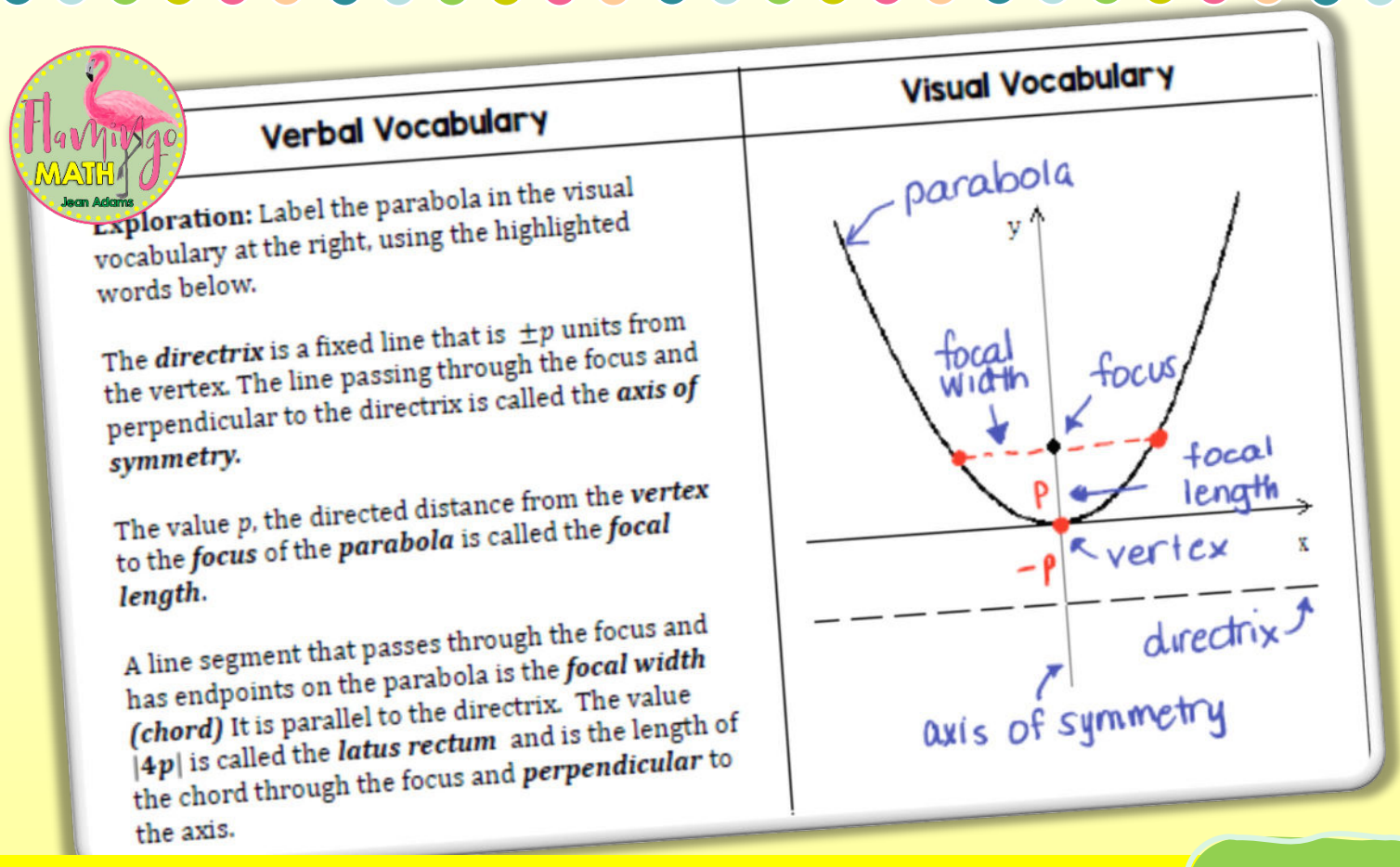
Precalculus Honors

Parabolas



Verbal Vocabulary

Exploration: Label the parabola in the visual vocabulary at the right, using the highlighted words below.

The ***directrix*** is a fixed line that is $\pm p$ units from the vertex. The line passing through the focus and perpendicular to the directrix is called the ***axis of symmetry.***

The value p, the directed distance from the ***vertex*** to the ***focus*** of the ***parabola*** is called the ***focal length.***

A line segment that passes through the focus and has endpoints on the parabola is the ***focal width (chord)*** It is parallel to the directrix. The value $|4p|$ is called the ***latus rectum*** and is the length of the chord through the focus and ***perpendicular*** to the axis.

Visual Vocabulary

Completely Editable 8.1

Lesson 8.1: Parabolas

DEFINITION OF A PARABOLA

A parabola is the set of all points (x, y) in a plane that are equidistant from the ***directrix*** (a fixed line) and the ***focus*** (a point not on the line).

