9.1 The Ellipse

1) **Exercise Set 9.1 # 15 pg 930** **Graph: $4x^2 + 16y^2 = 64$** 1) _____

Divide both sides of the equation by 64.

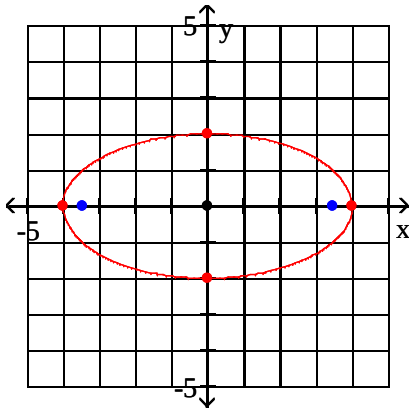
$\frac{x^2}{16} + \frac{y^2}{4} = 1$ The center is: (0, 0). $a^2 = 16 \rightarrow a = 4$; $b^2 = 4 \rightarrow b = 2$

The vertices are: (–4, 0) and (4, 0).

The endpoints of the minor axis are: (0, –2) and (0, 2).

$c^2 = a^2 - b^2 = 16 - 4 = 12 \rightarrow c = \sqrt{12} = 2\sqrt{3}$

The foci are $(-2\sqrt{3}, 0)$ and $(2\sqrt{3}, 0)$.



2) **Exercise Set 9.1 # 13 pg 930** **Graph: $25x^2 + 4y^2 = 100$** 2) _____

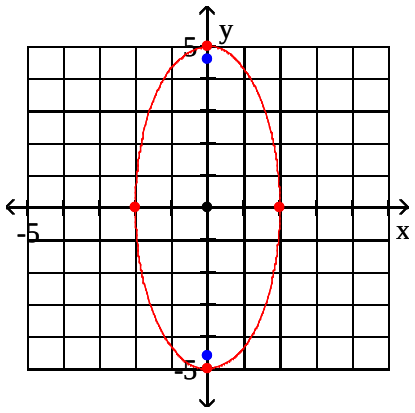
Divide both sides of the equation by 100.

$\frac{x^2}{4} + \frac{y^2}{25} = 1$ The center is: (0, 0). $a^2 = 25 \rightarrow a = 5$; $b^2 = 4 \rightarrow b = 2$

The vertices are: (0, –5) and (0, 5).

The endpoints of the minor axis are: (–2, 0) and (2, 0).

$c^2 = a^2 - b^2 = 25 - 4 = 21 \rightarrow c = \sqrt{21}$ The foci are $(0, -\sqrt{21})$ and $(0, \sqrt{21})$.



3) **Exercise Set 9.1 # 39 pg 931** **Graph: $(x + 3)^2 + 4(y - 2)^2 = 16$** 3) _____

Divide both sides of the equation by 16.

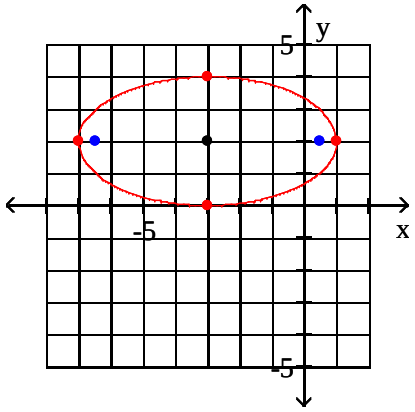
$\frac{(x + 3)^2}{16} + \frac{(y - 2)^2}{4} = 1$ **h = –3 and k = 2 → The center is: (–3, 2).**

$a^2 = 16 \rightarrow a = 4$; $b^2 = 4 \rightarrow b = 2$ The vertices are: (–7, 2) and (1, 2).

The endpoints of the minor axis are: (–3, 4) and (–3, 0).

$c^2 = a^2 - b^2 = 16 - 4 = 12 \rightarrow c = \sqrt{12} = 2\sqrt{3}$

The foci are $(-3 - 2\sqrt{3}, 2)$ and $(-3 + 2\sqrt{3}, 2)$.



