

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

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

$$\bullet \quad \frac{gt}{2} v_0 \sin \alpha + h = 0$$

$$D = (v_0 \sin \alpha)^2 + 4 \cdot \frac{g}{2} h = v_0^2 \sin^2 \alpha + 2gh$$

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

$$\bullet \quad \neq v_0 \sin \alpha \quad \frac{2 \cdot g}{g}$$

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

$$2) \text{ b) } v_x = v_0 \cos \alpha \cdot t; v_x = s; t = \frac{v_0 \sin \alpha + \sqrt{v_0^2 \sin^2 \alpha + 2gh}}{g}$$

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

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

$$a) \quad v_y = v_0 \sin \alpha - g t$$

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

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

$$3) \quad v = \sqrt{v_x^2 + v_y^2}; v_x = v_0 \cos \alpha; v_y = -\sqrt{v_0^2 \sin^2 \alpha + 2gh}$$

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

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

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

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

$$S = v_0 \cdot \cos \alpha \cdot \left( \frac{v_0 \cdot \sin \alpha + \sqrt{v_0^2 \cdot \sin^2 \alpha + 2gh}}{g} \right)$$

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