

Ellipse: Converting From General Form To Standard Form

$$Ax^2 + By^2 + Cx + Dy + E = 0$$

$$Ax^2 + Cx \quad By^2 + Dy \quad = -E$$

$$A\left(x^2 + \frac{C}{A}x\right) + B\left(y^2 + \frac{D}{B}y\right) = -E$$

$$A\left(x^2 + \frac{C}{A}x + \frac{C^2}{4A^2}\right) + B\left(y^2 + \frac{D}{B}y + \frac{D^2}{4B^2}\right) = -E$$

$$A\left(x + \frac{C}{2A}\right)^2 + B\left(y + \frac{D}{2B}\right)^2 = -E + \frac{C^2}{4A} + \frac{D^2}{4B}$$

$$A\left(x + \frac{C}{2A}\right)^2 + B\left(y + \frac{D}{2B}\right)^2 = \frac{-4ABE}{4AB} + \frac{Bc^2}{4AB} + \frac{AD^2}{4AB}$$

$$A\left(x + \frac{C}{2A}\right)^2 + B\left(y + \frac{D}{2B}\right)^2 = \frac{Bc^2 + AD^2 - 4ABE}{4AB}$$

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$$\frac{4AB \cdot A \left(x + \frac{C}{2A}\right)^2}{BC^2 + 4D^2 - 4AB\bar{E}} + \frac{4AB \cdot B \left(y + \frac{D}{2B}\right)^2}{BC^2 + 4D^2 - 4AB\bar{E}} = 1$$

$$\frac{4A^2B \left(x + \frac{C}{2A}\right)^2}{BC^2 + 4D^2 - 4AB\bar{E}} + \frac{4AB^2 \left(y + \frac{D}{2B}\right)^2}{BC^2 + 4D^2 - 4AB\bar{E}} = 1$$

$$\text{DENOM1} = \frac{BC^2 + 4D^2 - 4AB\bar{E}}{4A^2B}$$

$$\text{DENOM2} = \frac{BC^2 + 4D^2 - 4AB\bar{E}}{4AB^2}$$

* IF DENOM1 > DENOM2 Horizontal *

$$a = \sqrt{\text{DENOM1}}, \quad b = \sqrt{\text{DENOM2}}$$

$$c = \sqrt{\text{DENOM1} - \text{DENOM2}}$$

$$h = \frac{-c}{2A} \quad k = \frac{-D}{2B}$$

center (h, k) ; vertices $(h+a, k)$ $(h-a, k)$

covertices $(h, k+b)$ $(h, k-b)$

foci $(h+c, k)$ $(h-c, k)$

$a =$ semi-major axis

$b =$ semi-minor axis

$$e = \frac{c}{a}$$

else if

$DENOM2 > DENOM1$ Vertical

$$a = \sqrt{DENOM2} \quad b = \sqrt{DENOM1}$$

$$c = \sqrt{DENOM2 - DENOM1}$$

$$h = \frac{-C}{2A} \quad k = \frac{-D}{2B}$$

center (h, k) ; vertices $(h, k+a)$ $(h, k-a)$

covertices $(h+b, k)$ $(h-b, k)$

foci $(h, k+c)$ $(h, k-c)$

$a =$ semi-major axis

$b =$ semi-minor axis

$$e = \frac{c}{a}$$