College Algebra CHS

Name Key

Hyperbolas

Date

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

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

x first = left/right

center $(-1,-1)$

$a=4$ $b=4$

foci: $(-1+4\sqrt{2},-1)$ $(-1-4\sqrt{2},-1)$

$c^2-4^2=4^2$

$c^2=32$

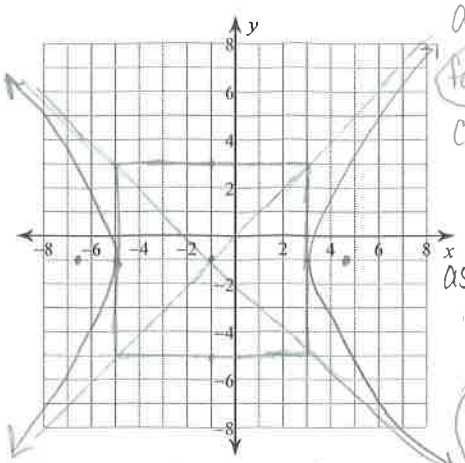
$c=4\sqrt{2}$

asymptotes:

$y=-1\pm\frac{4}{4}(x+1)$

$y=x$

$y=-x-2$



vertices major x

$(-1+4,-1)$ = $(3,-1)$

$(-1-4,-1)$ $(-5,-1)$

2) $\frac{(y-\frac{3}{2})^2}{25} - \frac{x^2}{20} = 1$ $\frac{y^2}{25} - \frac{x^2}{20} = 1$

center $(0,0)$

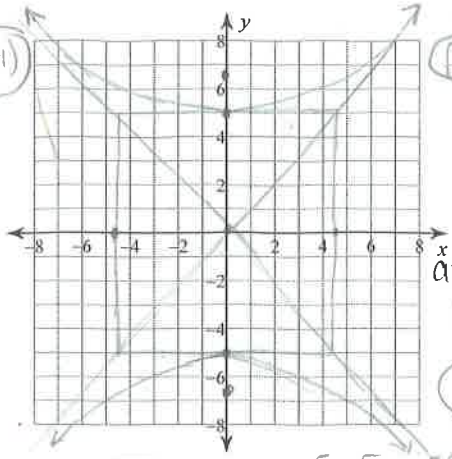
$a=2\sqrt{5}$ $b=5$

foci: $(0,3\sqrt{5})$ $(0,-3\sqrt{5})$

$c^2-20=25$

$c^2=45$

$c=3\sqrt{5}$



asymptotes:

$y=0\pm\frac{5}{2\sqrt{5}}(x-0)$

$y=\frac{\sqrt{5}}{2}x$

$y=-\frac{\sqrt{5}}{2}x$

$\frac{5}{2\sqrt{5}}\cdot\frac{\sqrt{5}}{\sqrt{5}}=\frac{5\sqrt{5}}{2\cdot 5}=\frac{\sqrt{5}}{2}$

vertices

$(0,5)$ $(0,-5)$

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

center $(-1,0)$

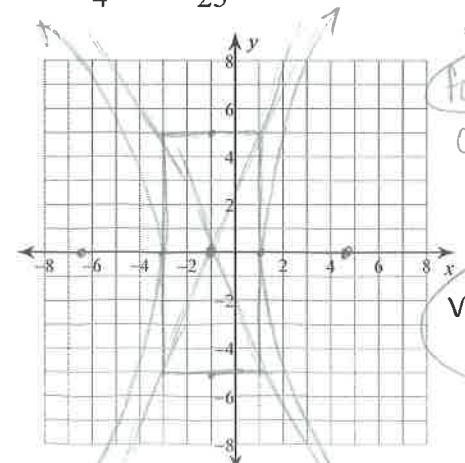
$a=2$ $b=5$

foci: $(-1+\sqrt{29},0)$ $(-1-\sqrt{29},0)$

$c^2-4=25$

$c^2=29$

$c=\sqrt{29}$



vertices

$(1,0)$ $(-3,0)$

asymptotes: $y=\frac{5}{2}x+\frac{5}{2}$; $y=\frac{-5}{2}x-\frac{5}{2}$

$y=0\pm\frac{5}{2}(x+1)$

4) $\frac{x^2}{16} - \frac{(y-1)^2}{4} = 1$

center $(0,1)$

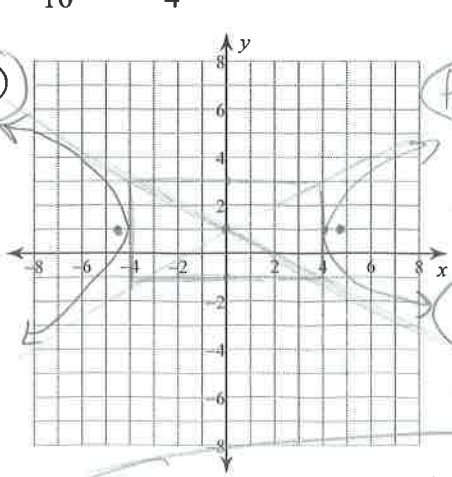
$a=4$ $b=2$

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

$c^2-16=4$

$c^2=20$

$c=2\sqrt{5}$



vertices

$(4,1)$ $(-4,1)$

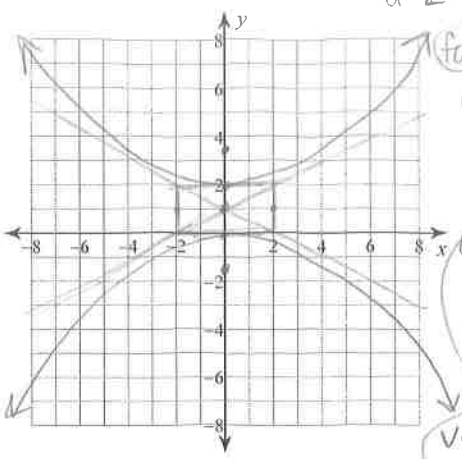
asymptotes: $y=\frac{1}{2}x+1$; $y=\frac{-1}{2}x+1$

