|  |  |  |  |
| --- | --- | --- | --- |
| **Multiple Choice Worked Solutions** | | | |
| **No** | **Working** | | **Answer** |
| **1** | From (2) | | **B** |
| **2** | At (1, 2)  Gradient of Normal = | | **D** |
| **3** | Let  (*x* and *y* real)  ∴*A*  = *x*2 – y2 + 2xy*i*  ∴ *x*2 – *y*2 = –16 -------------------(1)  *2xy* = 30      =  = 1156  ------------------- (2)  (1) + (2)    Since *2xy* = 30    OR you can square the 4 alternative answers to determine the correct answer. | | **D** |
| **4** |  | | **A** |
| **5** | Using the shell Method | OR find volume to *y* axis and subtract from cylinder | **C** |
| **6** | *M* = 1200 *kg*, *V* = 20 *m/s*, r = 30*m* | | **D** |
| **7** |  | | **A** |
| **8** | P(at least 3 misses) = P (3 misses) + P(4 misses) | | **B** |
| **9** |  | | **A** |
| **10** | Graph C,as the curve maintains the same shape when cubed, but *y* values greater than 1 get larger and those less than 1 get smaller. Discontinuities remain the same. | | **C** |

**Trial HSC Examination 2019**

**Mathematics E2 Course**

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Teacher \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Section I** – **Multiple Choice Answer Sheet**

**Allow about 15 minutes for this section**

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sample:** | 2 + 4 = | (A) 2 | (B) 6 | (C) 8 | (D) 9 |
|  |  |  |  |  |  |
|  |  | A oval2 | B oval-fill | C oval2 | D oval2 |

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | A oval-fill | B oval-cross | C oval2 | D oval2 |

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | A oval-cross | B oval-correct | C oval2 | D oval2 |

1. A B C D

2. A B C D

3. A B C D

4. A B C D

5. A B C D

6. A B C D

7. A B C D

8. A B C D

9. A B C D

10. A B C D

| **Question 11** | **2019** |
| --- | --- |

|  | Solution | Marks | Allocation of marks |
| --- | --- | --- | --- |
| (a)  (i) |  | **2** | 1 mark – rationalising  1 mark - correct Answer |
| (ii) |  | **1** | Correct Answer |
| (iii) | *Arg (Z)* | **1** | Correct Answer |
| (iv) |  | **1** | Correct Answer |
| (b) | (i)  Since is also a zero  Therefore divisible by  By division  i.e. | **2** | 1 mark – establish division  1 mark – correct division  1 mark – correct factorisation |
| (c) | When *x* = -1:    Coefficient of    Constants: | **4** | 2 marks for correct values of *A, B* and *C*  *1 mark for each incorrect*  2 marks correct integral  – *lose 1 mark for each mistake.* |
| (d) |  | **3** | One mark for each correct graph and one mark for correct region |

| **Question 12** | **2019** |
| --- | --- |

|  | Solution | Marks | Allocation of marks |
| --- | --- | --- | --- |
| (a) | (i) | **2** | 1 for correct manipulation of integral  1 correct answer |
|  | (ii) | **3** | 3 marks – correct integral  - *lose 1 mark for each mistake in working* |
|  | (iii) Let | **3** | 3 marks – correct use of integration by parts leading to correct answer.   * *Lose 1 mark for each mistake in working* |
| (b) | If    Differentiating both sides | **3** | 1 – use of logarithms  1 – correctly differentiating using implicit differentiation  1 – answer  Either of last 2 lines or any correct equivalent expression in terms of *x* is okay as there are different forms of the result possible. |
| (c) | (i) | **1** | Correct Graph |
|  | (ii) | **3** | 1 mark – establish integral  1 - working  1 mark – correct answer |

| **Question 13** | **2019** |
| --- | --- |

|  | Solution | Marks | Allocation of marks |
| --- | --- | --- | --- |
| (a) | (i) Graph – absolute value | **1** | Correct graph |
|  | (ii) Graph – reciprocal | **2** | 2 marks for correct graph,  1 mark for graph with some correct features but some errors |
|  | (iii) Graph – +/- square root | **2** | 2 marks for correct graph,  1 mark for graph with some correct features but some errors |
|  | (iv) Graph natural logarithm graph | **2** | 2 marks for correct graph,  1 mark for graph with some correct features but some errors |
| (b) | (i)      Foci:  Directrices: | **3** | 1 - for eccentricity  1 - for the coordinates of the foci  1 - for the equations of the directrices |
|  | (ii)  *P*(4sin θ, 5cos θ)  Therefore *P* lies on ellipse | **1** |  |
| \* | (iii) *P*(4sin θ, 5cos θ)                            *PS + PS’ = = 10*  Which is independent of *P*  **NOTE: Alternative proof using definition of an ellipse.** | **2** | 1 for expression for *PS*  1 for expression for *PS’* |
|  | (iv)    At *P*(4sin θ, 5cos θ)  Gradient of normal =  Equation of normal is | **2** | 1 gradient of normal  1 equation of normal |

