

## L2 Simultaneous Equations Practice #4

Solve the following pairs of Simultaneous Equations

### Warm Up

1.  $a = 3b + 2$  and  $a = b - 6$

2.  $a + b + 4 = 0$  and  $2a + b + 9 = 0$

### Achieved

3.  $y = x(x - 4)$  and  $y = 3x - 10$

4.  $a = \frac{2}{b + 1}$  and  $2a = b + 1$

### Merit

5.  $(x - 1)^2 + y^2 = 25$  and  $3x + 4y = 3$

6.  $x^2 + y^2 + xy = 25$  and  $x + 2y + 5 = 0$

### Excellence

7. Find  $k$  so that  $y^2 + k = 2x$  does not cross  $y = 4x + 5$

8. Find  $k$  so that  $x - y + k = 0$  is a tangent to  $x^2 + y^2 = 1000$

## Answers: L2 Simultaneous Equations Practice #4

1.  $a = 3b + 2$  and  $a = b - 6$

make  $a = a : 3b + 2 = b - 6$                       answer  $a = -10, b = -4$

2.  $a + b + 4 = 0$  and  $2a + b + 9 = 0$  rearranges to  $b = -a - 4$  and  $b = -2a - 9$

make  $-b = -b : a + 4 = 2a + 9$                       answer  $a = -5, b = 1$

3.  $x + 3y = 5$  and  $xy + y^2 = 3$  rearranges to  $x = 5 - 3y$  and  $xy + y^2 = 3$

substitute out  $x : (5 - 3y)y + y^2 = 3$                       answer = (2, 1) or (0.5, 1.5)

4.  $a = \frac{2}{b+1}$  and  $2a = b + 1$  rearrange to  $a(b+1) = 2$  and  $b = 2a - 1$

substitute out  $b : a(2a - 1 + 1) = 2$                       answer  $a = 1, b = 1$  or  $a = -1, b = -3$

5.  $(x - 1)^2 + y^2 = 25$  and  $3x + 4y = 3$  is awkward because can't find  $y =$  or  $x =$  easily

so sub in  $4y$  by rearranging to  $4^2(x - 1)^2 + (4y)^2 = 4^2 \times 25$  and  $4y = 3 - 3x$

putting in  $4y : 16(x - 1)^2 + (3 - 3x)^2 = 400$

$16x^2 - 32x + 16 + 9 - 18x + 9x^2 = 400$                       answer = (5, -3) and (-3, 3)

6.  $x^2 + y^2 + xy = 25$  and  $x + 2y + 5 = 0$  rearranges to circle and  $x = -2y - 5$

substitute out  $x : (-2y - 5)^2 + y^2 + (-2y - 5)y = 25$  being careful with negatives

$3y^2 + 15y = 0$                       answer = (5, -5) and (-5, 0)

7. Find  $k$  so that  $y^2 + k = 2x$  does not cross  $y = 4x + 5$

substitute out  $y : (4x + 5)^2 + k = 2x$  which gives :  $16x^2 + 38x + (25 + k) = 0$

no intersection when  $b^2 - 4ac < 0$  which gives:  $(38)^2 - 4 \times 16 \times (25 + k) < 0$

$1444 - 1600 - 64k < 0$                       answer  $k < -2.4375$

8.  $x - y + k = 0$  and  $x^2 + y^2 = 1000$  rearrange to  $y = x + k$  and to  $x^2 + y^2 = 1000$

substitute out  $y : x^2 + (x + k)^2 = 1000$  which gives  $2x^2 + 2kx + k^2 - 1000 = 0$

tangent when  $b^2 - 4ac = 0$  which gives:  $(2k)^2 - 4 \times 2 \times (k^2 - 1000) = 0$

$4k^2 - 8k^2 + 8000 = 0$                       answer  $k = \pm\sqrt{2000}$