Pearson Edexcel

# Mark Scheme

## Summer 2023

Pearson Edexcel Level 3 Certificate
In Mathematics in Context (7MC0) Paper 2

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Publications Code 7MC0_02_MS

**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.

<table>
<tr><th>Question</th><th>Working</th><th>Answer</th><th>Mark</th><th>Notes</th></tr>
<tr>
<td>1(a)(i)</td>
<td>
<table>
<tr><th>League position</th><th>Net transfer spend (£m)</th><th>d</th><th>$d^2$</th></tr>
<tr><td>1</td><td>20 (1)</td><td>−19 (0)</td><td>361 (0)</td></tr>
<tr><td>2</td><td>19 (2)</td><td>−17 (0)</td><td>289 0 ()</td></tr>
<tr><td>8</td><td>18 (3)</td><td>−10 (5)</td><td>100 (25)</td></tr>
<tr><td>5</td><td>17 (4)</td><td>−12 (1)</td><td>144 (1)</td></tr>
<tr><td>15</td><td>16 (5)</td><td>−1 (10)</td><td>1 (100)</td></tr>
<tr><td>14</td><td>15 (6)</td><td>−1 (8)</td><td>1 (64)</td></tr>
<tr><td>20</td><td>14 (7)</td><td>6 (13)</td><td>36 (169)</td></tr>
<tr><td>16</td><td>13 (8)</td><td>3 (8)</td><td>9 (64)</td></tr>
<tr><td>11</td><td>12 (9)</td><td>−1 (2)</td><td>1 (4)</td></tr>
<tr><td>12</td><td>11 (10)</td><td>1 (2)</td><td>1 (4)</td></tr>
<tr><td>9</td><td>10 (11)</td><td>−1 (−2)</td><td>1 (4)</td></tr>
<tr><td>3</td><td>9 (12)</td><td>−6 (−9)</td><td>36 (81)</td></tr>
<tr><td>19</td><td>8 (13)</td><td>11 (6)</td><td>121 (36)</td></tr>
<tr><td>10</td><td>7 (14)</td><td>3 (−4)</td><td>9 (16)</td></tr>
<tr><td>4</td><td>6 (15)</td><td>−2 (−11)</td><td>4 (121)</td></tr>
<tr><td>13</td><td>5 (16)</td><td>8 (−3)</td><td>64 (9)</td></tr>
<tr><td>7</td><td>4 (17)</td><td>3 (−10)</td><td>9 (100)</td></tr>
<tr><td>6</td><td>3 (18)</td><td>3 (−12)</td><td>9 (144)</td></tr>
<tr><td>18</td><td>2 (19)</td><td>16 (−1)</td><td>256 (1)</td></tr>
<tr><td>17</td><td>1 (20)</td><td>16 (−3)</td><td>256 (9)</td></tr>
</table>
$\sum d^2 = 1708$<br>
$1 - \frac{6 \times 1708}{20(20^2 - 1)} = -0.284...$<br>
**OR**<br>
$\sum d^2 = 952$<br>
$1 - \frac{6 \times 952}{20(20^2 - 1)} = 0.284...$
</td>
<td>−0.284</td>
<td>5</td>
<td>M1 method to find consistent rank numbers d for the rankings, (condone 1 error)<br><br>M1 ft finding d for their rankings<br>(condone 1 error)<br><br>M1 ft for finding $\sum d^2$ for at least 12 of their rankings<br><br>M1 (dep on previous M1) ft for using the Spearman rank formula correctly for their figures<br><br>A1 for SR = awrt −0.284 or awrt 0.284 supported</td>
</tr>
<tr>
<td>1(a)(ii)</td>
<td></td>
<td>Appropriate comment</td>
<td>1</td>
<td>C1 valid interpretation ft their SR, eg, League position and net transfer spend don’t affect each other because there is weak correlation</td>
</tr>
</table>

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 1(b) | | Yes with supporting reasoning | 1 | C1 for valid decision ft their SR, eg Amber is correct because SR coefficient is higher for wage bill than net transfer spend. |
| 1(c) | | Appropriate comment | 1 | C1 for valid interpretation, eg the greater the wage bill, the league position will be a lower value<br>**or** the greater the wage bill, the higher up the league |

