$\sin(2x)\cos(3x) = 8\cos^4 x \sin x - 6\cos^2 x \sin x$

$\hookrightarrow$ $\sin x$ times powers of cosine.

$\boxed{\sin(2x) = 2\cos x \sin x}$ ← Here's our factor of $\sin x$

$\boxed{\cos(3x) =}\ \cos(x+2x) = \cos x \cos 2x - \sin x \sin 2x$

Handle the $\sin(2x)$ & $\cos(3x)$ separately, and then put 'em together!

$= \cos x\,(2\cos^2 x - 1) - \sin x\,(2\sin x \cos x)$

$= 2\cos^3 x - \cos x - 2\sin^2 x \cos x$

$= 2\cos^3 x - \cos x - 2(1-\cos^2 x)\cos x$

$= 2\cos^3 x - \cos x - 2(\cos x - \cos^3 x)$

$= 2\cos^3 x - \cos x - 2\cos x + 2\cos^3 x$

$= \boxed{4\cos^3 x - 3\cos x}$

$\cos x \cos 2x - \sin x \sin 2x$

$\cos 2x \to 2\cos^2 x - 1$, $\cancel{\cos^2 x - \sin^2 x}$

So, $\sin(2x)\cos(3x) =$

$2\sin x \cos x\,(4\cos^3 x - 3\cos x)$

$= 8\sin x \cos^4 x - 6\sin x \cos^2 x$

$= \boxed{8\cos^4 x \sin x - 6\cos^2 x \sin x}$ ∎ Done.

Also, $\sin(2x)\cos(3x) = \frac{1}{2}\left[\sin(5x) - \sin(-x)\right]$

Calculus Goal: $\int \sin(2x)\cos(3x)\,dx$

$= \boxed{\frac{1}{2}\left[\sin(5x) + \sin(x)\right]}$

$-3\cos(-x) = -3\cos x$, so DON'T be thinkin' you can factor stuff out of the inside of a trig function!

Mar 30-8:13 AM

$\frac{3 \text{ rotations}}{1 \text{ sec}}$ Tire has 24-inch diameter
$r = 12$ in.

How fast, in ft per second.
(Then in miles per hour)

$$\underbrace{\left(\frac{3\ \cancel{\text{rot}}}{1\ \text{sec}}\right)\left(\frac{2\pi \cdot 12\ \cancel{\text{in}}}{1\ \cancel{\text{rot}}}\right)\left(\frac{1\ \text{ft}}{12\ \cancel{\text{in}}}\right)}_{\text{Rate in } \frac{\text{ft}}{\text{s}}.} = 6\pi \frac{\text{ft}}{\text{s}} \approx 18.850 \frac{\text{ft}}{\text{s}}$$

$$\underbrace{\left(6\pi \frac{\cancel{\text{ft}}}{\cancel{\text{s}}}\right)\left(\frac{1\ \text{mi}}{5280\ \cancel{\text{ft}}}\right)\left(\frac{3600\ \cancel{\text{s}}}{1\ \text{hr}}\right)}_{\text{Rate in mi/hr.}} \approx 12.852 \frac{\text{mi}}{\text{hr}}$$

How many minutes to travel 3 miles?

$$D = rt \implies t = \frac{D}{r} =$$

$$= \left(\frac{3\text{mi}}{\left(\frac{21600\pi}{5280} \frac{\text{mi}}{\text{hr}}\right)}\right) = (3\ \cancel{\text{mi}})\underbrace{\left(\frac{5280\ \cancel{\text{hr}}}{21600\pi\ \cancel{\text{mi}}}\right)}_{\text{Inverted \& multiplied.}}\left(\frac{60\ \text{min}}{1\ \cancel{\text{hr}}}\right)$$

$\approx$ 14.006 Minutes.

We just did arc length application

$s = r\theta$, where θ is in radians.

That's where circumference comes from:

2π radians times radius:

$$2\pi r = r \cdot 2\pi = r\theta$$

Area of a sector of a circle comes from πr^2 = area of a whole circle

and the angle is 2π radians

$\frac{2\pi}{2} r^2$ is area of circle.

$$\frac{\theta}{2} r^2 = \boxed{\frac{1}{2} r^2 \theta}$$

Mar 30-8:48 AM

2π 2π

$\theta = 40^\circ$, $r = 8$ in

$$A = \frac{1}{2}r^2\theta = \frac{1}{2}\cdot 8^2\cdot(40^\circ)\left(\frac{\pi \text{ radians}}{180^\circ}\right)$$

$$= \frac{(32)(40)\pi}{180} \approx \boxed{22.340 \text{ in}^2}$$

Karla's evil trick:

$$\frac{\text{Area of sector}}{\text{Area of circle}} = \frac{\overset{40^\circ}{\text{Angle of sector}}}{360^\circ}$$

$$\text{Area} = \frac{\text{Area of circle}\cdot\text{Angle of sector}}{}$$

$$= \left(\frac{\pi\cdot 8^2}{1}\right)\left(\frac{40^\circ}{360^\circ}\right) \approx \boxed{22.340 \text{ in}^2}$$