The intersection of a plane and a double-napped cone will create the basic conic sections, ***circle parabola, ellipse*** and ***hyperbola***. However, when the plane intersects with the vertex a ***degenerate conic*** will occur. Examples: ***point, single line,*** or ***intersecting lines***.



Image used with permission: Pearson Scott Foresman

The conic sections can be defined algebraically as the graphs of **second-degree (quadratic) equations in two variables**, that is, equations of the form

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$$

where A, B, and C are not all zero.

Verbal Vocabulary

Exploration: Label the parabola in the visual vocabulary at the right, using the highlighted words below.

The ***directrix*** is a fixed line that is $\pm p$ units from the vertex. The line passing through the focus and perpendicular to the directrix is called the ***axis of symmetry***.

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A line segment that passes through the focus and has endpoints on the parabola is the ***focal width (chord)*** It is parallel to the directrix. The value $|4p|$ is called the ***latus rectum*** and is the length of the chord through the focus and ***perpendicular*** to the axis.

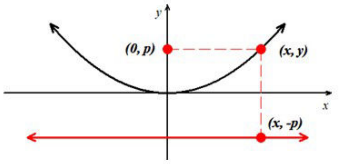
Visual Vocabulary

Conic Sections

While the Greeks defined conics in terms of the intersections of planes and the double-napped cone, we will study each of the conics as a **locus** (collection) **of points** that satisfy some given geometric properties. For example, in our study of parabolas, you learned that a parabola is the graph of a quadratic function and can be written in the form $y = ax^2 + bx + c$ or $y = a(x - h)^2 + k$.

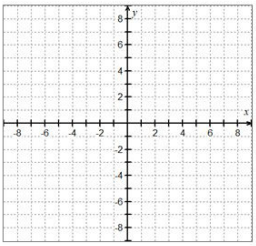
Standard Form of the Equation of a Parabola

The **standard form of the equation of a parabola** with the vertex at the origin can be found using the distance formula. There are two equations, one for a focus on the *x-axis* and one for a focus on the y-axis, shown at right.



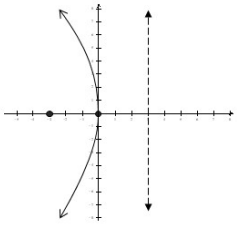
Focus on the y-axis: $x^2 = 4py$

and Directrix of a Parabola



Finding the Equation of a Parabola from its Focus and Directrix

EX #2: Use the graph at right to find the standard form of the equation for the parabola.



The graph of a parabola can have a vertex at (h, k) when it has been translated from the origin. These translations will change the standard form equations shown in the table below.

Standard Forms of Equations of Parabolas

Axis of Symmetry	Vertical
Equation	$(x-h)^2 = 4p(y-$
Direction: p > 0	
Direction: p < 0	
Vertex	
Focus	
Directrix	
Axis	
Focal Length	
Focal Width	

EX #3: $(x-1)^2 = 2(y+2)$

$h =$_____ $k =$_____ $p =$_____

Vertex: _____

Focus: _____

Directrix: _____

Focal width: _____

Finding an Equati

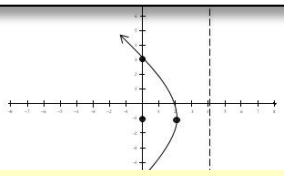
EX #4: Use the graph at right to find the standard form of the equation for the parabola.

$h =$_____ $k =$_____ $p =$_____

Equation:

_____

Vertex: _____



EX #5: Find the standard form of the equation for the parabola with focus $(4, 0)$ and directrix $x = 2$.

EX #6: Show that the graph of the equation is a parabola, and find its vertex, focus, and directrix.

$$y^2 - 8x - 6y + 17 = 0$$

NOTES

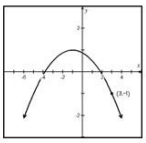
8.1 **Parabolas Homework**

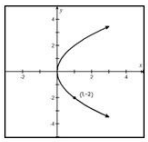
Name _____

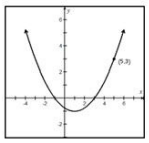
Date _____ Period _____

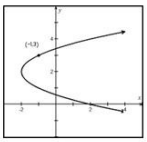
Problems 1 – 6, the graph of a parabola is given. Match each graph to its equation.

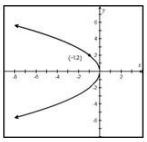
A. $(y-2)^2 = (x+2)$	B. $(x-1)^2 = 4(y+1)$	C. $y^2 = -4x$
D. $y^2 = 4x$	E. $(x-2)^2 = -4(y-2)$	F. $(x+1)^2 = -8(y-1)$

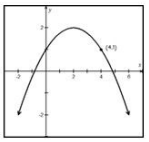
1. 

