

Linear Equations and Expressions

Assessment Preparation

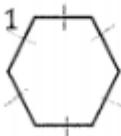
[Level 4](#)

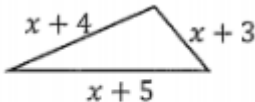
[Level 5](#)

Level 4

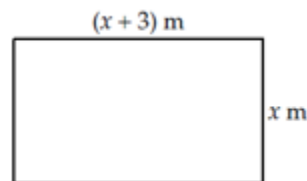
Merit

- 1) Our kapa haka group is made up of some Māori students and 11 Pākehā students. The kapa haka group is divided into four equal groups for practices. Each of the practice groups has 19 students in it. Write an equation that describes this situation, and solve it to find the number of Māori students in kapa haka?
- 2) Alex has a job filling bags of cement. He calculated that if he filled 4 bags, he would have 17 kg left over. However, if he tried to fill 5 bags, he would be 3 kg short. Write an equation and solve it to work out x , the amount of cement in a bag.
- 3) Stan is 4 years less than twice David's age. John is 3 years older than David. Their ages add up to 35. Let David's age be x . Write an algebraic equation and find the age of each boy.
- 4) Suppose:
 $\triangle + \triangle = \square$
 $\square + \triangle = \bigcirc$
 $\diamond = \bigcirc + \square + \triangle$
How many $\triangle$ s are equal to $\diamond$?
- 5) If 2 is substituted into the following equation for x , find y .
$$5y = 3(8 + x)$$
- 6) I think of a number, multiply it by 7, add 2, and then divide by 15. If my answer is 2, what was the original number I thought of?
- 7) Jade needs \$490 for a class trip to the snow. She has saved \$150 already, and earns \$20 a week for a paper delivery job. Give the equation relating the amount of money Jade has saved over time.
 M = Money saved (\$) and W = Time in weeks.
Demonstrate how you use your equation and find how many weeks it takes for Jade to have enough money for the trip.
- 8) Find the value of x if both perimeters for the shapes are the same.

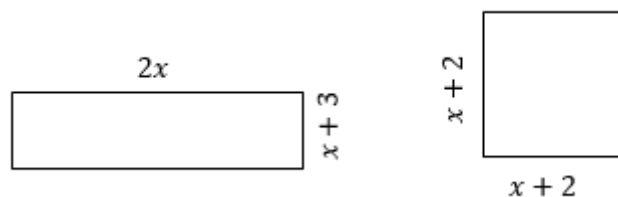
$x + 1$


$x + 4$ $x + 3$

 $x + 5$
- 9) There are 3 children in the Wheeler family. There are 2 years between each child. The sum of their ages is 39. How old is the middle child?

- 10) I am thinking of two numbers. One of them is 11 more than the other and their sum is 131. Form an equation and solve it to find the two numbers.
- 11) One number is 4 times as large as another. Their sum is 45. Write an algebraic equation and solve it to find the numbers.
- 12) The cost of a pie and a coke is \$4.50. The pie cost \$2 more than the coke. Write an **algebraic equation** and solve to find **how much the pie cost**.
- 13) If the perimeter of this rectangle is 42m then find its length and width (you must form an equation and solve it).



- 14) A man who won \$63,000 decided to divide it among his wife and 3 children. The **two** daughters were **each** to receive twice as much as the son, and the wife was to receive twice as much as one of the daughters. How much did each person receive?
- 15) Dave is 3 years older than Liz. Liz is 7 years older than Tilly. The sum of their ages is 74. **Form an equation** and solve it to find out how old **Tilly** is?
- 16) Emma's mum is twice Emma's age. Emma is 5 years younger than her brother Sam. Find Sam's age if the sum of their ages is 117.
- 17) The shapes below have the same perimeter. Write an algebraic equation and solve. Give the length of the side of the square.



- 18) Gloria sends Christmas Cards to her friends every Christmas. Stamps costs 50 cents and each card costs \$2.75. She spent a total of \$68.25.

