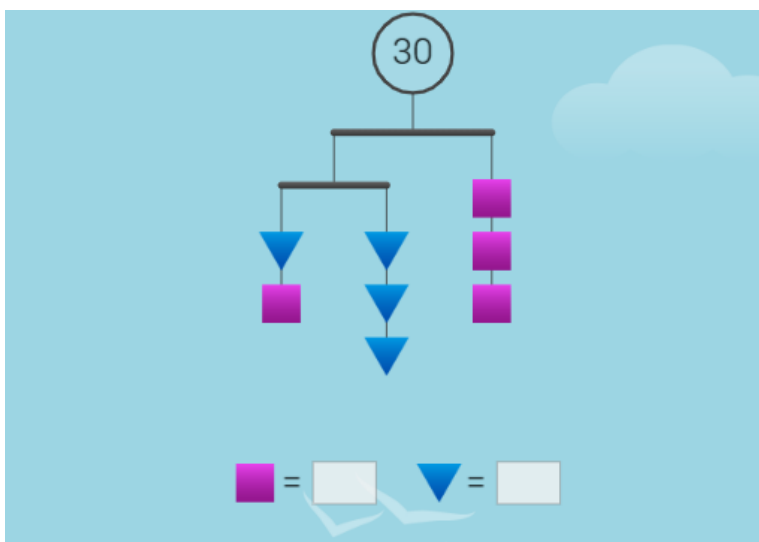


Algebra

Grade 9 Math

Fall 2025

NAME:



Letters in Action	Solving equations (two step)
Expressions	Completing and Balancing
Polynomials	Solving equations (multi-step)
Substitution	Solving equations (fractions)
BEDMAS	Formulas: substitution
Solving equations (one step)	Formulas: rearranging

G9 Unit 4 Lesson 1: Letters in action

The language of letters in math

In math a single letter can stand in place for a number.

The letter can stand for a number of any size and any kind. Let $x = 3$ and $y = 10$

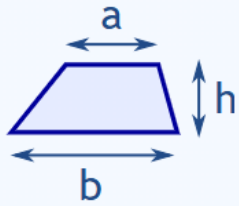
Rules:

x	
$5x$	
$1y$	
$x \div 2$	
xy	
$x - x$	
$\frac{x}{x}$	
xx	
$3xy^2$	

Why are letters in math useful?

1. Formulas
2. Functions
3. Equations & Unknowns
4. Derivations

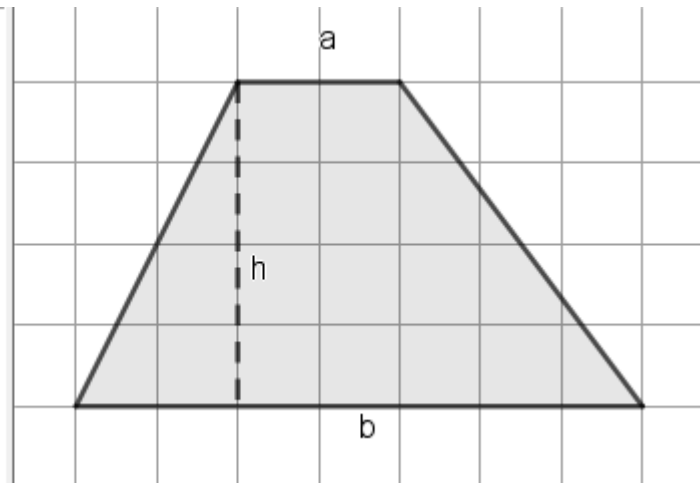
Area of a Trapezoid



The Area is the **average of the two base lengths** times the **altitude**:

$$\text{Area} = \frac{a+b}{2} \times h$$

- Point
- Quadrilateral
- q1 = 18**
- Segment

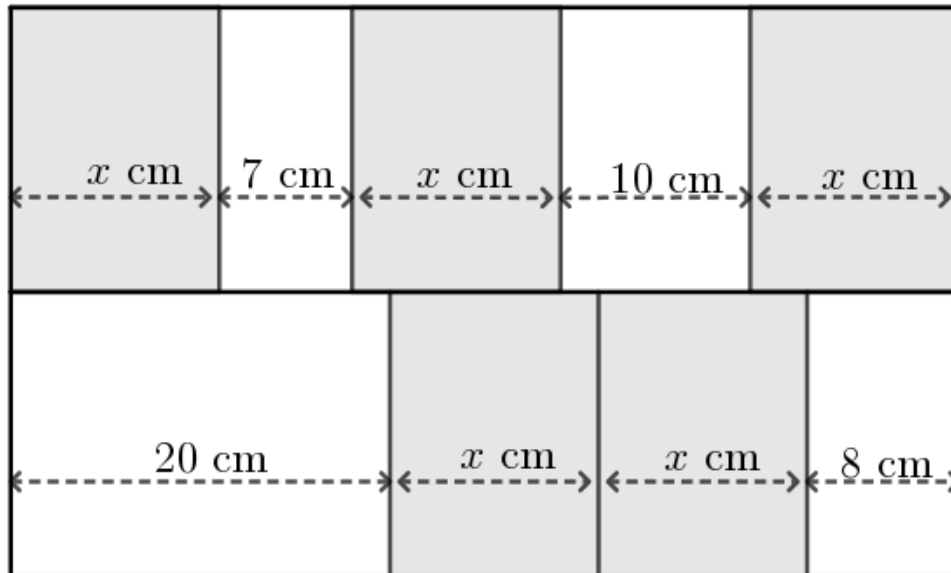


Letters in action: (unknowns & equations)

This rectangle is split into two rows. The rows have equal length.

Write an equation and solve. (Or use the link to shuffle the order of the rectangles to simplify the problem.)

<https://www.geogebra.org/m/fa2j4z4u>



Go to: <https://solveme.edc.org/mobiles/>

Solve some puzzles. Write down the numbers of the puzzles you solve correctly here:

I solved it!

These puzzles can help us understand the balancing method of solving equations.

The balancing method assumes that you can visualize numbers as heavy objects.

Choose one of the most complex puzzles you solved and draw it here. Use colour.

Puzzle #

Explain how you solved it. Use a single letter to represent any value you had to solve.

G9 Core Unit 4 Algebra Lesson 2: Substituting into expressions & formulas

When substituting numerical values into an expression or a formula, we should include three lines of work: formula, substitution line, answer. You may need an additional line or more to help with your calculations.

Example: Let $x = 7$, $y = -5$. Evaluate:

$\begin{aligned} 2x + y \\ &= 2(7) + (-5) \\ &= 14 - 5 \\ &= 9 \end{aligned}$	$\begin{aligned} 5x^2 + 3x - 10 \\ &= 5(7)^2 + 3(7) - 10 \\ &= 5 \times 49 + 21 - 10 \\ &= 245 + 11 \\ &= 256 \end{aligned}$
---	--



Substitution

Video 20 on www.corbettmaths.com

Question 1: If $a = 7$ $b = 10$ $c = 3$ $d = 8$ and $e = 15$
Find the value of each expression.

(a) $a + 5$

(c) $c + d$

(e) $2a$

(g) $3e$

(i) $\frac{b}{2}$

(k) $\frac{d}{4}$

(m) a^2

(o) c^2

(q) $2a + 1$

(s) $9c + 11$

(u) $2a + 3c$

(w) $5a + 2d$

Question 2: If $f = 5$ $g = 6$ $h = 4$ and $i = 2$
Find the value of each expression.

(a) fg

(c) fgh

(e) \sqrt{h}

(g) $5h + 7i$

Question 3: If $a = -2$ $b = 5$ $c = -6$ $d = 10$ and $e = 9$
Find the value of each expression.

(a) $a + 4$

(c) $c + e$

(e) $d - c$

(g) $7a$

(i) $2d + 3c$

(k) $5a + 7$

(m) ac

(o) $2e - a$

Question 4: If $a = 1.5$ $b = 4$ $c = 6$ $d = 0.5$ and $e = -3$
Find the value of each expression.

(a) $4(a + d)$

(c) $3(10 - e)$

(e) e^3

(g) $5b^2$

(i) $\frac{b + 2}{3}$

(k) $\frac{10d + 4b}{7}$

Apply

Question 1: The cost of hiring a car for a number of days is calculated using the formula

$$\text{Hire Cost} = 30 \times \text{Number of Days} + 50$$



- (a) Calculate the cost of hiring a car for 4 days.
- (b) Calculate the cost of hiring a car for 9 days.
- (c) The hire cost is £110, how many days was the car hired for?
- (d) The hire cost is £380, how many days was the car hired for?

Question 2: The cost of photocopying is given as:

Cost in pence = 3 x number of black & white pages + 15 x number of colour pages

- (a) Ella orders 20 black & white pages and 6 colour pages, work out the cost.
- (b) Tom orders 400 black & white pages and 70 colour pages, work out the cost.

Question 3: The time in minutes, taken to cook a chicken is given by the formula

Time = 40 minutes per kilogram plus 20 minutes

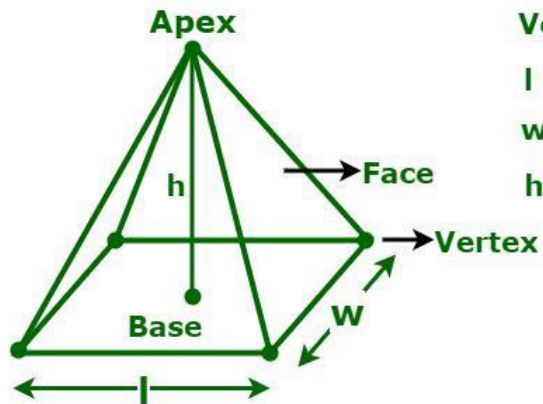
- (a) Work out the time taken to cook a 5kg chicken.
- (b) Work out the time taken to cook a 2.5kg chicken.



