

Markscheme

November 2015

Mathematical Studies

Standard level

Paper 1

1.

	N	Z	Q	R
$\sqrt{14}$				✓
$\sin 30^\circ$			✓	✓
4	✓	✓	✓	✓
-3		✓	✓	✓
4.12×10^1			✓	✓
$3\frac{1}{3}$			✓	✓

(A6) (C6)

Note: Award (A1) for each completely correct row, (A0) otherwise. Allow X symbols in the blank spaces.

[6 marks]

2. (a) (i) 6

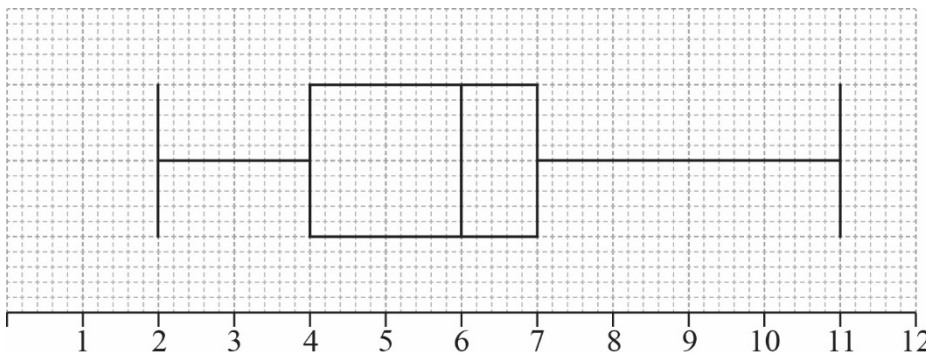
(M1)(A1)

Note: Award (M1) for an ordered list of numbers seen. Award (A2) for 6.

(ii) 7

(A1) (C3)

(b)



(A1)(ft)(A1)(A1) (C3)

Note: Follow through from part (a). Award (A1)(ft) for their median, (A1) for quartiles correct, (A1) for endpoints correct. If a horizontal line goes through the box, award at most (A1)(A1)(A0). Award at most (A0)(A1)(A1) if a ruler has not been used.

[6 marks]

3. (a) 5000×1.1824 (M1)
 5912 (BRL) (A1) (C2)

(b) $\left| \frac{6000 - 5912}{5912} \right| \times 100$ (M1)

Note: Award (M1) for their correctly substituted percentage error formula. Accept a method in two steps where “×100” is implicit from their answer.

1.49 (1.48849...) (A1)(ft) (C2)

Note: Follow through from part (a). Accept 1.49%. Do not accept 0.0149. Do not accept a negative answer.

(c) $\frac{\text{their part (a)} - 4000}{1.1824}$ (M1)

Note: Award (M1) for subtracting 4000 from their part (a) and dividing by 1.1824.

1617.05 (FJD) (A1)(ft) (C2)

Note: Answer must be given to 2 decimal places for the final (A1) to be awarded. Follow through from part (a).

[6 marks]

4. (a) $28 = u_1 + 6d; 37 = u_1 + 9d$ OR $\frac{37 - 28}{3}$ (M1)

Note: For the first method, award (M1) for two correctly substituted arithmetic sequence formulae.

$d = 3$ (A1) (C2)

(b) $28 = u_1 + 6(3)$ OR $37 = u_1 + 9(3)$ (M1)

Note: Award (M1) for correctly substituting their part (a) into substituted arithmetic sequence formula.

$u_1 = 10$ (A1)(ft) (C2)

Note: Follow through from part (a).

