

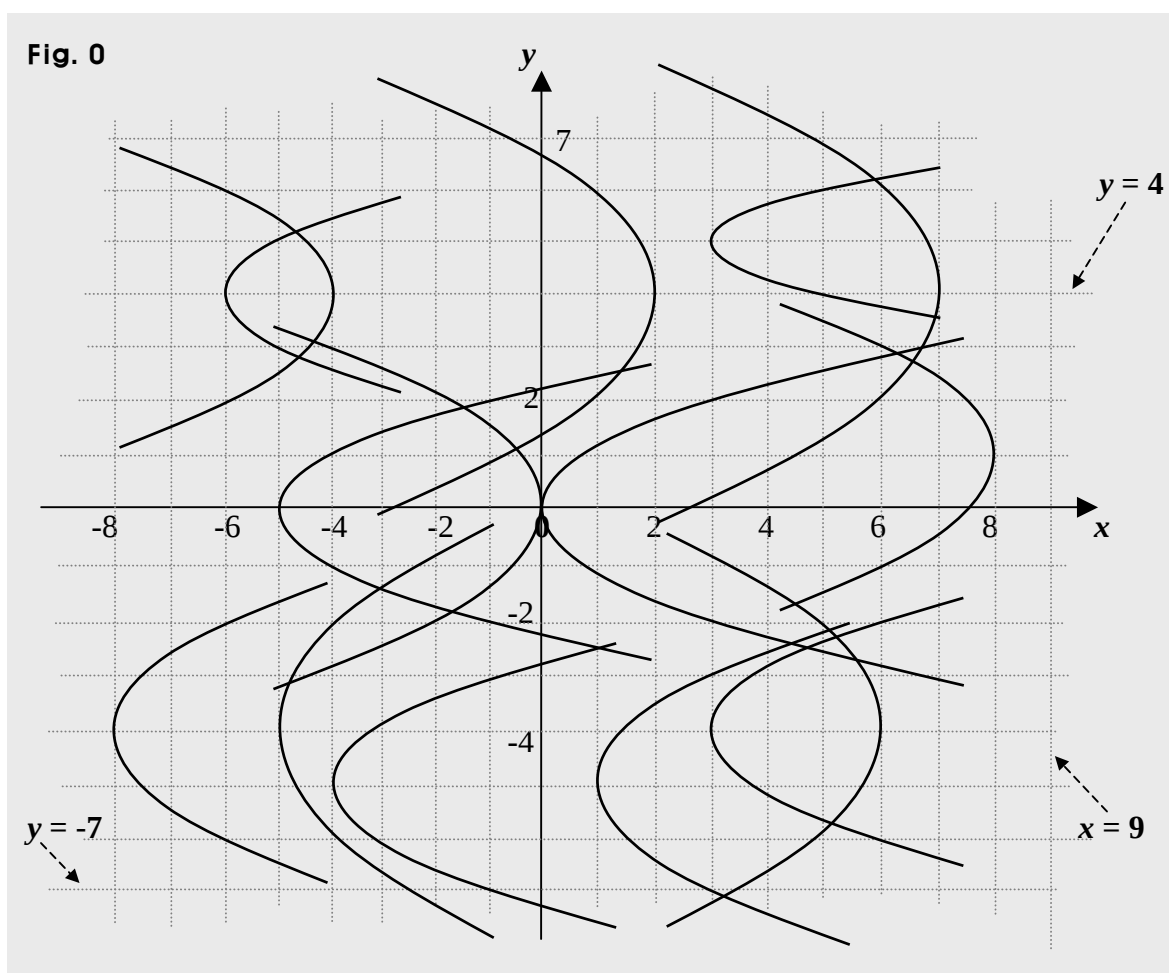
Examples 2 in the Vertex Form

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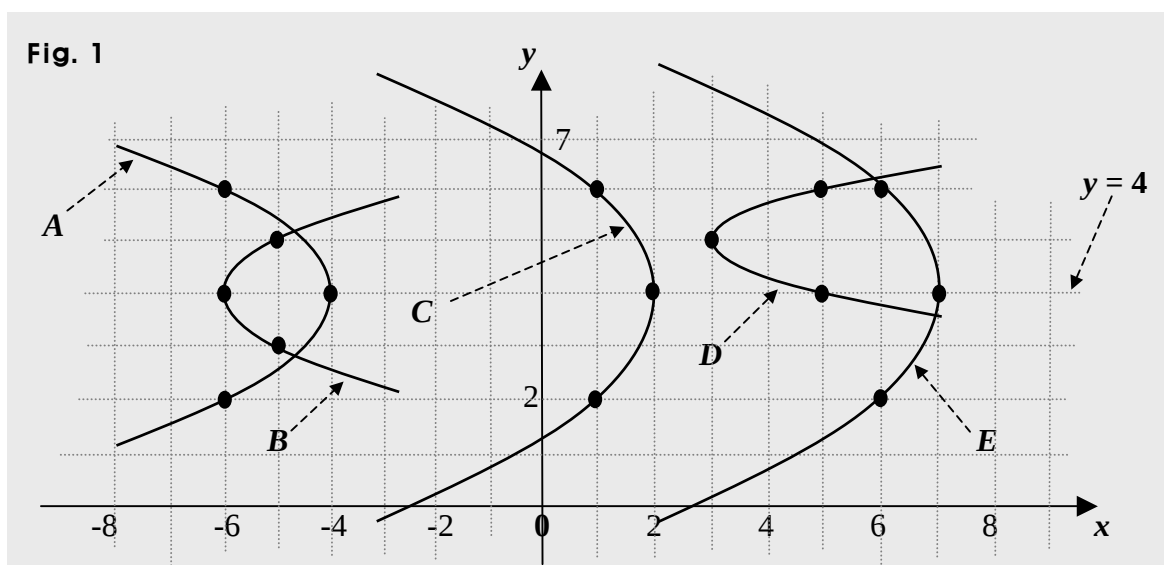
Examples 2 in the Vertex Form

Label each parabola below, and then find the equation of each of the parabolas.



Suggestions or Solutions To the Problems in the Examples

Beginning with the parabolas below, we can see first, that the parabola *A* has the vertex at $(-4, 4)$, and has a point at $(-6, 2)$ or $(-6, 6)$.



And we can specify the vertex and a point each of all the other parabolas has.

Next, if a parabola is horizontal, and we know the vertex and a point in the parabola, we can get the equation of the parabola using the vertex form as follows.

$$x - s = a(y - t)^2, \text{ or } x = a(y - t)^2 + s, \text{ where } (s, t) \text{ is the vertex.}$$

And thus, beginning with the parabola *A*, since the vertex is at $(-4, 4)$, we can get first,

$$x = a(y - t)^2 + s \Rightarrow x = a(y - 4)^2 - 4.$$

Next, since the parabola *A* has a point at $(-6, 2)$, we can get

$$x = a(y - 4)^2 - 4 \Rightarrow -6 = a(2 - 4)^2 - 4 = 4a - 4 \Rightarrow 4a = 4 - 6 = -2 \Rightarrow a = -1/2.$$

So we get $x = (-1/2)(y - 4)^2 - 4$, which is the equation of the parabola *A*.

And also, even if we use the point $(-6, 6)$ instead of the point $(-6, 2)$, since $(-6, 6)$ is in the parabola **A**, too, we will get the same equation, and we can get it the way as follows.

$$\begin{aligned} x &= a(y - 4)^2 - 4 \Rightarrow -6 = a(6 - 4)^2 - 4 = 4a - 4 \Rightarrow 4a = 4 - 6 = -2 \Rightarrow a = -1/2 \\ \Rightarrow x &= (-1/2)(y - 4)^2 - 4. \end{aligned}$$

And we can put it this way, too: $x + 4 = -(y - 4)^2/2$.