Question 4

Use this formula information to solve the Pyramid problem below:

Rectangular Pyramid



$$\text{Volume} = (1/3)lwh$$

l = base length

w = base width

h = height of the pyramid

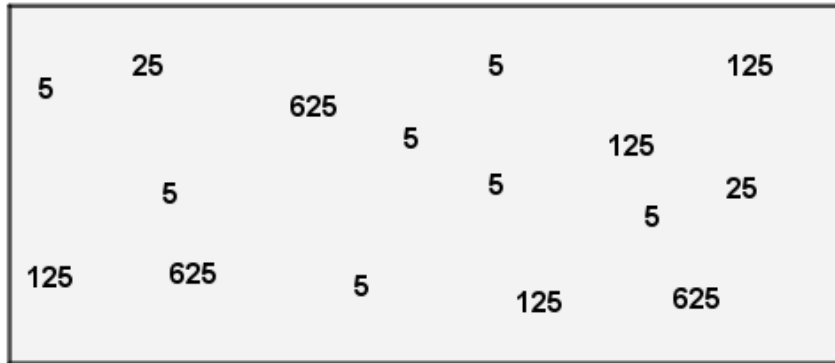
1. The length of each side of the square base of the Great Pyramid of Giza is 230m. The height of the pyramid is 147m. Calculate its volume in cubic metres.



G9 Core Unit 4 Algebra Lesson 3 Polynomials: Colour & Gather Like Terms

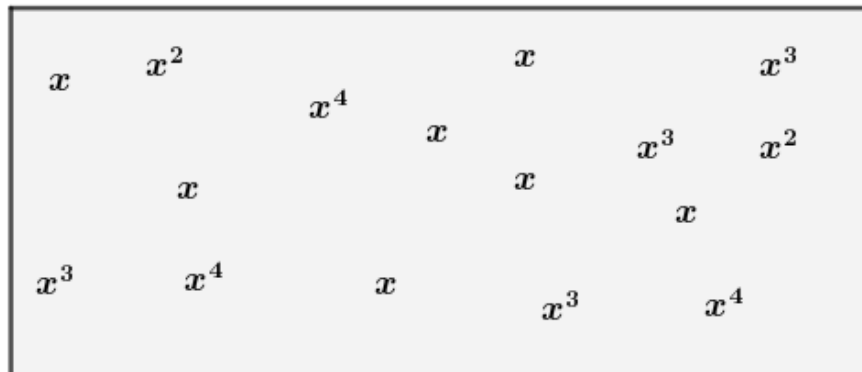
Use four colours. Colour the 5s, the 25s, the 125s and the 625s one colour respectively.

Add all the numbers in the box together:



The numbers above are all powers of 5. We can write the value in the box above as an expression to do with 5:

In this box the numbers above are written using a single letter.



Gather like terms to a single expression:

Find the value in the box (of the expression) when

- (a) $x = 5$
- (b) $x = 10$
- (c) $x = 1$
- (d) $x = -1$
- (e) $x = 2$

There are 12 terms in this box. Colour code terms that have the same value the same colour.

b	a	ab	ab^2
	a	ab	ab
	b	ab	
ab			a

Write the sum of the numbers in the box as an expression with four terms:

Evaluate the expression when $a = 3$ and $b = 10$

Two or more terms are **like** when:

The terms have the same letter combination including the same exponents on each letter

Now the terms have a variety of coefficients. Colour code the terms so that *like terms* are the same colour.

$2b$	$-3a$	$2ab$	$5ab^2$
	$5a$	$3ab$	$-7ab$
	$7b$	$7ab$	
$-3ab$			$-a$

Write the sum of the terms in the box as an expression with four terms:

Evaluate the expression when $a = 3$ and $b = 10$

Question 1: Simplify each of the following

(a) $y + y + y + y$

(c) $a + a + a + a + a + a$

(e) $n + n$

(g) $y + y + y + y - y - y$

(i) $3y + 2y$

(k) $9k + 5k$

(m) $15c + 20c$

(o) $10y + 3y - 5y$

(q) $7x - 3x - x$

(s) $7y - 2y + y$

(u) $y^2 + y^2$

(w) $c^2 + c^2 + c^2 + c^2 + c^2$

(y) $2w^2 + 4w^2 + 8w^2$

Question 2: Simplify the following expressions

(a) $4u - 6u$

(c) $4a + 2a - 9a$

(e) $-3g - 2g$

(g) $-m - 7m$

(i) $6a^2 + 2a^2 - 9a^2$

Question 3: Simplify the following expressions

(a) $3a + 2b + 4a + b$

(c) $g + 8a + 2a + g$

(d) $7m + 7p + 8m + p + 2p$

(f) $4 + 3a + 2a + 8$

(g) $2y + 4 + 3y - 1$

(i) $5 - 4s - 2 + 10s$

(j) $3x + 6y + 5x - 2y$

(l) $2a + 3b - 2 + a + 3b + 4$

(m) $3a - 2b + a - 5b$

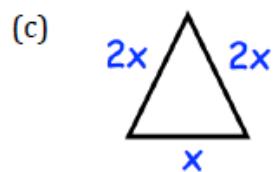
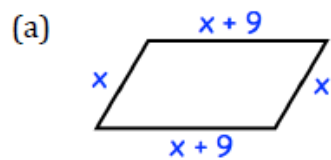
(o) $y - 4m - 3y - 5m$

Question 4: Simplify the following

(a) $3y^2 + 4ab + 7y^2 + ab$ (b) $9x^2 - 2x - 11x^2 + 5x$ (c) $7ac - 3ab + 9ab - 7ac$

Apply

Question 1: Write down the perimeter of each shape below

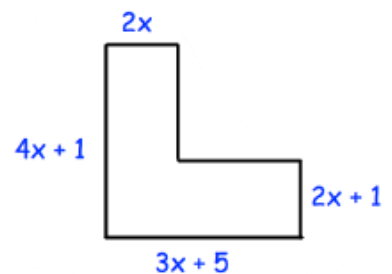


Question 2: A square has a side length of $3x$.
Find an expression for the perimeter of the square.

Question 3: $6x + 7y + x - 8y = 7x - y$
Write down three other expressions that are equal to $7x - y$

--	--	--

Question 4: Find an expression for the perimeter of this shape



Lesson wrap up: Enter these words to the vocabulary page on page 2:

Term, Expression, Coefficient, Polynomial, Like Terms

<https://www.mathsisfun.com/algebra/definitions.html>

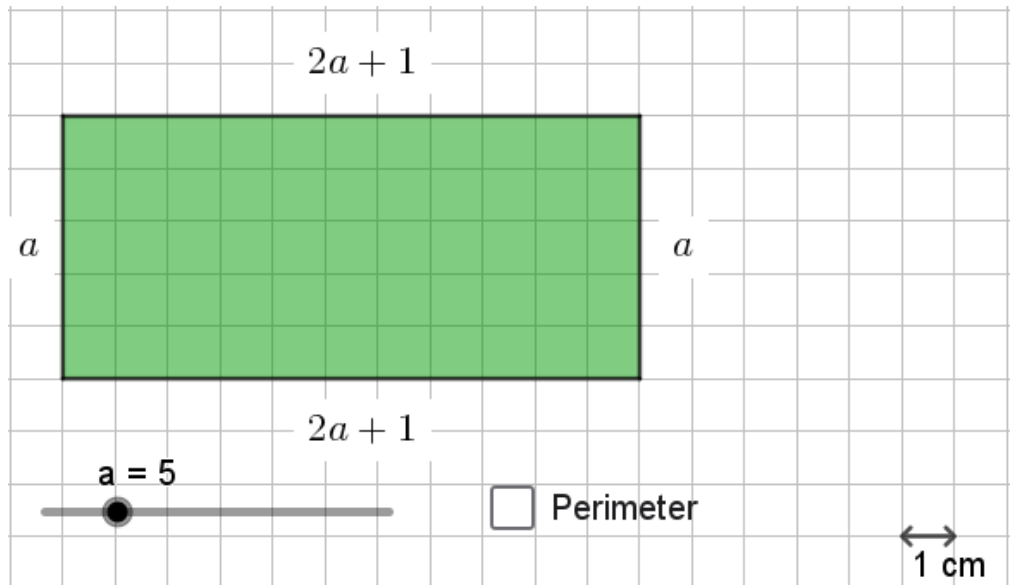
G9 Core Unit 4 Algebra Lesson 4 Polynomials and Perimeters

INTRO: Enter these two words to the vocabulary list: Variable; Constant

Use the GeoGebra activity <https://www.geogebra.org/m/zmyat2qj> with this lesson.

Shape Study 1: Rectangle

This shape varies with the number a . In this diagram, the value of a is 5.



