November 2, 2022

Completing The Square

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

$x+2 = \pm 5$

$x = -2 \pm 5$

$x = 3$ or -7

$(x+3)^2 = (x+3)(x+3)$

$= x^2 + 3x + 3x + 9$

$= x^2 + 6x + 9$

$x^2 + 10x \underline{+25} = (x+5)^2$ (+5)

$x^2 - 20x \underline{+100} = (x-10)^2$ (-10)

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

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

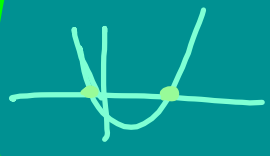
$x^2 - 6x + 9 = 1 + 9$ (-3)

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

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

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

$3+\sqrt{10}$ $\quad$ $3-\sqrt{10}$



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

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

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

$$+5 \qquad +5$$

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

$$9 \cdot 5$$

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

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

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Quadratic Formula

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

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

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

$$+\frac{b}{2a}$$

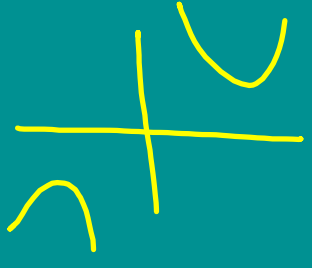
$$\left(x+\frac{b}{2a}\right)^2=\frac{b^2}{4a^2}-\frac{c}{a}\cdot\frac{4a}{4a}$$

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

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

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

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



Al-Jabr

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

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

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

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

$$=\frac{-2\pm\sqrt{20}}{8}\quad\sqrt{4\cdot5}$$

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

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

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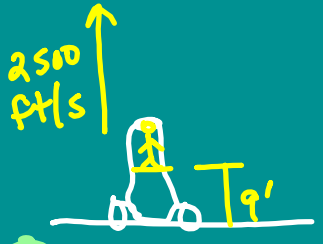
Projectile Motion

$$h(t) = \frac{1}{2}at^2 + V_0t + S_0$$

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

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

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



$$h(t) = \frac{1}{2}at^2 + V_0t + S_0$$

Find maximum height.

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

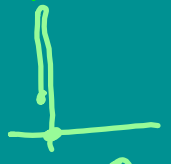
$$h(t) = -16t^2 + 2500t + 9$$

Vertex: $t = \frac{-b}{2a} = \frac{-2500}{2(-16)} = 78.125$

$$h(78.125) = -16(78.125)^2 + 2500(78.125) + 9$$

$$= 97,665.25 \text{ ft.}$$

How long to ground?



$h = 0$

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

$$t = \frac{-2500 \pm \sqrt{2500^2 - 4(-16)(9)}}{2(-16)}$$