Problem 1

You have a paint roller that has a diameter of 6 inches.

You push the roller against the wall and it travels $2872°$

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

$2872°/360° = \frac{359}{45}$ **revs** ≈ 7.9777778 **revolutions**

≈ 7.98 **revolutions**

OR

$2872° \cdot \frac{\pi \cdot radians}{180°} = \frac{718 \cdot \pi}{45}$ radians

$\frac{718 \cdot \pi}{45}$ radians $\cdot \frac{1 \cdot rev}{2 \cdot \pi} = \frac{359}{45}$ **revs** ≈ 7.9777778 **revolutions**

≈ 7.98 **revolutions**

You have a paint roller that has a diameter of 6 inches.

You push the roller against the wall and it travels $2872°$

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

$2872° \cdot \frac{\pi \cdot radians}{180°} = \frac{718 \cdot \pi}{45}$ radians ≈ 50.125856 radians

$\theta = 2872 \cdot \pi / 180$ radians $= \frac{718 \cdot \pi}{45}$ **radians**

$\approx 15.96 \pi$ radians

≈ 50.125856 radians

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or** $\mathbf{r} = \frac{1}{4}$ **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)?

$AL = \theta \cdot r$

$= \frac{718 \cdot \pi}{45}$ radians $\cdot$ 3 **inches**

$= \frac{718 \cdot \pi}{15}$ inches

≈ 150.38 inches

$AL = \theta \cdot r$

$= \frac{718 \cdot \pi}{45}$ radians $\cdot \frac{1}{4}$ **feet**

$= \frac{359 \cdot \pi}{90}$ feet

≈ 12.53 feet

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or** $\mathbf{r} = \frac{1}{4}$ **feet**

AL in inches $= \frac{718 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{359 \cdot \pi}{90}$ **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

$LS = \frac{AL}{t} = \frac{718 \cdot \pi}{15}$ **inches** /45 **seconds**

$= \frac{718 \cdot \pi}{15} \cdot \frac{1}{45} \frac{inches}{second}$

$= \frac{718 \cdot \pi}{675} \frac{inches}{second}$

$\approx 3.34 \frac{inches}{second}$

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or r** $= \frac{1}{4}$ **feet**

AL in inches $= \frac{718 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{359 \cdot \pi}{90}$ **feet**

LS in $\frac{inches}{sec} = \frac{718 \cdot \pi}{675} \frac{inches}{sec}$

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 $= \frac{AL}{t} = \frac{359 \cdot \pi}{90}$ **feet** /45 **second**

$= \frac{359 \cdot \pi}{90} \cdot \frac{1}{45} \frac{feet}{sec}$

$= \frac{359 \cdot \pi}{4050} \frac{feet}{sec}$

$\approx 0.28 \frac{feet}{sec}$

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or r** $= \frac{1}{4}$ **feet**

AL in inches $= \frac{718 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{359 \cdot \pi}{90}$ **feet**

LS in $\frac{inches}{sec} = \frac{718 \cdot \pi}{675} \frac{inches}{sec}$ **LS in** $\frac{feet}{sec} = \frac{359 \cdot \pi}{4050} \frac{feet}{sec}$

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 $= \frac{AL}{t} = \frac{359 \cdot \pi}{90}$ **feet** $/ \frac{3}{4}$ **minute**

$= \frac{359 \cdot \pi}{90} \cdot \frac{4}{3} \frac{feet}{minute}$

$= \frac{718 \cdot \pi}{135} \frac{feet}{minute}$

$\approx 16.71 \frac{feet}{minute}$

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or r** $= \frac{1}{4}$ **feet**

AL in inches $= \frac{718 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{359 \cdot \pi}{90}$ **feet** **LS in** $\frac{inches}{sec} = \frac{718 \cdot \pi}{675} \frac{inches}{sec}$

LS in $\frac{feet}{sec} = \frac{359 \cdot \pi}{4050} \frac{feet}{sec}$ **LS in** $\frac{feet}{minute} = \frac{718 \cdot \pi}{135} \frac{feet}{minute}$

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 $= \frac{\theta}{t} = \frac{718 \cdot \pi}{45}$ **radians** /45 **seconds**

