

THE PARABOLA

Letos rectorum

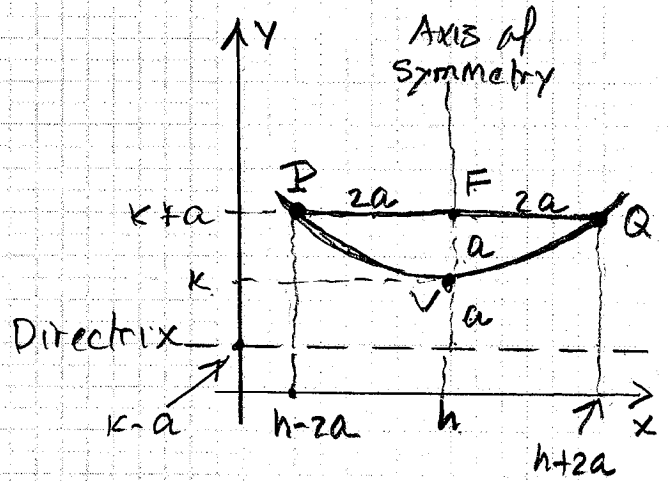
$V = (h, k)$ $F = (h, k+a)$

Directrix $y = k-a$

Axis: $x = h$

$(x-h)^2 = 4a(y-k)$

$P = (h-2a, k+a)$ $Q = (h+2a, k+a)$



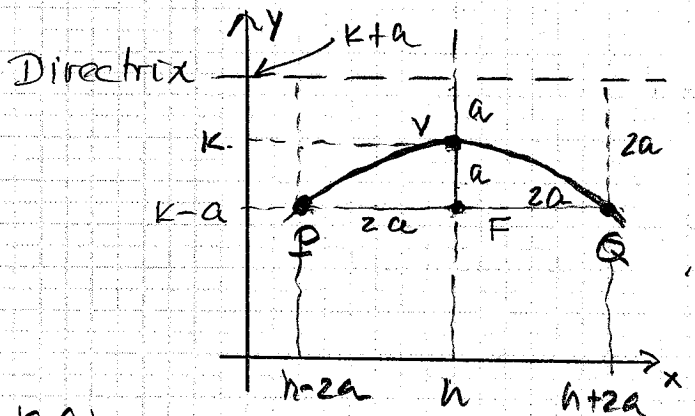
$V = (h, k)$ $F = (h, k-a)$

Directrix: $y = k+a$

Axis: $x = h$

$(x-h)^2 = -4a(y-k)$

$P = (h-2a, k-a)$ $Q = (h+2a, k-a)$

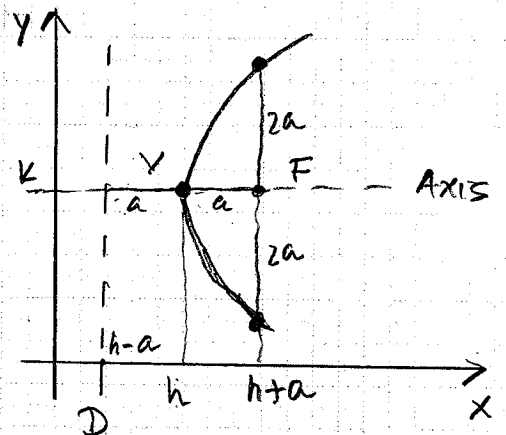


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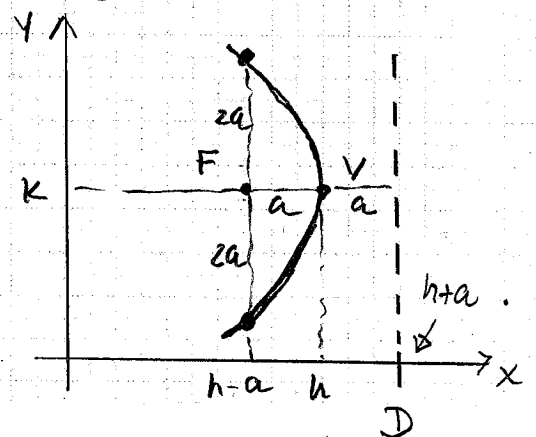


