Name_____ Date_____ 4.2 Applications

EXTRA PRACTICE – Arcs and arc length:

1. A pulley with a radius of 10 inches uses a belt to drive a pulley with a radius of 6 inches. Find the angle through which the smaller pulley turns as the 10-inch pulley makes one revolution. State your answer in radians and also degrees.

2. A pulley with a radius of 14 inches uses a belt to drive a pulley with a radius of 28 inches. The 14-inch pulley turns through an angle of $150°$. Find the angle through which the 28-inch pulley turns.

3. A pulley with a diameter of 1.2 meters uses a belt to drive a pulley with a diameter of .8 meter. The 1.2 meter pulley turns through an angle of $240°$. Find the angle through which the .8 meter pulley turns.

Angular Speed:

4. Find the angular speed, in radians per second, of the second hand on a clock.

5. Find the angular speed, in radians per second, of a point on the equator of the earth.

6. A wheel is rotating at 200 revolutions per minute. Find the angular speed in radians per second.

7. A car with a wheel of radius 14 inches is moving with a speed of 55 mph. Find the angular speed of the wheel in radians per second.

Linear Speed:

8. Each tire on a car has a radius of 15 inches. The tires are rotating at 450 revolutions per minute. Find the speed of the car to the nearest mile per hour.

9. Each tire on a truck has a radius of 18 inches. The tires are rotating at 500 revolutions per minute. Find the speed of the truck to the nearest mile per hour.

10. The chain wheel of Emma's bicycle has a radius of 3.5 inches. The rear gear has a radius of 1.75 inches, and the back tire has a radius of 12 inches. If Emma pedals for 150 revolutions of the chain wheel, how far will she travel?

Solutions:

1. **Worked out:** Using the formula $s = r\theta$. As the 10 inch pulley turns through an angle θ_1, a point on that pulley moves s_1 inches, where $s_1 = 10\theta_1$. At the same time, the 6-inch pulley turns through an angle of θ_2 and a point on that pulley moves s_2 inches, where $s_2 = 6\theta_2$. Assuming that the belt does not slip on the pulleys, we have $s_1 = s_2$. Thus:

$$10\theta_1 = 6\theta_2$$

$$10(2\pi) = 6\theta_2$$

$$\frac{10\pi}{3} = \theta_2$$

So the 6-inch pulley moves through an angle of $\frac{10\pi}{3}$ radians, or $600°$.

2. $\frac{5\pi}{12} = 75°$ 3. $2\pi = 360°$ 4. $\frac{\pi}{30}$ radian/sec 5. $\frac{2\pi}{86{,}400} = \frac{\pi}{43{,}200}$rad/sec

6. $\frac{20\pi}{3}$ rad/sec 7. $\frac{484}{7} rad\ /\ sec = 69.143$rad/sec 8. $\frac{1125\pi}{88}$mph ≈ 40.162mph

9. $\frac{375\pi}{22}$ mph ≈ 53.55 mph

10. $r_1\theta_1 = r_2\theta_2$

$3.5(150 \cdot 2\pi) = (1.75)\theta_2$

$600\pi = \theta_2$

$300\,(2\pi) = \theta_2$

Rear gear makes 300 revs

Rear gear and tire make equal number of revolutions.

Tire is 12 inches = 1 ft. $s = 1ft.\,(300)(2\pi) = 1885\,ft.$