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 2(a) | | Explanation | 1 | C1 for a valid explanation, e.g. the points do not appear to lie on/close to a straight line. |
| 2(b)(i) | | 21125 | 1 | B1 21125 |
| 2(b)(ii) | $t = 2023 - 1993\ (=30)$<br>**or** $2.9 \times \text{time}^3$<br><br>eg $2.9 \times 30^3 - 146 \times 30^2 + 2\,490 \times 30 + 21125 = 42725$ | 42725 | 3 | M1 for beginning to use the model,<br>eg finding the value of $t$<br>**or** for calculating at least one term<br><br>M1 ft for complete substitution of $t$ and $c$<br><br>A1 cao |
| 2(b)(iii) | | Appropriate comment | 1 | C1 for valid comment eg model predicts unlimited growth so not reliable<br>**or** the model works until stadium capacity is reached<br>**or** growth may be impacted by other factors such as pandemics |
| 2(c)(i) | eg $21125 = 40400 - B \times 1.09^{-(1993-1993)}$<br><br>eg $B = 40400 - 21125$ | 19275 | 3 | M1 for correct substitution<br><br>M1 (indep) for method to isolate $B$<br><br>A1 cao |
| 2(c)(ii) | eg $40400 - \text{“}19275\text{”} \times 1.09^{-(2023-1993)} = 38947$ | 38947 | 2 | M1 ft for complete substitution<br><br>A1 awrt 39000 or ft (c)(i) |
| 2(c)(iii) | | 40400 | 1 | B1 cao |

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 3 | eg $3x + 7y = 12.74$ and $2x + 4y = 7.6$<br><br>$6x + 14y = 25.48$ $\quad$ $14x + 28y = 53.2$<br>$6x + 12y = 22.8$ $\quad$ $12x + 28y = 50.96$<br>$2y = 2.68$ $\quad$ $2x = 2.24$ | Type A: £1.12<br><br>Type B: £1.34 | 4 | B1 for setting up the correct equations<br><br>M1 for correct method to eliminate one variable (condone one arithmetic error)<br><br>M1 (dep M1) for a complete method to find the other variable, eg by substitution **or** by elimination<br><br>C1 Type A: (£)1.12 **and** Type B: (£)1.34<br><br>Condone $x = 1.12$ and $y = 1.34$ if no ambiguity in variables used |

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 4(a) | 384 16 288 312 | Venn diagram completed | 3 | B3 all regions correct<br><br>(B2 three regions correct)<br><br>(B1 one or two regions correct) |
| 4(b)(i) | | Description | 1 | C1 for valid description, eg those people who aren't given the medicine |
| 4(b)(ii) | | $M \cap B'$ | 1 | C1 for $M \cap B'$ **or** $(M' \cup B)'$ |
| 4(b)(iii) | | Description | 1 | C1for valid description, eg, those people who did not receive the medicine who have high blood pressure |
| 4(c) | "288" ÷ "288"+"312" = 0.48<br>or "312" ÷ "288"+"312" = 0.52 | 0.04<br>0.4 **0.96**<br>**0.48**<br>**0.6** **0.52** | 3 | B1 for 0.96 **and** 0.6<br><br>M1ft for method to find at least one of the two remaining probabilities<br><br>A1 0.48 **and** 0.52 placed correctly<br>**or** ft 4(a) |
| 4(d) | "0.48" ÷ 0.04 = 12<br>or 0.04 ÷ "0.48" = 0.083 **and** 1 ÷ 18 = 0.055..<br>or 18 × "0.04" = 0.72<br>or "0.48" ÷ 18 = 0.0266.. | Decision with justification | 3 | B1 ft for use of "0.48" **or** 0.04<br><br>M1 ft for a complete method to find figures to compare<br><br>C1 ft for valid decision **and** accurate comparable figures, eg claim is not correct **and** 12 (less than 18)<br>**or** 0.08(3..) **and** 0.05(5..)<br>**or** $0.72 \neq 0.48$<br>**or** 0.02(6..) is less than 0.04 |

