Precalc 10.5

Use and determine standard and general forms of the equation of a parabola
Graph parabolas

parent graph $y=x^2$ $x^2=y$ $y^2=x$

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

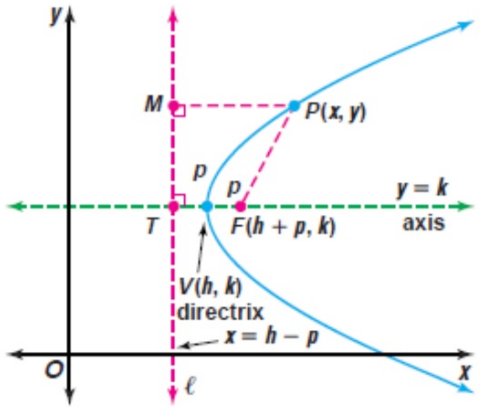
p
focus
directrix
axis of symmetry
vertex
latus rectum
↳ right

eccentricity

light bulbs

https://www.youtube.com/watch?v=Vq7xXUaCDl4

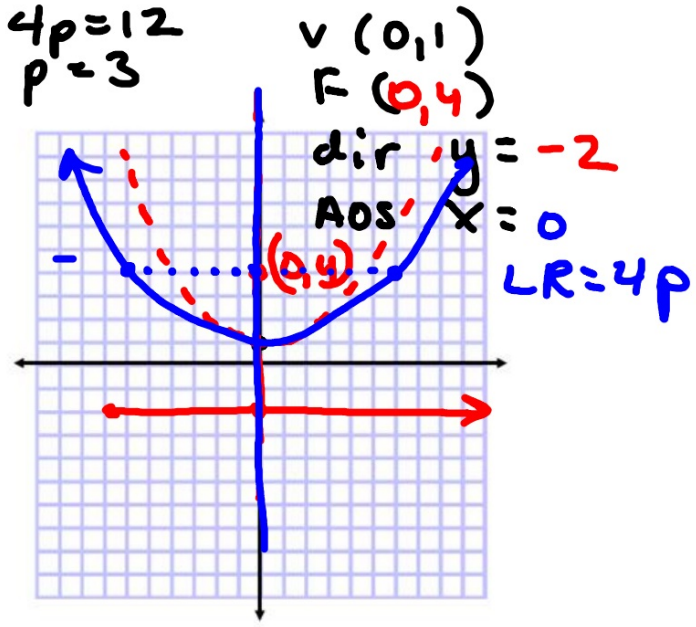
p (parabola constant)



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

For the equation of each parabola, find the coordinates of the vertex and focus, and the equations of the directrix and axis of symmetry. Then graph the equation.