$= \frac{718 \cdot \pi}{45} \cdot \frac{1}{45} \frac{radians}{second}$

$= \frac{718 \cdot \pi}{2025} \frac{radians}{second}$

$\approx 1.11 \frac{radians}{second}$

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or r** $= \frac{1}{4}$ **feet**

AL in inches $= \frac{718 \cdot \pi}{15}$ **inches** **AL in feet** $= \frac{359 \cdot \pi}{90}$ **feet** **LS in** $\frac{inches}{sec} = \frac{718 \cdot \pi}{675} \frac{inches}{sec}$

LS in $\frac{feet}{sec} = \frac{359 \cdot \pi}{4050} \frac{feet}{sec}$ **LS in** $\frac{feet}{minute} = \frac{718 \cdot \pi}{135} \frac{feet}{minute}$ AS in $\frac{radians}{second} = \frac{718 \cdot \pi}{2025} \frac{radians}{second}$

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 $= \frac{\theta}{t} = \frac{718 \cdot \pi}{45}$ **radians** $/ \frac{3}{4}$ **minute**

$= \frac{718 \cdot \pi}{45} \cdot \frac{4}{3} \frac{radians}{minute}$

$= \frac{2872 \cdot \pi}{135} \frac{radians}{minute}$

$\approx 66.83 \frac{radians}{minute}$

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

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or r** = $\frac{1}{4}$ **feet**

AL in inches = $\frac{718 \cdot \pi}{15}$ **inches** **AL in feet** = $\frac{359 \cdot \pi}{90}$ **feet** AS in $\frac{radians}{second} = \frac{718 \cdot \pi}{2025} \frac{radians}{second}$

AS in $= \frac{2872 \cdot \pi}{135} \frac{radians}{minute}$

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

a. Linear speed in inches per second

$$LS = AS \cdot r = \frac{718 \cdot \pi}{2025} \frac{radians}{\text{sec}} \cdot 3 \textbf{ inches}$$
$$= \frac{718 \cdot \pi}{675} \frac{inches}{second}$$
$$\approx 3.34 \frac{inches}{second}$$

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or r** = $\frac{1}{4}$ **feet**

AL in inches = $\frac{718 \cdot \pi}{15}$ **inches** **AL in feet** = $\frac{359 \cdot \pi}{90}$ **feet** AS in $\frac{radians}{second} = \frac{718 \cdot \pi}{2025} \frac{radians}{second}$

AS in $= \frac{2872 \cdot \pi}{135} \frac{radians}{minute}$ **LS in** $\frac{inches}{\text{sec}} = \frac{718 \cdot \pi}{675} \frac{inches}{\text{sec}}$

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

b. Linear speed in feet per second

$$LS = AS \cdot r = \frac{718 \cdot \pi}{2025} \frac{radians}{\text{sec}} \cdot \frac{1}{4} \textbf{ foot} \quad \textbf{OR} \quad \textbf{LS} = \textbf{LS} \frac{inches}{second} \cdot \frac{1 \, foot}{12 \, inches}$$
$$= \frac{359 \cdot \pi}{4050} \frac{feet}{second} \qquad = \frac{718 \cdot \pi}{675} \cdot \frac{1}{12} \frac{feet}{second}$$
$$\approx 0.28 \frac{feet}{second} \qquad = \frac{359 \cdot \pi}{4050} \frac{feet}{second}$$
$$\approx 0.28 \frac{feet}{second}$$

So at this point we know $\theta = \frac{718 \cdot \pi}{45}$ radians and r = 3 **inches or r** = $\frac{1}{4}$ **feet**

AL in inches = $\frac{718 \cdot \pi}{15}$ **inches** **AL in feet** = $\frac{359 \cdot \pi}{90}$ **feet** AS in $\frac{radians}{second} = \frac{718 \cdot \pi}{2025} \frac{radians}{second}$

AS in $= \frac{2872 \cdot \pi}{135} \frac{radians}{minute}$ **LS in** $\frac{inches}{\text{sec}} = \frac{718 \cdot \pi}{675} \frac{inches}{\text{sec}}$ **LS in** $\frac{feet}{second} = \frac{359 \cdot \pi}{4050} \frac{feet}{second}$

