RECOGNISING ACHIEVEMENT

GCSE

# Applications of Mathematics (Pilot)

General Certificate of Secondary Education

Unit **A382/02:** Higher Tier

# Mark Scheme for June 2011

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

© OCR 2011

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Annotations used in the detailed Mark Scheme.

| Annotation | Meaning |
|---|---|
| ✓ | Correct |
| ✗ | Incorrect |
| BOD | Benefit of doubt |
| FT | Follow through |
| ISW | Ignore subsequent working (after correct answer obtained), provided method has been completed |
| M0 | Method mark awarded 0 |
| M1 | Method mark awarded 1 |
| M2 | Method mark awarded 2 |
| A1 | Accuracy mark awarded 1 |
| B1 | Independent mark awarded 1 |
| B2 | Independent mark awarded 2 |
| MR | Misread |
| SC | Special case |
| ^ | Omission sign |

These should be used whenever appropriate during your marking.

The **M**, **A, B** etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.
It is vital that you annotate these scripts to show how the marks have been awarded.
It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

**Subject-Specific Marking Instructions**

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
   **A** marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
   **B** marks are independent of **M** (method) marks and are awarded for a correct final answer or a correct intermediate stage.
   **SC** marks are for special cases that are worthy of some credit.

2. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

   Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.

3. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

   Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT 180 × (*their* '37' + 16), or FT 300 – √(*their* '$5^2 + 7^2$'). Answers to part questions which are being followed through are indicated by eg FT 3 × *their* (a).

   For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.

   - **cao** means **correct answer only**.
   - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
   - **isw** means **ignore subsequent working** (after correct answer obtained).
   - **nfww** means **not from wrong working**.
   - **oe** means **or equivalent**.
   - **rot** means **rounded or truncated**.
   - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
   - **soi** means **seen or implied**.

6. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.

7. As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

8. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

9. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

10. If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.

    If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

    If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.

