Problem 1

You have a paint roller that has a diameter of 8 inches.

You push the roller against the wall and it travels $1242°$

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

$1242°/360° = \frac{69}{20}$ **revs** ≈ 3.45 **revolutions**

≈ 3.45 **revolutions**

OR

$1242° \cdot \frac{\pi \cdot radians}{180°} = \frac{69 \cdot \pi}{10}$ radians

$\frac{69 \cdot \pi}{10}$ radians $\cdot \frac{1 \cdot rev}{2 \cdot \pi} = \frac{69}{20}$ **revs** ≈ 3.45 **revolutions**

≈ 3.45 **revolutions**

You have a paint roller that has a diameter of 8 inches.

You push the roller against the wall and it travels $1242°$

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

$1242° \cdot \frac{\pi \cdot radians}{180°} = \frac{69 \cdot \pi}{10}$ radians ≈ 21.676989 radians

$\theta = 1242 \cdot \pi / 180$ radians $= \frac{69 \cdot \pi}{10}$ **radians**

$\approx 6.9\pi$ radians

≈ 21.676989 radians

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** $\mathbf{r} = \frac{1}{3}$ **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)?

$AL = \theta \cdot r$

$= \frac{69 \cdot \pi}{10}$ radians $\cdot$ 4 **inches**

$= \frac{138 \cdot \pi}{5}$ inches

≈ 86.71 inches

$AL = \theta \cdot r$

$= \frac{69 \cdot \pi}{10}$ radians $\cdot \frac{1}{3}$ **feet**

$= \frac{23 \cdot \pi}{10}$ feet

≈ 7.23 feet

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** $\mathbf{r} = \frac{1}{3}$ **feet**

AL in inches $= \frac{138 \cdot \pi}{5}$ **inches** **AL in feet** $= \frac{23 \cdot \pi}{10}$ **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

$LS = \frac{AL}{t} = \frac{138 \cdot \pi}{5}$ **inches** $/50$ **seconds**

$= \frac{138 \cdot \pi}{5} \cdot \frac{1}{50} \frac{inches}{second}$

$= \frac{69 \cdot \pi}{125} \frac{inches}{second}$

$\approx 1.73 \frac{inches}{second}$

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** r = $\frac{1}{3}$ **feet**

AL in inches = $\frac{138 \cdot \pi}{5}$ **inches** **AL in feet** = $\frac{23 \cdot \pi}{10}$ **feet**

LS in $\frac{inches}{\sec} = \frac{69 \cdot \pi}{125} \frac{inches}{\sec}$

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 = $\frac{AL}{t} = \frac{23 \cdot \pi}{10}$ **feet** /50 **second**

$= \frac{23 \cdot \pi}{10} \cdot \frac{1}{50} \frac{feet}{\sec}$

$= \frac{23 \cdot \pi}{500} \frac{feet}{\sec}$

$\approx 0.14 \frac{feet}{\sec}$

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** r = $\frac{1}{3}$ **feet**

AL in inches = $\frac{138 \cdot \pi}{5}$ **inches** **AL in feet** = $\frac{23 \cdot \pi}{10}$ **feet**

LS in $\frac{inches}{\sec} = \frac{69 \cdot \pi}{125} \frac{inches}{\sec}$ **LS in** $\frac{feet}{\sec} = \frac{23 \cdot \pi}{500} \frac{feet}{\sec}$

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 = $\frac{AL}{t} = \frac{23 \cdot \pi}{10}$ **feet** /$\frac{5}{6}$ **minute**

$= \frac{23 \cdot \pi}{10} \cdot \frac{6}{5} \frac{feet}{minute}$

$= \frac{69 \cdot \pi}{25} \frac{feet}{minute}$

$\approx 8.67 \frac{feet}{minute}$

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** r = $\frac{1}{3}$ **feet**

AL in inches = $\frac{138 \cdot \pi}{5}$ **inches** **AL in feet** = $\frac{23 \cdot \pi}{10}$ **feet** **LS in** $\frac{inches}{\sec} = \frac{69 \cdot \pi}{125} \frac{inches}{\sec}$

