***Problem* 7.6.** Let $a \neq 0$, b, and c be complex constants. Show that the quadratic equation $a \cdot z^2 + b \cdot z + c = 0$ has one or two roots.

Problem 7.7. Let b and c be complex constants such that $z^2 + b \cdot z + c = 0$ has only real roots. Show that b and c are real.

8. Geometric figures described using complex numbers

***Problem* 8.1.** Sketch and describe the set of complex numbers satisfying $|z| = 2$ without using a calculator.

Answer to 8.1: The circle at $(0, 0)$ of radius 2.

***Problem* 8.2.** Sketch and describe the set of complex numbers satisfying $|z - 1| = 2$ without using a calculator.

Answer to 8.2: The circle at $(1, 0)$ of radius 2.

***Problem* 8.3.** Sketch and describe the set of complex numbers satisfying $|z/2-1| = 2$ without using a calculator.

Answer to 8.3: The circle at $(2, 0)$ of radius 4.

***Problem* 8.4.** Sketch and describe the set of complex numbers satisfying $|2 \cdot z - i| > 4$ without using a calculator.

Answer to 8.4: Outside of the circle at $(0, 1/2)$ of radius 2.

***Problem* 8.5.** Sketch and describe the set of complex numbers satisfying $|2 \cdot z + i| < 4$ without using a calculator.

Answer to 8.5: Inside of the circle at $(0, -1/2)$ of radius 2.

***Problem* 8.6.** Sketch and describe the set of complex numbers satisfying $|z - 2| = |z - 1|$ without using a calculator.

Answer to 8.6: The vertical line passing through $(1.5, 0)$.

***Problem* 8.7.** Sketch and describe the set of complex numbers satisfying $|z - 2 \cdot i| = |z - 1 \cdot i|$ without using a calculator.

Answer to 8.7: The horizontal line passing through $(0, 1.5)$.

***Problem* 8.8.** Sketch and describe the set of complex numbers satisfying $Re(z) = 2$ without using a calculator.

Answer to 8.8: The vertical line passing through $(2, 0)$.

***Problem* 8.9.** Sketch and describe the set of complex numbers satisfying $Re(z) > 2$ without using a calculator.

Answer to 8.9: The half-plane to the right of the vertical line passing through $(2, 0)$.

***Problem* 8.10.** Sketch and describe the set of complex numbers satisfying $Im(z) = 2$ without using a calculator.

Answer to 8.10: The horizontal line passing through $(0, 2)$.

***Problem* 8.11.** Sketch and describe the set of complex numbers satisfying $Im(z) < 2$ without using a calculator.

Answer to 8.11: The half-plane below the horizontal line passing through $(0, 2)$.

***Problem* 8.12.** Sketch and describe the set of complex numbers satisfying $Re(2/z) = 1$ without using a calculator.

Answer to 8.12: The circle at $(1, 0)$ of radius 1 minus origin.

***Problem* 8.13.** Sketch and describe the set of complex numbers satisfying $Im(2/z) = 1$ without using a calculator.

Answer to 8.13: The circle at $(0, -1)$ of radius 1 minus origin.

***Problem* 8.14.** Sketch and describe the set of complex numbers satisfying $Re(2/(z-1)) = 1$ without using a calculator.

Answer to 8.14: The circle at $(2,0)$ of radius 1 minus $(1,0)$.

***Problem* 8.15.** Sketch and describe the set of complex numbers satisfying $Im(2/(z-1)) = 1$ without using a calculator.

Answer to 8.15: The circle at $(1,-1)$ of radius 1 minus $(1,0)$.

***Problem* 8.16.** Sketch and describe the set of complex numbers satisfying $|2 \cdot z/(z+3)| = 1$ without using a calculator.

Answer to 8.16: The circle at $(1, 0)$ of radius 2.

***Problem* 8.17.** Sketch and describe the set of complex numbers satisfying $|(z+4)/(z+1)| = 2$ without using a calculator.

Answer to 8.17: The circle at $(0,0)$ of radius 2.

***Problem* 8.18.** Suppose $a \neq 0$ and b are complex constants. Show that $Im(a \cdot z + b) = 0$ is the equation of a straight line on the plane. Can every straight line be expressed by such an equation?

Math Dept, University of Tennessee, Knoxville, TN 37996-1300, USA
E-mail address: dydak@math.utk.edu