**2009 VCAA Specialist Mathematics**

**Written Examination 2**

**MAV Suggested answers and solutions**

**SECTION 1 MULTIPLE CHOICE**

**Answers**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | **E** |  | 2. | **D** |  | 3. | **D** |  | 4. | **A** |  | 5. | **C** |
| 6 | **A** |  | 7. | **C** |  | 8. | **E** |  | 9. | **B** |  | 10. | **B** |
| 11. | **C** |  | 12. | **E** |  | 13. | **A** |  | 14. | **B** |  | 15. | **C** |
| 16. | **D** |  | 17. | **D** |  | 18. | **B** |  | 19. | **A** |  | 20. | **E** |
| 21. | **D** |  | 22. | **B** |  |

**Solutions**

**Question 1 [E]**



A sketch of the graph using addition of ordinates shows two asymptotes, and , and a turning point at

**Question 2 [D]**



A sketch of the ellipse and hyperbola shows three point of intersection.

**Question 3 [D]**

Dom

Dom for is

**Question 4 [A]**

**Question 5 [C]**

**Question 6 [A]**

Distance between is given by

**Question 7 [C]**

Given that has real coefficients, and has a complex root its conjugate must also be a root.

The polynomial with minimum degree would be   
This polynomial 3rd degree.

**Question 8 [E]**

**Question 9 [B]**

The direction field suggests the function is an ellipse with center (6,3).

Differentiating this relation we gain

**Question 10 [B]**



Let

Terminals

**Question 11 [C]**



A sketch of would look similar to the above, which suggests that a sketch of would be:



**Question 12 [E]**

From Formula sheet we know

**Question 13 [A]**

The quantity of salt in the tank is **100*x*** kg

Rate of inflow = *0*

Rate if outflow = 

(Remember ***x*** is the **concentration,** not quantity)

rate of inflow – rate of outflow



**Question 14 [B]**

The vectors

Consider *m* =1

**Question 15 [C]**

4

3

135o

**Question 16 [D]**

**Question 17 [D]**

**Question 18 [B]**

*N*

2*g*

30o

Equation of Motion

**Question 19 [A]**

45o

Initial vertical speed:

Final vertical speed:

Acceleration:

**Question 20 [E]**

Given

**Question 21 [D]**

**Question 22 [B]**



Distance from starting point is given by the signed area bounded by the curve and the *t*-axis

**SECTION 2**

**Question 1 a**



**Question 1 b**

**Question 1 c**

**Question 1 d**

**Question 1 e**

Using a calculator

**Question 1 f**

It is safe to assume that the car will overtake the motorcycle after it has accelerated to a velocity of

**Question 2 a**

**Question 2 b**

**Question 2 c**

(since 3rd quadrant)

**Question 2 d**

Substituting (2) into (1)

Substituting into (2)

Points of intersection: and

**Question 2 e**



**Question 2 f**



Area = 

**Question 3 a**

Height given by

At

**Question 3 b**

Ground level would be Height = 0

**Question 3 c**

Period of loop: =

**Question 3 d**

**Question 3 e**

**Question 3 f**

is a constant

**Question 3 g. i.**

**Question 3 g. ii.**

Evaluate Distance using a calculator

**Question 4 a**



A quick sketch of the graph shows that it is symmetrical about the y-axis, and on either side of the axis it is one to one. So we can find the domain by solving

Using a calculator

**Question 4 b**



**Question 4 c**

From original equation, and which means we can reject .

**Question 4 d. i.**

**Question 4 d. ii.**

Using a calculator to evaluate the definite integral

**Question 4 e**

When the surface is 6 cm from the top *y* is equal to 4

**Question 5 a**

4*v*

2*g*

**Question 5 b**

From diagram in Q5a, since object is moving downward, then 

So, 

At *t =* 0, *v* = 0

**Question 5 c**

Limiting velocity occurs when *a* approaches zero

**Question 5 d**

**Question 5 e**

To find *x* when *t =* 180 given *x* = 0 when *t* = 0

(calculator formula)

Solving this integral using a calculator, we gain

**OR**



When *x=0*, *t=0*  



**Question 5 f**



When 



**OR**



To find *x* when *v =*  given *x* = 0 when *v* = 0

(calculator formula)



**Question 5 g**

At *t* = 0, *x* = 0

When *x* = 1200

Using calculator

Distance travelled by boat

1200

490.8

sea bed