(a) When $a = 5$, length = , width = , Perimeter =

(b) When $a = 12$, length = , width = , Perimeter =

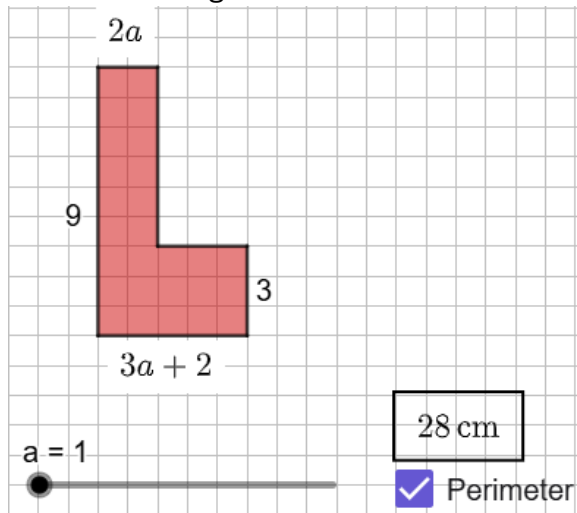
(c) Write and simplify an expression for the perimeter of the rectangle in terms of a .

(d) Substitute these values into your expression. Use the applet to determine if your expression is correct.

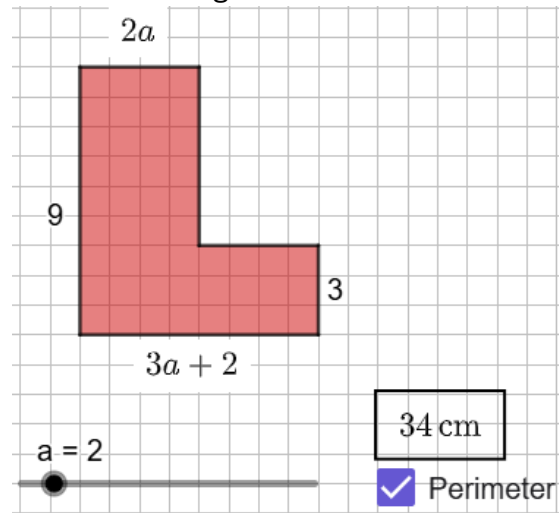
a	Substitution	Perimeter	Applet value
$a = 2$			
$a = 10$			
$a = 7$			

Shape Study 2: 'L' shape (hexagon)

In this image, $a = 1$. Write the length of each side on the diagram.



In this image, $a = 2$. Write the length of each side on the diagram.

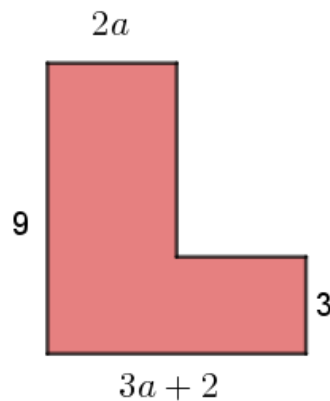


Constant or Variable?

Use the applet to vary the value of a .

Colour the sides of the 'L' shape that have a constant length green.

Colour the sides of the 'L' shape that vary with a red.



(c) Write and simplify an expression for the perimeter of the 'L' shape in terms of a .

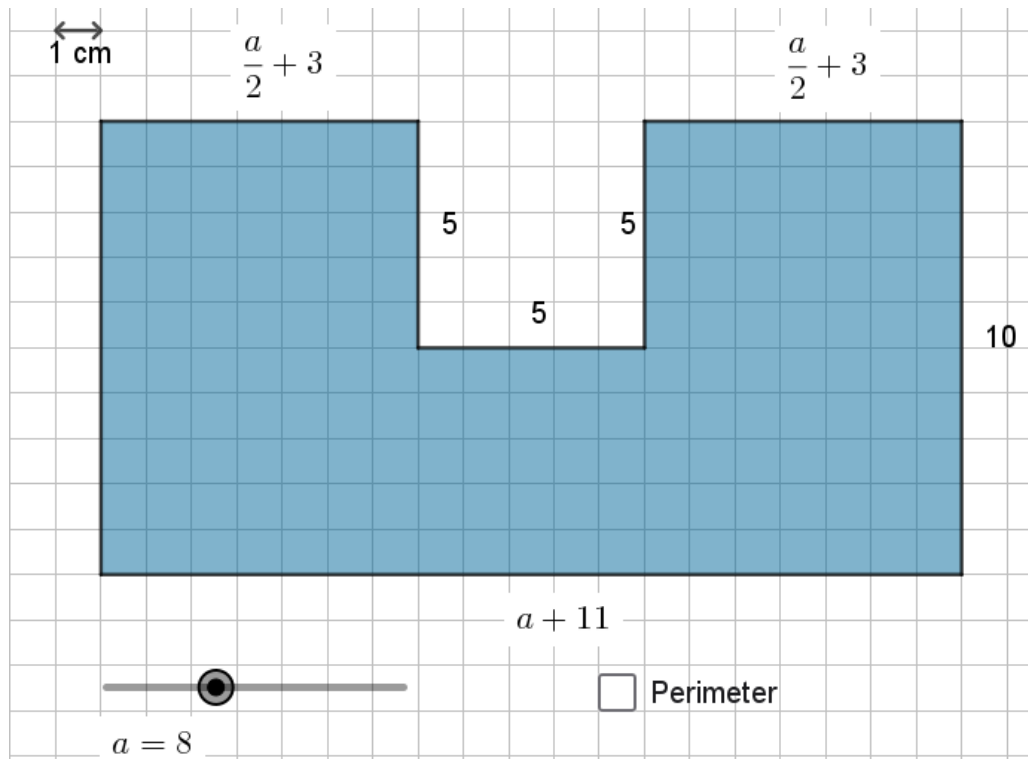
Perimeter =

(d) Substitute these values into your expression. Use the applet to determine if your expression is correct.

a	Substitution	Perimeter	Applet value
$a = 3$			
$a = 10$			
$a = 7$			

Shape Study 3: 'U' Shape

This shape varies with the number a . In this diagram, the value of a is 8.



(a) Use the applet to vary a . Colour the sides that have a constant length green. Colour the sides that have varying length red.

(b) Calculate the perimeter of the shape when $a = 8$

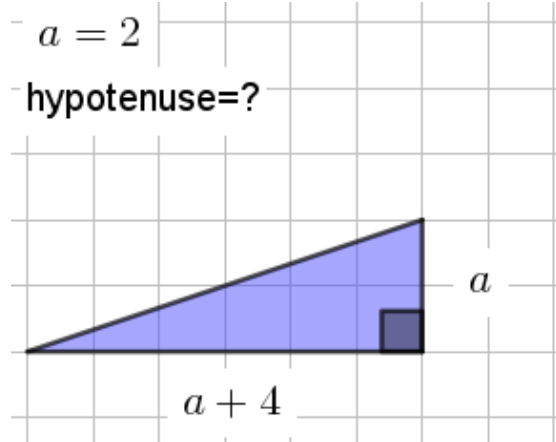
(c) Write and simplify an expression for the perimeter of the 'U' shape in terms of a .

Perimeter =

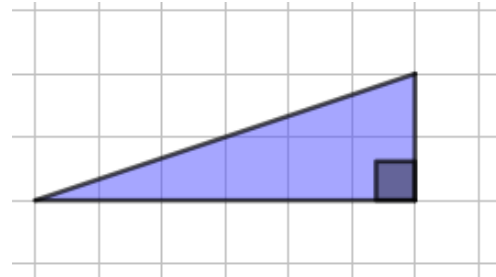
(d) Substitute these values into your expression. Use the applet to determine if your expression is correct.

a	Substitution	Perimeter	Applet value
$a = 2$			
$a = 10$			
$a = 7$			

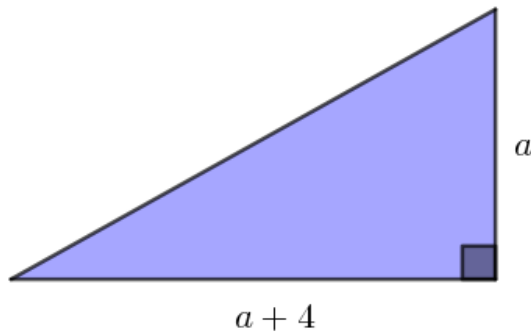
Shape Study 4: Using the Pythagorean Theorem



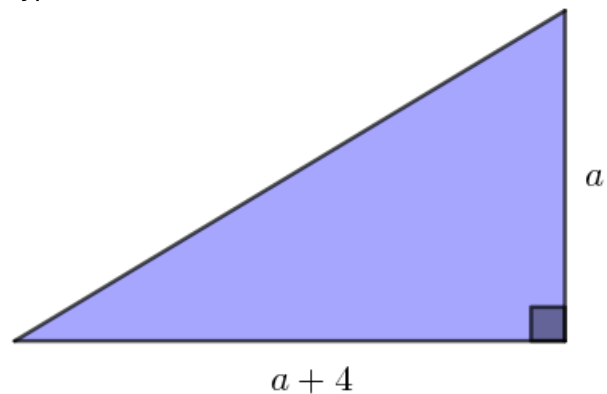
1. Write the dimensions on each edge when $a = 2$
Use the **Pythagorean theorem** to calculate the hypotenuse.



