| Question Number | Scheme | Marks |
|---|---|---|
| **9. (a)** | (i) 3<br>(ii) 101<br>(iii) 2 | B1<br>B1<br>B1<br>**(3)** |
| **(b)** | $a = \frac{2\pi}{3}$ o.e. | B1<br>**(1)** |
| **(c)** | Attempts $x$ coordinate of $Q$: $x = "\frac{2\pi}{3}" + \pi = \frac{5\pi}{3}$ | M1 |
| | Attempts both $y$ coordinates $P\left(\frac{2\pi}{3}, \frac{\pi}{3}\right)$ $Q\left(\frac{5\pi}{3}, -\frac{2\pi}{3}\right)$ | dM1 |
| | Attempts mid-point $PQ = \left(\frac{1}{2}\left(\frac{2\pi}{3} + \frac{5\pi}{3}\right), \frac{1}{2}\left(\frac{\pi}{3} - \frac{2\pi}{3}\right)\right)$ | ddM1 |
| | $= \left(\frac{7\pi}{6}, -\frac{\pi}{6}\right)$ | A1<br>**(4)**<br>**(8 marks)** |

**The answers to parts (a) and (b) may very well appear in the question. Be aware of this when marking.**

(a)(i) B1: 3

(a)(ii) B1: 101

(a)(iii) B1: 2

(b)

B1: $a = \frac{2\pi}{3}$ o.e. so accept $a = \frac{4\pi}{6}$. Condone $x \leftrightarrow a$

Do not accept/condone $120°$

(c)

M1: For

- either the correct $x$ coordinate of $Q$ which can be scored for $\left(\frac{3\pi}{2} + \frac{\pi}{6}\right)$
- or an attempt at the $x$ coordinate of $Q$ by adding on $\pi$ to the $x$ coordinate of $P$

The following marks are dependent upon this, so if (c) starts M0, it is automatically dM0, ddM0, A0.

dM1: Attempts coordinates for **BOTH** $P$ and $Q$ using the equation $y = \pi - x$

It is dependent upon the previous method mark.

ddM1: Correct attempt at mid-point.

There must be an attempt to add the pairs of coordinates before halving the sum.

It is dependent upon BOTH the previous method marks **and the value of *a* lying in the region** $\frac{\pi}{2} < a < \pi$. Look for $\left(\frac{a + (a + \pi)}{2}, \frac{(\pi - a) + (\pi - (a + \pi))}{2}\right)$

A1: $\left(\frac{7\pi}{6}, -\frac{\pi}{6}\right)$ but may be written as $x = \ldots, y = \ldots$

| Question Number | Scheme | Marks |
|---|---|---|
| **10** | $y=\frac{2}{3}x^3-25x-\frac{56}{x}+\frac{194}{3}$ | |
| **(a)** | $\frac{dy}{dx}=2x^2-25+\frac{56}{x^2}$ | M1, A1 |
| | Finds $\left.\frac{dy}{dx}\right\|_{x=2}=2\times4-25+\frac{56}{4}=-3$ | dM1 |
| | Equation of tangent $y+8="-3"(x-2)\Rightarrow y=-3x-2$ * | ddM1, A1* |
| | | **(5)** |
| **(b)** | Sets $2x^2-25+\frac{56}{x^2}=-3$ | M1 |
| | $x^4-11x^2+28=0$ | dM1, A1 |
| | $(x^2-4)(x^2-7)=0\Rightarrow x^2=..$ | ddM1 |
| | $x=\sqrt{7}$ only | A1 |
| | | **(5)** |
| | | **(10 marks)** |

**This is a non-calculator question so you must see evidence for all calculations/marks**

(a)

M1: Correctly differentiates two of the four terms. The indices must be processed

So, look for two of $\frac{2}{3}x^3\to\frac{2}{3}\times3x^2$, $-25x\to-25$, $-\frac{56}{x}\to+\frac{56}{x^2}$, $+\frac{194}{3}\to0$

A1: Correct differentiation. Allow un-simplified

dM1: Substitutes $x=2$ into their $\frac{dy}{dx}$ (to find the gradient of the tangent).

Allow values to be embedded following the M mark E.g. $2\times2^2-25+\frac{56}{4}$

It is dependent upon the previous M mark, so there must be some correct differentiation.

If there is no working for this, it is implied by a correct value for their $\frac{dy}{dx}$

ddM1: Dependent upon both previous M's.

For a correct method of finding the equation of the tangent at (2, −8).

Look for $y+8=\left.\frac{dy}{dx}\right|_{x=2}(x-2)$

If the form $y=mx+c$ is used it must proceed as far as $c$ = ...

A1*: CSO: $y=-3x-2$ following the award of previous M's and A.

This is a given answer so all aspects must be correct.