Next, moving on to the parabola **B**, since the vertex is at $(-6, 4)$, we can get first,

$$x = a(y - t)^2 + s \Rightarrow x = a(y - 4)^2 - 6.$$

Next, since the parabola **B** has a point at $(-5, 3)$, we can get

$$x = a(y - 4)^2 - 6 \Rightarrow -5 = a(3 - 4)^2 - 6 = a - 6 \Rightarrow a = 6 - 5 = 1 \Rightarrow a = 1.$$

So we get $x = (y - 4)^2 - 6$, which is the equation of the parabola **B**.

Next, looking at the parabola **C**, since the vertex is at $(2, 4)$, we can get first,

$$x = a(y - t)^2 + s \Rightarrow x = a(y - 4)^2 + 2.$$

Next, since the parabola **C** has a point at $(1, 2)$, we can get

$$x = a(y - 4)^2 + 2 \Rightarrow 1 = a(2 - 4)^2 + 2 = 4a + 2 \Rightarrow 4a = 1 - 2 = -1 \Rightarrow a = -1/4.$$

So we get $x = (-1/4)(y - 4)^2 + 2$, which is the equation of the parabola **C**.

Next, examining the parabola **D**, we can notice that the vertex is $(3, 5)$, so we can get

$$\text{first, } x = a(y - t)^2 + s \Rightarrow x = a(y - 5)^2 + 3.$$

And next, the parabola **D** has a point at $(5, 4)$, we can get

$$x = a(y - 5)^2 + 3 \Rightarrow 5 = a(4 - 5)^2 + 3 = a + 3 \Rightarrow a = 5 - 3 = 2 \Rightarrow a = 2.$$

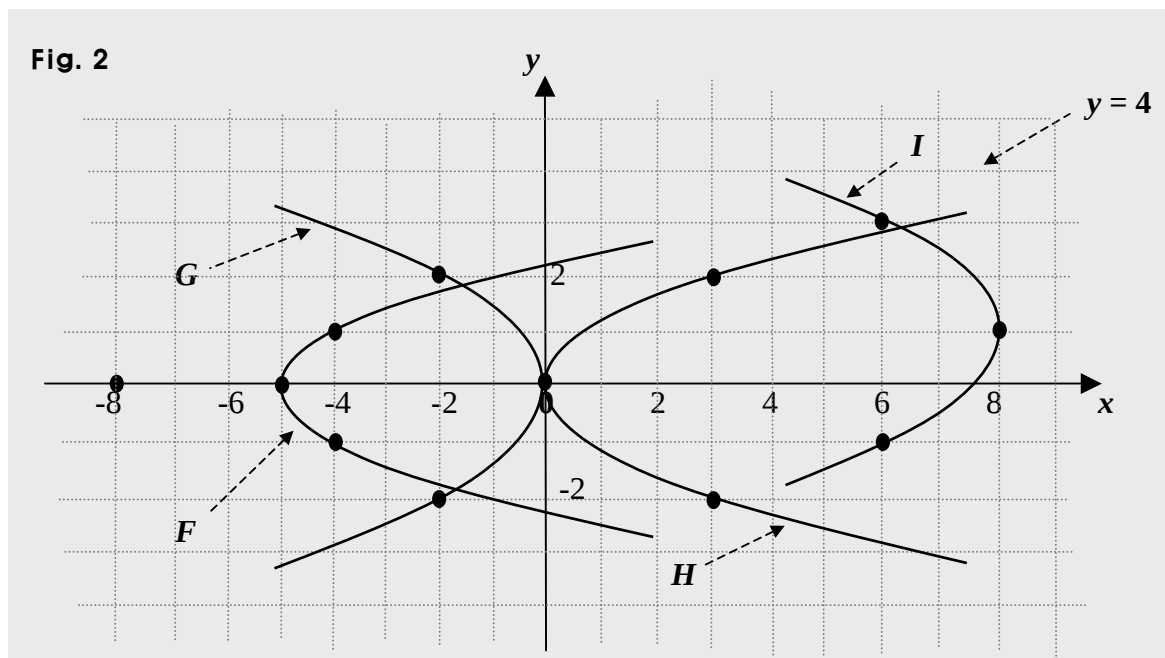
So we get $x = 2(y - 5)^2 + 3$, which is the equation of the parabola **D**.

