1. $\cos x = 3\cos x - 2$

$2\cos x = 2$

$\cos x = 1 \quad x = 0$

$\boxed{x = 0 + 2\pi n}$

2. $2\sin^2 x - 1 = 0$

$\sin^2 x = 1/2$

$\sin x = \pm\sqrt{1/2} = \pm\sqrt{2}/2$

$x = \pi/4, 3\pi/4, 5\pi/4, 7\pi/4$

$\boxed{x = \frac{\pi}{4} + 2\pi n, \frac{3\pi}{4} + 2\pi n, \frac{5\pi}{4} + 2\pi n \quad \cancel{\frac{7\pi}{4} + 2\pi n}}$

3. $\sqrt{\cos x} = 2\cos x - 1$

$\cos x = (2\cos x - 1)^2$

$\cos x = 4\cos^2 x - 4\cos x + 1$

$0 = 4\cos^2 x - 5\cos x + 1$

$0 = (4\cos x - 1)(\cos x - 1)$

$4\cos x = 1 \qquad \cos x = 1$

$\cos x = 1/4 \qquad x = 0$ ✓

$x = \cos^{-1}\frac{1}{4}$ ✗

$\boxed{x = 0 + 2\pi n}$

#3 Check

$\sqrt{1/4} = 2(\frac{1}{4}) - 1$

$\frac{1}{2} = \frac{1}{2} - 1$ NO

$\sqrt{1} = 2(1) - 1$ yes

4. $2\sin^2 x - 5\sin x + 2 = 0$

$(2\sin x - 1)(\sin x - 2) = 0$

$\sin x = \frac{1}{2} \qquad \sin x = 2$

$x = \frac{\pi}{6}, \frac{5\pi}{6} \qquad$ no sol

$x = \frac{\pi}{6} + 2\pi n, \frac{5\pi}{6} + 2\pi n$

Check

$2(\frac{1}{2})^2 - 5(\frac{1}{2}) + 2 = 0$

$2/4 - 5/2 + 2 = 0$

$\frac{1}{2} - \frac{5}{2} + 2 = 0 \quad \frac{-4}{2} + 2 = 0$ ✓

5. $\sec^2 x + \tan x = 1$

$\tan^2 x + 1 + \tan x = 1$

$-1 \qquad -1$

$\tan^2 x + \tan x = 0$

$\tan x(\tan x + 1) = 0$

$\tan x = 0 \qquad \tan x = -1$

$\boxed{x = 0, \pi}$ ✓ ✓ $\qquad \boxed{x = \frac{3\pi}{4}, \frac{7\pi}{4}}$ ✗ ✗

Check

$(\frac{1}{\cos 0})^2 + 0 = 1$ ✓

$(\frac{1}{\cos \pi})^2 + 0 = 1$

$-1^2 + 0 = 1$ ✓

$\frac{1}{(\frac{\sqrt{2}}{2})^2} + 0 \neq 1$

$(-\sqrt{2})^2 - 1 = 1$ ✓

6. $3\tan x - \sqrt{3} = 0$

$3\tan x = \sqrt{3}$

$\tan x = \frac{\sqrt{3}}{3}$

$\boxed{x = \frac{\pi}{6}, \frac{7\pi}{6}}$

7. $4\sin^2 x - 4\sin x + 1 = 0$

$(2\sin x - 1)(2\sin x - 1) = 0$

$2\sin x = 1 \quad 2\sin x - 1$

$\sin x = 1/2$

$x = \frac{\pi}{6}, \frac{5\pi}{6}$

8. $4\cos^2 x - 1 = 0$

$4\cos^2 x = 1$

$\cos^2 x = 1/4$

$\cos x = \pm\sqrt{1/4}$

$\cos x = \pm 1/2$

$\boxed{x = \frac{\pi}{3}, \frac{5\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}}$

