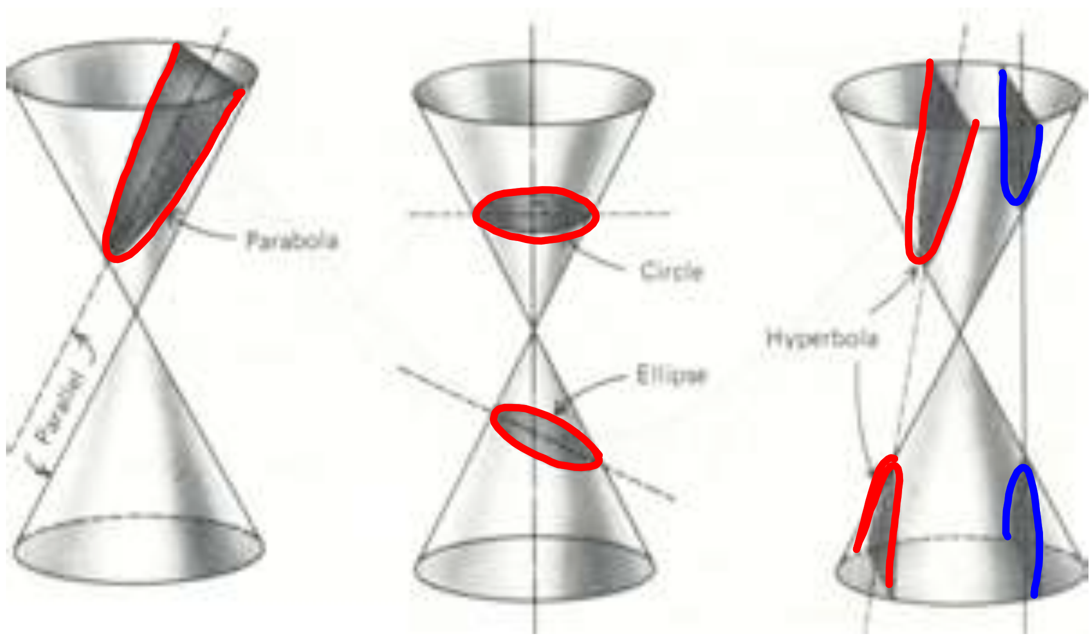
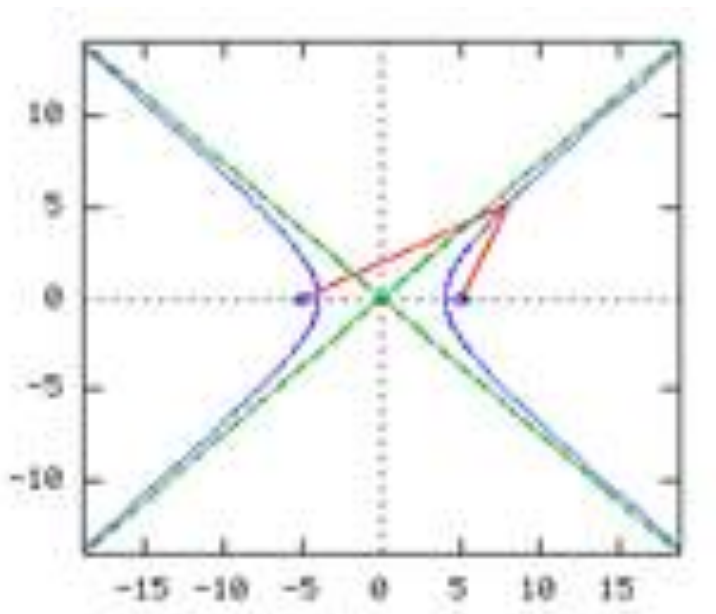
HAT

Hyperbolas

2/13/18


Parabola
Parallel
Circle
Ellipse
Hyperbola

This curve is the locus of points such that the difference of the distances to two foci is constant.




St. Louis Science Center
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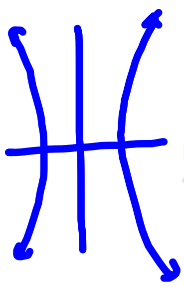
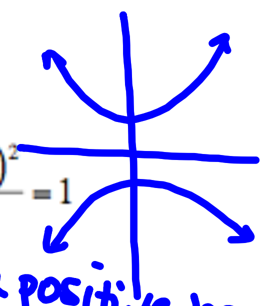
A hyperbola is the set of all points in a plane such that the difference of the distances to two fixed points (called foci) is a constant.