Form an equation and solve it to find out how many cards Gloria had sent.
- 19) Find the sum of

$$\begin{aligned}
 &5 + x - x^2 - x^3 \\
 &+ 3x - 5 + 2x^2 - x^3 \\
 &+ x + 5 + 2x^3 - 5x^2
 \end{aligned}$$

20) Sandra sells chocolate brownies. It cost her \$80 for the ingredients, and she sells them for \$3 each. Write an algebraic expression for Sandra's profit for making x number of brownies.

21) Expand and simplify $4(x - 3) + 2x(x + 3)$

22) Expand **and** simplify

$$3(x - 5) + x(x + 8)$$

Excellence

- 1) Pok Hao eats twice as many caterpillars as Jennifer, but Jennifer eats three times as many caterpillars as Yvonne. Pok Hao eats 40 caterpillars more than Yvonne, how many caterpillars does Jennifer eat?
- 2) My phone company is charging me \$2 a month for unlimited calling plus 20c for each text. They are now going to charge me \$3 a month for unlimited calling but only 10c for every text. They say this will be cheaper. Is this true? Write an algebraic equation for each scenario. Investigate and justify your answer.
- 3) For each of seven consecutive years, Arsh makes a model airplane. The sum of the ages of the three youngest model airplanes is 42 years. What is the sum of the ages of the three oldest model airplanes?
- 4) Each day after school, Adam, Bart and Cat are given lollies. Bart is given twice as many lollies as Adam, and Cat has three times as many lollies as Adam plus two lollies. For the five days of the school week, they are given 70 lollies total. How many lollies did Adam get each day?
- 5) After tennis training, Andy collected twice as many balls as Roger, and five more than Maria. If they collected 35 balls in total, how many did Andy collect? You must show an algebraic equation.
- 6) A delivery van is delivering 200 laptops to three schools that won a competition. The 2nd prize is to get 20 more than 3rd prize, and the 1st prize is to have twice as many as the 2nd. How many laptops did each school get? You must write an algebraic equation.
- 7) Given that the area of this shape is $(x + 21)m^2$ find its perimeter.



4

- 8) In this **Multiplication** Magic Square, the **product** of the three numbers in each row, column and

each of the diagonals is 1. What

is the value of $r + s$?

p	q	r
s	1	t
u	4	$\frac{1}{8}$

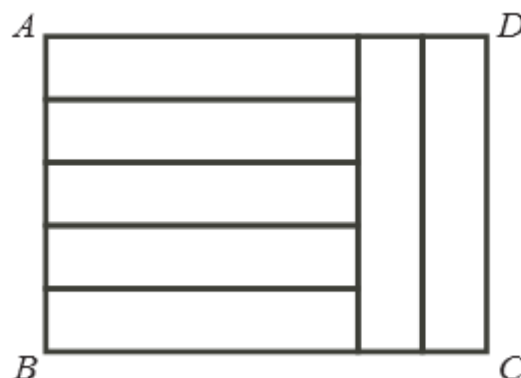
- 9) Nga and Pauline both belong to the SPCA.

Nga recently paid for five years' membership, and also made a donation of \$40.

At the same time, Pauline paid for three years' membership and made a donation of \$120.

The SPCA noticed that the cheques from Nga and Pauline were made out for the same amount. **Write down an equation** and **solve** it to work out x , the **cost of one year's membership**.

- 10) Sujay is 5 years older than Vijay and Ajay is 10 years younger than twice Vijay. The sum of their ages is 131. How old are they?
- 11) Carmel is five years older than Peter. Peter is twice as old as Mary. The total of their three ages is 80. Calculate how old Peter is.
- 12) The sum of 3 consecutive numbers is 27. Find the product of the smallest and the largest number. Show all working.
- 13) A father is twice as old as his son. If half the son's age, plus 84, equals twice the father's age, how old is each person? Let the son's age be x years. Form an equation and solve it.
- 14) Seven identical rectangles are arranged as shown in the diagram to form a large rectangle ABCD.



If the area of the rectangle ABCD is 560 square cm, determine the dimensions of the smaller rectangles.

Form an equation and solve it.

