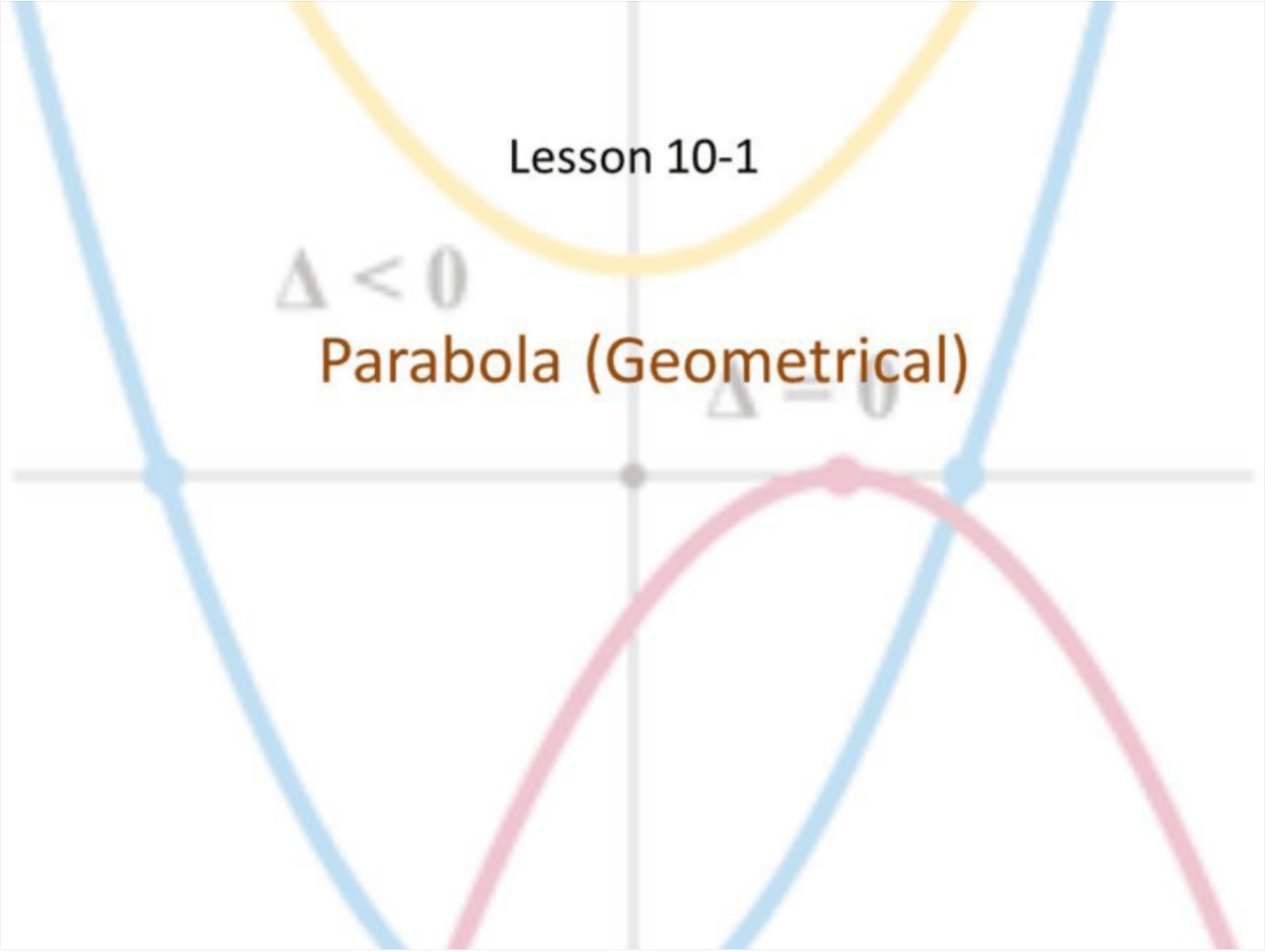

Lesson 10-1
$\Delta < 0$
Parabola (Geometrical)
$\Delta = 0$

Objective

Students will…

- Be able to give a geometric definition of a parabola.
- Be able to define focus (foci), directrix, axis of symmetry, and vertex.
- Be able to find the equation of a parabola.

Parabola within a Cone

As seen from yesterday's video, a parabola can be cut out from a cone. Parabolas are easily found in the real-world.

Parabola

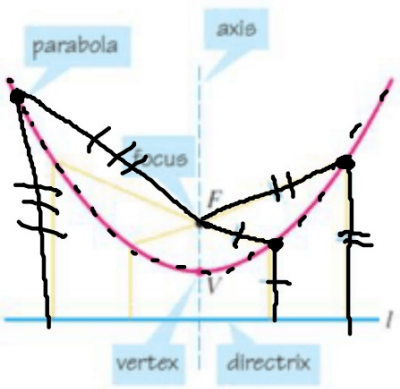
The trajectory of a basketball is a parabola.

