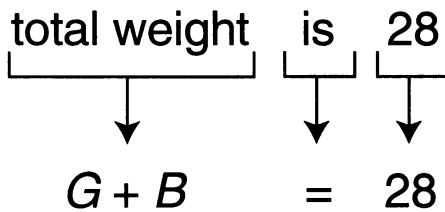
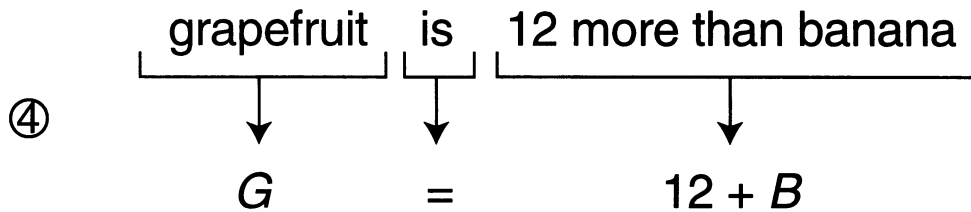
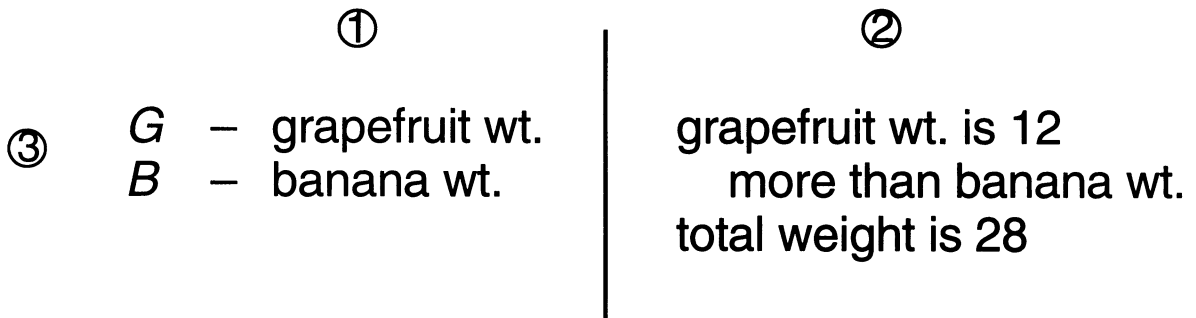


“The weight of a grapefruit is 12 ounces more than the weight of a banana. The total weight for both pieces of fruit is 28 ounces. Find the weight of each piece of fruit.”



$G = 12 + B$

$G + B = 28$

Subst.       $(12 + B) + B = 28$

⋮

⋮

Banana is 8 oz.  
Grapefruit is 20 oz.

# “NUMBER” PROBLEMS

“Twice the small of two numbers, plus three times the larger of the two numbers, is 123. Three times the larger number subtracted from four times the smaller number is -15. Find the two numbers.”

①

②

③  $n$  – smaller no.  
 $m$  – larger no.

twice smaller plus three times larger is 123  
 three times larger subtracted from four times smaller is -15

④

twice smaller plus three times larger is 123

$$2n + 3m = 123$$

three times larger subtracted from four times smaller is -15

$$4n - 3m = -15$$

$$\begin{array}{r} 2n + 3m = 123 \\ \text{Add } 4n - 3m = -15 \\ \hline 6n = 108 \\ \vdots \end{array}$$

$n = 18$ $m = 29$
----------------------

# “AGE” PROBLEMS

“Mary is twice as old as Jane was 3 years ago.  
In three years, Mary will be three times as old as  
Jane was 4 years ago. Find the present age of each.”