The equation of a hyperbola is



$$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1 \quad \text{or} \quad \frac{(y-k)^2}{a^2}-\frac{(x-h)^2}{b^2}=1$$



a^2 is always the denom. of the positive term.

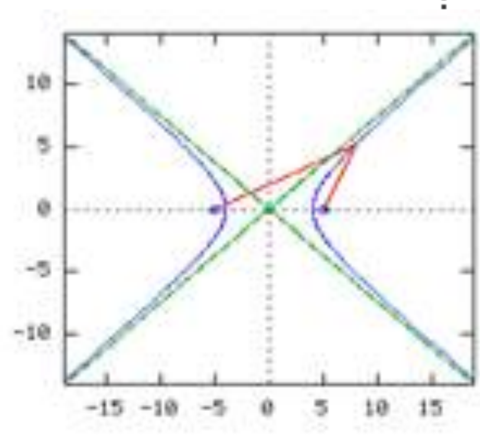
where (h, k) is the center and

the asymptotes are determined by the values of a and b.

linear

The distance from the center to eac

$$c^2 = a^2 + b^2.$$



Example #1: Graph the hyperbola with the equation. Label the foci with coordinates. Write equations from the asymptotes.

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

Center: (2, -5)

a = 3 b = 4

Equations of Asymptotes

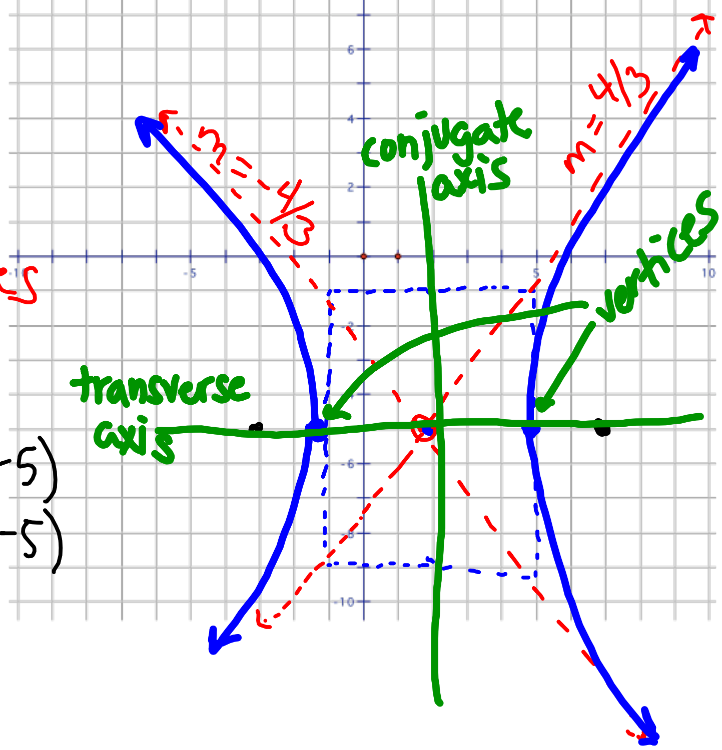
$(y+5) = \pm \frac{4}{3}(x-2)$

$c^2 = 9 + 16$

$c = 5$

Foci: (7, -5)
(-3, -5)

eccentricity: $e = \frac{5}{3}$



Find the coordinates of the vertices and foci, and the equations for the asymptotes for the hyperbola. Then graph the hyperbola. Find the eccentricity.

$$16x^2 - 9y^2 - 128x - 18y + 103 = 0$$

$$16x^2 - 128x \quad - 9y^2 - 18y = -103$$

$$16(x^2 - 8x + \underline{16}) - 9(y^2 + 2y + \underline{1}) = -103 \; +256 \; -9$$

