

$$1) y = -h; y = v_0 \cdot \sin \alpha \cdot t - \frac{gt^2}{2}$$

$$\frac{v_0^2 \cdot \sin^2 \alpha \cdot t^2 - gt^2}{2} = -h$$

$$D = v_0^2 \cdot \sin^2 \alpha + h = 0$$

$$t_1 = \frac{v_0 \cdot \sin \alpha + \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}}{g}$$

$$= \frac{v_0 \cdot \sin \alpha + \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}}{g}$$

$$= v_0 \cdot \sin \alpha + \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}$$

$$2) \frac{dy}{dt} = v_0 \cdot \cos \alpha \cdot t; \quad y = v_0 \cdot \sin \alpha \cdot t + \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}$$

$$S: v_0 \cdot \cos \alpha \cdot t = v_0 \cdot \cos \alpha \cdot v_0 \cdot \sin \alpha \cdot t + \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}$$

$$= v_0 \cdot \cos \alpha \cdot \sin \alpha \cdot t + \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}$$

$$0) v_y = v_0 \cdot \sin \alpha - gt$$

$$v_y = v_0 \cdot \sin \alpha - g \cdot \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh + v_0 \cdot \sin \alpha}$$

$$v_0 \cdot \sin \alpha - v_0 \cdot \sin \alpha - \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh} = -\sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}$$

$$3) D = \sqrt{v_{x0}^2 + v_{y0}^2}; v_{x0} = v_0 \cdot \cos \alpha; v_{y0} = \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}$$

$$v^2 = \sqrt{v_0^2 \cdot \cos^2 \alpha + 1 - \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}} =$$

$$= \sqrt{v_0^2 \cdot \cos^2 \alpha + v_0^2 \cdot \sin^2 \alpha + 2gh} = \sqrt{v_0^2 \cdot (\cos^2 \alpha + \sin^2 \alpha) + 2gh} =$$

$$= \sqrt{v_0^2 \cdot 1 + 2gh} = \sqrt{v_0^2 + 2gh}$$

2) a) $x = v_0 \cdot \cos \alpha \cdot t$; $y = v_0 \cdot \sin \alpha \cdot t + \frac{1}{2} g t^2$

$$S = \sqrt{v_0^2 \cdot \cos^2 \alpha \cdot t^2 + (v_0 \cdot \sin \alpha \cdot t + \frac{1}{2} g t^2)^2}$$
$$= \sqrt{v_0^2 \cdot \cos^2 \alpha \cdot t^2 + v_0^2 \cdot \sin^2 \alpha \cdot t^2 + g^2 t^2 + 2 v_0 \cdot \sin \alpha \cdot t \cdot g t + \frac{1}{4} g^2 t^4}$$