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

c. Linear speed in feet per minute

$$LS = AS \cdot r = \frac{2872 \cdot \pi}{135} \frac{radians}{minute} \cdot \frac{1}{4} \textbf{ foot} \quad \textbf{OR} \quad \textbf{LS} = \textbf{LS} \frac{feet}{second} \cdot \frac{60 \, seconds}{1 \, minute}$$
$$= \frac{718 \cdot \pi}{135} \frac{feet}{minute} \qquad = \frac{359 \cdot \pi}{4050} \cdot \frac{60}{1} \frac{feet}{minute}$$
$$\approx 16.71 \frac{feet}{minute} \qquad = \frac{718 \cdot \pi}{135} \frac{feet}{second}$$
$$\approx 16.71 \frac{feet}{second}$$

1) $2872/360 = \frac{359}{45}$ revolutions $= 7.98$ revolutions

2) $2872 \cdot \frac{\pi}{180} = \frac{718 \cdot \pi}{45}$ radians $\approx 15.955556\ \pi$ radians ≈ 50.13 radians

3) $2872 \cdot \frac{\pi}{180} \cdot 3 = 8616 \cdot \frac{\pi}{180}$ inches $= \frac{718 \cdot \pi}{15}$ **inches** $\approx 47.866667\ \pi$ inches ≈ 150.38 inches

$2872 \cdot \frac{\pi}{180} \cdot \frac{1}{4} = 718 \cdot \frac{\pi}{180}$ feet $= \frac{359 \cdot \pi}{90}$ **feet** $\approx 3.9888889\ \pi$ feet ≈ 12.53 feet

4a) $2872 \cdot \frac{\pi}{180} \cdot 3 \cdot \frac{1}{45} = 8616 \cdot \frac{\pi}{8100} \frac{inches}{second} = \frac{718 \cdot \pi}{675} \frac{inches}{second} \approx 1.0637037\ \pi \frac{inches}{second} \approx 3.34 \frac{inches}{second}$

4b) $2872 \cdot \frac{\pi}{180} \cdot \frac{1}{4} \cdot \frac{1}{45} = 718 \cdot \frac{\pi}{8100} \frac{feet}{second} = \frac{359 \cdot \pi}{4050} \frac{feet}{second} \approx 0.08864198\ \pi \frac{feet}{second} \approx 0.28 \frac{feet}{second}$

$\frac{718 \cdot \pi}{675} \frac{inches}{second} \cdot \frac{1\ foot}{12\ inches} = \frac{359 \cdot \pi}{4050} \frac{feet}{second} \approx 0.08864198\ \pi \frac{feet}{second} \approx 0.28 \frac{feet}{second}$

4c) $2872 \cdot \frac{\pi}{180} \cdot \frac{1}{4} \cdot 1/(\frac{3}{4}) = 718 \cdot \frac{\pi}{135} \frac{feet}{minute} = \frac{718 \cdot \pi}{135} \frac{feet}{minute} \approx 5.3185185\ \pi \frac{feet}{minute} \approx 16.71 \frac{feet}{minute}$

$\frac{359 \cdot \pi}{\quad} \frac{feet}{\quad} \cdot \frac{60\ seconds}{\quad} = \frac{718 \cdot \pi}{\quad} \frac{feet}{\quad} \approx 5.3185185\ \pi \frac{feet}{\quad} \approx 16.71 \frac{feet}{\quad}$

5a) $2872 \cdot \frac{\pi}{180} \cdot \frac{1}{45} = 2872 \cdot \frac{\pi}{8100} \frac{radians}{second} = \frac{718 \cdot \pi}{2025} \approx 0.3545679\ \pi \frac{radians}{second} \approx 1.11 \frac{radians}{second}$

5b) $2872 \cdot \frac{\pi}{180} \cdot 1/(\frac{3}{4}) = 2872 \cdot \frac{\pi}{135} \frac{radians}{minute} = \frac{2872 \cdot \pi}{135} \approx 21.274074\ \pi \frac{radians}{minute} \approx 66.83 \frac{radians}{minute}$