6. $x^2 = 12(y - 1)$ 7. $y^2 - 4x + 2y + 5 = 0$ 8. $x^2 + 8x + 4y + 8 = 0$



Standard form or...
Complete the square...
$x^2=$
$y^2=$

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

$y^2 - 4x + 2y + 5 = 0$

$(y^2 + 2y + 1) = 4x - 5 + 1$

$(y+1)^2 = 4x - 4$

$= 4(x-1)$

$4p = 4$

$p = 1$

$V(1, -1)$

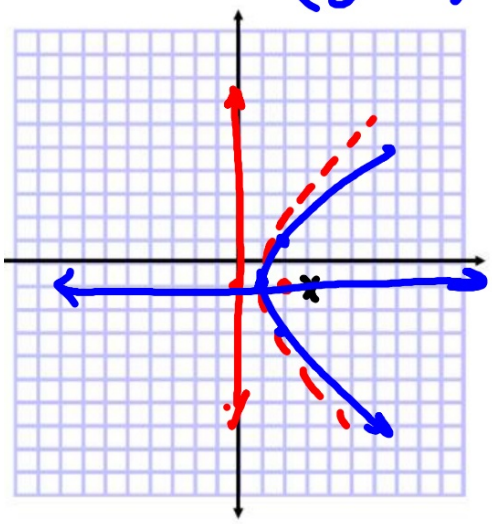
$(y+1)^2 = 4(x-1)$

$F(2, -1)$

dir $x = 0$

AOS $y = -1$

$LR = 4 \cdot 1 = 4$



$x^2 = 4py$

$x^2 + 8x + 4y + 8 = 0$

$x^2 + 8x + 16 = -4y - 8 + 16$

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

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

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

$p = -1$

$4(-1) = -4$

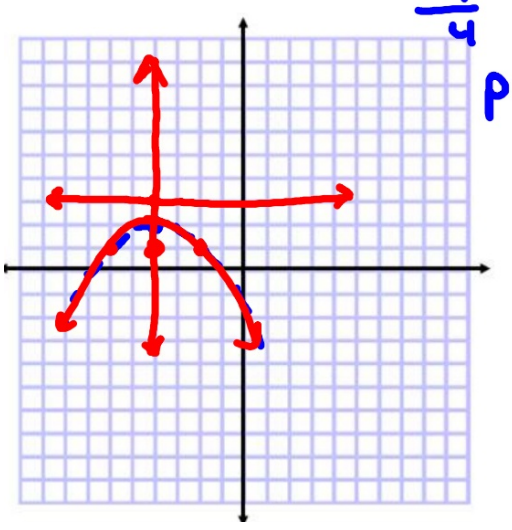
V $(-4, 2)$

F $(-4, 1)$

dir $y = 3$

AOS $x = -4$

LR



General Form for the Equation of a Parabola

The general form of the equation of a parabola is
$y^2 + Dx + Ey + F = 0$, when the directrix is parallel to the y-axis, or
$x^2 + Dx + Ey + F = 0$, when the directrix is parallel to the x-axis.

$x^2 = 4fy$

$y^2 = 4px$

$+Cxy$

$Ax^2 + By^2 + Dx + Ey + F = 0$

18. $x^2 + 10x + 25 = -8y + 24$

$x^2 = 4py$

3 Consider the equation $2x^2 - 8x + y + 6 = 0$.

a. Write the equation in standard form.

b. Find the coordinates of the vertex and focus and the equations for the directrix and the axis of symmetry.

c. Graph the equation of the parabola.

$\frac{4p}{4} = \frac{-\frac{1}{2}}{4}$

$p = -\frac{1}{8}$

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

factor

complete the square

solve for $x^2=4py$

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

$+4 \quad +4$

$y = -2(x-2)^2 + 4$ ★

$2(x^2 - 4x + 4) = -y - 6 + 8$

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

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

$V(2, 4)$

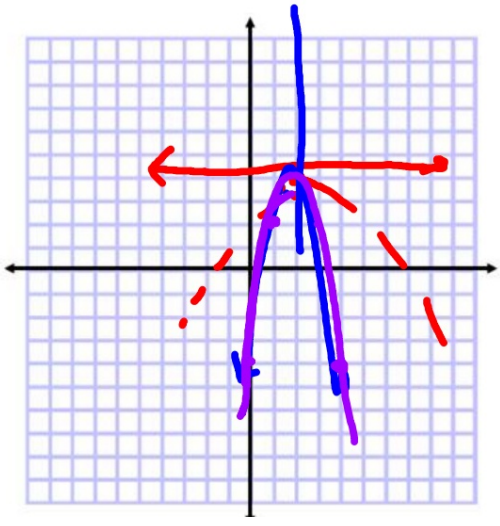
$F\left(2, 3\frac{7}{8}\right)$

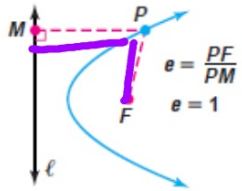
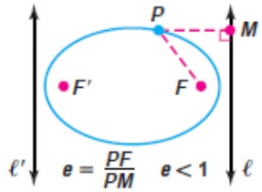
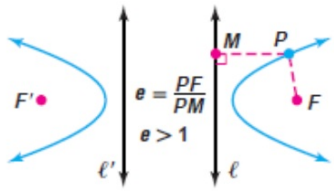
dir $y = 4\frac{1}{8}$

