Solving equations
Higher worksheet

Solve the following equations

1) $2x + 5y = 31$
   $-9x + 5y = 53$

2) $4x + 9y = -7$
   $8x - 9y = -2$

3) $4x - 6y = 28$
   $2x + 4y = -42$

Solving equations
Higher worksheet

4) $-2x + y = -11$
   $-7x + 4y = -40$

5) $2x + 6y = -46$
   $-3x + 19y = -71$

6) $y = 6x - 12$
   $y = 9x + 3$

7) $y = 7x + 11$
     $4x + 8y = 148$

8) $7x - 9y = -419$
     $y = 8x - 4$

Solving equations
Higher worksheet

9) $y = x^2 - 13x + 42$
     $y = 3x - 6$

10) $(x - 4)^2 + (y - 14)^2 = 50$
      $y = x + 10$

Solving equations
Higher worksheet

Solve the following equations

1) $2x + 5y = 31$ [1]
$-9x + 5y = 53$ [2]

$9x - 5y = -53$ (multiplying [2] by -1) [3]
$11x = -22$ (adding [1] and [3] together) [4]
$x = -2$ (dividing each side of [4] by 11) [5]
$-4 + 5y = 31$ (substituting [5] into [1]) [6]
$5y = 35$ (adding 4 to each side of [6]) [7]
$y = 7$ (dividing each side of [7] by 5) [8]
So $x = -2, y = 7$ (from [5] and [8]) [9]

2) $4x + 9y = -7$ [1]
$8x - 9y = -2$ [2]

$12x = -9$ (adding [1] and [2] together) [3]
$x = -\frac{3}{4}$ (dividing each side of [3] by 12) [4]
$-3 + 9y = -7$ (substituting [4] into [1]) [5]
$9y = -4$ (adding 3 to each side of [5]) [6]
$y = -\frac{4}{9}$ (dividing each side of [6] by 9) [7]
So $x = -\frac{3}{4}, y = -\frac{4}{9}$ (from [4] and [7]) [8]

3) $4x - 6y = 28$ [1]
$2x + 4y = -42$ [2]

$-4x - 8y = 84$ (multiplying [2] by -2) [3]
$-14y = 112$ (adding [1] and [3] together) [4]
$y = -8$ (dividing each side of [4] by -14) [5]
$2x + (-32) = -42$ (substituting [5] into [2]) [6]
$2x - 32 = -42$ (rewriting [6]) [7]
$2x = -10$ (adding 32 to each side of [7]) [8]
$x = -5$ (dividing each side of [8] by 2) [9]
So $x = -5, y = -8$ (from [9] and [5]) [10]

4) $-2x + y = -11$ [1]
$-7x + 4y = -40$ [2]

$8x - 4y = 44$ (multiplying [1] by -4) [3]
$x = 4$ (adding [2] and [3] together) [4]
$-8 + y = -11$ (substituting [4] into [1]) [5]
$y = -3$ (adding 8 to each side of [6]) [6]
So $x = 4, y = -3$ (from [4] and [8]) [7]

5) $2x + 6y = -46$ [1]
$-3x + 19y = -71$ [2]

$6x + 18y = -138$ (multiplying [1] by 3) [3]
$-6x + 38y = -142$ (multiplying [2] by 2) [4]

$56y = -280$ (adding [3] and [4] together) [5]
$y = -5$ (dividing each side of [5] by 56) [6]
$2x + (-30) = -46$ (substituting [6] into [1]) [7]
$2x - 30 = -46$ (rewriting [7]) [8]
$2x = -16$ (adding 30 to each side of [8]) [9]
$x = -8$ (dividing each side of [9] by 2) [10]
So $x = -8, y = -5$ (from [10] and [6]) [11]

6) $y = 6x - 12$ [1]
$y = 9x + 3$ [2]

$6x - 12 = 9x + 3$ (substituting [1] into [2]) [3]
$-15 = 3x$ (adding $-6x - 3$ to each side of [3]) [4]
$-5 = x$ (dividing each side of [4] by 3) [5]
$y = -30 - 12 = -42$ (substituting [5] into [1]) [6]
So $x = -5, y = -42$ (from [5] and [6]) [7]

Solving equations
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7) $y = 7x + 11$ [1]
    $4x + 8y = 148$ [2]

    $4x + 8(7x + 11) = 148$ (substituting [1] into [2]) [3]
    $60x + 88 = 148$ (expanding brackets and simplifying in [3]) [4]
    $60x = 60$ (subtracting 88 from each side of [4]) [5]
    $x = 1$ (dividing each side of [5] by 60) [6]
    $y = 7 + 11 = 18$ (substituting [6] into [1]) [7]
    So $x = 1, y = 18$ (from [6] and [7]) [8]

8) $7x - 9y = -419$ [1]
    $y = 8x - 4$ [2]

    $7x - 9(8x - 4) = -419$ (substituting [2] into [1]) [3]
    $-65x + 36 = -419$ (expanding brackets and simplifying in [3]) [4]
    $-65x = -455$ (subtracting 36 from each side of [4]) [5]
    $x = 7$ (dividing each side of [5] by -65) [6]
    $y = 56 - 4 = 52$ (substituting [6] into [2]) [7]
    So $x = 7, y = 52$ (from [6] and [7]) [8]

Solving equations
Higher worksheet

9) $y = x^2 - 13x + 42$ [1]
     $y = 3x - 6$ [2]

     $x^2 - 13x + 42 = 3x - 6$ (substituting [1] into [2])   [3]
     $x^2 - 16x + 48 = 0$ (adding $-3x + 6$ to each side of [3])   [4]
     $(x - 12)(x - 4) = 0$ (factorising the left-hand side of [4])   [5]
     $x = 12, x = 4$ (Solving [5])   [6]
     If $x = 12$, $y = 36 - 6 = 30$ (substituting $x = 12$ into [2])   [7]
     If $x = 4$, $y = 12 - 6 = 6$ (substituting $x = 4$ into [2])   [8]
     So $x = 12, y = 30$ (from [6] and [7])   [9]
     So $x = 4, y = 6$ (from [6] and [8])   [10]

10) $(x - 4)^2 + (y - 14)^2 = 50$ [1]
     $y = x + 10$ [2]

     $(x - 4)^2 + (x + 10 - 14)^2 = 50$ (substituting [2] into [1])   [3]
     $(x - 4)^2 + (x - 4)^2 = 50$ (simplifying in [3])   [4]
     $2x^2 - 16x + 32 = 50$ (expanding and simplifying the left side of [4]) [5]
     $x^2 - 8x + 16 = 25$ (dividing each side of [5] by 2)   [6]
     $x^2 - 8x - 9 = 0$ (subtracting 25 from each side of [6])   [7]
     $(x - 9)(x + 1) = 0$ (factorising the left-hand side of [7])   [8]
     $x = 9, x = -1$ (Solving [8])   [9]
     If $x = 9$, $y = 9 + 10 = 19$ (substituting $x = 9$ into [2])   [10]
     If $x = -1$, $y = -1 + 10 = 9$ (substituting $x = -1$ into [2])   [11]
     So $x = 9, y = 19$ (from [9] and [10])   [12]
     So $x = -1, y = 9$ (from [9] and [11])   [13]