Differentiate

Key

1. $y = (1 - 4x + 7x^5)^2$

$y' = 2(1 - 4x + 7x^5)(-4 + 35x^4)$

2. $y = \sqrt{13x^2 - 5x + 8}$ $= (13x^2 - 5x + 8)^{1/2}$

$y' = \frac{1}{2}(13x^2 - 5x + 8)^{-\frac{1}{2}}(26x - 5) = \frac{26x - 5}{2\sqrt{13x^2 - 5x + 8}}$

3. $y = 3 \sin 5x$

$y' = 3\cos(5x) \cdot 5 \quad (15\cos 5x)$

4. $y = 4 \tan \sqrt{x}$ $= 4 \tan x^{1/2}$

$y' = 4\sec^2\sqrt{x} \cdot \left(\frac{1}{2}x^{-\frac{1}{2}}\right) = \frac{2\sec^2\sqrt{x}}{\sqrt{x}}$

5. $y = \cos^2(x^3)$

$y' = 2\cos(x^3) \cdot -\sin(x^3) \cdot 3x^2 \quad (-6x^2\cos(x^3)\sin(x^3))$

6. $y = \tan^3\sqrt{\cot(7x)}$ $= \tan^3(\cot(7x))^{1/2}$

$y' = (3\tan^2\sqrt{\cot(7x)}) \cdot \sec^2(\sqrt{\cot(7x)}) \cdot \frac{1}{2}(\cot(7x))^{-\frac{1}{2}} \cdot -\csc^2(7x) \cdot 7$

$= \left[-\frac{21}{2}\tan^2\sqrt{\cot(7x)} \cdot \sec^2(\sqrt{\cot(7x)}) \cdot \frac{1}{\sqrt{\cot(7x)}} \cdot \csc^2(7x)\right]$

Key

Calculus
Chain Rule with Trig

Find the derivative of each of the following functions.

1. $f(x) = \sin x \cos^3 x$

$f'(x) = \sin x(3\cos^2 x)(-\sin x) + \cos^3 x \cdot \cos x$
$= -3\sin^2 x \cdot \cos^2 x + \cos^4 x$

2. $f(x) = \tan x \sin^2 3x$

$f'(x) = \sec^2 x \cdot \sin^2(3x) + \tan x \cdot 2\sin(3x)(\cos(3x)) \cdot 3$
$= \sec^2 x \sin^2(3x) + 6\tan x \cdot \sin(3x)\cos(3x)$

3. $f(x) = \tan^3 x \cos^2 4x$

$f'(x) = 3\tan^2 x \cdot \sec^2 x \cdot \cos^2(4x) + \tan^3 x \cdot 2\cos(4x) \cdot -\sin(4x) \cdot 4$
$f'(x) = 3\tan^2 x \sec^2 x \cdot \cos^2(4x) + -8\tan^3 x \cos(4x)\sin(4x)$

4. $f(x) = \sin^4 \sqrt{x} = \sin^4(x)^{\frac{1}{2}}$

$f'(x) = 4\sin^3\sqrt{x} \cdot (\cos\sqrt{x}) \cdot \frac{1}{2}x^{-\frac{1}{2}} = \frac{2\sin^3\sqrt{x} \cdot \cos\sqrt{x}}{\sqrt{x}}$

5. $f(x) = \tan^5(x^3 + x)$

$f'(x) = (5\tan^4(x^3+x)) \cdot \sec^2(x^3+x)(3x^2+1)$

6. $f(x) = \sqrt{\sin 2x}$ $(\sin(2x))^{\frac{1}{2}}$

$f'(x) = \frac{1}{2}(\sin 2x)^{-1/2} \cos(2x) \cdot 2$

$\frac{\cos(2x)}{\sqrt{\sin(2x)}}$