1. Use mathematical induction to prove that $\overline{z^n} = \overline{z}^n$ for all $n \geq 1$, where z is a complex number.

2. Let $p(x) = 6x^3 + kx^2 - (6+5i)x + 4 + 2i$, where k is an unknown complex number. It is given that $z_0 = -\frac{1}{2} - \frac{1}{2}i$ is a zero of $p(x)$.

   (a) Find the value of k.

   (b) Is $\overline{z_0}$ also a zero of $p(x)$? Justify your answer.

   (c) Does your answer in (b) contradict Theorem 3.5 on Page 28 of the textbook? Explain.

   (d) Find all zeros of $p(x)$.

3. Given that $2 - 3i$ is a zero of $f(x) = 2x^5 - 9x^4 + 32x^3 - 24x^2 + 38x - 39$, find all zeros of $f(x)$.

4. For each of the following polynomials:

   (a) Use Descartes' rules of signs to state the number of possible positive and negative zeros of the polynomial.

   (b) Use the bounds theorem to find bounds for zeros of the polynomial.

   (c) Taking the results of (a) and (b) into account, use the rational root theorem to list all possible rational zeros of the polynomial.

   (d) Find all roots of the equation.

   (1) $p(x) = 24x^5 + 32x^4 - 26x^3 - 22x^2 + 6x + 4$

   (2) $p(x) = 4x^5 + 20x^4 + 37x^3 + 52x^2 + 43x + 12$

5. Consider the polynomial $f(x) = 2015^2 + \sum_{n=1}^{2015} (-1)^n n^2 x^n$

   (a) Show that $f(x)$ must have at least one positive real root.

   (b) Show that $f(x)$ has no negative real roots.

   (c) Show that if x is any root of $f(x)$, then $|x| < 2$.

1.
Sketch the region bounded between the curves $y = \sin x$, $y = \cos x$, $x = 0$, $x = 2\pi$. Find the area of this region.

2.
Let R be the region bounded by the graphs of $y = x$ and $x = 4y - y^2$. Which is greater, the volume of the solid generated when R is revolved about the x-axis or the y-axis ?

3.
Sketch the region R bounded by the curves $y = x^2$ and $y = \sqrt{x}$ between $x = 0$ and $x = 1$. Set up, but **DO NOT EVALUATE**, integrals that can be used to find the volume of the solid generated if R is revolved about the x-axis

(a) using cylindrical shells,

(b) using disks or washers.

4.
Evaluate.

(a) $\int (x^2 - 2x)e^{kx}\,dx$ (hint: use integration by part)

(b) $\int e^{2x} \sin 3x\,dx$ (hint: use integration by part)

(c) $\int \sqrt{\sin x} \cos^3 x\,dx$

(d) $\int \sin^6 x\,dx$.