Mark Scheme (Results)

January 2013

International GCSE Mathematics A (4MA0) Paper 4H

Level 1 / Level 2 Certificate in Mathematics (KMA0) Paper 4H
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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate’s response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate’s response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Types of mark
- M marks: method marks
- A marks: accuracy marks
- B marks: unconditional accuracy marks (independent of M marks)

Abbreviations
- cao – correct answer only
- ft – follow through
- isw – ignore subsequent working
- SC - special case
- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- eeeoo – each error or omission

No working
- If no working is shown then correct answers normally score full marks
- If no working is shown then incorrect (even though nearly correct) answers score no marks.
• **With working**

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If it is clear from the working that the “correct” answer has been obtained from incorrect working, award 0 marks.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

If there is no answer on the answer line then check the working for an obvious answer.

• **Follow through marks**

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

• **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

• **Parts of questions**

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.
**International GCSE and Level 1/Level 2 Certificate in Maths  Jan 2013 – Paper 4H Mark scheme**

Apart from Questions 10, 14, 18 and 26 (where the mark scheme states otherwise) the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

<table>
<thead>
<tr>
<th>Q</th>
<th>Working</th>
<th>Answer</th>
<th>Mark</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>(a) 11.5 or 1.96 seen</td>
<td>2</td>
<td>M1</td>
<td>Also award for $\frac{85}{98}$ or $\frac{575}{98}$ or answer of 5.9 or 5.87</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A1</td>
<td>for at least first 5 figures (ignore figures after the first five)</td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>5.9</td>
<td>1</td>
<td>B1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total 3 marks</strong></td>
</tr>
<tr>
<td>2.</td>
<td>$\pi \times 7.6$</td>
<td>2</td>
<td>M1</td>
<td>or $2\pi \times \frac{7.6}{2}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>23.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total 2 marks</strong></td>
</tr>
<tr>
<td>3.</td>
<td>$6 \times 2 + 7 \times 4 + 8 \times 5 + 9 \times 8 + 10 \times 1$ or $12 + 28 + 40 + 72 + 10$ or 162</td>
<td>3</td>
<td>M1</td>
<td>for at least 3 correct products and summing them</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>“162” ÷ 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NB: Award A0 if 8.1 clearly comes from incorrect figures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total 3 marks</strong></td>
</tr>
<tr>
<td>4.</td>
<td>0.2 + 0.7</td>
<td>2</td>
<td>M1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9 oe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total 2 marks</strong></td>
</tr>
</tbody>
</table>
5. (a) 4, 8 & one even number other than 2, 6 or 10 2 B2 B1 for 4, 8 alone or for 4, 8 and one odd number or for 4, 8 and more than one other even number (any extra even numbers must not be 2 or 6 or 10) Accept 0 as an even number
(b) 3 even numbers other than 2, 4, 6, 8 or 10 eg 12, 14, 16 1 B1

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>(a)</td>
<td>4, 8 &amp; one even number other than 2, 6 or 10</td>
<td>2</td>
<td>B2</td>
<td>B1 for 4, 8 alone or for 4, 8 and one odd number or for 4, 8 and more than one other even number (any extra even numbers must not be 2 or 6 or 10) Accept 0 as an even number</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>3 even numbers other than 2, 4, 6, 8 or 10 eg 12, 14, 16</td>
<td>1</td>
<td>B1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total 3 marks

6. (a) \[1 - \frac{5}{9} \text{ or } \frac{4}{9} \text{ seen} \] 3 M1 \[\frac{4}{9} \text{ oe} \]
\[\frac{4}{9} \times \frac{5}{6} \text{ oe or } \frac{5}{9} \times \frac{5}{6} \text{ oe} \] M1
\[\frac{20}{54} \text{ or } \frac{10}{27} \text{ A1} \]
(b) 27 2 B2 cao B1 for 18 or 54 or any multiple of 27

Total 5 marks
7. Splits shape appropriately
   eg rectangle + triangle or rectangle + trapezium or 'completing the rectangle'

