<table>
<tr><th>Q</th><th>Marking Instructions</th><th>AO</th><th>Marks</th><th>Typical Solution</th></tr>
<tr><td rowspan="5">4</td><td>Selects a method of integration, which could lead to a correct solution. Evidence of integration by parts

OR an attempt at integration by inspection.</td><td>AO3.1a</td><td>M1</td><td rowspan="5">$u = \ln 2x; \quad \dfrac{dv}{dx} = x^3$
$\dfrac{du}{dx} = \dfrac{1}{x}; \quad v = \dfrac{x^4}{4}$
$\left[\dfrac{x^4}{4}\ln(2x)\right]_1^2 - \int_1^2 \dfrac{x^3}{4}\,dx$
$\left[\dfrac{x^4}{4}\ln(2x) - \dfrac{x^4}{16}\right]_1^2$
$= \left(\dfrac{2^4}{4}\ln(4) - \dfrac{2^4}{16}\right) - \left(\dfrac{1}{4}\ln(2) - \dfrac{1}{16}\right)$
$\dfrac{31}{4}\ln 2 - \dfrac{15}{16}$
so $p = \dfrac{31}{4} \qquad q = -\dfrac{15}{16}$

ALT
$\dfrac{d}{dx}(x^4 \ln 2x) = 4x^3 \ln 2x + x^4 . \dfrac{1}{x}$
$\therefore \int_1^2 x^3 \ln 2x\,dx = \left[\dfrac{1}{4}(x^4 \ln 2x - \dfrac{x^4}{4})\right]_1^2$
$= \left(\dfrac{2^4}{4}\ln(4) - \dfrac{2^4}{16}\right) - \left(\dfrac{1}{4}\ln(2) - \dfrac{1}{16}\right)$
$\dfrac{31}{4}\ln 2 - \dfrac{15}{16}$
$p = \dfrac{31}{4} \qquad q = -\dfrac{15}{16}$</td></tr>
<tr><td>Applies integration by parts formula correctly

OR correctly differentiates an expression of the form $Ax^4 \ln 2x$</td><td>AO1.1b</td><td>A1</td></tr>
<tr><td>Obtains correct integral, condone missing limits.</td><td>AO1.1b</td><td>A1</td></tr>
<tr><td>Substitutes correct limits into ‘their’ integral</td><td>AO1.1a</td><td>M1</td></tr>
<tr><td>Obtains correct p and q

FT use of incorrect integral provided both M1 marks have been awarded</td><td>AO1.1b</td><td>A1F</td></tr>
<tr><td></td><td>Total</td><td></td><td>5</td><td></td></tr>
</table>