International Baccalaureate®
Baccalauréat International
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MARKSCHEME

May 2014

MATHEMATICAL STUDIES

Standard Level

Paper 1

1.   (a) 1.5×10^8 (km)   *(A2)*   *(C2)*

> **Notes:** Award *(A2)* for the correct answer.
>   Award *(A1)(A0)* for 1.5 and an incorrect index.
>   Award *(A0)(A0)* for answers of the form 15×10^7.

(b) $2\pi\, 1.5 \times 10^8$ *(M1)*

$= 942\,000\,000$ (km) $(942\,477\,796.1..., \ 3 \times 10^8 \pi, \ 9.42 \times 10^8)$ *(A1)(ft)*   *(C2)*

> **Notes:** Award *(M1)* for correct substitution into correct formula. Follow
>   through from part (a).
>   Do not accept calculator notation 9.42E8
>   Do not accept use of $\dfrac{22}{7}$ or 3.14 for π.

(c) $17 \times 942\,000\,000$ *(M1)*

$= 1.60 \times 10^{10}$ (km) $(1.60221... \times 10^{10}, \ 1.6014 \times 10^{10}, \ 16022122530, \ (5.1 \times 10^9)\pi)$ *(A1)(ft)*   *(C2)*

> **Note:** Follow through from part (b).

[6 marks]

2.   (a)   If Eva is losing weight then Eva is on a diet   *(A1)(A1)*   *(C2)*

> **Notes:** Award *(A1)* for If… then…
>   For Spanish candidates, **only** accept "Si" and "entonces".
>   For French candidates, **only** accept "Si" and "alors".
>   *For all 3 languages these words are from the subject guide.*
>   Award *(A1)* for correct propositions in correct order.

(b)   If Eva is not on a diet then she is not losing weight   *(A1)(A1)*   *(C2)*

> **Notes:** Award *(A1)* for "not on a diet" and "not losing weight" seen,
>   *(A1)* for complete correct answer.
>   No follow through from part (a).

(c)   The statements are logically equivalent   *(A1)(ft)*
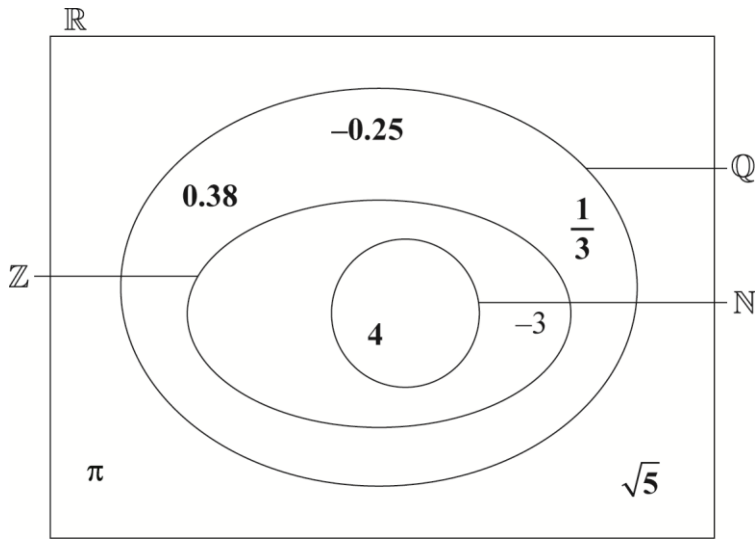   The contrapositive is always logically equivalent to the original statement   *(R1)(ft)*

   OR

   A correct truth table showing the equivalence   *(R1)(ft)*   *(C2)*

> **Note:** Follow through from their answers to part (a) and part (b).

[6 marks]

3.

$\mathbb{R}$

-0.25

$\mathbb{Q}$

0.38

$\dfrac{1}{3}$

$\mathbb{Z}$

4   -3 $\mathbb{N}$

π $\sqrt{5}$

(A1)(A1)(A1)(A1)(A1)(A1) **(C6)**

Note: Award *(A1)* for each number correctly placed.
Award *(A0)* for any entry in more than one region.

