Solving Systems of Equations

Name Key

Solve each of 1-6 by substitution.

1. $y = 5x$
$2x + 3y = 34$

$2x + 3(5x) = 34$
$2x + 15x = 34$
$17x = 34$
$x = 2$
$y = 5(2)$
$y = 10$

ANSWER: (2, 10)

2. $4c = 3d + 3$
$c = d - 1$

$4(d-1) = 3d + 3$
$4d - 4 = 3d + 3$
$d = 7$
$c = (7) - 1$
$c = 6$

ANSWER: (6, 7)

3. $2x - y = -4$
$-3x + y = -9$

$y = 3x - 9$
$y = 3(13) - 9$
$y = 30$
$2x - (3x - 9) = -4$
$2x - 3x + 9 = -4$
$-x + 9 = -4$
$-x = -13$
$x = 13$

ANSWER: (13, 30)

4. $8x + 2y = 13$
$4x + y = 11$

$y = -4x + 11$
$8x + 2(-4x + 11) = 13$
$8x - 8x + 22 = 13$
$0 = -9$ X

ANSWER: no solution

5. $3x - 2y = 11$
$x - \frac{1}{2}y = 4$

$x = \frac{1}{2}y + 4$
$x = \frac{1}{2}(a) + 4$
$x = 5$
$3(\frac{1}{2}y + 4) - 2y = 11$
$\frac{3}{2}y + 12 - 2y = 11$
$-\frac{1}{2}y + 12 = 11$
$-\frac{1}{2}y = -1$
$y = 2$

ANSWER: (5, 2)

6. $x = \frac{1}{2}y + 3$
$2x - y = 6$

$2(\frac{1}{2}y + 3) - y = 6$
$y + 6 - y = 6$
$6 = 6$ ✓

ANSWER: infinite solutions

Solve each of 7-12 by elimination.

7. $3m - 2n = 13$
$m + 2n = 7$

$4m = 20$
$m = 5$
$5 + 2n = 7$
$2n = 2$
$n = 1$

ANSWER: (5, 1)

8. $2m - 5n = -6$
$-(2m + 7n = +14)$

$2n = 8$
$n = 4$
$2m - 5(4) = -6$
$2m - 20 = -6$
$2m = 14$
$m = 7$

ANSWER: (7, 4)

9. $(4x - 7y = 10)\,3$
$(3x + 2y = -7) - 4$

$12x - 21y = 30$
$-12x - 8y = 28$
$-29y = 58$
$y = -2$
$4x - 7(-2) = 10$
$4x + 14 = 10$
$4x = -4$
$x = -1$

ANSWER: (-1, -2)

10. $(4x + 5y = 7)\,-2$
$8x + 5y = 9$

$-8x - 10y = -14$
$-5y = -5$
$y = 1$
$4x + 5(1) = 7$
$4x + 5 = 7$
$4x = 2$
$x = \frac{1}{2}$

ANSWER: $(\frac{1}{2}, 1)$

11. $-5x + 3y = 6$
$(x - y = 4)\,5$

$5x - 5y = 20$
$-2y = 26$
$y = -13$
$x - (-13) = 4$
$x + 13 = 4$
$x = -9$

ANSWER: (-9, -13)

12. $(2x + y = 5)\,5$
$(5x - 2y = 4) - 2$

$10x + 5y = 25$
$-10x + 4y = -8$
$9y = 17$
$y = \frac{17}{9}$
$2x + (\frac{17}{9}) = 5$
$2x = \frac{28}{9}$
$x = \frac{14}{9}$

$\frac{45}{9} - \frac{17}{9}$

ANSWER: $(\frac{14}{9}, \frac{17}{9})$

Solve each of the following equations using either substitution or elimination.

