(4) $4x^2 + 4y^2 + 16x - 8y - 5 = 0$

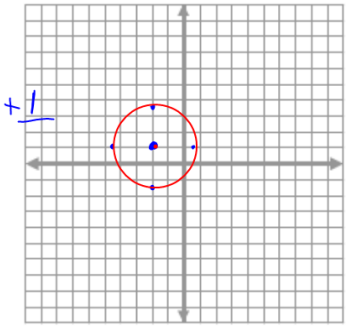
$\frac{4}{4}$

$x^2+4x+\underline{4}+y^2-2y+\underline{1} = \frac{5}{4}+\underline{4}+\underline{1}$

$(x+2)^2 + (y-1)^2 = \frac{25}{4}$

center $(-2, 1)$

radius $\frac{5}{2}$



(8) $4x^2 + 9y^2 - 8x + 36y + 4 = 0$

$4(x^2-2x+\underline{1}) + 9(y^2+4y+\underline{4}) = -4+\underline{4(1)}+\underline{9(4)}$

$4(x-1)^2 + 9(y+2)^2 = 36$

$\frac{36}{36}$

$\frac{(x-1)^2}{9} + \frac{(y+2)^2}{4} = 1$

center $(1, -2)$

vertices $(4, -2)$ $(-2, -2)$ $(1, 0)$ $(1, -4)$

foci $(1 \pm \sqrt{5}, -2)$

$h = 1$

$k = -2$

$a = 3$

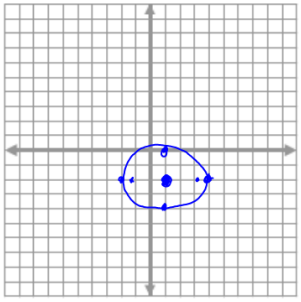
$b = 2$

$c = \sqrt{5}$

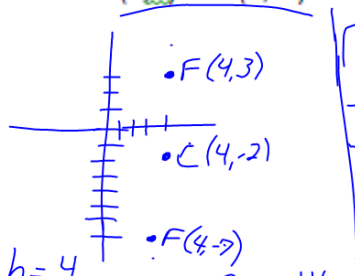
$c^2 = 9 - 4$

$c^2 = 5$

$c = \sqrt{5}$



(9) foci at (4,3) and (4,-7) and the length of the major axis is 14.



$h = 4$
$k = -2$
$a = 7$
$b = 2\sqrt{6}$
$c = 5$

$2a = 14$
$a = 7$

midpoint → center
$\left(\frac{4+4}{2}, \frac{3+-7}{2}\right)$

$\frac{(y+2)^2}{49} + \frac{(x-4)^2}{24} = 1$

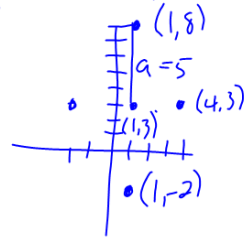
center $(4, -2)$

vertices $(4, 5)(4, -9)$
$(4 \pm 2\sqrt{6}, -2)$

$25 = 49 - b^2$
$b^2 = 24$
$b = 2\sqrt{6}$

7. Write the equation of the ellipse that has center (1,3), the major axis is parallel to the y-axis, one vertex is (1,8), and $b = 3$. Then list the coordinates of the other vertices and the foci.

$h = 1$
$k = 3$
$a = 5$
$b = 3$
$c = 4$



$\frac{(x-1)^2}{9} + \frac{(y-3)^2}{25} = 1$

vertices $(1,8)(1,-2)$
$(4,3)(-2,3)$

foci $(1,7)(1,-1)$

$c^2 = 25 - 9$
$c^2 = 16$
$c = 4$