



MARKSCHEME

November 2014

MATHEMATICAL STUDIES

Standard Level

Paper 1

1. (a) (i) 300 (minutes) **OR** 5 hours (AI)

Note: If answer given in hours, the unit **must** be seen.

- (ii) 220–100 (MI)

Notes: Award (MI) for the two quartiles seen.

- = 120 (minutes) **OR** 2 hours (AI) (C3)

Note: If answer given in hours, the unit **must** be seen.

- (b) median (time spent on homework per day) (AI) (C1)

Note: Do not accept middle or medium etc.

- (c) (i) 25 (AI)

- (ii) 75 (AI) (C2)

[6 marks]

2. (a) $BD = \sqrt{4^2 + 8^2}$ (M1)

Note: Award (M1) for correct substitution into the distance formula.

$= 8.94 (8.94427\dots, \sqrt{80}, 4\sqrt{5})$ (A1) (C2)

(b) $\text{Area ABCD} = 2 \times \left(0.5 \times \frac{\text{their BD}}{2} \times \sqrt{500} \right)$ (M1)(M1)(M1)

Note: Award (M1) for dividing their BD by 2, (M1) for **correct** substitution into the area of triangle formula, (M1) for adding two triangles (or multiplied by 2).

Accept alternative methods:

Area of kite = $0.5 \times \sqrt{500} \times$ their part (a).

Award (M1) for stating kite formula.

Award (M1) for correctly substituting in $\sqrt{500}$.

Award (M1) for correctly substituting in their part (a).

$= 100$ (A1) (C4)

Note: Accept 99.9522 if 3 sf answer is used from part (a).

[6 marks]

3. (a) discrete (AI) (CI)
- (b) (i) 60 (AI)
- (ii) 5 (AI) (C2)
- (c) (i) $\frac{1 \times 4 + 2 \times 7 + 3 \times 12 \dots}{60}$ (MI)

Notes: Award (MI) for an attempt to substitute into the “mean of a set of data” formula, **with at least three correct terms** in the numerator.
Denominator must be 60.
Follow through from part (b)(i), only if work is seen.

= 4.03 (4.03333...) (AI)

Notes: Award at most (MI)(A0) for an answer of 4 but only if working seen.

- (ii) 1.54 (1.53803...) (AI) (C3)
- [6 marks]

4. (a) $\frac{0.97 \times 3550}{1.95}$ (M1)(M1)(M1)

Note: Award (M1) for 0.97 seen, (M1) for 0.97×3550 , (M1) for division by 1.95.

OR

$(3550 - 0.03 \times 3550) \times \frac{1}{1.95}$ (M1)(M1)(M1)

Note: Award (M1) for 0.03×3550 seen, (M1) for subtracting 0.03×3550 from 3550, (M1) for division by 1.95.

= 1765.90 (EUR) (A1) (C4)

(b) $20 \times 1.90 - 34.50$ (M1)

Note: Award (M1) for subtraction of 34.50 from their product of 20×1.90 .

= 3.50 (BGN) (A1) (C2)

Notes: Award at most (M1)(A0) for an answer of 4, but only if working seen.

[6 marks]

5. (a) If I do not break my arm, then it will not hurt (AI)(AI) (C2)

Note: Award (AI) for “if... then...”
 For Spanish candidates, **only** accept “Si” and “entonces”.
 Award (AI) for “not break my arm” and “not hurt” in correct order.

(b)

p	q	$p \Rightarrow q$	Inverse of $p \Rightarrow q$	Converse of $p \Rightarrow q$
T	T	T	T	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T

(AI)(AI) (C2)

Notes: Award (AI) for each correct column.

- (c) logically equivalent (AI)(ft)
 last two columns of the truth table are identical (RI)(ft) (C2)

Notes: Do not award (AI)(ft)(R0).
 Follow through from the last two columns of the table in part (a).

