

SOLUTIONS TO VARIOUS MATH PROBLEMS

(Version 02-14-2026)

Neil Tyson Math Problem

PROBLEM: Show that the maximum speed a car can have without sliding when taking a curve with a bank angle of 24 degrees is 163 miles per hour.

SOLUTION: Derived while in Apple Bees. The best place to do your homework

$$\cos \theta = \frac{F_1}{F_c} \quad F_1 = F_c \cos(\theta) \quad F_2 = \mu_s F_N \quad F_3 = m g \sin \theta$$

$$F_N = W \cos \theta + F_c \sin \theta$$

$$F_2 = \mu_s W \cos \theta + \mu_s F_c \sin \theta$$

$$F_1 = F_2 + F_3 = \mu_s W \cos \theta + \mu_s F_c \sin \theta + m g \sin \theta = F_c \cos \theta$$

$$F_c \cos \theta - \mu_s F_c \sin \theta = \mu_s W \cos \theta + m g \sin \theta$$

$$F_c (\cos \theta - \mu_s \sin \theta) = \mu_s m g \cos \theta + m g \sin \theta$$

$$F_c = \frac{\mu_s m g \cos \theta + m g \sin \theta}{\cos \theta - \mu_s \sin \theta} = \frac{m v^2}{r}$$

$$v = \sqrt{\frac{r \cdot g \cdot (\mu_s \cos \theta + \sin \theta)}{\cos \theta - \mu_s \sin \theta}}$$

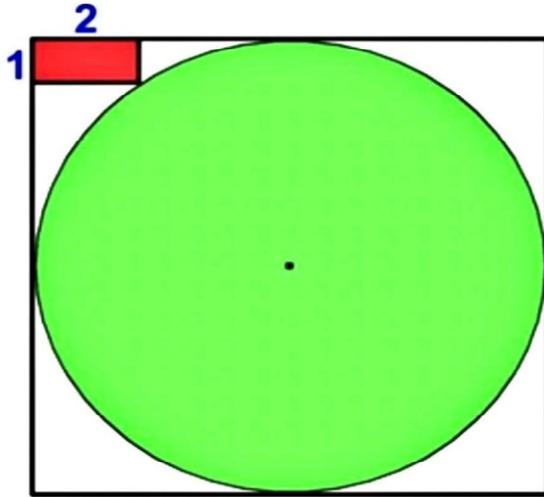
F_c = Centripetal Force
 μ_s = Static Friction = 1.0 ($\mu_s = \tan 45^\circ$) The car slides for $\theta > 45^\circ$
 F_N = Normal Force
 F_2 = Friction Force = $F_N \cdot \mu_s$
 r = Turn Radius = 685 feet
 W = Weight of Vehicle
 m = mass of Vehicle
 g = Gravity = 9.81 m/s^2
 θ = Bank Angle = 24°

$W = mg$
 $\cos(24) = .9135$
 $\sin(24) = .4067$
 $\mu_s \cos(24) + \sin(24) = .9135 + .4067 = 1.3202$
 $\cos(24) - \mu_s \sin(24) = .9135 - .4067 = .5068$

$$v_{\text{mph}} = \sqrt{\frac{(685)(.3048)(9.81) [1.3202]}{.5068}} \cdot \frac{3600}{1609} = 163.43 \text{ miles/hour}$$

Face Book Math Problem # 2

Find the Area of the Green Circle Inside of a Square ?



Let R be the radius of the green Circle and $P(x_1, y_1)$ the point where the red square touches the circle. Also given that the equation of a circle, placed in the center of the X-Y axis is :

$$(Eq 1) X^2 + Y^2 = R^2.$$

Therefore, the point P coordinates will be

$$(Eq 2) x_1=R-2 \text{ and } (Eq 3) y_1=R-1$$

Using Equations 1, 2 and 3 we determine that

$$(Eq 4): (R - 2)^2 + (R - 1)^2 = R^2$$

Solving for the variable R

$$(Eq 5): R^2 - 4R + 4 + R^2 - 2R + 1 = R^2$$

Simplifying Eq 5 we have $R^2 - 6R + 5 = 0$ which is equal to the expression $(R - 5)(R + 1) = 0$

