**Read Me First:** *Show all essential work neatly. Use correct notation when presenting your computations. Write using complete sentences. In particular, be very careful when using "=", **equals**, and "⇒", **implies**. Do not "box" your answers. Communicate.*

1. (15 pts.) Identify each of the following polar equations as completely as possible by transforming each equation to rectangular coordinates. [These are fairly easy!!]

(a) $r = 5$

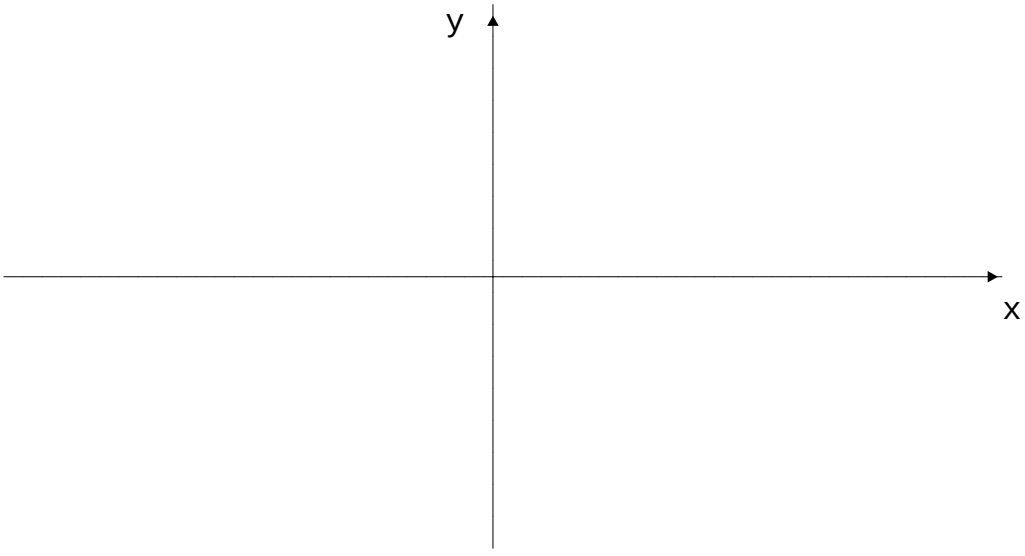
(b) $r = 2 \cdot \cos(\theta)$

(c) $\theta = (3/4)\pi$

(d) $r \cdot \sin(\theta) = -4$

(e) $r \cdot \sin(\theta) = r \cdot \cos(\theta)$

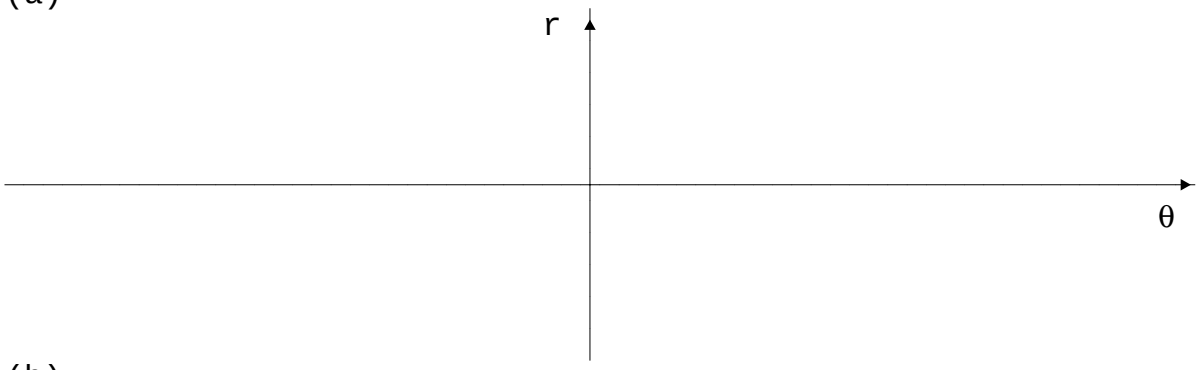
2. (10 pts.) Very carefully sketch the graph of the equation $(y + 1)^2 = -4(x - 2)$ below.