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>B1</th>
<th>If lines not present on diagram then can be implied by correct method for at least two areas (areas must not overlap and must not be contradictory)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M1</td>
<td>for area of one appropriate rectangle, triangle or trapezium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M1</td>
<td>for complete method</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>111</td>
<td>A1</td>
<td>cao</td>
</tr>
</tbody>
</table>

Total 4 marks
8. (a) \( n(n + 8) \) 2 B2 Award B2 also for \((n \pm 0)(n + 8)\)
B1 for factors which, when expanded & simplified, give two terms, one of which is correct
SC B1 for \(n(n + 8n)\)

(b) \(6x^2 - 15 - 4x - 12\) 2 M1 for 3 correct terms

(c) \(y^2 + 2y + 7y + 14\) 2 M1 for 3 correct terms out of 4
or for 4 correct terms ignoring signs
or for \(y^2 + 9y + c\) for any non-zero value of \(c\)
or for \(\ldots + 9y + 14\)

\(y^2 + 9y + 14\) A1 cao

Total 6 marks

9. \(8.6^2 - 6.9^2\) or 73.96 - 47.61 or 26.35 3 M1 for squaring and subtracting
\(\sqrt{8.6^2 - 6.9^2}\) or \(\sqrt{26.35}\) M1 (dep) for square root

5.13 A1 for answer which rounds to 5.13

Total 3 marks
### 10.

<p>| | | | |</p>
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<tbody>
<tr>
<td>10.</td>
<td>$5x = -15$ or $5x = 1 - 16$ or $3x + 2x = -15$ or $5x + 15 = 0$</td>
<td>3</td>
<td>M2 for correct rearrangement with $x$ terms on one side and numbers on the other AND correct collection of terms on at least one side. M2 also for $-5x = 15$, $-5x = 16 - 1$ or $-2x - 3x = 15$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-3</td>
<td>A1 Award 3 marks if M1 scored and answer correct.</td>
<td></td>
</tr>
</tbody>
</table>

### 11.

<p>| | | | |</p>
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</thead>
</table>
| 11. | $5 + 9$ or $14$ seen or $\frac{n}{14}$ oe (provided no evidence of $14$ from incorrect method) | 3 | M1 $\frac{5 + 9}{5 + 9 + 6} \times x = 56$

- $56 \div \text{"14"}$ or $4 \text{ or } \frac{6}{14} \times 56$

- $56 \div \text{14}$ or $80$

- $24$ A1 Also accept $20 : 36 : 24$ as final answer |

### 12.

<p>| | | |</p>
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>12.</td>
<td>arc centre $B$ cutting $BA$ and $BC$ at (say) $P$ and $Q$</td>
<td>2</td>
</tr>
</tbody>
</table>

A1 dep |

**Total 2 marks**
### 13.

-2 ≤ x ≤ 4  
1 ≤ y ≤ 3

or

x ≥ -2  
x ≤ 4  
y ≥ 1  
y ≤ 3

B3  B2 for 3 correct inequalities

B1  for 2 correct inequalities

(Treat double-ended inequalities as two separate inequalities)

Accept < and > throughout

Total 3 marks

### 14.

\[
\frac{2(6x + 1)}{(5x - 2)(6x + 1)} = \frac{3(5x - 2)}{(5x - 2)(6x + 1)}
\]

or

\[
\frac{2(6x + 1)}{(5x - 2)(6x + 1)} = \frac{3(5x - 2)}{(5x - 2)(6x + 1)}
\]

M1  Need to see both expressions in an equation

May be implied by second M1;

NB: Denominators must be correct

12x + 2 = 15x - 6  

or

12x + 2 = 15x - 6  

\[
\frac{12x + 2}{(5x - 2)(6x + 1)} = \frac{15x - 6}{(5x - 2)(6x + 1)}
\]

M1  Need to see both expressions in an equation

NB: Denominators must be correct

3x = 8  or  -3x = -8  or

3x = 2 + 6  or  -3x = -6 - 2  

or

15x - 12x = 8  

or

12x - 15x = -8  or

3x - 8 = 0

M1  dep on awarding first two method marks

for correct rearrangement with x terms on one side and

numbers on the other AND correct collection of terms on

at least one side

or for 3x - 8 = 0

2\frac{2}{3}  

oe

A1  for 2\frac{2}{3}  

oe including decimal equivalent rounded or

truncated to at least 2 decimal places

Award 4 marks if first two method marks scored and

answer correct.