All +

$(2\cos x + 1)(2\cos x - 1)$

$\cos x = \pm 1/2$

$4(\frac{1}{2})^2 - 1 = 0$ ✓

all work

9 $\frac{\cos^2 x}{\sin x} = \cot x$

$\cos^3 x = \cot x \sin x$

$\cos^3 x = \cos x$

$\cos^3 x - \cos x = 0$

$\cos x(\cos x^2 - 1) = 0$

$\cos x = 0 \quad \cos x^2 = 1$

~~$\frac{\pi}{2}, \frac{3\pi}{2}$~~ ~~$\pi/2$~~ ~~0~~

$\cos x = 0$

$\boxed{x = \frac{\pi}{2}, \frac{3\pi}{2}}$

Check

$\frac{\cos^2 0}{\sin 0} = \cot 0$ no sol

$\frac{\cos^2 \pi}{\sin \pi}$ ... no sol

$\frac{\cos^2 \pi/2}{\sin \pi/2} = \cot \frac{\pi}{2}$

$0 = 0$ ✓

10. $\tan x \sin^2 x = 3\tan x$

$-3\tan x + \tan x \sin x = 0$

$\tan x(-3 + \sin^2 x) = 0$

$\tan x = 0$ $\quad \sin^2 x = 3$

$\boxed{x = 0, \pi}$ $\quad \sin x = \pm\sqrt{3}$

no solution

Check

$\tan 0$

$0 = 0$

$\tan \pi$

$0 = 0$

1. $h = \dfrac{d}{\cot\alpha - \cot\beta}$

$1 = \dfrac{\left(\frac{3-\sqrt{3}}{3}\right)}{\cot\alpha - \cot 45^\circ}$

$\cot\alpha - 1 = \left(\frac{3-\sqrt{3}}{3}\right)$

$\cot\alpha = \frac{3}{3} - \frac{\sqrt{3}}{3} + \frac{3}{3}$

$\cot\alpha = 2 - \frac{\sqrt{3}}{3}$

$\alpha = \cot^{-1}\left(2 - \frac{\sqrt{3}}{3}\right)$

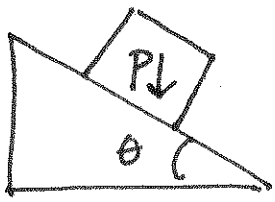
$\boxed{\alpha = 35.134^\circ}$

$\tan^{-1} = \left(\frac{1}{\left(\frac{2\sqrt{3}}{\sqrt{7}}\right)}\right)$

2. $I = 30\sin\left(50\pi t - \frac{7\pi}{3}\right)$

$15 = 30\sin\left(50\pi t - \frac{7\pi}{3}\right)$

from graph: $t = 0.01$

4. 

$\mu \Rightarrow p\sin\theta = \mu p\cos\theta$

a $\mu = \underline{0.26}$ $\quad p = 20,\ \theta = 15°$

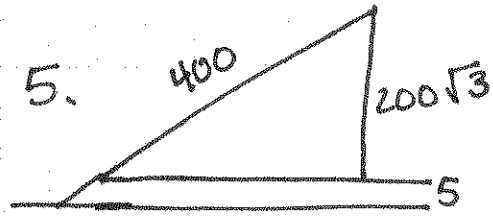
$$\frac{20\sin 15°}{20\cos 15°} = \frac{\mu(20\cos 15°)}{20\cos 15°}$$

$\mu = \tan 15° \quad \mu = .26$

b. $\theta = \underline{68.963°}$ $\quad p = 35g \quad \mu = 2.6$

$$\frac{35\sin\theta}{35\cos\theta} = 2.6$$

$\tan\theta = 2.6 \quad \tan^{-1} 2.6 = 68.963$

5. 

$h = d\sin\theta + c$

$h = 200\sqrt{3} + 5$
$d = 400$
$c = 5$

$200\sqrt{3} + 5 = 400\sin\theta + 5$

$200\sqrt{3} = 400\sin\theta$

$\sin\theta = \frac{\sqrt{3}}{2}$ $\quad \boxed{\theta = \frac{\pi}{3} \text{ or } 60°}$