Next, looking at the parabola **E**, we can see **E** has the vertex at $(7, 4)$ and a point at $(6, 2)$,

$$\text{so we can get } x = a(y - t)^2 + s \Rightarrow 6 = a(2 - 4)^2 + 7 = 4a + 7 \Rightarrow 4a = -1 \Rightarrow a = -1/4.$$

So we get $x = (-1/4)(y - 4)^2 + 7$, which is the equation of the parabola **E**, and we can put it the way as follows, too. $x = 7 - (1/4)(y - 4)^2$, or $x = 7 - (y - 4)^2/4$.

Next, moving on to the parabolas below, we can see that the parabola *F* has the vertex at $(-5, 0)$, and a point at $(-4, -1)$ or $(-4, 1)$.



And we can specify the vertex and a point each of all the other parabolas has.

Next, if a parabola is horizontal, and we know the vertex and a point in the parabola, we can get the equation of the parabola using the vertex form as follows.

$$x - s = a(y - t)^2, \text{ or } x = a(y - t)^2 + s, \text{ where } (s, t) \text{ is the vertex.}$$

Beginning thus, with the parabola *F*, since the vertex is at $(-5, 0)$, we can get first,

$$x = a(y - t)^2 + s \Rightarrow x = a(y - 0)^2 - 5 \Rightarrow x = ay^2 - 5.$$

And next, since the parabola *F* has a point at $(-4, -1)$, we can get

$$x = ay^2 - 5 \Rightarrow -4 = a - 5 \Rightarrow a = 5 - 4 = 1 \Rightarrow a = 1 \Rightarrow x = y^2 - 5, \text{ which is the equation of the parabola } F.$$

Next, moving on to the parabola *G*, since the vertex is the origin $(0, 0)$, we can get first,

$$x = a(y - t)^2 + s \Rightarrow x = a(y - 0)^2 + 0 \Rightarrow x = ay^2.$$

And next, since the parabola **G** has a point at $(-2, 2)$, we can get

$x = ay^2 \Rightarrow -2 = 4a \Rightarrow a = -1/2 \Rightarrow x = (-1/2)y^2$, which is the equation of the parabola **G**, and we can put it this way, too, of course: $x = -y^2/2$.

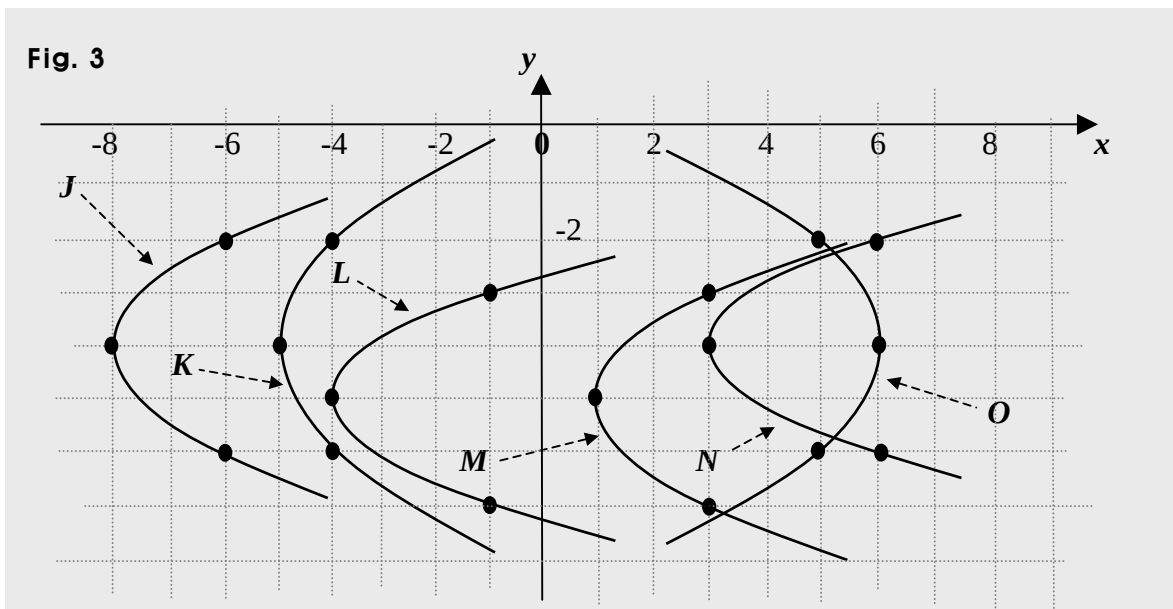
Next, looking at the parabola **H**, we can see that **H** has the vertex at the origin $(0, 0)$ and a point at $(3, 2)$, so we can get $x = a(y - t)^2 + s \Rightarrow 3 = a(2 - 0)^2 + 0 = 4a \Rightarrow a = 3/4$.

