3.2 - 1 REACHING A LIMIT

Notes by Linda Shirk – To accompany Elementary Algebra for College Students by Angel & Runde, 8th Ed.

Real life math problem:
Go to grocery store with $18 cash.
Pick out groceries that total $13.20.
Decide to buy gum also; each package costs $1.15.
How many packages can be bought and not spend more than $18?

Mental math:

\[
\begin{align*}
\text{\$18.00 cash} & \\
\text{\$13.20 groceries} & \\
\text{\$4.80 left to spend on gum} & \\
\end{align*}
\]

\[
\frac{\$4.80}{\$1.15} = 4 \text{ packages can be bought and a little change is left over.}
\]

How would this problem be done with algebra?

Set up variable: \( x = \text{no. of packages of gum} \)

Write equation:

\[
\text{Groceries} + \text{gum} = \$18 \text{ (or less)}
\]

\[
\begin{align*}
\$13.20 + (1) \times \$1.15 & = \$14.35 \text{ buy another} \\
\$13.20 + (2) \times \$1.15 & = \$15.50 \text{ buy another?} \\
\$13.20 + (3) \times \$1.15 & = \$16.65 \\
\vdots
\end{align*}
\]

\[
\begin{align*}
\$13.20 + (4) \times \$1.15 & = \$18 \\
or \quad 13.20 + 1.15x & = 18
\end{align*}
\]

Solve equation:

\[
\begin{align*}
13.20 + 1.15x & = 18 \\
-13.20 & \\
1.15x & = 4.80 \\
\frac{1.15x}{1.15} & = \frac{4.80}{1.15} \\
x & = 4.2
\end{align*}
\]

Answer question: 4 packages of gum can be purchased.

This problem involved a fixed part (cost of groceries) and a variable part (cost of buying gum) which together were limited (by cash on hand).

This type of problem takes this form \( \text{FIXED + VARIABLE = LIMIT} \)

The variable goes in here.
Another example - Not in the book

Truck rental - $38/day
Mileage - $0.25/mile

More information to make this a complete problem: Maria only has $75 to rent the truck.

Question - What is the maximum number of miles Maria can drive in the truck.

Let $x$ = no. of miles

Fixed + Variable = Limit

Rental + Mileage = $75
$38 + 0.25x = 75

\[
\begin{align*}
-38 & \\
-38 + 0.25x &= 37
\end{align*}
\]

\[
Check:
148 \text{ miles} \times 0.25 = 37
\]

\[
\frac{\text{miles}}{\text{mile}} = \frac{\text{rental fee}}{75}
\]

$x = 148$ miles

The first book example is on p. 188 Example 4, we could first write the equation like this:

\[
\text{Fixed} + \text{Variable} = \text{Limit (goal)}
\]

\[
(\text{present production}) + (\text{increased production}) = \text{future production}
\]

The second book example is on p. 189 Example 5, we could first write the equation like this:

\[
\text{Fixed} + \text{Variable} = \text{Limit}
\]

\[
(\text{delivery charge}) + (\text{cost of sod}) = \text{total cost}
\]

The book uses the word “fixed” as part of the solution explanation.

The cost of the sod is variable because a small number of square feet or a large number could be purchased.