2. 

3. 

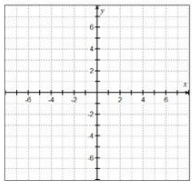
4. 

5. 

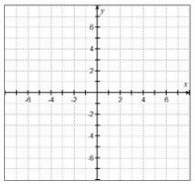
6. 

Problems 7 – 12, find the equation of the parabola. Find the endpoints of the focal chord (latus rectum) and graph the equation.

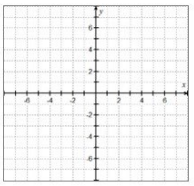
7. Focus at (0,4); vertex at (0,0)



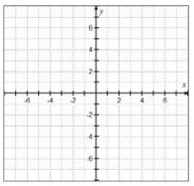
8. Focus at (2,0); vertex at (0,0)



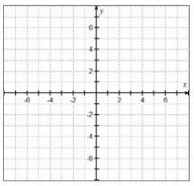
9. Focus at (1,3); directrix $x = -3$



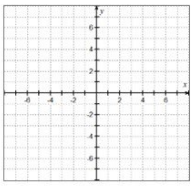
10. Vertex at $(4,-2)$; focus at $(6,-2)$



11. Focus at $(-2,2)$; directrix $y = 6$

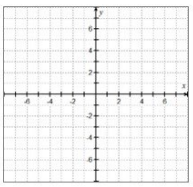


12. vertex at (1,3); axis of symmetry y=3; containing the point (0,1)

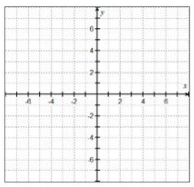


Problems 13 – 16, find the vertex, focus, and directrix of each parabola. Graph the equation.

13. $(y-1)^2 = 8(x+2)$



14. $(x+1)^2 = 16y$



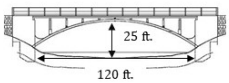
15. $x^2 + 8x = 4y - 12$

16. $y^2 + 6y + 4x + 1 = 0$

Problems 13-15, solve.

17. A paraboloid-shaped satellite dish is 10 feet across at its opening and 4 feet deep at its center. The radio signals are reflected from a single point, where the receiver is located. Find the position where the receiver should be positioned.

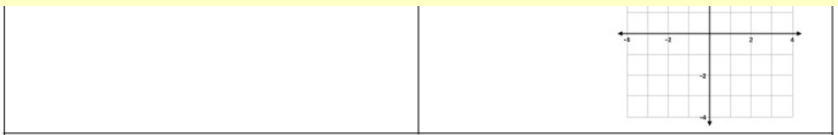
18. The parabolic arch of a bridge over a small river is 25 feet above the water at the center and 120 feet wide at the base. Find the height of the arch at a distance 10 feet from the center.



19. A large searchlight is shaped like a paraboloid. If the light source is located 2 feet from the base

Practice Sets

Lesson Warm-Ups



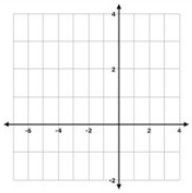
3. Find an equation for the parabola in standard form with vertex (2,3) and directrix $y = 4$.

Name _____ Date _____ Period _____

Lesson 8.I: Parabolas **Warm-Up # 2**

1. Find the vertex, focus, and directrix of the parabola. $(x + 3)^2 = -8(y - 2)$

2. Sketch the graph.



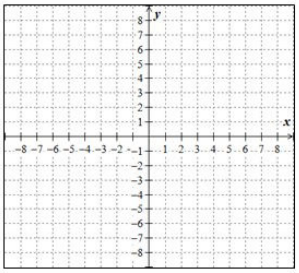
3. Find an equation for the parabola in standard form with vertex $(4, -2)$ and directrix $y = -3$.

orm A

of the

Directrix: _____

2.



3. Find an equation for the parabola in standard form with vertex (3,2) and directrix $y = 5$.

Grade:

8.1 Parabolas **Form B**

Name _____

Date _____ Period _____

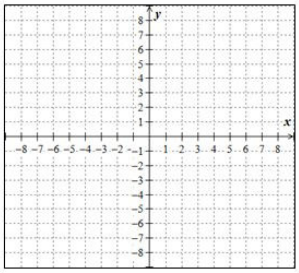
1-2: Find the vertex, focus, and directrix of the parabola: and sketch the graph in the grid.

1. $(x + 2)^2 = -12(y - 1)$

Vertex: _____ Focus: _____

Directrix: _____

2.



3. Find an equation for the parabola in standard form with vertex $(2, -4)$ and directrix $x = -2$.

Grade:

Daily Lesson Quiz