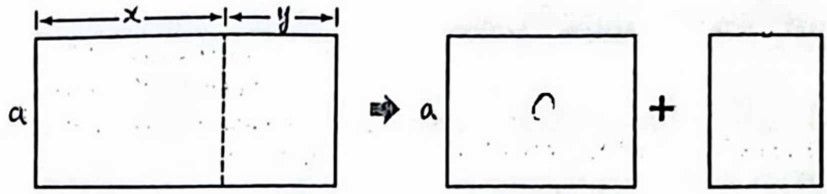
DGS CH3-4 Basic Algebra notes

Ch 3 Using Algebra to Solve Problems (I)

Distributive Law of Multiplication

A rectangle P of dimension $(x + y)$ by a is cut into two small rectangles Q and R, as shown below.



Area of rectangle P = ____________

Area of rectangle Q = ____________

Area of rectangle R = ____________

Conclusion:

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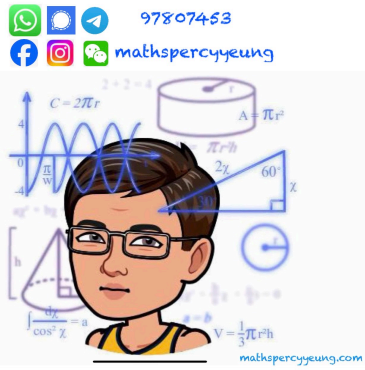
$a(x+y) =$ ____________

$(x+y)a =$ ____________



Solve the following equations.

(a) $y+13=22$

(b) $3z=21$

(c) $2x+3=11$

(d) $9+\frac{v}{4}=25$

(e) $\frac{9+v}{4}=25$

(f) $-2(x+3)=16$

(g) $6(x-2)-4x=6$

(h) $n+3=\frac{3}{4}n-\frac{1}{2}$

(i) $\frac{2n-1}{3}+\frac{2n-3}{5}=-2$

Ch 3 Basic Algebra (I)

3.1 Basic Concepts of Algebra (Algebra: using ________ to represent ________.)

Algebraic Expressions

+ : $n+5$	× : $n \times 5$ / ______	⟶
− : $n-5$	÷ : $n \div 5$	⟶

Terms of Algebraic Expressions

An algebraic expression is divided into terms by ________ ( ) and __________ ( ).

$x+3y-5z-7$ (___ terms) $4\times a+1\div b$ (___ terms) $3(-4)ab$ (___ terms)

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1. Represent the following word phrases by an algebraic expression.

   (a) Add 4 to the product of 6 and n.

   (b) Subtract 7 from n and then divide the difference by 3.

2. Emily has \$56 and she gets n red packets of \$20 during the day. If she uses half of the money she has to buy a present, how much does the present cost?

1.

Terms	Meaning	Example
Constant Terms	Terms with ________ only.	$5, -4, \frac{2}{3}$
Like Terms	Terms with same ________ ________.	$3x, 7x$ $4ab, -7ba$ $9y^2, -y^2$
Unlike Terms	Terms with ________ ________.	$4a, 4b$ $5c^2d,\ -4cd^2$ $-2p,\ -p^2$

2. Are constant terms like terms? ________________

3. Consider the following terms:

   $-5m^3n,\ 4mn^3,\ -3mn,\ 2m^3n,\ -mn^3$

   a) Identify all pairs of like terms. ________________

   b) Identify two pairs of unlike terms. ________________

Simplifying Algebraic Expressions

$2a^2 + 5a^2 =$ $3ab - ab =$ $5x + \frac{2x}{3} =$

Simplify the following expressions.

(a) $2 \times a \div 3$

(b) $a \times a + b \div 3$

(c) $6x \cdot 3y - 4xy$

(d) $4a - \frac{2a}{3}$

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

(f) $4a + a^2 - \frac{a}{2} + 1 - 3a^2$

3.2 Linear Equations in One Unknown

Solving Equations: The Balancing Method

- Reverse the order of the operations
- Original operations: $+ \quad - \quad \times \quad \div$
  Reverse operations: ______________
- Apply the "reverse operation" on both sides of the equation
- Check the solution!!

Solving more complicated equations:

1) There are more than one term with "x". (E.g. $x + 3 = 2x - 1$) ______________
2) There are brackets. ______________

?.3 Formulating Equations

A team of boys and girls joined a cross country race. There are 4 more boys than girls. Each boy runs 5 km, while each girl runs 3 km. If the total distance run by this team is 52 km, find the number of boys who joined the race.