11. Ranges of answers given in the mark scheme are always inclusive.

12. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

13. Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| 1 | (a) | | 30 | 1 | | |
| | (b) | (i) | 80 | 1 | | |
| | | (ii) | On average times are now quicker<br><br>Times before and after are consistent | 1<br><br>1 | Condone average time lower | Allow median for average, but not mean or mode<br>Allow range of times is unchanged<br>Must be comparison of summary measure, not individual values |
| | | (iii) | No, the time 75 could have become 80 | 1 | Must have reason | Accept any valid reason |
| 2 | (a) | | 30 | 1 | | Accept ½ hour, but not just ½ |
| | (b) | | 29 or 30 or 31 | 2 | **M1** for 2 + 17 + 10 or 2.5 + 17.5 + 10 or 3 + 18 + 10<br><br>If **M0** then **SC1** for final answer 25 | May be done in stages |
| | (c) | | Last 30 mins or last ½ hour or 10:15 – 10:45<br>Gradient or slope steepest | 1<br><br>1 | Marks independent | Allow final section, last part<br><br>Condone line & steeper or implies most miles in shortest time |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| 3 | | | 40 ÷ 0·611<br>65.46 or 65.47<br>45 ÷ 0·713<br>63.11<br>Euros | **M1**<br>**A1**<br>**M1**<br>**A1**<br>**B1** | For B1 **FT** their method and solutions & accept any clear indication of correct currency<br><br>If **M0** and **M0** then **SC1** for 40 × 0.611 or 24.44 AND 45 × 0.713 or 32.08 or 32.09 **and B1** for pounds | For A marks cost to be given as correct money term<br>Allow answers in cents (100 cents = AU$ 1)<br>For B1 must have scored at least M1 and M1 or SC1 |
| 4 | (a) | | £200 < *m* ≤ £400 | **1** | | Allow any indication of correct class eg 200 – 400<br>Do not accept '300' '1st one' '24' |
| | (b) | | £400 < *m* ≤ £600 | **1** | | Allow any indication of correct class eg 400 – 600<br>Do not accept '500' '2nd one' '18' |
| | (c) | | £485·96 or £486 | **4** | **M2** for ∑ (*their* frequency x salary) ÷ 57<br>(300×24+500×18+700×10+900×5)÷57<br>**or**<br>**M1** for frequency × salary where salary is within correct class (condone lower bound used)<br>**and**<br>**B1** for 3 or 4 correct midpoints | For M marks condone for 'salary midpoint' any value in correct class including lower bound<br>For M2 condone one error in products<br>If products not seen allow for M2 or M1 *their* sum implied by total in range 22000 – 33400<br>For B1 midpoints correct are implied by 27700 seen or by 3 or 4 correct products |
| | (d) | | Mean would increase | **1** | | Allow average for mean<br>Accept any valid reason |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| 5 | (a) | | 600 | 4 | **B3** for 75 + 225 + 300 or 75 × 8<br>**or**<br>**M2** for using 75 as multiplier consistently eg 75, 225 and 300 seen<br>**or**<br>**M1** for 310 ÷ 4 or 77.5 or 225 ÷ 3 | |
| | (b) | | 2m & 1.28m or 1·6m & 1·6m | 4 | **B3** for values that fit criteria given to appropriate degree accuracy ie no more accurate than nearest mm and product approximately 2.56<br>**or**<br>**M2** for (0.32 ÷ 0.125) ÷ ≥ 1·2 or (0.32 ÷ 0.125) ÷ ≥ 1·5<br>**or**<br>**M1** for 0.32 ÷ 0.125 or 2.56<br><br>If **M1** then also **SC1** for two values one of which ≥ 1.2 & the other value ≥ 1.5 given to appropriate degree accuracy ie no more accurate than nearest mm and product in range 2 – 2.7<br><br>If **M0** then **SC2** for their two values with evidence of product 0.125 and their two values approximately equal to 0.32 | For 4 marks condone width > length<br>For B3 allow their values truncated or rounded and condone product in range 2.4 – 2.7 |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| *6 | | | A correct complete solution to the whole problem, clearly structured, leading to a correct conclusion with actual distance and *d* compared | **5** | | For 5 marks need evidence<br><br>eg comparing two distances from calculations<br><br>Jayne $d = \sqrt{13} \times 1.55 = 4.48 – 4.5$ |
| | | | | **or** | | |
| | | | Both d and actual distance between islands found or one of *d* and actual map distance calculated with other distance stated and correct conclusion | **4 – 3** | For lower mark – both *d* and actual distance between islands calculated, minor errors in working | Map distance 3 – 3.2 cm<br>Actual distance 6 – 6.4 km |
| | | | | **or** | | |
| | | | Actual distance between islands or value for *d* calculated | **2 – 1** | For lower mark – an attempt to find *d* or attempt to find distance between islands | |
| | | | | **or** | | |
| | | | No relevant measurement or calculation | **0** | | |
| 7 | | | Any evaluated trial | **B1** | | Evaluated trial means trial and correct outcome (condone truncating), from correct equation, clearly shown |
| | | | A better evaluated trial from 2 to 3 inclusive | **B1dep** | Dep on 1st **B1** | |
