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Question 1

\[ z = (1 + i)^3 \]
\[ = (\sqrt{2}e^{\pi i/4})^3 \]
\[ = 2^{3/2}e^{3\pi i/4} \]

Question 2

\[ (x^2 + y^2)^2 = x^2 - y^2 \]
\[ ((r \cos \theta)^2 + (r \sin \theta)^2)^2 = (r \cos \theta)^2 - (r \cos \theta)^2 \]
\[ r^4 = r^2 \cos^2 \theta - r^2 \sin^2 \theta \]
\[ r^2 = \cos^2 \theta - \sin^2 \theta \]

Question 3

One leaf of the graph is given by \( 0 \leq \theta \leq \pi/4 \). Area is

\[ A = \int_0^{\pi/4} \frac{1}{2} \sin^2(4\theta) d\theta \]
\[ = \frac{1}{8} \int_0^\pi \sin^2(u) du \]
\[ = \frac{1}{8} \int_0^\pi \frac{1}{2} - \frac{\cos(2u)}{2} du \]
\[ = \frac{\pi}{16} \]

Question 4

\[ x = 5 \cos(\pi/4) = 5\sqrt{2}/2 \]
\[ y = 5 \sin(\pi/4) = 5\sqrt{2}/2 \]

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Question 1

\[ z = (1 - i)^3 \]
\[ = (\sqrt{2}e^{-\pi i/4})^3 \]
\[ = 2^{3/2}e^{-3\pi i/4} \]
Question 2

Note \( \sin(2\theta) = 2\sin(\theta)\cos(\theta) \).

\[
\begin{align*}
r &= 2\sin(\theta)\cos(\theta) \\
\sqrt{x^2 + y^2} &= 2\sin(\tan^{-1}(y/x))\cos(\tan^{-1}(y/x)) \\
\sqrt{x^2 + y^2} &= \frac{y}{\sqrt{x^2 + y^2}} \frac{x}{\sqrt{x^2 + y^2}} \\
(x^2 + y^2)^{3/2} &= 2xy
\end{align*}
\]

Question 3

\[
\begin{align*}
x &= 6\cos(3\pi/4) = -6\sqrt{2}/2 = -3\sqrt{2} \\
y &= 6\sin(3\pi/4) = 6\sqrt{2}/2 = 3\sqrt{2}
\end{align*}
\]

Question 4

The graph given is a circle of radius 2. The length of the circle is the diameter. \( D = 2\pi r = 4\pi \).

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Question 1

\[
z = (2i)^5 = 32i^5 = 32i = 32e^{\pi i/2}
\]

Question 2

\[
\begin{align*}
(x^2 + y^2)^2 &= x^2 - y^2 \\
((r\cos\theta)^2 + (r\sin\theta)^2)^2 &= (r\cos\theta)^2 - (r\cos\theta)^2 \\
r^4 &= r^2\cos^2\theta - r^2\sin^2\theta \\
r^2 &= \cos^2\theta - \sin^2\theta
\end{align*}
\]

Question 3

\[
\begin{align*}
L &= \int_0^\pi \sqrt{(\sin^2(\theta/2))^2 + (\sin(\theta/2)\cos(\theta/2))^2} d\theta \\
&= \int_0^\pi \sqrt{\sin^2(\theta/2)((\sin^2(\theta/2) + \cos^2(\theta/2))^2} d\theta \\
&= \int_0^\pi \sin(\theta/2) d\theta \\
&= -2\cos(\pi/2) + 2\cos(0) \\
&= 2
\end{align*}
\]
Question 4

\[ x = 4 \cos(-\pi/3) = 4 \frac{1}{2} = 2 \]
\[ y = 4 \sin(-\pi/3) = 4 \frac{-\sqrt{3}}{2} = -2\sqrt{3} \]

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Question 1

\[ z = (-1 - i)^2 \]
\[ = (\sqrt{2} e^{\frac{5\pi i}{4}})^2 \]
\[ = 2 e^{\frac{10\pi i}{4}} \]
\[ = 2 e^{\pi i/2} \]

Question 2

Note \( \sin(2\theta) = 2 \sin(\theta) \cos(\theta) \).

\[ r = 6 \sin(\theta) \cos(\theta) \]
\[ \sqrt{x^2 + y^2} = 6 \sin(\tan^{-1}(y/x)) \cos(\tan^{-1}(y/x)) \]
\[ \sqrt{x^2 + y^2} = 6 \frac{y}{\sqrt{x^2 + y^2}} \frac{x}{\sqrt{x^2 + y^2}} \]
\[ (x^2 + y^2)^{3/2} = 6xy \]

Question 3

\[ A = \int_{-\ln 3}^{0} \frac{1}{2} e^{2\theta} d\theta \]
\[ = \frac{1}{4} e^0 - e^{-2\ln(3)} \]
\[ = \frac{1}{4} - 3^{-2} \]
\[ = \frac{5}{36} \]

Question 4

\[ x = 3 \cos(5\pi/6) = 3 \frac{-\sqrt{3}}{2} = -\frac{3\sqrt{3}}{2} \]
\[ y = 3 \sin(5\pi/6) = 3 \frac{1}{2} = 3/2 \]
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Question 1

\[ z = (3 + 3i)^2 \]
\[ = (\sqrt{18}e^{\pi i/4})^2 \]
\[ = 18e^{2\pi i/4} \]
\[ = 18e^{\pi i/2} \]

Question 2

\[ (r \cos(\theta))^2 + (r \sin(\theta))^2 = 3r \cos(\theta) + 1 \]
\[ r^2 = r \cos(\theta) + 1 \]

Question 3

\[ x = 4 \cos(-5\pi/6) = 4 \frac{-\sqrt{3}}{2} = -2\sqrt{3} \]
\[ y = 4 \sin(-5\pi/6) = 4 \frac{-1}{2} = -2 \]

Question 4

The graph given is a circle of radius 2. The length of the circle is the diameter. \( D = 2\pi r = 4\pi \).

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Question 1

\[ z = (2 - 2i)^2 \]
\[ = (\sqrt{8}e^{-\pi i})^2 \]
\[ = 8e^{-\pi i} \]

Question 2

Note \( \sin(2\theta) = 2 \sin(\theta) \cos(\theta) \).

\[ (x^2 + y^2)^2 = 2x^2 - 2y^2 \]
\[ ((r \cos \theta)^2 + (r \sin \theta)^2)^2 = 2(r \cos \theta)^2 - 2(r \cos \theta)^2 \]
\[ r^4 = 2r^2 \cos^2 \theta - 2r^2 \sin^2 \theta \]
\[ r^2 = 2 \cos^2 \theta - 2 \sin^2 \theta \]
Quiz 1 Answers

Question 3

\[ A = \int_{-\pi/8}^{\pi/8} \frac{1}{2} (2 \cos(4\theta))^2 d\theta \]
\[ = \int_{0}^{\pi/8} 4 \cos^2(4\theta) d\theta \]
\[ = \int_{0}^{\pi/2} \cos^2(u) du \]
\[ = \int_{0}^{\pi/2} \frac{1}{2} + \frac{\cos(2u)}{2} du \]
\[ = \frac{\pi}{4} + \frac{1}{4} \int_{0}^{\pi} \cos(v) dv \]
\[ = \frac{\pi}{4} \]

Question 4

\[ x = 6 \cos(3\pi/4) = 6 \frac{-\sqrt{2}}{2} = -3\sqrt{2} \]
\[ y = 6 \sin(3\pi/4) = 6 \frac{\sqrt{2}}{2} = 3\sqrt{2} \]