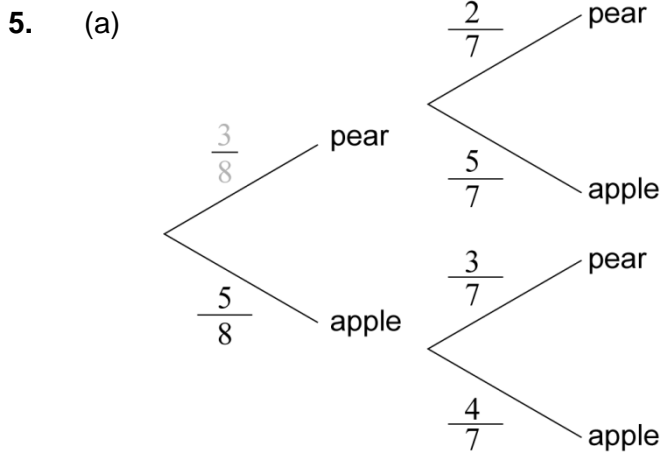
(c) $S_{200} = \frac{200}{2}(2(10) + (200 - 1)3)$ (M1)

Note: Award (M1) for correctly substituting their part (a) and part (b) into arithmetic series formula.

$= 61700$ (A1)(ft) (C2)

Note: Follow through from parts (a) and (b).

[6 marks]



(A1)(A1)(A1) (C3)

Note: Award (A1) for each correct pair of branches.
Accept decimal or percentage responses as equivalent forms on branches.

(b) $\left(\frac{3}{8} \times \frac{2}{7}\right) + \left(\frac{5}{8} \times \frac{4}{7}\right)$ (A1)(ft)(M1)

Note: Award (A1)(ft) for two products consistent with their tree diagram, (M1) for addition of their products.

$\frac{26}{56} \left(\frac{13}{28}, 0.464285\dots, 46.4\% \right)$ (A1)(ft) (C3)

Note: Follow through from their tree diagram, provided all the probabilities are between zero and 1.

[6 marks]

6. (a) 90 (A1) (C1)

(b) the preferred drink is independent of gender (A1) (C1)

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

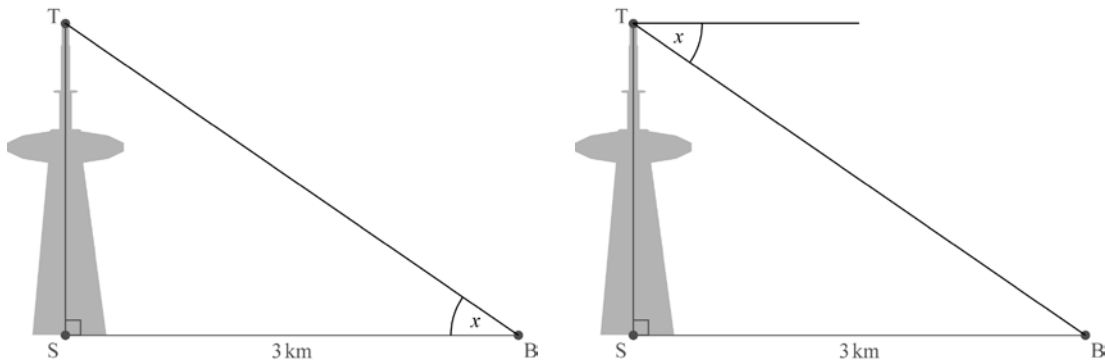
(c) 11.0 (11.025) (A2) (C2)

(d) reject H_0 (A1)(ft)
11.0 > 5.99 OR 0.00403600... < 0.05 (R1) (C2)

Note: Follow through from part (c). Do not award (A1)(ft)(R0).
Reference to the null hypothesis must be explicit for the (A1)(ft) to be awarded; do not accept “It is rejected” or similar.
A comparison of numbers must be seen to be awarded the reasoning mark.
Award (R1) for comparison of χ values consistent with their answer to part (c) OR for correct comparison of p -values but only if p -value (0.004036...) is seen.

[6 marks]

7. (a) 0.328 (km) (A1) (C1)
- (b) a line on TB drawn and angle x correctly marked on the diagram (A1) (C1)



(c) $\tan x = \frac{0.328}{3}$ (M1)

Note: Award (M1) for correct substitution into the angle formula.
Award (M1) if Pythagoras' theorem is used correctly ie $BT^2 = 0.328^2 + 3^2$
and correct use of trig ratio.

