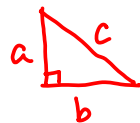


# Applications of Quadratic Equations

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## Right Triangle Application

A 13-ft ladder is leaning against a house. The distance from the bottom of the ladder to the house is 7 ft less than the distance from the top of the ladder to the ground. How far is the bottom of the ladder from the house?



$a, b$  legs  
 $c$  hypotenuse  
 $a^2 + b^2 = c^2$

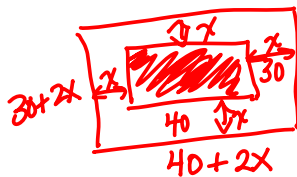


$12 - 7 = 5 \text{ ft}$

$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 (x)^2 + (x-7)^2 &= (13)^2 \\
 x^2 + x^2 - 14x + 49 &= 169 \\
 \phantom{x^2 + x^2 - 14x + 49} &\quad -169 \quad -169 \\
 2x^2 - 14x - 120 &= 0 \\
 \hline
 x^2 - 7x - 60 &= 0 \\
 (x-12)(x+5) &= 0 \\
 x-12=0 &\quad \text{or} \quad x+5=0 \\
 x=12 &\quad \text{or} \quad x=-5
 \end{aligned}$$

## Geometric Application

A swimming pool is 30 ft wide and 40 ft long. An exposed aggregate border in a strip of uniform width is put around the pool. They have enough material for 296 square feet. How wide can the strip be?



$$x + 37 \neq 0 \text{ or } x - 2 = 0$$

$$x \neq 37$$

$$x = 2$$

$x =$  width of strip  
 area of border = 296  
 total area - area of pool = border area

$$(40 + 2x)(30 + 2x) - (40)(30) = 296$$

$$1200 + 80x + 60x + 4x^2 - 1200 = 296$$

$$4x^2 + 140x - 296 = 0$$

$$x^2 + 35x - 74 = 0$$

$$(x + 37)(x - 2) = 0$$

$$\frac{74}{1,74}$$

$$\frac{2}{37}$$

## Height of an object

A toy rocket is launched from ground level. Its distance in feet from the ground in  $t$  sec is given by  $d(t) = -16t^2 + 208t$

At what times will the rocket be 550 ft from the ground?

$$550 = -16t^2 + 208t$$

$$16t^2 - 208t + 550 = 0$$

$$8t^2 - 104t + 275 = 0$$

$$a=8, b=-104, c=275$$

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

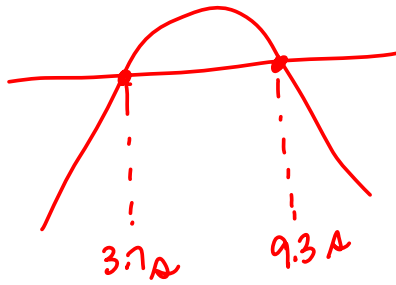
$$t = \frac{-(-104) \pm \sqrt{(-104)^2 - 4(8)(275)}}{2(8)}$$

$$t = \frac{104 \pm \sqrt{2016}}{16}$$

$$t = \frac{104 + \sqrt{2016}}{16} \quad \text{or} \quad t = \frac{104 - \sqrt{2016}}{16}$$

$$t \approx 9.3$$

$$t \approx 3.7$$



When will it reach  
ground? (height = 0 ft)

$$-16t^2 + 208t = 0$$

$$-16t(t - 13) = 0$$

$$-16t = 0 \quad \text{or} \quad t - 13 = 0$$

$$t = 0 \quad t = 13$$

0 sec, 13 sec