2. Write the dimensions on each edge when $a = 5$
Use the Pythagorean theorem to calculate the hypotenuse.



3. Write the dimensions on each edge when $a = 6$
Use the Pythagorean theorem to calculate the hypotenuse.



Explain why the expression for the length of the hypotenuse is:

$$h = \sqrt{(a + 4)^2 + a^2}$$

(d) Substitute these values into your expression. Use the applet to determine if your expression is correct.

a	Substitution to $\sqrt{(a + 4)^2 + a^2}$	Hypotenuse	Applet value
$a = 7$			
$a = 10$			

G9 Core Unit 4 Algebra Lesson 5 Polynomials

Definitions from <https://www.mathsisfun.com/algebra/polynomials.html>

Polynomials

A polynomial looks like this:

$$4xy^2 + 3x - 5$$

terms

example of a polynomial
this one has 3 terms



Polynomial comes from *poly-* (meaning "many") and *-nomial* (in this case meaning "term") ... so it says "many terms"

A polynomial can have:

- **constants** (like **3**, **-20**, or $\frac{1}{2}$)
- **variables** (like **x** and **y**)
- **exponents** (like the 2 in y^2), but only **0, 1, 2, 3, ...** etc are allowed

that can be combined using **addition, subtraction, multiplication and division ...**

... but **not** division by a variable (so something like $\frac{2}{x}$ is right out)

Like Terms

"Like terms" are **terms** whose variables (and their **exponents** such as the 2 in x^2) are the same.

$$(1/3)xy^2 \quad -2xy^2 \quad 6xy^2 \quad xy^2/2$$

Are all **like terms** because the variables are all xy^2

These **are** polynomials:

$$3x$$

$$x - 2$$

$$-6y^2 - \left(\frac{7}{9}\right)x$$

$$3xyz + 3xy^2z - 0.1xz - 200y + 0.5$$

$$512v^5 + 99w^5$$

$$5$$

These are **not** polynomials

- $3xy^{-2}$ is not, because the exponent is "-2" (exponents can only be 0,1,2,...)
- $2/(x+2)$ is not, because dividing by a variable is not allowed
- $1/x$ is not either
- \sqrt{x} is not, because the exponent is "1/2" (see [fractional exponents](#))

Monomial, Binomial, Trinomial

There are special names for polynomials with 1, 2 or 3 terms:

$$3xy^2$$

Monomial (1 term)

$$5x - 1$$

Binomial (2 terms)

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

Trinomial (3 terms)

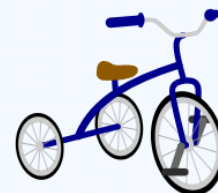
How do you remember the names? Think cycles!



*Mono*cycle



*Bi*cycle



*Tri*cycle

A. This box contains 12 terms. Colour code *like terms*, then write the sum of the terms:

$5x^2$	$-7y$	$-3x^2$	$2x$
$2y$		$7xy$	$-2xy$
$-3x$			y^2
	$5y^2$	$3x^2$	$-y$

Sum of terms:

Evaluate the expression when $x = 2$ and $y = 10$

B. Colour code like terms in each box, then add the like terms:

$5x^2$ 12 $3x^3$ $-7x$	+	$2x^2$ $4x$ x^3 -5
-----------------------------	---	---------------------------

Simplified Expression:

Evaluate the expression when $x = 2$

C. Colour code like terms in each box, then subtract the like terms:

$5x^2$ 12 $3x^3$ $-7x$	-	$2x^2$ $4x$ x^3 -5
-----------------------------	---	---------------------------

Simplified Expression:

Evaluate the expression when $x = 2$

D. Add and subtract polynomials written in line

$$(4x^2 + 5x - 7y^2 + 5) + (x^2 - 3x + 9y^2 + y + 2)$$

Line up the like terms:

$$\begin{array}{r} 4x^2 + 5x - 7y^2 + 5 \\ + \quad x^2 - 3x + 9y^2 + y + 2 \\ \hline 5x^2 + 2x + 2y^2 + y + 7 \end{array}$$

$$(4x^2 + 5x - 7y^2 + 5) - (x^2 - 3x + 9y^2 + y + 2)$$

Line up the like terms:

$$\begin{array}{r} 4x^2 + 5x - 7y^2 + 0y + 5 \\ - \quad x^2 - 3x + 9y^2 + y + 2 \\ \hline 3x^2 + 8x - 16y^2 - y + 3 \end{array}$$

Simplify:

1) $(4d^3 + 2d^5) + (8d^5 - 3)$

6) $(9z^4 + 2 - 5z^2) - (z + 8z^2 - 4)$

2) $(2 - 5k^3 - 9k^4) + (8k^4 - 7) + (3k^3 + 4k^2)$

7) $(2h - 4h^4) - (6h + 3h^2 - 5h^4)$

3) $(2y^4 - 7y^3 + 5) - (4y^3 - 3y^2 + 6)$

8) $(6h^2 - 4h^3 - 2h^4) + (3h^4 + 8) - (7h^3 + 5h^2)$

4) $(2q^4 + 7q^3) + (9q^3 + 3q - 5q^4)$

9) $(2 - 3h^4) + (9h^4 + 8)$

5) $(6k - 8k^4) - (3k + 2k^4 + 5)$

10) $(8y^2 - 6) + (3y^2 - 5 - y^4) - (2y^4 - 9)$

G9 Core Unit 4 Algebra Lesson 6: Check your answer, One and Two Step Equations

To solve an equation is to calculate the value of the unknown that makes the two sides of the equation equal.

After solving any equation, check your answer by substituting it into the first line of the equation.

Equations (a) to (j) below all have the answer $x = 6$.

$$(a) \quad 2(x + 13) = 11x - 28$$

$$(f) \quad \frac{x + 70}{2} = 11x - 28$$

$$(b) \quad \frac{x + 70}{2} = 38$$

$$(g) \quad \frac{x + 70}{2} + \frac{8x + 17}{5} = 51$$

$$(c) \quad 2(x + 13) = \frac{7x + 376}{11}$$

$$(h) \quad \frac{x + 70}{2} - \frac{8x + 17}{5} = 25$$

$$(d) \quad \frac{x + 70}{2} + 4 = 7x$$

$$(i) \quad \frac{x + 70}{2} + \frac{8x + 17}{5} + \frac{7x - 196}{11} = 37$$

$$(e) \quad \frac{x + 70}{2} = \frac{7x + 376}{11}$$

$$(j) \quad \frac{x + 70}{2} + \frac{8x + 17}{5} = \frac{7x + 519}{11}$$

A. Check the answer is correct by substituting $x = 6$:

$$(a) \quad 2(x + 13) = 11x - 28$$

$$(b) \quad \frac{x+70}{2} = 38$$

Choose another equation from (c) to (j) on page 21. Substitute $x = 6$ to both the LHS and RHS.

To solve an equation using the methods of completing and balancing means to make a math move on each line that results in a simpler equation on the next line.

Example – solve equation (h) on page 21:

math move

$$\frac{x+70}{2} - \frac{8x+17}{5} = 25$$

$$10\left(\frac{x+70}{2}\right) - 10\left(\frac{8x+17}{5}\right) = 10(25)$$

$$5(x + 70) - 2(8x + 17) = 250$$

$$5x + 350 - 16x - 34 = 250$$

$$-11x + 316 = 250$$

$$11x - 316 = -250$$

$$11x = 66$$

$$x = 6$$

B. Write the answer to these 'one-step' equations. Identify the step – the *math move* applied to both sides to balance the equation. Use a colour pencil to write the math move.

Examples:

Equation	$x - 3 = 10$	$x + 1 = 10$	$2x = 10$	$\frac{x}{2} = 10$
math move				
answer	$x =$	$x =$	$x =$	$x =$

(a) $w + 5 = 7$ (b) $c + 2 = 10$ (c) $a - 1 = 6$ (d) $x - 4 = 5$

(e) $x + 4 = 13$ (f) $3w = 12$ (g) $2x = 18$ (h) $\frac{w}{2} = 6$

(i) $\frac{x}{4} = 7$ (j) $5y = 30$ (k) $x + 10 = 40$ (l) $\frac{-}{2}x = 34$

(m) $x - 9 = 7$ (n) $\frac{m}{6} = 8$ (o) $w - 15 = 35$ (p) $\frac{x}{10} = 5$

C. Write the answer to these 'two-step' equations. Identify the two steps – the *math moves* applied to both sides to balance the equation. Use a colour pencil to write the math moves.

Equation	$2x - 3 = 10$	$3x + 1 = 10$	$\frac{x}{4} + 1 = 7$	$\frac{1}{3}x - 5 = 4$
math move i				
new equation				
math move ii				
answer	$x =$	$x =$	$x =$	$x =$
check answer				

(a) $2x + 3 = 9$

(b) $3w - 1 = 14$

(c) $7y + 2 = 30$

(m) $\frac{1}{2}x + 3 = 15$

(n) $\frac{1}{4}m - 7 = 2$

(o) $\frac{1}{3}x - 2 = -6$

D. These are 'three step' equations. Begin by multiplying both sides by the denominator.

(j) $\frac{10m + 20}{15} = 6$

(k) $\frac{2x + 5}{3} = 7$

(l) $\frac{7x - 5}{10} = 10$

E. Choose any equation from page 21. Derive the answer $x = 6$. Use your notebook/whiteboard.

G9 Core Unit 4 Algebra Lesson 7: Methods to solve Two and Multi- Step Equations

Number Recall

This is when you remember a number fact that solves the problem.

E.g.

Guess and Check

This is when you guess a number and see if it works. If it doesn't, guess again.

E.g.

Working backwards

If one side of the equation is a constant, we can usually work backwards.

A flow chart can help keep track.

E.g.

Balancing like a mobile

This is the 'completing and balancing' method. Step by step, by balancing and completing, equations can be solved.

E.g.

$$2a + 22 = 5a + 1$$

A mobile diagram can help:

Flow Charts: A flow chart can usually be constructed if the unknown appears once on only one side of the equation. Use a flow chart to solve these four equations.

