

## Identifying Conic Sections and Rotation of Axes

Period \_\_\_\_\_

Identify each of the following conic sections, without completing the square, as either a circle, ellipse, parabola, or hyperbola. **AC**

1)  $25x^2 - 10x - 200y - 119 = 0$

$(25)(0) = 0$

**Parabola**

3)  $4x^2 + 3y^2 + 8x - 24y + 51 = 0$

$4(3) = 12$

 $A \neq C$  **Ellipse**

5)  $4x^2 - 8x + 36y^2 - 72y + 4 = 0$

$4(36) = 144$

 $A \neq C$  **Ellipse**

2)  $4x^2 + 4y^2 - 16y + 15 = 0$

$(4)(4) = 16$

 $A = C$  **Circle**

4)  $7x^2 - 2y^2 + 14x - 32y - 8 = 0$

$(7)(-2) = -14$

**Hyperbola**

6)  $x^2 - 2y^2 + 4 = 0$

$1(-2) = -2$

**Hyperbola**

Identify each of the following rotated conic sections as either a circle, ellipse, parabola, or hyperbola.  **$B^2 - 4AC$**

7)  $36x^2 - 60xy + 25y^2 + 9y = 0$

$(-60)^2 - 4(36)(25) = 0$

**Parabola**

9)  $16x^2 - 24xy + 9y^2 - 30x - 40y = 0$

$(-24)^2 - 4(16)(9) = 0$

**Parabola**

11)  $8x^2 + 8xy + 2y^2 + 80x - 60y = 0$

$(8)^2 - 4(8)(2) = 0$

**Parabola**

13)  $3x^2 + 8xy + 4y^2 - 7 = 0$

$(8)^2 - 4(3)(4) = 16$

**Hyperbola**

8)  $x^2 - 6xy - 5y^2 + 4x - 22 = 0$

$(-6)^2 - 4(1)(-5) = 56$

**Hyperbola**

10)  $2x^2 + 4xy + 5y^2 + 3x - 4y - 20 = 0$

$(4)^2 - 4(2)(5) = -24$

**Ellipse/Circle**

12)  $6x^2 - 5xy + 2y^2 + 18x - 13y - 7 = 0$

$(-5)^2 - 4(6)(2) = -23$

**Ellipse/Circle**

14)  $x^2 + 3xy + y^2 + 2x - 8y + 3 = 0$

$(3)^2 - 4(1)(1) = 5$

**Hyperbola**

Identify each of the following conic sections as either a circle, ellipse, parabola, or hyperbola. Also, determine the angle through which the axes are rotated (radians and degrees)

Exact if possible  $B^2 - 4AC$   $\tan 2\theta = \frac{B}{A-C}$

15)  $8x^2 + xy + 7y^2 + 3x - 2y - 1 = 0$

$(1)^2 - 4(8)(7) = -223$

**E/C**

$\tan 2\theta = \frac{1}{8-7} = 1$

$2\theta = \frac{\pi}{4}$

$\theta = \frac{\pi}{8} ; 22.5^\circ$

17)  $9x^2 - 12xy + 4y^2 + x - y - 12 = 0$

$(-12)^2 - 4(9)(4) = 0$

**Parabola**

$\theta = -33.7^\circ$   
 $-.59$

$\tan 2\theta = \frac{-12}{9-4} = -\frac{12}{5}$

$2\theta = -67.4^\circ$   
 $2\theta = -1.18$

19)  $5\sqrt{3}x^2 - 6xy + 7\sqrt{3}y^2 + 7 = 0$

$(-6)^2 - 4(5\sqrt{3})(7\sqrt{3}) = -384$

**E/C**

$\tan 2\theta = \frac{-6}{5\sqrt{3} - 7\sqrt{3}} = \frac{3}{\sqrt{3}}$

$2\theta = \frac{\pi}{3}$   $\theta = \frac{\pi}{6} ; 30^\circ$

21)  $5x^2 + 7xy + 5y^2 - 6x + 4y - 1 = 0$

$(7)^2 - 4(5)(5) = -51$

**E/C**

$\tan 2\theta = \frac{7}{5-5} = \text{und.}$

$2\theta = \frac{\pi}{2}$

$\theta = \frac{\pi}{4} ; 45^\circ$

23)  $13x^2 + 72xy - 11y^2 - 5x + 7y - 11 = 0$

$(72)^2 - 4(13)(-11) = 5756$

**Hyperbola**

$\theta = 35.8^\circ ; .62$

$\tan 2\theta = \frac{72}{13+11} = 3$

$2\theta = 71.6^\circ$

$2\theta = 1.25$

16)  $-3\sqrt{3}x^2 - 3xy - 6\sqrt{3}y^2 - 5 = 0$

$(-3)^2 - 4(-3\sqrt{3})(0) = 9$

**Hyp**

$\tan 2\theta = \frac{-3}{-3\sqrt{3}-0} = \frac{-3}{-3\sqrt{3}} = \frac{1}{\sqrt{3}}$

$2\theta = \frac{\pi}{6}$

$\theta = \frac{\pi}{12} ; 15^\circ$

18)  $9x^2 - 2\sqrt{3}xy + 7y^2 - 8x + 2y - 54 = 0$

$(-2\sqrt{3})^2 - 4(9)(7) = -240$

**C/E**

$\tan 2\theta = \frac{-2\sqrt{3}}{9-7} = -\sqrt{3}$

$2\theta = -\frac{\pi}{3}$

$\theta = -\frac{\pi}{6} ; -30^\circ$

20)  $2x^2 - 3xy - 4y^2 + 5x - 6y - 7 = 0$

$(-3)^2 - 4(2)(-4) = 41$

**Hyperbola**

$\tan 2\theta = \frac{-3}{2+4} = -\frac{1}{2}$

$2\theta = -26.6$   
 $2\theta = -.46$

$\theta = -13.3^\circ$   
 $-.23$

22)  $2\sqrt{3}x^2 - 4xy - 2\sqrt{3}y^2 - 85 = 0$

$(-4)^2 - 4(2\sqrt{3})(-2\sqrt{3}) = 64$

**Hyperbola**

$\tan 2\theta = \frac{-4}{2\sqrt{3}+2\sqrt{3}} = -\frac{1}{\sqrt{3}}$

$2\theta = -\frac{\pi}{6}$

$\theta = -\frac{\pi}{12} ; -15^\circ$

24)  $x^2 - 6xy + 9y^2 - 2y + 1 = 0$

$(-6)^2 - 4(1)(9) = 0$

**Parabola**

$\tan 2\theta = \frac{-6}{1-9} = \frac{3}{4}$

$2\theta = 36.9^\circ$

$2\theta = .64$

$\theta = 18.4^\circ$   
 $.32$