✓✓

 (b) ✓

 ✓

 (c) and ✓✓

 (d)

 ✓

 ✓

 ✓ [9]

15. (a) does not exist because is not a one-to-one function.✓

 (b) (i) Need , hence ✓

 Then, ✓✓

 (ii) Domain and Range ✓✓

 (c)

✓ sinusoidal and symmetrical over the line y=x

✓ correct location and boundaries (accuracy)

 (d)

 ✓✓ [10

16. ✓

 ✓

 Similarly,

 ✓

 and , and for domain to remain the same:

 ✓

 Hence, ✓ [5]

 (Other methods are possible depending on their choice of trigonometric

 identity. Award marks accordingly).