The Problem Solver's Toolkit 1

VANCOUVER COMMUNITY COLLEGE

TRANSLATIONS

ADDING	w <u>increased by</u> 4	w + 4
	2 <u>more than</u> k *	k + 2
	<u>the sum of</u> h and 8	h + 8
	<u>the total of</u> 6 and t	6 + t
	y <u>exceeds</u> x by 15 **	y = x + 15
SUBTRACTING	7 <u>decreased by</u> x	7 − x
	<u>difference between</u> k and 3	k − 3
	2 <u>less than</u> h *	h − 2
	y <u>exceeds</u> x by 15 **	y − 15 = x
MULTIPLYING	<u>two-fifths of</u> x	$\frac{2}{5}$ x
	<u>fifty percent of</u> z	50% · z
	<u>the product of</u> 4 and n	4n
	8 <u>times</u> b	8b
DIVIDING	k <u>divided by</u> 7	$k/7$
	<u>the quotient of</u> c and 4	$c/4$
	<u>the ratio of</u> f to 6	$f/6$

* — "More than" and "less than" are written backwards from the order they appear in the question.
** — "Exceeds" can be written either way.

CONSECUTIVE INTEGERS

three <u>consecutive integers</u>	x, x + 1, x + 2
three <u>consecutive {even/odd} integers</u>	x, x + 2, x + 4
three <u>consecutive multiples of 4</u>	x, x + 4, x + 8

AGE PROBLEMS

For ages in the *future*, add years to the age now. For ages in the *past*, subtract years from the age now.

6 years ago	now	5 years from now
4	10	15
x − 6	x	x + 5

I am 10. <u>In how many years</u>…	10 + x
I am 23. <u>How many years ago</u>...	23 − x

OPPOSITES
Two numbers are <u>opposites</u>…   x and −x

COIN PROBLEMS

| Number of coins | × | Value of coin | = | Total value for that type of coin |

Coin	Number	Value	Total
penny		1	
nickel		5	
dime		10	
quarter		25	

The "Value" and "Total" columns must be in the same unit (here, ¢).

If the total of number of all coins is given, you may have to represent one type as "part of the whole"…

PARTS OF THE WHOLE

"A metal rod measuring 20 cm is cut in two pieces…" The lengths of the pieces can be written: x, 20 − x.

"A board 120 cm long is cut into three pieces. Two are the same length…" The three pieces can be written: x, x, 120 − 2x.

"Out of 18 coins, there are twice as many dimes as pennies, and the rest are nickels…" Pennies: x, dimes: 2x, nickels: 18 − 3x.

Authored by Gordon Wong

MOTION PROBLEMS
Think DiRT: Distance is Rate · Time.

Type of problem	Illustration	Key Relationships
One person travels, then a second traveller catches up after leaving from the same place at a later time.	**START** d_1 (t) d_2 (t − 3) traveller starts 3 hours later	$d_1 = d_2$ First traveller has time t. Second traveller has time t − head start, such as t − 3.
A traveller changes transportation or speed at some point during a trip.	**START** d_1 change-over d_2 d_{total}	$d_{total} = d_1 + d_2$
Two travellers leave the same place at the same time going in opposite directions.	**START** d_1 d_2 d_{total}	$d_{total} = d_1 + d_2$
A traveller goes to a destination, and then returns to his starting place.	**START** d_1 d_2	$d_1 = d_2$

BUSINESS PROBLEMS

COMMISSIONS
x% × Total sales = Commission

COST PROBLEMS
# of items × Cost/item = Total value

INTEREST PROBLEMS
Principal × Rate = Interest

MARKDOWNS
x% × Original price = Markdown

Original price − Markdown = Sale price

MARKUPS
x% × Original price = Markup

Original price + Markup = Sale price

PROFITS
Revenue − Expenses = Profit

SALES TAX
x% × Marked Price = Sales Tax

NUMBERS IN RATIOS

Two numbers have a ratio of 4 to 3…
        4x and 3x
Three numbers in the ratio 6:2:1…
        6x, 2x and x

PERIMETER AND AREA PROBLEMS

	Perimeter	Area
Square (x)	4x	x^2
Rectangle (W, L)	2L + 2W = 2(L + W)	L × W
Triangle (a, h, c, b)	a + b + c	½bh
Circle (r, d)	2πr = πd	$\pi r^2 = \dfrac{\pi d^2}{4}$

ANGLE PROBLEMS

complementary angles x, 90 − x
supplementary angles x, 180 − x

angles in a triangle   a + b + c = 180
…in a right triangle   a + b = 90
…in an isosceles
          triangle   a + 2b = 180