Problem 1

You have a paint roller that has a diameter of 4 inches.

You push the roller against the wall and it travels $822°$

1. What is the number of revolutions that the roller has travelled?

$822°/360° = \frac{137}{60}$ **revs** ≈ 2.2833333 **revolutions**

≈ 2.28 **revolutions**

OR

$822° \cdot \frac{\pi \cdot radians}{180°} = \frac{137 \cdot \pi}{30}$ radians

$\frac{137 \cdot \pi}{30}$ radians $\cdot \frac{1 \cdot rev}{2 \cdot \pi} = \frac{137}{60}$ **revs** ≈ 2.2833333 **revolutions**

≈ 2.28 **revolutions**

You have a paint roller that has a diameter of 4 inches.

You push the roller against the wall and it travels $822°$

2. What is the measure of the angle in radians?

$822° \cdot \frac{\pi \cdot radians}{180°} = \frac{137 \cdot \pi}{30}$ radians ≈ 14.346606 radians

$\theta = 822 \cdot \pi / 180$ radians $= \frac{137 \cdot \pi}{30}$ **radians**

$\approx 4.57\,\pi$ radians

≈ 14.346606 radians

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or** $\mathbf{r} = \frac{1}{6}$ **feet**

3. If the paint on the roller was dispensed from the beginning of the motion, then how far on the wall have you painted (linearly)?

$AL = \theta \cdot r$

$= \frac{137 \cdot \pi}{30}$ radians $\cdot$ 2 **inches**

$= \frac{137 \cdot \pi}{15}$ inches

≈ 28.69 inches

$AL = \theta \cdot r$

$= \frac{137 \cdot \pi}{30}$ radians $\cdot \frac{1}{6}$ **feet**

$= \frac{137 \cdot \pi}{180}$ feet

≈ 2.39 feet

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or** $\mathbf{r} = \frac{1}{6}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet**

4. If it took you 45 seconds to perform this task, then state each of the following

a. Linear speed in inches per second

$LS = \frac{AL}{t} = \frac{137 \cdot \pi}{15}$ **inches** $/15$ **seconds**

$= \frac{137 \cdot \pi}{15} \cdot \frac{1}{15} \frac{inches}{second}$

$= \frac{137 \cdot \pi}{225} \frac{inches}{second}$

$\approx 1.91 \frac{inches}{second}$

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or r** $= \frac{1}{6}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet**

LS in $\frac{inches}{sec} = \frac{137 \cdot \pi}{225} \frac{inches}{sec}$

4. If it took you 45 seconds to perform this task, then state each of the following

c. Linear speed in feet per second

LS $= \frac{AL}{t} = \frac{137 \cdot \pi}{180}$ **feet** /15 **second**

$= \frac{137 \cdot \pi}{180} \cdot \frac{1}{15} \frac{feet}{sec}$

$= \frac{137 \cdot \pi}{2700} \frac{feet}{sec}$

$\approx 0.16 \frac{feet}{sec}$

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or r** $= \frac{1}{6}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet**

LS in $\frac{inches}{sec} = \frac{137 \cdot \pi}{225} \frac{inches}{sec}$ **LS in** $\frac{feet}{sec} = \frac{137 \cdot \pi}{2700} \frac{feet}{sec}$

4. If it took you 45 seconds to perform this task, then state each of the following

c. Linear speed in feet per minute

LS $= \frac{AL}{t} = \frac{137 \cdot \pi}{180}$ **feet** $/ \frac{1}{4}$ **minute**

$= \frac{137 \cdot \pi}{180} \cdot 4 \frac{feet}{minute}$

$= \frac{137 \cdot \pi}{45} \frac{feet}{minute}$

$\approx 9.56 \frac{feet}{minute}$

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or r** $= \frac{1}{6}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet** **LS in** $\frac{inches}{sec} = \frac{137 \cdot \pi}{225} \frac{inches}{sec}$

LS in $\frac{feet}{sec} = \frac{137 \cdot \pi}{2700} \frac{feet}{sec}$ **LS in** $\frac{feet}{minute} = \frac{137 \cdot \pi}{45} \frac{feet}{minute}$

