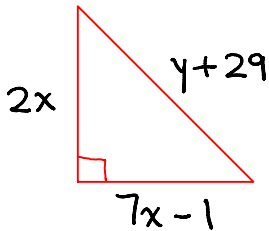


8.2b Applications of Systems of Equations

For the following problems, create two equations and solve by using one of the two algebraic methods (substitution or elimination).

Ex. 1 A triangle has a perimeter of 112m and an area of 16y. Determine the value of x and y.



Equation for the perimeter:

$$2x + y + 29 + 7x - 1 = 112$$

$$9x + y + 28 = 112$$

$$\textcircled{1} 9x + y = 84$$

$$y = -9x + 84$$

Equation for the area:

$$\frac{2x(7x-1)}{2} = 16y$$

$$\textcircled{2} 7x^2 - x = 16y$$

$$7x^2 - x = 16(-9x + 84)$$

$$7x^2 - x = -144x + 1344$$

$$7x^2 + 143x - 1344 = 0$$

$$x = \frac{-143 \pm \sqrt{20449 - 4(-7)(-1344)}}{14}$$

$$x = \frac{-143 \pm 241}{14}$$

$$x = 7 \quad \text{or} \quad x = -\frac{192}{7}$$

← reject neg length

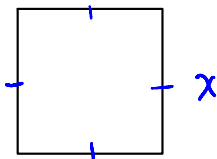
$$x = 7$$

$$y = -9(7) + 84$$

$$y = 21$$

$$x = 7 \text{ and } y = 21$$

Ex. 2 A square has an area that is 3.25 times its perimeter. Determine the side lengths of the square.



$$A = 3.25P$$

area:

$$A = x^2$$

perimeter:

$$P = 4x$$

$$x^2 = 3.25(4x)$$

$$x^2 = 13x$$

$$x^2 - 13x = 0$$

$$x(x-13) = 0$$

$$x = 0 \quad \text{or} \quad x = 13$$

Side length is 13

Ex. 3 One number plus 4 more than 5 times another number adds to 67. Three times the first number plus 8 less than the square of the second number adds to 167. Determine the numbers.

Equation 1:

$$x + 4 + 5y = 67$$

Equation 2:

$$3x + 8 - y^2 = 167$$

$$x + (5y + 4) = 67$$

$$\textcircled{1} x + 5y = 63$$

$$x = 63 - 5y$$

$$3x + (y^2 - 8) = 167$$

$$\textcircled{2} 3x + y^2 = 175$$

$$3(63 - 5y) + y^2 = 175$$

$$189 - 15y + y^2 = 175$$

$$y^2 - 15y + 14 = 0$$

$$(y - 14)(y - 1) = 0$$

$$y = 14 \text{ or } y = 1$$

$$y = 14$$

$$x = 63 - 5(14)$$

$$x = -7$$

$$\boxed{(-7, 14)}$$

$$\text{or } y = 1$$

$$x = 63 - 5(1)$$

$$x = 58$$

$$\text{or } \boxed{(58, 1)}$$

Ex. 4 A crate is dropped out of a plane. After free falling a bit, a parachute opens.

If $h = -4.9t^2 + 900$ represents the height of the crate during free fall and

$h = -4t + 500$ represents its height when the parachute is open...

a) How long does the crate freefall? 9.4 sec.

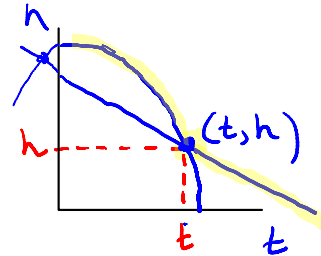
b) At what height does the parachute open?

$$\text{a) } -4.9t^2 + 900 = -4t + 500$$

$$0 = 4.9t^2 - 4t - 400$$

$$t = \frac{4 \pm \sqrt{16 - 4(4.9)(-400)}}{9.8} = \frac{4 \pm 88.63}{9.8}$$

$t = 9.4$
 ~~$x = \text{neg}$~~



$$\text{b) } h = -4(9.4) + 500$$

$$h = 462.4 \text{ m}$$

Assignment: p452 #8 - 11, 12ab, 13

*Quiz next class on sections 8.1 and 8.2a.