4) **Exercise Set 9.1 # 49 pg 931** **Graph: $9(x - 1)^2 + 4(y + 3)^2 = 36$** 4) _____

Divide both sides of the equation by 36.

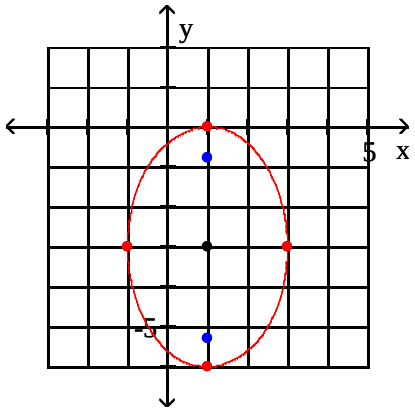
$\frac{(x - 1)^2}{4} + \frac{(y + 3)^2}{9} = 1$ **h = 1 and k = –3 → The center is: (1, –3).**

$a^2 = 9 \rightarrow a = 3$; $b^2 = 4 \rightarrow b = 2$ The vertices are: (1, –6) and (1, 0).

The endpoints of the minor axis are: (–1, –3) and (3, –3).

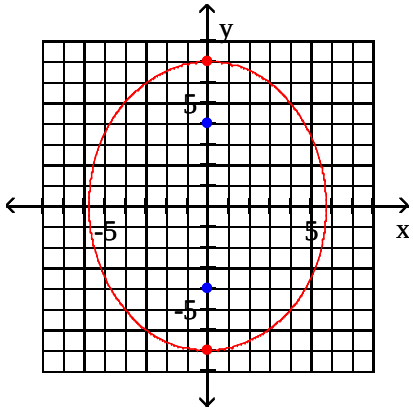
$c^2 = a^2 - b^2 = 9 - 4 = 5 \rightarrow c = \sqrt{5}$

The foci are $(1, -3 - \sqrt{5})$ and $(1, -3 + \sqrt{5})$.



5) **Exercise Set 9.1 # 27 pg 931** 5) _____

Find the standard form of the equation of the ellipse.
Foci: (0, –4), (0, 4) ; vertices: (0, –7), (0, 7)

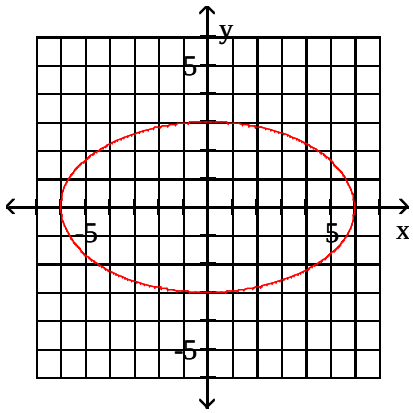


$2a = 14 \rightarrow a = 7$; $c = 4$

$c^2 = a^2 - b^2 \rightarrow b^2 = a^2 - c^2 = 49 - 16 = 33$ The equation is: $\frac{x^2}{33} + \frac{y^2}{49} = 1$

6) **Exercise Set 9.1 # 32 pg 931** 6) _____

Find the standard form of the equation of the ellipse.
Major axis horizontal, length 12 ; length of minor axis = 6 ; center (0, 0).

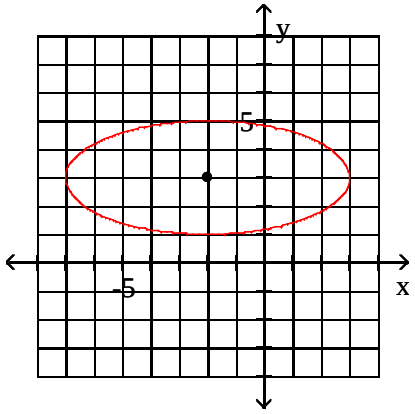


$2a = 12 \rightarrow a = 6$; $2b = 6 \rightarrow b = 3$ The equation is: $\frac{x^2}{36} + \frac{y^2}{9} = 1$

7) **Exercise Set 9.1 # 33 pg 931** 7) _____

Find the standard form of the equation of the ellipse.

