Question Number	Scheme	Marks
5(a)	$9^x = p^2,\quad 3^{x+2} = 9p \quad \text{or} \quad 3^{x-1} = \frac{p}{3}$	B1
	$3\times 9^x + 3^{x+2} = 1 + 3^{x-1} \Rightarrow 3p^2 + 3^2 \times p = 1 + \frac{p}{3^1}$	M1
	$9p^2 + 26p - 3 = 0$ via $3p^2 + 9p = 1 + \frac{p}{3}$*	A1*
		(3)
(b)	$9p^2 + 26p - 3 = 0 \Rightarrow (9p-1)(p+3) = 0$	M1
	$3^x = \frac{1}{9}$	A1 M1 in EPEN
	$x = -2$	A1
		(3)
		(6 marks)

(a) Mark (a) and (b) together.

B1: Uses an index law and states or implies any of $9^x = p^2$, $3^{x+2} = 9p$ or $3^{x-1} = \frac{p}{3}$ or equivalent forms

e.g. $9^x = p \times p$, $3^{x+2} = 3^2 \times p$, $3^{x-1} = p \times 3^{-1}$

If awarding for the first term, then it must be from correct work so $3\times 9^x = 3\times 3^x \times 3^x = 3p^2$ is fine but $3\times 9^x = 3\times 3^2 \times 3^x = 3p^2$ or $3\times 9^x = 3\times 3\times 3^x = 3p^2$ is not, but do check the other terms.

M1: Look for $3\times 9^x + 3^{x+2} = 1 + 3^{x-1} \Rightarrow 3p^2 \pm kp = 1 \pm \frac{p}{3}$ oe **obtained from correct work**, with $k = 6$ or 9

So if e.g. $3p^2$ is obtained from $3\times 9^x = 3\times 3^2 \times 3^x = 3p^2$ or $3\times 9^x = 3\times 3\times 3^x = 3p^2$ then score M0.

A1*: Proceeds to the given answer of $9p^2 + 26p - 3 = 0$ with no errors or omissions.

An intermediate line of $3p^2 + 9p = 1 + \frac{p}{3}$ o.e. must be seen.

Note that the following is common in part (a) and scores no marks: $3\times 9^x + 3^{x+2} = 1 + 3^{x-1} \Rightarrow 3\times 3p + p^2 = 1 + p^{-1}$

(b)

M1: Valid **<u>non-calculator</u>** attempt at solving $9p^2 + 26p - 3 = 0$ – see General Guidance.

It must be clear they are solving the given quadratic not their incorrect one.

Answers just written down scores M0

A1(M1 in EPEN): For $3^x = \frac{1}{9}$ seen. It must be clear that it is a value for 3^x and not a value for p or x.

May be implied by e.g. $p = \frac{1}{9} \Rightarrow x = -2$. You can ignore e.g. $3^x = -3$ for this mark.

A1: $x = -2$ only

Question Number	Scheme	Marks
6(a)	$A=\frac{1}{2}r^2\theta \Rightarrow 40=\frac{1}{2}r^2\times 2.4\Rightarrow r=...$	M1
	$r=\sqrt{\frac{80}{2.4}}\Rightarrow r=5.77$ (m)	A1
		(2)
(b)	States or uses that angle *AOB* = awrt 0.37	B1
		(1)
(c)	$\frac{1}{2}\times "5.77"\times 6.25\times \sin "0.37"\ \left(=6.5377...\right)$	M1
	Full method for area of stage = $40+2\times\frac{1}{2}\times 5.77\times 6.25\times \sin 0.37$	dM1
	= 53.1 m^2	A1
		(3)
(d)	$r\theta = "5.77"\times 2.4 = \left(13.848\right)$	M1
	$x^2=6.25^2+"5.77"^2-2\times 6.25\times "5.77"\cos "0.37"\qquad \left(x=2.26\right)$	M1
	Full method for perimeter of stage = $12.5+2\times "2.26"+"5.77"\times 2.4$	ddM1
	= 30.9 m	A1
		(4)
		(10 marks)

Allow equivalent correct work in degrees but part (b) must be in radians.

(a)

M1: Attempts to use $A=\frac{1}{2}r^2\theta$ with A = 40 and θ = 2.4 to find a value for r

A1: Achieves awrt 5.77 (m). Apply isw if necessary e.g. if they subsequently write 5.77 as 5.8.

(b)

B1: Angle *AOB* = awrt 0.37. Allow this to score anywhere in their answer.

(c)

M1: Attempts area of triangle *AOB* (or triangle *DOC*) $\frac{1}{2}\times "a"\times 6.25\times \sin "b"$ (May be seen "doubled")

NB: "doubled" is 13.075…

dM1: Attempts area of stage $40+2\times\frac{1}{2}\times "a"\times 6.25\times \sin "b"$

or e.g. $\frac{1}{2}\times "5.77"^2\times 2.4+2\times\frac{1}{2}\times "a"\times 6.25\times \sin "b"$

A1: Awrt 53.1 (m^2). Condone awrt 53.0 but not just 53 unless awrt 53.1 or awrt 53.0 is seen earlier.