#43: (a) $M(a,a) = \displaystyle\int_{-\infty}^{\infty} \frac{dx}{x^2+a^2} = \left[\frac{1}{a} \arctan \frac{x}{a}\right]_{-\infty}^{\infty} = \frac{1}{a}\left(\frac{\pi}{2} - \left(-\frac{\pi}{2}\right)\right) = \underline{\underline{\frac{\pi}{a}}}$

(b) If we make a larger, then $\dfrac{1}{\sqrt{(x^2+a^2)(x^2+b^2)}}$ becomes smaller, and so will the integral.

Therefore

$$\underbrace{M(2.7,\, 2.7)}_{=\frac{\pi}{2.7} = 1.164} > M(2.7, 2.8) > \underbrace{M(2.8, 2.8)}_{\frac{\pi}{2.8} = 1.122}$$

So $M(2.7, 2.8) \approx 1.143$ with an error at most 0.021 which is an error of ~~[illegible]~~ $< 2\%$

(c) $u = \frac{1}{2}\left(x - \frac{ab}{x}\right)$ Must solve this for x

$2ux = x^2 - ab$

$x^2 - 2ux - ab = 0$

$x = u \pm \sqrt{u^2+ab}$. Clearly "+" gives $x > 0$

"−" gives $x < 0$

Let's plot the relation $u = \frac{1}{2}\left(x - \frac{ab}{x}\right)$: