

Math 120 – Teamwork # 8

You may write your work here, on the back, or on another sheet of paper. Please box your answers. Round to three decimal places where necessary.

1. Let $z = -3 + 6i$ and $w = -12 - 9i$.

- a. Use the FOIL method to find the product $z \cdot w$ and rationalizing to find $\frac{z}{w}$.

[show work]

- b. Convert z and w into polar form, $r(\cos \theta + i \sin \theta)$. [Be careful of the quadrants!]

- c. Use the *polar form product formula* to find $z \cdot w$. Use the *polar form quotient formula* to find $\frac{z}{w}$. Leave your answers in polar form.

- d. Convert your answers to [c] back into rectangular form, $a + bi$. What do you notice?

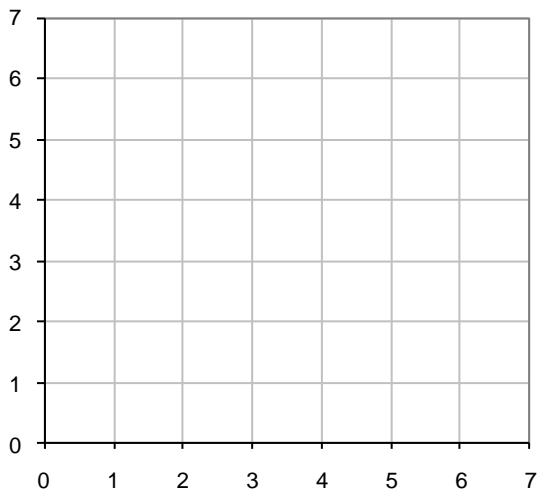
2. Compute the following using de Moivre's theorem. Convert your answers to rectangular $a + bi$ form.

a. $\left[3(\cos 15^\circ + i \sin 15^\circ)\right]^4$

b. $(-5 - 5i)^9$ [Hint: first convert $-5 - 5i$ into polar form]

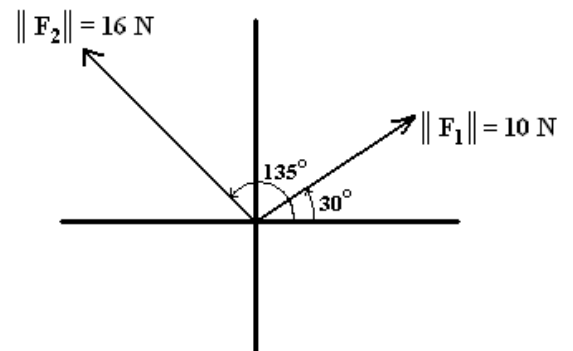
3. A video game shows a monster on the screen at $(6, 2)$. As part of the game, the monster needs to be rotated through an angle of 20° about the origin in a counter-clockwise direction. Assume the origin is the lower left-hand corner of the screen. Here's how to find the monster's new location:

- a. **Step 1:** Below is a diagram of the screen. Label the original point of where the monster is located. Find the magnitude and angle of the vector from the origin to the point $(6, 2)$. Give magnitude in exact, simplified form and angle in DMS format.



- b. **Step 2:** The new location of the monster will have the same magnitude from the origin as the previous one, but with an angle 20° larger. Calculate the new angle and write the answer in DMS format.
- c. **Step 3:** Use the vector formulas to find the x - and y -coordinates of the new location of the monster (round to three decimal places). [SHOW WORK]
- d. **Step 4:** Sketch the new position vector of the monster on the graph above. Be sure to label which is which.
- e. **Step 5:** Use the dot product and the cosine formula to verify that the angle between these two vectors is indeed 20° .

4. Two forces of magnitude 10 newtons (N) and 16 N act on an object at angles 30° and 135° , as shown, such that $\vec{F}_1 = 10\angle 30^\circ$ and $\vec{F}_2 = 16\angle 135^\circ$.



- a. Convert the two forces from polar form to rectangular, unit vector form, $a\vec{i} + b\vec{j}$. Give exact values for a and b .
- b. Add the two vectors together to find the resultant force. Leave your answer in rectangular form, $a\vec{i} + b\vec{j}$, but round a and b to three decimal places (keep the exact values stored in your calculator).
- c. Convert the answer to [b] back into polar form. What is the magnitude and direction of the resultant force? [Give the magnitude rounded to three decimal places and the angle in DMS form.]