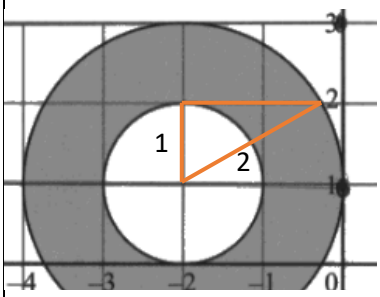
| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **5(a)** | $a = 1,\ d = 2$ | B1 | 1.1b |
| | $b = 2$ | B1 | 1.1b |
| | $c = -1$ | B1 | 1.1b |
| | | **(3)** | |
| **(b)** | $\lvert z-\mathrm{i}\rvert = \lvert z-3\mathrm{i}\rvert \Rightarrow y = 2$ | B1 | 2.2a |
| | Area between the circles $= \pi\times 2^2 - \pi\times 1^2$ | M1 | 1.1a |
| |  Angle subtended at centre $= 2\times\cos^{-1}\left(\frac{1}{2}\right)$<br>Alternatively<br>$(x+2)^2+(y-1)^2 = 4,\ y = 2 \Rightarrow x = \ldots$<br>Or $x = \sqrt{2^2-1^2}$<br>Leading to Angle subtended at centre $= 2\times\tan^{-1}\left(\frac{\sqrt{3}}{1}\right)$ | M1 | 3.1a |
| | Segment area $= \frac{1}{2}\times\frac{2\pi}{3}\times 2^2 - \frac{1}{2}\times 2^2\times\sin\left("\frac{2\pi}{3}"\right)\left\{=\frac{4}{3}\pi-\sqrt{3}\right\}$ | M1<br>A1 | 2.1<br>1.1b |
| | Area of $Q$: $\pi\times 2^2 - \pi\times 1^2 - \left(\frac{1}{2}\times\frac{2\pi}{3}\times 2^2 - \frac{1}{2}\times 2^2\times\sin\left(\frac{2\pi}{3}\right)\right)$ | M1 | 3.1a |
| | $= \frac{5\pi}{3} + \sqrt{3}$ | A1 | 1.1b |
| | | **(7)** | |
| | | | **(10 marks)** |

**Notes**

(a)

B1: Correct values for $a$ and $d$

B1: Correct value for $b$

B1: Correct value for $c$

(b)

B1: Deduces that $\lvert z-\mathrm{i}\rvert = \lvert z-3\mathrm{i}\rvert$ is a perpendicular bisector with equation $y = 2$, this may be drawn on a diagram.

M1: Selects the correct procedure to find the area of the large circle – the area of the small circle.

M1: Correct method to find the angle at the centre (or half this angle).

Recognises that the hypotenuse is the radius of the larger circle and the adjacent is the radius if the smaller circle and using cosine

Alternatively find where the perpendicular bisector intersects the larger circle so uses their $y = 2$ and the equation of the larger circle in an attempt to establish the $x$ values for the intersection points or uses geometry and Pythagoras to identify the required length and then uses tangent.

M1: Correct method for the area of the minor segment (allow equivalent work)

A1: Correct expression
M1: Fully correct strategy for the required area. Must be subtracting the area of the minor segment from the annulus area.
A1: Correct exact answer
Note: 6.968