1. Every time a wheel completes one revolution, it passes through 2π radians, so in 3 minutes it passes through $5 \times 2\pi = 10\pi$ radians.

So $\omega = \frac{\theta}{t} = \frac{10\pi}{3}$ radians/min

2. a) $V = r\omega = 1.5 \times 6$ ft/min $= 9$ ft/min

b) 1 ft $= 12$ in so 9 ft $= 9 \times 12 = 108$ in

so 9 ft/min $= 108$ in/min

c) 1 min $= 60$ seconds

so 9 ft/min $= \frac{9}{60}$ ft/second

3. a) $V = r\omega \Rightarrow \omega = \frac{V}{r} = \frac{20}{10} = 2$ radians/second.

b) 2π radians $= 1$ revolution

so 1 radian $= \frac{1}{2\pi}$ revolutions

so 2 radians $= \frac{2}{2\pi} = \frac{1}{\pi}$ revolutions

So 2 radians/sec $= \frac{1}{\pi}$ revolutions/sec.

$= \frac{1}{\pi} \times 60$ rev/min

$= \frac{60}{\pi}$ rev/min

4) We want to use $\theta = \frac{s}{r}$, but first we need to convert $35°$ into radians:

π radians $= 180°$

$\frac{\pi}{180}$ radians $= 1°$

so $\frac{35 \times \pi}{180}$ radians $= 35°$

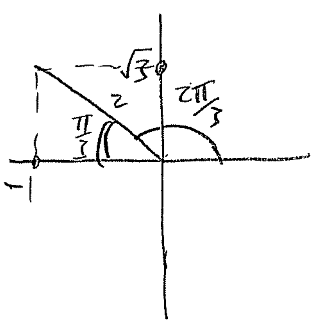
Then $\theta = \frac{s}{r} \Rightarrow s = \theta r = \frac{35\pi}{180} \times 10 = \frac{350\pi}{180} = \frac{35\pi}{18} =$

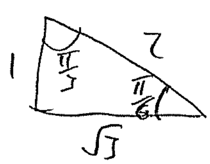
5)

$\theta = 60° = \frac{60\pi}{180}$ radians $= \frac{\pi}{3}$ radians

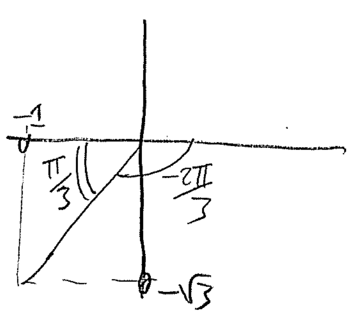
$\theta = \frac{s}{r} \Rightarrow r = \frac{s}{\theta} = \frac{15}{\left(\frac{\pi}{3}\right)} = \frac{15 \times 3}{\pi} = \frac{45}{\pi}$.

6)





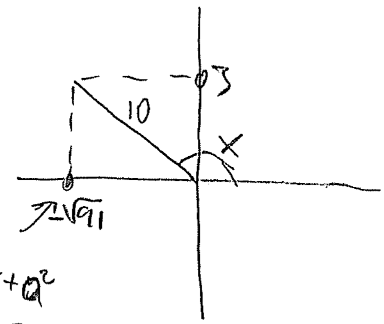
so $\cos\left(\frac{2\pi}{3}\right) = \frac{-1}{2}$



so $\tan\left(\frac{-2\pi}{3}\right) = \frac{-\sqrt{3}}{-1} = \sqrt{3}$

7. $\sin\theta = \dfrac{y\text{-coord}}{r} = 0.3 = \dfrac{3}{10}$

so



$10^2 = 3^2 + a^2$

$\Rightarrow a^2 = 10^2 - 3^2 = 91$

$\Rightarrow a = \sqrt{91}$

so $\cos\theta = \dfrac{x\text{-coord}}{r} = \dfrac{-\sqrt{91}}{10}$

so $\sin(2\theta) = 2\sin\theta\cos\theta) = 2 \times \dfrac{3}{10} \times \dfrac{-\sqrt{91}}{10} = \dfrac{-6\sqrt{91}}{100} = \dfrac{-3\sqrt{91}}{50}$

8. $1'' = \dfrac{1}{60\times 60}$ degrees $\longrightarrow 30'' = \dfrac{30}{60\times 60}{}^\circ = \dfrac{1}{120}{}^\circ$

$1' = \dfrac{1}{60}$ degrees $\longrightarrow 30' = \dfrac{30^\circ}{60^\circ} = \dfrac{1}{2}{}^\circ$

so $15^\circ 30' 30'' = \left(15 + \dfrac{1}{2} + \dfrac{1}{120}\right)^\circ \simeq 30.5^\circ$

9.

$\cos y \sin y(\sec y + \csc y) = \cos y \sin y\left(\dfrac{1}{\cos y} + \dfrac{1}{\sin y}\right)$

$= \sin y + \cos y$.

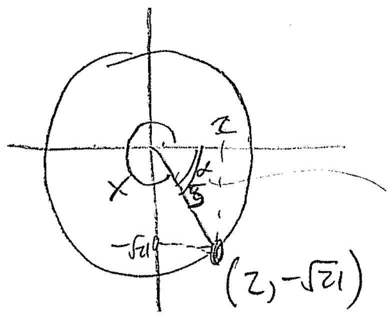
10. $$\frac{\cos^2\alpha - 1}{\cos\alpha + 1} = \frac{(\cos\alpha - 1)\cancel{(\cos\alpha + 1)}}{\cancel{\cos\alpha + 1}} = \cos\alpha - 1$$

11. $$2\sin^2\theta\cos^2\theta + \cos^4\theta = \cos^2\theta(2\sin^2\theta + \cos^2\theta)$$

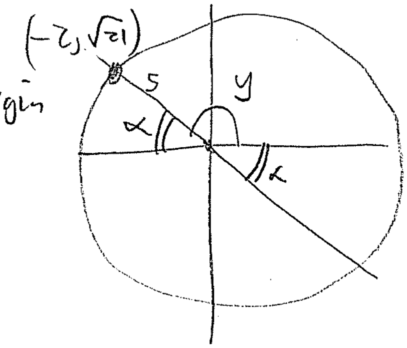
$$= \cos^2\theta(\sin^2\theta + (\sin^2\theta + \cos^2\theta)) \overset{\text{PyThag}}{=} \cos^2\theta(\sin^2\theta + 1)$$

$$\overset{\text{PyThag}}{=} (1 - \sin^2\theta)(1 + \sin^2\theta) = 1 - \sin^4(\theta)$$

12.



reflect through origin



$$5^2 = 2^2 + a^2$$
$$\Rightarrow a^2 = 25 - 4$$
$$= 21$$
$$\Rightarrow a = \sqrt{21}$$

$$y = \pi - \alpha$$
$$= \pi - 2\pi + x$$
$$= x - \pi$$

so $\cos(x - \pi) = \frac{-2}{5}$

$$x = 2\pi - \alpha$$
$$\alpha = 2\pi - x$$

$\boxed{\text{or}}$

$$\cos(x - \pi) = \cos(x)\cos(\pi) + \sin x \sin(\pi)$$
$$= \cos x(-1) + \sin x \cdot 0$$
$$= -\cos x = \frac{-2}{5}$$