Major axis vertical, length 10 ;length of minor axis = 4 ; center (–2, 3).



$2a = 10 \rightarrow a = 5$; $2b = 4 \rightarrow b = 2$ $\quad \frac{(x+2)^2}{4} + \frac{(y-3)^2}{25} = 1$

9.2 The Hyperbola

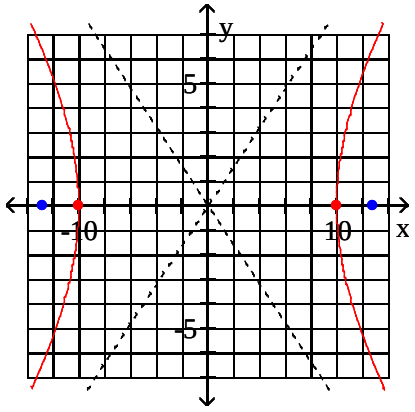
8) **Exercise Set 9.2 # 15 pg 945 Graph:** $\frac{x^2}{100} - \frac{y^2}{64} = 1$ **The center is: (0, 0).** 8) _____

$a^2 = 100 \rightarrow a = 10$; $b^2 = 64 \rightarrow b = 8$; **The vertices are: (–10, 0) and (10, 0).**

$c^2 = a^2 + b^2 = 100 + 64 = 164 \rightarrow c = \sqrt{164} = 2\sqrt{41}$

The foci are $(-2\sqrt{41}, 0)$ **and** $(2\sqrt{41}, 0)$.

The equations of the asymptotes are $y = \pm \frac{4}{5} x$.



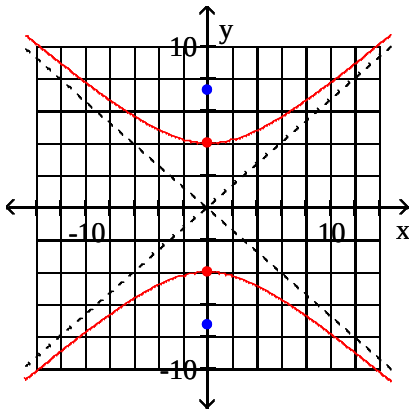
9) **Exercise Set 9.2 # 17 pg 945** **Graph:** $\frac{y^2}{16} - \frac{x^2}{36} = 1$ **The center is: (0, 0).** 9) _____

$a^2 = 16 \rightarrow a = 4$; $b^2 = 36 \rightarrow b = 6$ **The vertices are: (0, –4) and (0, 4).**

$c^2 = a^2 + b^2 = 16 + 36 = 52 \rightarrow c = \sqrt{52} = 2\sqrt{13}$

The foci are $(0, -2\sqrt{13})$ **and** $(0, 2\sqrt{13})$.

The equations of the asymptotes are $y = \pm \frac{2}{3} x$.



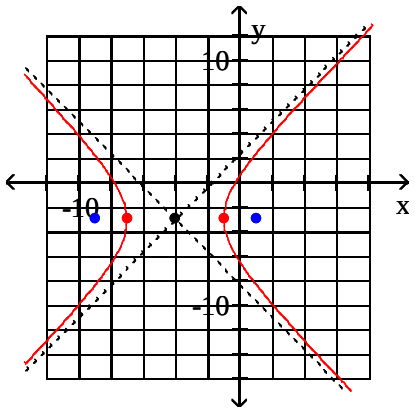
10) **Exercise Set 9.2 # 33 pg 946** **Graph:** $\frac{(x+4)^2}{9} - \frac{(y+3)^2}{16} = 1$ 10) _____

$h = -4$ **and** $k = -3 \rightarrow$ **The center is: (–4, –3).**

$a^2 = 9 \rightarrow a = 3$ $b^2 = 16 \rightarrow b = 4$ **The vertices are: (–7, –3) and (–1, –3).**

$c^2 = a^2 + b^2 = 9 + 16 = 25 \rightarrow c = 5$ **The foci are (–9, –3) and (1, –3).**

The equations of the asymptotes are $y + 3 = \pm \frac{4}{3}(x + 4)$.