$$(x-4)(x-4) \qquad (y+1)(y+1)$$

$$\frac{16(x-4)^2}{144} - \frac{9(y+1)^2}{144} = \frac{144}{144}$$

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

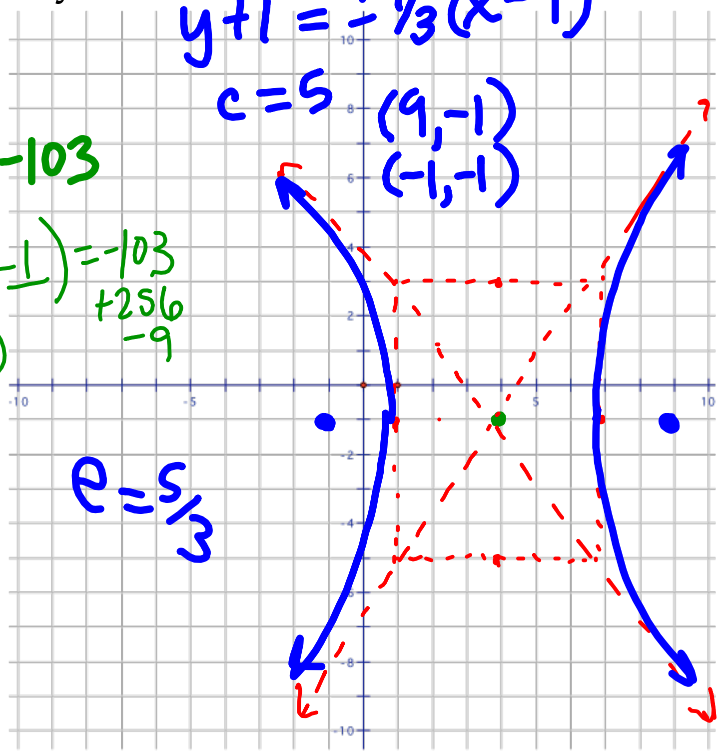
$$y+1 = \pm \tfrac{4}{3}(x-4)$$

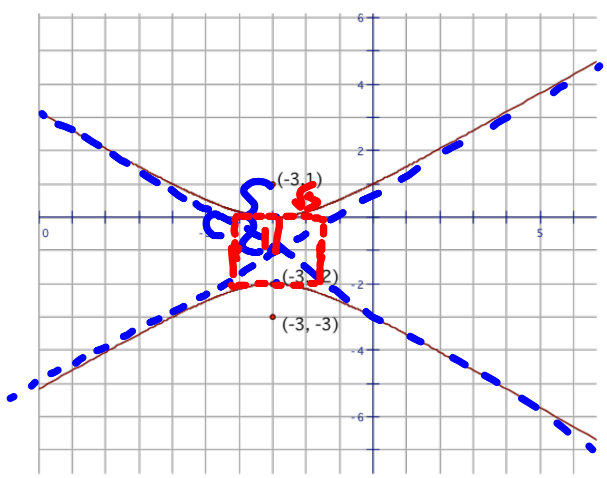
$c = 5$

$(9,-1)$

$(-1,-1)$

$e = 5/3$





center: $(-3,-1)$

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

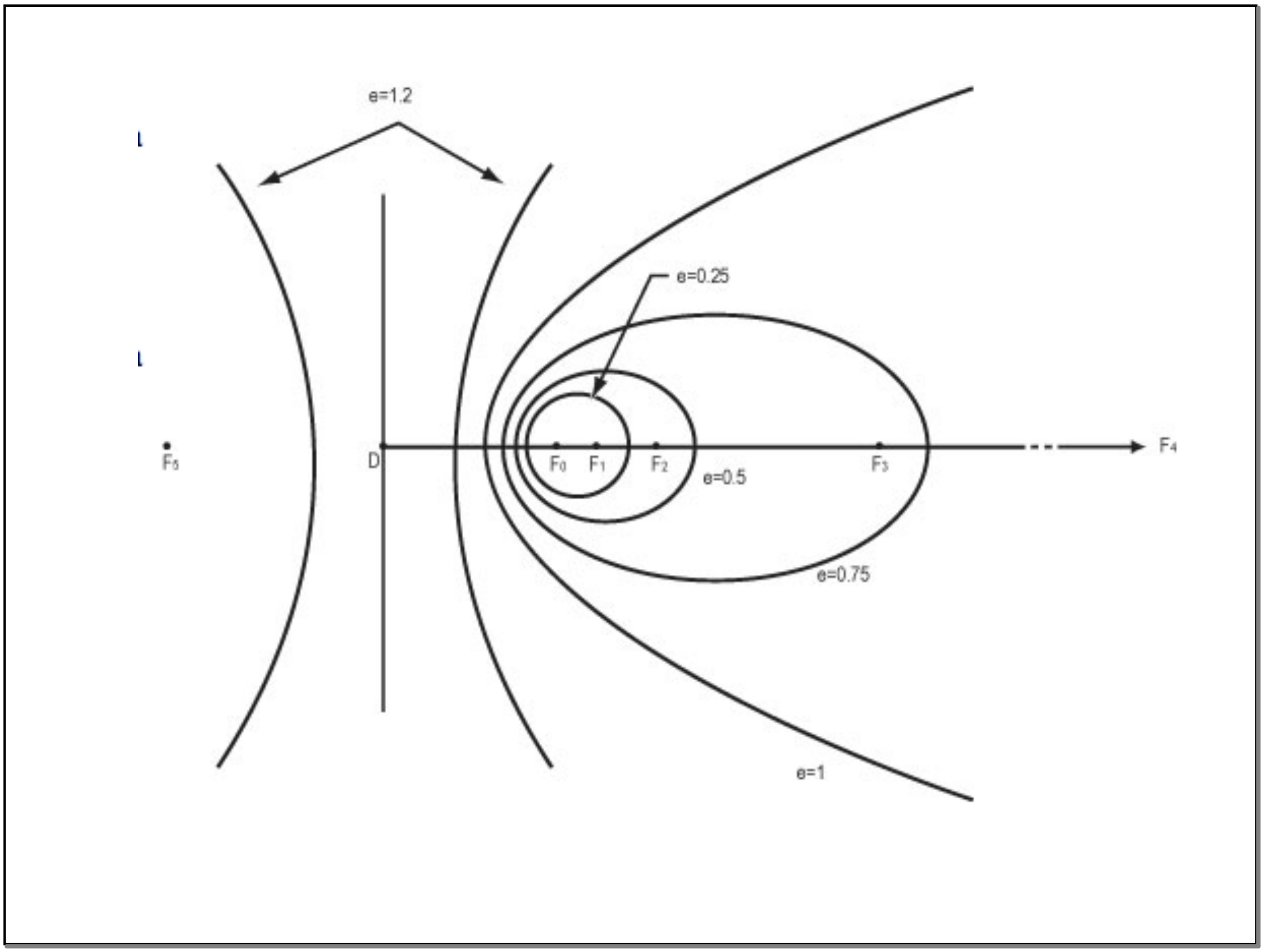
$e=2$

$a=1 \quad c=2$

