

QT - Solving by substitution

1. Solve:

$$y - 2x = 3 \rightarrow y = 3 + 2x$$

$$x^2 + y^2 = 18$$

$$x^2 + (3 + 2x)^2 = 18$$

$$x^2 + (3 + 2x)(3 + 2x) = 18$$

$$x^2 + 9 + 12x + 4x^2 = 18$$

$$5x^2 + 12x - 9 = 0$$

$$5x^2 + 15x - 3x - 9 = 0$$

$$5x(x + 3) - 3(x + 3) = 0$$

$$(x + 3)(5x - 3) = 0$$

$$x = -3 \quad \left| \quad x = \frac{3}{5}$$

$$y = 3 + 2x \\ = 3 + 2(-3)$$

$$y = -3$$

$$y = 3 + 2x \\ = 3 + 2\left(\frac{3}{5}\right) \\ = 3 + \frac{6}{5} \\ = 4\frac{1}{5}$$

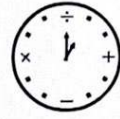
$$\therefore x = -3, y = -3$$

$$\therefore x = \frac{3}{5}, y = 4\frac{1}{5}$$

$$= 0.6$$

$$= 4.2$$

$$\begin{array}{r} -45 \\ 1 \\ \hline +5 \quad -3 \end{array}$$



2. Solve:

$$x - 2y = 1$$

$$x = 1 + 2y$$

$$x^2 + y^2 = 13$$

$$(1 + 2y)(1 + 2y) + y^2 = 13$$

$$1 + 4y + 4y^2 + y^2 = 13$$

$$5y^2 + 4y - 12 = 0$$

$$5y^2 + 10y - 6y - 12 = 0$$

$$5y(y + 2) - 6(y + 2) = 0$$

$$(y + 2)(5y - 6) = 0$$

$$y = -2$$

$$x = 1 + 2y$$
$$= 1 + 2(-2)$$

$$x = -3$$

$$y = \frac{6}{5}$$

$$x = 1 + 2\left(\frac{6}{5}\right)$$

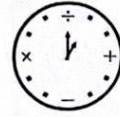
$$x = \frac{17}{5}$$

$$\begin{array}{r} -60 \\ / \quad \backslash \\ 10 \quad -6 \end{array}$$

$$\therefore x = -3 \quad y = -2$$

$$x = \frac{17}{5} \quad y = \frac{6}{5}$$

$$= 3.4 \quad = 1.2$$



3. Solve, giving your answer correct to 2 decimal places:

$$\begin{aligned}x + y &= 2 & y &= 2 - x \\x^2 + y^2 &= 9\end{aligned}$$

$$x^2 + (2-x)(2-x) = 9$$

$$x^2 + 4 - 4x + x^2 = 9$$

$$2x^2 - 4x - 5 = 0$$

$$a = 2$$

$$b = -4$$

$$c = -5$$

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

$$= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-5)}}{2(2)}$$

$$= \frac{4 \pm \sqrt{16 + 40}}{4}$$

$$x = \frac{4 + \sqrt{56}}{4}$$

$$x = 2.8708$$

$$\begin{aligned}y &= 2 - x \\ &= -0.8708\end{aligned}$$

$$x = \frac{4 - \sqrt{56}}{4}$$

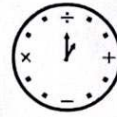
$$x = -0.8708$$

$$y = 2.8708$$

$$x = 2.87 \quad y = -0.87$$

$$x = -0.87 \quad y = 2.87$$

Ldp .



4. Solve:

$$y = x^2 + x - 7$$
$$4x + 2y + 1 = 0$$

$$2y = -1 - 4x$$

$$y = \frac{-1 - 4x}{2}$$

$$\times 2 \quad \frac{-1 - 4x}{2} = x^2 + x - 7 \quad \times 2$$

$$-1 - 4x = 2(x^2 + x - 7)$$

$$0 = 2x^2 + 2x - 14 + 1 + 4x$$

$$0 = 2x^2 + 6x - 13$$

$$a = 2$$

$$b = 6$$

$$c = -13$$

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

$$= \frac{-(6) \pm \sqrt{(6)^2 - 4(2)(-13)}}{2(2)}$$

$$x = \frac{-6 + \sqrt{140}}{4}$$

$$x = 1.45803$$

$$y = -3.42607$$

$$x = 1.46$$

$$y = \underline{\underline{-3.42}}$$

$$x = \frac{-6 - \sqrt{140}}{4}$$

$$x = -4.458$$

$$y = 8.416074$$

$$x = -4.46$$

$$y = \underline{\underline{8.42}}$$



Solve

$$y = x - 2$$

$$2x^2 - xy = 11$$

$$2x^2 - x(x-2) = 11$$

$$2x^2 - x^2 + 2x = 11$$

$$x^2 + 2x - 11 = 0$$

$$\begin{aligned} a &= 1 \\ b &= 2 \\ c &= -11 \end{aligned}$$

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

$$= \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(-11)}}{2}$$

$$x = \frac{-2 \pm \sqrt{48}}{2}$$

$$x = 2.464$$

$$y = 0.464$$

$$x = -4.46$$

$$y = -0.46$$

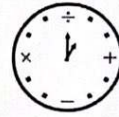
$$x = \frac{-2 \pm \sqrt{48}}{2}$$

$$x = -4.464$$

$$y = -0.464$$

$$\therefore x = -4.46$$

$$y = -0.46$$

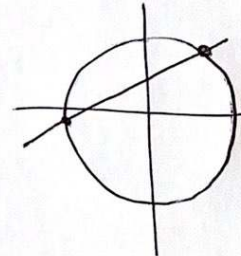


6. L is the straight line with equation $y = x + 2$

C is the circle with equation $x^2 + y^2 = 34$

The line intersects the equation at two points.

Find the coordinates of both points.



$$x^2 + (x+2)^2 = 34$$

$$x^2 + (x+2)(x+2) = 34$$

$$x^2 + x^2 + 4x + 4 = 34$$

$$2x^2 + 4x - 30 = 0$$

$$x^2 + 2x - 15 = 0$$

$$(x-3)(x+5) = 0$$

$$\therefore x = 3$$

$$y = x + 2$$

$$y = 5$$

$$x = 3$$

$$y = 5$$

$$x = -5$$

$$y = -5 + 2$$

$$y = -3$$

$$x = -5$$

$$y = -3$$