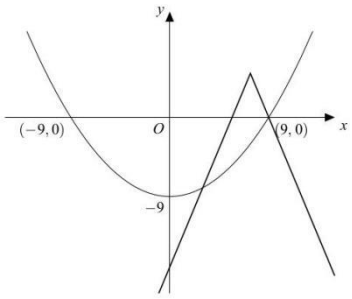
Question	Scheme		Marks
7(a)	(i) $\left(\frac{22}{3}, 5\right)$		**B1**
	(ii) $(0, -17)$		**B1**
			(2)
(b)	$5-(3x-22)=0 \Rightarrow x=...$ **and** $5+(3x-22)=0 \Rightarrow x=...$		**M1**
	$x=9$ and $x=\frac{17}{3}$		**A1**
			(2)
(c)		Correct U shape symmetric about *y*-axis with vertex on negative *y*-axis.	**B1**
		Graphs meet $(9,0)$ with $(-9,0)$ also shown.	**B1**
		Intercept at $(0,-9)$ stated or labelled.	**B1**
			(3)
(d)	Intersect at $(9,0)$		**B1**
	Or when $5+3x-22=\frac{1}{9}x^2-9$		**M1**
	$\Rightarrow (x-3)(x-24)=0 \Rightarrow x=...$		**dM1**
	Need smaller root $x=3 \Rightarrow y=...$		**dM1**
	$(3,-8)$		**A1**
			(5)
			(12 marks)

Notes:

(a)

Mark (a) and (b) as a whole

(i) B1: Correct coordinates. May be listed as separate coordinates, $x = \ldots$, $y = \ldots$

(ii) B1: Correct y intercept (and no other). Accept as coordinates, or stated as $y = \ldots$ (allow without the $x = 0$) or seen on graph as the y intercept. However just -17 on its own is B0.

(b)

M1: Attempts to solve **both** equations, though allow sign slips when expanding the brackets.

A1: Both values correct.

(c)

B1: Correct U shape symmetric about *y*-axis with vertex on negative *y*-axis. Allow a little tolerance with shape, but the curve must not clearly bend back on itself, and the minimum should be clearly intended as on the *y*-axis.

B1: Graphs meet at $(9,0)$ both *x* intercepts labelled or clearly stated (and no others). Shape need not be correct for this mark e.g. inverted parabola may be shown). Must pass through the same point as the modulus graph at (9,0).

B1: States or labels the *y* intercept at $(0,-9)$ and intercept must be on the negative *y*-axis.

(d)

B1: Deduces one point of intersection is (9,0). Must be seen in (d), or clearly stated as the answer if parts are not labelled, do not accept just this marked on the diagram.

M1: Sets up equation for the intersection of the quadratic with the positive gradient line segment, accept $5+3x\pm 22=\frac{1}{9}x^2-9$

dM1: Solves their equation, any valid means. After the equation is seen you may see just the correct root, or 24, which implies the M. Alternatively, expanding and solving the quadratic by usual rules.

dM1: Depends on first M mark. Selects the correct (smaller) root of their quadratic and attempts to find the *y* value (accept any *y* value appearing after choosing the correct root as an attempt). The larger root must be rejected. Following a correct equation, if no working is shown for finding the root (see above) they must have achieved $x = 3$ and go on to find *y* for this mark. From an incorrect equation/incorrect method to solve, if only one root is given it must correspond to the smaller root of their equation/method.

A1: $(3,-8)$ only

Alternative by squaring.

B1: As main scheme.

M1: Rearranges to $|3x-22|=a+bx^2\left(=14-\frac{1}{9}x^2\right)$ and squares both sides to reach a quartic equation. If correct it is $\frac{1}{81}x^4-\frac{109}{9}x^2+132x-288=0$

dM1: Solves the resulting quartic (any means). If no method is shown, a correct value from the correct equation will imply the mark.

dM1: Depends on first M mark Selects correct root (second of the four in ascending order) and finds the *y* coordinate. If no method shown, but the quartic was correct, they must be using $x = 3$.

A1: As scheme.

Question	Scheme	Marks
8(a)	$R = 17$	**B1**
	$\tan\alpha = \frac{15}{8}$	**M1**
	$\alpha = 1.081$	**A1**
		(3)
(b)	(i) Min f(x) $= \frac{15}{41 + 2\times"17"}$	**M1**
	$= \frac{1}{5}$	**A1**
	(ii) Occurs when $\sin(x - 1.081) = 1 \Rightarrow x - 1.081 = \frac{\pi}{2} \Rightarrow x = ...$	**M1**
	$x =$ awrt 2.65	**A1**
		(4)
(c)	$-\frac{23}{5}$ (or -4.6)	**B1ft**
		(1)
(d)	Awrt 1.33	**B1ft**
		(1)
		(9 marks)

Notes:

(a)

B1: For 17 only.

M1: Attempts an equation in α. Accept $\tan\alpha = \pm\frac{15}{8}$ or $\tan\alpha = \pm\frac{8}{15}$. If using R accept $\cos\alpha = \pm\frac{8}{"17"}$ or $\sin\alpha = \pm\frac{15}{"17"}$. Implied by a correct value for α

A1: Awrt 1.081. Must be in radians.

(b)(i)

M1: Attempts to apply the result from (a) to find the minimum. Allow for $\frac{15}{41 \pm 2\times"\text{their } R"}$

A1: cao.

(ii)

M1: Attempts to solve $x \pm "\alpha" = \frac{\pi}{2}$

A1: cao

(c)

B1ft: Correct answer or follow through $2\times\left("\text{their}"\frac{1}{5}\right) - 5$ and no other solutions.

(d)

B1ft: For awrt 1.33 or follow through $0.5\times\text{their } 2.65$ and no other solutions.