5. If it took you 45 seconds to perform this task, then state each of the following

a. Angular speed in radians per second

AS $= \frac{\theta}{t} = \frac{137 \cdot \pi}{30}$ **radians** /15 **seconds**

$= \frac{137 \cdot \pi}{30} \cdot \frac{1}{15} \frac{radians}{second}$

$= \frac{137 \cdot \pi}{450} \frac{radians}{second}$

$\approx 0.96 \frac{radians}{second}$

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or r** $= \frac{1}{6}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet** **LS in** $\frac{inches}{sec} = \frac{137 \cdot \pi}{225} \frac{inches}{sec}$

LS in $\frac{feet}{sec} = \frac{137 \cdot \pi}{2700} \frac{feet}{sec}$ **LS in** $\frac{feet}{minute} = \frac{137 \cdot \pi}{45} \frac{feet}{minute}$ AS in $\frac{radians}{second} = \frac{137 \cdot \pi}{450} \frac{radians}{second}$

5. If it took you 45 seconds to perform this task, then state each of the following

b. Angular speed in radians per minute

AS $= \frac{\theta}{t} = \frac{137 \cdot \pi}{30}$ **radians** $/ \frac{1}{4}$ **minute**

$= \frac{137 \cdot \pi}{30} \cdot 4 \frac{radians}{minute}$

$= \frac{274 \cdot \pi}{15} \frac{radians}{minute}$

$\approx 57.39 \frac{radians}{minute}$

What if we did Problem 5 FIRST, then we did Problem 4?

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or** $\mathbf{r = \frac{1}{6}}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet** AS in $\frac{radians}{second} = \frac{137 \cdot \pi}{450} \frac{radians}{second}$

AS in $= \frac{274 \cdot \pi}{15} \frac{radians}{minute}$

4. If it took you 45 seconds to perform this task, then state each of the following

a. Linear speed in inches per second

$$LS = AS \cdot r = \frac{137 \cdot \pi}{450} \frac{radians}{\text{sec}} \cdot 2 \text{ inches}$$

$$= \frac{137 \cdot \pi}{225} \frac{inches}{second}$$

$$\approx 1.91 \frac{inches}{second}$$

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or** $\mathbf{r = \frac{1}{6}}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet** AS in $\frac{radians}{second} = \frac{137 \cdot \pi}{450} \frac{radians}{second}$

AS in $= \frac{274 \cdot \pi}{15} \frac{radians}{minute}$ **LS in** $\frac{inches}{\text{sec}} = \frac{137 \cdot \pi}{225} \frac{inches}{\text{sec}}$

4. If it took you 45 seconds to perform this task, then state each of the following

b. Linear speed in feet per second

$$LS = AS \cdot r = \frac{137 \cdot \pi}{450} \frac{radians}{\text{sec}} \cdot \frac{1}{6} \text{ foot} \quad \textbf{OR} \quad \mathbf{LS = LS} \frac{inches}{second} \cdot \frac{1 \, foot}{12 \, inches}$$

$$= \frac{137 \cdot \pi}{2700} \frac{feet}{second} \qquad = \frac{137 \cdot \pi}{225} \cdot \frac{1}{12} \frac{feet}{second}$$

$$\approx 0.16 \frac{feet}{second} \qquad = \frac{137 \cdot \pi}{2700} \frac{feet}{second}$$

$$\approx 0.16 \frac{feet}{second}$$

So at this point we know $\theta = \frac{137 \cdot \pi}{30}$ radians and r = 2 **inches or** $\mathbf{r = \frac{1}{6}}$ **feet**

AL in inches $= \frac{137 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{137 \cdot \pi}{180}$ **feet** AS in $\frac{radians}{second} = \frac{137 \cdot \pi}{450} \frac{radians}{second}$

AS in $= \frac{274 \cdot \pi}{15} \frac{radians}{minute}$ **LS in** $\frac{inches}{\text{sec}} = \frac{137 \cdot \pi}{225} \frac{inches}{\text{sec}}$ **LS in** $\frac{feet}{second} = \frac{137 \cdot \pi}{2700} \frac{feet}{second}$