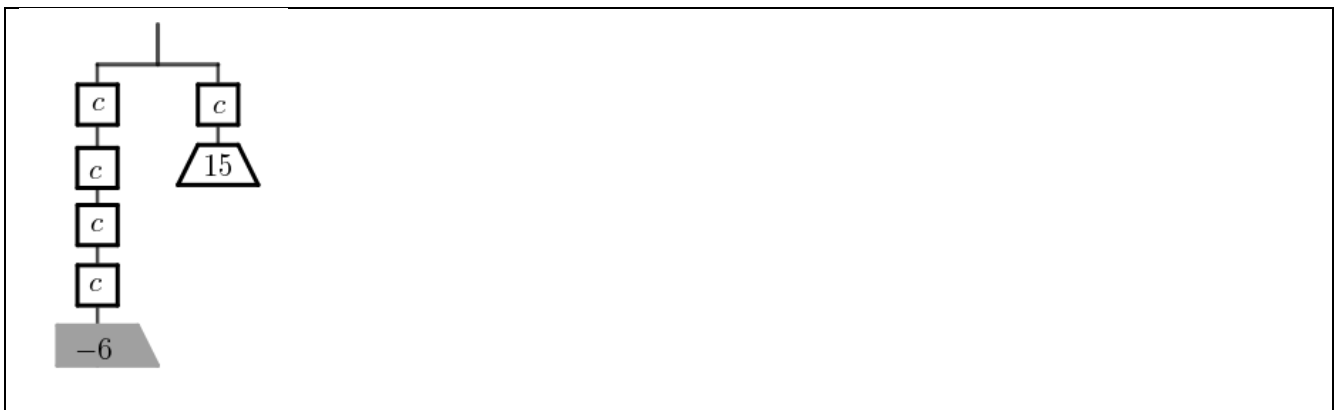
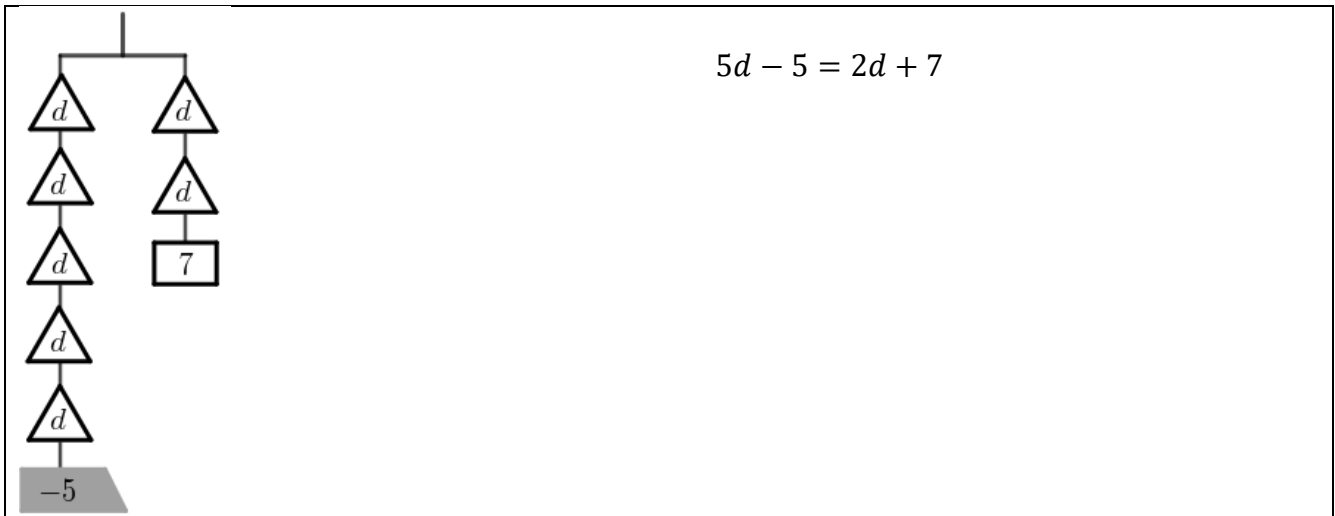
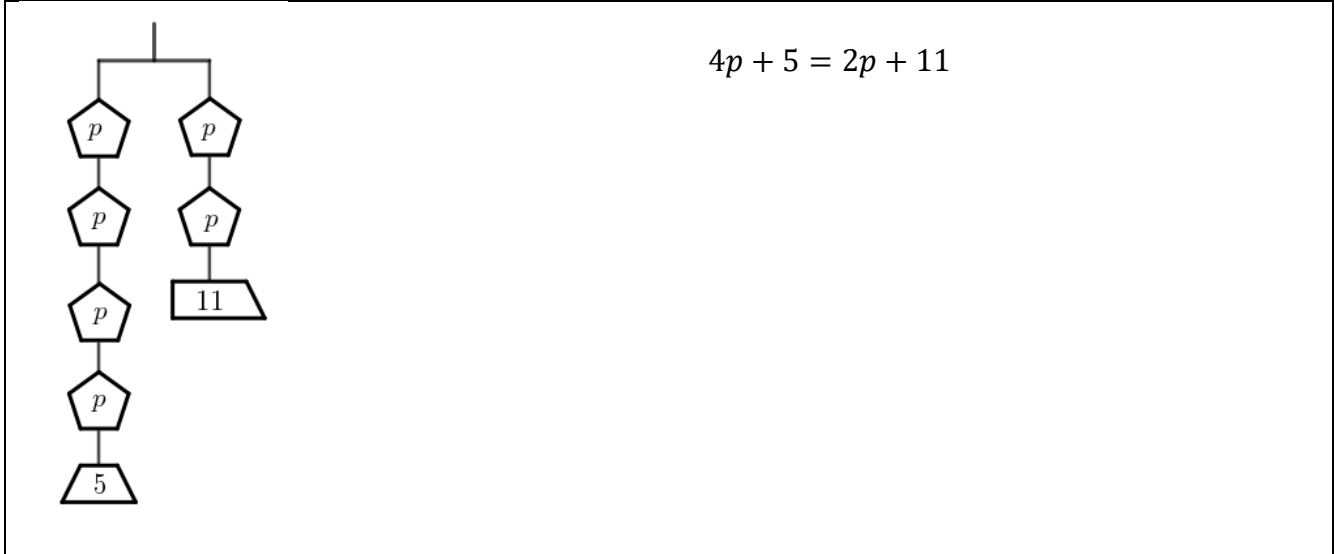
$$7y + 2 = 30$$

$$\frac{2x + 5}{3} = 7$$

$$4p - 5 = 13$$

$$\frac{10m + 20}{15} = 6$$

Mobile Diagrams: A mobile diagram can be constructed when the unknown appears on both sides and the coefficients are quite small.



Completing and balancing: One math move made on each line.

math move	math move
$6x + 29 = 10x + 17$	$2(5x + 51) = -3x + 11$
$29 = 4x + 17$	$10x + 102 = -3x + 11$
$12 = 4x$	$13x + 102 = 11$
$3 = x$	$13x = -91$
$x = 3$	$x = -7$
Check:	

Use your notebook to solve these equations. Check every answer using substitution.

Question 1

- (a) $4x + 1 = 2x + 7$ (b) $5x + 4 = 3x + 16$ (c) $2x + 8 = x + 12$
(d) $7x + 1 = 2x + 46$ (e) $6x - 3 = 2x + 13$ (f) $9x - 10 = 7x + 24$
(g) $2x + 21 = 4x + 5$ (h) $x + 2 = 5x - 2$ (i) $6x - 9 = 4x - 1$

Question 2

- (a) $5(x + 3) = 3(x + 9)$ (b) $8(x - 1) = 4(x + 3)$ (c) $3(x + 13) = 10(x - 1)$
(d) $2(4x - 3) = 5(2x - 5)$ (e) $9(2x - 5) = 3(4x + 7)$ (f) $2(9 - x) = 3(x + 16)$
(g) $5(2x + 9) + 2(x + 11) = 3(3x + 4) + 46$
(h) $8(x - 2) - 3(1 - x) = 9(x + 2) + 1$

G9 Core Unit 4 Algebra Lesson 8: Catch up/extension lesson.

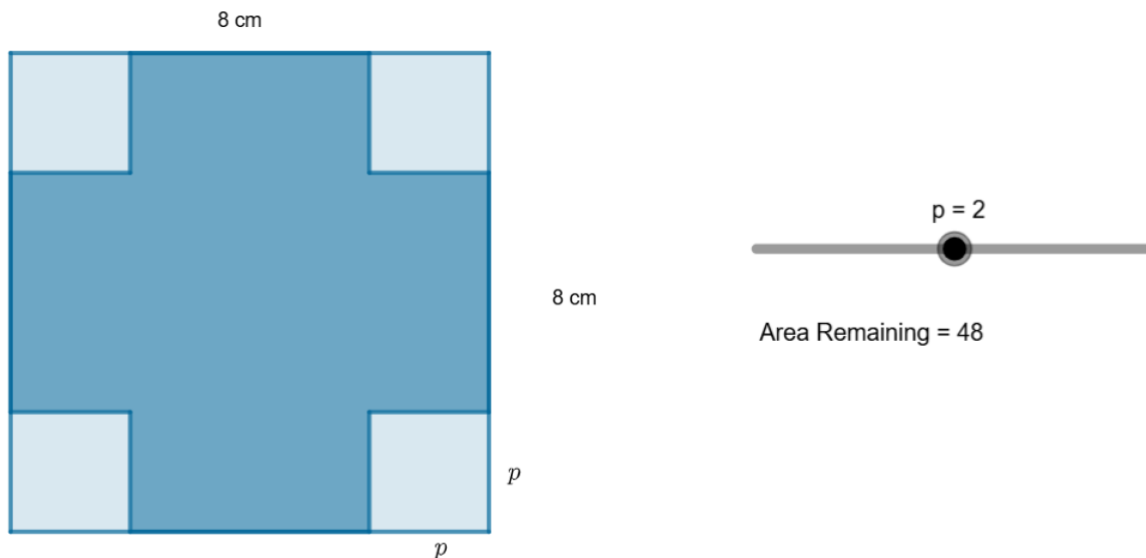
Please complete any missing pages in your algebra booklet, in particular pages 19 & 20.