Therefore, $R = 5$ and $R = -1$. Since $R = -1$ is not a real solution

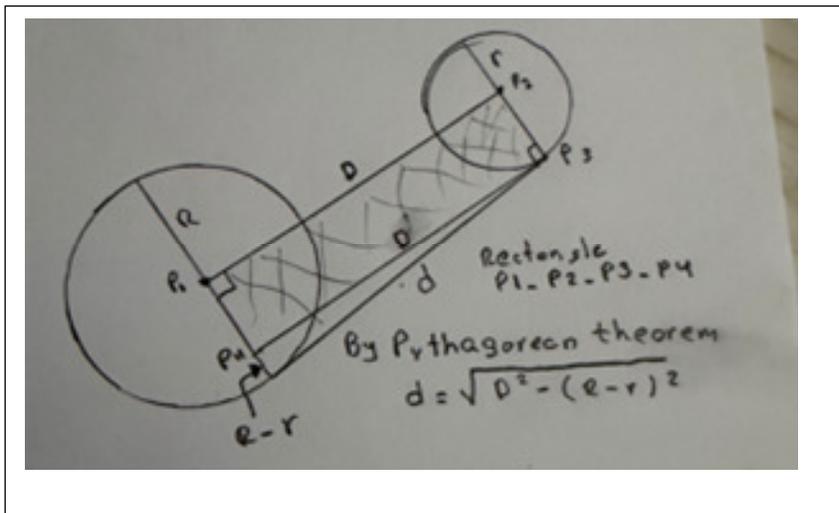
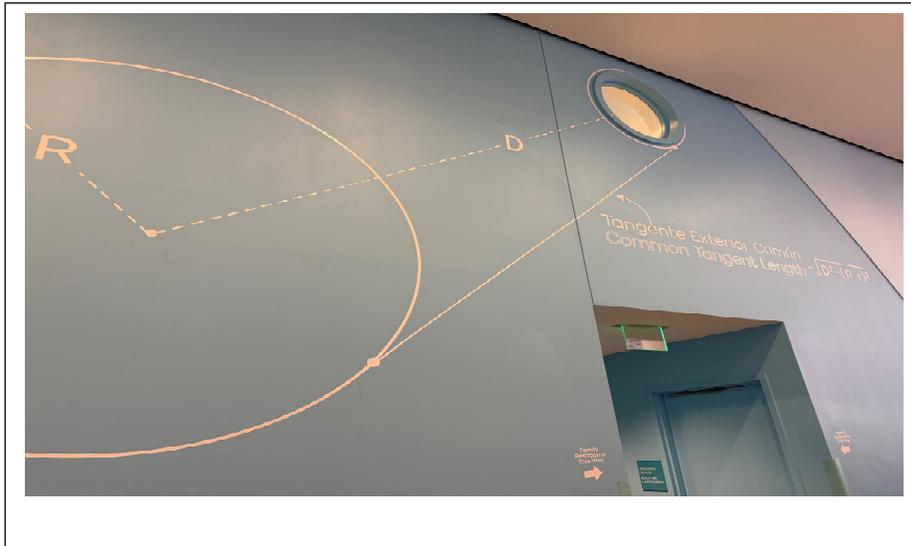
Therefore, the radius of the circle is $R = 5$

and the Area of the circle is $\pi * R^2 = 25*\pi$ where

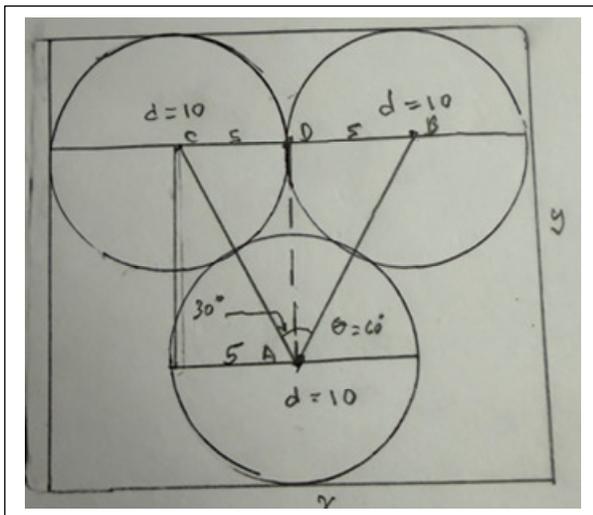
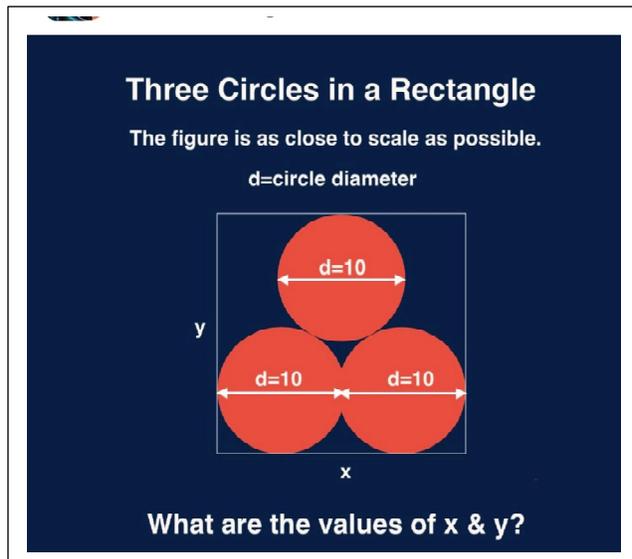
$\pi = 3.1416$.

Problem in the Children Science Museum "La Nube"

Find the Length of the Tangent Line "d" between two circles of radiuses R and r



Math Problem



Find X & Y values

$CD=5$, $\theta=60$ degrees by definition of equilateral triangle

Therefore $\tan(30 \text{ deg}) = 5 / AD : AD = 5 / \tan(30 \text{ deg}) = 8.66$

Therefore $Y = 8.66 + 5 + 5 = 18.66$

And $X = 10 + 10 = 20$