# Simultaneous Equations : 2 : Answers.

1) $y = 10x^2 - 5x - 2$ — ①
$y = 2x - 3$ — ②

sub ② into ①

$2x - 3 = 10x^2 - 5x - 2$
$0 = 10x^2 - 7x + 1$
$0 = (5x - 1)(2x - 1)$

either $5x - 1 = 0$, $x = 1/5$ or $2x - 1 = 0$, $x = 1/2$

② ⇒

$y = 2(\frac{1}{5}) - 3$, $y = \frac{2}{5} - \frac{15}{5}$, $y = \frac{-13}{5}$

$y = 2(\frac{1}{2}) - 3$, $y = 1 - 3$, $y = -2$

$x = \frac{1}{5}$, $y = \frac{-13}{5}$ } ANS

$x = 1/2$, $y = -2$ } ANS

2) $y - 3 = 2x$ — ①
$y + 7 = x^2 - x$ — ②

① ⇒ $y = 2x + 3$ (*)

Sub into ② ⇒ $2x + 3 + 7 = x^2 - x$
$0 = x^2 - 3x - 10$
$0 = (x - 5)(x + 2)$

either $x - 5 = 0$, $x = 5$ or $x + 2 = 0$, $x = -2$

from (*) ↓

$y = 2(5) + 3$, $y = 13$

$y = 2(-2) + 3$, $y = -4 + 3$, $y = -1$

$x = 5$, $y = 13$ } ANS

$x = -2$, $y = -1$ } ANS.

3) $x^2 + y^2 = 25$ — (1)

$2y + x = 10$ — (2)

(2) $\Rightarrow$ $x = 10 - 2y$ (*)

sub into (1) $\Rightarrow$ $(10-2y)^2 + y^2 = 25$

$100 - 40y + 4y^2 + y^2 = 25$

$5y^2 - 40y + 75 = 0$

$y^2 - 8y + 15 = 0$

$(y-5)(y-3) = 0$

either $y - 5 = 0$ or $y - 3 = 0$

$y = 5$ $\quad$ $y = 3$

(*) $\downarrow$ $\quad$ $\downarrow$

$x = 10 - 2(5)$ $\quad$ $x = 10 - 2(3)$

$x = 0$ $\quad$ $x = 4$

$y = 5$, $x = 0$ } ANS $\quad$ $x = 4$, $y = 3$ } ANS

4) $y = x$ — (1)

$y^2 = 4x$ — (2)

(2) $\Rightarrow$ $x^2 = 4x$

$x^2 - 4x = 0$

$x(x-4) = 0$

either $x = 0$ or $x - 4 = 0$

$x = 4$

(1) $\downarrow$ $\quad$ $\downarrow$

$y = 0$ $\quad$ $y = 4$

$x = 0$, $y = 0$ } ANS $\quad$ $x = 4$, $y = 4$ } ANS

5) $xy = 64 \quad -①$

$4x - y = 60 \quad -②$

② $\Rightarrow \quad 4x - 60 = y \quad (*)$

sub into ①

$x(4x-60) = 64$

$4x^2 - 60x = 64$

$4x^2 - 60x - 64 = 0$

$x^2 - 15x - 16 = 0$

$(x-16)(x+1) = 0$

either $x - 16 = 0$ or $x + 1 = 0$

$x = 16$ $\quad$ $x = -1$

(*) ↓ ↓

$4(16) - 60 = y$ $\quad$ $4(-1) - 60 = y$

$64 - 60 = y$ $\quad$ $-4 - 60 = y$

$4 = y$ $\quad$ $-64 = y$

$x = 16$, $y = 4$ } ANS $\quad$ $x = -1$, $y = -64$ } ANS.

6) $x - 3y = 8 \quad -①$

$x^2 - 3y^2 = 22 \quad -②$

① $\Rightarrow \quad x = 8 + 3y \quad (*)$

② $\Rightarrow \quad (8+3y)^2 - 3y^2 = 22$

$64 + 48y + 9y^2 - 3y^2 = 22$

$6y^2 + 48y + 42 = 0$

$y^2 + 8y + 7 = 0$

$(y+7)(y+1) = 0$

either $y + 7 = 0$ or $y + 1 = 0$

$y = -7$ $\quad$ $y = -1$

(*) ↓ ↓

$x = 8 + 3(-7)$ $\quad$ $x = 8 + 3(-1)$

$x = 8 - 21$ $\quad$ $x = 8 - 3$

$x = -13$ $\quad$ $x = 5$

$x = -13$, $y = -7$ } ANS $\quad$ $x = 5$, $y = -1$ } ANS.