③

①

- $M$  – Mary’s age
- $J$  – Jane’s age
- $M - 3$  – Mary 3 yrs. ago
- $J - 3$  – Jane 3 yrs. ago
- $M + 3$  – Mary in 3 yrs.
- $J + 3$  – Jane in 3 yrs.
- $M - 4$  – Mary 4 yrs. ago
- $J - 4$  – Jane 4 yrs. ago

②

Mary is twice Jane  
3 years ago  
In 3 yrs. Mary will be  
three times Jane 4  
yrs. ago

④

$$\begin{array}{ccccccc} \text{Mary} & \text{is} & \text{twice} & \text{Jane 3 yrs. ago} \\ \hline \downarrow & \downarrow & \downarrow & \downarrow \\ M & = & 2 \cdot & (J - 3) \end{array}$$

$$\begin{array}{ccccccc} \text{In 3 yrs. Mary} & \text{will be} & \text{three times} & \text{Jane 4 yrs. ago} \\ \hline \downarrow & \downarrow & \downarrow & \downarrow \\ M + 3 & = & 3 \cdot & (J - 4) \end{array}$$

$$\begin{array}{l} M = 2(J - 3) \\ M + 3 = 3(J - 4) \\ \vdots \end{array}$$

Mary is 12  
Jane is 9

# “GEOMETRIC FIGURE” PROBLEMS

“A rectangular dog pen is 12 meters longer than it is wide.  
One-half of the perimeter of the pen is 72 meters.  
What are the dimensions of the pen?”

<p>③</p> <p><math>L</math> – length <math>W</math> – width</p>		<p>②</p> <p>length is 12 more than width one-half perimeter is 72</p>
--	--	---

④

length	is	12 more than width
↓	↓	↓
$L$	=	$12 + W$

one-half perimeter	is	72
↓	↓	↓
$\frac{1}{2}(2L + 2W)$	=	72

$L = 12 + W$

$\frac{1}{2}(2L + 2W) = 72$

⋮

Length is 42  
Width is 30

# “MOTION” PROBLEMS

“Larry took 36 minutes to row 3 miles downstream. When he returned, he took 90 minutes. What is the rate of speed of the boat in still water, and what is the rate of speed of the current of the river?”

①

down distance  
up distance  
down rate  
up rate  
down time  
up time  
current rate

②

down distance is 3 mi.  
up distance is 3 mi.  
up rate is same as down rate  
down time is 36 min.  
up time is 90 min.  
down distance is down rate  $\times$  down time  
up distance is up rate  $\times$  up time

③

	<i>D</i>	<i>R</i>	<i>T</i>
Down	3	$R+C$	36
Up	3	$R-C$	90

④

$$3 = (R + C)36$$

$$3 = (R - C)90$$

$$\vdots$$

$R$ is $3\frac{1}{2}$ mph $C$ is $1\frac{1}{2}$ mph
--

# “PERCENT” PROBLEMS

“Any number is a percent of any number”

“An appliance store discounts the original price of a certain type of television 18% to a sale price of \$410. What was the original price?”

<p>③</p> <p><math>D</math> – discount amt.</p> <p><math>\frac{18}{100}</math> – discount rate</p> <p><math>P</math> – original price</p> <p>410 – sale price</p>		<p>②</p> <p>discount rate is 18%</p> <p>sale price is \$410</p> <p>discount amt. is a percent of original price</p> <p>sale price is original price minus discount amt.</p>
--	--	---

④

Discount amount	is	percent	of	original price
↓		↓	↓	↓
$D$	=	$\frac{18}{100}$	•	$P$
Sale price	is	original price	minus	discount amount
↓		↓	↓	↓
\$410	=	$P$	–	$D$

$$D = \frac{18}{100} P$$

$$\$410 = P - D$$

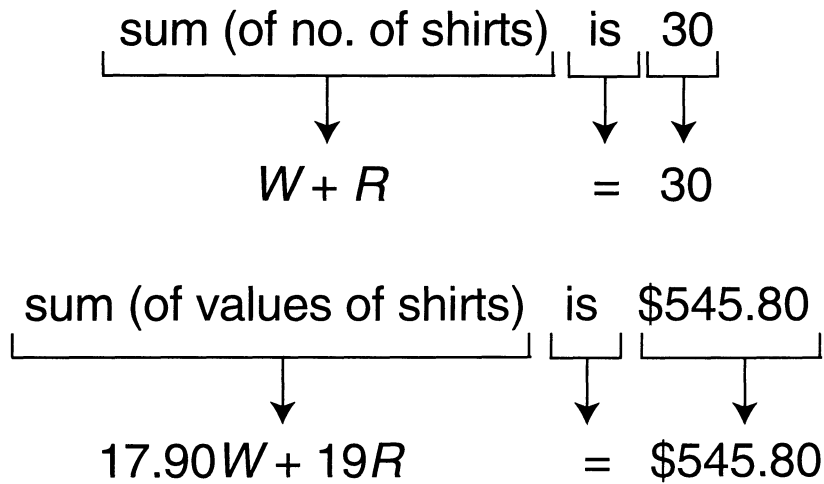
⋮

Discount is \$90  
Original Price is \$500

“A store sold 30 sweatshirts. They sold white ones for \$17.90 and red ones for \$19. They took in \$545.80. How many of each color did they sell?”