$y=1\pm\frac{2}{4}(x-0)$

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

center (0,1)

$a=2 \quad b=1$



foci: $(0, 1+\sqrt{5})(0, 1-\sqrt{5})$

$c^2-4=1$

$c^2=5$

$c=\sqrt{5}$

asymptotes:

$y=\frac{1}{2}x+1$

$y=-\frac{1}{2}x+1$

vertices

(0,2)(0,0)

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

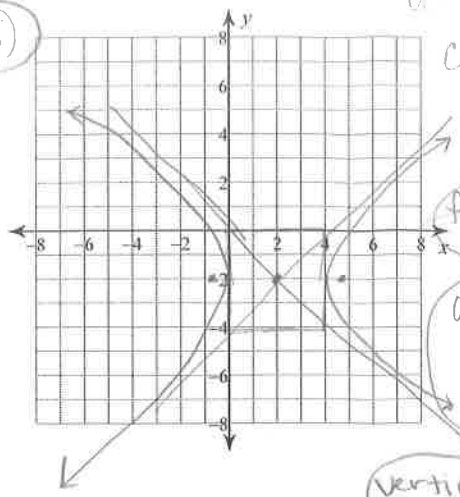
center (2,-2)

$a=2 \quad b=2$

$c^2=4+4$

$c^2=8$

$c=2\sqrt{2}$



foci: $(2-2\sqrt{2}, -2)$ $(2+2\sqrt{2}, -2)$

asymptotes:

$y=x-4$

$y=-x$

vertices

(4,-2)(0,-2)

Use the information provided to write the standard form equation of each hyperbola.

7) $-x^2 + y^2 - 4x - 18y + 61 = 0$

$-x^2-4x \quad +y^2-18y \quad = -61$

$-1(x^2+4x+4-4)+y^2-18y+81-81=-61$

$-(x+2)^2+4+(y-9)^2-81=-61$ $-4+81$

$(y-9)^2-(x+2)^2=16$

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

8) $25x^2 - y^2 - 100x + 14y - 49 = 0$

$25x^2-100x \quad -y^2+14y \quad =49$

$25(x^2-4x+4-4)-(y^2-14y+49-49)=49$ $+100$ -49

$25(x-2)^2-(y-7)^2=100$

$\frac{(x-2)^2}{4} - \frac{(y-7)^2}{100} = 1$

9) $-4x^2 + 9y^2 + 8x + 90y - 355 = 0$

$-4x^2+8x \quad +9y^2+90y \quad =355$

$-4(x^2-2x+1-1)+9(y^2+10y+25-25)=355$ -4 $+225$

$9(y+5)^2-4(x-1)^2=576$

$\frac{(y+5)^2}{64} - \frac{(x-1)^2}{144} = 1$

10) $-9x^2 + 4y^2 + 18x + 80y + 247 = 0$

$-9x^2+18x \quad +4y^2+80y \quad =-247$ -9 $+400$

$-9(x^2-2x+1-1)+4(y^2+20y+100-100)=-247$

$4(y+10)^2-9(x-1)^2=144$

$\frac{(y+10)^2}{36} - \frac{(x-1)^2}{16} = 1$

11) Vertices: (8, 10), (2, 10)
Foci: (10, 10), (0, 10)

major = x

center $\left(\frac{8+2}{2}, \frac{10+10}{2}\right)$

(5, 10)

$a=3 \quad c=5$

$c^2-a^2=b^2$

$25-9=b^2$

$16=b^2$

$b=4$

$\frac{(x-5)^2}{9} - \frac{(y-10)^2}{16} = 1$

12) Vertices: (7, –9), (1, –9)
Foci: (9, –9), (–1, –9)

major = x

center $\left(\frac{7+1}{2}, \frac{-9-9}{2}\right)$

(4, -9)

$25-9=b^2$

$b=4$

$a=3 \quad c=5$

$\frac{(x-4)^2}{9} - \frac{(y+9)^2}{16} = 1$

13) Vertices: (7, 0), (7, –16)
Foci: $(7, -8+2\sqrt{41}), (7, -8-2\sqrt{41})$

major = y

center $\left(\frac{7+7}{2}, \frac{0-16}{2}\right)$

(7, -8)

$a=8 \quad c=2\sqrt{41}$

$164-64=b^2$

$100=b^2$

$b=10$

$\frac{(y+8)^2}{64} - \frac{(x-7)^2}{100} = 1$

14) Vertices: (5, 10), (–7, 10)
Foci: $(-1+\sqrt{61}, 10), (-1-\sqrt{61}, 10)$

major = x

center $\left(\frac{5-7}{2}, \frac{10+10}{2}\right)$

(-1, 10)

$a=6 \quad c=\sqrt{61}$

$61-36=b^2$

$25=b^2$

$5=b$

$\frac{(x+1)^2}{36} - \frac{(y-10)^2}{25} = 1$