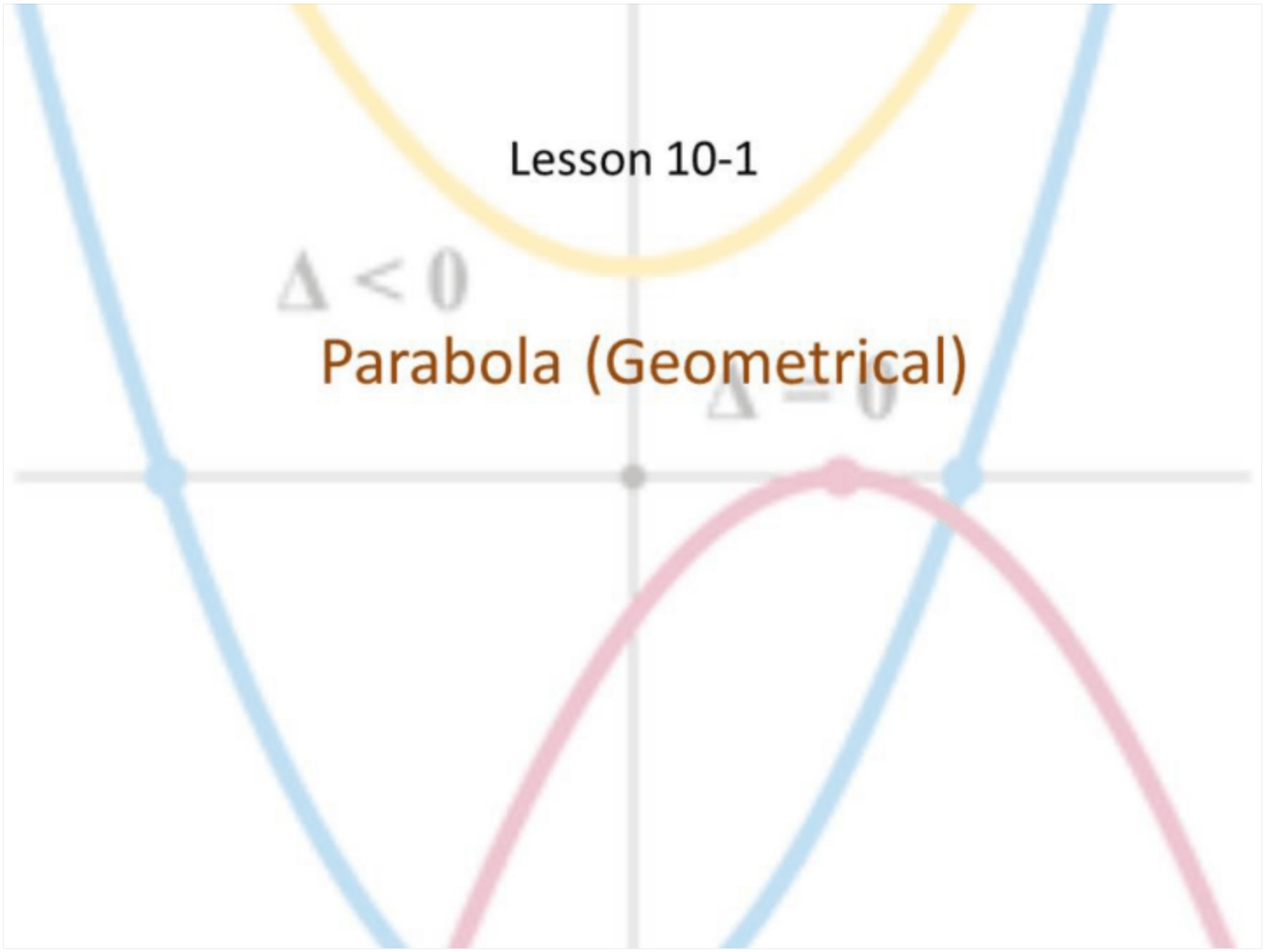

Lesson 10-1
$\Delta < 0$
Parabola (Geometrical)
$\Delta = 0$

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.

Geometric

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

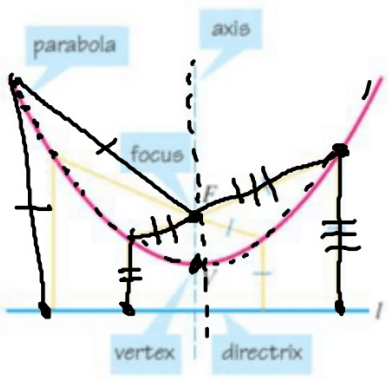
The trajectory of a basketball is a parabola.

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:

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: $4p$ **(the number in front of y)**	$4p$ **(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.

