$$x = 2y^2 \Rightarrow y^2 = \frac{x}{2} \Rightarrow y = \pm\sqrt{\frac{x}{2}} = \pm\frac{\sqrt{x}}{\sqrt{2}}$$

Line meets parabola where both $x = 1-y$ and $x = 2y^2 \Rightarrow$

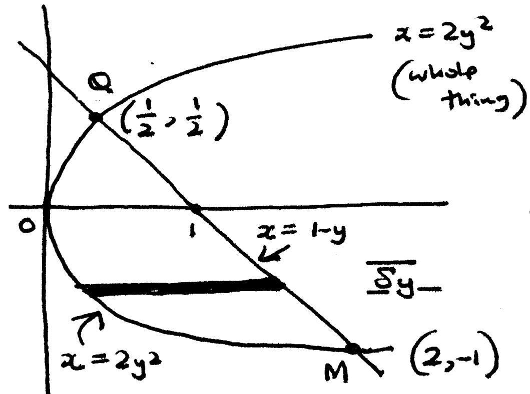
$1 - y = 2y^2 \Rightarrow 2y^2 + y - 1 = 0$

$\Rightarrow (2y-1)(y+1) = 0$

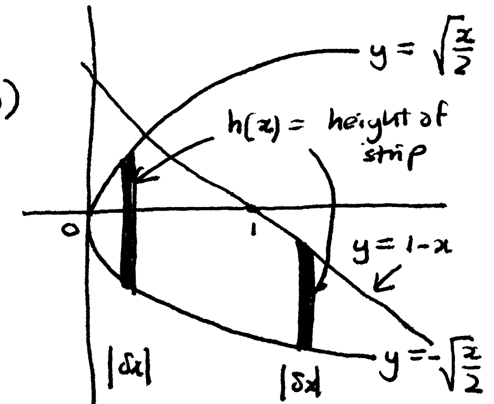
$\Rightarrow y = \frac{1}{2}$ or $y = -1$

$\Rightarrow x = 2\left(\frac{1}{2}\right)^2$ or $2(-1)^2$,

i.e., $\frac{1}{2}$ or 2



Method B



Method A

Hence Q is $\left(\frac{1}{2}, \frac{1}{2}\right)$ and M is $(2,-1)$ (and the lack of scale is lousy, but who cares about that?)

Method B (easier): $\delta A = \{(1-y) - (2y^2)\}\,\delta y + o(\delta y)$ for $-1 \le y \le \frac{1}{2}$

$$\Rightarrow A = \int_{-1}^{1/2} (1 - y - 2y^2)\,dy = \left(y - \frac{1}{2}y^2 - \frac{2}{3}y^3\right)\Big|_{-1}^{1/2} =$$

$$\frac{1}{2} - \left(\frac{1}{2}\right)^3 - \frac{2}{3}\left(\frac{1}{2}\right)^3 - \left(-1 - \frac{1}{2}(-1)^2 - \frac{2}{3}(-1)^3\right) = \frac{1}{2} - \frac{1}{8} - \frac{1}{12} + 1 + \frac{1}{2} - \frac{2}{3} = \frac{9}{8}$$

Method A: $\delta A = h(x)\,\delta x + o(\delta x)$ for $0 \le x \le 2$ where

$$h(x) = \begin{cases} \sqrt{\frac{x}{2}} - \left(-\sqrt{\frac{x}{2}}\right) = \frac{1}{\sqrt{2}}\sqrt{x} + \frac{1}{\sqrt{2}}\sqrt{x} = \frac{2}{\sqrt{2}}\sqrt{x} = \sqrt{2}\sqrt{x} & \text{for } 0 \le x \le \frac{1}{2} \\ 1 - x - \left(-\sqrt{\frac{x}{2}}\right) = 1 - x + \frac{1}{\sqrt{2}}\sqrt{x} & \text{for } \frac{1}{2} \le x \le 2 \end{cases}$$

$$\text{So } A = \int_0^2 h(x)\,dx = \int_0^{1/2} h(x)\,dx + \int_{1/2}^2 h(x)\,dx$$

$$= \int_0^{1/2} \sqrt{2}\sqrt{x}\,dx + \int_{1/2}^2 \left(1 - x + \frac{1}{\sqrt{2}}\sqrt{x}\right)dx = \sqrt{2}\int_0^{1/2} x^{1/2}\,dx + \int_{1/2}^2 (1-x)\,dx$$

$$+ \frac{1}{\sqrt{2}}\int_{1/2}^2 \sqrt{x}\,dx = \sqrt{2}\,\frac{2}{3}x^{3/2}\Big|_0^{1/2} + \left\{-\frac{(1-x)^2}{2}\right\}\Big|_{1/2}^2 + \frac{1}{\sqrt{2}}\,\frac{2}{3}x^{3/2}\Big|_{1/2}^2 =$$

$$\sqrt{2}\left(\frac{2}{3}\,\frac{1}{2\sqrt{2}} - 0\right) + \left\{-\frac{1}{2}(1-2)^2 + \frac{1}{2}\left(1 - \frac{1}{2}\right)^2\right\} + \frac{\sqrt{2}}{3}\left\{2\sqrt{2} - \frac{1}{2\sqrt{2}}\right\} =$$

$$\frac{1}{3} - \frac{1}{2} + \frac{1}{8} + \frac{4}{3} - \frac{1}{6} = \frac{9}{8} \text{ (perforce)}$$