11) **Exercise Set 9.2 # 37 pg 946** **Graph:** $\frac{(y+2)^2}{4} - \frac{(x-1)^2}{16} = 1$ 11) _____

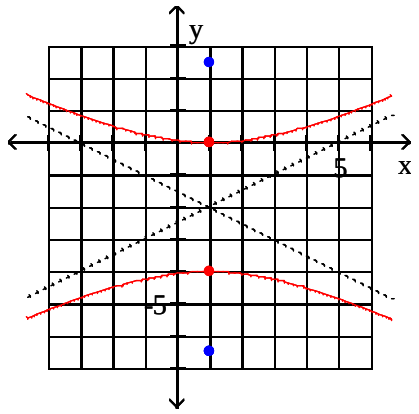
$h = 1$ and $k = -2 \rightarrow$ The center is: $(1, -2)$.

$a^2 = 4 \rightarrow a = 2$; $b^2 = 16 \rightarrow b = 4$ The vertices are: $(1, -4)$ and $(1, 0)$.

$c^2 = a^2 + b^2 = 4 + 16 = 20 \rightarrow c = \sqrt{20} = 2\sqrt{5}$

The foci are $(1, -2 - 2\sqrt{5})$ and $(1, -2 + 2\sqrt{5})$.

The equations of the asymptotes are $y + 2 = \pm\frac{1}{2}(x - 1)$.



Find the standard form of the equation of the hyperbola satisfying the given conditions.

12) **Exercise Set 9.2 # 5 pg 945** **Foci: (0, –3), (0, 3) ; vertices: (0, –1), (0, 1)** 12) _____

$a = 1$; $c = 3$ $c^2 = a^2 + b^2 \rightarrow b^2 = c^2 - a^2 = 9 - 1 = 8$

The transverse axis is vertical. The equation is: $\frac{y^2}{1} - \frac{x^2}{8} = 1$

13) **Exercise Set 9.2 # 12 pg 945** **Center: (–2, 1) ; Focus: (–2, 6) ; Vertex: (–2, 4)** 13) _____

$a = (k + a) - k = 4 - 1 = 3.$ $c = (k + c) - k = 6 - 1 = 5.$

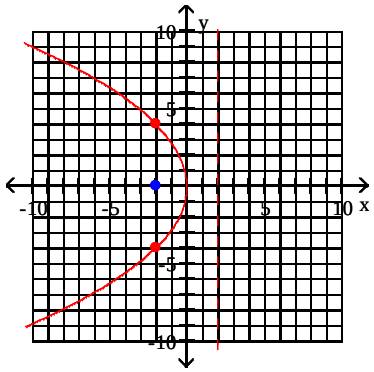
$c^2 = a^2 + b^2 \rightarrow b^2 = c^2 - a^2 = 25 - 9 = 16.$

The transverse axis is vertical. The equ ation is: $\frac{(y-1)^2}{9} - \frac{(x+2)^2}{16} = 1$

9.3 The Parabola

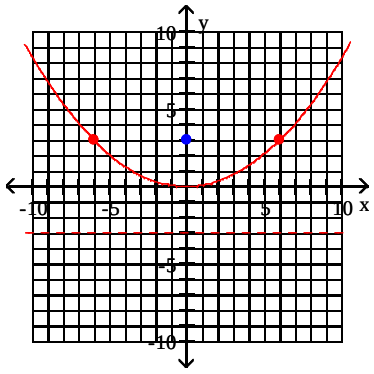
14) **Exercise Set 9.3 #7 pg 958** Graph: $y^2 = -8x$ 14) _____

$4p = -8 \rightarrow p = -2$ The focus is $(-2, 0)$. The directrix is $x = 2$.
The length of the latus rectum is $|4p| = |-8| = 8$.
The latus rectum extends 4 units below and 4 units above the focus.
The endpoints of the latus rectum are $(-2, 4)$ and $(-2, -4)$.