Total 4 marks
15. (a) \(5x^3y^2\) 2 B2 B1 for 2 of \(5, x^3, y^2\) correct in a single product with no additional terms or \(5x^5y^6\), \(y^4\) for 2 of 5, \(x^3, y^2\) correct in a single product with no additional terms or 5.

(b) \(8n^{12}\) 2 B2 B1 for 8 or \(n^{12}\) in a product

| Total 4 marks |

16. (a) 4 12 28 60 132 160 1 B1 cao

(b) Points correct 2 B1 \(\pm \frac{1}{2}\) sq ft from sensible table, ie clear attempt to add frequencies

Curve or line segments B1 ft from points if 4 or 5 correct or if all points are plotted consistently within each interval at the correct heights. Accept curve which is not joined to the origin

(c) 80 (or 80.5) indicated on cf graph or stated 2 M1 for 80 (or 80.5) indicated on cf axis or stated

approx 4.3 A1 If M1 scored, ft from cf graph. If no indication of method, ft only from correct curve & if answer is correct \(\pm \frac{1}{2}\) sq tolerance) award M1 A1

<p>| Total 5 marks |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>17.</strong></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(a)</td>
<td>$\frac{BC}{5.2} = \frac{7}{5.6}$ or $\frac{BC}{7} = \frac{5.2}{5.6}$ oe</td>
<td>2 M1 for correct, relevant proportionality statement with 3 values substituted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.5 A1 cao</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b)</td>
<td>$\frac{DE}{7.5} = \frac{5.6}{7}$ or $\frac{DE}{7} = \frac{5.6}{7}$ oe or $\frac{DE}{5.2} = \frac{&quot;6.5&quot;}{5.2}$ or $\frac{DE}{7.5} = \frac{&quot;6.5&quot;}{7.5}$</td>
<td>2 M1 for correct, relevant proportionality statement with 3 values substituted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 A1 cao</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c)</td>
<td>(scale factor) eg $\frac{7}{5.6}$ or $\frac{5.6}{7}$ or $\frac{4}{5}$ oe or $\frac{5}{4}$ oe (May be implied by second M1) allow ratio notation</td>
<td>3 M1 Also award M1 for ht of $\Delta CDE$ $\frac{4}{5} \cdot \frac{21}{\frac{1}{2} \times 7.5}$ ($= 4.48$) M2 for eg. (Area $\Delta ABC =$) $\frac{1}{2} \times 6.5 \sin C = 21$ and (Area $\Delta CDE =$) $\frac{1}{2} \times 5.2 \times 5.6 \sin C$ allow ratio notation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(scale factor)$^2$ eg $\left( \frac{4}{5} \right)^2$ oe or 0.64 or $\left( \frac{5}{4} \right)^2$ oe 1.5625</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M1 Also award M1 for $\frac{1}{2} \times 6 \times &quot;4.48&quot;$ allow ratio notation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M1 Also award M2 for $s=\frac{5.2+5.6+&quot;6&quot;}{2}$ ($= 8.4$) and Area $= \sqrt{8.4\times(8.4-5.2)(8.4-5.6)(8.4-6)}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>13.44 A1 Also accept 13.4 if both method marks scored</td>
</tr>
</tbody>
</table>

**Total 7 marks**
### 18.

\[
-2 \pm \sqrt{2^2 - 4 \times 5 \times (-4)}\]

or for this expression with one or more of \(2^2, 4 \times 5 \times (-4), 2 \times 5\) or \(2^2 - 4 \times 5 \times (-4)\) evaluated eg \(\frac{-2 \pm \sqrt{84}}{10}\)

\[\sqrt{84}\] or \(\sqrt{4 + 80}\) or \(2\sqrt{21}\) or \(9.165\ldots\)

M1 for correct substitution (brackets not necessary)

\(-1.12, 0.717\)

A1 for values rounding to \(-1.12\) and \(0.717\) \((-1.11651\ldots, 0.71651\ldots)\)

Award 3 marks if first M1 scored and answer correct.

