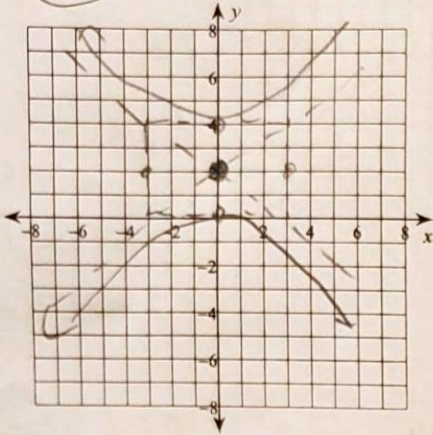


# Hyperbolas Graphing and properties

Identify the vertices, foci, and asymptotes of each. Then sketch the graph.

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



center: (0, 2)

$a^2 = 4$      $a = 2$

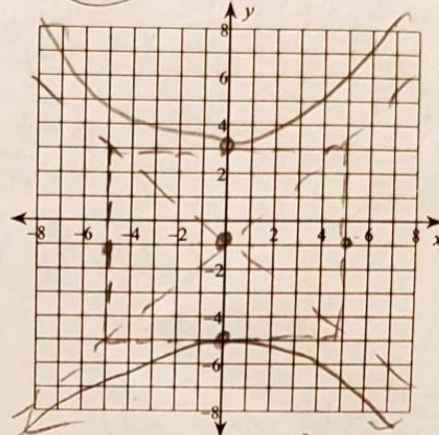
$b^2 = 9$      $b = 3$

V: (0, 4), (0, 0)

CV: (3, 2), (-3, 2)

$c = \sqrt{a^2 + b^2} = \sqrt{4 + 9} = \sqrt{13}$   
 $F: (0, 2 \pm \sqrt{13})$

2)  $\frac{(y+1)^2}{16} - \frac{x^2}{25} = 1$



center: (0, -1)

$a^2 = 16$      $a = 4$

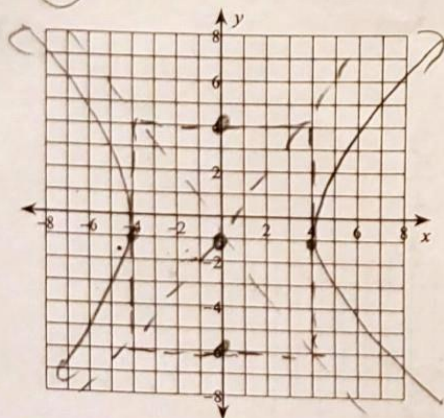
$b^2 = 25$      $b = 5$

V: (0, 3), (0, -5)

CV: (5, -1), (-5, -1)

$c = \sqrt{a^2 + b^2} = \sqrt{16 + 25} = \sqrt{41}$   
 $F: (0, -1 \pm \sqrt{41})$

3)  $\frac{x^2}{25} - \frac{(y+1)^2}{16} = 1$



center: (0, -1)

$a^2 = 25$      $a = 5$

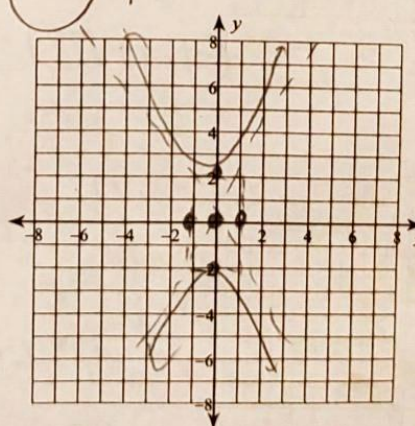
$b^2 = 16$      $b = 4$

V: (4, -1), (-4, -1)

CV: (0, 4), (0, -6)

$c = \sqrt{a^2 + b^2} = \sqrt{25 + 16} = \sqrt{41}$   
 $F: (0 \pm \sqrt{41}, -1)$  or  $(\pm \sqrt{41}, -1)$

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



center: (0, 0)

$a^2 = 4$      $a = 2$

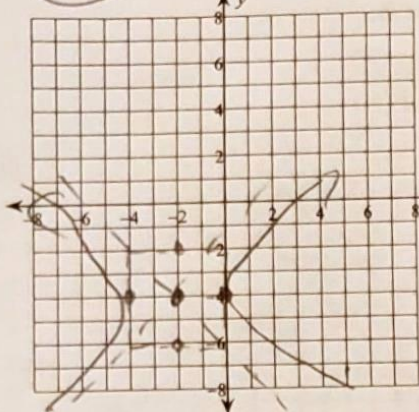
$b^2 = 1$      $b = 1$

V: (0, 2), (0, -2)

CV: (-1, 0), (1, 0)

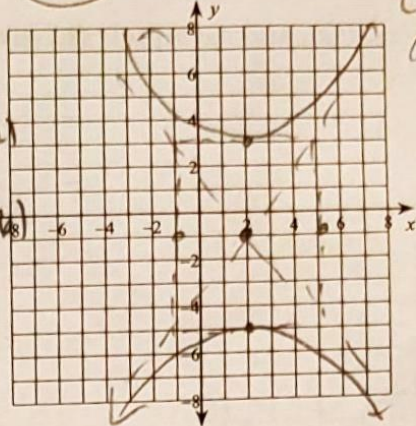
$c = \sqrt{a^2 + b^2} = \sqrt{4 + 1} = \sqrt{5}$   
 $F: (0, 0 \pm \sqrt{5})$  or  $(\pm \sqrt{5}, 0)$