15) If a number is added to eight and then the result is divided by 3, you get exactly the same number you started with. Form an equation and solve it to find the number.

16) We define $a \oplus b = ab + a + b$. Given that $3 \oplus 5 = 2 \oplus x$ what is the value of x ?

17) A man is six times as old as his daughter, Veronica. In 4 years time the sum of their ages will be 43. Use algebra to find out how old Veronica is now.

18) Think of a whole number, double it, then add 3.

Multiply your answer by 4 and then take away 5.

Now take away the number you first thought of.

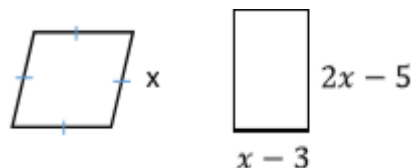
Your answer will always be a multiple of which number?

Can you show this using **algebraic thinking**?

Level 5

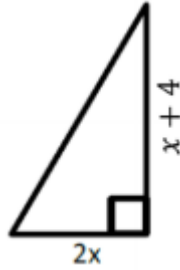
Merit

- Sally is organising a surprise dinner for a friend. She has been quoted a price of \$26 per person for the meal, with an additional \$30 for the cake. Sally will get everyone attending, **except the birthday girl**, to pay an equal share of the full cost.
 - Write a rule that will allow Sally to work out how much **each guest** should pay if n people attend.
 - Use your rule to find the cost per person if 12 people attend (including the birthday girl).
- Cameron Pools have lockers available for rent. The amount to pay is calculated from the formula $\frac{2n+5}{4}$, where n is the number of hours the locker is hired for. Someone pays \$3.50 to use a locker. How many hours did they hire it for?
- The company six degrees has a phone plan that has a fixed charge of \$15 per month, free text messaging and charges 20 cents for every minute on a call. If the user was charged \$67.80, how many minutes were they on the phone? Write an equation and solve.
- The rhombus and rectangle have the same perimeter. Write an algebraic equation then find the perimeter.

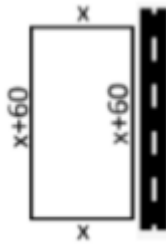


- Which is bigger: $x + 8$ or $2x - 1$? How did you decide?

6. The height of this triangle is $x + 4$ with a base length of $2x$. Write an expression for the area of the triangle. Show your working. Remember the area of a triangle formula is $A = \frac{1}{2} b h$.



7. A rectangular field is to be fenced. The length is 60m more than its width (x). The farmer estimates he will need 300m of fencing. Write an equation and solve.



The fence roadside will cost \$25 per meter, while the other 3 sides will cost \$15 per meter. How much will the fence cost?

Excellence

L4 MERIT

$$1) \frac{x+11}{4} = 19$$

$$x+11 = 19 \times 4$$

$$x = 76 - 11$$

$$x = 65 \text{ Maan students}$$

$$2) 4x + 17 = 5x - 3$$

$$20 = x$$

20 kg per bag.

$$3) \text{ David } x$$

$$\text{Sten } 2x - 4$$

$$\text{John } x + 3$$

$$4x - 1 = 35$$

$$4x = 36$$

$$x = 9$$

$$4) \triangle + \triangle = \square$$

$$\triangle + \triangle + \triangle = \square$$

$$\diamond = 3\triangle + 2\triangle + \triangle$$

$$\diamond = 6\triangle$$

$$5) 5y = 3x(8+2)$$

$$5y = 30$$

$$y = 6$$

$$6) \frac{7x+2}{15} = 2$$

$$7x+2 = 30$$

$$7x = 28$$

$$x = 4$$

$$7) m = 20w + 150$$

$$490 = 20w + 150$$

$$340 = 20w$$

$$17 = w$$

17 weeks needed.

$$8) \text{ Hexagon}$$

$$6(x-1) = 3x+12$$

$$6x-6 = 3x+12$$

$$3x = 18$$

$$x = 6$$

middle

$$9) x, x+2, x+4$$

$$x+x+2+x+4 = 39$$

$$3x+6 = 39$$

$$3x = 33$$

$$x = 11$$

middle child is 13.