| | | | 2.6 | **B1** | | Trial Outcome<br>2·6 27·9(76…) or 28<br>2·61 28·2(…) |
| | | | For two trials from 2·6 to 2·65 inclusive leading to answers above and below 29 or numerical evidence that 2·6 is closest | **B1dep** | Dep on 3rd **B1** | 2·62 28·4(6…) or 28.5<br>2·63 28·7(…)<br>2·64 28·9(597…)<br>2·65 29·2(…)<br>2·7 30·4(8…) |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| 8 | | | 22(·02…) | 3 | **M2** for $(x =) \sin^{-1}\left(\frac{6.9}{18.4}\right)$<br>**or**<br>**M1** for $\sin x = \left(\frac{6.9}{18.4}\right)$ | Full alternative methods involving trig score M2<br>Scale diagram scores 0 marks |
| 9 | (a) | | Graph or line goes down from attempt 2 to attempt 3 | 1 | | or better terminology eg gradient negative |
| | (b) | | 44<br><br>3rd attempt 43 is a fail and graph goes up for mark of 44 or between 5th & 6th attempts<br>or structured explanation of pass/fail from graph eg F P F P F P (P P) | B1<br><br>B1 | Marks independent | <br><br>Accept any valid reason |
| | (c) | | $\frac{12}{15}$ $(=\frac{4}{5}$ or 0·8) or $\frac{30}{40}$ $(=\frac{3}{4}$ or 0·75)<br>If 12/15 then reason uses last 15 attempts as most recent<br>If 30/40 then reason uses all the data | B1<br><br>B1 | Correct reason must follow from fraction | |
| | (d) | | $\frac{32}{75}$ or 0·426 - 0·427 | 2 | **M1** for $\frac{12}{15} \times \frac{8}{15}$ oe | |
| | (e) | (i) | 43 | 1 | | |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| | | (ii) | Identifies 6 passes – may be seen circled on graph or $\frac{6}{15}$<br><br>$\frac{6}{15}$ $(=\frac{2}{5}$ or $0{\cdot}4) \approx \frac{32}{75}$ | B1<br><br>B1 | **Dep on 1st B1**<br>**FT** comparison with *their* (d) provided *their* (d) is a probability fraction | Need not be in words |
| 10 | | | Two or more lines inside or outside the L 3cm (± 2mm) from L<br>Arc radius 3cm (± 2mm) outside corner or at either end of L<br>Two arcs & inner lines meet at 90° (±2°) or 3 arcs (± 2mm)<br>Completely correct (± 2mm / ±2°) | M1<br>M1<br>M1<br>A1 | | Accept full circles at corners for arcs, not freehand |
| 11 | (a) | | $x \geq 1$<br>$y > 2$ | 1<br>1 | | |
| | (b) | | $2x + 0{\cdot}5y \leq 5$ or $200x + 50y \leq 500$ | 1 | | Allow 0.5 = ½ |
| | (c) | (i) | Both lines $x = 1$ and $y = 2$ drawn and correct shading for all three lines | 3 | **B2** for one correct line drawn and correct shading for two correct inequalities<br>**or**<br>**B1** for correct shading for given inequality or both lines $x = 1$ and $y = 2$ drawn or shading for either $x \geq 1$ or $y > 2$ | Condone line $y = 2$ not dotted for all marks<br>Allow consistent shading of required area or consistent shading out area not required – consistent shading in or out can only be seen if two or more areas shaded |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| | | **(ii)** | All 4 correct points circled with no extra points circled | **2** | **B1** for 2 or 3 correct points only or 3 correct points and no more than 1 incorrect or all 4 correct points circled and no more than 2 incorrect<br><br>If **B0** then **SC1** for all points circled in their identified solution space (must see two lines drawn and shading for all three lines) | |
| **12** | **(a)** | | 10 with correct values shown | **3** | **M2** for 3 + 7 or<br>(½ × 2 × (1 + 2)) + (½ × 2 × (2 + 5))<br>**or**<br>**M1** for 3 or 7 or<br>½ × 2 × (1 + 2) or ½ × 2 × (2 + 5)<br>If values not shown **SC1** for answer 10 | Values may be seen on diagram |
| | **(b)** | | Top line of trapezium above the curve or curve below line | **1** | | Allow any valid explanation of overestimate |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| 13 | | | 60·5m from P or 39·5m from Q | 5 | **B4** for AF = BF = 63.7(…)<br>**or**<br>**B3** for improved trial AND its correct solution using Pythagoras to find both correct distances AF and BF with PF+FQ =100<br>**or**<br>**B2** for using Pythagoras to find both correct distances AF and BF with PF+FQ =100<br>**or**<br>**B1** for using Pythagoras to find one correct distance AF or BF | **Alt** algebraic approach<br>**B4** for $200y = 7900$<br>**or**<br>**B3** for<br>$2500+10000 -200y+y^2= 400+y^2$<br>or $400+10000-200y+y^2= 2500+y^2$<br>**or**<br>**B2** for $20^2 + (100 – y)^2 = 50^2 + y^2$<br>or $50^2 + (100 – y)^2 = 20^2 + y^2$<br>**or**<br>**M1** for $20^2 + (100 – y)^2$<br>or $50^2 + (100 – y)^2$ $20^2 + y^2$<br>or $50^2 + y^2$<br>Any letter used for $y$ the distance PF or QF |
| 14 | (a) | | 4860 | 3 | **M2** for $(1·0445^5$ x 20000) - 20000<br>**or**<br>**M1** for $1·0445^5$ | For M2 allow £4864.06 - £4864·07 or £4864 or 0·0486 × 5 × 20000<br>For M1 allow 0·0486 × 5 |
| | (b) | | 4·86 × 0·8<br>= 3·89 to 2 dp | **M1**<br>**A1** | | May be done in stages<br>FT embedded method using a principal amount |
| 15 | (a) | | End values for last class and any value given 26 -100 inclusive | 1 | | |