LS in $\frac{feet}{\sec} = \frac{23 \cdot \pi}{500} \frac{feet}{\sec}$ **LS in** $\frac{feet}{minute} = \frac{69 \cdot \pi}{25} \frac{feet}{minute}$

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 = $\frac{\theta}{t} = \frac{69 \cdot \pi}{10}$ **radians** /50 **seconds**

$= \frac{69 \cdot \pi}{10} \cdot \frac{1}{50} \frac{radians}{second}$

$= \frac{69 \cdot \pi}{500} \frac{radians}{second}$

$\approx 0.43 \frac{radians}{second}$

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** r = $\frac{1}{3}$ **feet**

AL in inches = $\frac{138 \cdot \pi}{5}$ **inches** **AL in feet** = $\frac{23 \cdot \pi}{10}$ **feet** **LS in** $\frac{inches}{\sec} = \frac{69 \cdot \pi}{125} \frac{inches}{\sec}$

LS in $\frac{feet}{\sec} = \frac{23 \cdot \pi}{500} \frac{feet}{\sec}$ **LS in** $\frac{feet}{minute} = \frac{69 \cdot \pi}{25} \frac{feet}{minute}$ AS in $\frac{radians}{second} = \frac{69 \cdot \pi}{500} \frac{radians}{second}$

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 = $\frac{\theta}{t} = \frac{69 \cdot \pi}{10}$ **radians** /$\frac{5}{6}$ **minute**

$= \frac{69 \cdot \pi}{10} \cdot \frac{6}{5} \frac{radians}{minute}$

$= \frac{207 \cdot \pi}{25} \frac{radians}{minute}$

$\approx 26.01 \frac{radians}{minute}$

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

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** $\mathbf{r = \frac{1}{3}}$ **feet**

AL in inches $= \frac{138 \cdot \pi}{5}$ **inches** **AL in feet** $= \frac{23 \cdot \pi}{10}$ **feet** AS in $\frac{radians}{second} = \frac{69 \cdot \pi}{500} \frac{radians}{second}$

AS in $= \frac{207 \cdot \pi}{25} \frac{radians}{minute}$

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

a. Linear speed in inches per second

$$LS = AS \cdot r = \frac{69 \cdot \pi}{500} \frac{radians}{\text{sec}} \cdot 4 \text{ inches}$$
$$= \frac{69 \cdot \pi}{125} \frac{inches}{second}$$
$$\approx 1.73 \frac{inches}{second}$$

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** $\mathbf{r = \frac{1}{3}}$ **feet**

AL in inches $= \frac{138 \cdot \pi}{5}$ **inches** **AL in feet** $= \frac{23 \cdot \pi}{10}$ **feet** AS in $\frac{radians}{second} = \frac{69 \cdot \pi}{500} \frac{radians}{second}$

AS in $= \frac{207 \cdot \pi}{25} \frac{radians}{minute}$ **LS in** $\frac{inches}{\text{sec}} = \frac{69 \cdot \pi}{125} \frac{inches}{\text{sec}}$

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

b. Linear speed in feet per second

$$LS = AS \cdot r = \frac{69 \cdot \pi}{500} \frac{radians}{\text{sec}} \cdot \frac{1}{3} \text{ foot} \quad \textbf{OR} \quad \textbf{LS} = \textbf{LS} \frac{inches}{second} \cdot \frac{1 \, foot}{12 \, inches}$$
$$= \frac{23 \cdot \pi}{500} \frac{feet}{second} \qquad = \frac{69 \cdot \pi}{125} \cdot \frac{1}{12} \frac{feet}{second}$$
$$\approx 0.14 \frac{feet}{second} \qquad = \frac{23 \cdot \pi}{500} \frac{feet}{second}$$
$$\approx 0.14 \frac{feet}{second}$$

So at this point we know $\theta = \frac{69 \cdot \pi}{10}$ radians and r = 4 **inches or** $\mathbf{r = \frac{1}{3}}$ **feet**

AL in inches $= \frac{138 \cdot \pi}{5}$ **inches** **AL in feet** $= \frac{23 \cdot \pi}{10}$ **feet** AS in $\frac{radians}{second} = \frac{69 \cdot \pi}{500} \frac{radians}{second}$