$$10) x + x+11 = 131$$

$$2x = 120$$

$$x = 60$$

$$x = 71$$

$$11) x + 4x = 45$$

$$5x = 45$$

$$x = 9$$

$$12) \text{ Pie} = x+2$$

$$\text{Cake} = x$$

$$2x+2 = 4.50$$

$$2x = 2.50$$

$$x = \$1.25$$

$$\text{Pie costs } \$3.25$$

$$13) \begin{array}{c} x+3 \\ \square \\ x+3 \end{array} x$$

$$4x+6 = 42$$

$$4x = 36$$

$$x = 9m$$

So Length = 18m.

$$14) -4x^2 + 5x + 5$$

$$21) 4x - 12 + 2x^2 + 6x$$

$$= 2x^2 + 10x - 12$$

$$14) \text{ wife } 4x = 28000$$

$$\text{daughter } 2x = 14000$$

$$\text{daughter } 2x = 14000$$

$$\text{son } x = 7000$$

$$9x = 63,000$$

$$x = \$7,000$$

$$15) \text{ Dave } x+10$$

$$\text{Liz } x+7$$

$$\text{Tilly } x$$

$$3x+17 = 74$$

$$3x = 57$$

$$x = 19$$

Tilly is 19.

$$16) \text{ Sam } x+5 = 33$$

$$\text{Emma } x = 28$$

$$\text{Mia } 2x = 56$$

$$4x+5 = 117$$

$$4x = 112$$

$$x = 28$$

Sam is 33.

$$17) \begin{array}{c} 2x \\ x+3 \square x+3 \\ 2x \end{array} \begin{array}{c} x+2 \\ x+2 \square x+2 \\ x+2 \end{array}$$

$$6x+6 = 4x+8$$

$$6x-4x = 8-6$$

$$2x = 2$$

$$x = 1$$

Square length is 3.

$$18) x = \text{No. of friends}$$

$$3.25x = 68.25$$

$$x = 21 \text{ cards sent.}$$

$$20) 3x - 80 = \text{Profit}$$

$$21) 3x - 15 + x^2 + 8x$$

$$= x^2 + 11x - 15$$

L4 - Excellence.

1) Yousef = $x = 8$

Jennifer = $3x = 24$

Rokhan = $6x + x + 40 = 48$

Marwa = $6x + x + 40$

$5x = 40$

$x = 8$

Jennifer eats 24 catapillars

2) 2 = no. of texts

$0.2x + 2$ / $0.1x = 3$
Before / now

x	cost Before	cost now
10	$0.2 \times 10 + 2 = 4$	$0.1 \times 10 + 3 = 4$
12	$0.2 \times 12 + 2 = 4.4$	$0.1 \times 12 + 3 = 4.2$

From 10 texts have same cost.

Anything more than 10, the new plan is cheaper.

3) $\begin{matrix} x \\ x+1 \\ x+2 \\ x+3 \end{matrix}$ $\begin{matrix} 3x+3 = 42 \\ 3x = 39 \\ x = 13 \end{matrix}$

$\left. \begin{matrix} x+4 = 17 \\ x+5 = 18 \\ x+6 = 19 \end{matrix} \right\} \underline{54 \text{ years}}$

4) Adam = x

Bart = $2x$

Cal = $3x + 2$

Total per day = $6x + 2$

$5(6x + 2) = 70$

$6x + 2 = 14$

$6x = 12$

$x = 2$

Adam gets 2 bottles

5) Andy = x

Roger = $x + 2$

Maria = $x - 5$

$2x + \frac{x}{2} - 5 = 35$

$2.5x = 30$

$x = 12$

Andy collects 12.

