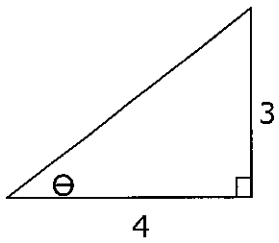
PreCalculus
Double Angle Trig Identities WS

Name Key

Use the figure to find the exact value of each trig function.



1. $\sin\theta = \frac{3}{5}$ 2. $\cos\theta = \frac{4}{5}$ 3. $\tan\theta = \frac{3}{4}$

4. $\csc\theta = \frac{5}{3}$ 5. $\sec\theta = \frac{5}{4}$ 6. $\cot\theta = \frac{4}{3}$

7. $\sin 2\theta = 2\sin\theta\cos\theta$
$= 2 \cdot \frac{3}{5} \cdot \frac{4}{5}$
$= \boxed{\frac{24}{25}}$

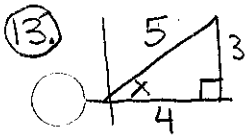
8. $\cos 2\theta = \cos^2\theta - \sin^2\theta$
$(\frac{4}{5})^2 - (\frac{3}{5})^2$
$\frac{16}{25} - \frac{9}{25} = \boxed{\frac{7}{25}}$

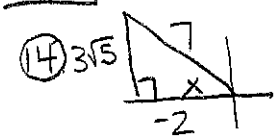
9. $\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$
$\frac{2(3/4)}{1-(3/4)^2} = \frac{6/4}{\frac{16}{16}-\frac{9}{16}} = \frac{6/4}{7/16} =$
$\frac{6}{4} \cdot \frac{16^4}{7} = \boxed{\frac{24}{7}}$

10. $\csc 2\theta = \boxed{\frac{25}{24}}$

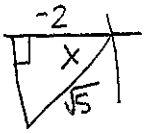
11. $\sec 2\theta = \boxed{\frac{25}{7}}$

12. $\cot 2\theta = \boxed{\frac{7}{24}}$

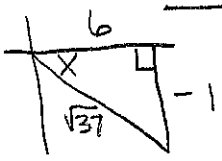
13. 

14. 

$x^2 + (-2)^2 = 7^2$
$x^2 + 4 = 49$
$x^2 = 45$
$3 \cdot 3 \cdot 5$
$x = 3\sqrt{5}$

15. 

$(-1)^2 + (-2)^2 = c^2$
$1 + 4 = c^2$
$5 = c^2$
$\sqrt{5} = c$

16. 

$(-1)^2 + 6^2 = c^2$
$1 + 36 = c^2$
$37 = c^2$
$\sqrt{37} = c$

Find the exact values of $\sin 2x$, $\cos 2x$, and $\tan 2x$ using the double-angle identities.

13. $\sin x = \frac{3}{5}$, $0 < x < \frac{\pi}{2}$

$\sin 2x = 2\sin x\cos x = 2 \cdot \frac{3}{5} \cdot \frac{4}{5} = \boxed{\frac{24}{25}}$

$\cos 2x = 1 - 2\sin^2 x = 1 - 2(\frac{3}{5})^2 = 1 - 2(\frac{9}{25}) =$
$\frac{25}{25} - \frac{18}{25} = \boxed{\frac{7}{25}}$

$\tan 2x = \frac{2\tan\theta}{1-\tan^2\theta} = \frac{2 \cdot 3/4}{1-(3/4)^2} = \frac{6/4}{1-9/16} = \frac{6/4}{16/16 - 9/16} =$
$\frac{6/4}{7/16} = \frac{6}{4} \cdot \frac{16^4}{7} = \boxed{\frac{24}{7}}$

14. $\cos x = -\frac{2}{7}$, $\frac{\pi}{2} < x < \pi$

$\sin 2x = 2\sin x\cos x = 2 \cdot \frac{3\sqrt{5}}{7} \cdot \frac{-2}{7} = \boxed{\frac{-12\sqrt{5}}{49}}$

$\cos 2x = 2\cos^2 x - 1 = 2(\frac{-2}{7})^2 - 1 = 2(\frac{4}{49}) - 1 = \frac{8}{49} - \frac{49}{49} = \boxed{\frac{-41}{49}}$

$\tan 2x = \frac{2\tan x}{1-\tan^2 x} = \frac{2(\frac{3\sqrt{5}}{-2})}{1-(\frac{3\sqrt{5}}{-2})^2} = \frac{-3\sqrt{5}}{1-(\frac{45}{41})} = \frac{-3\sqrt{5}}{\frac{41}{41} - \frac{45}{41}} = \frac{-3\sqrt{5}}{\frac{-41}{41}} =$
$-3\sqrt{5} \cdot \frac{-4}{41} = \boxed{\frac{12\sqrt{5}}{41}}$

15. $\tan x = \frac{1}{2}$, $\pi < x < \frac{3\pi}{2}$

$\sin 2x = 2\sin x\cos x = 2 \cdot \frac{-1}{\sqrt{5}} \cdot \frac{-2}{\sqrt{5}} = \boxed{\frac{4}{5}}$

$\cos 2x = \cos^2 x - \sin^2 x = (\frac{-2}{\sqrt{5}})^2 - (\frac{-1}{\sqrt{5}})^2 =$
$\frac{4}{5} - \frac{1}{5} = \boxed{\frac{3}{5}}$

$\tan 2x = \frac{2\tan x}{1-\tan^2 x} = \frac{2(1/2)}{1-(1/2)^2} = \frac{1}{\frac{4}{4} - 1/4} = \frac{1}{3/4} =$
$1 \cdot \frac{4}{3} = \boxed{\frac{4}{3}}$

16. $\cot x = \frac{-6}{10}$, $\frac{3\pi}{2} < x < 2\pi$

$\sin 2x = 2\sin x\cos x = 2 \cdot \frac{-1}{\sqrt{37}} \cdot \frac{6}{\sqrt{37}} = \boxed{\frac{-12}{37}}$

$\cos 2x = \cos^2 x - \sin^2 x = (\frac{6}{\sqrt{37}})^2 - (\frac{-1}{\sqrt{37}})^2 = \frac{36}{37} - \frac{1}{37} =$
$\boxed{\frac{35}{37}}$

$\tan 2x = \frac{2\tan x}{1-\tan^2 x} = \frac{2(\frac{-1}{6})}{1-(\frac{-1}{6})^2} = \frac{-2/6}{\frac{36}{36} - \frac{1}{36}}$

$\frac{-1/3}{35/36} = \frac{-1}{3} \cdot \frac{36^{12}}{35} = \boxed{\frac{-12}{35}}$