1. Showing $a + b + c = 6$ o.e.
   
   $bc = \frac{9^2 - 17}{16}$
   
   $= 64/16$ o.e. correctly obtained
   
   Completion showing $abc = 6$ o.e.

   - **1**
     - M1: Simple equiv fraction eg 192/32 or 24/4
     - M1: Correct expansion of numerator; may be unsimplified 4 term expansion; M0 if get no further than $\left(\sqrt{17}\right)^2$; M0 if no evidence before 64/16 o.e.
     - A1: May be implicit in use of factors in completion

2. 
   
   (i) $a^3b^3$ as final answer

   (ii) \(\frac{(x + 2)(x - 2)}{(x - 2)(x - 3)}\)

   $\frac{x + 2}{x - 3}$ as final answer

   - **2**
     - M2: 1 for 2 ‘terms’ correct in final answer
     - M1: M1 for each of numerator or denom. correct or M1, M1 for correct factors seen separately

3. 
   
   Correct expansion of both brackets seen (may be unsimplified), or difference of squares used

   \(4m^2\) correctly obtained

   \([p =] [\pm]2m\) cao

   - **3**
     - M2: M1 for one bracket expanded correctly; for M2, condone done together and lack of brackets round second expression if correct when we insert the pair of brackets
     - A1: A1

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<th>y = 2x + 3 drawn on graph x = 0.2 to 0.4 and −1.7 to −1.9</th>
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</table>
| ii | 1 = 2x² + 3x  
\[2x^2 + 3x - 1 = 0\] attempt at formula or completing square  
\[x = \frac{-3 \pm \sqrt{17}}{4}\] |
| M1 | 1 each; condone coords; must have line drawn |
| A2 | for multiplying by x correctly |
| M1 | for correctly rearranging to zero (may be earned first) or suitable step re completing square if they go on |
| M1 | ft, but no ft for factorising |
| iii | branch through (1,3), branch through (−1,1), approaching y = 2 from below |
| iv | −1 and ½ or ft intersection of their curve and line [tolerance 1 mm] |
| | A2  
A1 for one soln  
1 and approaching \(y = 2\) from above  
1 and extending below x axis  
2 1 each; may be found algebraically; ignore y coords.  
2
| 5 | (x − 3.5)^2 − 6.25 | 3 | B1 for a = 7/2 o.e, B2 for b = −25/4 o.e. or M1 for 6 − (7/2)^2 or 6 − (their a)^2 |
|   | (3.5, −6.25) o.e. or ft from their (i) | 1+1 | allow x = 3.5 and y = −6.25 or ft; allow shown on graph 1 each [stated or numbers shown on graph] |
| ii | (0, 6) (1, 0) (6, 0) | 3 | G1 G1 |
| iii | curve of correct shape fully correct intns and min in 4th quadrant | 5 | M1 M1 |
| iv | x^2 − 7x + 6 = x^2 − 3x + 4 2 = 4x |  | or 4x − 2 = 0 (simple linear form; condone one error) condone no comment re only one intn |
|    | x = ½ or 0.5 or 2/4 cao |   | A1 |

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| 6 (i)    | \( x = 4 \)  
          | (4, -3) | B1     | or \( x = 4, y = -3 \)  
          |        | B1     | condone 4, -3 |
| 6 (ii)   | (0, 13) isw  
          | \([\text{when } y = 0, ] \ (x - 4)^2 = 3\)  
          | \([x =]4 \pm \sqrt{3} \text{ or } \frac{8 \pm \sqrt{12}}{2} \text{ isw}\) | 1 M1  
          |        | 1 M1  | or [when \( x = 0 \), \( y = 13 \) isw  
          |        |        | 0 for just (13, 0) or \((k, 13)\) where \( k \neq 0 \)  
          |        |        | or \( x^2 - 8x + 13 = 0 \)  
          |        |        | annotate this question if partially correct  
          |        |        | may be implied by correct value(s) for \( x \) found  
          |        |        | allow M1 for \( y = x^2 - 8x + 13 \) only if  
          |        |        | they go on to find values for \( x \) as if \( y \) were 0  
          |        |        | need not go on to give coordinate form  
          |        |        | A1 for one root correct  
| 6 (iii)  | replacement of \( x \) in their eqn by \((x - 2)\)  
          | completion to given answer \( y = x^2 - 12x + 33 \),  
          | showing at least one correct interim step | M1 A1  
          |        |        | may be simplified; eg \([y = ] (x - 6)^2 - 3\)  
          |        |        | or allow M1 for \((x - 6 - \sqrt{3} )(x - 6 + \sqrt{3} )\)  
          |        |        | [=0 or \( y \)]  
          |        |        | cao; condone using \(f(x - 2)\) in place of \( y \)  
          |        |        | condone omission of ‘\( y =’\) for M1, but  
          |        |        | must be present in final line for A1  

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<tr>
<td>6 (iv)</td>
<td>(x^2 - 12x + 33 = 8 - 2x) or ((x - 6)^2 - 3 = 8 - 2x)</td>
<td>M1</td>
<td>for equating curve and line; correct eqns only; or for attempt to subst ((8 - y)/2) for (x) in (y = x^2 - 12x + 33)</td>
</tr>
<tr>
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<td>(x^2 - 10x + 25 = 0)</td>
<td>M1</td>
<td>for rearrangement to zero, condoning one error such as omission of (\pm 0)</td>
</tr>
<tr>
<td></td>
<td>((x - 5)^2 = 0)</td>
<td>A1</td>
<td>or showing (b^2 = 4ac)</td>
</tr>
<tr>
<td></td>
<td>(x = 5) (\text{www} [\text{so just one point of contact}])</td>
<td>A1</td>
<td>may be part of coordinates ((5, k))</td>
</tr>
<tr>
<td></td>
<td>point of contact at ((5, -2))</td>
<td>A1</td>
<td>dependent on previous A1 earned; allow for (y = -2) found</td>
</tr>
<tr>
<td></td>
<td>alt. method</td>
<td>or</td>
<td></td>
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<tr>
<td></td>
<td>for curve, (y' = 2x - 12)</td>
<td>M1</td>
<td>for equating their (y') to (-2)</td>
</tr>
<tr>
<td></td>
<td>(2x - 12 = -2)</td>
<td>M1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(x = 5, \text{and } y \text{ shown to be } -2) using eqn to curve</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tgt is (y + 2 = -2 (x - 5))</td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>deriving (y = 8 - 2x)</td>
<td>A1</td>
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annotate this question if partially correct

allow \(\frac{10 \pm \sqrt{6}}{2}\) oe if \(b^2 - 4ac = 0\) is not used explicitly

A0 for \((x - 5)^2 = y\)

allow recovery from \((x - 5)^2 = y\)

examiners: use one mark scheme or the other, to the benefit of the candidate if both methods attempted, but do not use a mixture of the schemes

condone no further interim step if all working in this part is correct so far
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| 7 (i) | translation by \(
|   | \begin{pmatrix}-4 \\
|   | 0
|   | \end{pmatrix}\) or 4 [units] to left | B1 B1 0 for shift/move or 4 units in negative x direction o.e. |
| 7 (ii) | sketch of parabola right way up and with minimum on negative y-axis min at (0, −4) and graph through −2 and 2 on x-axis | B1 B1 mark intent for both marks must be labelled or shown nearby |