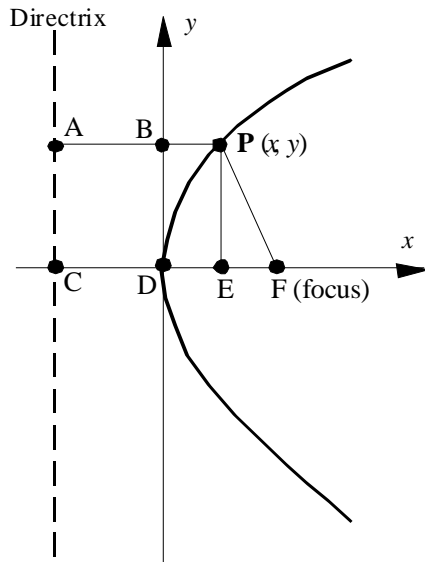


The Parabola Defined



Given that focus and directrix are equidistant from the origin, and given that any point P on the curve is equidistant from focus and directrix, show that the equation of the curve is $y^2 = 4ax$

- 1 In triangle EFP we have (by Pythagorus): $(EP)^2 = (FP)^2 - (EF)^2$
- 2 Let $EP = y$, let $AP = FP = b$ and let $CD = FD = a$;
- 3 Now, since $CF = 2a$ and $CE = AP = b$, then $EF = (2a - b)$
- 4 So in triangle EFP we have: $y^2 = b^2 - (2a - b)^2 \therefore y^2 = b^2 - (4a^2 - 4ab + b^2) = 4a(b - a)$
- 5 But, $(b - a) = AP - AB = BP = DE$ which is the x coordinate at point P
- 6 Thus $y^2 = 4ax$ as required.