# Math 135: Intermediate Algebra 

## Worksheet 9

Dec 6, 2007

1. A fighter jet can fly 300 miles per hour faster by using afterburners in addition to its regular engines. The jet flies 300 miles from an aircraft carrier using both the engines and the afterburners, and then 300 miles back using just engines. The trip takes a total of 50 minutes.
(a) Write algebraic expressions for the jet's speed both with and without afterburners. (Hint: this problem will be easier if you convert everything to minutes and miles per minute.)
(b) Write algebraic expressions for the time taken for each part of the trip.
(c) Use your answer for (b) to solve for the jet's speed when it uses just engines.
2. It is possible to treat complex numbers just like coordinates and plot them in something called the complex plane. To do this, we just treat the real part as the $x$ coodinate and the imaginary part as the $y$ coordinate. For example, the number $3+2 i$ would be placed as $(3,2)$.
(a) Plot the following points in the complex plane:

| Point | Value |
| :---: | :---: |
| A | $3-4 i$ |
| B | $5 i$ |
| C | $-3-4 i$ |

Use the graph below:

(b) The absolute value of a complex number $z=x+y i$ is defined as $|z|=\sqrt{x^{2}+y^{2}}$. Find the absolute value of points $\mathrm{A}, \mathrm{B}$, and C .
(c) Give a geometric interpretation of what the absolute value of a complex number means. Hint: the formula for absolute value should look very similar to another formula you know.
(d) On your drawing of the complex plane, draw the set of all complex numbers whose absolute value is 5 . What shape is this, and why?
3. Division of complex numbers also means something in the complex plane.
(a) For the point $A$ from the previous problem, compute $A / i$. Do the same for points $B$ and $C$.
(b) Draw each of the points you just found on your graph of the complex plane above. Be sure to label each point.
(c) Compute the absolute value of each point you just found. How do they compare to the absolute values of the original points?
(d) How do the points you just drew relate to the original points $A, B$, and $C$ geometrically? In other words, have the points been stretched, have they moved relative to each other, have they rotated, etc.? Based on this, give a geometric description of what it means to divide by $i$.
4. Two pumps working together require 4 hours to fill a swimming pool. Working alone, it would take the smaller pump 15 hours longer than the larger pump to fill the pool.
(a) Write expressions for the rate of work for the small pump and the large pump.
(b) Write expressions for the total part of the pool filled by each pump.
(c) Use your answer to part (b) to figure out how long each pump would have taken on its own.