AS in $= \frac{207 \cdot \pi}{25} \frac{radians}{minute}$ **LS in** $\frac{inches}{\text{sec}} = \frac{69 \cdot \pi}{125} \frac{inches}{\text{sec}}$ **LS in** $\frac{feet}{second} = \frac{23 \cdot \pi}{500} \frac{feet}{second}$

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

c. Linear speed in feet per minute

$$LS = AS \cdot r = \frac{207 \cdot \pi}{25} \frac{radians}{minute} \cdot \frac{1}{3} \text{ foot} \quad \textbf{OR} \quad \textbf{LS} = \textbf{LS} \frac{feet}{second} \cdot \frac{60 \, seconds}{1 \, minute}$$
$$= \frac{69 \cdot \pi}{25} \frac{feet}{minute} \qquad = \frac{23 \cdot \pi}{500} \cdot \frac{60}{1} \frac{feet}{minute}$$
$$\approx 8.67 \frac{feet}{minute} \qquad = \frac{69 \cdot \pi}{25} \frac{feet}{second}$$
$$\approx 8.67 \frac{feet}{second}$$

1) $1242/360 = \frac{69}{20}$ revolutions $= 3.45$ revolutions

2) $1242 \cdot \frac{\pi}{180} = \frac{69 \cdot \pi}{10}$ radians $\approx 6.9\,\pi$ radians ≈ 21.68 radians

3) $1242 \cdot \frac{\pi}{180} \cdot 4 = 4968 \cdot \frac{\pi}{180}$ inches $= \frac{138 \cdot \pi}{5}$ **inches** $\approx 27.6\,\pi$ inches ≈ 86.71 inches

$1242 \cdot \frac{\pi}{180} \cdot \frac{1}{3} = 414 \cdot \frac{\pi}{180}$ feet $= \frac{23 \cdot \pi}{10}$ **feet** $\approx 2.3\,\pi$ feet ≈ 7.23 feet

4a) $1242 \cdot \frac{\pi}{180} \cdot 4 \cdot \frac{1}{50} = 4968 \cdot \frac{\pi}{9000} \frac{inches}{second} = \frac{69 \cdot \pi}{125} \frac{inches}{second} \approx 0.552\,\pi \frac{inches}{second} \approx 1.73 \frac{inches}{second}$

4b) $1242 \cdot \frac{\pi}{180} \cdot \frac{1}{3} \cdot \frac{1}{50} = 414 \cdot \frac{\pi}{9000} \frac{feet}{second} = \frac{23 \cdot \pi}{500} \frac{feet}{second} \approx 0.046\,\pi \frac{feet}{second} \approx 0.14 \frac{feet}{second}$

$\frac{69 \cdot \pi}{125} \frac{inches}{second} \cdot \frac{1\ foot}{12\ inches} = \frac{23 \cdot \pi}{500} \frac{feet}{second} \approx 0.046\,\pi \frac{feet}{second} \approx 0.14 \frac{feet}{second}$

4c) $1242 \cdot \frac{\pi}{180} \cdot \frac{1}{3} \cdot 1/(\frac{5}{6}) = 414 \cdot \frac{\pi}{150} \frac{feet}{minute} = \frac{69 \cdot \pi}{25} \frac{feet}{minute} \approx 2.76\,\pi \frac{feet}{minute} \approx 8.67 \frac{feet}{minute}$

$\frac{23 \cdot \pi}{500} \frac{feet}{second} \cdot \frac{60\ seconds}{1\ minute} = \frac{69 \cdot \pi}{25} \frac{feet}{minute} \approx 2.76\,\pi \frac{feet}{minute} \approx 8.67 \frac{feet}{minute}$

5a) $1242 \cdot \frac{\pi}{180} \cdot \frac{1}{50} = 1242 \cdot \frac{\pi}{9000} \frac{radians}{second} = \frac{69 \cdot \pi}{500} \approx 0.138\,\pi \frac{radians}{second} \approx 0.43 \frac{radians}{second}$

5b) $1242 \cdot \frac{\pi}{180} \cdot 1/(\frac{5}{6}) = 1242 \cdot \frac{\pi}{150} \frac{radians}{minute} = \frac{207 \cdot \pi}{25} \approx 8.28\,\pi \frac{radians}{minute} \approx 26.01 \frac{radians}{minute}$