So we get $x = (3/4)y^2$, or $x = 3y^2/4$, which is the equation of the parabola **H**.

Next, looking at the parabola **I**, we can see it has the vertex at $(8, 1)$ and a point at $(6, -1)$, so we can get $x = a(y - t)^2 + s \Rightarrow 6 = a(-1 - 1)^2 + 8 = 4a + 8 \Rightarrow 4a = -2 \Rightarrow a = -1/2$.

So we get $x = (-1/2)(y - 1)^2 + 8$, which is the equation of the parabola **E**, and can be put this way, too, of course: $x = 8 - (1/2)(y - 1)^2$, or $x = 8 - (y - 1)^2/2$.

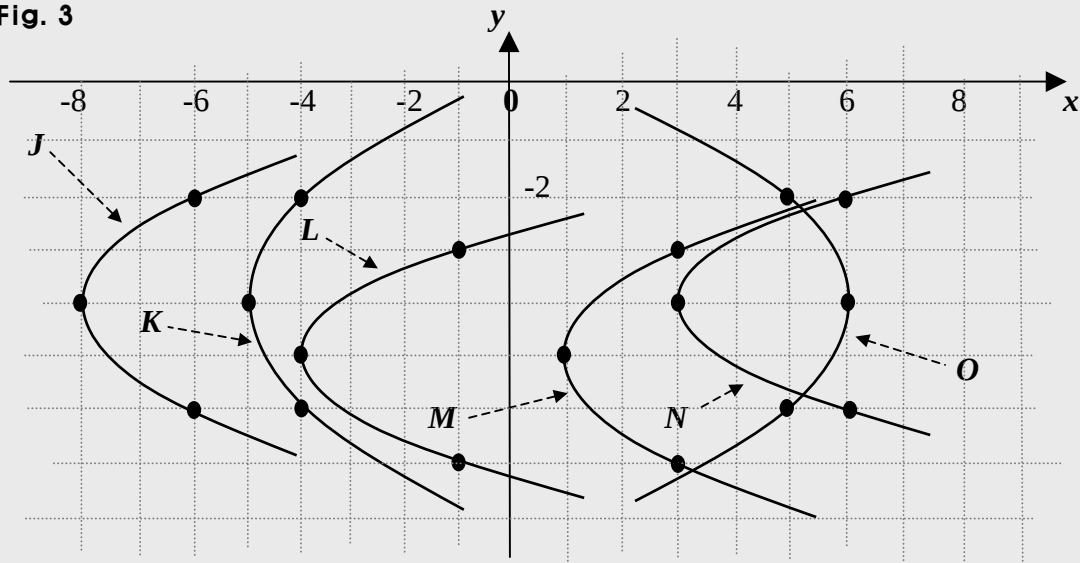
Next, moving on to the other parabolas below, we can see that the parabola **I** has the vertex at $(-6, -2)$, and a point at $(-8, 0)$ or $(-4, 0)$.



