# 4.5 Modelling With Algebra

## Part 1: English to Algebra

**Example 1:** Write an algebraic expression for each English phrase.

**a)** the sum of 5 and y $5+y$

**b)** the product of 4 and x $4x$

**c)** the product of 4 and m, then increase the result by 7 $4m+7$

**d)** the sum of 4 and d, then multiply the result by 2 $2(4+d)$

**e)** add 4 to d, then double the result $2(d+4)$

**f)** three consecutive numbers $x, x+1, x+2$

**Example 2:** Write an algebraic expression for each English phrase.

**a)** 7 more than twice a number $2x+7$

**b)** one-quarter of a number increased by 3 $\frac{x}{4}+3$

**c)** double the sum of a number and 5 $2(x+5)$

**d)** triple a number $3x$

**e)** 6 less than one-half of a number $\frac{x}{2}-6$

**f)** the quotient of a number and 4 $\frac{x}{4}$

**Example 3:** Write an equation for each English statement.

**a)** Five more than a number is twenty-seven. $x+5=27$

**b)** Seven less than a number is 4. $x-7=4$

**c)** Double a number less eleven is sixteen. $2x-11=16$

**d)** The sum of 4 consecutive integers is fifty. $x+(x+1)+(x+2)+(x+3)=50$

**e)** Six times a number is 42. $6x=42$

**Example 4:** Write an equation for each sentence.

**a)** A number increased by six is twenty $x+6=20$

**b)** A number multiplied by four is sixteen $4x=16$

**c)** Seven less than a number is fifteen $x-7=15$

**d)** One fifth of a number is six $\frac{x}{5}=6$

**e)** A number divided by six is seven. $\frac{x}{6}=7$

**f)** Two more than triple a number is 14 $3x+2=14$

## Part 2: Word Problems

When solving word problems,

- define the unknowns.
- write an equation to model the situation.
- solve the equation.
- answer the question asked in the problem.

**Example 5:** Mr. Jensen operates a variety store with his two best friends, Sidney and Evgeni. Sidney makes twice as much as Evgeni. Mr. Jensen makes $200 a week more than Sidney. The total weekly payroll is $1450. How much does each friend make?

**Step 1:** Let's define our variables:

| Worker | Expression |
|---|---|
| Evgeni | $x$ |
| Sidney | $2x$ |
| Mr. Jensen | $2x+200$ |
| Total | 1450 |

**Step 2:** Write an equation that relates these expressions to the total payroll

$$x+2x+2x+200=1450$$

**Step 3:** Solve the equation

$$5x+200=1450$$

$$5x=1450-200$$

$$\frac{5x}{5}=\frac{1250}{5}$$

$$x=250$$

**Step 4:** Answer the question in context.

Each friend makes the following amount per week:

Eugeni = $x$ = \$250

Sidney = $2x$ = \$500

Mr. Jensen = $2x+200$ = \$700

**Example 6:** Curtis works at a ballpark selling peanuts. He is paid \$6/h plus a 50 cent commission for every bag of peanuts he sells.

**a)** Find Curtis' earnings if he sells 42 bags of peanuts during a 4 hour shift.

E = earnings
h = hours
p = peanuts

$E = 6h + 0.50p$

$E = 6(4) + 0.5(42)$

$E = 24 + 21$

$E = \$45$

He would earn \$45.

**b)** How many bags of peanuts must he sell to earn $100 in 7 hours?

$E = 6h + 0.5p$

$100 = 6(7) + 0.5p$

$100 = 42 + 0.5p$

$100 - 42 = 0.5p$

$\frac{58}{0.5} = \frac{0.5p}{0.5}$

$116 = p$

He must sell 116 bags.

**Example 7:** The length of a rectangle is 7m more than its width. The perimeter of the rectangle is 60m. What are the dimensions?

Length $= x + 7$

Width $= x$

$P = 2(\text{length}) + 2(\text{width})$

$60 = 2(x+7) + 2(x)$

$60 = 2x + 14 + 2x$

$60 - 14 = 4x$

$\frac{46}{4} = \frac{4x}{4}$

$x = 11.5$

Length $= x + 7 = 18.5$ m

Width $= x = 11.5$ m