$\frac{69 \cdot \pi}{500} \frac{radians}{second} \cdot \frac{60\ seconds}{1\ minute} = \frac{207 \cdot \pi}{25} \frac{radians}{minute} \approx 8.28\,\pi \frac{radians}{minute} \approx 26.01 \frac{radians}{minute}$

		exact		approximate					
given	d_1	**8**	inches	8.	inches				
	r_1	**4**	inches	4.	inches				
	r_2	**1/3**	feet	0.33	feet				
given	angle_1	**1242**	degrees	1242.	degrees				
	angle_1r	**69*π/10**	radians	21.68	radians	**6.9**	π		
	rev_1	**69/20**	revs	3.45	revs				
	as_1	**69*π/500**	rad/second	0.43	rad/second	**0.138**	π		
	as_2	**207*π/25**	rad/minute	26.01	rad/minute	**8.28**	π		
	ls_1	**69*π/125**	inches/second	1.73	inches/second	**0.552**	π		
	ls_2	**828*π/25**	inch/minute	104.05	inch/minute	**33.12**	π		
	ls_3	**23*π/500**	feet/second	0.14	feet/second	**0.046**	π		
	ls_4	**69*π/25**	feet/minute	8.67	feet/minute	**2.76**	π		
given	t_1	**50**	seconds	50.	seconds				
	t_2	**5/6**	minute	0.83	minute				
	al_1	**138*π/5**	inches	86.71	inches	**27.6**	π		
	al_2	**23*π/10**	feet	7.23	feet	**2.3**	π		

Problem 2

6. You are pulling a cart and the cart's wheel is 80 inches in diameter and you notice that the wheel is making 6.8 revolutions per second

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

$$AS = 6.8\,\frac{revs}{second}\cdot\frac{2\cdot\pi\ radian}{1\ rev} = 13.6\,\pi\,\frac{rad}{second} = 42.73\,\frac{rad}{second}$$

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

$r = 40\,\mathbf{inches}$

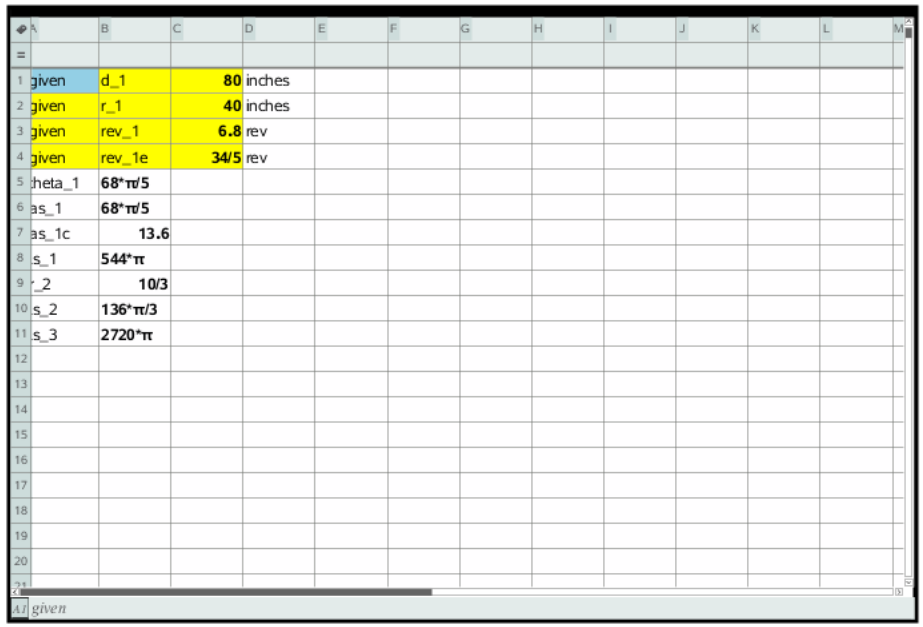
$$\mathbf{LS = AS(r)} = 13.6\cdot\pi\,\frac{rad}{second}\cdot 40\,\mathbf{inches} = 544\cdot\pi\,\frac{inches}{second} \approx 1709.03\,\frac{inches}{second}$$