$x = 6.24(^{\circ})(6.23955...^{\circ})$ (A1)(ft) (C2)

Note: Follow through from part (a) and their angle marked in part (b).
Award (A1)(A0) for 0.109 (0.108900...) irrespective of whether there is working.

(d) $d = \sqrt{0.328^2 + 3^2}$ (M1)

Note: Award (M1) for their correct substitution into Pythagoras' theorem.

$d = 3.02 (3.01787...) (km)$ (A1)(ft) (C2)

Note: Follow through from part (a). Accept alternative methods.

[6 marks]

8. (a) $\frac{99921 - 97579}{97579} (\times 100)$ (M1)

Note: Award (M1) for subtraction and division by 97 579.

2.40 % (2.40010...) (A1) (C2)

(b) $97579 \times (1.024)^8$ OR $99921 \times (1.024)^7$ (M1)

Note: Award (M1) for their correct expression.

118000 (117966...) (A1)(ft) (C2)

Note: Follow through from part (a).

(c) 1.18×10^5 (1.17966... $\times 10^5$) (A1)(ft)(A1)(ft) (C2)

Note: Award (A1)(ft) for 1.18.
Award (A1)(ft) for $\times 10^5$.
Award (A0)(A0) for answers of the type: 118×10^3 .
Follow through from part (b) with the same level of accuracy.

[6 marks]

9. (a)

p	q	$\neg p$	$\neg p \Rightarrow q$
T	T	F	T
T	F	F	T
F	T	T	T
F	F	T	F

(A1) (C1)

Note: Award (A1) for completely correct final column.

(b) if Emma does not play tennis, then Emma goes to the beach (A1)(A1) (C2)

Note: Award (A1) for “If... then”, (A1) for correct statements in the correct order.
Accept “she” in place of the second “Emma”.

(c) $p \Rightarrow \neg q$ (A1)(A1) (C2)

Note: Award (A1) for “ \Rightarrow ”, (A1) for correct symbols in the correct order.
Accept $\neg q \Leftarrow p$.

(d) neither (A1)(ft) (C1)

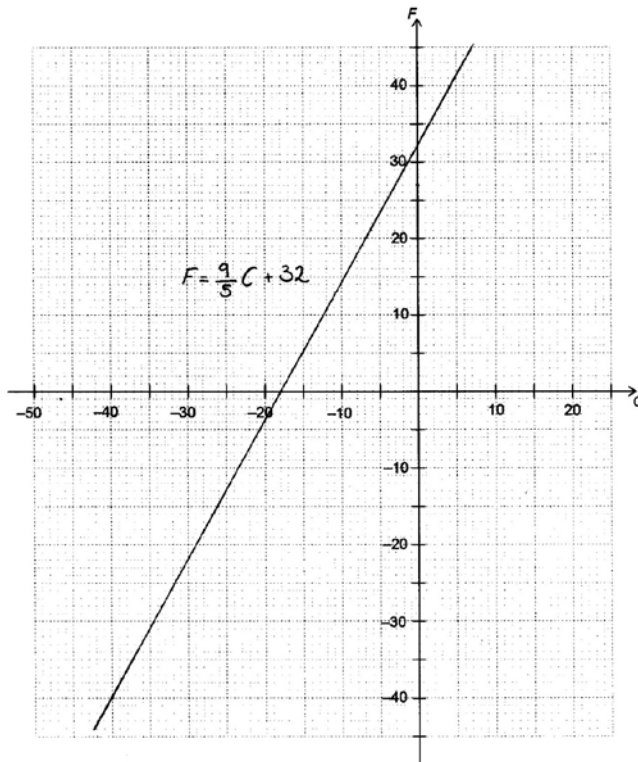
Note: Follow through from part (a).