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Exercises

- 1) Write the equation of the parabola in the given sketch

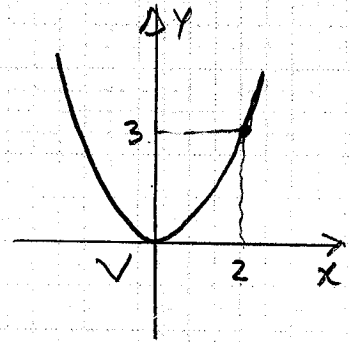
$$(x-h)^2 = 4a(y-k)$$

$$V = (h, k) = (0, 0) \Rightarrow h = 0 \quad k = 0$$

$$x^2 = 4ay$$

$$2^2 = 4a \cdot 3 \rightarrow 4 = 12a \Rightarrow a = \frac{1}{3}$$

$$x^2 = 4 \cdot \frac{1}{3} y \Rightarrow \boxed{x^2 = \frac{4}{3} y}$$



- 2) Given $V = (4, 3)$ $F = (2, 3)$

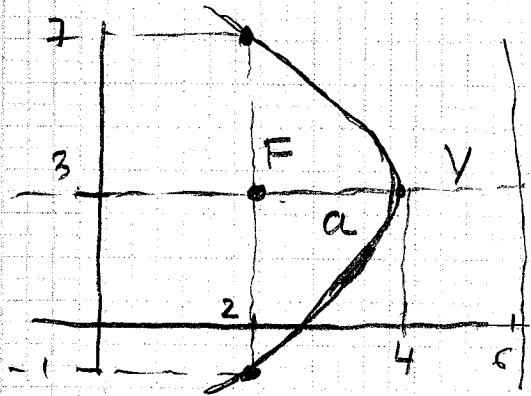
Find the equation of the parabola, the endpoints of the latus rectum, and the equations of the axis of symmetry and the directrix

$$a = 2$$

$$(y-k)^2 = -4a(x-h)$$

$$(y-3)^2 = -4 \cdot 2 (x-4) \Rightarrow (y-3)^2 = -8(x-4)$$

$$(2, 7) \quad (2, -1) \quad \text{Axis: } y = 3 \quad D: x = 6$$



- 3) Find the standard equation of the following parabola, the coordinates of the vertex and focus, the equations of the axis and directrix and graph it.

$$x^2 - 4x + 12y - 20 = 0$$

Completing the squares

$$x^2 - 4x + 4 = -12y + 20 + 4$$

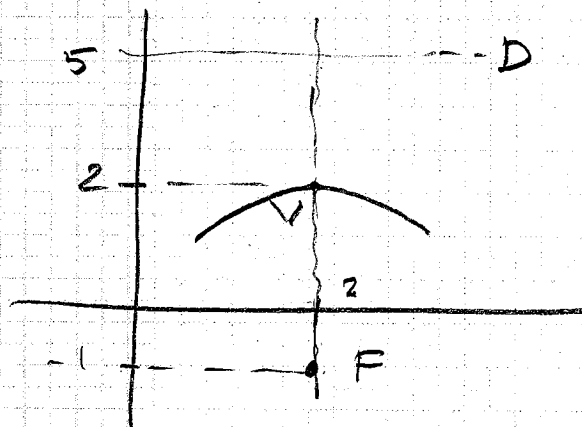
half
-2 square it

$$(x - 2)^2 = -12y + 24$$

$$(x - 2)^2 = -12(y - 2)$$

$$h = 2$$

$$k = 2$$



$$V = (h, k) = (2, 2)$$

$$-12 = -4a \Rightarrow a = 3$$

$$F = (2, -1)$$

$$\text{Axis: } x = 2$$

$$D: y = 5$$