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



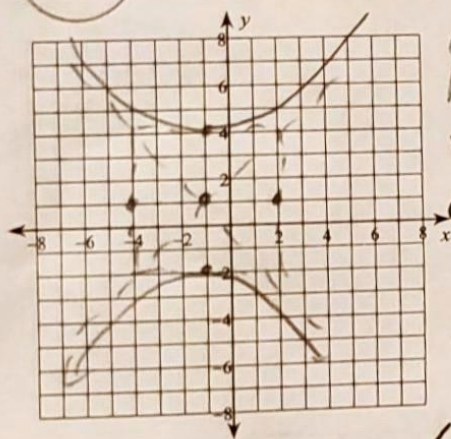
$C: (-2, -4)$   
 $a^2 = 4 \quad a = 2$   
 $b^2 = 1 \quad b = 1$   
 $V: (-4, -4), (0, -4)$   
 $CV: (-2, -2), (-2, -6)$   
 $F: c^2 = \sqrt{4+1}$   
 $c = \pm\sqrt{5}$   
 $(-2 \pm \sqrt{5}, -4)$

$$6) \frac{(y+1)^2}{16} - \frac{(x-2)^2}{9} = 1$$



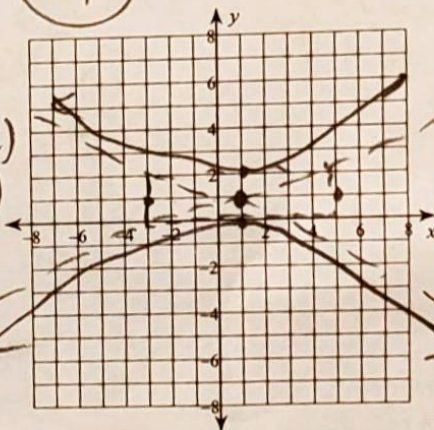
$C: (2, -1)$   
 $a^2 = 16 \quad a = 4$   
 $b^2 = 9 \quad b = 3$   
 $V: (2, 3), (2, -5)$   
 $CV: (5, -1), (-1, -1)$   
 $F: c^2 = \sqrt{16+9}$   
 $c = \pm 5$   
 $(2, -1 \pm 5)$   
 $(2, -6), (2, 4)$

$$7) \frac{(y-1)^2}{9} - \frac{(x+1)^2}{9} = 1$$



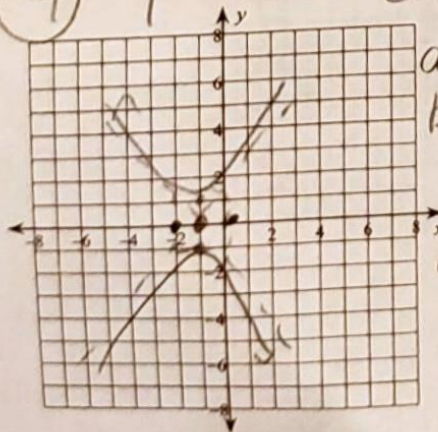
$C: (-1, 1)$   
 $a^2 = 9 \quad a = 3$   
 $b^2 = 9 \quad b = 3$   
 $V: (-1, 4), (-1, -2)$   
 $CV: (2, 1), (-4, 1)$   
 $F: c^2 = \sqrt{18}$   
 $c = \pm\sqrt{18}$   
 $(-1, 1 \pm \sqrt{18})$

$$8) \frac{(x-1)^2}{1} - \frac{(y-1)^2}{16} = 1$$



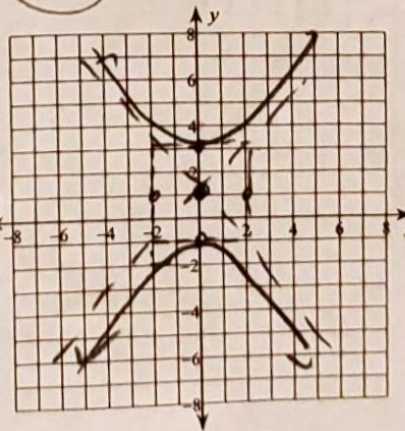
$C: (1, 1)$   
 $a^2 = 1 \quad a = 1$   
 $b^2 = 16 \quad b = 4$   
 $V: (1, 2), (1, 0)$   
 $CV: (5, 1), (-3, 1)$   
 $F: c^2 = \sqrt{17}$   
 $c = \pm\sqrt{17}$   
 $(1, 1 \pm \sqrt{17})$

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



$C: (-1, 0)$   
 $a^2 = 1 \quad a = 1$   
 $b^2 = 1 \quad b = 1$   
 $V: (-1, 1), (-1, -1)$   
 $CV: (-2, 0), (0, 0)$   
 $F: c^2 = \sqrt{2}$   
 $c = \pm\sqrt{2}$   
 $(-1, 0 \pm \sqrt{2})$   
 $(-1, \pm\sqrt{2})$

$$10) \frac{(y-1)^2}{4} - \frac{x^2}{4} = 1$$



$C: (0, 1)$   
 $a^2 = 4 \quad a = 2$   
 $b^2 = 4 \quad b = 2$   
 $V: (0, 3), (0, -1)$   
 $CV: (2, 1), (-2, 1)$   
 $c^2 = \sqrt{8}$   
 $F: (0, 1 \pm \sqrt{8})$