Create & Test an expression: Open the applet <https://www.geogebra.org/m/bnuta5gq>

Use notepaper to respond to the questions below. Attach your notepaper to your booklet.

1. A piece of paper measures 8 cm by 8 cm.

Four squares measuring p cm by p cm are cut off from each corner as shown:



(a) p is a variable. The smallest value possible for p is zero, the largest value is

(b) Explain with calculations/diagrams/words why when $p = 2$ the area of the paper remaining is 48 cm^2 .

(c) Calculate the area remaining when $p = 3$. Verify your answer with the applet.

(d) Create and simplify an expression A in terms of p for the area remaining.

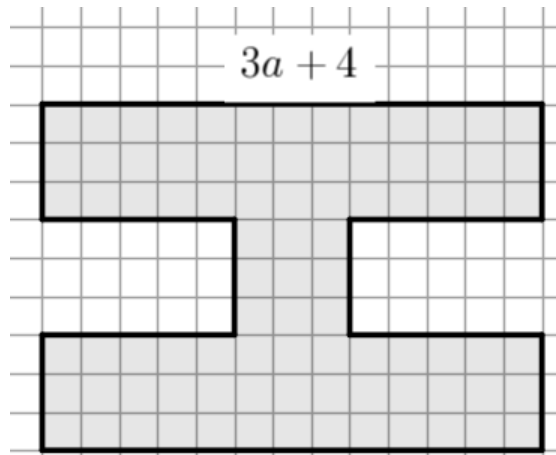
(e) Substitute the values in the table into your expression. Use the applet to determine if your expression/calculations are correct.

p	$A =$	Area Remaining	Applet value
$p = 0.7$			
$p = 2.8$			

2. The I shape

The 'I' shape below has 12 sides. Some of the sides vary with the value 'a'. Other sides are constant. The longest side measures $(3a + 4)$ cm.

(a) Open the applet. <https://www.geogebra.org/m/bnuta5gq> Vary 'a' to determine which of the sides have variable length, and which have constant length. Colour the variable sides red. Colour the constant sides green.



(b) Write the lengths of the constant sides (green) on the diagram above. These sides don't change.

(c) Write the lengths of the variable sides (red) as an expression of 'a'.

(d) Create an expression for the perimeter of the shape in terms of 'a'.

(e) Create an expression for the area of the shape in terms of 'a'.

(f) Test both your expressions out using the applet.

(g) Explain how you arrived at either your expression for area or your expression for perimeter. Use diagrams/text/algebra to explain.

G9 Core Unit 4 Algebra Lesson 9: Equation workshop (i)

Use these examples to help solve a variety of equations on pages 32. Remember to check.

math move

$$3(x + 13) = 5x + 37$$

$$3x + 39 = 5x + 37$$

$$39 = 2x + 37$$

$$2 = 2x$$

$$1 = x$$

$$x = 1$$

Check: *LHS*: $3(1 + 13) = 3 \times 14 = 42$
RHS: $5(1) + 37 = 42$, $42 = 42 \checkmark$

math move

$$-2(3x - 23) = 2(2x - 37)$$

$$-6x + 46 = 4x - 74$$

$$46 = 10x - 74$$

$$120 = 10x$$

$$12 = x$$

$$x = 12$$

LHS: $-2(36 - 23) = -2 \times 13 = -26$
RHS: $2(24 - 37) = 2 \times -13 = -26 \checkmark$

$$\frac{x + 33}{2} = 6x + 44$$

$$2\left(\frac{x + 33}{2}\right) = 2(6x + 44)$$

$$x + 33 = 12x + 88$$

$$33 = 11x + 88$$

$$-55 = 11x$$

$$x = -5$$

LHS: $\frac{-5+33}{2} = \frac{28}{2} = 14$

RHS: $6(-5) + 44 = -30 + 44 = 14 \checkmark$

$$\frac{x + 42}{2} - 55 = -8x$$

$$2\left(\frac{x + 42}{2} - 55\right) = 2(-8x)$$

$$x + 42 - 110 = -16x$$

$$x - 68 = -16x$$

$$17x - 68 = 0$$

$$17x = 68$$

$$x = 4$$

LHS: $\frac{4+42}{2} - 55 = \frac{46}{2} - 55 = 23 - 55 = -32$

RHS: $-8(4) = -32 \checkmark$

Use your notebook or a whiteboard to practice solving these equations. Check your answer.

A

(d) $5w + 11 = 19$

(e) $8x + 2 = 30$

(f) $4x + 11 = 3$

(g) $6w + 20 = 2$

(h) $2w - 9 = -6$

(i) $3c + 8 = -13$

(j) $\frac{x}{3} + 6 = 1$

(k) $\frac{w}{2} + 8 = 3$

(l) $\frac{m}{8} + 7 = -1$

(m) $\frac{1}{2}x + 3 = 15$

(n) $\frac{1}{4}m - 7 = 2$

(o) $\frac{1}{3}x - 2 = -6$

B

(g) $2x + 21 = 4x + 5$

(h) $x + 2 = 5x - 2$

(i) $6x - 9 = 4x - 1$

(j) $5x + 2 = 16 - 2x$

(k) $3x - 1 = 23 - x$

(l) $6x + 8 = 38 - 4x$

C

(a) $3x + 3 = x + 8$

(b) $9x + 10 = 7x + 39$

(c) $3x + 1 = 7x - 17$

(d) $x + 4 = 13 - x$

(e) $16x + 3 = 6x + 24$

(f) $9x + 12 = 6x + 14$

D

(d) $2(4x - 3) = 5(2x - 5)$ (e) $9(2x - 5) = 3(4x + 7)$ (f) $2(9 - x) = 3(x + 16)$

(g) $5(2x + 9) + 2(x + 11) = 3(3x + 4) + 46$

E

(a) $\frac{3x + 5}{2} = 7$ (b) $\frac{5x - 12}{3} = 11$ (c) $\frac{4x + 2}{6} = 5$ (d) $\frac{10x + 3}{4} = 4$

F

(a) $\frac{2x + 1}{3} = x - 2$

(b) $\frac{5x - 3}{2} = 2x + 4$

(c) $\frac{x + 17}{5} = x + 1$

(d) $4x - 9 = \frac{2x + 3}{3}$

(e) $\frac{9 - x}{2} = x + 3$

(f) $\frac{15 - 2x}{3} = 2x - 3$

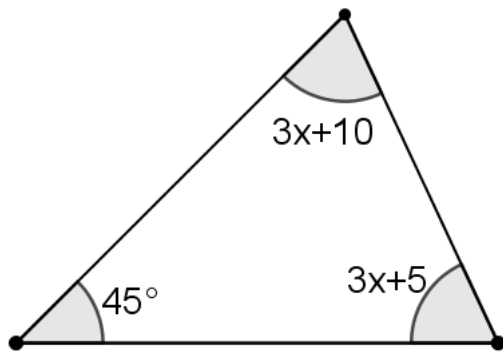
G9 Core Unit 4 Algebra Lesson 10: Equations & Geometry

Equations are used in all areas of math/science/other disciplines to solve number problems.

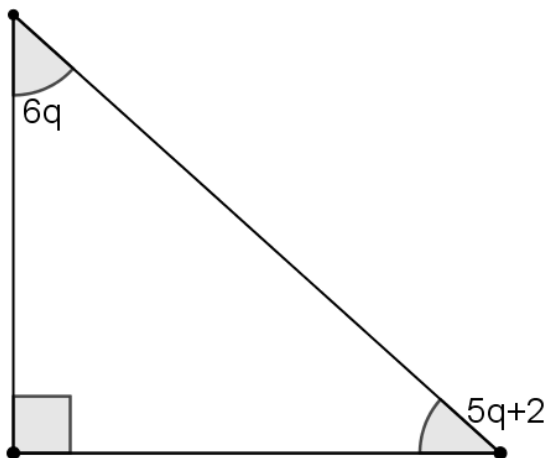
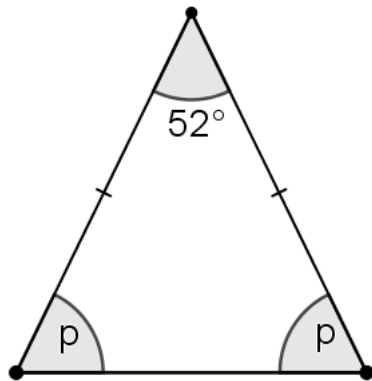
In these three questions, use the knowledge that the three angles in a triangle add to 180° .

Use an equation to determine the value of the unknown. Calculate the size of each angle.