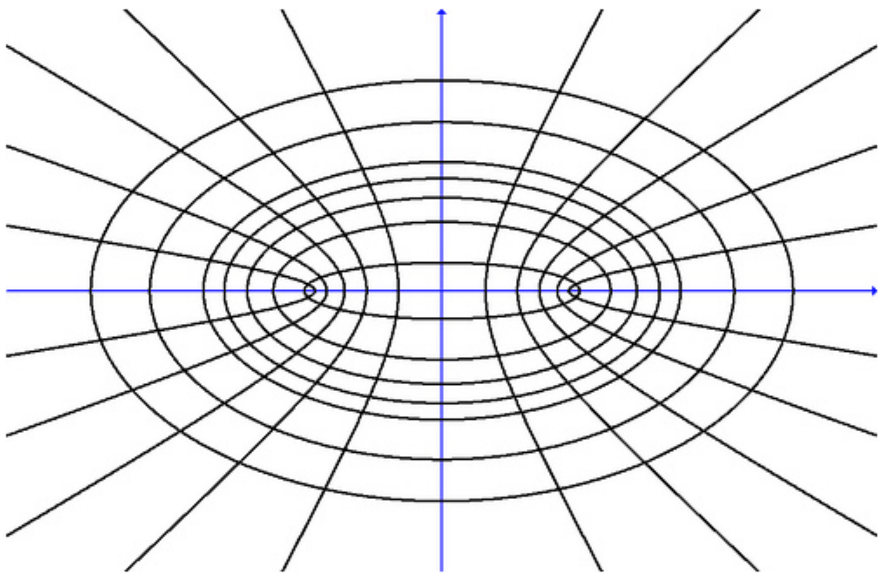
$2^2=1^2+b^2$

$4=1+b^2 \quad b^2=3$

$$y+1=\pm\frac{1}{\sqrt{3}}(x+3)$$


e=1.2
e=0.25
D
F0
F1
F2
F3
F4
F5
e=0.5
e=0.75
e=1

The Grid Flower



Any pair of points define an infinity of ellipses and an infinity of hyperbolas.

The ellipses do not touch one another, nor do the hyperbolas.

But every ellipse meets every hyperbola at a right angle.

Assignment:

pg. 629 #19, 21, 23, 25-30, 37, 39, 45, 47