[6 marks]

4.   *The first time a correct answer has incorrect or missing units, the final (A1) is not awarded.*

(a) $\dfrac{4}{3}\pi(1)^3$ *(M1)*

> **Notes:** Award *(M1)* for correct substitution into correct formula.

   $=4.19\left(4.18879\ldots,\ \dfrac{4}{3}\pi\right)\mathrm{cm}^3$ *(A1)*   *(C2)*

(b) $83.8\left(83.7758\ldots,\ \dfrac{80}{3}\pi\right)\mathrm{cm}^3$ *(A1)(ft)*   *(C1)*

> **Note:** Follow through from their answer to part (a).

(c) $10\times8\times2$ *(M1)*

> **Note:** Award *(M1)* for correct substitution into correct formula.

   $=160\,\mathrm{cm}^3$ *(A1)*   *(C2)*

(d) $76.2\left(76.2241\ldots,\ \left(160-\dfrac{80}{3}\pi\right)\right)\mathrm{cm}^3$ *(A1)(ft)*   *(C1)*

> **Note:** Follow through from their part (b) and their part (c).

[6 marks]

5. (a)   43 (mm)   *(A1)*   *(C1)*

(b)   10 (mm)   *(A1)*   *(C1)*

(c) $48-20$ *(A1)*
       $=28$ *(A1)*   *(C2)*

Note: Award *(A1)* for identifying correct quartiles, *(A1)* for correct subtraction of the quartiles.

(d)   (i)   20 (days)   *(A1)*

     (ii)   60 (days)   *(A1)*   *(C2)*
                                                                             [6 marks]

6. (a) $2x(x-4)$ **or** $2x^2-8x$ *(A1)*   *(C1)*

Note: Award *(A0)* for $x-4\times2x$.

(b) $2x(x-4)=10$ *(M1)*

Note: Award *(M1)* for equating their answer in part (a) to 10.

       $x^2-4x-5=0$ *(M1)*
       OR

       Sketch of $y=2x^2-8x$ and $y=10$ *(M1)*
       OR

       Using GDC solver $x=5$ and $x=-1$ *(M1)*
       OR

       $2(x+1)(x-5)$ *(M1)*

       $x=5\,(\text{m})$ *(A1)*(ft)   *(C3)*

Notes: Follow through from their answer to part (a).
          Award at most *(M1)(M1)(A0)* if both 5 and −1 are given as final answer.
          Final *(A1)*(ft) is awarded for choosing only the positive solution(s).

(c) $2\times5=10$ (m)   *(A1)*(ft)
       $5-4=1$ (m)   *(A1)*(ft)   *(C2)*

Note: Follow through from their answer to part (b).
          Do not accept negative answers.

                                                                             [6 marks]

7. (a) $-\dfrac{80}{940}\left(-0.0851,\,-0.085106...,\,-\dfrac{4}{47}\right)$ *(A1)*   *(C1)*

    (b) $-0.0851\,(-0.085106...) < -\dfrac{1}{12}\,(-0.083333...)$ *(A1)***(ft)**   *(C1)*

> **Notes:** Accept "less than" in place of inequality.
>   Award *(A0)* if incorrect inequality seen.
>   Follow through from part (a).

    (c)   (i)   ramp B is safe   *(A1)*

              the gradient of ramp B is $-\dfrac{1}{12}$ *(R1)*

> **Notes:** Award *(R1)* for "the gradient of ramp B is $-\dfrac{1}{12}$" seen.
>   Do not award *(A1)(R0)*.

         (ii) $2x = 1920$ *(M1)*

> **Note:** Accept alternative methods.

             960 (cm)   *(A1)*   *(C4)*

                                                    [6 marks]

8. (a) $\dfrac{30}{100} \times \dfrac{48}{100} \times 100$ **OR** $\dfrac{30 \times 48}{100}$ *(M1)*

> **Note:** Award *(M1)* for correct substitution into correct formula.

$= 14.4 \left(\dfrac{72}{5} \right)$ *(A1)* *(C2)*

(b) 13.0 (12.9554…) *(A2)* *(C2)*

> **Note:** Award *(A1)(A0)* for 12.9.