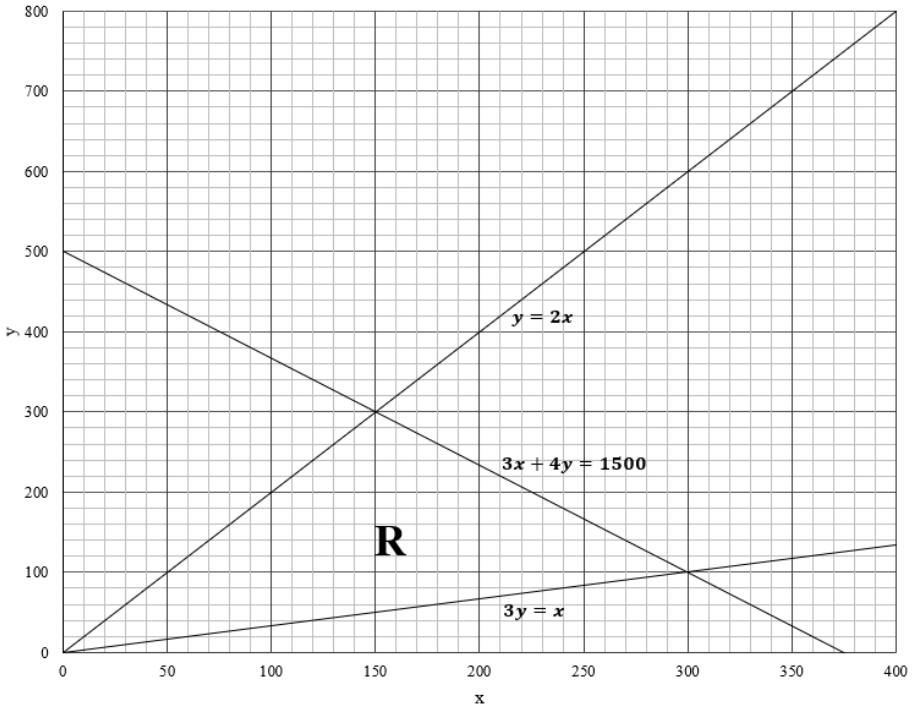
| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| | | | | |
| 5 | eg 450 × 0.7 = 315 or 400 × 0.3 = 120<br>or 1000 × 0.7 = 700 or 100 × 0.3 = 30<br><br>eg 450 × 5 × 0.7 + 400 × 5 × 0.3 = 2175<br>or 1000 × 5 × 0.7 + 100 × 5 × 0.3 = 3650<br><br>eg 450 × 5 × 0.7 + 400 × 5 × 0.3 – "1300" = 875<br>or 1000 × 5 × 0.7 + 100 × 5 × 0.3 – "3000" = 650 | Small factory<br>and 875(000)<br>and 650(000) | 4 | M1 for one correct product using probability<br><br>M1 for complete method to find expected income for one factory for 5 years<br><br>M1 for a complete method to find profit for 5 years for one factory<br><br>C1 for identifying Small factory **and**<br>eg £875(000) **and** £650(000) |

<table>
<tr><th>Question</th><th>Working</th><th>Answer</th><th>Mark</th><th>Notes</th></tr>
<tr><td>6(a)</td><td></td><td>$20 \le T < 25$</td><td>1</td><td>B1 $20 \le T < 25$</td></tr>
<tr><td>6(b)</td><td>$7 \div 5 = 1.4$</td><td>1.4</td><td>1</td><td>B1 1.4 o.e.</td></tr>
<tr><td>6(c)</td><td></td><td>Correct scale</td><td>1</td><td>C1 indicates at least 2 correct figures on the FD axis</td></tr>
<tr><td>6(d)</td><td>$0 \le T < 10 = 2 \div 10 = 0.2$<br>$30 \le T < 40 = 4 \div 10 = 0.4$</td><td>Correct histogram</td><td>2</td><td>B2 for fully correct histogram<br><br>(B1 for at least 1 bar drawn correctly<br>or 0.2 or 0.4 seen)</td></tr>
<tr><td>6(e)</td><td><table><tr><th>Number of days ($f$)</th><th>Midpoint ($T$)</th><th>$f \times T$</th></tr><tr><td>2</td><td>5</td><td>10</td></tr><tr><td>7</td><td>15</td><td>105</td></tr><tr><td>10</td><td>22.5</td><td>225</td></tr><tr><td>7</td><td>27.5</td><td>192.5</td></tr><tr><td>4</td><td>35</td><td>140</td></tr><tr><td>30</td><td></td><td>672.5</td></tr></table>“672.5” ÷ “30” = 22.4166..</td><td>22.4(166..)</td><td>4</td><td>M1 for at least 4 products $f \times T$ consistently within interval (including end points).<br><br>M1 (dep) for use of at least 3 correct midpoints.<br><br>M1 (dep on 1st M) for $\Sigma f \times T \div (2 + 7 + 10 + 7 + 4)$<br><br>A1 awrt 22</td></tr>
<tr><td>6(f)</td><td>eg “22” – 7.8 =14.2</td><td>14.6</td><td>1</td><td>B1 for 14.6 or ft 6(e)</td></tr>
<tr><td>6(g)</td><td>(“14.6” – 10) ÷ (20 – 10) × 7<br><br>2 + (“14.6” – 10) ÷ (20 – 10) × 7</td><td>5 to 6</td><td>3</td><td>M1 ft for a method to use proportion in the interval $10 \le T < 20$<br><br>M1 ft for a full method<br><br>A1 for answer in the range 5 to 6 supported</td></tr>
</table>