Total 3 marks

### 19.

\[
12 + 3\sqrt{a} + 4\sqrt{a} + a \quad \text{or} \quad 12 + 7\sqrt{a} + a
\]

M1 Accept \(\sqrt{a} \sqrt{a}\) or \((\sqrt{a})^2\) instead of \(a\)

\(a = 5\)

A1

Award B3 for \(a = 25, k = 11\) or \(a = 1, k = 3\)

\(k = 7\)

B1

Total 3 marks
## 20.

(a) \[ \frac{4}{5} \times \frac{3}{5} \]

2 M1 or probability of \( \frac{3}{5} \) clearly associated with box Y (eg may be on tree diagram or by box)

\[ \frac{12}{25} \text{ oe} \]

A1

(b) \[ \frac{4}{5} \times \frac{2}{5} + \frac{1}{5} \times \frac{3}{5} \]

3 M1 for \( \frac{4}{5} \times \frac{2}{5} \) or \( \frac{1}{5} \times \frac{3}{5} \)

or 0.32 oe or 0.12oe

\[ \frac{11}{25} \text{ oe} \]

A1

Total 5 marks

## 21.

(a) \( t = kf^2 \)

3 M1 for \( t = kf^2 \) but not for \( t = f^2 \)

Also award for correct equation in \( t, f^2 \) and a constant or for \( t = \) some numerical value \( \times f^2 \)

\[ 0.02 = k \times 8^2 \]

or

\[ k = \frac{1}{3200} \]

or

\[ k = 0.0003125 \]

or

\[ 3.125 \times 10^{-4} \]

M1 for \( 0.02 = k \times 8^2 \) or for correct substitution into an equation which scores the first method mark (may be implied by correct evaluation of the constant)

\[ t = 0.0003125f^2 \]

or

\[ t = \frac{1}{3200} f^2 \]

A1 Award 3 marks if answer is \( t = kf^2 \) but \( k \) is evaluated in part (b)

(b) \[ f^2 = \frac{0.0098}{0.0003125} \]

or

\[ f^2 = \frac{0.0098}{0.02} \times 8^2 \]

2 M1 for substitution and rearrangement into form \( f^2 = \frac{0.0098}{k} \) with their value of \( k \) except for \( k = 1 \)

or

\[ f^2 = \frac{0.0098}{0.02} \times 8^2 \]

5.6 oe

A1

Total 5 marks
### 22.\[\angle PAO = 90^\circ \text{ or } \angle PBO = 90^\circ\]

\[\angle AOB = 2 \times 76^\circ \text{ or } 152^\circ\]

or \[\angle POA = 76^\circ \text{ or } \angle POB = 76^\circ\]

\[360 - \left(\text{“}152\text{”} + 90 + 90\right) \text{ or } 2 \times (180 - 76 - 90) \text{ or } 180 - 2 \times 76\]

Angles may be stated or marked on diagram or used in calculations provided any use is not ambiguous.