(c) the null hypothesis is not accepted *(A1)*(ft)
$\chi^2_{calc} > \chi^2_{crit}$ **OR** 13.0 > 7.82 *(R1)*

OR

the null hypothesis is not accepted *(A1)*(ft)
p-value (0.0047) (0.00473391…) < 0.05 *(R1)* *(C2)*

> **Notes:** Follow through from their answer to part (b).
> Do not award *(A1)*(ft)*(R0)*.

[6 marks]

9. (a) $\dfrac{100000}{129}$ *(M1)*

      $= 775$ (GBP)   *(A1)*   *(C2)*

   (b) (i) $\dfrac{30200}{239}$ *(M1)*

         1GBP=126 JPY   *(A1)*

> **Note:** Accept 126 (JPY).
> Award *(M1)* for $\dfrac{239}{30200}$.
> Award *(A0)* for $1\text{JPY} = 0\text{GBP}$

      (ii) No, the part (b)(i) rate is not better value than the part (a) rate.   *(A1)***(ft)**
          $30200 < 30831$ *(R1)*

          OR

          No, the part (b)(i) rate is not better value than the part (a) rate.   *(A1)***(ft)**
          $129 > 126$ *(R1)*   *(C4)*

> **Note:** Accept "part (a) rate is better" for the *(A1)***(ft)**.
> Follow through from part (b)(i).
> A numerical comparison must be seen to award *(R1)*.

                                                         [6 marks]

10. (a) $\dfrac{350}{\tan 20°}$ *(M1)*

$= 961.617\ldots$ *(A1)*
$= 962\,(\text{m})$ *(A1)(ft)* *(C3)*

Notes: Award *(M1)* for correct substitution into correct formula, *(A1)* for correct answer, *(A1)*(**ft**) for correct rounding to the nearest metre.
Award *(M0)(A0)(A0)* for 961 without working.

(b) $961.617\ldots - 250 = 711.617...$ *(A1)*(**ft**)

$\tan^{-1}\left(\dfrac{350}{711.617...}\right)$ *(M1)*

$= 26.2°\quad(26.1896...)$ *(A1)*(**ft**) *(C3)*

Notes: Accept 26.1774... from use of 3 sf answer 962 from part (a). Follow through from their answer to part (a).
Accept alternative methods.

[6 marks]

11. (a) 1.2 $(\mathrm{mg\,l}^{-1})$ *(A1)* *(C1)*

(b) $1.2\times(0.87)^{3}$ *(M1)*

> **Note:** Award *(M1)* for correct substitution into given formula.

$=0.790\ (\mathrm{mg\,l}^{-1})\ (0.790203...)$ *(A1)* *(C2)*

(c) $1.2\times0.87^{t}=0.333$ *(M1)*

> **Note:** Award *(M1)* for setting up the equation.
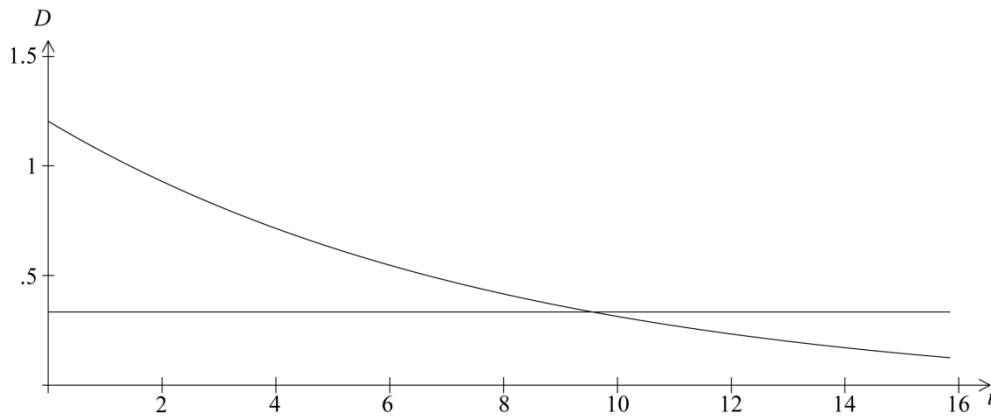
(M1)

> **Notes:** Some indication of scale is to be shown, for example the window used on the calculator.
> Accept alternative methods.