13. $3x-4y=-10$ $5x+8y=-2$

$6x-8y=-20$

$11x=-22$

$x=-2$

$3(-2)-4y=-10$

$-6-4y=-10$

$-4y=-4$

$y=1$

ANSWER: $(-2,1)$

14. $x-y=2$ $5x+3y=18$

$x=y+2$ $5(y+2)+3y=18$

$x=(1)+2$ $5y+10+3y=18$

$x=3$ $8y+10=18$

$8y=8$

$y=1$

ANSWER: $(3,1)$

15. $\frac{1}{2}x-\frac{2}{3}y=\frac{7}{3}$ $\frac{3}{2}x+2y=-25$

$\frac{3}{2}-2y=7$ $\frac{1}{2}(-6)-\frac{2}{3}y=\frac{7}{3}$

$3x=-18$ $-3-\frac{2}{3}y=\frac{7}{3}$

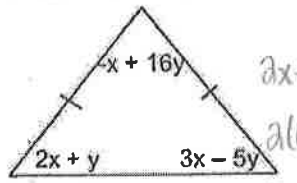
$x=-6$ $-\frac{2}{3}y=\frac{16}{3}$

$y=-8$

ANSWER: $(-6,-8)$

In 16 and 17, write out two equations involving x and y. Solve using substitution or elimination.

16.



$2x+y-x+16y+3x-5y=180$

$2(16y)+y-6y+16y+3(16y)-5y=180$

$12y+y-6y+16y+18y-5y=180$

$36y=180$

$y=5$

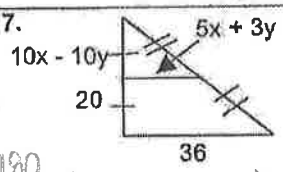
$2x+y=3x-5y$

$y=x-5y$

$6y=x$

$6(5)=x$ $x=30$

17.



$(10x-10y=20)\cdot 1$ $2(5x+3y)=36$

$10x-10(1)=20$ $10x+6y=36$

$10x-10=20$ $-10x+10y=-20$

$10x=30$ $16y=16$

$x=3$ $y=1$

Algebra Practice:

18. Multiply and Simplify: $(3x+2)(4x-3)$

$12x^2-9x+8x-6$

$12x^2-x-6$

19. Multiply and Simplify: $(x-6)^2$

$(x-6)(x-6)$

$x^2-6x-6x+36$

$x^2-12x+36$

20. If $a^2+b^2=36$ and $a^2=8b^2$, find a and b by substitution.

$8b^2+b^2=36$ $a^2=8(a)^2$

$9b^2=36$ $a^2=8(4)$

$b^2=4$ $b=\pm 2$ $a^2=32$ $a=\pm 4\sqrt{2}$

21. Solve $3x^2-9x=0$

$3x(x-3)=0$

$3x=0$ $x-3=0$

$x=0$ $x=3$

22. Solve: $x^2-x-20=0$

$(x+4)(x-5)$

$x+4=0$ $x-5=0$

$x=-4$ $x=5$

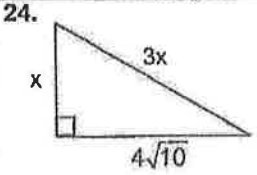
23. Solve: $x^2-13x=-42$

$x^2-13x+42=0$ $x-6=0$ $x-7=0$

$(x-6)(x-7)$ $x=6$ $x=7$

Solve for the given variable(s). Write answers as exact values (fraction, radicals, as needed):

24.



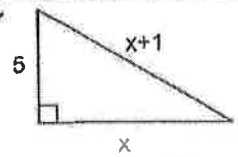
$x^2+(4\sqrt{10})^2=(3x)^2$

$x^2+160=9x^2$ $160=8x^2$

$20=x^2$

$x=\pm 2\sqrt{5}$

25.

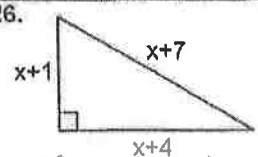


$x^2+5^2=(x+1)^2$

$x^2+25=x^2+2x+1$

$2x=24$ $x=12$

26.



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

$x^2+2x+1+x^2+8x+16=x^2+14x+49$

$2x^2+10x+17=x^2+14x+49$

$x^2-4x-32=0$

$(x+4)(x-8)$

$x+4=0$ $x-8=0$

$x=-4$ $x=8$