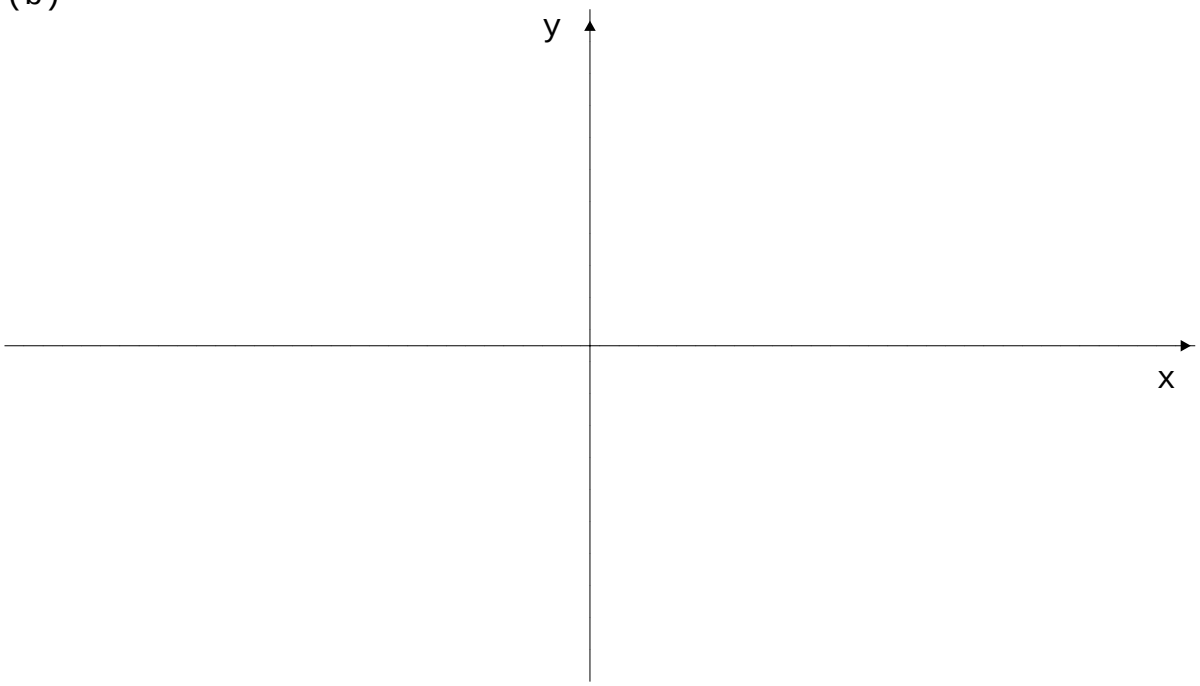
3. (15 pts.) Sketch the given curve in polar coordinates. Do this as follows: (a) Carefully sketch the auxiliary curve, a rectangular graph on the coordinate system provided. (b) Then translate this graph to the polar one.

**Equation:** $r = 2 \cdot \sin(2\theta)$

(a)




(b)




4. (10 pts.) Write each expression in the standard form a + bi.