Geometric Parabola

We worked extensively with parabolas **algebraically** back in chapters 2 and 3. Here in this chapter, we now look at parabolas **geometrically**.

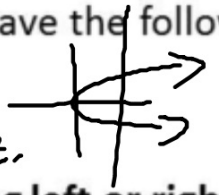
Geometric Definition of a Parabola- A parabola is a set of points in the plane **equidistant** from a fixed point F (called the **focus**) and a fixed line l (called the **directrix**). We define the vertex as the point that lies **halfway** between the **focus** and the **directrix**, and the **axis of symmetry** is the line that runs through the focus **perpendicular** to the directrix.

Ex.



Equations and Graphs of Parabolas

Using the distance formula, we can see that parabolas have the following equations:



Vertical

Opening up or down	**Opening left or right**
$x^2 = 4py$	$y^2 = 4px$
Vertex: $V(0,0)$	$V(0,0)$
Focus: $F(0,p)$	$F(p,0)$
Directrix: $y = -p$	$x = -p$
Focal Diameter: $\lvert 4p \rvert$ (the number in front of y)	$\lvert 4p \rvert$ (the number in front of x)
Opens...	
Up: $p > 0$	Right: $p > 0$
Down: $p < 0$	Left: $p < 0$

Example

Find the equation of the parabola with vertex $V(0,0)$ and focus $F(0,2)$, and sketch its graph.

Vertical (up)

0, p

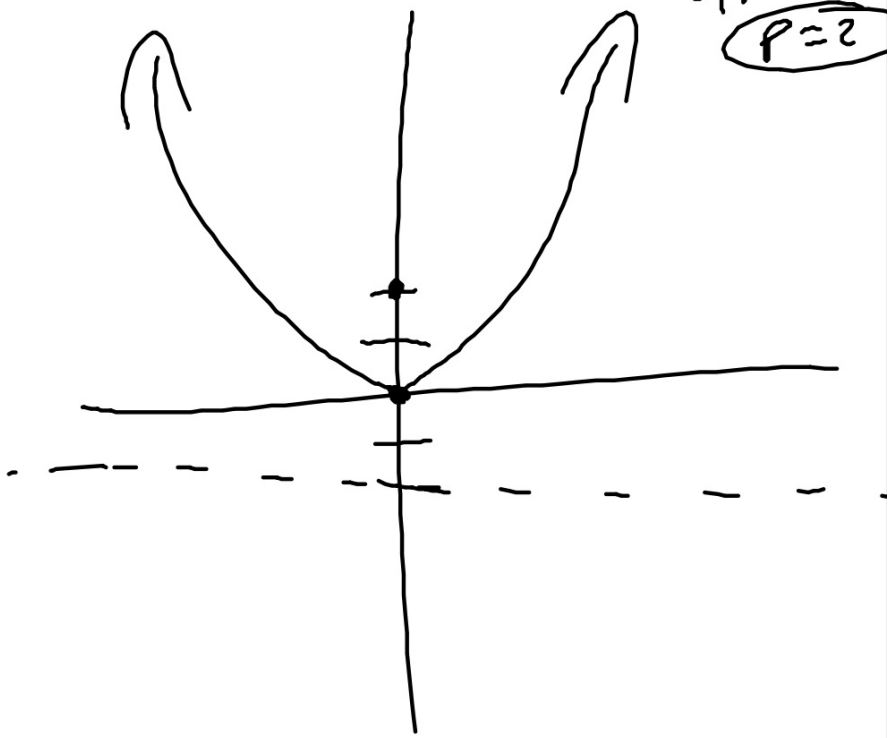
p = 2

$x^2 = 4py$

$x^2 = 4(2)y$

$\boxed{x^2 = 8y}$

D: $y = -2$



ax^2+bx+c

Example

Find the equation of the parabola with vertex $V(0,0)$ and focus $F(0,-8)$, and sketch its graph.

p

Vertical (down)