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 7(a) | $10 \times 0.95^9 = 6.302\ldots$<br>2021 10.000<br>2022 9.500<br>2023 9.025<br>2024 8.574<br>2025 8.145<br>2026 7.738<br>2027 7.351<br>2028 6.983<br>2029 6.634<br>2030 6.302<br>2031 5.987 | £6.3million | 2 | M1 for use of $10 \times \left(\frac{100 - 5}{100}\right)^n$ oe, where $n$ = 8, 9, or 10<br>A1 awrt (£)6.3(million) o.e. |
| 7(b) | $\frac{10(1 - "0.95"^n)}{1 - "0.95"}$<br>eg $\frac{10(1 - 0.95^{10})}{1 - 0.95}$<br>**or** $10(0.95^0 + 0.95^1 + 0.95^2 \ldots 0.95^9)$ | £80.25million | 3 | M1 for attempt to sum 9, 10, or 11 terms, where $r = \left(\frac{100 - 5}{100}\right)$ or ft 7(a)<br>M1 for a complete method where $a$ = 10 and $r = \left(\frac{100 - 5}{100}\right)$<br>A1 awrt (£)80(million) oe |
| 7(c) | $\frac{10}{1 - 0.95}$ | Shown | 2 | M1 $\frac{10}{1 - r}$, where $r = \left(\frac{100 - 5}{100}\right)$<br>C1 (£)200(million) from a correct calculation |

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 8(a) | Condone $600x + 200y + 250z \leq 225$<br>eg $0.6x + 0.2y + 0.25z \leq 225$<br><br>Accept any integer multiple e.g.<br>$600x + 200y + 250z \leq 225000$<br><br>eg $\frac{x}{x+y+z} \geq \frac{20}{100}$<br>$\frac{x}{x+y+z} \leq \frac{60}{100}$<br><br>Accept integer multiples<br>eg $8x \geq 2y + 2z$ **and** $4x \leq 6y + 6z$ oe | $12x + 4y + 5z \leq 4500$<br><br>$4x \geq y + z$<br>$2x \leq 3y + 3z$ | 5 | M1 for $600x + 200y + 250z \leq 225000$ oe<br>Allow use of $<$ or $=$<br><br>A1 $12x + 4y + 5z \leq 4500$<br><br>M1 for $x \geq 0.2(x + y + z)$ oe, allow use of $>$ or $=$<br>**or** $x \leq 0.6(x + y + z)$ oe, allow use of $<$ or $=$<br><br>M1 for $x \geq 0.2(x + y + z)$ oe, allow use of $>$ or $=$<br>**and** $x \leq 0.6(x + y + z)$ oe, allow use of $<$ or $=$<br>**or** for $4x \geq y + z$ oe **or** $2x \leq 3y + 3z$ oe<br>using integer values<br><br>A1 for eg $4x \geq y + z$ oe **and** $2x \leq 3y + 3z$ oe<br>using integer values |
| 8(b) | | $80x + 50y + 70z$ | 1 | B1 for $80x + 50y + 70z$ |
| 8(c) | $3y = x$<br>$y = 2x$<br>$4x + 3y = 1500$ | Diagram drawn and feasible region identified | 4 | M2 all three lines correctly drawn<br><br>(M1 for one line correctly drawn)<br><br>A2 for a fully correct diagram with R labelled<br><br>(A1 for correct region for 2 lines correctly drawn) |

| Question | Working | Answer | Mark | Notes |
|---|---|---|---|---|
| 8(d)(i) | <table><tr><th>*x*</th><th>*y*</th><th>*P*</th></tr><tr><td>150</td><td>300</td><td>48000</td></tr><tr><td>300</td><td>100</td><td>36000</td></tr></table><br>Only ft non-zero coordinate points | (150, 300) | 5 | B1 for use of $y = z$, eg $80x + (50 + 70)y$<br>May be seen in a substitution<br>**or** for extracting an appropriate vertex from their FR<br><br>M1 ft for beginning to test one of their vertices in the FR with 2 of 3 variables correctly used<br><br>M1 ft for fully testing two of their vertices in the FR<br><br>A1ft accurate figure for one of their vertices<br><br>C1 ft for correct decision supported by at least 2 accurate figures, eg (150, 300) **and** 48000 **and** 36000 |
| 8(d)(ii) | | £480<br>jeans = 150<br>t-shirts = 300<br>skirts = 300 | 4 | C4 for all of:<br>P = 48000(p) or (£)480, jeans = 150, t-shirts = 300, skirts = 300<br><br>(C3 for any 3 values correctly interpreted)<br><br>(C2 for any 2 values correctly interpreted)<br><br>(C1 for any value correctly interpreted<br>**or** ft for interpreting at least 3 of **their** values correctly) |
| 8(e) | | Assumption | 1 | C1 for valid assumption, eg all the clothes manufactured are sold **or** cost of cotton doesn't change **or** demand is consistent |


800
700
600
500
400
300
200
100
0
y
0
50
100
150
200
250
300
350
400
x
$y = 2x$
$3x + 4y = 1500$
R
$3y = x$

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