Final
The final is cumulative, study practice exams 1-5. Bring scratch paper. There is not much room for work. Come 5 minutes early to fill out my teacher evaluation.

Second degree equations such as $x^2 + xy + y^2 = 1$ which involve a product of $x$ and $y$ are also parabolas, ellipses and hyperbolas but their axes may be slanted rather than horizontal or vertical. The simplest example is $xy = 1$. Solving for $y$ gives $y = \frac{1}{x}$. The graph is

Here the focal axis of the hyperbola is the major diagonal $y = x$. You won’t be asked to find such slanted axes.

Check your graphs by calculating the $x$ and $y$ intercepts.
Classifying parabolas, ellipses, and hyperbolas.

If there is an $x$ along with an $x^2$, combine the two into a perfect square $(x \pm a)^2$. Replace $x \pm a$ with $x$ to get the unshifted graph. Likewise for $y$.

Write in one of the following forms possibly with shifts.

- Horizontal parabola: $y^2 = kx$ only $y$ is squared.
- Horizontal parabola: $x^2 = ky$ only $x$ is squared.
- Horizontal ellipse: \[
\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ with } a \geq b > 0. \text{ Bigger first.}
\]
- Vertical ellipse: \[
\frac{y^2}{a^2} + \frac{x^2}{b^2} = 1 \text{ with } a \geq b > 0.
\]
- Horizontal hyperbola: \[
\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1. \text{ Positive first.}
\]
- Vertical hyperbola: \[
\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1.
\]

- $4x^2 - \frac{y^2}{3} = 1$
- $x^2 + y = 2$
- $y^2 + 4x^2 - 8x = 0$
Frequently missed problems from the last final

- \( y = \ln(-3 - x) - 2. \)
  (a) Find the asymptote.
  (b) Find the domain.
  (c) Graph.

- Given: \( \tan \theta = \sqrt{a} \), \( \pi < \theta < \frac{3\pi}{2} \).
  Write \( \cos(\theta/2) \) in terms of \( a \).

- Prove: \( \cos^2 \theta - \sin^2 \theta = \frac{1-\tan^2\theta}{1+\tan^2\theta} \)

- Find the exact value of \( \sin^{-1}(\sin \frac{5\pi}{7}) \).

- Find the polar coordinates of the point with rectangular coordinates \((-\sqrt{3}, -3)\).

- Convert the polar equation to a rectangular equation:
  \( \sin^2 \theta - 2 \cos^2 \theta = 3 \). Assume \( r \neq 0 \).

The most missed problem.

- Find the area of a triangle with sides 2, 3, 4.