November 3, 2021

Completing The Square

$\sqrt{(x+2)^2} = \sqrt{25}$

$x + 2 = \pm 5$

$x = -2 \pm 5$

$x = 3 \quad x = -7$

$(x+8)^2 = x^2 + 16x + 64$

$(x-7)^2 = x^2 - 14x + 49$

$x^2 + 10x + 25 = (x+5)^2$

$x^2 - 20x + 100 = (x-10)^2$

$x^2 - 7x + \frac{49}{4} = (x - \frac{7}{2})^2$

$x^2 - 6x - 1 = 0$

$x^2 - 6x + 9 = 1 + 9$

$\sqrt{(x-3)^2} = \sqrt{10}$

$x - 3 = \pm\sqrt{10}$

$x = 3 \pm \sqrt{10}$

$$\frac{4x^2}{4} + \frac{40x}{4} + \frac{280}{4} = \frac{0}{4}$$

$$x^2 + 10x + 70 = 0$$

$$x^2 + 10x + 25 = -70 + 25$$

$$+5 \qquad \sqrt{(x+5)^2} = \sqrt{-45}$$

$$-1 \cdot 9 \cdot 5$$

$$x + 5 = \pm 3i\sqrt{5}$$

$$x = \boxed{-5 \pm 3i\sqrt{5}}$$

QUADRATIC FORMULA

$$\frac{a}{a}x^2+\frac{b}{a}x+\frac{c}{a}=0$$

$$x^2+\frac{b}{a}x+\frac{c}{a}=0$$

$$x^2+\frac{b}{a}x+\frac{b^2}{4a^2}=\frac{4a}{4a}\cdot\frac{c}{a}+\frac{b^2}{4a^2}$$

$$\sqrt{\left(x+\frac{b}{2a}\right)^2}=\sqrt{\frac{-4ac+b^2}{4a^2}}$$

$$x+\frac{b}{2a}=\frac{\pm\sqrt{b^2-4ac}}{2a}$$

$$x=\frac{-b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a}$$

$$\boxed{x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}}$$

Discriminant

Given $ax^2+bx+c=0$

$$2x+4x^2=1$$

$$\underset{a}{4}x^2+\underset{b}{2}x\underset{c}{-1}=0$$

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

$$=\frac{-2\pm\sqrt{4+16}}{8}$$

$$=\frac{-2\pm\sqrt{20}}{8}$$ ← 4.5

$$=\frac{-2\pm2\sqrt{5}}{8}$$

$$=\boxed{\frac{-1\pm\sqrt{5}}{4}}$$

Projectile Motion

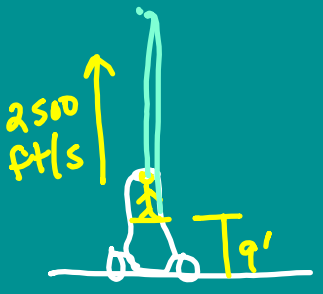
$f(x)$

$$h(t) = \frac{1}{2}at^2 + V_0 t + S_0$$

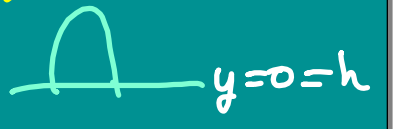
- h: height
- t: time
- a: accel. of gravity
- V_0: initial Velocity
- S_0: initial position

$a = -32 \frac{ft}{s^2}$

$a = -9.8 \frac{m}{s^2}$



$$h(t) = \frac{1}{2}(-32)t^2 + 2500t + 9$$
$$= -16t^2 + 2500t + 9$$



Find maximum height.

Find Vertex.

$$x = t = -\frac{b}{2a} = \frac{-2500}{2(-16)} = 78.125 \text{ sec}$$

$$y = h(78.125) = -16(78.125)^2 + 2500(78.125) + 9$$
$$= 97{,}665.25 \text{ ft.}$$

How long to ground?

$0 = -16t^2 + 2500t + 9$

Quadratic formula