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

$$r = 40\,\mathbf{inches}\cdot\frac{1\ foot}{12\ inches} = 40/\mathbf{12}\ feet = \frac{10}{3}\,\mathbf{feet}$$

$$\mathbf{LS = AS(r)} = 13.6\cdot\pi\,\frac{rad}{second}\cdot\frac{10}{3}\,\mathbf{feet} = \frac{136\cdot\pi}{3}\,\frac{feet}{second} \approx 142.42\,\frac{feet}{second}$$

$$\mathbf{LS = AS(r)} = \frac{136\cdot\pi}{3}\,\frac{feet}{second}\cdot\frac{60\ seconds}{1\ minute} = 2720\cdot\pi\,\frac{feet}{minute} \approx 8545.13\,\frac{feet}{minute}$$



	A	B	C	D
1	given	d_1	80	inches
2	given	r_1	40	inches
3	given	rev_1	6.8	rev
4	given	rev_1e	34/5	rev
5		theta_1	68*π/5	
6		as_1	68*π/5	
7		as_1c	13.6	
8		s_1	544*π	
9		r_2	10/3	
10		s_2	136*π/3	
11		s_3	2720*π	

Problem 3

7. The diameter of the drum on an electric hoist is 14 inches. Find the approximate number of degrees through which the drum must rotate to lift a beam 5 feet.

$AL = 5\,\text{feet}$ $\quad AL = 5\,\mathbf{feet}\cdot\frac{12\ inches}{1\ foot} = 60\,\mathbf{inches}$

$\mathbf{r} = 7\,\mathbf{inches}$

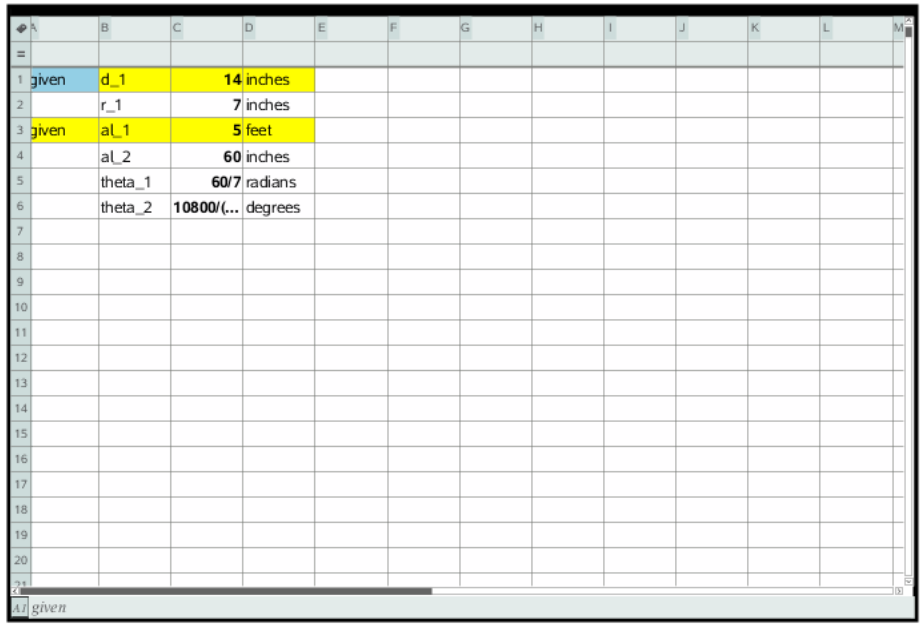
$AL = \theta\cdot r$

$60 = 7\cdot\theta$

$60/7 = 7\cdot\theta/7$

$$\theta = \frac{60}{7}\,\mathbf{radians}$$

$$\theta = \frac{60}{7}\,\mathbf{radians}\cdot\frac{180°}{\pi\cdot radians} = \frac{10800}{7\cdot\pi}° \approx 491.11°$$



	A	B	C	D
1	given	d_1	14	inches
2		r_1	7	inches
3	given	al_1	5	feet
4		al_2	60	inches
5		theta_1	60/7	radians
6		theta_2	10800/(...	degrees

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

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

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