6) $1^{st} = 2x + 40 = 110$

$2^{nd} = x + 20 = 55$

$3^{rd} = x = 35$

$4x + 60 = 200$

$4x = 140$

$x = 35$

7) $4(x - 6) = x + 21$

$4x - 24 = x + 21$

$3x = 45$

$x = 15$

So perimeter

$4 \times \frac{9}{9} \times 4 = 26m$

8)

8	$\frac{1}{4}$	$\frac{1}{2}$
$\frac{1}{16}$	1	16
2	4	$\frac{1}{8}$

$r + s = \frac{1}{2} + \frac{1}{16} = \frac{9}{16}$

9) $5x + L = 0 = 3x + 120$

$2x = 80$

$x = 40$

\$40 for one year membership.

10) Sanjay = $x + 5 = 29$

Vijay = $x + 34$ $4x - 5 = 131$

$4x = 136$

Ajay = $2x - 10 = 58$ $x = 34$

11) Cornelia = $2x + 5$

Peter = $2x$ $5x + 5 = 80$

Mary = x $5x = 75$

$x = 15$

Peter is 30 yrs old.

12) $x + x - 1 + x + 2 = 27$

$3x + 3 = 27$

$3x = 24$

$x = 8$

$3 \times 10 = 80$

13) Father = $2x$

Son = x

$\frac{x}{2} + 84 = 4x$

$84 = 3.5x$

$24 = x$

Son is 24, Father 48 yrs

14) $\begin{matrix} \text{Length} & L \\ \text{Width} & W \end{matrix}$

$5W$ $2L$ $L = 5W$

$L + 2W$ $5W + 2W = 7W$

$5W \times W = 80$ $W^2 = 16$ $W = 4$

$560 \div 7 = 80 \text{ cm}^2$

width = 4 cm

length = 20 cm

L4 Excellence

$$15) \frac{x+8}{3} = x$$

$$x+8 = 3x$$

$$8 = 2x$$

$$4 = x$$

$$16) a=3 \quad b=5$$

$$ab+a+b$$

$$3 \times 5 + 3 + 5 = 2x + 2 + x$$

$$23 = 3x + 2$$

$$21 = 3x$$

$$3 = x$$

$$17) \begin{array}{l|l} \text{Veronica} = x & \text{4 years later} \\ \text{then} = 6x & x+4 \\ & 6x+4 \end{array}$$

$$x+4 + 6x+4 = 43$$

$$7x+8 = 43$$

$$7x = 35$$

$$x = 5$$

Veronica will be 9 yrs old.

$$18) 2x+3$$

$$4(2x+3) - 5 = 8x+7$$

$$8x+7 - x = 7x+7$$

$$7(x+1)$$

7 is always a factor

so must be a multiple of 7.

L5 Merit

1) x = number of people

$$26x + 30$$

$$x-1$$

$$\frac{26(12) + 30}{1} = \$31.09$$

" each person to pay (not birthday girl)

$$2) 3.50 = \frac{2n+5}{4}$$

$$14 = 2n+5$$

$$9 = 2n$$

$$4.5 = n$$

happ.

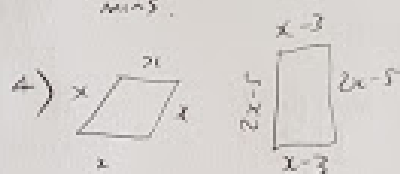
$$3) 67.80 = 0.2x + 15$$

if x = no. of mins.

$$52.80 = 0.2x$$

$$\frac{52.80}{0.2} = x$$

$$264 = x$$



$$6x = 6x - 16$$

$$16 = 2x$$

$$8 = x$$

So perimeter = 32.

5)	x	$x+8$	$2x-1$
	0	8	-1
	5	13	9
	10	18	19
	9	17	17

When $x=9$ same number.

If $x \leq 8$ $x+8$ is larger

If $x \geq 10$ $2x-1$ is larger.

$$6) A = \frac{1}{2} \times 2x \times (x+4)$$

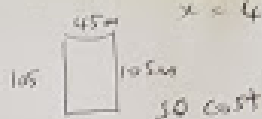
$$A = x(x+4)$$

$$A = x^2 + 4x$$

$$7) 4x + 120 = 300$$

$$4x = 180$$

$$x = 45 \text{ m}$$



$$45\text{m}$$

$$105 \times 25 + (105 + 45 +$$

$$45) \times 15 = \$5550$$