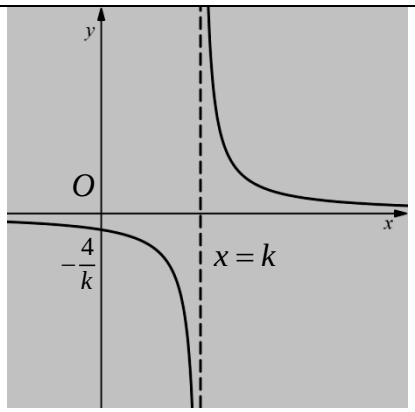
| Question Number | Scheme | Marks |
|---|---|---|
| **7. (a)** |  | |
| | Shape in quadrant One | M1 |
| | Fully correct shape and position | A1 |
| | $C$ cuts the $y$-axis at $-\frac{4}{k}$ | B1 |
| | $C$ has a vertical asymptote at $x=k$ | B1 **(4)** |
| **(b)** | $\frac{4}{x-k}=9-x \Rightarrow x^2-(9+k)x+9k+4=0$ | M1, A1 |
| | Uses $b^2-4ac<0 \Rightarrow (9+k)^2-4\times1\times(9k+4)<0$ | dM1 |
| | $k^2-18k+65<0 \Rightarrow (k-13)(k-5)<0 \Rightarrow 5<k<13$ | ddM1, A1 **(5)** **(9 marks)** |

(a) Marks for intercept and asymptote must be shown on the graph and hence cannot be scored without a sketch

M1: For a monotonically decreasing function in quadrant one. It must not cross either axis but be tolerant of functions that (a) don't go down as far as the $x$-axis and (b) extend as far left as the $y$ -axis

A1: Correct shape and position (for whole curve). Be tolerant of slips of the pen but the intension should be clear. Look for the curve in quadrants 1, 3 and 4 with a vertical asymptote in quadrant 1 and 4. The left-hand branch should not intentionally dip below the intercept away from the $x$ -axis

B1: $C$ cuts the $y$-axis once at $-\frac{4}{k}$ which must be on the negative $y$-axis as $-\frac{4}{k}$, $\left(0,-\frac{4}{k}\right)$ but not $\left(-\frac{4}{k},0\right)$

B1: $C$ must have one vertical asymptote to the right of the $y$-axis marked $x=k$

(b)

M1: Equates curve with given line and attempts to form a quadratic. The terms do not need to be collected

Look for $\frac{4}{x-k}=9-x$ (condoning slips), cross multiplies and proceeds to a quadratic expression

A1: Achieves a simplified quadratic with collected terms. Look for $x^2-(9+k)x+9k+4=0$ o.e. or else gives the correct values of $a$, $b$ and $c$ which may be implied by values embedded within $b^2-4ac$.

dM1: Attempts to use the discriminant $b^2-4ac...0$ for their $ax^2+bx+c=0$ with both $b$ and $c$ expressions in $k$

ddM1: Solves their quadratic in $k$ resulting from $b^2-4ac=0$ and chooses the inside region for their critical values. Allow calculator solutions here so you may need to check if the method is not apparent. Condone the boundaries being included in the inequality for this mark.
It is dependent upon both previous M's

A1: CSO $5<k<13$ o.e. The variable must be $k$.

Accept alternatives such as $k>5$ and $k<13$ $k>5, k<13$ $(5,13)$ or $k\in(5,13)$

BUT NOT $k>5$ or $k<13$

| Question Number | Scheme | Marks |
|---|---|---|
| **8 (a)** | Attempts to use $S = r\theta \Rightarrow 9 = OD \times 0.8 \Rightarrow OD = 11.25$ or $\frac{45}{4}$ | M1, A1 |
| | $AO = \frac{5}{8} \times "11.25" = 7.03\,\text{m}$ * | A1* |
| | | **(3)** |
| **(b)** | Attempts $A = 7.03 \times (2\pi - 0.8) = (38.55)$ | M1 |
| | Attempts $9 + 2 \times (11.25 - 7.03) + 7.03 \times \theta$ | M1 |
| | Perimeter = awrt 56.0 m | A1 |
| | | **(3)** |
| **(c)** | Attempts $\frac{1}{2} \times "11.25"^2 \times 0.8 = (50.625)$ OR $\frac{1}{2} \times 7.03^2 \times (2\pi - 0.8) = (135.4)$ | M1 |
| | Full method for area of platform = $\frac{1}{2} \times "11.25"^2 \times 0.8 + \frac{1}{2} \times 7.03^2 \times (2\pi - 0.8)$ | M1 |
| | =awrt 186 $\text{m}^2$ | A1 |
| | | **(3)** |
| | | **(9 marks)** |

(a) **This is a show that question and it is important that the method is shown**

M1: Attempts to use $S = "r"\theta \Rightarrow 9 = "r" \times 0.8 \Rightarrow "r" = ...$ Implied by $(r) = \frac{9}{0.8}$

A1: Achieves $\underline{OD} = 11.25$ or $\underline{OC} = 11.25$ but condone $\underline{"r"} = 11.25$. May be implied by $AO = \frac{5}{8} \times \left(\frac{9}{0.8}\right)$ o.e

A1*: Shows that $AO$ is $7.03(m)$ via $\frac{5}{8} \times 11.25, 11.25 - \frac{3}{8} \times 11.25$ o.e. Units are not required.

You do not need to see *AO* specifically mentioned as long as there was an *OD*, *OC* or *r* stated earlier.
You do not need to see 7.03125 before it being rounded to 7.03.
You can also condone leaving as a more accurate value, e.g. *AO* = 7.03125
Allow a more accurate value of 7.03 to be used in part (b) and (c). E.g. 7.03125

(b)

M1: Attempts arc length *AEB* via $7.03 \times (2\pi - 0.8)$ o.e such as $2\pi(7.03) - 7.03 \times (0.8)$

Allow the angle calculation to be implied by sight of awrt 5.48 so score for $7.03 \times 5.48$

If the calculation $(2\pi - 0.8)$ has been seen, allow 5.5 to be used for the angle

M1: Attempts to add the correct parts together E.g. $9 + 2 \times ("11.25" - 7.03) + 7.03 \times \theta$

The major arc must have been attempted by a correct formula but allow for this mark an incorrect angle to be used for candidates who don't equate $2\pi$ to $360°$. So allow for this mark calculations with e.g. $7.03(\pi - 0.8)$

You may see $9 + 2 \times \left(\frac{3}{8} \times 11.25\right) + 7.03 \times \theta$. Allow accuracy to 1 dp so $9 + 2 \times 4.2 + 38.6$

A1: Perimeter = awrt 56.0m. ISW after a correct answer. Condone 56m following a correct calculation.
The units are not necessary, they can be ignored