7) $2x - 5y = 3$ — (1)

$2xy + y^2 = 9$ — (2)

(1) $\Rightarrow$ $2x = 3 + 5y$ (*)

(2) $\Rightarrow$ $(3+5y)y + y^2 = 9$

$3y + 5y^2 + y^2 = 9$

$6y^2 + 3y - 9 = 0$

$2y^2 + y - 3 = 0$

$(2y+3)(y-1) = 0$

either $2y+3=0$ or $y-1=0$

$y = -\frac{3}{2}$ $\quad$ $y = 1$

(*) ↓ $\quad$ ↓

$2x = 3 + 5\left(-\frac{3}{2}\right)$ $\quad$ $2x = 3 + 5(1)$

$2x = \frac{6}{2} - \frac{15}{2}$ $\quad$ $2x = 8$

$2x = -\frac{9}{2}$ $\quad$ $x = 4$

$x = -\frac{9}{4}$

$x = -\frac{9}{4}$, $y = -\frac{3}{2}$ } ANS $\quad$ $x = 4$, $y = -\frac{3}{2}$ } ANS.

8) $2x - 3y = 3$ — (1)

$2x^2 + 3y^2 = 21$ — (2)

(1) $\Rightarrow$ $2x = 3 + 3y$

$x = \frac{(3+3y)}{2}$ (*)

(2) $\Rightarrow$ $2\frac{(3+3y)^2}{4} + 3y^2 = 21$

$\frac{(3+3y)^2}{2} + 3y^2 = 21$

$\times 2$ $\quad$ $(3+3y)^2 + 6y^2 = 42$

$9 + 18y + 9y^2 + 6y^2 = 42$

$15y^2 + 18y - 33 = 0$

$5y^2 + 6y - 11 = 0$

$(5y+11)(y-1) = 0$

either $5y+11=0$ or $y-1=0$

$y = -11/5$ $\quad$ $y = 1$

(*) ↓ $\quad$ ↓

$x = \frac{3 + 3\left(-11/5\right)}{2}$ $\quad$ $x = \frac{3+3(1)}{2}$

$x = 9/5$ $\quad$ $x = 3$

$x = 9/5$, $y = -\frac{11}{5}$ } ANS $\quad$ $x = 3$, $y = 1$ } ANS

9) $2x+3y=8$ — (1)
$x^2+y^2=5$ — (2)

(1) $\Rightarrow$ $2x=8-3y$
$x=\frac{(8-3y)}{2}$ (*)

(2) $\Rightarrow$ $\frac{(8-3y)^2}{4}+y^2=5$

$\times 4$ $(8-3y)^2+4y^2=20$
$64-48y+9y^2+4y^2=20$
$13y^2-48y+44=0$
$(13y-22)(y-2)=0$

either $y=\frac{22}{13}$ or $y=2$

(*) ↓ ↓

$x=\frac{8-3(\frac{22}{13})}{2}$ $x=\frac{8-3(2)}{2}$

$x=1$

$x=\frac{104-66}{\frac{13}{2}}$

$x=\frac{38}{26}$

$x=\frac{19}{13}$

$x=1$
$y=2$ } ANS

$x=\frac{19}{13}$
$y=\frac{22}{13}$ } ANS.

10) $3x-2y=4$ — (1)
$x^2-y^2=3$ — (2)

(1) $\Rightarrow$ $3x=4+2y$
$x=\frac{(4+2y)}{3}$ (*)

(2) $\Rightarrow$ $\frac{(4+2y)^2}{9}-y^2=3$

$\times 9$
$(4+2y)^2-9y^2=27$
$16+16y+4y^2-9y^2=27$
$0=5y^2-16y+11$
$0=(5y-11)(y-1)$
either $y=\frac{11}{5}$ or $y=1$

↓

$x=\frac{4+2(\frac{11}{5})}{3}$ $x=\frac{4+2(1)}{3}$

$x=\frac{42}{15}$ $x=2$

$x=42/15$
$y=11/5$ } ANS

$x=2$
$y=1$ } ANS