Step 1: Let x be ____

Step 2: Number of girls = ______________________

Total distance run by the boys = ______________________

Total distance run by the girls = ______________________

Equation: ______________________________________

Step 3: Solve the equation in step 2.

Step 4: Answer the question.

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Step 5: Check the answer!

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1. The price of an adult ticket and a student ticket to a wetland park are \$30 and \$15 respectively. If the total ticket price for a group of 20 adults and students is \$420, find the number of adults in the group.

2. Ken has \$80 originally and he gives part of the money to Tony. After spending $\frac{3}{5}$ of the money received from Ken, Tony now has \$10 less than Ken's remaining amount. Find the amount of money that Ken gives to Tony.

4.1 Formulae and Method of Substitution

1. A triangle has base b cm and height h cm. Let A cm^2 be the area of the triangle.	$A =$ __________
2. A car travels with a uniform speed of c km/h for t hours. Let D km be the distance travelled by the car.	$D =$ __________
3. The figure below shows a pattern of hearts formed by some sticks. Let n be the number of hearts and T be the total number of sticks.	$T =$ __________

- A **formula** represents a __________ between 2 or more unknowns / variables.
- The **subject** of a formula is the _________ on the _________ of the formula.

Examples: ____

Method of Substitution

In the formula $A = \pi r^2$: when $r = 2$, $A =$ ________.

when $r = 5$, $A =$ ________.

when $r = 7$, $A =$ ________. (Leave the answer in terms of π.)

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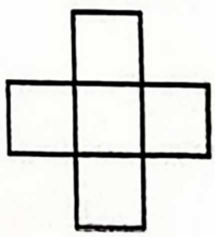
1. The figure shows the net of an opened top cube.

   (a) If the side length of each square is 3 cm, find the outer surface area of the cube.



   (b) Suppose the side length of each square is d cm and the outer surface area of the cube is $A\ \text{cm}^2$. Express A in terms of d.

   (c) Find the value of d if the outer surface area of the cube is $180\ \text{cm}^2$.

(c) 2, 4, 8, 16, ____________________

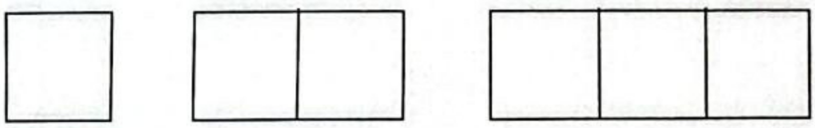
(d) 324, 108, 36, 12 ____________________

3. The general term of a sequence is $2n^2 - 1$.

(a) Find the 10^{th} term of the sequence.

(b) Which term of the sequence has a value of 449?

4. The following figure shows a pattern formed by match sticks.



(a) Fill in the table below to see how the number of match sticks (m) is depended on the number of squares (s) formed.

s	1	2	3	4	5	…	s
m	4					…	$m =$ ________

(b) Use different ways to analyze the match stick pattern to obtain the formula relating m and s.

4.2 Sequences

A sequence is a ______________________ arranged in order.

1, 2, 3, 4, ⋯ Set $a_1 = 1$ ____________

$a_2 = 2$ ____________

$\vdots$

$a_n = n$ ____________ of the sequence

Some Special Sequences

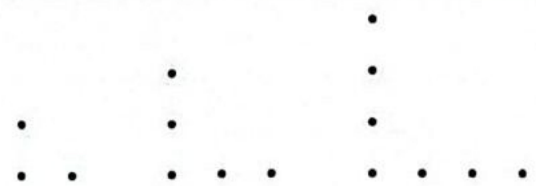
(1) A fixed difference between terms

E.g. ____

(2) A fixed multiple of the previous term

E.g. ____

1.



$n = 1$ $n = 2$ $n = 3$

Let a_n be the number of dots in the n^{th} pattern as shown above.

(a) Write down the terms a_n for $n = 1, 2, 3$. ______________________

(b) Guess the values of a_4 and a_5. ______________________

(c) Guess the value of a_0, and express a_1, a_2, a_3 and a_4 **in terms of a_0**.

$a_1 =$

$a_2 =$

$a_3 =$

$a_4 =$

(d) Hence deduce the general term a_n. ______________________

2. Write down the next two terms and the general term in the following sequences.

(a) 4, 7, 10, 13, ______________________

(b) 36, 31, 26, 21, ______________________