$(0, p)$

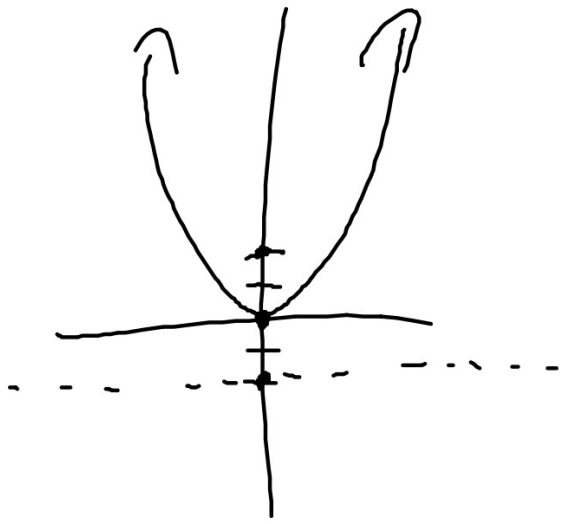
$x^2 = 4py$ or $y^2 = 4px$

$x^2 = 4(2)y$

$x^2 = 8y$

directrix: $y = -2$

x	y
0	0
1	$\frac{1}{8}$
2	$\frac{1}{2}$
4	2



Example

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

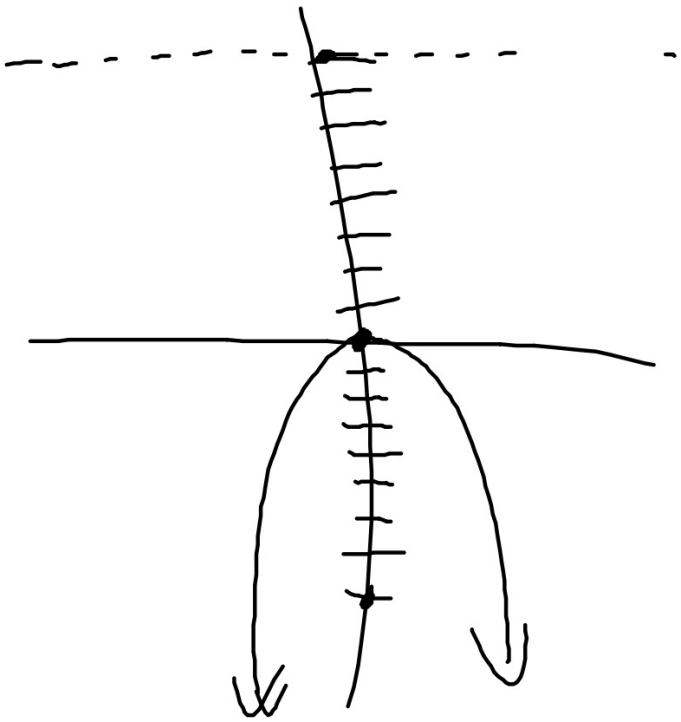
$(0, p)$.

$x^2 = 4py$

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

$x^2 = -32y$

directrix: $y = 8$



$x^2 = 4py$ ~~$y^2 = 4px$~~

Example

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

$6x + y^2 = 0$

$-6x \quad -6x$

$y^2 = -6x$

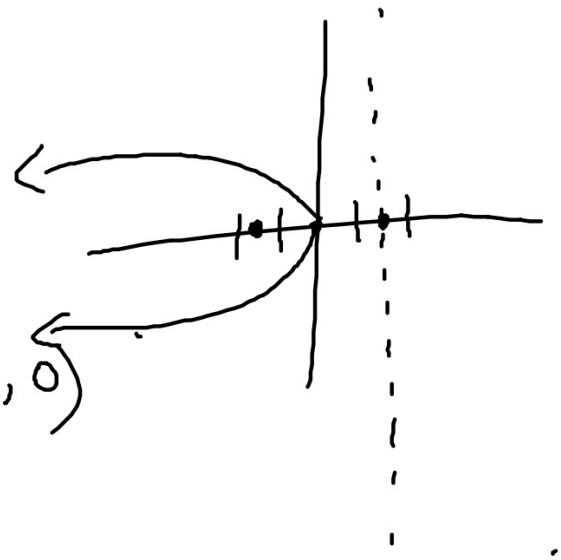
F.D: $|6|$

Focus: $F(p, 0) \Rightarrow F(\frac{-3}{2}, 0)$

direct: $x = \frac{3}{2}$

$\frac{4p}{4} = \frac{-6}{4}$

$p = \frac{-3}{2}$



Homework Problems

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

$y^2 = 4px$.

7. $y^2 = 4x$

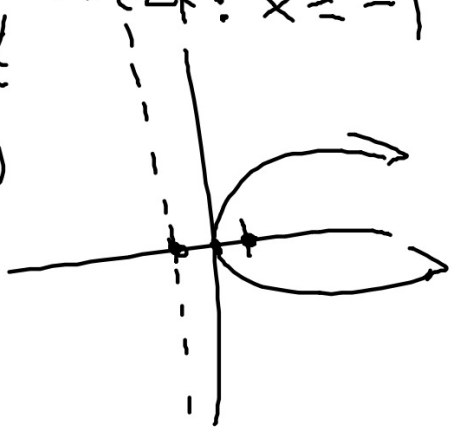
F, D : 4

focus : $F(p, 0) \Rightarrow F(1, 0)$

direct : $x = -1$

$\frac{4p}{4} = \frac{4}{4}$

$p = 1$



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

$-x \quad = -x$

$-7y^2 = -x$

$\frac{-7y^2}{-7} = \frac{-x}{-7}$

$y^2 = \frac{1}{7}x$

F.D : $\frac{1}{7}$

focus : $F(p, 0) \Rightarrow F(\frac{1}{28}, 0)$

direct : $x = -\frac{1}{28}$

$\frac{4p}{4} = \frac{\frac{1}{7}}{4}$ $\quad p = \frac{1}{28}$

Homework Problems

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

$y^2 = 4px$. $x = -p$

29. Directrix $x = 2$

$p = -2$

$F: (-2, 0)$

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

$y^2 = -8x$

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

Homework 5/13

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