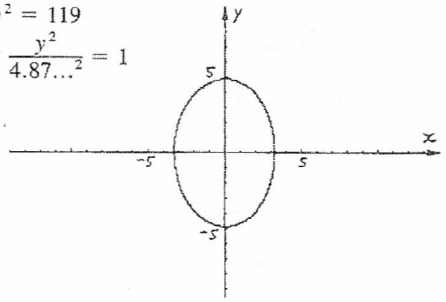
14. $11x^2 + 5y^2 = 119$

$$\frac{x^2}{3.28\ldots^2} + \frac{y^2}{4.87\ldots^2} = 1$$



15. *Critical Points for Ellipses or Circles*

For $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$,

a = distance from origin to graph in the x-direction.

b = distance from origin to graph in the y-direction.

16. *Critical Points for Hyperbolas*

For $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$,

a = distance from origin to graph in the x-direction.

For $-\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$,

b = distance from origin to graph in the y-direction.

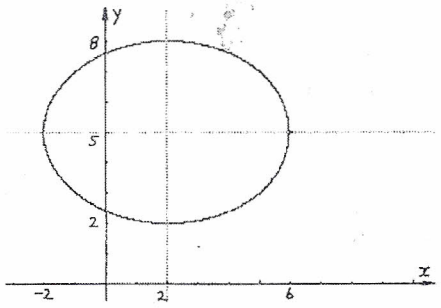
For both equations, $\pm b/a$ are the slopes of the asymptotes.

EXERCISE 12-3, page 370; Dilated and Translated Conics

1. $9x^2 + 16y^2 - 36x - 160y + 292 = 0$

$9(x^2 - 4x + 4) + 16(y^2 - 10y + 25) = 144$

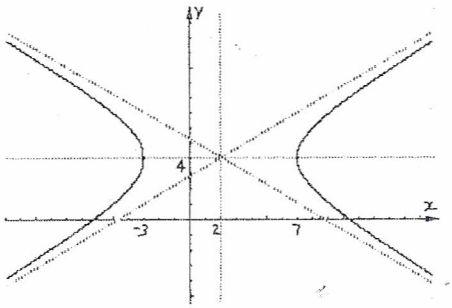
$\left(\frac{x-2}{4}\right)^2 + \left(\frac{y-5}{3}\right)^2 = 1$



2. $9x^2 - 25y^2 - 36x + 200y - 589 = 0$

$9(x^2 - 4x + 4) - 25(y^2 - 8y + 16) = 225$

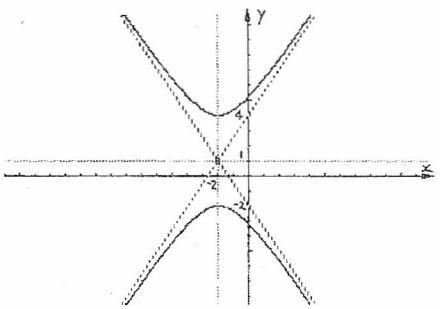
$\left(\frac{x-2}{5}\right)^2 - \left(\frac{y-4}{3}\right)^2 = 1$



3. $9x^2 - 4y^2 + 36x + 8y + 68 = 0$

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

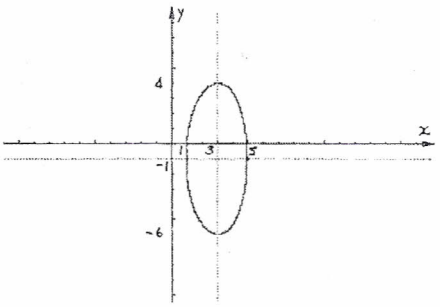
$-\left(\frac{x+2}{2}\right)^2 + \left(\frac{y-1}{3}\right)^2 = 1$



4. $25x^2 + 4y^2 - 150x + 8y + 129 = 0$

$25(x^2 - 6x + 9) + 4(y^2 + 2y + 1) = 100$

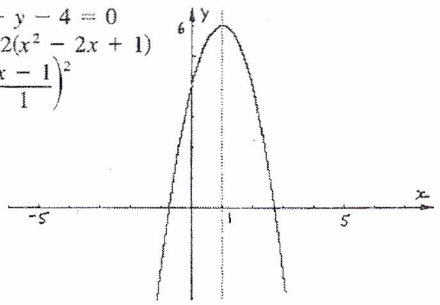
$\left(\frac{x-3}{2}\right)^2 + \left(\frac{y+1}{5}\right)^2 = 1$



5. $2x^2 - 4x + y - 4 = 0$

$y - 6 = -2(x^2 - 2x + 1)$

$\frac{y-6}{-2} = \left(\frac{x-1}{1}\right)^2$



6. $x^2 + 6x - 4y + 17 = 0$

$4y - 8 = x^2 + 6x + 9$

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