And if a parabola is vertical, and we know the vertex and a point in the parabola, we can get the equation of the parabola using the vertex form as follows.

$x - u = m(y - v)^2$, or $x = m(y - v)^2 + u$, where (u, v) is the vertex.

Fig. 3



And thus, beginning with the parabola J , since the vertex is at $(-8, -4)$, we can get first,
 $x = m(y - v)^2 + u \Rightarrow x = m(y + 4)^2 - 8$.

Next, since the parabola J has a point at $(-6, -2)$, we can get

$$x = m(y + 4)^2 - 8 \Rightarrow -6 = m(-2 + 4)^2 - 8 = 4m - 8 \Rightarrow 4m = 8 - 6 = 2 \Rightarrow m = 1/2.$$

So we get $x = (1/2)(y + 4)^2 - 8$, which is the equation of the parabola J , and of course, can be put this way, too: $x = (y + 4)^2/2 - 8$.

Next, moving on to the parabola K , since the vertex is at $(-5, -4)$, we can get first,

$$x = m(y - v)^2 + u \Rightarrow x = m(y + 4)^2 - 5.$$

And next, since the parabola K has a point at $(-4, -2)$, we can get

$$x = m(y + 4)^2 - 5 \Rightarrow -4 = m(-2 + 4)^2 - 5 = 4m - 5 \Rightarrow 4m = 5 - 4 = 1 \Rightarrow m = 1/4.$$

So we get $x = (1/4)(y + 4)^2 - 5$, which is the equation of the parabola K , and of course, can be put this way, too: $x = (y + 4)^2/4 - 5$.

Next, examining the parabola L , we can see that the vertex is at $(-4, -5)$, and it has a point at $(-1, -3)$, so we get $x = m(y - v)^2 + u \Rightarrow -1 = m(-3 + 5)^2 - 4 = 4m - 4 \Rightarrow 4m = 3 \Rightarrow m = 3/4 \Rightarrow x = (3/4)(y + 5)^2 - 4$, which is the equation of the parabola L , and of course, can be put this way, too: $x = 3(y + 5)^2/4 - 4$.

Looking at next, the parabola **M**, we can see that the vertex is (1, -5), and it has a point at (3, -3), so we can get $x = m(y - v)^2 + u \Rightarrow 3 = m(-3 + 5)^2 + 1 = 4m + 1 \Rightarrow 4m = 2 \Rightarrow m = 1/2 \Rightarrow x = (1/2)(y + 5)^2 + 1$, which is the equation of the parabola **M**, and of course, can be put this way, too: $x = (y + 5)^2/2 + 1$.

Moving next, on to the parabola **N**, we can see that it has the vertex at (3, -4), and a point (6, -2), so we can get $x = m(y - v)^2 + u \Rightarrow 6 = m(-2 + 4)^2 + 3 = 4m + 3 \Rightarrow 4m = 3 \Rightarrow m = 3/4 \Rightarrow x = (3/4)(y + 4)^2 + 3$, which is the equation of the parabola **N**, and of course, can be put this way, too: $x = 3(y + 4)^2/4 + 3$.

And next, moving on to the parabola **O**, we can see that it has the vertex at (6, -4), and a point (5, -2), so we can get $x = m(y - v)^2 + u \Rightarrow 5 = m(-2 + 4)^2 + 6 = 4m + 6 \Rightarrow 4m = -1 \Rightarrow m = -1/4 \Rightarrow x = (-1/4)(y + 4)^2 + 6$, which is the equation of the parabola **O**, and of course, can be put this way, too: $x = -(y + 4)^2/4 + 6$, or $x = 6 - (y + 4)^2/4$.

