

Sheet 2

1. $V^2/2g, 2V/g, \frac{1}{2}m(V-gt)^2, mg(V-\frac{1}{2}gt)t$
2. $x = V(2h/g)^{1/2}, y = h - \frac{gx^2}{2V^2}, t = (\frac{2h}{g})^{1/2}$
3. $x = \frac{V^2 \sin 2\alpha}{g}, y = x \tan \alpha - \frac{1}{2}g(\frac{x}{V})^2 \sec^2 \alpha, \pi/4$
4. $(\kappa^2 l^2 + \frac{V^2 l}{g})^{1/2}, 2\pi(l/g)^{1/2}$
5. $r^{-1} = C \cos[(1 - \frac{\mu}{h^2})^{1/2} \theta - \theta_0], \mu < h^2$
 $r^{-1} = C\theta + D, \mu = h^2$
 $r^{-1} = A e^{(\frac{\mu}{h^2} - 1)^{1/2} \theta} + B e^{-(\frac{\mu}{h^2} - 1)^{1/2} \theta}, \mu > h^2$
6. —
7. $x = \frac{1}{2}e^{-t}(4\cos 4t + \sin 4t), x = 2e^{-\frac{n\pi}{4}}(-1)^n \text{ at } t = n\pi/4$
8. $x = (a + (V+ka)t)e^{-kt}, t = \frac{V}{k(V+ka)}$
9. $x = e^{-2t}(Ae^{\sqrt{3}t} + Be^{-\sqrt{3}t})$
- 10.

Sheet 3

$$1. x = \{4420 + 2975e^{-2t} - 6747e^{-\frac{2}{3}t} - 648\cos 3t + 484\sin 3t\} / 1105$$

$$2. x = a \left\{ \frac{1}{2}e^{-\omega t} - \frac{1}{5}e^{-2\omega t} - \frac{3}{10}\cos \omega t + \frac{1}{10}\sin \omega t \right\}$$

$$3. x = \frac{1}{2}a(\sin \omega t - \omega t \cos \omega t)$$

$$4. \ddot{x} + \omega^2 x = \frac{\omega^2 V}{\Omega} (1 - \cos \Omega t), x = \frac{2V\Omega \cos \omega t}{\omega^2 - \Omega^2} + \frac{V}{\Omega} \left(1 - \frac{\omega^2}{\omega^2 - \Omega^2} \cos \Omega t\right)$$

$$5. -\frac{4}{27} < A < 0, x = 1 - \tanh^2\left(\frac{1}{2}t + C\right)$$

$$6. -2 < x < 1$$

$$7. 1(S); 1(S); \frac{\pi}{2} + n\pi (S, n \text{ even}; U, n \text{ odd}); 0(S), \pm 1(U)$$

$$8. r = (R^{\frac{3}{2}} + \frac{3}{2}(2\mu)^{\frac{1}{2}}t)^{\frac{2}{3}}$$

$$9. \eta = \frac{1}{2}(\operatorname{sech}(x-ct) + \operatorname{sech}(x+ct))$$

$$10. \eta = \frac{1}{2}(x-ct)e^{-3(x-ct)} + \frac{1}{2}(x+ct)e^{-3(x+ct)}, x > ct$$

$$\eta = \frac{1}{2}(x-ct)e^{3(x-ct)} + \frac{1}{2}(x+ct)e^{-3(x+ct)}, 0 < x < ct$$
$$(1-3ct)e^{-3ct}$$

$$11. \eta = a \sin\left\{\frac{\omega}{c}(ct-x)\right\}, x < ct; \eta = 0, x > ct.$$

$$12. x = \frac{1}{3}e^{-t} - \frac{1}{3}e^{-4t}, x = 4^{-\frac{1}{3}} \text{ at } t = \frac{1}{3}\ln 4; x = -\frac{17}{3}e^{-t} + \frac{8}{3}e^{-4t} + 3\cos t + 5\sin t$$