

Exercise 1-1 Express the following in the form $a + bi$ (for real a and b) and also in the form $Re^{i\theta}$ (for real R and θ):

- (a) $\frac{1}{3-3i}$
 - (b) $\left(\frac{\sqrt{3}}{2} + \frac{1}{2}i\right)^3$
 - (c) $i^2, i^3, i^4, i^5, \dots$
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Exercise 1-2 Find all solutions of

- (a) $e^z = i$
 - (b) $e^z = 1 + i$
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Exercise 1-3 Find all solutions of

- (a) $z^3 = -1$
 - (b) $z^2 = 4i$
 - (d) $z^2 = -1 + i$
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Exercise 1-4 Verify the following functions $f(z)$ are analytic for all $z = x + iy$. Use the Cauchy-Riemann conditions (Hint: find a way to express these functions as $f(z) = u(x, y) + iv(x, y)$).

- (a) $f(z) = e^z$
 - (b) $f(z) = \cos(z)$
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Exercise 1-5 Find all analytic functions $f = u + iv$ with $u(x, y) = 2xy$. Simplify the expression $f(z)$ as much as possible.