[6 marks]

10. (a) 212 (°F)

(A1) (C1)

(b)



(A1)(A1) (C2)

Note: Award (A1) for y-intercept at (0, 32), (A1) for correct gradient.
 Gradient can be checked by acceptable x-intercepts $-18 < x < -17$ or pass through $(-40, -40)$ if y-intercept is correct.
 Award at most (A1)(A0) if not a straight line.

(c) -10 (°C)

(A1)(ft) (C1)

Note: Follow through from their graph in part (b).

(d) drawing $C = F$ correctly onto the graph

(M1)

OR

drawing $C = \frac{5}{9}(F - 32)$ correctly onto the graph

(M1)

OR

$$x = \frac{9}{5}x + 32$$

(M1)

Note: Award (M1) for substituting x for y in the given equation.

$$(x =) -40$$

(A1)(ft) (C2)

Note: Follow through from part (b) if a graphical method is used.

[6 marks]

11. (a) $1200\left(1 + \frac{3.4}{100 \times 4}\right)^{7 \times 4}$ **(M1)(A1)**

Note: Award **(M1)** for substitution into the compound interest formula. Award **(A1)** for correct substitutions.

OR

$$N = 7$$

$$I\% = 3.4$$

$$PV = (\pm)1200$$

$$P/Y = 1$$

$$C/Y = 4$$

(A1)(M1)

Note: Award **(A1)** for $C/Y = 4$ seen, **(M1)** for all other entries correct.

OR

$$N = 28$$

$$I\% = 3.4$$

$$PV = (\pm)1200$$

$$P/Y = 4$$

$$C/Y = 4$$

(A1)(M1)

Note: Award **(A1)** for $C/Y = 4$ seen, **(M1)** for all other entries correct.

$$(FV =) 1520.92$$

(A1)

(C3)

Note: The answer must be given to the correct two decimal places for the final **(A1)** to be awarded.

continued...

Question 11 continued

(b) $669 = 1200 \left(1 - \frac{r}{100} \right)^7$ **(M1)(A1)**

Note: Award **(M1)** for substitution into compound interest formula equated to 669 or equivalent. Accept a plus or minus symbol within the bracket.
Award **(A1)** for correct substitutions.

OR

$$N = 7$$

$$PV = \pm 1200$$

$$FV = \mp 669$$

$$P/Y = 1$$

$$C/Y = 1$$

(A1)(M1)

Note: Award **(A1)** for $FV = \mp 669$ seen, **(M1)** for all other entries correct.
 PV and FV must have opposite signs.

$$r = 8.01 (\%) (8.00816\dots)$$

(A1)

(C3)

Note: Do not accept 8%.
Award **(A2)** for an answer of $-8.01 (\%)$.

[6 marks]

12. (a) $\frac{3}{4}$ (0.75) (A1) (C1)

(b) 648 (A1)(ft) (C1)

Note: Follow through from part (a).

(c) 648, 486, 364.5 (M1)

Note: Award (M1) for calculating subsequent terms until non-integer term reached.

$(u_7 =) 364.5$ (A1)(ft) (C2)

Note: Accept “the 7th term” or “7” or u_7 as a final answer. Follow through from parts (a) and (b).

(d) $S_{20} = \frac{2048 \left(1 - \frac{3^{20}}{4}\right)}{\left(1 - \frac{3}{4}\right)}$ (M1)

Note: Award (M1) for correct substitution of their r and 2048 and 20 into geometric series formula i.e. $\frac{2048(1 - (\text{their } r)^{20})}{1 - \text{their } r}$.

8170 (8166.02...) (A1)(ft) (C2)

Note: Follow through from part (a). If their $r = \frac{4}{3}$, the answer is unrealistic (as their total will be greater than $20 \times$ first term, which is impossible for a decreasing sequence). Award a maximum of (M1)(A0).

[6 marks]