[6 marks]

6. (a) $FV = 900000 \left(1 + \frac{15}{12 \times 100} \right)^{24}$ (MI)(AI)

Note: Award (MI) for substitution in the compound interest formula (either FV or interest), do not penalize if -PV not seen. Award (AI) for correct substitution.

OR

N = 2

I% = 15

PV = 900000

P/Y = 1

C/Y = 12

(AI)(MI)

Note: Award (AI) for C/Y = 12 seen, (MI) for other correct entries.

OR

N = 24

I% = 15

PV = 900000

P/Y = 12

C/Y = 12

(AI)(MI)

Note: Award (AI) for C/Y = 12 seen, (MI) for other correct entries.

interest = 312615.945

(AI)

= 312600 (KHR)

(AI)(ft)

(C4)

Notes: Award the final (AI) for the correct rounding of their unrounded answer. If final amount is 1 212 600 and working is shown award (MI)(AI)(A0)(AI)(ft). Award (A2) for (FV =) 1212600 if no working is seen.

(b) 3.126×10^5

(AI)(ft)(AI)(ft)

(C2)

Notes: Award (AI)(ft) for their 3.126 (3.13), (AI)(ft) for $\times 10^5$. Follow through from part (a).

[6 marks]

7. (a) $\frac{600 - 150}{6 - 1}$ (MI)

OR

$600 = 150 + (6 - 1)m$ (MI)

Note: Award (MI) for correct substitution into gradient formula or arithmetic sequence formula.

$= 90$ (AI) (C2)

(b) the annual rate of growth of the number of apartments (AI) (CI)

Note: Do not accept common difference.

(c) $150 = 90 \times (1) + n$ (MI)

Note: Award (MI) for correct substitution of their gradient and one of the given points into the equation of a straight line.

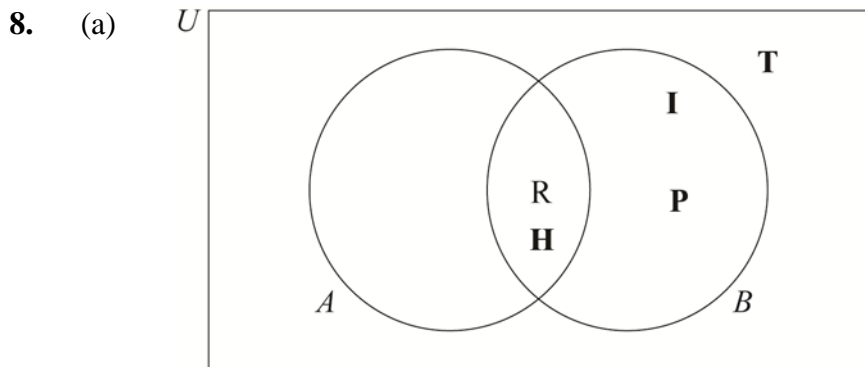
$n = 60$ (AI)(ft) (C2)

Note: Follow through from part (a).

(d) the initial number of apartments (AI) (CI)

Note: Do not accept “first number in the sequence”.

[6 marks]



(A3) (C3)

Note: Award (A3) if all four letters placed correctly,
(A2) if three letters are placed correctly,
(A1) if two letters are placed correctly.

(b) (i) Rhombus and rectangle **OR** H and R

(A1)(ft)

(ii) Scalene triangle **OR** T

(A2)(ft) (C3)

Notes: Award (A1) for a list R, H, I, P seen (identifying the union).
Follow through from their part (a).

[6 marks]

9. (a) $2x + 2y = 44$

(A1) (C1)

Note: Accept equivalent forms.

(b) $xy = 112$

(A1) (C1)

(c) 8, 14

(A1)(ft)(A1)(ft) (C2)

Notes: Accept $x = 8, y = 14$ **OR** $x = 14, y = 8$
Follow through from their answers to parts (a) and (b) only if
both values are positive.

(d) $\frac{112}{1250} \times 100$

(M1)

Note: Award (M1) for 112 divided by 1250.