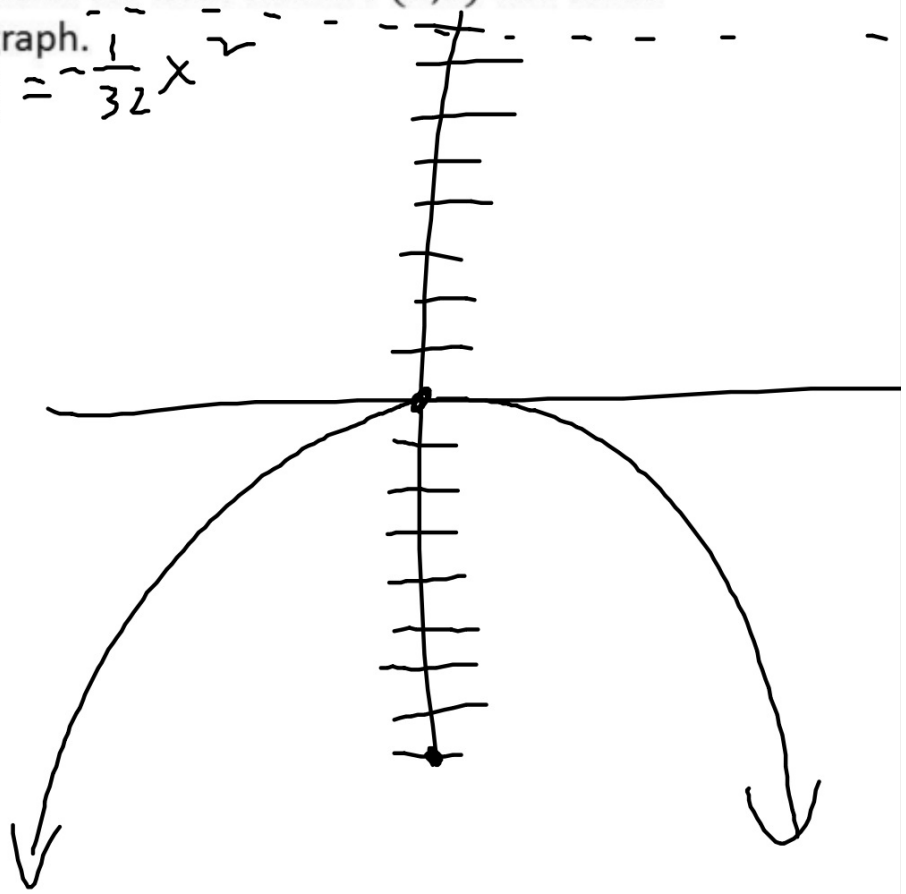
$x^2 = 4py$

$x^2 = 4(-8)y$

$\boxed{x^2 = -32y}$

$y = -\frac{1}{32}x^2$

D: $y = +8$



Example

A parabola has the equation $6x + y^2 = 0$. Find its focus, directrix, and the focal diameter, and sketch its graph.

$y^2 = -6x$ F.D

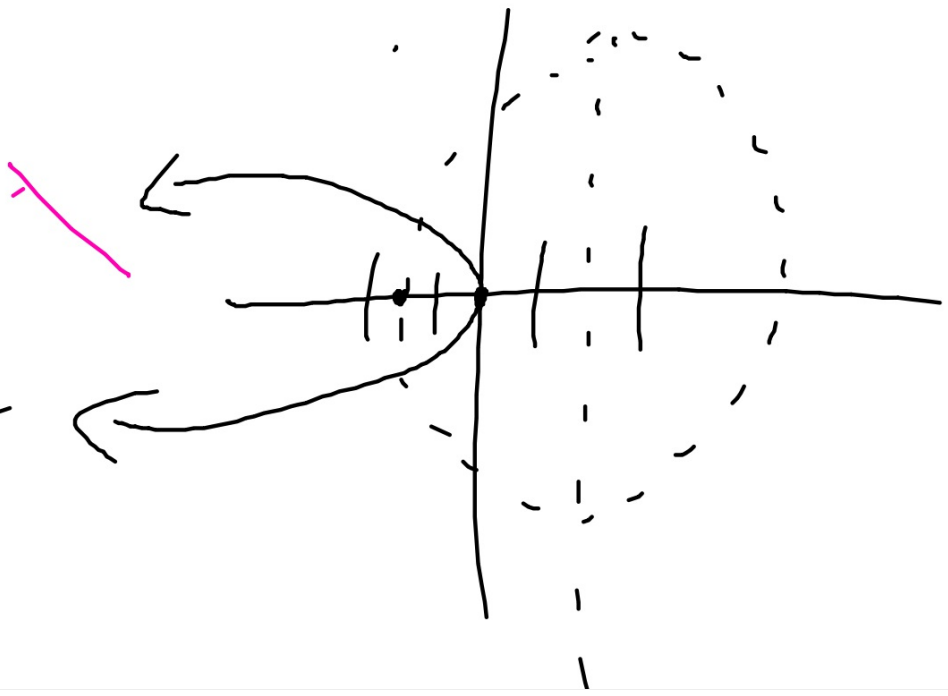
$\frac{4p}{4} = \frac{-6}{4} \Rightarrow p = -3/2 = -1.5 = -1\frac{1}{2}$

$F(-3/2, 0)$

$V(0, 0)$

$D: x = 3/2$

$F.D = 6$



Homework Problems

Find the focus, directrix, and focal diameter of the parabola, and sketch its graph.

7. $y^2 = 4x$

16. $x - 7y^2 = 0$

Homework Problems

Find an equation for the parabola that has its vertex at the origin and satisfies the given condition(s).

29. Directrix $x = 2$

35. Opens upward with focus 5 units from the vertex.

Homework 4/6

TB pg. 751 #1-6, 7-17 (odd), 25, 27, 29, 33, 35