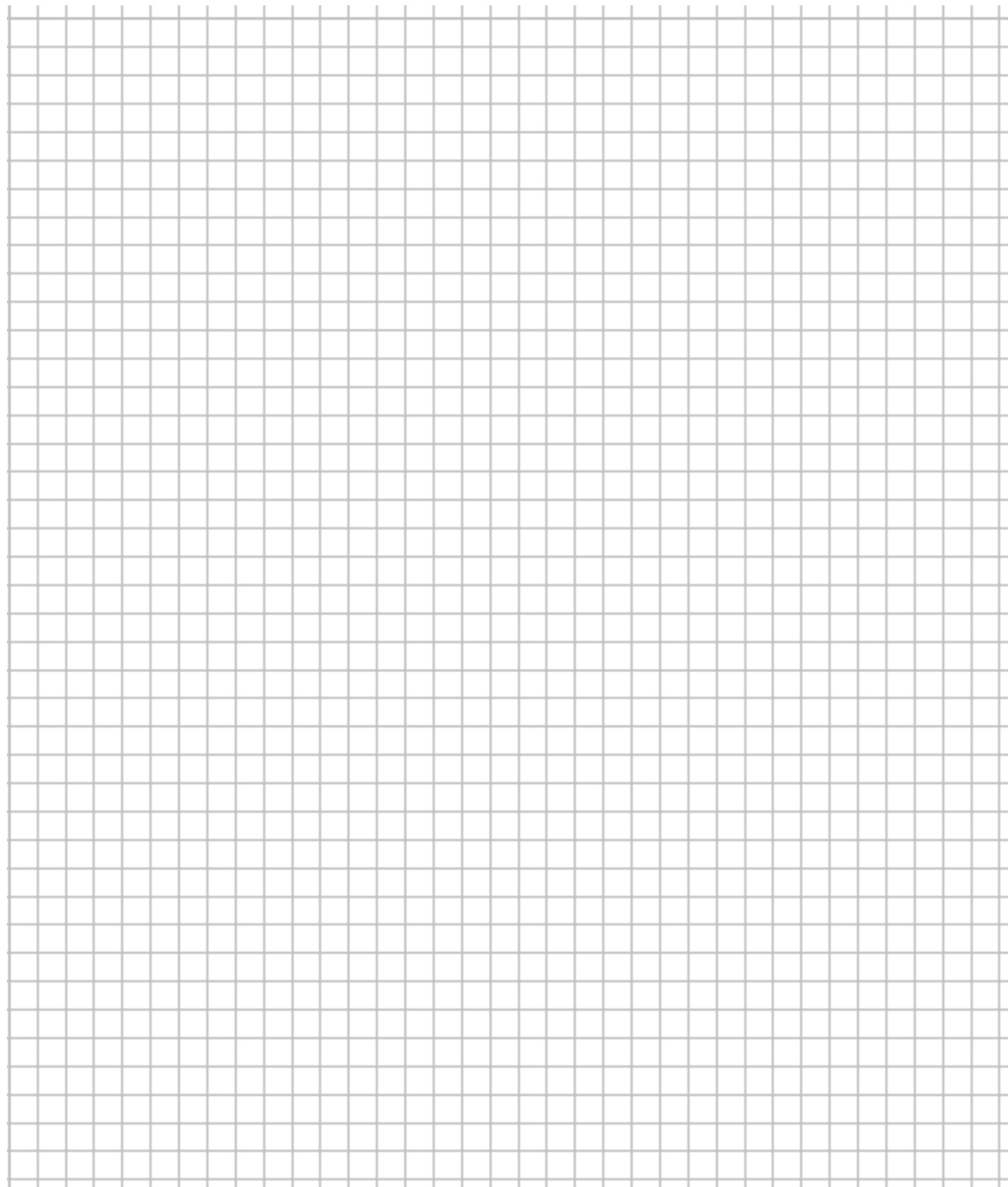
Check your answer by making sure all three angles add to 180°



$$3x + 10 + 3x + 5 + 45 = 180$$



Use your notebook/whiteboard to practice equations from the 'perimeter/angles' worksheet. Write up two or three examples of your work here, showing line by line derivation. Line up '=', write a check.



G9 Core Unit 4 Algebra Lesson 11:

$$6(4x + 1) - 9 = 93$$

LHS:
RHS:

$$2(5x + 3) - 6(2x - 1) = 3(x + 14)$$

LHS:
RHS:

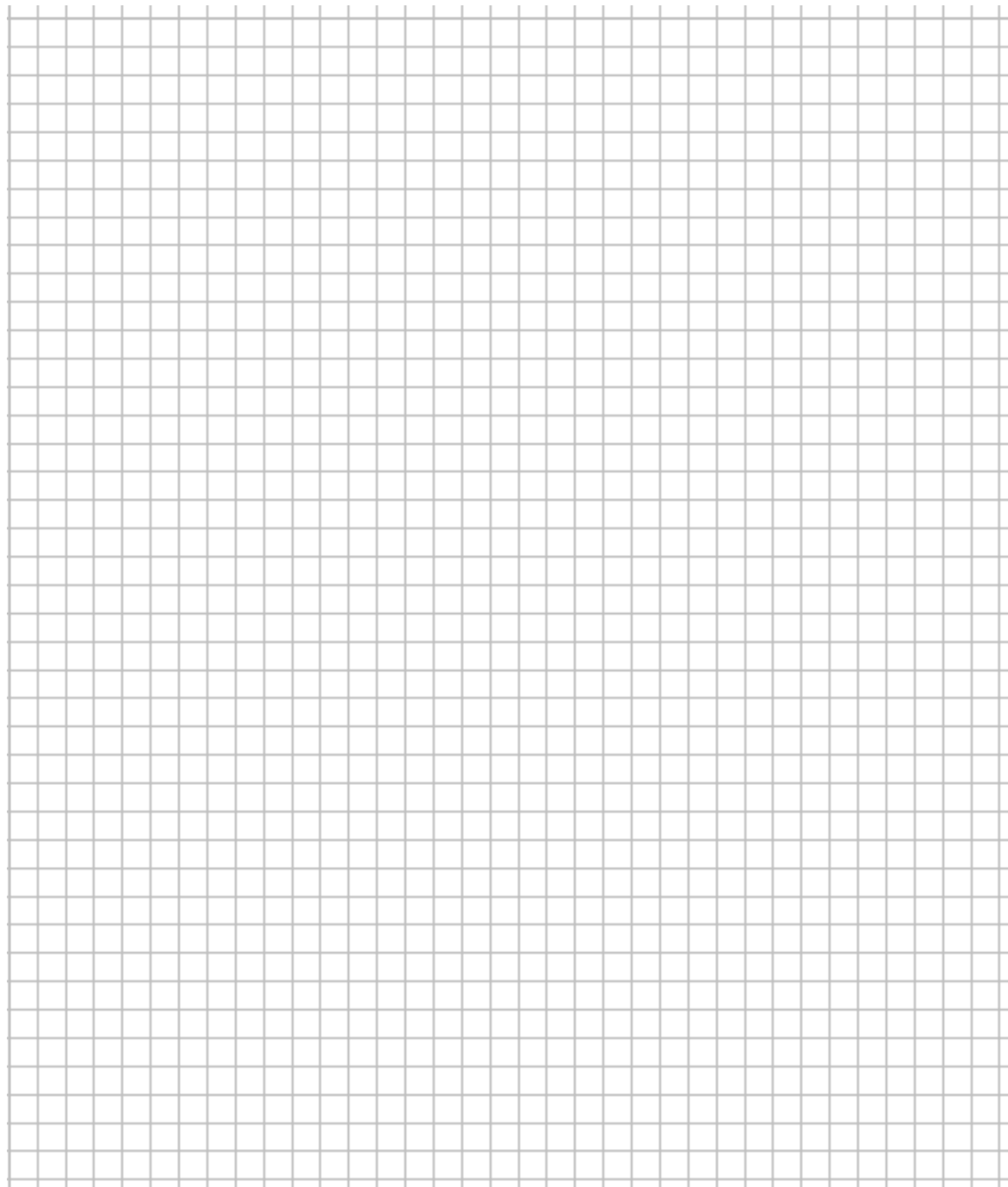
$$\frac{4x - 8}{7} = 6$$

LHS:
RHS:

$$\frac{3x - 5}{4} - \frac{9 - 2x}{3} = \frac{x - 3}{2}$$

LHS:
RHS:

Use your notebook/whiteboard to practice equations from transum math equations levels 1- 5; and levels 1 -5 transum math fraquations. At the end of the lesson, write up two or three examples of your work here, showing line by line derivation. Line up '=', write a check.



