Identities:

next $2x = 4$, $x = 2$ → $2x + x = 3x$, $x =$ all reals

- Reciprocals
  - $\sec\theta = \frac{1}{\cos\theta}$ $\quad \cos\theta = \frac{1}{\sec\theta}$
  - $\csc\theta = \frac{1}{\sin\theta}$ $\quad \sin\theta = \frac{1}{\csc\theta}$
  - $\cot\theta = \frac{1}{\tan\theta}$ $\quad \tan\theta = \frac{1}{\cot\theta}$

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- Quotient
  - $\tan\theta = \frac{\sin\theta}{\cos\theta}$
  - $\cot\theta = \frac{\cos\theta}{\sin\theta}$

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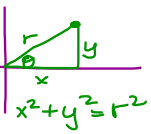
- Pythagorean:
  - $\cos^2\theta + \sin^2\theta = 1$




  - $1 + \tan^2\theta = \sec^2\theta$
  - $\cot^2\theta + 1 = \csc^2\theta$

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- Solve for values of $\theta$:

① $\cot\theta = 2$, find $\tan\theta = \frac{1}{2}$

② $\sin\theta = \frac{1}{2}$, $\cos\theta$

$\cos^2\theta + \sin^2\theta = 1$

$\cos^2\theta + \left(\frac{1}{2}\right)^2 = 1$

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

$-\frac{1}{4}$ $\quad -\frac{1}{4}$

$\sqrt{\cos^2\theta} = \pm\sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{\sqrt{4}}$

$\cos\theta = \pm\frac{\sqrt{3}}{2}$

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③ $\cot\theta = \frac{8}{10} = \frac{4}{5}$, $\csc\theta$

$1 + \cot^2\theta = \csc^2\theta$

$1 + \left(\frac{4}{5}\right)^2 = \csc^2\theta$

$\frac{25}{25} + \frac{16}{25} = \sqrt{\csc^2\theta}$

$\frac{\sqrt{41}}{\sqrt{25}} = \pm\frac{\sqrt{41}}{5} = \csc\theta$

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④ $\sin\theta = \frac{40}{41}$, $\tan\theta$

$1 + \cot^2\theta = \csc^2\theta$

$1 + \cot^2\theta = \left(\frac{41}{40}\right)^2$

$1 + \cot^2\theta = \frac{1681}{1600}$ $\quad -1 \quad -\frac{1600}{1600}$

$\sqrt{\cot^2\theta} = \frac{\sqrt{81}}{\sqrt{1600}}$

$\cot\theta = \pm\frac{9}{40}$

$\tan\theta = \pm\frac{40}{9}$

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(5) $\cos\theta = \frac{3}{5}$, find $\tan\theta$

(6) $\cos\theta = \frac{3}{10}$, find $\cot\theta$

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• Simplify:

$\frac{8}{10} = \frac{4}{5}$

(1) $\frac{\tan x \csc x}{\sec x}$

$\frac{\frac{\sin x}{\cos x} \cdot \frac{1}{\sin x}}{\frac{1}{\cos x}} = \frac{\frac{1}{\cos x}}{\frac{1}{\cos x}} = 1$

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(2) $\cos x \tan x \csc x$

$\frac{\cos x}{1} \cdot \frac{\sin x}{\cos x} \cdot \frac{1}{\sin x} = 1$

(3) $\frac{1}{\sin^2\theta} - \frac{\cos^2\theta}{\sin^2\theta}$

$\csc^2\theta - \cot^2\theta$

$1$

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(4) $\frac{\csc\beta}{1 + \cot^2\beta}$

$\frac{\csc\beta}{\csc^2\beta} = \frac{1}{\csc\beta} = \sin\beta$

$\frac{1}{\csc\beta \cdot \csc\beta}$

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(5) $\tan^2\theta \cos^2\theta$

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

$\sin^2\theta$

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(6) $\frac{\sin^2\theta + \cos^2\theta}{\cos^2\theta}$

$\frac{1}{\cos^2\theta} = \sec^2\theta$

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