4. If it took you 45 seconds to perform this task, then state each of the following

c. Linear speed in feet per minute

$$LS = AS \cdot r = \frac{274 \cdot \pi}{15} \frac{radians}{minute} \cdot \frac{1}{6} \text{ foot} \quad \textbf{OR} \quad \mathbf{LS = LS} \frac{feet}{second} \cdot \frac{60 \, seconds}{1 \, minute}$$

$$= \frac{137 \cdot \pi}{45} \frac{feet}{minute} \qquad = \frac{137 \cdot \pi}{2700} \cdot \frac{60}{1} \frac{feet}{minute}$$

$$\approx 9.56 \frac{feet}{minute} \qquad = \frac{137 \cdot \pi}{45} \frac{feet}{second}$$

$$\approx 9.56 \frac{feet}{second}$$

1) $822/360 = \frac{137}{60}$ revolutions $= 2.28$ revolutions

2) $822 \cdot \frac{\pi}{180} = \frac{137 \cdot \pi}{30}$ radians $\approx 4.5666667\ \pi$ radians ≈ 14.35 radians

3) $822 \cdot \frac{\pi}{180} \cdot 2 = 1644 \cdot \frac{\pi}{180}$ inches $= \frac{137 \cdot \pi}{15}$ **inches** $\approx 9.1333333\ \pi$ inches ≈ 28.69 inches

$822 \cdot \frac{\pi}{180} \cdot \frac{1}{6} = 137 \cdot \frac{\pi}{180}$ feet $= \frac{137 \cdot \pi}{180}$ **feet** $\approx 0.76111111\ \pi$ feet ≈ 2.39 feet

4a) $822 \cdot \frac{\pi}{180} \cdot 2 \cdot \frac{1}{15} = 1644 \cdot \frac{\pi}{2700} \frac{inches}{second} = \frac{137 \cdot \pi}{225} \frac{inches}{second} \approx 0.60888889\ \pi \frac{inches}{second} \approx 1.91 \frac{inches}{second}$

4b) $822 \cdot \frac{\pi}{180} \cdot \frac{1}{6} \cdot \frac{1}{15} = 137 \cdot \frac{\pi}{2700} \frac{feet}{second} = \frac{137 \cdot \pi}{2700} \frac{feet}{second} \approx 0.05074074\ \pi \frac{feet}{second} \approx 0.16 \frac{feet}{second}$

$\frac{137 \cdot \pi}{225} \frac{inches}{second} \cdot \frac{1\ foot}{12\ inches} = \frac{137 \cdot \pi}{2700} \frac{feet}{second} \approx 0.05074074\ \pi \frac{feet}{second} \approx 0.16 \frac{feet}{second}$

4c) $822 \cdot \frac{\pi}{180} \cdot \frac{1}{6} \cdot 1/(\frac{1}{4}) = 137 \cdot \frac{\pi}{45} \frac{feet}{minute} = \frac{137 \cdot \pi}{45} \frac{feet}{minute} \approx 3.0444444\ \pi \frac{feet}{minute} \approx 9.56 \frac{feet}{minute}$

$\frac{137 \cdot \pi}{2700} \frac{feet}{second} \cdot \frac{60\ seconds}{1\ minute} = \frac{137 \cdot \pi}{45} \frac{feet}{minute} \approx 3.0444444\ \pi \frac{feet}{minute} \approx 9.56 \frac{feet}{minute}$

5a) $822 \cdot \frac{\pi}{180} \cdot \frac{1}{15} = 822 \cdot \frac{\pi}{2700} \frac{radians}{second} = \frac{137 \cdot \pi}{450} \approx 0.30444444\ \pi \frac{radians}{second} \approx 0.96 \frac{radians}{second}$

5b) $822 \cdot \frac{\pi}{180} \cdot 1/(\frac{1}{4}) = 822 \cdot \frac{\pi}{45} \frac{radians}{minute} = \frac{274 \cdot \pi}{15} \approx 18.266667\ \pi \frac{radians}{minute} \approx 57.39 \frac{radians}{minute}$

$\frac{137 \cdot \pi}{450} \frac{radians}{second} \cdot \frac{60\ seconds}{1\ minute} = \frac{274 \cdot \pi}{15} \frac{radians}{minute} \approx 18.266667\ \pi \frac{radians}{minute} \approx 57.39 \frac{radians}{minute}$