### 23.\(\text{ (a) } \frac{4}{5}\) oe 1 B1

\(\text{ (b) } \frac{1}{(\sqrt{x-1})^2+1} \text{ or } \frac{1}{x-1+1}\)

\[\frac{1}{x}\] A1 Also accept \(x^{-1}\)

Total 3 marks

### 24.\[\frac{1}{1.25} \text{ oe eg } \frac{1}{5}, \frac{4}{5}, 0.8(0), \frac{100}{125}, 80\%\]

\[t_1 = \frac{d}{s} \text{ and } t_2 = \frac{d}{(1+0.25)s}\]

or \[\frac{t_1}{t_2} = 0.8\]

\[1 - 0.8 \text{ oe eg } 1 - \frac{4}{5}, 100\% - 80\%\]

Alternative method (assigns values to distance and average speed)

M1 for calculating both times correctly

M1 (dep) for finding

\[\frac{\text{Mon time} - \text{Tues time}}{\text{Mon time}}\]

Total 3 marks
### Question 25

**Diagram:**

- ∠ADC = 149° or ∠CAD = 21°

**Calculation:**

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{AC}{\sin 149°} = \frac{16.5}{\sin 10°} )</td>
<td>( 48.938... )</td>
</tr>
<tr>
<td>( \frac{CD}{\sin 21°} = \frac{16.5}{\sin 10°} )</td>
<td>( 34.052... )</td>
</tr>
<tr>
<td>( AC = 48.938... \times \sin 69° ) or ( 45.6(88...) )</td>
<td>( 45.7 )</td>
</tr>
<tr>
<td>( BD = 34.052... \times \sin 59° ) or ( 29.1(88...) )</td>
<td>( 45.7 )</td>
</tr>
</tbody>
</table>

**Total 6 marks**

**Alternative scheme:**

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>( BD = BC \tan 59° )</td>
<td>( 45.7 )</td>
</tr>
<tr>
<td>( BD + 16.5 = BC \tan 69° )</td>
<td>M1</td>
</tr>
<tr>
<td>( BD + 16.5 = \frac{\tan 69°}{\tan 59°} BD )</td>
<td>M1</td>
</tr>
<tr>
<td>( \left( \frac{\tan 69°}{\tan 59°} - 1 \right) BD = 16.5 ) or ( 0.5652... BD = 16.5 )</td>
<td>M1</td>
</tr>
<tr>
<td>( BD = 29.188... )</td>
<td>( 45.7 )</td>
</tr>
</tbody>
</table>

**Total 6 marks**
26. $x^2 + (3x + 2)^2 = 20$

$x^2 + 9x^2 + 6x + 6x + 4 = 20$

or $x^2 + 9x^2 + 12x + 4 = 20$

6 M1

$\left(\frac{y-2}{3}\right)^2 + y^2 = 20$

or $\left(\frac{y^2 - 4y + 4}{9}\right) + y^2 = 20$

or $\left(\frac{y^2 - 2y - 2y + 4}{9}\right) + y^2 = 20$

M1 (indep) for correct expansion of $(3x + 2)^2$ or $\left(\frac{y-2}{3}\right)^2$ even if unsimplified

$5x^2 + 6x - 8 = 0$

or $10x^2 + 12x - 16 = 0$

A1

$5y^2 - 2y - 88 = 0$ oe

Condone omission of ‘= 0’

$(5x - 4)(x + 2) = 0$

or $(10x - 8)(x + 2) = 0$

or $(5x - 4)(2x + 4) = 0$

or $5x(x + 2) - 4(x + 2) = 0$

or $x(5x - 4) + 2(5x - 4) = 0$

or $-6 \pm \sqrt{6^2 - 4 \times 5 \times -8}

2 \times 5$

or $-12 \pm \sqrt{12^2 - 4 \times 10 \times -16}

2 \times 10$

or better

M1

$(5y - 22)(y + 4) = 0$ oe

or $2 \pm \sqrt{(-2)^2 - 4 \times 5 \times -88}

2 \times 5$

or better

Condone omission of ‘= 0’

$x = \frac{4}{5}$ or $x = -2$

A1

$y = 4 \frac{2}{5}$ or $y = -4$

dep on all preceding marks

$x = \frac{4}{5}, y = 4 \frac{2}{5}$

$x = -2, y = -4$

A1

No marks for

$x = -2, y = -4$

with no working

Total 6 marks