= 8.96

(A1) (C2)

Note: Do not penalize if percentage sign seen.

[6 marks]

10. (a) H_0 : Choice of morning snack is independent of (not dependent on) gender. (AI) (C1)

Note: Accept there is “no association” between snack chosen and gender.
Do not accept “not related” or “not correlated” or “influenced”.

- (b) 2 (AI) (C1)

- (c) $\frac{210 \times 150}{350}$ (MI)

Note: Award (MI) for correct substitution in the correct formula.

= 90 (AI) (C2)

- (d) Null hypothesis is accepted (not rejected). (AI)

OR

Choice of morning snack is independent of gender (AI)

$3.576 < 5.99$ **OR** $\chi^2_{\text{calc}} < \chi^2_{\text{crit}}$ (R1) (C2)

Note: Do not award (AI)(R0).

[6 marks]

11. (a) (i) (-1, 0) (AI)

Note: Accept -1.

- (ii) (0, -1) (AI) (C2)

Note: Accept -1.

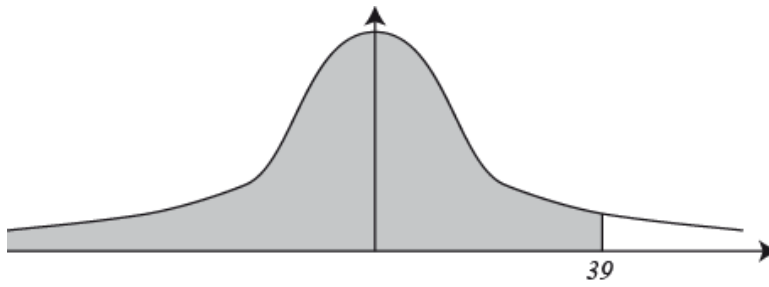
- (b) (x =) -2.96 (-2.96135...) (AI)
(x =) 1.34 (1.33508...) (AI) (C2)

- (c) $-2.96 < x < 1.34$ **OR**]-2.96, 1.34[**OR** (-2.96, 1.34) (AI)(ft)(AI) (C2)

Notes: Award (AI)(ft) for both correct endpoints of the interval, (AI) for correct strict inequalities (or correct open interval notation).
Follow through from part (b).

[6 marks]

12. (a)



(M1)

Note: Award (M1) for correctly shaded area.

0.952 (95.2%, 0.952209...)

(A1) (C2)

(b) $31 \times (1 - 0.952209)$

(M1)

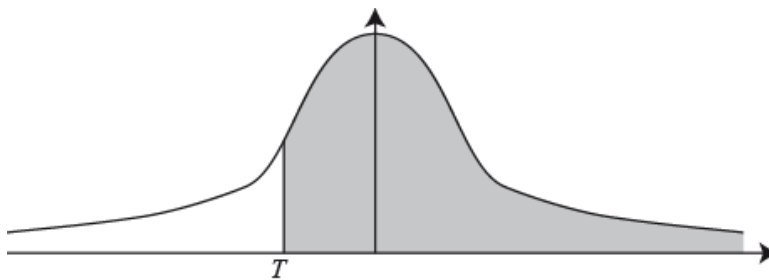
Note: Award (M1) for multiplying 31 by (1 - their answer to part (a)).

= 1.48 (1.48150...)

(A1)(ft) (C2)

Note: Follow through from part (a).

(c)



(M1)

Note: Award (M1) for correctly shaded area..

32.4 (32.4267...)

(A1) (C2)
[6 marks]

13. For parts (a) and (b) only, the first time a correct answer has incorrect or missing units, the final (A1) is not awarded.

(a) $200 - 190(0.97)^0$ (M1)

Note: Award (M1) for correct substitution.

$= 10 \text{ }^\circ\text{C}$ (A1) (C2)

Note: Units are required.

(b) $200 - 190(0.97)^{30}$ (M1)

Note: Award (M1) for correct substitution.