		exact		approximate					
given	d_1	**4**	inches	4.	inches				
	r_1	**2**	inches	2.	inches				
	r_2	**1/6**	feet	0.17	feet				
given	angle_1	**822**	degrees	822.	degrees				
	angle_1r	**137*π/30**	radians	14.35	radians	**4.56666...**	π		
	rev_1	**137/60**	revs	2.28	revs				
	as_1	**137*π/450**	rad/second	0.96	rad/second	**0.30444...**	π		
	as_2	**274*π/15**	rad/minute	57.39	rad/minute	**18.2666...**	π		
	ls_1	**137*π/225**	inches/second	1.91	inches/second	**0.60888...**	π		
	ls_2	**548*π/15**	inch/minute	114.77	inch/minute	**36.5333...**	π		
	ls_3	**137*π/2700**	feet/second	0.16	feet/second	**0.05074...**	π		
	ls_4	**137*π/45**	feet/minute	9.56	feet/minute	**3.04444...**	π		
given	t_1	**15**	seconds	15.	seconds				
	t_2	**1/4**	minute	0.25	minute				
	al_1	**137*π/15**	inches	28.69	inches	**9.13333...**	π		
	al_2	**137*π/180**	feet	2.39	feet	**0.76111...**	π		

Problem 2

6. You are pulling a cart and the cart's wheel is 40 inches in diameter and you notice that the wheel is making 4.8 revolutions per second

a. Determine the angular speed of the cart's wheel (leave answer in radians/second)

$$AS = 4.8\frac{revs}{second}\cdot\frac{2\cdot\pi\ radian}{1\ rev} = 9.6\,\pi\frac{rad}{second} = 30.16\frac{rad}{second}$$

b. Determine the speed of the cart (give exact and approximate speed in inches/second)

$r = 20\,\mathbf{inches}$

$$\mathbf{LS = AS(r)} = 9.6\cdot\pi\frac{rad}{second}\cdot 20\,\mathbf{inches} = 192\cdot\pi\frac{inches}{second} \approx 603.19\frac{inches}{second}$$

c. Determine the speed of the cart (give exact and approximate speed in feet/minute)

$$r = 20\,\mathbf{inches}\cdot\frac{1\ foot}{12\ inches} = 20/12\ feet = \frac{5}{3}\,\mathbf{feet}$$

$$\mathbf{LS = AS(r)} = 9.6\cdot\pi\frac{rad}{second}\cdot\frac{5}{3}\,\mathbf{feet} = 16\cdot\pi\frac{feet}{second} \approx 50.27\frac{feet}{second}$$

$$\mathbf{LS = AS(r)} = 16\cdot\pi\frac{feet}{second}\cdot\frac{60\ seconds}{1\ minute} = 960\cdot\pi\frac{feet}{minute} \approx 3015.93\frac{feet}{minute}$$

	A	B	C	D
1	given	d_1	40	inches
2	given	r_1	20	inches
3	given	rev_1	4.8	rev
4	given	rev_1e	24/5	rev
5		theta_1	48*π/5	
6		as_1	48*π/5	
7		as_1c	9.6	
8		s_1	192*π	
9		r_2	5/3	
10		s_2	16*π	
11		s_3	960*π	

given

Problem 3

7. The diameter of the drum on an electric hoist is 16 inches. Find the approximate number of degrees through which the drum must rotate to lift a beam 4 feet.

$AL = 4\,\text{feet}$ $\quad AL = 4\,\mathbf{feet}\cdot\frac{12\ inches}{1\ foot} = 48\,\mathbf{inches}$

$\mathbf{r} = 8\,\mathbf{inches}$

$AL = \theta\cdot r$

$48 = 8\cdot\theta$

$48/8 = 8\cdot\theta/8$

$\theta = 6\,\mathbf{radians}$

$$\theta = 6\,\mathbf{radians}\cdot\frac{180°}{\pi\cdot radians} = \frac{1080}{\pi}° \approx 343.77°$$

	A	B	C	D
1	given	d_1	16	inches
2		r_1	8	inches
3	given	al_1	4	feet
4		al_2	48	inches
5		theta_1	6	radians
6		theta_2	1080/(π)	degrees

given

Problem 4

EC: Can a circle have the same circumference as its area?

$C = d \cdot \pi$

$A = \pi \cdot r^2$

$\pi \cdot r^2 = d \cdot \pi$

$\pi \cdot r^2 = 2 \cdot \pi \cdot r$

$r^2 = 2 \cdot r$

$r^2 - 2r = 0$

$r \cdot (r - 2) = 0$

r = 0 and r = 2

OR

It is impossible to have circumference have the same measure as an area because the units are different

$C = 2 \cdot 2 \cdot \pi = 4 \cdot \pi$

$A = 2^2 \cdot \pi = 4 \cdot \pi$