15) **Exercise Set 9.3 #9 pg 958** Graph: $x^2 = 12y$ 15) _____

$4p = 12 \rightarrow p = 3$ The focus is $(0, 3)$. The directrix is $y = -3$.
The length of the latus rectum is $|4p| = |12| = 12$.
The latus rectum extends 6 units to the right and 6 units to the left of the focus. The endpoints of the latus rectum are $(-6, 3)$ and $(6, 3)$.



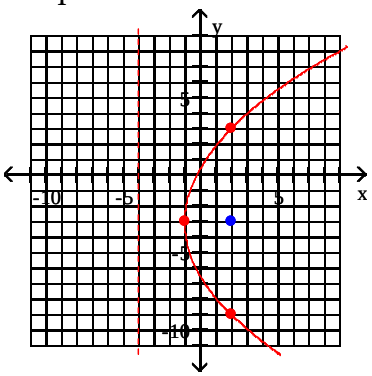
16) **Exercise Set 9.3 #39 pg 958** Graph: $(y + 3)^2 = 12(x + 1)$ 16) _____

$h = -1$ and $k = -3$ The vertex is $(-1, -3)$.

$4p = 12 \rightarrow p = 3$ The focus is $(2, -3)$. The directrix is $x = -4$.

The length of the latus rectum is $|4p| = |12| = 12$.

The latus rectum extends 6 units above and 6 units below the focus. The endpoints of the latus rectum are $(2, 3)$ and $(2, -9)$.



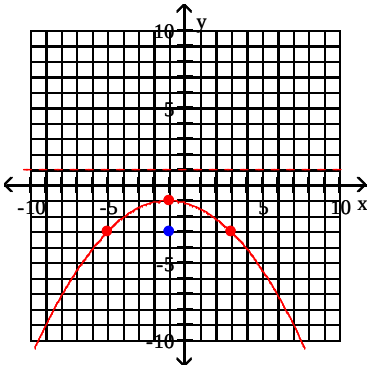
17) **Exercise Set 9.3 #37 pg 958** Graph: $(x + 1)^2 = -8(y + 1)$ 17) _____

$h = -1$ and $k = -1$ The vertex is $(-1, -1)$.

$4p = -8 \rightarrow p = -2$ The focus is $(-1, -3)$. The directrix is $y = 1$.

The length of the latus rectum is $|4p| = |-8| = 8$.

The latus rectum extends 4 units to the right and 4 units to the left of the focus. The endpoints of the latus rectum are $(3, -3)$ and $(-5, -3)$.



Find the standard form of the equation of the parabola using the information given.

18) **Exercise Set 9.3 #17 pg 958** **Focus: (7, 0) ; Directrix: x = –7.** 18) _____

$-p = -7 \rightarrow p = 7$; $y^2 = 4px \rightarrow y^2 = 28x$.

19) **Exercise Set 9.3 #26 pg 958** **Vertex: (5, –2); Focus: (7, –2).** 19) _____

Axis of symmetry is horizontal. **$p = (h + p) - h = 7 - 5 = 2$**

$(y - k)^2 = 4p(x - h) \rightarrow (y + 2)^2 = 8(x - 5)$.

20) **Exercise Set 9.3 #29 pg 958** **Focus: (–3, 4); Directrix: y = 2.** 20) _____

Axis of symmetry is vertical. **k – p = 2 and k + p = 4**

→ 2k = 6 → k = 3 ; p = 4 – k = 4 – 3 = 1

$(x - h)^2 = 4p(y - k)$ → $(x + 3)^2 = 4(y - 3)$.