| **Question 14** | **2019** |
| --- | --- |

|  | Solution | | Marks | Allocation of marks |
| --- | --- | --- | --- | --- |
| (a) | Let the roots be .  Product:      Sum (1 at a time):        Sum (2 at a time): =          *b =* 6 | | **3** | 1 for value of α  1 for working  1 for answer  Can also solve (1) to get  Either still gives *b* = 6 |
| (b) | A close up of a map  Description automatically generated  Area =        Volume = | | **3** | 1 for working  1 for expression for area  1 for evaluating volume |
| (c) | (i) | | **2** | 1 use of integration by parts  1 working towards answer |
|  | (ii)                Other forms possible eg | | **2** | 1 for working  1 for correct answer |
| (d) | (i) | | **2** | 1 for each expression |
|  | (ii)  *=* | | **1** |  |
| (e) | Prove that      If then    If *a = b* then  Hence | OR Alternate | **2** | 1  1 |

| **Question 15** | **2019** |
| --- | --- |

|  | Solution | Marks | Allocation of marks |
| --- | --- | --- | --- |
| (a) | (i)  A  *θ*  1*m*      *r* P  3*g*    1*m*  *θ*  Q  4*g* | **1** |  |
|  | (ii) At *P*, Vertically    At *P*, horizontally    At *Q*, Only Vertical | **3** | One mark for each equation |
|  | (iii) From (3) - - - - (4)  Sub (4) into (1)      Sub (4) into (2)    *Now*  0⋅40*m*  ∴ *P* is 40*cm* below *A* (nearest *cm*) | **3** | 2 marks for correct expression for *tan θ*   * *Lose 1 mark for each mistake.*   1 mark for distance *h* between *P* and *A.* |
| (b) | (i) - - - (1)  - - - (2)  Sub (1) in (2) | **1** | Correct equation |
|  | (ii) | **2** | 1 for working  1 for equation |
|  | (iii) First we must find the equation with roots    Since *A* is the point then  *B* is the point then    = 8 + 16  = 24 | **3** | 1 for extra equation  1 for sum  1 for answer |
| (c) | 1. Into (2)   If touches Δ = 0 | **2** | 1 for gaining quadratic equation  1 for use of discriminant |

| **Question 16** | **2019** |
| --- | --- |

|  | Solution | Marks | Allocation of marks |
| --- | --- | --- | --- |
| (a) | (i)  Resolving Horizontally N *sin*  ----- (1)  Resolving Vertically N *cos*  ----- (2)  (1) (2) | **2** | 1 for resolving forces  1 for working towards equation |
|  | (ii) 72 km/h = 20 m/s | **2** | 2 correct working leading to answer  1 mark if didn’t convert units. |
|  | (iii)    (using rounded value 5o) (using unrounded value 4o 34’)  *h* *h* = 0.15949 m  i.e. 17 cm (nearest centimetre.) i.e. = 16 cm (nearest cm) | **1** | Correct answer |
| (b) | (i)  *kv F x*  • •  (0, 0)  *F =* 0,  *When t = 0, v =* | **3** | 1 for force equation  1 for value of c  1 for using logs to get result |
|  | (ii)  *When t = 0, x = 0* | **3** | 1 for integral  1 for value of *c*  1 for distance |
|  | (iii) when ,  Limiting position | **1** |  |
| (c) | Produce *CP* beyond *P* to *D*, making *PD = PB.*  Since ∠*BAC* = 60° (Angle in equilateral triangle)  ∠*BPD* = 60° (Exterior angle of cyclic Quadrilateral *ABPC* is equal to opposite interior angle)  But *PD = PB (construction)*  *∴ ΔBPD is equilateral.*  *In Δ’s ABP, CBD*  *BA = BC (sides in equilateral triangle ABC)*  *BP = BD (sides in equilateral triangle BPD)*  *∠ABP = ∠CBD (both equal to ∠CBP + 60°)*  ∴ Δ’s ABP, CBD are congruent (SAS)  ∴PA = DC but DC = PC + PB (construction)  ∴ PA = PC + PB | **3** | 3 for complete proof  Lose one mark for each mistake in proof. |