AOS $x = 2$

LR $= \frac{1}{2}$

$4 \cdot -\frac{1}{8}$



parabola	ellipse	hyperbola
$e = 1$	$e < 1,\ e \neq 0$	$e > 1$
		

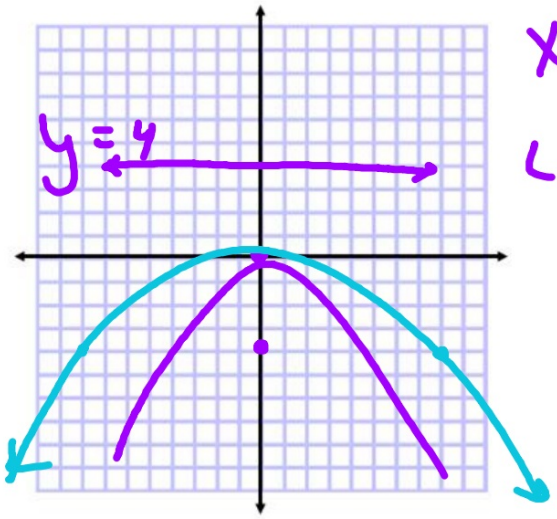
$e = 1$ $\quad \frac{c}{a} = e < 1$ $\quad e > 1$

Write the equation of the parabola that meets each set of conditions. Then graph the equation.

9. The vertex is at the origin, and the focus is at $(0, -4)$.

$x^2 = 4py$ $\quad p = 4$

$(x-0)^2 = -16(y-0)$



$x^2 = -16y$

LR $= 4p = 16$

If you can determine p, the problem will unravel from there.

p=distance:
vertex to focus=vertex to directrix

hint: always sketch first

Write the equation:

10. The parabola passes through the point at $(2, -1)$, has its vertex at $(-7, 5)$, and opens to the right.

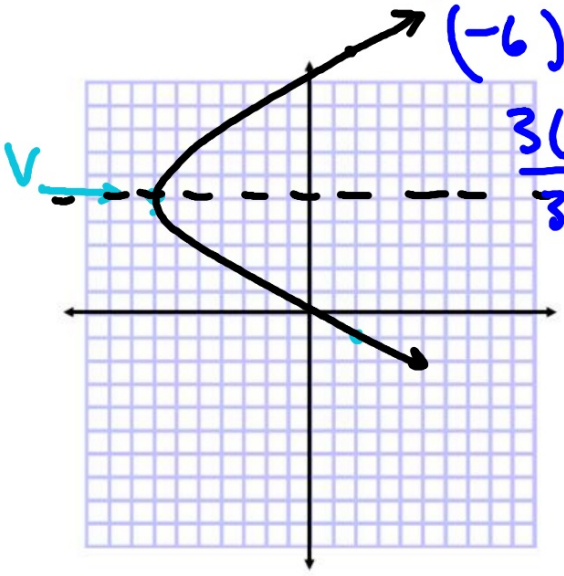
$(y-5)^2 = 4(x+7)$

What is the sign of p? (+)

$(-1-5)^2 = 4p(2+7)$

$(-6)^2 = 4p(9)$

$\frac{36}{36} = \frac{36p}{36}$ $p = 1$



Consider $x^2 =$ and $y^2 =$ equations. Which one is a function?

1 **Consider the equation $y^2 = 8x + 48$.**

a. Find the coordinates of the focus and the vertex and the equations of the directrix and the axis of symmetry.

b. Graph the equation of the parabola.

factor to find p

$y^2 = 8(x+6)$

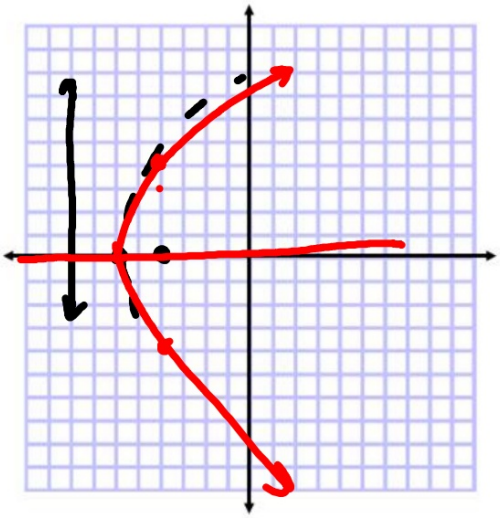
$4p = 8$

F (-4, 0)

V (-6, 0)

dir $x = -8$

AOS $y = 0$



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