| Question | | | Answer | Marks | Part marks and guidance | |
|---|---|---|---|---|---|---|
| | **(b)** | | Both axes scaled<br>132 ÷ 6 or 184 ÷ 2 or 120 ÷ 2 or 95 ÷ 5 **soi** or **FT** 25 ÷ their class interval using *their* value from **(a)**<br>Three of 22, 92, 60 and 19 **soi** from graph<br>Five bars drawn with 4 or 5 heights in correct proportion<br>Five bars with 4 or 5 widths in correct proportion<br>Fully correct histogram | **B1**<br>**M1**<br>**M1**<br>**A1**<br>**M1**<br>**A1** | If using widths 5, 1, 1, 4 for first four classes then<br>**SC1** for 132 ÷ 5 and 95 ÷ 4 **soi**<br>**and**<br>**SC1** for three of 26.4, 184, 120 and 23.75 soi from graph<br>**and**<br>**SC1** for five bars drawn with 4 or 5 heights in correct proportion<br>**and**<br>**SC1** for five bars with 4 or 5 widths in correct proportion | For both **M** and **SC** marks correct widths on bars implies no gaps<br>Heights correct ±½ small square |
| **16** | **(a)** | | Curve through (8am, 16) (10am, 8) (noon, 4) (2pm, 2) (4pm, 1) (6pm, ½) | **3** | **M2** for curve through at least 4 correct points or 5 correct points plotted & no curve or incorrect curve<br>**or**<br>**M1** for curve through at least 3 correct points or 4 correct points plotted & no curve or incorrect curve | Accuracy all plotted points & curve within ±½ small square<br>Condone points joined with straight lines |
| | **(b)** | | 10 ½ | **2** | **M1** for ½ + 2 + 8 | For M mark allow amounts of painkiller in blood indicated on graph by key points (noon, 20) and (4pm, 21) |

**OCR (Oxford Cambridge and RSA Examinations)**
**1 Hills Road**
**Cambridge**
**CB1 2EU**

**OCR Customer Contact Centre**

**14 – 19 Qualifications (General)**
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

**www.ocr.org.uk**

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

**Oxford Cambridge and RSA Examinations**
**is a Company Limited by Guarantee**
**Registered in England**
**Registered Office; 1 Hills Road, Cambridge, CB1 2EU**
**Registered Company Number: 3484466**
**OCR is an exempt Charity**

**OCR (Oxford Cambridge and RSA Examinations)**
**Head office**
**Telephone: 01223 552552**
**Facsimile: 01223 552553**

**© OCR 2011**