9.21 (hours) (9.20519…, 9 hours 12 minutes, 9:12) *(A1)* *(C3)*

[6 marks]

12. (a) $t = -20.1n + 205$
          $t = (-20.1046\ldots)\,n + (204.755...)$ *(A1)(A1)*   *(C2)*

> **Notes:** Award *(A1)* for –20.1 and 205 seen,
>   *(A1)* for an equation involving t and n.

(b)   –0.941 (–0.941366…)   *(A2)*   *(C2)*

> **Notes:** Award *(A0)(A1)* for +0.941.

(c) $-20.1046...\times 4 + 204.755...$ *(M1)*

> **Note:** Award *(M1)* for substitution into their regression equation.

      124 (minutes) (124.337…)   *(A1)(ft)*   *(C2)*

> **Notes:** Follow through from their regression equation found in part (a).
>   Accept 125 (minutes) (124.6).

[6 marks]

13.
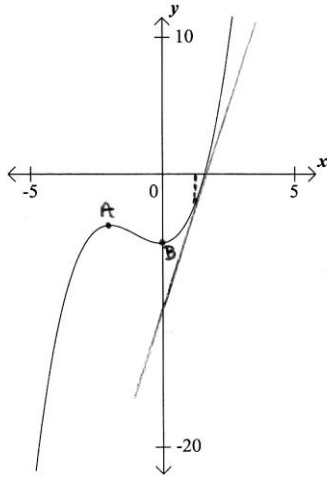
(a)   correct label on graph   *(A1)*   *(C1)*

(b)   correct label on graph   *(A1)*   *(C1)*

(c) $-1.33 < x < 0$ $\left(-\dfrac{4}{3} < x < 0\right)$ *(A1)*   *(C1)*

(d)   tangent drawn at $x=1$ on graph   *(A1)*   *(C1)*

(e) $y = 7x - 9$ *(A1)(A1)*   *(C2)*

Notes: Award *(A1)* for 7, *(A1)* for –9.
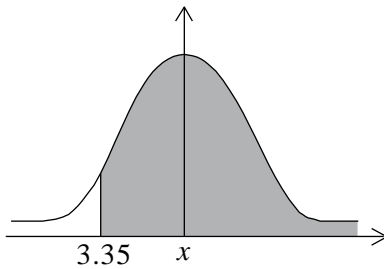   If answer not given as an equation award at most *(A1)(A0)*.

[6 marks]

14. (a) $0.5 \left(50\% , \dfrac{50}{100}, \dfrac{1}{2} \right)$ *(A1)*   *(C1)*

(b)   0.954 (0.954499…, 95.4 %, 95.4499…%)   *(A1)*   *(C1)*

> **Note:** Accept 95% or 0.95.
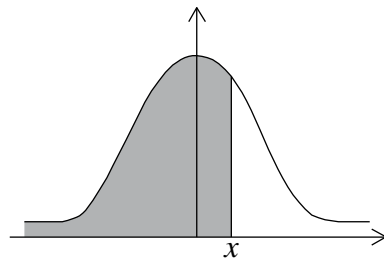
(c)

    (M1)

> **Note:** Accept alternative methods.

   0.631 (0.630558…, 63.1% , 63.0558…%)   *(A1)*   *(C2)*

(d)

    (M1)

> **Note:** Accept alternative methods.

   3.50 (3.50091...)   *(A1)*   *(C2)*

   [6 marks]

15. (a) $6x^2 - 5 - \dfrac{4}{x^2}$ *(A1)(A1)(A1)(A1)*   *(C4)*

> **Note:** Award *(A1)* for $6x^2$, *(A1)* for –5, *(A1)* for –4, *(A1)* for x^{-2} or $\dfrac{1}{x^2}$.
>   Award at most *(A1)(A1)(A1)(A0)* if additional terms are seen.

(b)   (1.15, 3.77) $\big((1.15469...,3.76980...) \big)$ *(A1)(A1)*   *(C2)*

> **Notes:** Award *(A1)(A1)* for " $x = 1.15$ and $y = 3.77$ ".
>   Award at most *(A0)(A1)***(ft)** if parentheses are omitted.

   [6 marks]