- |   |          |  |
|---|----------|--|
| <p>③</p> <p><math>W</math> – no. of white shirts</p> <p><math>R</math> – no. of red shirts</p> <p><math>17.90W</math> – total value of white shirts</p> <p><math>19R</math> – total value of red shirts</p> | <p>①</p> | <p>②</p> <p>sum (of no. of shirts) is 30</p> <p>sum (of the total value of shirts) is \$545.80</p> |
|---|----------|--|

④



$$W + R = 30$$

$$17.90W + 19R = \$545.80$$

$$\vdots$$

$$W = 22$$

$$R = 8$$

# “WORK” PROBLEMS

“A man can paint his house in 4 days. His son can do the job in 6 days. How long will it take if both of them work together?”

$$W_1 + W_2 + \dots = 1$$

$$R_1T_1 + R_2T_2 + \dots = 1$$

$$W_M + W_S = 1$$

$$R_M T_M + R_S T_S = 1$$

$$\frac{1}{\left(\begin{array}{c} \text{total} \\ \text{alone} \end{array}\right)_M} \cdot T_M + \frac{1}{\left(\begin{array}{c} \text{total} \\ \text{alone} \end{array}\right)_S} \cdot T_S = 1$$

$$\frac{1}{4} \cdot T + \frac{1}{6} \cdot T = 1$$

Multiply 12

$$3T + 2T = 12$$

$$T = \frac{12}{5} \text{ or } 2\frac{2}{5} \text{ days}$$

# “DIRECT VARIATION” PROBLEMS

“The amount ( $A$ ) of medication prescribed for a person varies directly as the person’s weight ( $W$ ). For a person weighing 60 kg, 4 ml of a particular medication are prescribed. How many milliliters of that medication are required for a person who weighs 75 kg?”

	①		②		③
<u>amount of medication</u>	→	$\frac{A}{W}$	=	$\frac{4}{60}$	=
weight of person	→	$\frac{A}{75}$			
				↑	
				constant of variation	
				┌──────────┐	
				equation of variation	

$$\frac{4}{60} = \frac{A}{75}$$

$$\begin{array}{ccc} 2 \cdot 2 \cdot 3 \cdot 5 & & 3 \cdot 5 \cdot 5 \\ \quad \quad \quad \swarrow & & \nwarrow \quad \quad \quad \\ & 2 \cdot 2 \cdot 3 \cdot 5 \cdot 5 & \\ & \underline{\quad\quad\quad 300 \quad\quad\quad} & \end{array}$$

Multiply 300

$$20 = 4A$$


---

Multiply  $\frac{1}{4}$

$$5 \text{ ml} = A$$

## “INVERSE VARIATION” PROBLEMS

“A software company sells a software package at a price ( $P$ ) that is inversely proportional to the number ( $N$ ) of packages sold per month. When the company is selling 900 packages per month, the price is \$80 each. How many packages must be sold per month in order to lower the price to a new price of \$64 per package?”

$$\begin{array}{ccccccc}
 & \textcircled{1} & & & \textcircled{2} & & \textcircled{3} \\
 & \text{price} \cdot \text{packages} & & & & & \\
 P \cdot N & = & 80 \cdot 900 & = & 64 \cdot N \\
 & & \uparrow & & & & \\
 & & \text{constant of} & & & & \\
 & & \text{variation} & & & & \\
 \hline
 & & \text{equation of} & & & & \\
 & & \text{variation} & & & & 
 \end{array}$$

$$\begin{array}{r}
 \text{Multiply } \frac{1}{64} \\
 \hline
 80 \cdot 900 = 64N \\
 \hline
 1125 \text{ pkgs.} = N
 \end{array}$$