

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

$$\sin(2x) = 2 \cos x \sin x$$

sin x times powers of cosine.

Here's our factor of sin x

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

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

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

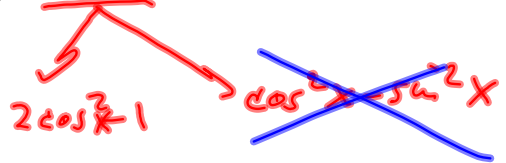
$$= 2 \cos^3 x - \cos x - 2(1 - \cos^2 x) \cos x$$

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

$$= 4 \cos^3 x - 3 \cos x$$

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

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



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

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

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

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

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

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

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

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

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

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

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

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

How many minutes to travel 3 miles?

$$D = r t \Rightarrow t = \frac{D}{r} =$$

$$= \left( \frac{3 \text{ mi}}{\frac{21600\pi \text{ mi}}{5280 \text{ hr}}} \right) = \left( 3 \cancel{\text{mi}} \right) \left( \frac{5280 \cancel{\text{hr}}}{21600\pi \cancel{\text{mi}}} \right) \left( \frac{60 \text{ min}}{1 \cancel{\text{hr}}} \right)$$

Inverted & multiplied.

$$\approx 14.006 \text{ minutes.}$$

We just did arc length application

$s = r\theta$ , where  $\theta$  is in radians.

That's where circumference comes from:

$2\pi$  radians times radius:

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


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Area of a sector of a circle comes from  $\pi r^2 =$  area of a whole circle and the angle is  $2\pi$  radians

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

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


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$2\pi$  $2\pi$ 

$$\theta = 40^\circ, r = 8 \text{ in}$$

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

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

Karla's evil trick:

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

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

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