G9 Core Unit 4 Algebra Lesson 12: (Cross multiply example)

$$\frac{x + 63}{2} + 7 = 6x$$

LHS:
RHS:

$$2(2x - 11) - 3(5 - x) = 6x - 30$$

LHS:
RHS:

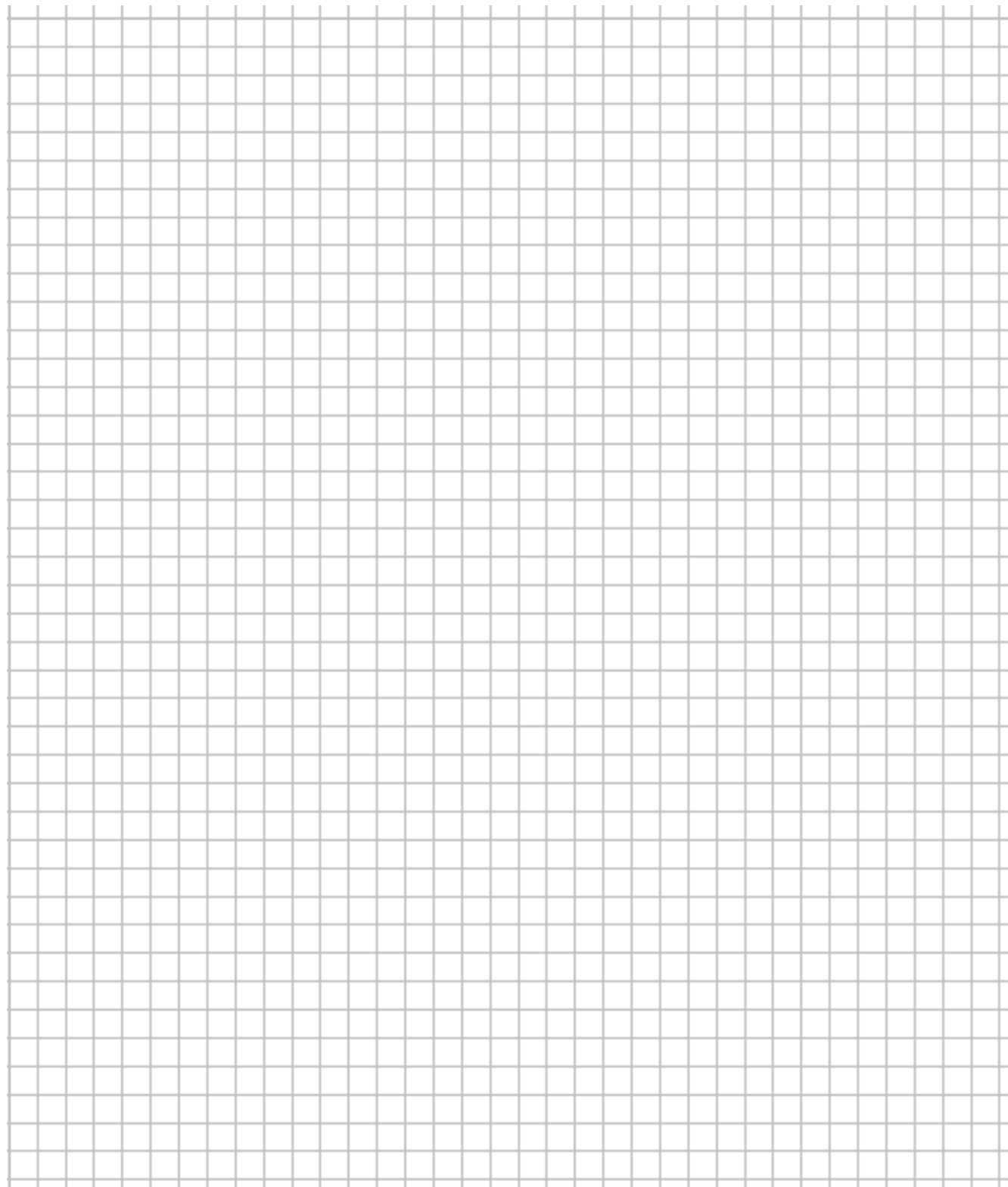
$$\frac{x - 18}{2} = \frac{5x - 74}{6}$$

LHS:
RHS:

$$\frac{x + 74}{3} + 2x + 9 = \frac{3x + 103}{4}$$

LHS:
RHS:

Use your notebook/whiteboard to practice equations from transum math equations levels 1- 5; and levels 1 -5 transum math fraquations. At the end of the lesson, write up two or three examples of your work here, showing line by line derivation. Line up '=', write a check.



G9 Core Unit 4 Algebra Lesson 13: Unknown on the denominator

$$\frac{36}{x} = 4$$

LHS:
RHS:

$$\frac{36}{7-x} = 3$$

LHS:
RHS:

$$\frac{7x+8}{5x-2} = 2$$

LHS:
RHS:

$$\frac{2}{9-x} = \frac{4}{11-3x}$$

LHS:
RHS:

This is the last lesson before the review. Organise your notes from page 1 – 40

Practice equations using the resources on the google classroom. At the end of the lesson, write up two or three examples of your work here, showing line by line derivation.

A large grid of graph paper, consisting of 20 columns and 30 rows of small squares, intended for students to write their mathematical work.

Grade 9 Unit 4: Lesson 14 Algebra Review

Section 1

A: **Vocabulary**. Draw a line between the vocabulary on the left and the matching example on the right.

Single Term

$$3xy + 2x^2 - 5xy$$

Equation

$$8x + 3yx + 9$$

Expression, 3 terms, with a constant

$$9x + 7 = 7(5x - 1)$$

Expression, 3 terms, without a constant

$$x^3 + 5x^2 - 3x + 7$$

Coefficient of x^2 is 5

$$8xy$$

B: **Substitute** $a = 4$ and $b = 10$ into these expressions and **evaluate**:

$$6a - b$$

$$3ab + 2$$

$$\frac{a^2 + b^3}{2}$$

C: **Simplify** these expressions. You may use colours to help.

$$8a + 6b + 6 - a - 2b + 6$$

$$8 + 2x + 7x + 6$$

$$7ab + 5b - 5a + 9ab + 11 - 4ab + 9$$

$$5a + 6 - 2b - ab + 10a + 6ab + 8$$

$$-4x + 11 - 2(2x + 3)$$

$$-2(5x - 3) + 2(5x - 4)$$

D: **Evaluate** this expression when $x = 10$ and $y = -2$

$$4xy - y^2 - xy + y^2 + 3x^2y^2 - 3xy$$

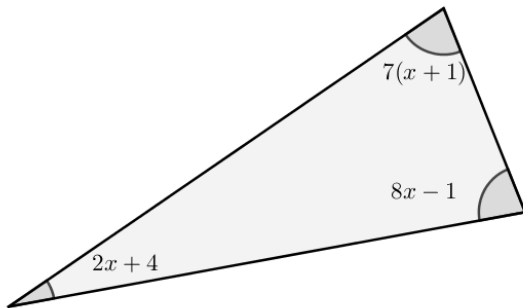
Section 2 Solve & Check equations

Solve the following equations for x . Include clear, written work. Check each answer.

$x + 3 = 10$	$x - 4 = 5$	$\frac{x}{7} = 3$	$6x = 30$
LHS:	LHS:	LHS:	LHS:
$6x - 4 = 50$		$\frac{x + 1}{2} = 7$	
LHS:		LHS:	
$\frac{x}{4} - 6 = -1$		$\frac{2x - 3}{3} = 5$	
LHS:		LHS:	
$7x + 3 = 11x - 33$		$3(x - 18) = -x - 34$	
LHS:		LHS:	
RHS:		RHS:	
$-2(5x + 12) = 6(x + 4)$		$4(x - 5) + 3(2x - 12) = 34$	
LHS:		LHS:	
RHS:		RHS:	

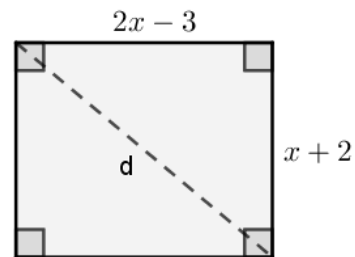
Section 3 Applications to Geometry

Calculate the size of each angle.

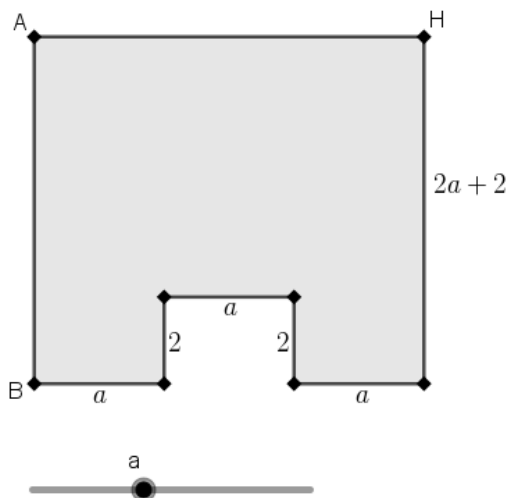


The perimeter of this rectangle is 31 cm.

Calculate the length of the diagonal d .



This shape is a rectangle with a smaller rectangle removed.



The lengths of some of the sides of this shape vary with the value a .

Colour the sides that *vary* red.

Colour the sides that *remain constant* blue.

Determine the length of AB in terms of a .

Determine the length of AH in terms of a .

Write an expression for the perimeter of the shape.

Evaluate your expression when $a = 5$.

Section 4 **Communication** with step by step writing. **Solving with fractions.**

The answer to each of these equations is $x = 8$.

Choose one or two equations to solve. Derive the solution $x = 8$. Show step by step solutions.

Align your equals signs from line to line.

$$(b) \quad \frac{x + 251}{7} = 37$$

$$(g) \quad \frac{x + 251}{7} + \frac{13x - 4}{10} = 47$$

$$(c) \quad 7x - 19 = \frac{x + 66}{2}$$

$$(h) \quad \frac{x + 251}{7} - \frac{13x - 4}{10} = 27$$

$$(d) \quad \frac{x + 251}{7} - 29 = x$$

$$(i) \quad \frac{x + 251}{7} + \frac{13x - 4}{10} + \frac{x - 20}{2} = 41$$

$$(e) \quad \frac{x + 251}{7} = \frac{x + 66}{2}$$

$$(j) \quad \frac{x + 251}{7} + \frac{13x - 4}{10} = \frac{x + 86}{2}$$

