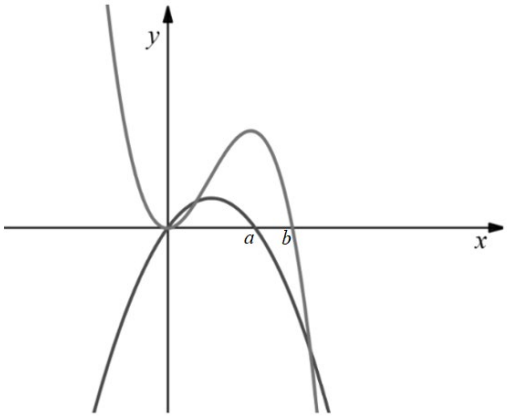
	$\{f(x) \text{ or } y =\}\quad 30x+12x^{\frac{1}{2}}-2x^{\frac{5}{2}}-88$	Correct and simplified four term expression. A0 if stops at $c=-88$. Do not need to see $f(x)=...$ Condone if e.g., a spurious integration sign remains	**A1**
			(5)
			Total 9

Question Number	Scheme	Notes	Marks
10	For this question, mark the parts together so e.g., marks for (b) and (c) may be scored for appropriate work in (a).		
(a)	$y = x(a-x), \quad y = x^2(b-x), \quad b > a > 0$  Ignore any labelling of the graphs with the equations. Work on the sketch takes precedence. If coordinates are given separately they must be identified e.g., labelled *P*, *Q* on the sketch and given in the answer space. Give BOD as a "slip of the pen" if curvature poor at the ends of the graphs. Allow asymmetry of the quadratic. Note that the vertex of the parabola could be above the maximum of the cubic.	For any **negative** quadratic curve (i.e., not an inverted V shape)	**1st B1**
		For **any** quadratic curve that intersects the *x*-axis at the origin and *a*, with *a* indicated on the positive *x*-axis. If coordinates, must be the right way round unless axis labelled	**2nd B1**
		For any **negative** cubic shaped curve (min then max - not point of inflection)	**3rd B1**
		For a **negative** cubic shaped curve with a minimum turning point at the origin	**4th B1**
		A completely correct diagram. Cubic crossing the positive *x*-axis at *b* to the right of *a*. If coordinates, must be the right way round unless axis labelled. The curves do not need to intersect in Q4 and do not be concerned about the relative gradients. Ignore any coords for intersections if given.	**5th B1**
			(5)

Question Number	Scheme	Notes	Marks
10(b)	$\{x(4-x)=x^2(7-x)\Rightarrow\}\ 4x-x^2=7x^2-x^3$ $\{x(4-x)=x^2(7-x)\Rightarrow\}\ x(4-x)=x(7x-x^2)$	Sets $x(4-x)=x^2(7-x)$ and multiplies out both brackets to achieve a correct form or factorises RHS to correct form	**M1**
	$\{\Rightarrow x^3-8x^2+4x=0\}\Rightarrow x\left(x^2-8x+4\right)=0$ Proceeds to the given answer with no errors seen. No intermediate step is required. Accept e.g., $0=\left(4+x^2-8x\right)x$ but must have 0 = or = 0 and be fully factorised		**A1***
			(2)
(c)	Question has: "Solutions relying on calculator technology are not acceptable"		
	$x^2-8x+4=0\Rightarrow x=\dfrac{-(-8)\pm\sqrt{8^2-4(1)(4)}}{2(1)}\Rightarrow x=4\pm2\sqrt{3}$ M1: Attempts to solve $x^2-8x+4=0$ by valid non-calculator means (not factorisation). May be complex if using CTS but see guidance. A1: $\{x=\}\ 4\pm2\sqrt{3}$ but allow $\{x=\}\ 4\pm\sqrt{12}$ and may just give one solution. Fraction must have been dealt with.		**M1** **A1**
	$x=4-2\sqrt{3}\ \ y=x(4-x)=2\sqrt{3}\left(4-2\sqrt{3}\right)=-12+8\sqrt{3}$		
	M1: Chooses either of their $x=4\pm2\sqrt{3}$ (rational number + surd) and uses $y=x(4-x)$ or $y=x^2(7-x)$ to obtain a value (rational number + surd). Method may not be shown - if so value must be correct for their *x*. If working is shown allow slips such as $\left(4-2\sqrt{3}\right)\left(4-4-2\sqrt{3}\right)=\ldots$ or $\left(4-2\sqrt{3}\right)\left(-2\sqrt{3}\right)=\ldots$ May be seen on the graph in (a). Note also that $x=4+2\sqrt{3}\Rightarrow y=-12-8\sqrt{3}$		**M1**
	dM1: **Shows a method** of finding *y* (achieving rational number + surd) from the **correct** $x=4-2\sqrt{3}$ (may use both) E.g. $\left(4-2\sqrt{3}\right)\left(2\sqrt{3}\right)=\ldots$ or $\left(4-2\sqrt{3}\right)\left(4-\left(4-2\sqrt{3}\right)\right)=\ldots$ Must start with a correct expression so do not condone starting with $\left(4-2\sqrt{3}\right)\left(4-4-2\sqrt{3}\right)$ or $\left(4-2\sqrt{3}\right)\left(-2\sqrt{3}\right)$ However, $\left(4-2\sqrt{3}\right)^2\left(3+2\sqrt{3}\right)$ requires the correct $\left(28-16\sqrt{3}\right)\left(3+2\sqrt{3}\right)$ or $2\sqrt{3}\left(4-2\sqrt{3}\right)$ seen Requires previous M mark		**dM1**
	$\left(4-2\sqrt{3},-12+8\sqrt{3}\right)$ Correct coordinates in this form. Accept $x=-2\sqrt{3}+4,\ \ y=8\sqrt{3}-12$		**A1**

	If both are given then the correct solution must be identified e.g., $A\left(4-2\sqrt{3},-12+8\sqrt{3}\right)$ and note that the other intersection is $\left(4+2\sqrt{3},-12-8\sqrt{3}\right)$ which can be ignored if the correct point is identified. $p=4,\ q=-2,\ r=-12,\ s=8$ is A0 without sight of $\left(p+q\sqrt{3},\ r+s\sqrt{3}\right)$ Note that 00111, 00110 and 00100 are possible.	
		(5)
		Total 12