$= 124 \text{ }^\circ\text{C}$ (123.808... $^\circ\text{C}$) (A1) (C2)

Note: Units are required, unless already omitted in part (a).

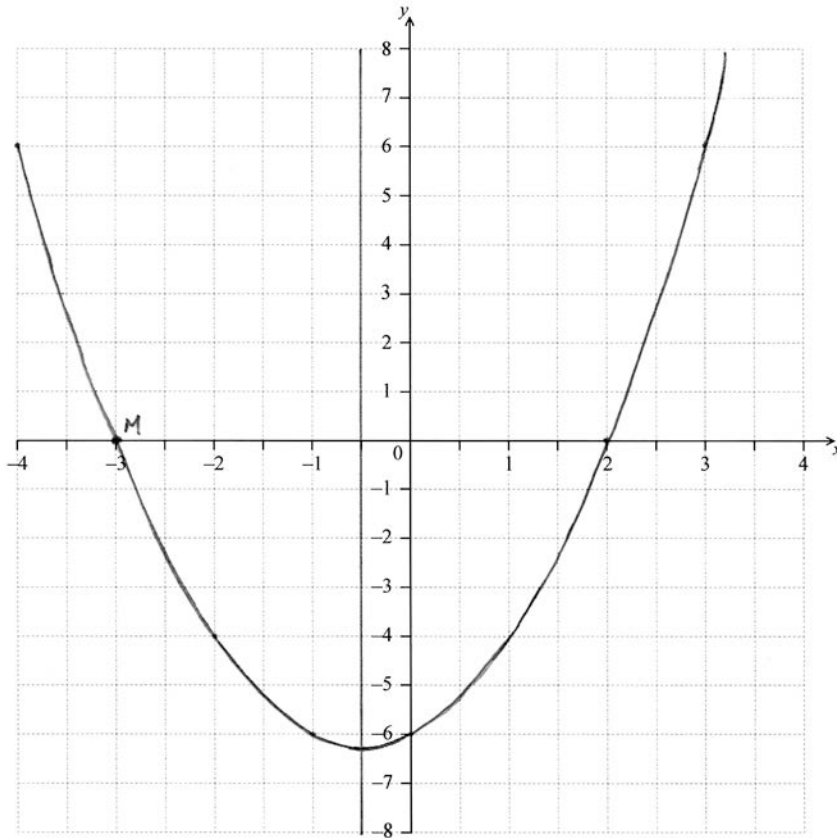
(c) $200 - 190(0.97)^k = 40$ (M1)

Note: Award (M1) for correct substitution.

$k = 5.64$ (minutes) (5.64198...) (A1) (C2)

[6 marks]

14. (a)



vertical straight line which may be dotted passing through $\left(-\frac{1}{2}, 0\right)$ (AI) (CI)

(b) point M $(-3, 0)$ correctly marked on the x -axis (AI)(ft) (CI)

Note: Follow through from part (a).

(c) (i) $b = 1, c = -6$ (AI)(ft)(AI)(ft)

Notes: Follow through from (b).

(ii) smooth parabola passing through M and N (AI)(ft)

Note: Follow through from their point M from part (b).

parabola passing through $(0, -6)$ and symmetrical about $x = -0.5$ (AI)(ft) (C4)

Note: Follow through from part (c)(i).
If parabola is not smooth and not concave up award at most (AI)(A0).

[6 marks]

15. (a) $2x - \frac{a}{x^2}$ (AI)(AI)(AI) (C3)

Notes: Award (AI) for $2x$, (AI) for $-a$ and (AI) for x^{-2} .
Award at most (AI)(AI)(A0) if extra terms are present.

(b) $2(1) - \frac{a}{1^2} = -14$ (M1)(M1)

Note: Award (M1) for substituting 1 into their gradient function,
(M1) for equating their **gradient** function to -14 .
Award (M0)(M0)(A0) if the original function is used instead
of the gradient function.

$a = 16$ (AI)(ft) (C3)

Note: Follow through from their gradient function from part (a).

[6 marks]
