

$$\frac{d}{dx} \left[2 \sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right) \right] = \frac{1}{\sqrt{(x-b)(a-x)}}$$

Working:

$$y = 2 \sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right)$$

$$\frac{y}{2} = \sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right)$$

$$\sin \left(\frac{y}{2} \right) = \sqrt{\frac{x-b}{a-b}}$$

$$\left[\sin \left(\frac{y}{2} \right) \right]^2 = \frac{x-b}{a-b}$$

$$\frac{dy}{dx} \cos \left(\frac{y}{2} \right) \sin \left(\frac{y}{2} \right) = \frac{1}{a-b}$$

$$\frac{dy}{dx} = \frac{1}{(a-b) \cos \left(\frac{y}{2} \right) \sin \left(\frac{y}{2} \right)}$$

$$\frac{dy}{dx} = \frac{1}{(a-b) \cos \left(\frac{2 \sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right)}{2} \right) \sin \left(\frac{2 \sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right)}{2} \right)}$$

$$\frac{dy}{dx} = \frac{1}{(a-b) \cos \left(\sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right) \right) \sin \left(\sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right) \right)}$$

$$\frac{dy}{dx} = \frac{1}{(a-b) \left[\sqrt{1 - \left(\sin \left(\sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right) \right) \right)^2} \right] \sin \left(\sin^{-1} \left(\sqrt{\frac{x-b}{a-b}} \right) \right)}$$

$$\frac{dy}{dx} = \frac{1}{(a-b) \left(\sqrt{1 - \frac{x-b}{a-b}} \right) \left(\sqrt{\frac{x-b}{a-b}} \right)}$$

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$$\frac{dy}{dx} = \frac{1}{(a-b) \sqrt{\frac{x-b}{a-b} - \frac{(x-b)^2}{(a-b)^2}}}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{(a-b)(x-b) - (x-b)^2}}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{(x-b)(a-b-x+b)}}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{(x-b)(a-x)}}$$