Given $\sec\alpha = \frac{25}{7}$ $270° < \alpha < 360°$ and $\tan\beta = \frac{12}{5}$ $180° < \beta < 270°$

$r = 25,\ x = 7,\ y = -24$

$y = -12$ $x = -5$ $r = 13$

sin(2α)
cos(2α)
tan(2α)

$\sin\alpha = -\frac{24}{25}$

$\sin\beta = -\frac{12}{13}$

$\cos\alpha = \frac{7}{25}$

$\cos\beta = -\frac{5}{13}$

$$\sin(\alpha-\beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$
$$= \frac{-24}{25}\cdot\left(\frac{-5}{13}\right) - \frac{7}{25}\cdot\left(\frac{-12}{13}\right) = \frac{120}{325} + \frac{84}{325} = \frac{204}{325} = \frac{y}{r}$$

$$\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$$
$$= \frac{7}{25}\cdot\left(\frac{-5}{13}\right) + \left(\frac{-24}{25}\right)\left(\frac{-12}{13}\right) = \frac{-35}{325} + \frac{288}{325} = \frac{253}{325} = \frac{x}{r}$$

$$\tan(\alpha-\beta) = \frac{y}{x} = \frac{204}{253}$$

What quadrant is $\alpha - \beta$ in? QI

$$\sin(2\alpha) = 2\sin\alpha\cos\alpha$$
$$= \frac{2}{1}\left(\frac{-24}{25}\right)\left(\frac{7}{25}\right)$$
$$= \frac{-336}{625} = \frac{y}{r}$$

$$\tan(2\alpha) = \frac{-336}{-527} = \frac{336}{527}$$

2α is in QIII

$$\cos(2\alpha) = \cos^2\alpha - \sin^2\alpha$$
$$= \left(\frac{7}{25}\right)^2 - \left(\frac{-24}{25}\right)^2$$
$$= \frac{49}{625} - \frac{576}{625}$$
$$= -\frac{527}{625} = \frac{x}{r}$$

4) $\tan\theta + \cot\theta - \sec\theta\csc\theta = 0$

$$\tan\theta + \cot\theta - \sec\theta\csc\theta = \overbrace{\frac{\sin\theta}{\cos\theta}\cdot\frac{\sin\theta}{\sin\theta}}+\overbrace{\frac{\cos\theta}{\sin\theta}\cdot\frac{\cos\theta}{\cos\theta}}-\overbrace{\frac{1}{\cos\theta}\cdot\frac{1}{\sin\theta}}$$

$$= \frac{\overbrace{\sin^2\theta + \cos^2\theta} - 1}{\sin\theta\cos\theta}$$

$$= \frac{1-1}{\sin\theta\cos\theta}$$

$$= 0$$

$$\frac{5}{7} - \frac{1}{3}$$

$$\frac{5\cdot 3 - 1\cdot 7}{7\cdot 3} = \frac{15-7}{21} = \frac{8}{21}$$

5) $\frac{1+\sin\theta}{1-\sin\theta} - \frac{1-\sin\theta}{1+\sin\theta} = 4\tan\theta\sec\theta$

$$\frac{1+\sin\theta}{1-\sin\theta} - \frac{1-\sin\theta}{1+\sin\theta} = \frac{(1+\sin\theta)(1+\sin\theta)-(1-\sin\theta)(1-\sin\theta)}{(1-\sin\theta)(1+\sin\theta)}$$

$$= \frac{(1+2\sin\theta+\sin^2\theta)-(1-2\sin\theta+\sin^2\theta)}{1-\sin^2\theta}$$

$$= \frac{\cancel{1}+2\sin\theta+\cancel{\sin^2\theta}-\cancel{1}+2\sin\theta-\cancel{\sin^2\theta}}{\cos^2\theta}$$

$$= \frac{4\sin\theta}{\cos^2\theta} = 4 \cdot \frac{\sin\theta}{\cos\theta} \cdot \frac{1}{\cos\theta}$$

$$= 4\tan\theta \cdot \sec\theta$$

If $\sin\theta = \frac{9}{41} = \frac{y}{r}$ then $\tan\frac{\theta}{2} = \frac{1-\cos\theta}{\sin\theta}$

θ in QI $\quad \frac{\theta}{2}$ in QI

$y = 9, \ x = 40, \ r = 41$

$$= \frac{\left(1 - \frac{40}{41}\right) 41}{\left(\frac{9}{41}\right) 41}$$

$$= \frac{41-40}{9}$$

$$= \frac{1}{9}$$

$$\sin\frac{\theta}{2} = \sqrt{\frac{1-\cos\theta}{2}} = \sqrt{\frac{\left(1 - 40/41\right)41}{2 \cdot 41}}$$

$$\sqrt{\frac{41-40}{82}} = \sqrt{\frac{1}{82}} = \frac{\sqrt{82}}{82}$$

$\cos\frac{\theta}{2} =$

$$\frac{9}{\sqrt{82}} \cdot \frac{\sqrt{82}}{\sqrt{82}} = \frac{9\sqrt{82}}{82}$$