(a) $(4 + 5i) + (-8 + 2i) =$

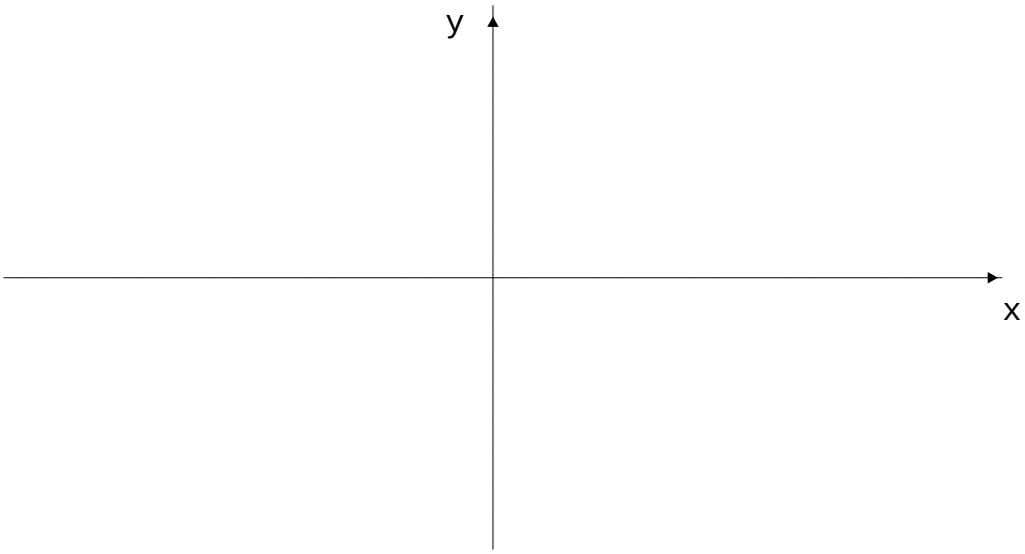
(b) $13/(5 - 12i) =$

(c) $6i^3 - 4i^5 =$

(d) $(4 + 5i) \cdot (-8 + 2i) =$

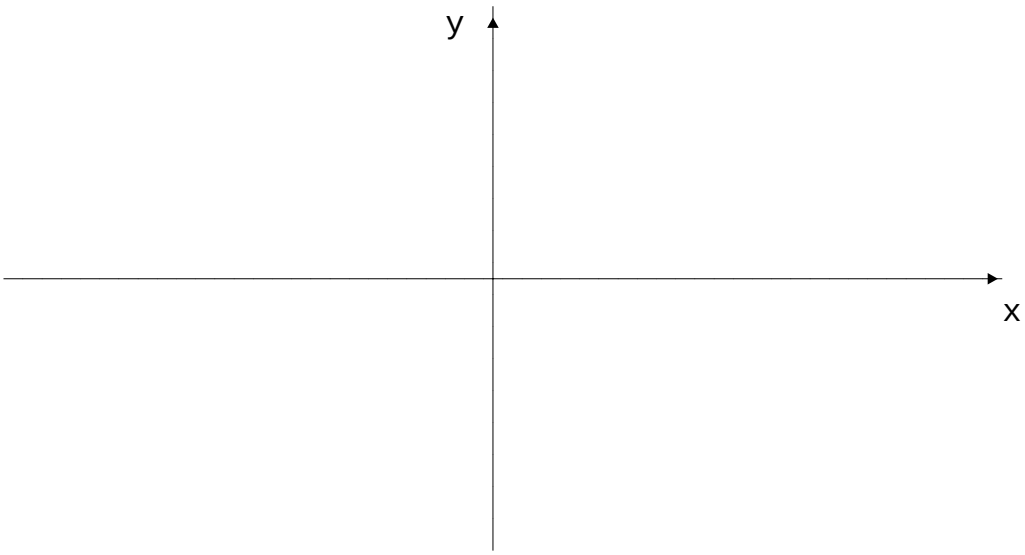
(e) $[4(\cos 30° + i \cdot \sin 30°)]^4 =$

5. (10 pts.) Very carefully sketch the graph of the equation $(1/4)(x - 3)^2 + (1/9)(y + 1)^2 = 1$ below.




6. (5 pts.) Solve the following equation in the complex number system: $x^4 + 3 \cdot x^2 - 4 = 0$

7. (10 pts.) Very carefully sketch the graph of the equation $(x + 1)^2 - (y + 2)^2 = 1$ below.



8. (5 pts.) Find all the complex fourth roots of $3^{1/2} - i$. Leave your answer in polar form with the arguments given in degrees.

9. (6 pts.) Suppose $\mathbf{v} = 3\mathbf{i} - 5\mathbf{j}$ and $\mathbf{w} = -2\mathbf{i} + 3\mathbf{j}$. Then

(a) $2\mathbf{v} + 3\mathbf{w} =$

(b) $\|\mathbf{v}\| =$

(c) Find the unit vector $\mathbf{u}$ having the same direction as $\mathbf{w}$.

$\mathbf{u} =$

10. (4 pts.) An airplane has an airspeed of 400 miles per hour in an easterly direction. If the wind velocity is 45 miles per hour in a north westerly direction, find the speed of the airplane relative to the ground.

11. (10 pts.) (a) Obtain an equation for the parabola with focus at (-2,0) and directrix the line x = 2.

(b) Obtain an equation for the ellipse with foci at (0,+3) and (0,-3) and x-intercepts of 2 and -2.

(c) Obtain an equation for the hyperbola with center at (-3,1), focus at (-3,6) and vertex at (-3,4).