$\frac{718 \cdot \pi}{2025} \frac{radians}{second} \cdot \frac{60\ seconds}{1\ minute} = \frac{2872 \cdot \pi}{135} \frac{radians}{minute} \approx 21.274074\ \pi \frac{radians}{minute} \approx 66.83 \frac{radians}{minute}$

		exact		approximate					
given	d_1	**6**	inches	6.	inches				
	r_1	**3**	inches	3.	inches				
	r_2	**1/4**	feet	0.25	feet				
given	angle_1	**2872**	degrees	2872.	degrees				
	angle_1r	**718*π/45**	radians	50.13	radians	**15.9555...**	π		
	rev_1	**359/45**	revs	7.98	revs				
	as_1	**718*π/2025**	rad/second	1.11	rad/second	**0.35456...**	π		
	as_2	**2872*π/135**	rad/minute	66.83	rad/minute	**21.2740...**	π		
	ls_1	**718*π/675**	inches/second	3.34	inches/second	**1.06370...**	π		
	ls_2	**2872*π/45**	inch/minute	200.5	inch/minute	**63.8222...**	π		
	ls_3	**359*π/4050**	feet/second	0.28	feet/second	**0.08864...**	π		
	ls_4	**718*π/135**	feet/minute	16.71	feet/minute	**5.31851...**	π		
given	t_1	**45**	seconds	45.	seconds				
	t_2	**3/4**	minute	0.75	minute				
	al_1	**718*π/15**	inches	150.38	inches	**47.8666...**	π		
	al_2	**359*π/90**	feet	12.53	feet	**3.98888...**	π		

Problem 2

6. You are pulling a cart and the cart's wheel is 60 inches in diameter and you notice that the wheel is making 5.8 revolutions per second

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

$$AS = 5.8\frac{revs}{second}\cdot\frac{2\cdot\pi\ radian}{1\ rev} = 11.6\,\pi\frac{rad}{second} = 36.44\ \frac{rad}{second}$$

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

$r = 30\ \mathbf{inches}$

$$\mathbf{LS = AS(r)} = 11.6\cdot\pi\frac{rad}{second}\cdot 30\ \mathbf{inches} = 348\cdot\pi\frac{inches}{second} \approx 1093.27\ \frac{inches}{second}$$

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

$$r = 30\ \mathbf{inches}\cdot\frac{1\ foot}{12\ inches} = 30/\mathbf{12}\ feet = \frac{5}{2}\ \mathbf{feet}$$

$$\mathbf{LS = AS(r)} = 11.6\cdot\pi\frac{rad}{second}\cdot\frac{5}{2}\ \mathbf{feet} = 29\cdot\pi\frac{feet}{second} \approx 91.11\ \frac{feet}{second}$$

$$\mathbf{LS = AS(r)} = 29\cdot\pi\frac{feet}{second}\cdot\frac{60\ seconds}{1\ minute} = 1740\cdot\pi\frac{feet}{minute} \approx 5466.37\ \frac{feet}{minute}$$

	A	B	C	D
1	given	d_1	60	inches
2	given	r_1	30	inches
3	given	rev_1	5.8	rev
4	given	rev_1e	29/5	rev
5		theta_1	58*π/5	
6		as_1	58*π/5	
7		as_1c	11.6	
8		s_1	348*π	
9		r_2	5/2	
10		s_2	29*π	
11		s_3	1740*π	

given

Problem 3

7. The diameter of the drum on an electric hoist is 10 inches. Find the approximate number of degrees through which the drum must rotate to lift a beam 3 feet.

$AL = 3\,\text{feet}$ $\quad AL = 3\ \mathbf{feet}\cdot\frac{12\ inches}{1\ foot} = 36\ \mathbf{inches}$

$\mathbf{r = 5\ inches}$

$AL = \theta\cdot r$

$36 = 5\cdot\theta$

$36/5 = 5\cdot\theta/5$

$$\theta = \frac{36}{5}\ \mathbf{radians}$$

$$\theta = \frac{36}{5}\ \mathbf{radians}\cdot\frac{180°}{\pi\cdot radians} = \frac{1296}{\pi}° \approx 412.53°$$

	A	B	C	D
1	given	d_1	10	inches
2		r_1	5	inches
3	given	al_1	3	feet
4		al_2	36	inches
5		theta_1	36/5	radians
6		theta_2	1296/(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

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

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