1 Bridging Unit: Algebra 1

Topic B: Solving linear equations and rearranging formulae

Bridging to Ch1.4

This topic recaps the **balance** method to solve problems involving linear equations, and both the **elimination** and **substitution** methods to solve linear simultaneous equations. You can solve linear equations and inequalities using the **balance** method where the same operation is applied to both sides.

Example 1

Solve the equation $7x-5=3x-2$

$4x-5=-2$ — Subtract $3x$ from both sides of the equation.

$4x=3$ — Add 5 to both sides of the equation.

$x=\frac{3}{4}$ — Divide both sides of the equation by 4

Try It 1

Solve the equation $3x+8=5x-6$

Example 2

Solve the inequality $5(x-2)\leq 2x+1$

$5x-10\leq 2x+1$ — First expand the brackets.

$3x-10\leq 1$ — Subtract $2x$ from both sides.

$3x\leq 11$ — Add 10 to both sides.

$x\leq\frac{11}{3}$ — Divide both sides by 3

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Try It 2

Solve the inequality $7x-4>x+8$

When solving inequalities, remember that multiplying or dividing by a negative number will reverse the inequality sign. For example, $5>3$ but $-5<-3$

Equations and formulae can be rearranged using the same method as for solving equations.

Example 3

Rearrange $Ax-3=\frac{x+B}{2}$ to make x the subject.

$2Ax-6=x+B$ — Multiply both sides by 2

$2Ax-6-x=B$ — Subtract x from both sides.

$2Ax-x=B+6$ — Add 6 to both sides.

$x(2A-1)=B+6$ — Factorise the side involving x

$x=\frac{B+6}{2A-1}$ — Divide both sides by $(2A-1)$ to make x the subject.

Try It 3

Rearrange $3(x+A)=Bx+1$ to make x the subject.

You can solve linear simultaneous equations using the **elimination** method, as shown in Example 4. The solutions to simultaneous equations give the point of intersection between the lines represented by the two equations.

Example 4

Solve the simultaneous equations $5x-4y=17$, $3x+8y=5$

$15x+40y=25$ (1) — Multiply the second equation by 5

$15x-12y=51$ (2) — Multiply the first equation by 3

$(1)-(2): 52y=-26$ — Subtract equation (2) from equation (1) to eliminate x

$y=-\frac{1}{2}$ — Substitute $y=-\frac{1}{2}$ into one of the original equations.

$5x-4\left(-\frac{1}{2}\right)=17$

$5x+2=17$ — Solve this equation to find the value of x

$5x=15$

$x=3$

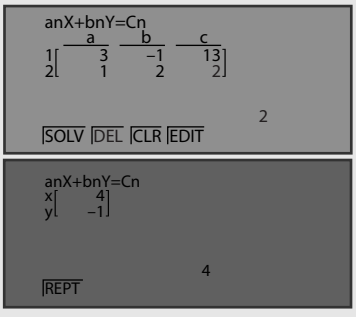
Try It 4

Solve the simultaneous equations $2x+5y=1, 3x-2y=-27$

Calculator

Try it on your calculator

You can use a calculator to solve linear simultaneous equations.



Activity

Find out how to solve the simultaneous equations $3x-y=13$ and $x+2y=2$ on *your* calculator.

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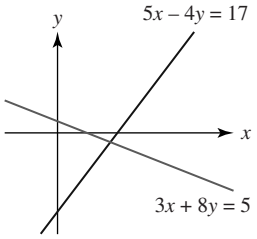
The example shows you that the lines $5x-4y=17$ and $3x+8y=5$ intersect at the point $\left(3,-\frac{1}{2}\right)$

If you are given the equation of two lines where y is the subject then the easiest way to solve these simultaneously is to use the **substitution** method as shown in the next example.



Example 5

Find the point of intersection between the lines with equations $y=2x+5$ and $y=7-3x$

$2x+5=7-3x$ — Substitute $2x+5$ for y in the second equation.

$5x+5=7$

$5x=2$

$x=0.4$ — Solve to find the value of x

$y=2(0.4)+5$

$=5.8$ — Substitute $x=0.4$ into either of the original equations to find the y-coordinate.

So the lines intersect at the point $(0.4, 5.8)$

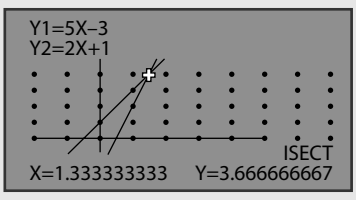
Try It 5

Find the point of intersection between the lines $y=3x+4$ and $y=6x-2$

Calculator

Try it on your calculator

You can use a graphics calculator to find the point of intersection of two lines.



Activity

Find the point of intersection of the lines $y=5x-3$ and $y=2x+1$ on your graphics calculator.

Bridging Exercise Topic B

Bridging to Ch1.4

1 Solve each of these linear equations.

a $3(2x+9)=7$

b $7-3x=12$

c $\frac{x+4}{5}=7$

d $2x+7=5x-6$

e $8x-3=2(3x+1)$

f $\frac{2x+9}{12} = x-1$

g $2(3x-7) = 4x$

h $7-2x = 3(4-5x)$

2 Solve each of these linear inequalities.

a $\frac{x}{2}+7 \geq 5$

b $3-4x < 15$

c $5(x-1)>12+x$

d $\frac{x+1}{3}>2$

e $8x-1\leq 2x-5$

f $3(x+1)\geq \frac{x-3}{2}$

g $3(2x-5)<1-x$

h $x-(3+2x)\geq 2(x+1)$

3 Rearrange each of these formulae to make x the subject.

a $2x+5=3A-1$

b $x+u=vx+3$

c $\dfrac{3x-1}{k}=2x$

d $5(x-3m)=2nx-4$

e $(1-3x)^2=t$

f $\frac{1}{x}=\frac{1}{p}+\frac{1}{q}$

g $\frac{1}{x^2+k}-6=4$

h $\sqrt{x+A}=2B$

4 Use algebra to solve each of these pairs of simultaneous equations.

a $5x+12y=-6,\ \ x+5y=4$

b $7x+5y=14,\ \ 3x+4y=19$

c $2x-5y=4,\ 3x-8y=5$

d $3x-2y=2,\ 8x+3y=4.5$

e $5x-2y=11,\ -2x+3y=22$

f $8x+5y=-0.5,\ -6x+4y=-3.5$

5 Use algebra to find the point of intersection between each pair of lines.

a $y=8-3x,\ y=2-5x$

b $y = 7x - 4,\ y = 3x - 2$

c $y = 2x + 3,\ y = 5 - x$

d $y + 5 = 3x,\ y = -5x + 7$

e $y=\frac{1}{2}x+3,\ y=5-2x$

f $y=3(x+2),\ y=7-2x$